



Australian Government

**BUILDING OUR FUTURE**



# **The Northern Road Upgrade Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park**

NSW Environmental Impact Statement /  
Commonwealth Draft Environmental Impact Statement

## **Volume 1: Main Report**

June 2017



# **The Northern Road Upgrade – Mersey Road, Bringelly to Glenmore Parkway, Glenmore Park**

**NSW Environmental Impact  
Statement / Commonwealth Draft  
Environmental Impact Statement  
June 2017**

## **Volume 1: Main Report**

Prepared for  
Roads and Maritime Services  
By Jacobs Australia  
RMS: 17.274  
ISBN: 978-1-925659-22-1

BLANK PAGE

# Contents

---

<b>Contents .....</b>	<b>iii</b>
<b>Glossary of terms and abbreviations.....</b>	<b>ix</b>
<b>Executive summary .....</b>	<b>xxi</b>
<b>1 Introduction .....</b>	<b>1</b>
1.1 The project.....	2
1.2 Location and context of the project.....	4
1.3 Project location .....	7
1.4 Structure of this environmental impact statement .....	8
<b>2 Assessment process .....</b>	<b>13</b>
2.1 Approval framework.....	14
2.2 Other legislation.....	17
<b>3 Strategic justification and project need.....</b>	<b>19</b>
3.1 NSW strategic planning and policy framework .....	19
3.2 National strategic planning and policy framework .....	26
3.3 Project need .....	27
3.4 Project objectives .....	30
3.5 Statement of strategic need.....	31
<b>4 Project development and alternatives .....</b>	<b>33</b>
4.1 Alternatives considered .....	34
4.2 Evaluation of alternatives considered .....	35
4.3 Route options development.....	42
4.4 The project.....	69
<b>5 Project description.....</b>	<b>75</b>
5.1 Project scope.....	76
5.2 The completed project.....	78
5.3 Design criteria.....	126
5.4 Construction .....	130
5.5 Staging .....	157
<b>6 Consultation .....</b>	<b>161</b>
6.1 Consultation objectives and strategy.....	163
6.2 Consultation process and activities to date .....	164
6.3 Summary of issues raised .....	174
6.4 Future consultation .....	180
<b>7 Assessment of key Issues .....</b>	<b>183</b>
7.1 Traffic and transport .....	187
7.2 Noise and vibration.....	219

7.3	Biodiversity .....	280
7.4	Socio-economic and land use .....	369
<b>8</b>	<b>Assessment of other issues .....</b>	<b>429</b>
8.1	Hydrology and flooding .....	430
8.2	Soils, water and contamination .....	454
8.3	Aboriginal heritage .....	498
8.4	Non-Aboriginal heritage .....	524
8.5	Urban design and visual impact .....	568
8.6	Air quality .....	614
8.7	Resources and waste management .....	632
8.8	Climate change and greenhouse gas .....	643
8.9	Hazard and risk .....	657
<b>9</b>	<b>Cumulative Impacts .....</b>	<b>667</b>
9.1	Nature of cumulative impacts .....	668
9.2	Potential cumulative impacts .....	675
9.3	Environmental management measures .....	687
<b>10</b>	<b>Sustainability .....</b>	<b>689</b>
10.1	What is sustainability .....	689
10.2	Project sustainability framework .....	690
10.3	Project sustainability strategy .....	692
10.4	Ecologically sustainable development .....	705
<b>11</b>	<b>Environmental risk analysis .....</b>	<b>709</b>
11.1	Overview .....	709
11.2	Environmental risk analysis results .....	710
<b>12</b>	<b>Summary of environmental management measures .....</b>	<b>725</b>
12.1	Environmental management framework .....	726
12.2	Construction Environmental Management Plan .....	726
12.3	Summary of construction safeguards and management measures .....	736
12.4	Operational environmental management .....	791
<b>13</b>	<b>Project justification and conclusion .....</b>	<b>797</b>
13.2	Conclusion .....	805
<b>14</b>	<b>References .....</b>	<b>811</b>
	<b>List of tables .....</b>	<b>823</b>
	<b>List of figures .....</b>	<b>829</b>



## **Appendices**

- Appendix A – Proponent details and environmental performance of the proponent
- Appendix B – Secretary’s environmental assessment requirements
- Appendix C – Commonwealth EIS Assessment requirements
- Appendix D – Environmental Planning and Assessment Regulation 2000 checklist
- Appendix E – Environment Protection and Biodiversity Conservation Regulation Checklist
- Appendix F – Persons and agencies contacted during the EIS
- Appendix G – Technical working paper: Traffic and transport
- Appendix H – Technical working paper: Noise and vibration
- Appendix I – Technical working paper: Biodiversity
- Appendix J – Technical working paper: Socio-economic
- Appendix K – Technical working paper: Flood risk assessment
- Appendix L – Technical working paper: Soils, water and contamination
- Appendix M – Technical working paper: Aboriginal cultural heritage assessment report
- Appendix N – Technical working paper: Non- Aboriginal heritage
- Appendix O – Technical working paper: Urban design, landscape character and visual impact assessment
- Appendix P – Technical working paper: Air quality
- Appendix Q – Technical working paper: Greenhouse gas assessment and Climate change risk assessment
- Appendix R – Draft Community Involvement Plan
- Appendix S – EIS Team
- Appendix T – Roads and Maritime Services Environmental Policy Statement

BLANK PAGE

### 8.2.9 Residual Impacts

Residual impacts are those that remain after the implementation of avoidance and minimisation measures and after mitigation measures have been implemented for the project.

#### Construction

The erosion and sedimentation controls outlined in Table 8-16 would be designed to mitigate soil loss in accordance with the Blue Book. For any weather events (rain/wind) that exceed the design capacity of controls, material may travel beyond the site boundary and potentially into receiving waterways. For instance, if the sediment basins are full after containing the volume generated by the design event, then some overflow with high turbidity may occur. The potential residual impact would depend on the intensity and duration of the weather event and therefore the amount of material leaving site.

For such weather events, and where it can be demonstrated the erosion and sedimentation controls have been implemented and maintained effectively, the incident is classified as a reportable event in accordance with Roads and Maritime Environmental Incident Classification and Reporting Procedure.

Similarly in the event of an unexpected leak or spill or if unexpected contamination is encountered, potential contamination impacts to surface or groundwater may occur before appropriate containment or clean-up operations can be implemented. For example an unexpected fuel leak from construction plant or vehicles that reaches a waterway or drain prior to containment.

Due to the application of effective environmental management measures, residual affects to soils and water from construction activities are considered to be temporary and of an acceptable nature.

#### Operation

The proposed swales are expected to manage water quality from project runoff to an acceptable level during operation of the project, and have been optimised at locations where sensitive receiving waterways have been identified. The key objective of the project is to minimise the potential impacts on downstream receiving waters, so that the project changes the existing water regime by the smallest amount practicable. This objective is consistent with the *Roads and Maritime's Water Policy, 1997* (RTA, 1997) and *Code of Practice for Water Management, 1999* (RTA, 1999).

Other potential residual impacts may occur during operation of the project in the event of unforeseen leaks or spills of materials that could potentially contaminate nearby waterways or seep into groundwater if uncontained, for example in the event of a road crash or during road maintenance activities. However, the occurrence of road crashes are expected to be reduced by the project due to proposed improvements to road safety.

It is expected that the residual impacts to soils and water from operation of the project would be managed to an acceptable level, however surface water monitoring is proposed for the pre-construction, construction and operational phases of the project to monitor the effectiveness of the implemented surface water quality controls and identify if any additional measures are required.

### 8.3 Aboriginal heritage

This chapter describes the environmental values relating to Aboriginal heritage and identifies the potential impacts to these values as a result of construction and operation of the project. This chapter also recommends environmental management measures to reduce the impacts of the project.

The technical working paper, Aboriginal Cultural Heritage Assessment Report (Appendix M) has been used to inform this chapter.



Table 8-17 sets out the Secretary's Environmental Assessment Requirements (SEARs) and Commonwealth EIS guidelines as they relate to Aboriginal heritage and states where in this EIS these have been addressed.

Table 8-17 NSW and Commonwealth Environmental Assessment Requirements

Requirement	Where addressed in the EIS
<b>Secretary's Environmental Assessment Requirements</b>	
<p><b>Heritage</b> — including:</p> <ul style="list-style-type: none"> <li>impacts to Aboriginal heritage (including cultural and archaeological significance), in particular impacts to Aboriginal objects and potential archaeological deposits (PAD), should be assessed. The assessment shall be undertaken generally consistent with the Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW (OEH, 2011) and related guidelines and requirements (whilst taking into account s.115ZG of the EP&amp;A Act). Where impacts are identified, the assessment shall: <ul style="list-style-type: none"> <li>be undertaken by a suitably qualified heritage consultant(s),</li> <li>demonstrate effective consultation with Aboriginal communities in determining and assessing impacts and developing and selecting options and mitigation measures (including the final proposed measures) generally consistent with the Aboriginal cultural heritage consultation requirements for proponents 2010 (DECCW, 2010),</li> <li>undertake appropriate archaeological investigations generally in accordance with the <i>Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW</i> (DECCW, 2010), to establish the full spatial extent and significance of any archaeological evidence across each site/area of PAD, and include the results of these excavations. If an alternative excavation method is proposed, it shall be developed in consultation with Office of Environment and Heritage,</li> </ul> </li> </ul>	<p>Section 8.3.3</p> <p>Appendix M</p> <p>Section 8.3.1, Section 6.2.3 Details of consultation with Aboriginal communities is provided in Chapter 6</p> <p>Section 8.3.1</p>
<ul style="list-style-type: none"> <li>assess and document the archaeological and cultural significance of cultural heritage values of affected sites, and</li> </ul>	Section 8.3.3
<ul style="list-style-type: none"> <li>detail proposed mitigation and management measures (including measures to avoid significant impacts and an evaluation of the effectiveness of the mitigation measures).</li> </ul>	Section 8.3.5
<b>Commonwealth EIS Guidelines (Commonwealth EPBC Act)</b>	
<p>The EIS must include a description of the environment of the proposal site and the surrounding areas that may be affected by the action. It is recommended that this include the following information:</p> <ul style="list-style-type: none"> <li>A description of the environment in all areas of potential impact, including all components of the environment as defined in Section</li> </ul>	Section 8.3.3

Requirement	Where addressed in the EIS
528 of the EPBC Act: – Heritage values of places.	
<ul style="list-style-type: none"> <li>To support the assessment of local historic and indigenous heritage values, the EIS must include a full heritage impact assessment and the findings of the further program of archaeological survey that was foreshadowed in the referral for this project.</li> </ul>	Section 8.3.3 Appendix M
Impacts to the environment (as defined in section 528) should include but not be limited to the following: <ul style="list-style-type: none"> <li>Removal and degradation of heritage items/places (historic, natural and indigenous).</li> </ul>	Section 8.3.1 Section 8.3.5 Section 8.4
Details of any consultation with indigenous stakeholders.	Section 8.3.1, Section 6.2.3

As well as the SEARs and EIS Guidelines, the Aboriginal heritage assessment has also considered the Commonwealth Heritage Management Principles as outlined in Schedule 7B of the EPBC Regulations. Table 8-18 lists these principles and summarises how each of them has been addressed.

Table 8-18 Consideration of the Commonwealth Heritage Management Principles

Heritage Management Principle	Where addressed in the EIS
The objective in managing Commonwealth Heritage places is to identify, protect, conserve, present and transmit, to all generations, their Commonwealth Heritage values.	The CHAR (Section 5.1) and this assessment identifies Aboriginal sites and values, outlines protections, conservation management strategies, and the transmittal of information (via reporting and artefact curation).
The management of Commonwealth Heritage places should use the best available knowledge, skills and standards for those places, and include ongoing technical and community input to decisions and actions that may have a significant impact on their Commonwealth Heritage values.	The CHAR was prepared by a qualified archaeologists and Aboriginal heritage specialists and has been used to inform this assessment. All heritage assessment and Aboriginal community consultation was in accordance with NSW Office of Environment and Heritage guidelines, Commonwealth EPBC requirements, SEARs and the Roads and Maritime PACHCI (Section 1). Aboriginal community consultation is ongoing for the duration of the project.
The management of Commonwealth Heritage places should respect all heritage values of the place and seek to integrate, where appropriate, any Commonwealth, State, Territory and local government responsibilities for those places.	The management strategy for identified Aboriginal sites in Section 9 of the CHAR, and as summarised into Section 8.3.5 of this assessment, was developed in consultation with the Aboriginal community and represents best practice by collecting heritage objects and cultural knowledge

Heritage Management Principle	Where addressed in the EIS
	to inform long term management and increase an understanding of Aboriginal culture for current and future generations.
The management of Commonwealth Heritage places should ensure that their use and presentation is consistent with the conservation of their Commonwealth Heritage values.	The management strategy for identified Aboriginal sites (Section 9 of the CHAR, and as summarised into Section 8.3.5 of this assessment) was developed with Aboriginal community and represents best practice for conserving Aboriginal heritage information and values.
The management of Commonwealth Heritage places should make timely and appropriate provision for community involvement, especially by people who: (a) have a particular interest in, or associations with, the place; and(b) may be affected by the management of the place;	Aboriginal community have been involved in the identification, significance assessment, and mitigation for all Aboriginal heritage objects as detailed in the CHAR and outlined in this assessment. All management recommendations have been prepared in consultation with the Aboriginal community.
Indigenous people are the primary source of information on the value of their heritage and that the active participation of indigenous people in identification, assessment and management is integral to the effective protection of indigenous heritage values.	Consultation with the Aboriginal community regarding the value of heritage objects within the project area was a central feature of the CHAR (Section 4, Section 6 and Section 9) and included an Aboriginal focus group meeting (Appendix B of the CHAR). The outcomes of this process are reflected in this assessment.
The management of Commonwealth Heritage places should provide for regular monitoring, review and reporting on the conservation of Commonwealth Heritage values.	The management strategy for identified Aboriginal sites (Section 9 of the CHAR, and as summarised into Section 8.3.5 of this assessment) was developed with Aboriginal community and represents best practice for monitoring, review and report on the conservation of Aboriginal heritage values.

### 8.3.1 Assessment methodology

The Aboriginal Cultural Heritage Assessment Report (Appendix M) used to inform this chapter has been prepared by Dr Matthew Kelleher of Kelleher Nightingale Consulting Pty Ltd.

The archaeological and cultural heritage values of the project area were previously identified as part of the *Stage 2 Procedure for Aboriginal Cultural Heritage Consultation and Investigation* (PACHCI) for the project in 2016. The assessment included a review of background information, including identification of previously recorded Aboriginal sites registered on the Aboriginal Heritage Information Management System (AHIMS) database, predictive modelling, Aboriginal community consultation and a full coverage archaeological field survey.

The methodology outlined below explains where sources of information were gathered and how those sources have been verified, either through archaeological survey or from cultural and archaeological knowledge provided by Aboriginal stakeholders.

## Previous archaeological investigations

Previous archaeological investigations have taken place within the project area and in the surrounding area. These investigations have involved pedestrian survey and desktop assessment, although some excavation programs have been carried out. Key, previous investigations that have been reviewed and considered as part of this assessment are:

- Assessments carried out for the Western Sydney Airport in 1985, 1997 and 2015. The most recent investigations included test excavation program that targeted a representative selection of landform types
- Assessments carried out for the South Penrith Development Site (later known as Glenmore Park) in 1981, 2001 and 2003. These investigations included a subsurface testing program of the area of potential archaeological sensitivity
- A number of archaeological sites were recorded on the AHIMS database within Lot 1 DP109697, Luddenham, during an archaeological field survey for an unknown project
- An Aboriginal archaeological survey was carried out for The Northern Road between Old Northern Road at Narellan and Mersey Road project at Bringelly in 2012
- The Stage 2 Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI) assessment for the project in 2016.

A detailed discussion of the results of investigations the previous investigations listed above is presented in Appendix M - Aboriginal Cultural Heritage Assessment Report (CHAR). Results of these previous investigations, including the results of excavations previously undertaken, have been used to inform the CHAR and subsequently this chapter. This information includes details of the location and significance of identified Aboriginal heritage items.

## Archaeological survey

Two AHIMS searches were carried out for the project in August and September 2015.

An Aboriginal archaeological survey assessment of the project area was carried out as part of the Stage 2 PACHCI assessment and to verify the desktop literature reviews and AHIMS searches. The full coverage survey was carried out in 2015 and 2016 by a team comprising representatives from the Deerubbin Local Aboriginal Land Council, Gandangara Local Aboriginal Land Council and archaeologists from Kelleher Nightingale Consulting.

Digital and printed maps were used for reference. Handheld GPS receivers were used to register archaeological sites. The team closely inspected exposed ground, such as unsealed tracks or eroded surfaces, for artefacts and any old growth trees for evidence of Aboriginal bark removal. The survey also focused on establishing a detailed appreciation of archaeologically sensitive landforms to assist in identifying the full spatial extent of identified archaeological sites.

## Aboriginal stakeholder consultation

Consultation with Aboriginal communities, including Deerubbin Local Aboriginal Land Council, Gundungarra Local Aboriginal Land Council and registered Aboriginal stakeholders for the project was carried out in accordance with *Aboriginal cultural heritage consultation requirements for proponents, 2010* (DECCW, 2010). Detailed discussion on Aboriginal stakeholder consultation as outlined in Section 8.3.2.

### 8.3.2 Existing environment

The following sections outline the existing environmental conditions relevant to Aboriginal heritage. This is considered to provide a baseline of existing conditions from which potential impacts from the project have been assessed.

## **Landscape context**

The project area is located on the Cumberland Plain, a low lying and gently undulating sub-region of the Sydney Basin. The formation of the basin began between 250 to 300 million years ago when river deltas gradually replaced the ocean that had extended as far west as Lithgow (Clark and Jones, 1991).

The basal geology of the project area is dominated by Bringelly Shale. More recent Quaternary Alluvium is present along the low lying areas adjacent to Badgerys Creek with a small deposit of Cranebrook Formation geology is present adjacent to Surveyors Creek.

Three principal soil landscapes are present within the project area. The basal geology is overlain by South Creek soils within the immediate vicinity of major creeks, transitioning to Blacktown soils on crests and low rises and Luddenham soils on hills and ridge slopes.

The erosional Luddenham soil landscape is situated on low rolling to steep hills with narrow convex ridges and crests, moderately inclined slopes and narrow drainage lines and has a high erosional susceptibility with moderate surface movement potential. The steeper hill slopes of the Luddenham Soil Landscapes are subject to minor gully erosion and moderate sheet erosion in areas that have been stripped of vegetation. Aboriginal sites within these areas are likely to be disturbed low density scatters exposed by the eroding landscape. However, landforms and vegetation that create stability for the soil landscape could have preserved Aboriginal sites. The landforms associated with this soil landscape are generally the furthest away from water sources and associated resources. It is therefore likely that these areas were utilised in a different way to other landforms in the project area.

## **Land use history**

Land use practices have had a variable impact on the landscape within the project area. The area is predominantly cleared of native vegetation and utilised for grazing cattle and cultivating crops. A number of large dams have been constructed throughout the area within former creek channels, altering the area's hydrology and drainage patterns. The landscape within the areas of urban expansion at Glenmore Park and the township of Luddenham contain low density residential and commercial structures with associated utilities and infrastructure. A portion of the project area is located within DEOH that contain several sealed and unsealed roads, a graded perimeter track, various buildings, dams and a landscaped golf course.

## **Ethnohistoric context**

The project area lies within a landscape which was important to, and intensively used by, past Aboriginal peoples (Attenbrow, 2002). The arrival of European settlers began a cataclysmic series of events which radically changed the lifestyle of Aboriginal people on the Cumberland Plain. Contact with Europeans introduced diseases, such as smallpox, that drastically altered the size and structure of the Aboriginal population, whilst the expansion of settlements and establishment of farmland subsumed the traditional areas used to meet subsistence needs (Attenbrow, 2002).

After their arrival in Sydney Cove in 1788, the British set about exploring the surrounding area. Early historical observations described the Cumberland Plain as a mosaic of Aboriginal groups associated with particular areas of land. These groups were described as 'tribes' in many historical observations, when in fact they were more likely small territorial clans or local clans consisting of extended family groups, forming larger land-using bands linked through marriage and communal participation in subsistence gathering activities (Attenbrow, 2002:22, Brook and Kohen, 1991:2).

It was only in the late 19th Century that the name Darug (also referred to as Daruk, Dharuk, Dharook, and Dharug) was used to refer to the language of the traditional inhabitants of the Cumberland Plain (Attenbrow, 2002:33). In the early 20th Century, anthropologist/linguist R. H. Matthews noted that "the Dharuk speaking people adjoined the Thurawal on the north, extending along the coast to the Hawkesbury River, and inland to what are now Windsor, Penrith, Campbelltown, and intervening towns" (Matthews, 1901:155 [in Attenbrow, 2002: 32]).



Kohen (1986:77) explains that the Aboriginal people who lived between Parramatta and the Blue Mountains were not as dependant on fish and shellfish as groups closer to the coast, but relied on small animals and plant foods in addition to seasonally available freshwater mullet and eels. Tench (1793:230) observed that 'they depend but little on fish, as the river yields only millets and that their principal support is derived from small animals which they kill and some roots (a species of wild yam chiefly) which they dig out of the earth'. These wild yams were found in considerable quantities along the banks of the Nepean and Hawkesbury Rivers. Berries, Banksia flowers and wild honey were also recorded as foods of the local inhabitants (Collins, 1798 [Kohen, 1985:9]). A particularly important plant food was the Burrawong (*Macrozamia communis*), which provided a nutritious nut that was pounded and soaked in running water to leach out toxins before the flour-like extract was made into small cakes and baked over a fire (Kohen, 1993:8).

Small animals provided the protein component of the Aboriginal diet on the Cumberland Plain, with hunting comprising a major economic role of the men. Along the river, traps and snares were set for bandicoots and wallabies, while decoys for snaring birds were also a commonly employed technique, 'these are formed of underwood and reeds, long and narrow, shaped like a mound raised over a grave, with a small aperture at one end for the admission of the prey' (Tench, 1793 [Kohen, 1985:9]). Possums and gliders were particularly common in the open woodland across the Cumberland Plain and probably formed the main sources of animal food. These were hunted in a number of ways, including smoking out the animal by lighting a fire in the base of a hollow tree, burning large tracts of land and gathering the stranded animals, as well as cutting toe-holds in trees mentioned above (Kohen, 1993:10; Tench, 1793:82).

### AHIMS search results

Aboriginal heritage sites were recorded on AHIMS within the search area. Of the 60 sites, one (B6, AHIMS # 45-5-2636) was found within the project area. The subsequent archaeological survey (see below) identified 28 sites within the project area (this includes site B6).

### Archaeological survey

As a result of the survey, 28 Aboriginal archaeological sites were identified within the project area (see Table 8-19). The sites comprised 23 artefact scatters and five isolated artefacts. The sites were predominantly found on the crests and upper slopes of a north–south ridgeline or on lower slopes and elevated locations adjacent to creeks. Artefacts were predominantly silcrete and silicified tuff with smaller quantities of quartz, medium grained siliceous material, chert and mudstone. The majority of recorded artefact types were flakes or flake fragments with small numbers of cores, utilised flakes and retouched flakes.

The spatial extent of sites was well defined by topography. Ground surface visibility was variable across the project area. The majority of the project area had moderate ground surface visibility with intermittent vegetation cover of the immediate ground surface. In areas where the ground cover had been disturbed by modern landuse practices such as excavated drainage channels, damming, vehicle and cattle tracks or natural process such as erosion and fluvial activity, ground surface visibility was generally high.

The locations of these sites are shown on Table 8-19 and Figure 8-8.

Table 8-19 Identified Aboriginal cultural heritage values within the project area

Site Name	AHIMS Site ID	Site Features	GDA Easting	GDA Northing
B 6	45-5-2636	Artefact		
TNR AFT 06	45-5-4785	Artefact		
TNR AFT 07	45-5-4784	Artefact		
TNR AFT 08	45-5-4789	Artefact		
TNR AFT 10	45-5-4781	Artefact		



Site Name	AHIMS Site ID	Site Features	GDA Easting	GDA Northing
TNR AFT 11	45-5-4780	Artefact		
TNR AFT 12	45-5-4778	Artefact		
TNR AFT 13	45-5-4779	Artefact		
TNR AFT 14	45-5-4786	Artefact		
TNR AFT 16	45-5-4796	Artefact		
TNR AFT 17	45-5-4787	Artefact		
TNR AFT 19	45-5-4790	Artefact		
TNR AFT 20	45-5-4792	Artefact		
TNR AFT 22	45-5-4793	Artefact		
TNR AFT 23	45-5-4794	Artefact		
TNR AFT 24	45-5-4795	Artefact		
TNR AFT 25	45-5-4791	Artefact		
TNR AFT 26	45-5-4798	Artefact		
TNR AFT 27	45-5-4799	Artefact		
TNR AFT 29	45-5-4801	Artefact		
TNR AFT 30	45-5-4797	Artefact		
TNR AFT 31	45-5-4802	Artefact		
TNR AFT 33	tbc	Artefact		
TNR IF 01	45-5-4805	Artefact		
TNR IF 02	45-5-4806	Artefact		
TNR IF 03	45-5-4807	Artefact		
TNR IF 04	45-5-4808	Artefact		
TNR IF 05	45-5-4809	Artefact		

### Aboriginal stakeholder consultation

Roads and Maritime is committed to effective consultation with Aboriginal communities regarding the project activities and their potential for impact on Aboriginal cultural heritage. The Roads and Maritime PACHCI was developed to provide a consistent means of effective consultation with Aboriginal communities regarding activities which may impact on Aboriginal cultural heritage and a consistent assessment process for Roads and Maritime activities across NSW. The aim of consultation is to integrate cultural and archaeological knowledge and ensure registered stakeholders have information to make decisions on Aboriginal cultural heritage. Aboriginal cultural heritage is defined in the PACHCI as 'The tangible (objects) and intangible (dreaming stories, songlines, and places) cultural practices and traditions associated with past and present-day Aboriginal communities' (Roads and Maritime, 2011).

The PACHCI outlines a four stage process for investigating potential impacts to Aboriginal cultural heritage as a result of Roads and Maritime's road planning, development, construction and maintenance activities. It includes a process of community consultation that aims to ensure that the role, function and views of Aboriginal people are considered and respected by Roads and Maritime (Roads and Maritime, 2011). The PACHCI also sets out Roads and Maritime's legislative responsibilities.

Chapter 5 of the PACHCI details the four stages in the consultation and assessment process as follows:

- Stage 1: Initial RMS assessment (ie desktop assessment)
- Stage 2: Further assessment and site survey
- Stage 3: Formal consultation and preparation of a cultural heritage assessment report (ie the CHAR)
- Stage 4: Implement project mitigation measures.

In the case of the project, stages one through three of PACHCI have been initiated, with the CHAR (Appendix M) satisfying Stage 3 of the PACHCI having been prepared in consultation with the registered Aboriginal stakeholders for the project. Stage 4 of the PACHCI would be initiated during construction through the implementation of the mitigation measures identified in the CHAR and summarised in Section 8.3.5 below, including salvage. Salvage excavation would be undertaken at impacted archaeological sites with at least moderate archaeological significance. Salvage excavation of these sites would focus on the extraction of collections of artefacts related to activity areas and geomorphic information.

Consultation with Aboriginal people has also been carried out in accordance with the *OEH Aboriginal Cultural Heritage Consultation Requirements for Proponents, 2010* (OEH, 2010a) and the requirements of Clause 80C of the National Parks and Wildlife Regulation, 2009. The PACHCI is consistent with these consultation requirements.

Roads and Maritime invited Aboriginal people who hold knowledge relevant to determining the cultural heritage significance of Aboriginal objects and Aboriginal places in the project area to register an interest in a process of community consultation. Investigations for the project have included consultation with 61 Aboriginal community groups and individuals as listed in Appendix M - Aboriginal Cultural Heritage Assessment Report.

The formal consultation process has included:

- Advertising for registered stakeholders (refer Appendix M)
- Government agency notification letters
- Notification of closing date for registration
- Provision of proposed archaeological assessment methodology (20/01/2016) (allowing 28 day review) outlining the methodology to prepare the CHAR
- Ongoing compilation of registrants list, through continuing to register individuals and groups for consultation on the project
- Provision of draft CHAR for review
- Aboriginal focus group meeting to discuss assessment methodology, investigation results, CHAR and detailed mitigation strategies (27/04/2016)
- Ongoing consultation with the local Aboriginal community.

This process for the project included consultation with Deerubbin Local Aboriginal Land Council, Gundungarra Local Aboriginal Land Council and other registered Aboriginal stakeholders for the project in order to assess impacts and develop mitigation measures.

A copy of the draft CHAR was provided to Aboriginal stakeholders for a 28 day review and comment period. Comments were received from Tocomwall and Darug Land Observations. The outcomes of the consultation process are summarised below and reflect the results of the Aboriginal heritage assessment. Comments received from Tocomwall and Darug Land Observations included:

- Support of the draft methodology proposed for the Aboriginal cultural heritage assessment
- Advice as to how the CHAR methodology would inform understanding of the individual cultures that exist in the region
- A comment that any recovered artefacts should be reburied on Country

- Land Observations would like to receive a copy of any section 90 Aboriginal Heritage Impact Permits (AHIP)
- Land Observations would like to be involved in the monitoring of topsoil removal and all other works carried out on site.

### 8.3.3 Assessment of potential impacts

#### Statement of significance

*The Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b) requires significance assessment according to criteria established in the *Australia ICOMOS Burra Charter*, 1999 (Australia ICOMOS, 1999). The Burra Charter and its accompanying guidelines are considered best practice standard for cultural heritage management, specifically conservation, in Australia.

The project area contains 28 identified Aboriginal archaeological sites containing Aboriginal objects as defined under the *National Parks and Wildlife Act, 1974*. The significance of recorded Aboriginal archaeological sites within the project area ranges from low to moderate, with the majority having been assessed as being of moderate significance. This assessment is based on a consideration of the research potential, connectivity (association with other sites), representativeness, intactness and rarity. Specific Aboriginal stakeholder comments and cultural values have been incorporated into the overall significance assessment as obtained during the consultation process.

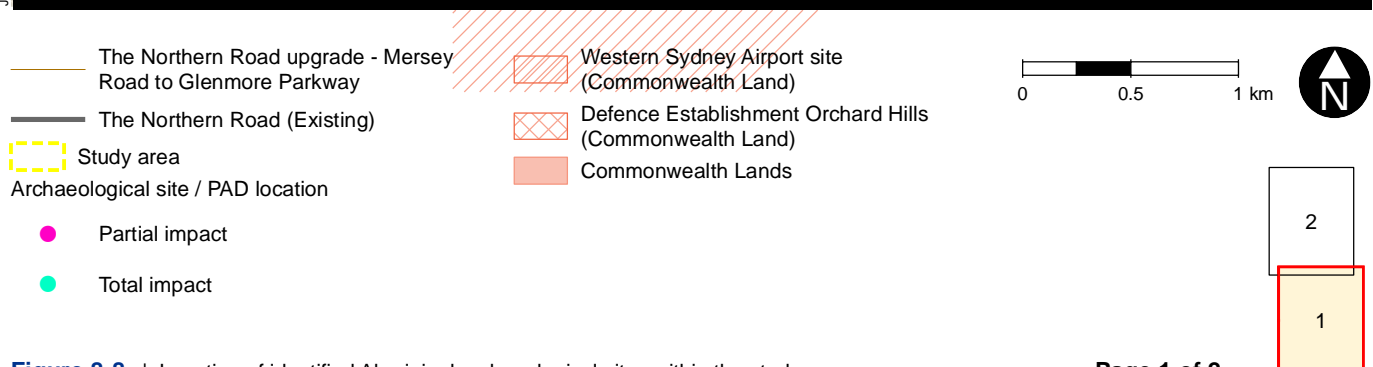
The identified level of moderate significance is predominantly driven by the fact that artefact scatters along the ridge (The Northern Road) are spatially connected by the landform itself, but also represent connections through thousands of years of time. These connections offer insights into the movements and actions of past Aboriginal people, enabling an understanding of how they spatially organised their culture and how they perceived the world around them. Additionally, recent research has found a strong association between contemporary use and perceptions of landscape and past Aboriginal landscapes (eg for travel). Therefore the significance of The Northern Roads' Aboriginal heritage also has much to do with what it can tell us about how the modern world utilises a landscape.

Collectively, the group of archaeological sites has a greater scientific and socio-cultural assessment value than individual site assessments. In this regard the projects' collection of impacted archaeological sites are rare as an assessment group, offering a statistically significant level of information about an area (the south west Cumberland Plain) where little large scale, connectable or representative information exists. Information obtained through the proposed salvaging of artefacts at key locations along this road corridor would greatly enhance our cultural and archaeological understanding of the area and allow for significant interpretation of past events and better management of Aboriginal heritage in the future.

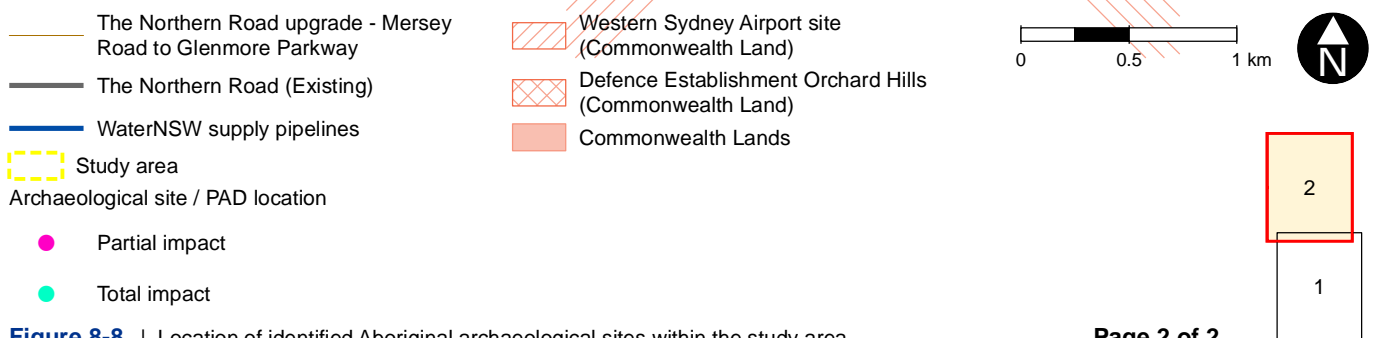
Table 8-20 Significance of Aboriginal sites within the project area

Significance	Site	Justification
Moderate	B 6 (45-5-2636) TNR AFT 06 (45-5-4785) TNR AFT 07 (45-5-4784) TNR AFT 08 (45-5-4789) TNR AFT 11 (45-5-4780) TNR AFT 12 (45-5-4778) TNR AFT 13 (45-5-4779) TNR AFT 14 (45-5-4786)	These sites offer good research potential as they represent intact archaeological deposits within the project area.  Further investigation would add to our understanding of Aboriginal activities in a transitional landscape between the Cumberland Plain and Nepean River.

Significance	Site	Justification
	TNR AFT 16 (45-5-4796) TNR AFT 17 (45-5-4787) TNR AFT 19 (45-5-4790) TNR AFT 20 (45-5-4792) TNR AFT 22 (45-5-4793) TNR AFT 24 (45-5-4795) TNR AFT 26 (45-5-4798) TNR AFT 27 (45-5-4799) TNR AFT 29 (45-5-4801) TNR AFT 30 (45-5-4797) TNR AFT 31 (45-5-4802) TNR AFT 33 (tbc)	
Low	TNR AFT 10 (45-5-4781) TNR AFT 23 (45-5-4794) TNR AFT 25 (45-5-4791) TNR IF 01 (45-5-4805) TNR IF 02 (45-5-4806) TNR IF 03 (45-5-4807) TNR IF 04 (45-5-4808) TNR IF 05 (45-5-4809)	<p>These sites are highly disturbed and the surrounding area showed very little potential for further archaeology.</p> <p>Every Aboriginal site is important to the local Aboriginal community, however, there are more intact or better examples of this site type within the project area and wider local area.</p> <p>Any change or loss of these sites is unlikely to diminish the overall Aboriginal cultural heritage values of the project area and wider local area.</p>



**Figure 8-8** | Location of identified Aboriginal archaeological sites within the study area



**Figure 8-8** | Location of identified Aboriginal archaeological sites within the study area



## Potential impacts

The CHAR evaluated the potential harm of the project on 28 Aboriginal archaeological heritage sites.

Where possible the project design has been modified to minimise the impacts to the identified cultural places and archaeological sites. The project design was able to avoid impact to seven archaeological sites through realignment. Furthermore, the refined project design has limited the impact to 16 archaeological sites which would only be partially impacts (ie partial impact). The remaining 12 archaeological sites would be wholly impacted by the project (ie total impact) as shown in Table 8-21. The location of totally impacted and partially impacted sites is also shown on Figure 8-8.

Table 8-21 Potential impact of the project on Aboriginal heritage

Site name	Assessed significance	Impact assessment	Proposed mitigation strategy
B 6	Moderate	Partial Impact	<ul style="list-style-type: none"> <li>Barrier fencing to be erected on the project approval boundary for the extent of the site to ensure that no construction impact extends into the portion of the site outside the project boundary. Portion of site area outside of project boundary should be identified on the Construction Environmental Management Plan (CEMP) as environmentally sensitive no-go zone to ensure no impact</li> <li>Archaeological salvage excavation</li> <li>Relevant project approval required prior to commencement of works affecting the site.</li> </ul>
TNR AFT 06	Moderate	Total Impact	<ul style="list-style-type: none"> <li>Archaeological salvage excavation</li> <li>Relevant project approval required prior to commencement of works affecting the site.</li> </ul>
TNR AFT 07	Moderate	Total Impact	<ul style="list-style-type: none"> <li>Archaeological salvage excavation</li> <li>Relevant project approval required prior to commencement of works affecting the site.</li> </ul>
TNR AFT 08	Moderate	Partial Impact	<ul style="list-style-type: none"> <li>Barrier fencing to be erected on the project approval boundary for the extent of the site to ensure that no construction impact extends into the portion of the site outside the project boundary. Portion of site area outside of project boundary should be identified on the Construction Environmental Management Plan (CEMP) as environmentally sensitive no-go zone to ensure no impact</li> <li>Archaeological salvage excavation</li> <li>Relevant project approval required prior to commencement of works affecting the site.</li> </ul>
TNR AFT 10	Low-moderate	Partial Impact	<ul style="list-style-type: none"> <li>Relevant project approval required prior to commencement of works affecting the site.</li> </ul>

Site name	Assessed significance	Impact assessment	Proposed mitigation strategy
TNR AFT 11	Moderate	Partial Impact	<ul style="list-style-type: none"> <li>Barrier fencing to be erected on the project approval boundary for the extent of the site to ensure that no construction impact extends into the portion of the site outside the project boundary. Portion of site area outside of project boundary should be identified on the Construction Environmental Management Plan (CEMP) as environmentally sensitive no-go zone to ensure no impact</li> <li>Archaeological salvage excavation of impacted portion of site</li> <li>Relevant project approval required prior to commencement of works affecting the site.</li> </ul>
TNR AFT 12	Moderate	Partial Impact	<ul style="list-style-type: none"> <li>Barrier fencing to be erected on the project approval boundary for the extent of the site to ensure that no construction impact extends into the portion of the site outside the project boundary. Portion of site area outside of project boundary should be identified on the Construction Environmental Management Plan (CEMP) as environmentally sensitive no-go zone to ensure no impact</li> <li>Salvage excavation of impacted portion of site</li> <li>Relevant project approval required prior to commencement of works affecting the site.</li> </ul>
TNR AFT 13	Moderate	Partial Impact	<ul style="list-style-type: none"> <li>Barrier fencing to be erected on the project approval boundary for the extent of the site to ensure that no construction impact extends into the portion of the site outside the project boundary. Portion of site area outside of project boundary should be identified on the Construction Environmental Management Plan (CEMP) as environmentally sensitive no-go zone to ensure no impact</li> <li>Archaeological salvage excavation</li> <li>Relevant project approval required prior to commencement of works affecting the site.</li> </ul>
TNR AFT 14	Moderate	Total Impact	<ul style="list-style-type: none"> <li>Barrier fencing to be erected on the project approval boundary for the extent of the site to ensure that no construction impact extends into the portion of the site outside the project boundary. Portion of site area outside of project boundary should be identified on the Construction Environmental Management Plan (CEMP) as environmentally sensitive no-go zone to ensure no impact</li> <li>Archaeological salvage excavation</li> <li>Relevant project approval required prior to commencement of works affecting the site.</li> </ul>

Site name	Assessed significance	Impact assessment	Proposed mitigation strategy
TNR AFT 16	Moderate	Total Impact	<ul style="list-style-type: none"> <li>Archaeological salvage excavation</li> <li>Relevant project approval required prior to commencement of works affecting the site.</li> </ul>
TNR AFT 17	Moderate	Total Impact	<ul style="list-style-type: none"> <li>Archaeological salvage excavation</li> <li>Relevant project approval required prior to commencement of works affecting the site.</li> </ul>
TNR AFT 19	Moderate	Total Impact	<ul style="list-style-type: none"> <li>Archaeological salvage excavation</li> <li>Relevant project approval required prior to commencement of works affecting the site.</li> </ul>
TNR AFT 20	Moderate	Partial Impact	<ul style="list-style-type: none"> <li>Barrier fencing to be erected on the project approval boundary for the extent of the site to ensure that no construction impact extends into the portion of the site outside the project boundary. Portion of site area outside of project boundary should be identified on the Construction Environmental Management Plan (CEMP) as environmentally sensitive no-go zone to ensure no impact</li> <li>Archaeological salvage excavation</li> <li>Relevant project approval required prior to commencement of works affecting the site.</li> </ul>
TNR AFT 22	Moderate	Partial Impact	<ul style="list-style-type: none"> <li>Barrier fencing to be erected on the project approval boundary for the extent of the site to ensure that no construction impact extends into the portion of the site outside the project boundary. Portion of site area outside of project boundary should be identified on the Construction Environmental Management Plan (CEMP) as environmentally sensitive no-go zone to ensure no impact</li> <li>Archaeological salvage excavation</li> <li>Relevant project approval required prior to commencement of works affecting the site.</li> </ul>
TNR AFT 23	Low	Total Impact	<ul style="list-style-type: none"> <li>Relevant project approval required prior to commencement of works affecting the site.</li> </ul>
TNR AFT 24	Moderate	Partial Impact	<ul style="list-style-type: none"> <li>Barrier fencing to be erected on the project approval boundary for the extent of the site to ensure that no construction impact extends into the portion of the site outside the project boundary. Portion of site area outside of project boundary should be identified on the Construction Environmental Management Plan (CEMP) as environmentally sensitive no-go zone to ensure no impact</li> </ul>

Site name	Assessed significance	Impact assessment	Proposed mitigation strategy
			<ul style="list-style-type: none"> <li>Archaeological salvage excavation</li> <li>Relevant project approval required prior to commencement of works affecting the site.</li> </ul>
TNR AFT 25	Low	Total Impact	<ul style="list-style-type: none"> <li>Relevant project approval required prior to commencement of works affecting the site.</li> </ul>
TNR AFT 26	Moderate	Partial Impact	<ul style="list-style-type: none"> <li>Barrier fencing to be erected on the project approval boundary for the extent of the site to ensure that no construction impact extends into the portion of the site outside the project boundary. Portion of site area outside of project boundary should be identified on the Construction Environmental Management Plan (CEMP) as environmentally sensitive no-go zone to ensure no impact</li> <li>Archaeological salvage excavation</li> <li>Relevant project approval required prior to commencement of works affecting the site.</li> </ul>
TNR AFT 27	Moderate	Partial Impact	<ul style="list-style-type: none"> <li>Barrier fencing to be erected on the project approval boundary for the extent of the site to ensure that no construction impact extends into the portion of the site outside the project boundary. Portion of site area outside of project boundary should be identified on the Construction Environmental Management Plan (CEMP) as environmentally sensitive no-go zone to ensure no impact</li> <li>Archaeological salvage excavation</li> <li>Relevant project approval required prior to commencement of works affecting the site.</li> </ul>
TNR AFT 29	Moderate	Partial Impact	<ul style="list-style-type: none"> <li>Barrier fencing to be erected on the project approval boundary for the extent of the site to ensure that no construction impact extends into the portion of the site outside the project boundary. Portion of site area outside of project boundary should be identified on the Construction Environmental Management Plan (CEMP) as environmentally sensitive no-go zone to ensure no impact</li> <li>Archaeological salvage excavation</li> <li>Relevant project approval required prior to commencement of works affecting the site.</li> </ul>
TNR AFT 30	Moderate	Partial Impact	<ul style="list-style-type: none"> <li>Barrier fencing to be erected on the project approval boundary for the extent of the site to ensure that no construction impact extends into the conserved portion of the site. Portion of site area outside of project boundary should be identified on the Construction Environmental Management Plan (CEMP) as</li> </ul>

Site name	Assessed significance	Impact assessment	Proposed mitigation strategy
			<p>environmentally sensitive no-go zone to ensure no impact</p> <ul style="list-style-type: none"> <li>Archaeological salvage excavation</li> <li>Relevant project approval required prior to commencement of works affecting the site.</li> </ul>
TNR AFT 31	Moderate	Partial Impact	<ul style="list-style-type: none"> <li>Barrier fencing to be erected on the project approval boundary for the extent of the site to ensure that no construction impact extends into the conserved portion of the site. Portion of site area outside of project boundary should be identified on the Construction Environmental Management Plan (CEMP) as environmentally sensitive no-go zone to ensure no impact</li> <li>Archaeological salvage excavation</li> <li>Relevant project approval required prior to commencement of works affecting the site.</li> </ul>
TNR AFT 33	Moderate	Partial Impact	<ul style="list-style-type: none"> <li>Barrier fencing to be erected on the project approval boundary for the extent of the site to ensure that no construction impact extends into the conserved portion of the site. Portion of site area outside of project boundary should be identified on the Construction Environmental Management Plan (CEMP) as environmentally sensitive no-go zone to ensure no impact</li> <li>Archaeological salvage excavation</li> <li>Relevant project approval required prior to commencement of works affecting the site.</li> </ul>
TNR IF 01	Low	Total Impact	<ul style="list-style-type: none"> <li>Relevant project approval required prior to commencement of works affecting the site.</li> </ul>
TNR IF 02	Low	Total Impact	<ul style="list-style-type: none"> <li>Relevant project approval required prior to commencement of works affecting the site.</li> </ul>
TNR IF 03	Low	Total Impact	<ul style="list-style-type: none"> <li>Relevant project approval required prior to commencement of works affecting the site.</li> </ul>
TNR IF 04	Low	Total Impact	<ul style="list-style-type: none"> <li>Relevant project approval required prior to commencement of works affecting the site.</li> </ul>
TNR IF 05	Low	Total Impact	<ul style="list-style-type: none"> <li>Relevant project approval required prior to commencement of works affecting the site.</li> </ul>

Twenty archaeological sites would require mitigation through archaeological salvage excavation because they exhibit at least moderately intact archaeological deposit, relatively intact soil structure, information bearing archaeological objects and Aboriginal cultural value. Recovery of information through archaeological salvage excavation would offset the loss caused by the upgrade works by increasing the understanding, strengthening the interpretation and improve the

recognition of Aboriginal heritage within an area where little previous documented information exists. Additionally, for these sites which would only be partially impacted by the project, the portion of the site outside the project boundary should be fenced off prior to the commencement of construction works to ensure that the area is not inadvertently affected as a result of construction work.

No archaeological salvage excavation would be required for the remaining eight sites as they have been assessed as being of low significance because they are only partially impacted by construction, highly disturbed or contain no secondary archaeological information. For the most part these sites would be totally impacted by the construction works and therefore no further mitigation would be required, however in the case of TNR AFT 10 which is of low-moderate significance and would only be partially impacted by the works, the portion of the site outside the project boundary would also be fenced off prior to the commencement of construction.

### 8.3.4 Summary of potential impacts to the environment of Commonwealth land

A summary of potential impacts to the environment of Commonwealth land as a result of construction and operation of the project is provided in this section.

Potential construction related Aboriginal heritage impacts are outlined in Section 8.3.3. This includes potential harm of the project on 28 Aboriginal archaeological heritage sites of low-moderate significance. In total 12 of these sites are located on Commonwealth land, the majority within the DEOH. Table 8-22 provides a summary of the assessed significance and impacts to these sites as a result of construction of the project.

Table 8-22 Potential impact of the project to the environment of Commonwealth land in relation to Aboriginal heritage

Site name	Assessed significance	Impact assessment
B 6	Moderate	Partial Impact
TNR AFT 06	Moderate	Total Impact
TNR AFT 07	Moderate	Total Impact
TNR AFT 08	Moderate	Partial Impact
TNR AFT 10	Low-moderate	Partial Impact
TNR AFT 11	Moderate	Partial Impact
TNR AFT 12	Moderate	Partial Impact
TNR AFT 30	Moderate	Partial Impact
TNR IF 01	Low	Total Impact
TNR IF 02	Low	Total Impact
TNR IF 03	Low	Total Impact
TNR IF 05	Low	Total Impact

This would result in impacts of low-moderate Aboriginal heritage significance. Impacts to these heritage items would be mitigated through the measures outlined in Section 8.3.5.

There are no operational related impacts to Aboriginal heritage identified for the project, therefore no potential operational impacts to Commonwealth land.

In summary, the potential Aboriginal heritage impacts to the environment of Commonwealth land during construction are not anticipated to be greater or different to those outlined above, limited to the identified heritage items on Commonwealth land. Additionally the residual impacts are considered to be consistent with those outlined in Section 8.3.6.



### 8.3.5 Environmental management measures

#### Expected environmental outcomes

The following general management outcomes would be implemented in accordance with the management procedures outlined in Table 8-23:

- Avoidance of Aboriginal archaeological sites beyond the project area
- Conservation of Aboriginal archaeological sites partially outside impact area to avoid additional or inadvertent impacts
- Mitigation through archaeological salvage excavation including:
  - To salvage a representative sample of the identified archaeological sites prior to construction impact
  - To analyse the salvaged archaeological material to gain and conserve knowledge and understanding of the scientific and cultural information exhibited by the activities associated with landforms within the project area.

Specific outcomes that would be achieved through the implementation of environmental management measures include:

- Minimising or avoiding impacts on known Aboriginal heritage sites
- Undertake all works in accordance with the provisions of cultural heritage management plans
- The employment of an approved salvage excavation plan in accordance with the salvage excavation methodology outlined in Appendix M
- Follow correct procedure to ensure notification of any non-Aboriginal heritage objects/places uncovered during construction
- Compliance with the relevant legislative requirements and project conditions of approval
- The project offers an opportunity to significantly advance the interpretation and management of Aboriginal heritage of the surrounding area by providing a baseline foundation for future heritage assessments.

#### Expected effectiveness

Project-specific management measures have been developed with the aim of minimising or mitigating, as far as practical, Aboriginal heritage impacts as described above. The management and mitigation measures draw on best management practice, government standards and guidelines, and specialist knowledge.

A management strategy (Cultural Heritage Management Plan) is outlined in the CHAR to facilitate the preconstruction mitigation plan and to enable the transition to construction and then guide ongoing construction program. Aboriginal stakeholders have been consulted regarding the mitigation plan and ongoing Cultural Heritage Management Plan to ensure upfront agreement regarding impacts to Aboriginal heritage and appropriate management of Aboriginal heritage.

A Construction Cultural Heritage Management Plan (CCHMP) including reference to the proposed salvage excavation methodology outlined in the CHAR would be prepared as part of the CEMP prior to construction in consultation with the NSW Heritage Division of OEH. The CHAR including the proposed salvage excavation methodology have been prepared in consultation with Aboriginal stakeholder groups. The CHMP would be prepared to address the requirements of the project approvals, the environmental management measures outlined in this EIS and all applicable legislation.

The CHAR has been prepared by Dr Matthew Kelleher and a suitably qualified archaeological consultant would also be responsible for the delivery of heritage management during construction including the salvage excavation program and directing the excavation component of the Aboriginal archaeological assessment.

In order to achieve the most robust and comparable result, Roads and Maritime advocates open area salvage excavation. The salvage methodology outlined in the CHAR is highly beneficial because it creates a robust inter-site sample, sufficiently random, critical for regional comparative analysis. No other method is as efficient or effective. The main aims of the proposed salvage excavation program are:

- Salvage a representative sample of the identified archaeological sites prior to construction impact
- Analyse the salvaged archaeological material to gain and conserve knowledge and understanding of the scientific and cultural information exhibited by the activities associated with landforms within the project area
- Analyse the geomorphological history of the project area, specifically examining the impacts of fluvial and erosional forces on the archaeological record (taphonomy and chronology)
- Retrieve a suitable quantity of artefacts for a regional analysis.

Salvage excavation would be undertaken at impacted archaeological sites with at least moderate archaeological significance. Salvage excavation of these sites would focus on the extraction of collections of artefacts related to activity areas and geomorphic information. A detailed salvage excavation methodology is outlined in Appendix M and will be incorporated into the project's CHMP. In summary, the salvage excavation methodology would include:

- Phase 1 excavations consisting of a series of 1 x 1 m<sup>2</sup> are excavated on a transect grid overlain on each site to mark the spread of lithics and related geomorphic activity. Core samples measuring at least 0.5 m deep will be collected as part of Phase 1
- Phase 2 excavations to further investigate information bearing deposits identified at Phase 1. A series of 9 x 1 m<sup>2</sup> expansion squares (3 x 3 m area, including original Phase 1 square) would be excavated around those deposits
- Phase 3 excavations are required where the Phase 2 triggers are found to extend beyond the 3 x 3 m Phase 2 excavation area. The location of Phase 3 open area investigations would be based on Phase 1 and 2 results.

Artefacts would be analysed on a comparable level with previous analyses of excavated assemblages. Information derived from this analysis; in particular the identification of specific artefact types and their distributions and associations; would be used to put together interpretations about how sites were used, where sites were located across the landscape, the age of sites and to assess cultural heritage values. By comparing different areas it would be possible to determine whether there were differences in the kinds of activities carried out and if different activities were related to different landforms.

The management measures outlined in this EIS have also been developed in consultation with Aboriginal communities, including Deerubbin Local Aboriginal Land Council, Gundungarra Local Aboriginal Land Council and registered Aboriginal stakeholders for the project. Consultation would continue throughout excavation and salvage activities to ensure the effectiveness of those activities.

Reporting and management requirements included in the *RMS Standard Procedure – Unexpected Heritage Items* in the event of unexpected finds would also be implemented as required. The procedure is effective at managing unknown or unexpected archaeological finds.

Table 8-23 outlines environmental management measures that have been developed to specifically manage potential impacts which have been predicted as a result of the proposed works.

Further detail regarding the management outcomes to be implemented in accordance with the management procedures for the project is provided in Appendix M.

Table 8-23 Aboriginal heritage environmental management measures

Impact	Ref #	Environmental management measures	Responsibility	Timing	Effectiveness of measures
Aboriginal construction heritage management plan	AH-1	<p>A Construction Cultural Heritage Management Plan (CCHMP) would be prepared prior to construction and implemented as part of the CEMP. The CHMP would include details on:</p> <ul style="list-style-type: none"> <li>• The policy basis for management measures</li> <li>• The erection of any temporary fencing for the protection of heritage sites being partially impacted</li> <li>• Unexpected finds procedures</li> <li>• Responsibilities for heritage management</li> <li>• Salvage excavation methodologies</li> <li>• Consultation requirements</li> <li>• Procedures for monitoring and reporting on the effectiveness of measures.</li> </ul>	Construction Contractor	Pre-construction	<p>Proven to be effective.</p> <p>Monitoring and reporting requirements of the CHMP to confirm effectiveness of measures. Specific measures carried out in accordance with agreed guidelines and by qualified archaeologists.</p>
Archaeological sites partially impacted by the project	AH-2	<p>The location of the portions of these sites to be conserved would be identified in the CHMP, Construction Heritage Sites Map and project inductions to ensure they are not inadvertently damaged as a result of construction works</p> <p>The portion of the site outside the project boundary would be fenced off prior to the commencement of construction works in accordance with the management procedures outlined in the CHMP. Archaeological salvage excavation would be undertaken for the impacted portion of the following sites in accordance with the salvage excavation</p>	Construction contractor	Construction	<p>Expected to be effective.</p> <p>Salvage excavation activities would be carried out in accordance with the methodology outlined in the CHAR by a qualified team and in consultation with relevant stakeholder groups.</p> <p>The salvage methodology is considered both efficient and effective.</p>

Impact	Ref #	Environmental management measures	Responsibility	Timing	Effectiveness of measures
		<p>methodology detailed in Appendix M:</p> <ul style="list-style-type: none"> <li>- B6</li> <li>- TNR AFT 08</li> <li>- TNR AFT 11</li> <li>- TNR AFT 12</li> <li>- TNR AFT 13</li> <li>- TNR AFT 14</li> <li>- TNR AFT 20</li> <li>- TNR AFT 22</li> <li>- TNR AFT 24</li> <li>- TNR AFT 26</li> <li>- TNR AFT 27</li> <li>- TNR AFT 29</li> <li>- TNR AFT 30</li> <li>- TNR AFT 31</li> <li>- TNR AFT 33.</li> </ul>			
Archaeological sites wholly impacted by the project	AH-3	<ul style="list-style-type: none"> <li>• Archaeological salvage excavation would be undertaken for the following wholly impacted sites in accordance with the management procedures outlined in Appendix M: <ul style="list-style-type: none"> <li>- TNR AFT 06</li> <li>- TNR AFT 07</li> <li>- TNR AFT 16</li> <li>- TNR AFT 17</li> <li>- TNR AFT 19</li> </ul> </li> <li>• Archaeological salvage excavation must be completed prior to any activities which may harm Aboriginal objects in accordance with the management procedures outlined in Appendix M</li> <li>• No construction activities would occur on lands to be salvaged until the relevant archaeological</li> </ul>	Roads and Maritime	Pre-Construction	<p>Expected to be effective.</p> <p>Salvage excavation activities would be carried out in accordance with the methodology outlined in the CHAR by a qualified team and in consultation with relevant stakeholder groups.</p>

Impact	Ref #	Environmental management measures	Responsibility	Timing	Effectiveness of measures
		excavations at the nominated site have been completed.			
Unexpected identification of skeletal remains	AH-4	<p>In the event of the unexpected discovery of suspected archaeological Aboriginal human remains during the proposed works, in addition to the procedures outlined in the Roads and Maritime Unexpected Heritage Items Procedure (2015a), the CHMP would require that Roads and Maritime immediately notify the identified knowledge holders of the discovery. If the material is confirmed to be archaeological Aboriginal human remains that consultation would occur with the identified knowledge holders. Procedures for Handling Human Remains are detailed in Appendix M and summarised below:</p> <ul style="list-style-type: none"> <li>• As soon as remains are exposed, all work is to halt at that location immediately and the Project environmental manager on site is to be immediately notified to allow assessment and management: <ul style="list-style-type: none"> <li>– Stop all activities</li> <li>– Secure the site</li> </ul> </li> <li>• Contact police as the discovery of human remains triggers a process which assumes that they are associated with a crime. The NSW Police retain carriage of the process until such time as the remains are confirmed to be Aboriginal or historic</li> <li>• The relevant approval authority(s) will be notified when human remains are found</li> <li>• Once the police process is complete and if remains are not associated with a contemporary crime contact the relevant approval authority(s) who will determine the process in consultation with OEH and/or the Heritage Office as appropriate</li> </ul>	Construction contractor	Construction	Expected to be effective if carried out in accordance with procedures outlined in CHAR.

Impact	Ref #	Environmental management measures	Responsibility	Timing	Effectiveness of measures
		<ul style="list-style-type: none"> <li>- If the remains are identified as Aboriginal, the site is to be secured and the approval authority(s) and all Aboriginal stakeholders are to be notified in writing. The approval authority(s) will act in consultation with OEH as appropriate. OEH will be notified in writing according to the approval authority(s) instructions; or</li> <li>- If the remains are identified as non-Aboriginal (historical) remains, the site is to be secured and the approval authority(s) is to be contacted, who will act in consultation with the Heritage Division as appropriate. The Heritage Division will be notified in writing according to the approval authority(s) instructions</li> <li>• Once the police process is complete and if the remains are identified as not being human work can recommence once the appropriate clearances have been given.</li> </ul>			
Unexpected identification of Aboriginal objects	AH-5	<p>Where there is a proposed change to the project (once approved), this change will be considered in the context of potential impact to Aboriginal cultural heritage, whether increased or reduced. Where a proposed change to the approved project occurs outside of the project boundary, further heritage assessment will be required in consultation with the appointed Archaeologist to determine if there would be an impact on Aboriginal cultural heritage.</p> <p>Where the change is considered to have a neutral or lesser significant impact on Aboriginal cultural heritage than that identified for the approved project (as per this assessment), it would be considered a consistent</p>	Construction contractor	Construction	Expected to be effective if carried out in accordance with procedures outlined in CHAR.



Impact	Ref #	Environmental management measures	Responsibility	Timing	Effectiveness of measures
		impact. Where the change to the approved project is considered to have a more significant impact on Aboriginal cultural heritage than that identified in the EIS, it would be considered an inconsistent impact. In this case, Roads and Maritime would require a modification to the approved project, and further consultation with Aboriginal stakeholders would be required to be undertaken.			

### 8.3.6 Residual impacts

Residual impacts are defined as those impacts that remain following the implementation of mitigation measures.

It is expected that some limited residual impact will exist for Aboriginal archaeological sites following completion of the proposed mitigation measures, which include archaeological salvage excavation (Table 8-23).

The scientific value of archaeological sites is linked to the physical information the sites contain. Although the loss of intrinsic Aboriginal cultural value of impacted sites cannot be offset through the proposed program of salvage excavation, the salvaged information would increase an understanding, strengthen the interpretations and improve ongoing and future management of Aboriginal heritage in the surrounding area. While the spatial extent and presence of archaeological deposits is well understood in the southern Cumberland Plain, an understanding of the activities related to Aboriginal occupation is less well known due to limited large scale excavation data. In this light, the project offers an opportunity to significantly advance the interpretation and management of Aboriginal heritage of the surrounding area by providing a baseline foundation for future heritage assessments. Moreover, the information recovered during the mitigation program would allow for informed management of the partially impacted sites, thereby achieving a positive result for Aboriginal heritage.

However while the proposed mitigation for impacted sites will contribute to our understanding, strengthen the interpretations and improve ongoing and future management of Aboriginal heritage in the surrounding area, the salvage work would have a residual impact to the heritage value of sites by physically removing artefacts.

## 8.4 Non-Aboriginal heritage

This chapter describes the environmental values relating to Non-Aboriginal heritage and identifies the potential impacts to these values as a result of construction and operation of the project. This chapter also recommends environmental management measures to reduce the impacts of the project.

The technical working paper, Non-Aboriginal Heritage Assessment (Appendix N) has been used to inform this chapter.

Table 8-24 sets out the Secretary's Environmental Assessment Requirements (SEARs) and Commonwealth EIS guidelines as they relate to Non-Aboriginal heritage and states where in this EIS these have been addressed.

Table 8-24 NSW and Commonwealth Environmental Assessment Requirements

Environmental assessment requirements	Where addressed in EIS
<b>Secretary's Environmental Assessment requirement (SEARs)</b>	
During the preparation of the EIS, you must assess project impacts to Non-Aboriginal heritage. This includes:	Consideration of Non-Aboriginal heritage impacts is described in Section 8.4.4.
Impacts to State and local historic heritage (including conservation areas, built heritage, landscapes and archaeology) should be assessed. Where impacts to State or locally significant historic heritage are identified, the assessment shall be undertaken by a suitably qualified heritage consultant(s) with relevant	Refer to Section 8.4.4 for the assessment of potential impacts Refer to Section 8.4.1 and Appendix N for the qualifications of the heritage consultants.

Environmental assessment requirements	Where addressed in EIS
heritage expertise (note: where archaeological excavations are proposed the relevant consultant must meet the NSW Heritage Council's Excavation Director criteria),	
Include a statement of heritage impact for all heritage items/conservation areas to be impacted (including significance assessment). This should include detailed mapping of all heritage items and how they are affected by the project,	Refer to Section 8.4.4 for statement of heritage impacts. Refer to Section 8.4.3 for assessment of significance. Refer to Appendix N for further details, including detailed mapping of all heritage items
Include details of any proposed environmental management measures (architectural and landscape),	Refer to Section 8.4.6
Consider impacts from, including but not limited to, vibration, demolition, archaeological disturbance, altered historical arrangements and access, landscape and vistas, and architectural noise treatment (as relevant)	Refer to Section 8.4.4
Detail proposed mitigation and environmental management measures (including measures to avoid significant impacts and an evaluation of the effectiveness of the environmental management measures), which are developed consistent with the guidelines in the NSW Heritage Manual (Heritage Office and DUAP 1996),	Refer to Section 8.4.6
Include provision of future mitigation strategies for all identified archaeological impacts that would arise from the project, and	Refer to Section 8.4.6
Where physical archaeological test excavations are proposed, develop an appropriate archaeological assessment methodology, including research design, in consultation with the Heritage Council of New South Wales (for items of State significance) and the Department, to guide the test excavations, and include the results of these excavations;	Refer to Section 8.4.6. Mitigation measures require detailed salvage archaeological investigation of the site, no test excavations are required. A research design and methodology for the salvage works is outlined in more detail in Appendix N
<b>Commonwealth EIS Guidelines</b>	
A description of the environment in all areas of potential impact, including all components of the environment as defined in Section 528 of the EPBC Act: <ul style="list-style-type: none"> <li>heritage values of places</li> </ul>	Refer to Section 8.4.2, 8.4.3 and 8.4.4
To support the assessment of local historic and indigenous heritage values, the EIS must include a full	Refer to Appendix N for a full impact assessment, a summary of impacts is

Environmental assessment requirements	Where addressed in EIS
heritage impact assessment	also provided in Section 8.4.4
Impacts to the environment (as defined in Section 528) should include but not be limited to the following: <ul style="list-style-type: none"> <li>Removal and degradation of heritage items/places (historic, natural and indigenous)</li> </ul>	Refer to Section 8.4.4 Indigenous heritage impact assessment is provided in The Cultural Heritage Assessment Report (CHAR), Appendix M of the EIS

### 8.4.1 Assessment methodology

As part of preparing the EIS, this non-Aboriginal heritage impact assessment (Appendix N) identifies the non-Aboriginal heritage items within and immediately adjacent to the project area (ie the study area), assesses the potential impacts on the heritage items from the proposed project activities, and develops measures to address impacts.

The study area for the purpose of this assessment is defined at different stages in the assessment process. In summary, the study area for the desktop assessment was based on previous studies undertaken in the area as well as a search radius of 500 m for all online database searches of heritage registers. This and a review of aerial imagery informed the identification of locations for the field survey undertaken to ground truth known and potential heritage items identified during the desktop assessment, and to identify any new heritage items or areas of archaeological potential. This informed the baseline upon which impacts were assessed. The assessment of impacts was based on areas where the construction footprint overlaps with the curtilage of identified heritage items.

The non-Aboriginal heritage impact assessment addresses archaeology, heritage items and conservation areas, in accordance with NSW Heritage Branch guidelines, and the Australia ICOMOS Charter for Places of Cultural Significance (Burra Charter).

For proposed actions situated on Commonwealth land or which may impact on Commonwealth land, the guidelines *Actions on, or impacting upon, Commonwealth land, and actions by Commonwealth agencies* (Significant Impact Guidelines 1.2) have been applied.

The report was prepared by Jennifer Chandler (Project Archaeologist, Jacobs) and Sally Waller (Senior Ecologist and Spatial Consultant, Jacobs), with technical review undertaken by Dr Karen Murphy (Technical Leader Historical Heritage, Jacobs). Further details regarding the Jacobs personnel involved in the preparation of the report are provided in Appendix N and summarised in Table 8-25.

Table 8-25 Qualifications of personnel undertaking the non-Aboriginal heritage assessment

Name	Qualifications	Role on the project
Dr Karen Murphy	PhD (Historical Archaeology) Bachelor of Arts (Honours) (Archaeology)	Management and direction of overall assessment Technical review of report
Jennifer Chandler	Master of Cultural Heritage Bachelor of Archaeology (Honours)	Field survey Writing and preparation of report
Amanda Goldfarb	Bachelor of Arts/Bachelor of Science (Archaeology, English, Physics) Bachelor of Arts (Honours – Archaeology) Masters of Arts (Archaeology)	Field survey

Name	Qualifications	Role on the project
Sally Waller	Masters GIS and Remote Sensing Bachelor of Science (Environmental and Analytical)	Writing of natural heritage sections of report

### Database Search

A search of all available non-Aboriginal heritage registers was undertaken on 13 January 2016 to identify heritage places within a 500 m search radius of the project. The register search included:

- NSW State Heritage Inventory
- NSW State Heritage Register (SHR)
- Roads and Maritime Section 170 Heritage and Conservation Register
- National Trust of Australia (NSW) Register
- Register of National Estate (RNE)
- Commonwealth Heritage List (CHL)
- National Heritage List (NHL)
- World Heritage List
- Penrith Local Environmental Plan, 2010 (PLEP)
- Liverpool Local Environmental Plan, 2008 (LLEP).

### Previous heritage assessments

Previous heritage assessments relevant to the project were reviewed. These assessments included:

- Western Sydney Airport EIS (RPS Manidis Roberts, 2015)
- The Northern Road Stage 4, Route Options Assessment (Artefact Heritage, 2015)
- Western Sydney Infrastructure Plan. Northern Road Upgrade Preliminary Environmental Investigation (ngh environmental, 2015)
- Badgerys Creek Initial Environmental Survey: Historic Heritage (Australian Museum Consulting, 2014)
- Defence Establishment Orchard Hills NSW Heritage Management Plan (Godden Mackay Logan, 2013)
- Penrith Heritage Study (Paul Davies Pty Ltd, 2007)
- Colonial Landscapes of the Cumberland Plain and Camden, NSW. A Survey of Selected Pre-1860 Cultural Landscapes from Wollondilly to Hawkesbury LGAs (Morris and Britton, 2000)
- The Penrith Heritage Study (Thorp, 1986).

It is noted that the Heritage Management Plan (HMP) developed by Godden Mackay Logan (2013) for the DEOH, which overlaps with the curtilage of the Orchard Hills Cumberland Plain Woodland Commonwealth Heritage Place (CHP), includes an assessment of both the natural and historic heritage values of this site, which are referenced throughout this assessment. This includes a significance ranking assigned to various natural and historic heritage values of the site. Further the HMP assigns a 'tolerance for change' ranking to different elements of the natural and historic heritage of the site, including an overall whole of site approach in relation to any new development, demolition and remediation works on the site. These rankings relate to the heritage values only, and it do not relate to the significance of impacts. Further details are provided within this assessment.

The HMP also divides the site into different sectors, some of which are referenced herein as they relate to the areas overlapping with the project, being Sector B (northern buffer) and Sector H (southern buffer zone). Further details are provided throughout this assessment and included in Appendix N.

Additionally, for the purpose of assessing the natural heritage values of this CHP, the Biodiversity Assessment Report (Appendix I of this EIS) was also reviewed.

Natural heritage values are components of the natural environment that have aesthetic, historic, scientific or social significance, or other special value, for current and future generations. These values lend to a sense of identity and place (ERM, 2011).

### **Review of aerial imagery**

Current aerial imagery was viewed to identify areas of heritage potential prior to the field survey. A number of properties were identified where the nature of visible features or buildings were unable to be identified and may have some heritage potential. These identified areas formed the basis of the focus of the field survey.

### **Site survey**

A site survey was conducted on 23-26 February and 5-6 April 2016 to ground truth the desktop assessment. A further field survey was undertaken of four additional areas relating to drainage works in the vicinity of the WaterNSW supply pipeline on 20 September 2016. The surveys included a physical inspection of all heritage listed items located near the study area (the works footprint with a surrounding buffer of 100 m) as well as potential heritage items identified during the desktop assessment. A photographic record was kept, with photographs taken of all heritage items and potential archaeological sites.

Based on the large volume of current and relevant information available for the Orchard Hills Cumberland Plains Woodland CHP, the assessment of natural heritage values was prepared at a desktop level using existing information as outlined above. No additional field work was conducted in preparing the natural heritage assessment.

### **Significance Assessment**

Based on the findings of the desktop assessment and site survey, known or potential heritage items were assessed for significance against the relevant criteria adopted by the NSW Heritage Council pursuant to the *Heritage Act, 1977* as well as guidelines under the NSW Heritage Manual. Additionally, for places on Commonwealth land, or owned or managed by the Commonwealth Government the Australian Heritage Council, these have been assessed against the relevant Australian Heritage Council guidelines and its 'significance threshold' test where relevant.

## **8.4.2 Existing environment**

### **Historical context**

There are several towns and areas associated with the project area: Orchard Hills and Glenmore Park in the north of the project area, Mulgoa in the centre and Luddenham in the south.

Europeans first arrived in the Orchard Hills area around 1804 when large land grants were made available. The area was considered suitable for grazing but smaller agricultural grants in areas of alluvial soil near creeks were also available. The Reverend Samuel Marsden had acquired land in the area in 1794, and in 1804 he received a grant of 1,030 acres for the development of a wool industry in the colony. His estate was named Mamre and crops of hemp and flax were also grown here. The homestead had a fruit orchard that was 20 acres in size. Large and small land grants were also made available in 1809, the largest being 2,000 acres, which went to Gregory Blaxland. Blaxland had arrived in the colony in 1805 and later became known for his exploration of the Blue Mountains with William Lawson and William Charles Wentworth. These grants were made to free settlers, public servants and emancipists. The land in the northern half of Orchard Hills, except for Marsden and Blaxland's land became part of the Regentville estate (Paul Davies Pty Ltd,



2007:196-198). In 1904 a Methodist Church was built in Orchard Hills and in 1910 a public school was opened to service the community that had grown through subdivisions in the area in 1888-1889. Residents comprised of farmers, railway employees, a dairyman and an orchardist. Today this rural area is utilised for market gardening and orchards (Paul Davies Pty Ltd, 2007:199).

In the southern part of Orchard Hills, and part of the project area, a large allotment of Commonwealth government acquired land was first used by the Royal Australian Air Force (RAAF) and Royal Australian Navy (RAN) in the mid-1940s in a limited capacity. In the 1950s the RAAF established the No. 1 Central Ammunition Depot. The depot, which is now called DEOH, currently stores munitions, contains development facilities and is a training centre (Paul Davies Pty Ltd, 2007:199).

The Mulgoa Valley, to the west of the project area, was first explored by Europeans when Captain Tench led an expedition along the Nepean River in 1789. There were further expeditions into the region over the next few decades with the surveying of Mulgoa Valley occurring in 1809. Land grants were made in Mulgoa, to the west of the project area, from 1810 until 1816. These grants were large blocks of land given to men with financial or official status. A large estate called Regentville was established by Sir John Jamison and had reached a size of 3,890 ha by 1834 (Paul Davies Pty Ltd, 2007:169). The carriage drive approach to the house from Penrith overlaps with present day Glenmore Park. The estate was sold in 1847, and in the early 1860s the central section of the estate was subdivided into farms ranging from 23 to 51 acres in size (Paul Davies Pty Ltd, 2007:103). The more recent suburban development of Glenmore Park occurred in the late 1980s when the area was developed by Penrith City Council (Paul Davies Pty Ltd, 2007:104).

In the Luddenham region, early settler John Blaxland (brother of Gregory Blaxland) was granted 6,710 acres in 1813. The land, which overlapped with the project area, was called 'Luddenham' and was used primarily for cattle and sheep grazing. The western portion of Blaxland's property, near the Nepean River, was developed with buildings, water and grain storage structures and a brewery. However, the eastern portion, located near the current Luddenham township remained undeveloped. Another early settler, D'Arcy Wentworth (father of William Charles Wentworth), was granted 1,200 acres of land located between The Northern Road and the Nepean River. The property was called 'Greendale' and overlapped with part of the project area (Australian Museum Consulting, 2014:21-23).

Initially, travel into the region would have been difficult, but became easier in 1815 when the Western Road began to be constructed (Thorp, 1986:12). The Northern Road, also known as Bringelly Road, was important as it connected the town settlement at Richmond with rural estates at Cowpastures (Camden). Elizabeth Drive, originally called Orphan Creek Road, connected the town settlement of Liverpool with the Mulgoa Valley (Paul Davies Pty Ltd, 2007:41).

By 1859 the land around Luddenham had been subdivided and was for sale. An area called 'Luddenham Village' was subdivided into one acre and half acre blocks and was located on the eastern side of The Northern Road. The village was located close to the Thistle Inn which was run by John Lawson. There was also provision made at this time for a school and a church. As a result of the subdivision, the township of Luddenham developed. Between 1857 and the 1880s two churches, a post office and a hall were built (Australian Museum Consulting, 2014:24-25). Today Luddenham is a semi-rural township surrounded by agricultural rural land.

### **Registered historic heritage items**

Previous studies and heritage register searches indicated that there are two registered heritage items located within the project area as described in Table 8-26. The assessment of significance of these items is included in Appendix N and summarised in Section 8.4.3 below.



Table 8-26 Registered historical heritage items within or immediately adjacent to the project area

Item	Heritage item name	Register	Number	Significance	Location
Item 2	Orchard Hills Cumberland Plain Woodland	CHL RNE	105317 102211	Commonwealth	The Northern Road, Orchard Hills
Item 10	Lawson's Inn site (former 'The Thistle' site)	LLEP	53	Local	2155 The Northern Road, Luddenham. Lots 1 and 2 DP 851626

The CHL listing includes reference to the natural heritage values of the site as well as historic heritage values associated with evidence of canals associated with the Chaffey Brothers irrigation scheme.

There are no items listed on the SHR, section 170 registers, National Trust register, NHL or World Heritage List, within or adjacent to the project area. A list of registered heritage items located within or immediately adjacent to the project area is also presented in Appendix N.

The two registered heritage items considered as part of this impact assessment are included in Figure 8-9.

### Archaeological potential

There is the potential for previously unidentified historical heritage items to be situated in the project area, based on the review of aerial imagery, and the nature of the previous heritage assessments which included limited field survey.

Following a search of the listed registers, and review of the previous literature, historical background and aerial imagery, the following types of historical heritage items are likely to be found in the project area:

- Houses, homesteads and other buildings associated with the settlement of the region
- Past rural uses related to agriculture and orcharding, including stockyards, fences, sheds and outbuildings, orchard trees, and wells.

Field investigations were carried out to ground truth the existence of items of known and potential archaeological value, which were identified during the desktop assessment.

### Potential heritage items

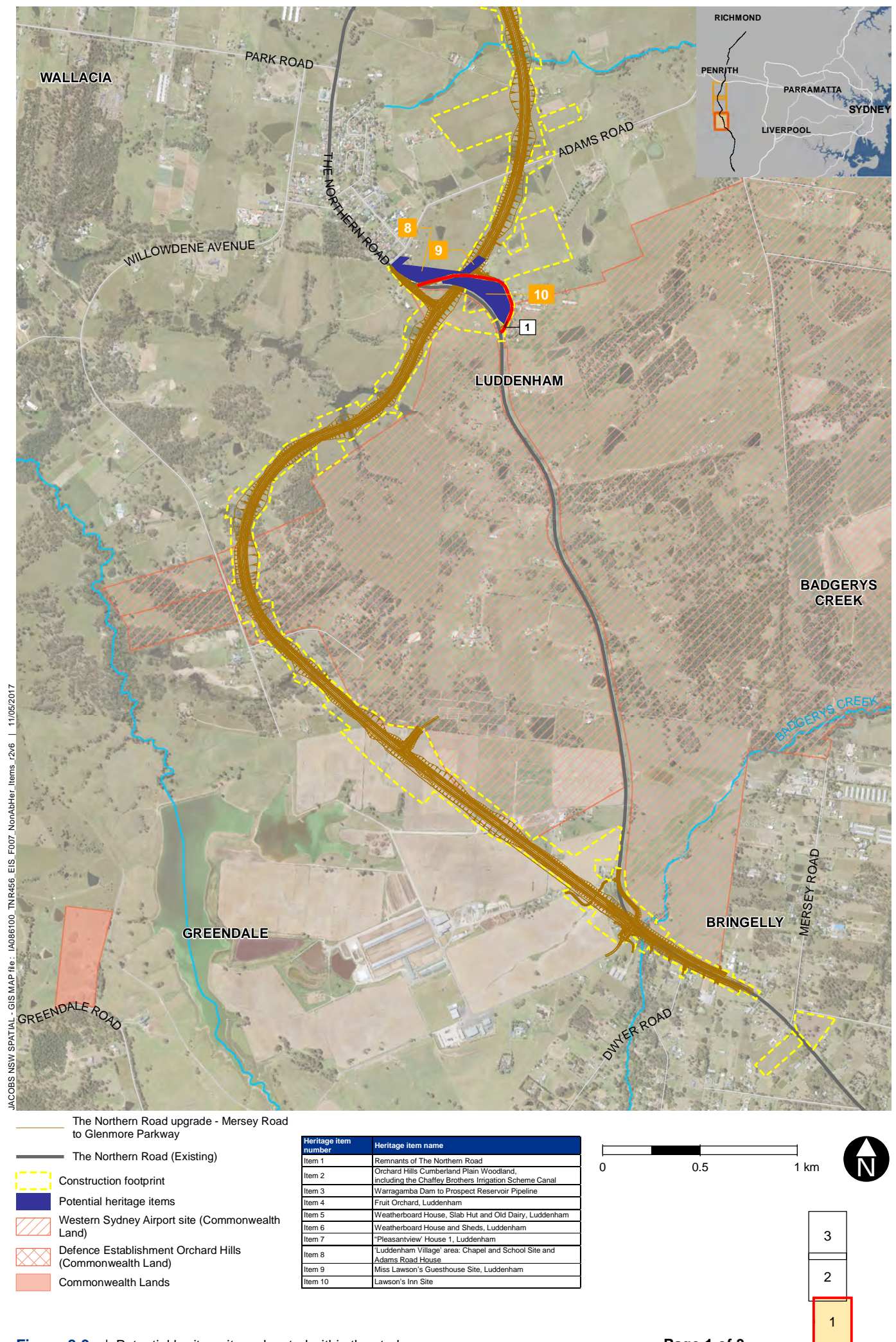
During the field survey eight potential heritage items were identified as outlined in Table 8-27.

All eight of these items were subject to significance assessment in accordance with the Australia ICOMOS Burra Charter and *Assessing Heritage Significance* (NSW Heritage Office, 2001), against the seven significance criteria adopted by the NSW Heritage Council in accordance with the *Heritage Act, 1977* (refer to Appendix N). Of the eight potential heritage items assessed, only two have been found to have heritage significance. A summary of the statement of heritage significance for these items is included in Section 8.4.3. The potential heritage items considered as part of this impact assessment are mapped in Table 8-27.

Table 8-27 Potential historical heritage items within or immediately adjacent to the project area

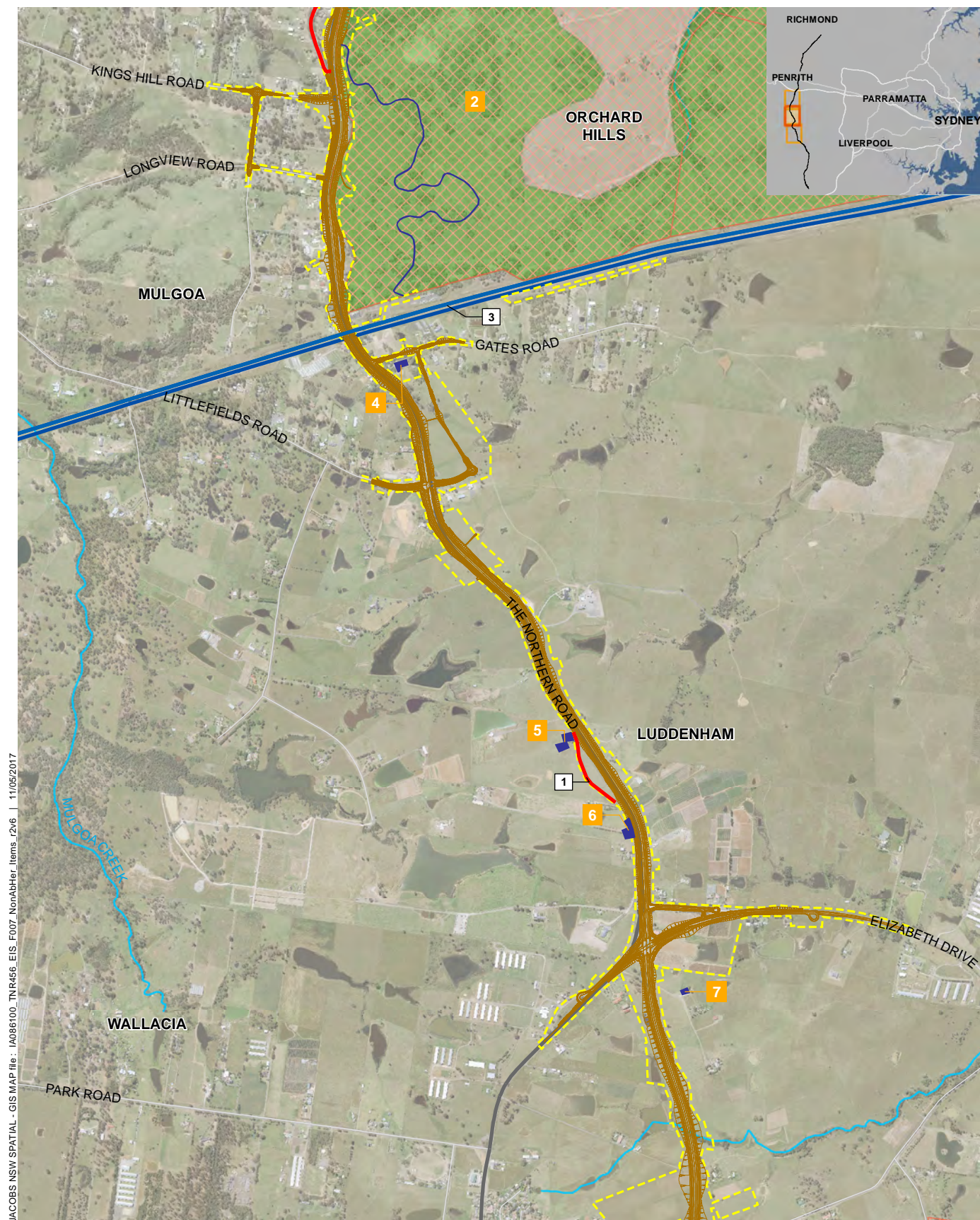
Item	Potential heritage item name	Location	Potential significance
Item 1	Remnant of The Northern Road	Glover Crescent, Eaton Road and a private driveway.	None
Item 3	Warragamba Dam to Prospect Reservoir Pipeline	South of DEOH	Local
Item 4	Fruit Orchard, Luddenham	2580 The Northern Road, Luddenham	None
Item 5	Weatherboard House, Slab Hut and Old Dairy, Luddenham	2787 The Northern Road, Luddenham	None
Item 6	Weatherboard House and Sheds, Luddenham	2825 The Northern Road, Luddenham	None
Item 7	'Pleasantview' House 1, Luddenham	2422-2430 The Northern Road, Luddenham	None
Item 8	Luddenham Village area: Chapel and School Site and Adams Road House	12-26 Eaton Road and 5 Adams Road, Luddenham	None
Item 9	Miss Lawson's Guesthouse Site, Luddenham	26 Adams Road, Luddenham	Local





**Figure 8-9** | Potential heritage items located within the study area



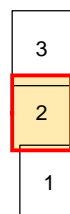


JACOBS NSW SPATIAL - GIS MAP file: JA086100\_TNR456\_EIS\_F007\_NonAbstr Items\_r2v6 | 11/05/2017

- The Northern Road upgrade - Mersey Road to Glenmore Parkway
- The Northern Road (Existing)
- Construction footprint
- Potential heritage items
- Western Sydney Airport site (Commonwealth Land)
- Defence Establishment Orchard Hills (Commonwealth Land)
- Commonwealth Lands
- Orchard Hills Cumberland Plain Woodland, including the Chaffey Brothers Irrigation Scheme Canal

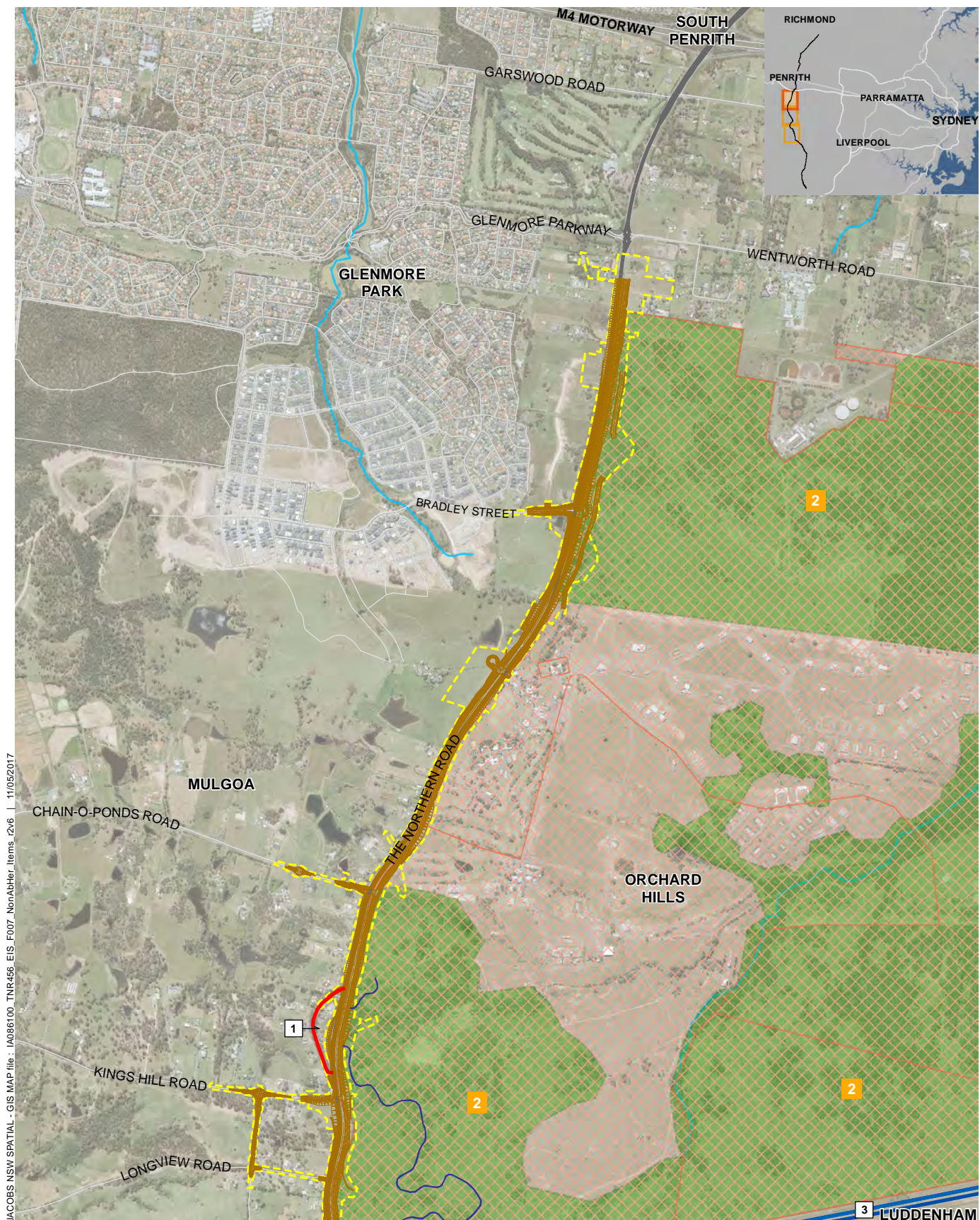
Heritage item number	Heritage item name
Item 1	Remnants of The Northern Road
Item 2	Orchard Hills Cumberland Plain Woodland, including the Chaffey Brothers Irrigation Scheme Canal
Item 3	Warragamba Dam to Prospect Reservoir Pipeline
Item 4	Fruit Orchard, Luddenham
Item 5	Weatherboard House, Slab Hut and Old Dairy, Luddenham
Item 6	Weatherboard House and Sheds, Luddenham
Item 7	"Pleasantview" House 1, Luddenham
Item 8	Luddenham Village' area: Chapel and School Site and Adams Road House
Item 9	Miss Lawson's Guesthouse Site, Luddenham
Item 10	Lawson's Inn Site

0 0.5 1 km



**Figure 8-9** | Potential heritage items located within the study area



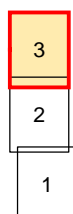


JACOBS NSW SPATIAL - GIS MAP file : JA086100\_TNR456\_EIS\_F007\_NonAbHer\_Items\_r2v6 | 11/05/2017

- The Northern Road upgrade - Mersey Road to Glenmore Parkway
- The Northern Road (Existing)
- Construction footprint
- Potential heritage items
- Western Sydney Airport site (Commonwealth Land)
- Defence Establishment Orchard Hills (Commonwealth Land)
- Commonwealth Lands
- Orchard Hills Cumberland Plain Woodland, including the Chaffey Brothers Irrigation Scheme Canal

Heritage item number	Heritage item name
Item 1	Remnants of The Northern Road
Item 2	Orchard Hills Cumberland Plain Woodland, including the Chaffey Brothers Irrigation Scheme Canal
Item 3	Warragamba Dam to Prospect Reservoir Pipeline
Item 4	Fruit Orchard, Luddenham
Item 5	Weatherboard House, Slab Hut and Old Dairy, Luddenham
Item 6	Weatherboard House and Sheds, Luddenham
Item 7	'Pleasantview' House 1, Luddenham
Item 8	Luddenham Village' area: Chapel and School Site and Adams Road House
Item 9	Miss Lawson's Guesthouse Site, Luddenham
Item 10	Lawson's Inn Site

0 0.5 1 km



**Figure 8-9** | Potential heritage items located within the study area



### 8.4.3 Assessment of significance

Assessments of significance were carried out for known and potential heritage items identified through desktop assessment and site survey (refer to Appendix N). These assessments were based on the NSW Heritage Council criteria for heritage assessment which have been gazetted pursuant to the *Heritage Act, 1977*. For places on Commonwealth land, or owned or managed by the Commonwealth Government, these were assessed against the Commonwealth Heritage List criteria for both its natural and historic heritage values.

As well as assessing a place against criteria for its heritage value, the Australian Heritage Council applies a 'significance threshold' test. To reach the threshold for the National Heritage List, a place must have 'outstanding' heritage value to the nation. To be entered on the Commonwealth Heritage List, a place must have 'significant' heritage value. Places on Commonwealth land were also assessed against these criteria.

Of the ten items assessed, only four were identified as having heritage significance as summarised in Table 8-28.

Further, in relation to the Orchard Hills Cumberland Plain Woodland CHP, the assessment below also considers the significance rankings assigned to the natural and historic heritage values of the site and associated 'tolerance for change' in areas relevant to the project. These rankings relate to the heritage values only, and it do not relate to the significance of impacts. This is based on the outcomes of the HMP for the DEOH, prepared by Godden Mackay Logan (2013).

Table 8-28 Summary of heritage significance for each heritage item

Heritage item number	Source	Heritage item name	Statement of significance	Significance
Item 1	Artefact Heritage (2015)	Remnants of The Northern Road	While the three sections of road show the original alignment of The Northern Road (Bringelly Road), the remains have the potential to provide only very limited information due to the modifications and renewal of the road surface over time. The item is considered to have insufficient significance to fulfil the criteria for State or local listing.	None
Item 2	CHL, RNE	Orchard Hills Cumberland Plain Woodland	<p>The DEOH is vegetated with remnants and regenerating areas of Cumberland Plain Woodland, Castlereagh Ironbark Forest and Sydney Coastal River Flat Forest. Cumberland Plain Woodland is listed as a critically endangered ecological community at both State (Cumberland Plain Woodland in the Sydney Basin Bioregion) and Commonwealth levels (Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest). At State level, Sydney Coastal River Flat Forest (River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions) and Castlereagh Ironbark Forest (Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion) are regarded as endangered ecological communities that are under-represented in reserves. DEOH is regarded as a core biodiversity area for conservation of both these communities.</p> <p>The place comprises the least disturbed and largest remaining remnant of Cumberland Plain Woodland. The size of the DEOH remnant provides a comparatively large area of continuous habitat for species likely to be excluded from small and isolated remnants, particularly the Cumberland Plain Woodland bird community. Mature tree heights at Orchard Hills reach 50 m and include some of the most outstanding examples of Forest Red gum trees remaining in western Sydney.</p> <p>The tributaries of Blaxland Creek at Orchard Hills are among the least disturbed catchments remaining on the Cumberland Plain and Wianamatta Shale in western Sydney. Blaxland Creek tributaries are richer in aquatic</p>	Commonwealth



Heritage item number	Source	Heritage item name	Statement of significance	Significance
			<p>macro-invertebrate genera than most other creeks in western Sydney. The macro-invertebrate community of this catchment has a high representation of disturbance-sensitive species. Stoneflies, Leptophlebiid mayflies and pollution-sensitive families of caddisflies appear to be confined to such streams within the Cumberland Plain. The DEOH therefore acts as a refuge and reservoir of regional conservation significance for such species that are dependent on low levels of agricultural and urban development.</p> <p>The bush thickknee (<i>Burhinus grallarius</i>) a rare bird, is listed as endangered in New South Wales and is regarded as a species of the greatest conservation concern in the Cumberland region. It has been recorded at Orchard Hills. The DEOH has one plant listed as vulnerable at Commonwealth level (<i>Pultenaea parviflora</i>), and two plants listed as vulnerable in New South Wales, the prickly spider-flower (<i>Grevillea juniperina</i>) and Dillwynia tenuifolia. Individuals from the Endangered Population of Marsdenia viridiflora subsp. viridiflora are found across DEOH. Six other plant species are found in the area, which are regarded as being of regional conservation significance. These are spreading bush-pea (<i>Putlenaea microphylla</i>), fuzzweed (<i>Vittadinia pustulata</i>) water-milfoil (<i>Myriophyllum simulans</i>), dwarf skull-cap (<i>Scutellaria humilis</i>), early nancy (<i>Wurmbea biglandulosa</i>) and the grass <i>Panicum obseptum</i>. An additional 32 plant species are found at Orchard Hills which are regarded as inadequately conserved in western Sydney.</p> <p>The low level of disturbance in the tributaries of Blaxland Creek within Orchard Hills provide a valuable benchmark to measure the degradation of creek systems generally in western Sydney. The absence of fire at Orchard hills for approximately 50 years to 2001 provides an opportunity for ecological research on regenerating Cumberland Plain Woodland.</p> <p>The DEOH is a component of the Darug Aboriginal people's cultural landscape, where the place contains a representative number of stone artefact sites, situated within intact landforms and soil deposits. Aboriginal sites identified thus far within DEOH represent a low percentage of those which could be present, but provide direct evidence for Darug Holocene</p>	

Heritage item number	Source	Heritage item name	Statement of significance	Significance
			<p>occupation and economy in the context of western Sydney. The DEOH has the potential to contain large numbers of representative archaeological sites which have not been significantly impacted by historical development.</p> <p>The range of archaeological evidence within the DEOH is important to the Darug people because it provides physical evidence for their land occupation, Aboriginal traditions and the connection to a larger tribal area. Further study of the archaeological resources within the DEOH could provide new evidence for spatial patterning of archaeological deposits, evidence for trade and exchange networks and possibly social regulations in terms of spatial occupation of the landscape.</p> <p>The Mulgoa Irrigation Scheme was privately funded and engineered by the Mulgoa Irrigation Company; a company owned by the Chaffey brothers who were directly responsible for the establishment of the towns of Mildura (Victoria) and Renmark (South Australia) around comparable irrigation schemes in the 1880s and 1890s. The archaeological remains of the Mulgoa Irrigation Scheme canal, contained within its original as-built landscape context, are integral elements of the scheme, which was intended to transform economic and social aspects of Mulgoa (and Orchard Hills) in the 1890s. Following an initial period of construction, when sections of the Mulgoa Irrigation Scheme infrastructure were built, the scheme failed as a consequence of the economic situation in New South Wales and Victoria/South Australia, combined with the Chaffey brothers' personal monetary difficulties. The resultant physical evidence of the Mulgoa Irrigation Scheme, primarily as archaeological remains within a rural landscape, provides direct evidence to support the history of the Mulgoa Irrigation Scheme, the engineering requirements of the gravity-fed water irrigation scheme, the commencement of construction and ultimately its failure.</p> <p>The physical evidence and landscape setting of the scheme, within a modified rural landscape, are vital for understanding the extent of the Mulgoa Irrigation Scheme and how it would have operated. The residual evidence provides a direct connection to the Chaffey brother, who visualised and engineered it. An</p>	

Heritage item number	Source	Heritage item name	Statement of significance	Significance
			assessment of the local area has shown that most of the remnant archaeological and landscape evidence for the Mulgoa Irrigation Scheme is to be found within the boundary of the DEOH.	
Item 3	Paul Davies Pty Ltd (2007)	Warragamba Dam to Prospect Reservoir Pipeline	The pipeline is associated with an important historical trend relating to the use of foreign labour in Australia during World War II. The pipeline also has the potential to yield information about steel pipe construction techniques employed at the time. The item is therefore considered to have sufficient significance to fulfil the criteria for local listing.	Local
Item 4	NA	Fruit Orchard, Luddenham	While the site is associated with the important historical industry of orcharding, the size of the orchard, the limited information about the history of the property and indeterminate age of the trees provide very little information about the industry. The site is therefore not considered to be significant.	None
Item 5	NA	Weatherboard House, Slab Hut and Old Dairy, Luddenham	While item 5 is associated with the important historical industry of dairying and early settlement of the area, the remains of the dairy (if any) and existing house have the potential to provide very limited information about the industry. The site is potentially associated with the Bouffier family with ties to the local area, however, the item is considered to have insufficient significance to fulfil the criteria for State or local listing.	None
Item 6	NA	Weatherboard House and Sheds, Luddenham	Item 6 is potentially associated with the Roots family, a well-known butchering family with ties to the local area through much of the 20th century. The house is in poor condition, and the sheds do not appear directly associated with the activity of butchering. Therefore the heritage item has limited potential to provide information about the activity of butchery and supply of meat to the local population. The item is considered to have insufficient significance to fulfil the criteria for State or local listing.	None
Item 7	NA	"Pleasantview' House 1, Luddenham	There is little information on the history of the Llandilo Hall and its importance to the original community, and having been relocated to its current position	None

Heritage item number	Source	Heritage item name	Statement of significance	Significance
			does not add to the building's significance. House 1 does not demonstrate any principal features of a community hall. It also does not appear to have any particular aesthetic or architectural characteristics of note. The item is therefore considered to have insufficient significance to fulfil the criteria for State or local listing.	
Item 8	Artefact Heritage (2015)	'Luddenham Village' area: Chapel and School Site and Adams Road House	Item 8 is associated with the early settlement of Luddenham, however it is not known whether a chapel or school were ever built at the site. Additionally there is little or no physical or historical evidence that the Luddenham Village was ever actually substantially developed. Even if the chapel and school did exist, it is unlikely that there are subsurface remnants of a chapel and school as they would be under the modern housing at this location. The Adams Road house is in poor condition and has been modified, and it is unclear whether it actually even dates to the time of the Luddenham Village development (mid-19th century). The lots therefore have limited potential to contribute information about early settlement of the area. The heritage item is considered to have insufficient significance to fulfil the criteria for State or local listing.	None
Item 9	Artefact Heritage (2015)	Miss Lawson's Guesthouse Site, Luddenham	The site is of historical significance in demonstrating the change in the area relating to road use and travel. The site is also associated with a family with ties to the local area through the late 19 <sup>th</sup> and 20 <sup>th</sup> century. The wells are potentially related to the occupation and use of the guesthouse, and given the low level of disturbance or development at the site, there is potential for other archaeological remains and deposits to be present at the site. These archaeological remains have the potential to provide information about the operation of, and custom of, guesthouses operating in the early 20 <sup>th</sup> century in western Sydney. There is potential for information to be obtained about the materials that people were transporting at the time, and the nature, scale and extent of the guesthouse. Comparisons with other inns in operation at this time can also be made. The item is considered to have sufficient significance to fulfil the criteria for local listing.	Local
Item 10	Liverpool	Lawson's Inn Site	The site of Lawson's Inn at Luddenham demonstrates the history of the early settlement of the area. The Inn formed the nucleus of the development of	Local

#### Chapter 8 – Assessment of other issues

Heritage item number	Source	Heritage item name	Statement of significance	Significance
	LEP		Luddenham which was laid out adjacent to the site in 1864. The site's location beside a major road is indicative of the importance of the early transport networks in facilitating settlement and development and is representative of early Inn and Hotel sites throughout the Sydney region. The site is also associated with a family with ties to the local area through the late 19 <sup>th</sup> and 20 <sup>th</sup> century. There is potential to gain more information on the site from further archaeological and documentary research.	

A further description of the findings of the assessment of significance for the four identified heritage items is outlined below.

## Item 2: Orchard Hills Cumberland Plain Woodland

The assessment of significance detailed in the Non-Aboriginal heritage assessment working paper includes an assessment of the natural heritage values of the site as well as the historic non-Aboriginal heritage values of the site in relation to the Chaffey Brothers Irrigation Scheme Canal (the canal). No other areas of archaeological potential relating to this heritage item were identified within the project area during the field survey.

The current statement of significance from the Heritage Management Plan (Godden Mackay Logan, 2013) is as follows:

Defence Establishment Orchard Hills (DEOH) is vegetated with remnants and regenerating areas of Cumberland Plain Woodland, Castlereagh Ironbark Forest and Sydney Coastal River Flat Forest. Cumberland Plain Woodland is listed as a critically endangered ecological community at both state (*Cumberland Plain Woodland in the Sydney Basin Bioregion*) and Commonwealth levels (*Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest*). At state level, Sydney Coastal River Flat Forest (*River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*) and Castlereagh Ironbark Forest (*Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion*) are regarded as endangered ecological communities that are under-represented in reserves. DEOH is regarded as a core biodiversity area for conservation of both these communities.

The place comprises the least disturbed and largest remaining remnant of Cumberland Plain Woodland. The size of the DEOH remnant provides a comparatively large area of continuous habitat for species likely to be excluded from small and isolated remnants, particularly the Cumberland Plain Woodland bird community. Mature tree heights at Orchard Hills reach 50 m and include some of the most outstanding examples of Forest Red gum trees remaining in western Sydney.

The tributaries of Blaxland Creek at Orchard Hills are among the least disturbed catchments remaining on the Cumberland Plain and Wianamatta Shale in Western Sydney. Blaxland Creek tributaries are richer in aquatic macro-invertebrate genera than most other creeks in Western Sydney. The macro-invertebrate community of this catchment has a high representation of disturbance-sensitive species. Stoneflies, *Leptophlebiid* mayflies and pollution-sensitive families of caddisflies appear to be confined to such streams within the Cumberland Plain. The DEOH therefore acts as a refuge and reservoir of regional conservation significance for such species that are dependent on low levels of agricultural and urban development.

The bush thickknee (*Burhinus grallarius*) a rare bird, is listed as endangered in New South Wales and is regarded as a species of the greatest conservation concern in the Cumberland region. It has been recorded at Orchard Hills. The DEOH has one plant listed as vulnerable at Commonwealth level (*Pultenaea parviflora*), and two plants listed as vulnerable in New South Wales, the prickly spider-flower (*Grevillea juniperina*) and *Dillwynia tenuifolia*. Individuals from the Endangered Population of *Marsdenia viridiflora* subsp. *viridiflora* are found across DEOH. Six other plant species are found in the area, which are regarded as being of regional conservation significance. These are spreading bush-pea (*Puttenaea microphylla*), fuzzweed (*Vittadinia pustulata*) water-milfoil (*Myriophyllum simulans*), dwarf skull-cap (*Scutellaria humilis*), early nancy (*Wurmbea biglandulosa*) and the grass *Panicum obseptum*. An additional 32 plant species are found at Orchard Hills which are regarded as inadequately conserved in western Sydney.

The low level of disturbance in the tributaries of Blaxland Creek within Orchard Hills provide a valuable benchmark to measure the degradation of creek systems generally in western Sydney. The absence of fire at Orchard hills for approximately 50 years to 2001 provides an opportunity for ecological research on regenerating Cumberland Plain Woodland.

The DEOH is a component of the Darug Aboriginal people's cultural landscape, where the place contains a representative number of stone artefact sites, situated within intact landforms and soil

deposits. Aboriginal sites identified thus far within DEOH represent a low percentage of those which could be present, but provide direct evidence for Darug Holocene occupation and economy in the context of western Sydney. The DEOH has the potential to contain large numbers of representative archaeological sites which have not been significantly impacted by historical development.

The range of archaeological evidence within the DEOH is important to the Darug people because it provides physical evidence for their land occupation, Aboriginal traditions and the connection to a larger tribal area. Further study of the archaeological resources within the DEOH could provide new evidence for spatial patterning of archaeological deposits, evidence for trade and exchange networks and possibly social regulations in terms of spatial occupation of the landscape.

The Mulgoa Irrigation Scheme was privately funded and engineered by the Mulgoa Irrigation Company; a company owned by the Chaffey brothers who were directly responsible for the establishment of the towns of Mildura (Victoria) and Renmark (South Australia) around comparable irrigation schemes in the 1880s and 1890s. The archaeological remains of the Mulgoa Irrigation Scheme canal, contained within its original as-built landscape context, are integral elements of the scheme, which was intended to transform economic and social aspects of Mulgoa (and Orchard Hills) in the 1890s. Following an initial period of construction, when sections of the Mulgoa Irrigation Scheme infrastructure were built, the scheme failed as a consequence of the economic situation in New South Wales and Victoria/South Australia, combined with the Chaffey brothers' personal monetary difficulties. The resultant physical evidence of the Mulgoa Irrigation Scheme, primarily as archaeological remains within a rural landscape, provides direct evidence to support the history of the Mulgoa Irrigation Scheme, the engineering requirements of the gravity-fed water irrigation scheme, the commencement of construction and ultimately its failure.

The physical evidence and landscape setting of the scheme, within a modified rural landscape, are vital for understanding the extent of the Mulgoa Irrigation Scheme and how it would have operated. The residual evidence provides a direct connection to the Chaffey brother, who visualised and engineered it. An assessment of the local area has shown that most of the remnant archaeological and landscape evidence for the Mulgoa Irrigation Scheme is to be found within the boundary of the DEOH.

An assessment of potential impacts to the natural and historic heritage values of the site against the Significant Impact Guidelines 1.2 is provided in Appendix N.

Further, as previously outlined, the HMP (Godden Mackay Logan, 2013) ranks the significance of the heritage values of the site, including natural and historic heritage values. The western periphery of the CHP which overlaps with the project construction footprint within Sectors B and H of the DEOH, has been identified to include areas of moderate to low natural heritage value being regenerating patches of vegetation occurring within largely cleared grasslands with a mixture of native and introduced species (Godden Mackay Logan, 2013). This is shown in Figure 8-10.

The natural heritage significance of aquatic fauna and its habitat has been ranked as moderate to high within areas of the DEOH, including areas within the CHP. This is shown in Figure 8-13.

In relation to its historic heritage values, the HMP identifies the remnants of the Mulgoa Irrigation Scheme, located within the south-western section of the CHP, as being of high significance.



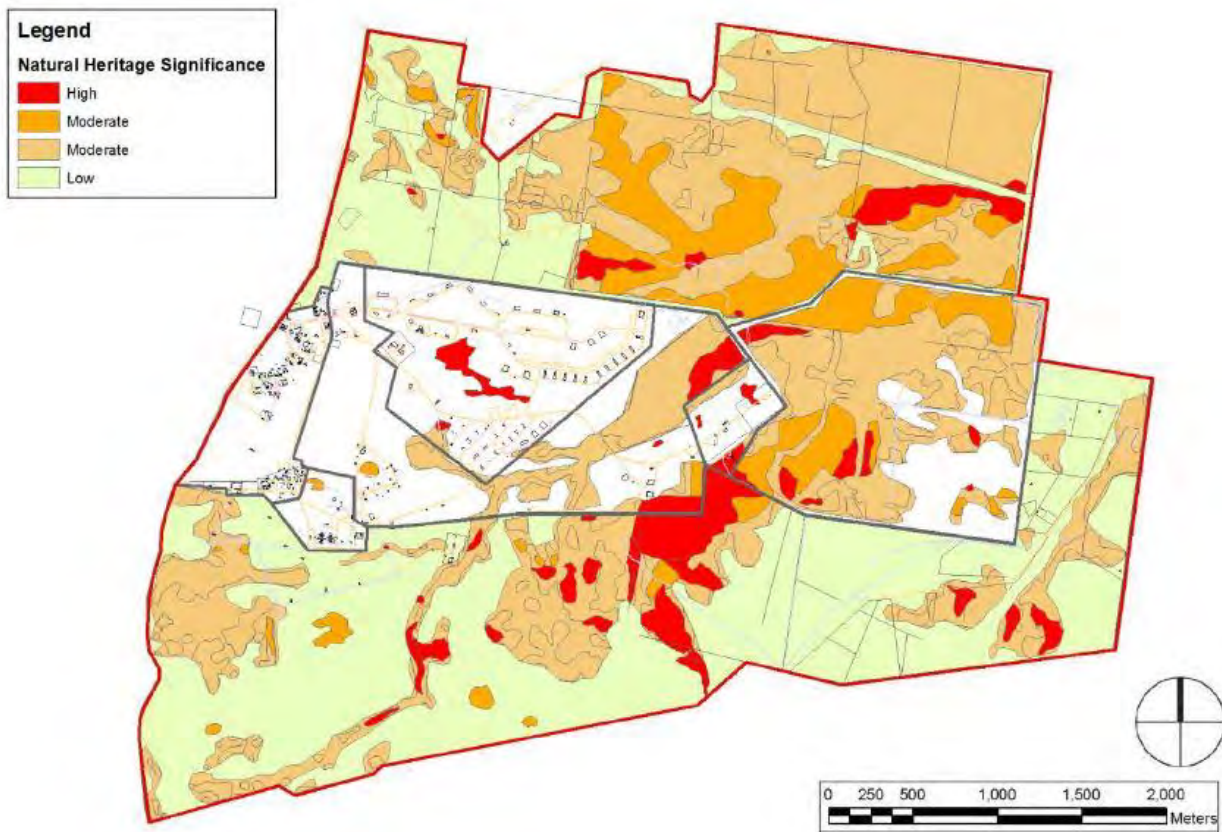


Figure 8-10 Natural heritage significance of the Orchard Hills Cumberland Plain Woodland CHP (source: Godden Mackay Logan, 2013)

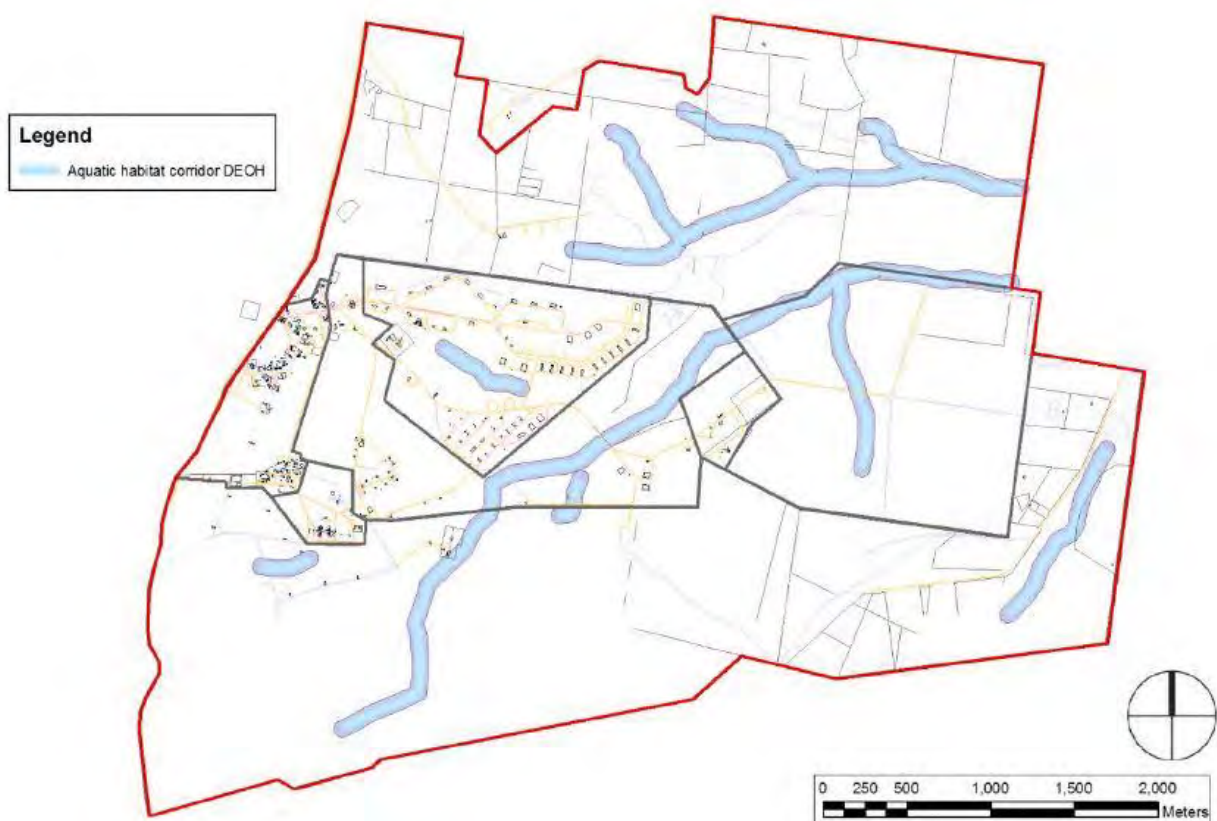


Figure 8-11 Indicative aquatic habitat corridor on the DEOH site (source: Godden Mackay Logan, 2013)

A ranking of 'tolerance for change' has also been applied across the DEOH site to identify the extent to which a place's heritage values/significance and key attributes are able to tolerate change without having an adverse impact on the nature or degree of its heritage values or the significance of the site overall (Godden Mackay Logan, 2013).

As identified above, the key attributes of natural heritage elements on DEOH are the floristics and structure of the ecological communities, and the existence of isolated relic trees (Godden Mackay Logan, 2013). These natural heritage elements have different tolerance for change as follows:

- Remnant vegetation communities have some tolerance for change
- Relic native trees have a low tolerance for change
- Regrowth natural vegetation communities have a reasonable tolerance for change
- Aquatic habitats have a low tolerance for change.

There are no areas of remnant vegetation communities located within the project construction footprint where it overlaps with the CHP. The majority of the project construction footprint overlaps with areas identified as regrowth natural vegetation communities along the western periphery of the CHP within sectors B and H of the DEOH. These areas would be able to tolerate a reasonable change, being that the sector or element and its key attributes have relatively little heritage value, but may contribute to the overall significance of the site. In general, the element can be altered to a reasonable degree provided it does not impact the heritage values of the DEOH.

The construction footprint also overlaps with one area of relic native trees located within the northern section of the CHP within Sector B of the DEOH. This area has a low tolerance for change meaning the sector/element and its key attributes embody the heritage values, retaining a high degree of intactness with no major change or alterations, or only minor alterations that do not detract from the heritage values. In general, the element should be retained and conserved.

Aquatic habitats mapped within the DEOH have a low tolerance for change; however the project does not overlap with these areas directly and is not expected to indirectly impact them.

In relation to historic heritage values potentially impacted by the project, the canal and the area in which is situated (Sector H) has a low tolerance for change in relation to new development and demolition/remediation.

### **Item 3: Warragamba Dam to Prospect Reservoir Pipeline**

The large steel pipeline is on an east/west alignment and located underground at The Northern Road. It emerges about 100 m from The Northern Road on either side. The pipeline is associated with an important historical trend relating to the use of foreign labour in Australia during World War II. The pipeline also has the potential to yield information about steel pipe construction techniques employed at the time. The item is therefore considered to have sufficient significance to fulfil the criteria for local listing.

No areas of archaeological potential were identified during the field survey of this heritage item. Two concrete culverts relating to the pipeline were also recorded during the site survey in September 2016. While the two concrete culverts are associated with the construction of the pipeline over its history, they do not contribute to the historical significance of the site, nor demonstrate the technological significance of the pipeline.

There has been no previous significance assessment undertaken for this heritage item.

### **Item 9: Miss Lawson's Guesthouse Site, Luddenham**

Areas of archaeological potential relating to this heritage item were identified during the field survey, summarised as follows:

- One shallow depression (well) with stone debris on the ground surface around the well, and several visible blocks inside the depression
- Another stone depression (well) with a nearby peppercorn tree

- Cutting into the ground surface that is in line with the gate on Eaton Road on a north/south axis
- Pieces of stone (squares/blocks) located near the gate on Eaton Road.

Further details are provided in Appendix N. No previous significance assessments have been undertaken for this heritage item.

The site is of historical significance in demonstrating the change in the area relating to road use and travel. The site is also associated with a family with ties to the local area through the late 19th and 20th century. The wells are potentially related to the occupation and use of the guesthouse, and given the low level of disturbance or development at the site, there is potential for other archaeological remains and deposits to be present at the site. These archaeological remains have the potential to provide information about the operation of, and custom of, guesthouses operating in the early 20th century in western Sydney. There is potential for information to be obtained about the materials that people were transporting at the time, and the nature, scale and extent of the guesthouse. Comparisons with other inns in operation at this time can also be made. The item is considered to have sufficient significance to fulfil the criteria for local listing.

#### **Item 10: Lawson's Inn site (former 'The Thistle' site)**

Areas of archaeological potential relating to this heritage item were identified during the field survey, including ceramic and glass fragments, and several stone blocks. Further details are provided in Appendix N.

The Lawson's Inn site is currently listed on the LLEP (53) and is classed as an archaeological-terrestrial type of item on the OEH listing. While the location on the LEP is incorrect, the existing 2004 Statement of Significance (OEH, 2016) is of relevance and the non-Aboriginal heritage assessment provided in this EIS concurs with the existing significance assessment as detailed below:

The site of Lawson's Inn at Luddenham demonstrates the history of the early settlement of the area. The Inn formed the nucleus of the development of Luddenham which was laid out adjacent to the site in 1864. The site's location beside a major road is indicative of the importance of the early transport networks in facilitating settlement and development and is representative of early Inn and Hotel sites throughout the Sydney region. The site is also associated with a family with ties to the local area through the late 19th and 20th century. There is potential to gain more information on the site from further archaeological and documentary research.

#### **8.4.4 Potential impacts**

Table 8-29 provides a summary of the potential impacts of the project on the four heritage items identified for this assessment.

As identified above, there were no items listed on the SHR, section 170 registers, National Trust register, NHL or World Heritage List, within or adjacent to the project, and items identified during the survey were assessed as being of local significance. Therefore potential impacts are limited to three items of local significance and one item of Commonwealth heritage significance as summarised below.

Table 8-29 Potential impacts from proposed works for each identified heritage item

Heritage item number	Heritage item name	Register number	Significance	Proposed activities	Potential impacts
Item 2	Orchard Hills Cumberland Plain Woodland	105317 (CHL) 102211 (RNE)	Commonwealth	Clearing of vegetation and construction of carriageway and associated fill slope as well as associated drainage and flood retardation works	<p>Potential impacts to the Orchard Hills Cumberland Plain Woodland Commonwealth Heritage Place (CHP) as a result of the project include impacts to the natural heritage values of the site through native vegetation removal and associated habitat loss, as well as impacts to the historic heritage values of the site as a result of impacts to the Chaffey Brothers Irrigation Scheme Canal (the canal). These potential impacts are summarised below.</p> <p>The main impacts to natural heritage are as a result of clearing of around 9.68 ha of native vegetation within the western periphery of the CHP (Sectors B and H). However this is equivalent to only around 1.3 per cent of the total 726.32 ha of native vegetation within the CHP. The majority of these areas are made up of a mix of regrowth natural vegetation communities identified in the HMP for the DEOH as being of moderate natural heritage significance, as well as grassland areas ranked as being of low natural heritage significance (Godden Mackay Logan, 2013). There is also a small patch of relic native trees associated with two trees located within the north-western portion of the CHP that would also be impacted by the project. This area is identified as having moderate natural heritage significance (Godden Mackay Logan, 2013). Of</p>

Heritage item number	Heritage item name	Register number	Significance	Proposed activities	Potential impacts
					<p>the impacted areas, none are identified as remnant vegetation communities which are ranked as high natural heritage significance in the HMP.</p> <p>The regrowth natural vegetation communities have been identified as having a reasonable tolerance for change, being that this element and its key attributes have relatively little heritage value, but may contribute to the overall significance of the site. In general, the element can be altered to a reasonable degree provided it does not impact the heritage values of the site (Godden Mackay Logan, 2013). In the context of the CHP overall, impacts to regrowth natural vegetation communities as well as grasslands are expected to be minimal and are therefore considered reasonable. Given this and the moderate to low heritage significance of these elements, impacts as a result of the project are not expected to be significant.</p> <p>Relic native trees have been identified as having a low tolerance for change, being that this element and its key attributes embody heritage values, retaining a high degree of intactness with no major change or alterations, or only minor alterations that do not detract from the heritage values. In general, the element should be retained and conserved (Godden Mackay Logan, 2013). Although impacts to relic native trees in the overall context of the CHP as a result of the</p>



Heritage item number	Heritage item name	Register number	Significance	Proposed activities	Potential impacts
					<p>project would be minimal, given their moderate natural heritage significance and low tolerance for change, impacts to this element as a result of the project are considered moderate.</p> <p>The aquatic environment within the CHP that is ranked in the HMP as being of moderate to high significance (Godden Mackay Logan, 2013) is not expected to be impacted by the project due to the distance from the works and the proposed application of effective mitigation measures.</p> <p>Potential impacts to the historic heritage values of this item are related to impacts to the canal located within the south-western portion of the CHP (Sector H of the DEOH). The canal is ranked as high significance in the HMP (Godden Mackay Logan, 2013). Construction would overlap with only 2.43 per cent of the northern part of the canal, some of which is in poor condition as it is extremely shallow from erosion. The canal and the area in which is situated (Sector H) has a low tolerance for change in relation to new development and demolition /remediation. However, given the project is impacting a small proportion of the overall canal on DEOH land, and that the section being impacted is of relatively poor quality due to erosion, the overall impact on the historic heritage values are not considered to be significant.</p>

Heritage item number	Heritage item name	Register number	Significance	Proposed activities	Potential impacts
					Vibration is unlikely to impact the canal due to the structural nature of the canal and vegetation on the canal.
Item 3	Warragamba Dam to Prospect Reservoir pipeline	-	Local	Construction of carriageway and fill slope along The Northern Road project area section. Drainage infrastructure upgrades comprising a concrete drainage channel along the northern perimeter of the Water NSW Precinct (north of the pipeline) and an access track to the east of The Northern Road. A second concrete drainage channel about 500 m in length along the southern perimeter of the 1940s pipeline, to the east of The Northern Road.	The Northern Road carriageway construction is confined to section of pipeline that is underground. No impact.  Proposed access track and drainage works would impact on two culverts located in Survey Area No. 4-26 and Survey Area No. 4-27 respectively. As the culverts do not contribute to the significance of the pipeline, there is no impact on heritage significance.
Item 9	Miss Lawson's Guesthouse Site	-	Local	Construction of dual carriageway and cut slopes	Directly impacted by construction
Item 10	Lawson's Inn site	53 (LLEP)	Local	Construction of dual carriageway, two cul-de-sacs, intersection, cut slopes and construction compound and laydown site	Part of the site would be directly impacted by construction



Statements of Heritage Impact are provided below for each of the four identified heritage items. The implementation of the general and site-specific environmental management measures listed in Section 8.4.6 would minimise impacts on non-Aboriginal heritage to an acceptable level to proceed with the project as assessed.

## **Item 2: Orchard Hills Cumberland Plain Woodland (Lot 3 DP238092)**

### ***Proposed works***

Proposed works that would interact with the Orchard Hills Cumberland Plain Woodland CHP include clearing of vegetation and construction of a carriageway to the east of the existing The Northern Road, including associated fill slope formations and alterations to existing drainage lines for road-serving drainage and flood retardation works. This would have potential impacts on the natural heritage values of the site (refer to Figure 8-12). These works would also overlap with the western-most section of the Chaffey Brothers Irrigation Scheme Canal (the canal) in two locations, which would have potential impacts on the non-Aboriginal heritage values of the site (Figure 8-13).

### ***Impact Assessment***

Potential impacts to the Orchard Hills Cumberland Plain Woodland Commonwealth Heritage Place (CHP) as a result of the project include impacts to the natural heritage values of the site through native vegetation removal and associated habitat loss, as well as impacts to the historic heritage values of the site as a result of impacts to the Chaffey Brothers Irrigation Scheme Canal (the canal). These potential impacts are summarised below.

*The following aspects of the project respect or enhance the heritage significance of the item for the following reasons:*

The natural heritage values of the site are mainly focused on its natural vegetation, which includes areas of original native vegetation (including very old relic trees) as well as the natural regrowth of these original plant communities (Godden Mackay Logan, 2013). This includes small remnants and regenerating areas of Cumberland Plain Woodland, Castlereagh Ironbark Forest and Sydney Coastal Riverflat Forest (River Flat Eucalypt Forest), particularly in the eastern portion of the CHP. It is noted that impacts from the project would be limited to the western periphery of the CHP.

Cumberland Plain Woodland is listed as a critically endangered ecological community at both state (Cumberland Plain Woodland in the Sydney Basin Bioregion) and Commonwealth levels (Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest). As such, the CHP is considered a core biodiversity area for the conservation of these communities, and the place comprises the least disturbed and largest remaining remnant of Cumberland Plain Woodland (Godden Mackay Logan, 2013).

Although around 9.68 ha of native vegetation would be removed by the project, this is equivalent to only around 1.3 per cent of the 726.32 ha of native vegetation on the CHP. These areas are made up of a mix of regrowth natural vegetation communities identified in the HMP as being of moderate natural heritage significance, as well as grassland areas ranked as being of low natural heritage significance (Godden Mackay Logan, 2013). There is also a small patch of relic native trees associated with two trees located within the north-western portion of the CHP that would also be impacted by the project. This area is identified as having moderate natural heritage significance (Godden Mackay Logan, 2013).

Additionally of the 9.15 ha of the CPWSGTF and REFCF ecological communities that would be removed by the project, this would be equivalent to only around 1.5 per cent of the total 610.60 ha of these communities within the CHP. None of the areas impacted by the project have been identified in the HMP as remnant vegetation communities of high natural heritage value.

Additionally since the area is already disturbed by fencing, roadside and edge effects, impacts to fauna within the CHP as a result of the project (eg edge effects, light pollution, etc.) are not considered to be significant. For impacts to fauna refer to the Biodiversity assessment (Section 7.3).

As identified in the Hydrology and flooding assessment (refer to Section 8.1), the project would also result in an increase in the rate and volume of flow discharging to three Blaxland Creek tributaries and existing dams within the Blaxland Creek catchment within the DEOH site. As a result, the scour potential along these drainage lines would increase and ground conditions would become wetter. However, these impacts are not expected to extend to the aquatic areas mapped as moderate to high significance within the CHP, therefore the impact on these areas would be negligible. This is due to the distance of the works from these areas and the implementation of effective mitigation measures outlined in the Hydrology and Flooding Assessment (Section 8.1.6) and the Soils, water and contamination assessment (Section 8.4.6).

The entire length of the canal within the CHP is around 2,632 m and is ranked as being of high significance in the HMP (Godden Mackay Logan, 2013). There would be minimal impact to the canal as much of its extent is situated outside the construction footprint. The construction footprint (and therefore, area of impact) only overlaps with around 2.43 per cent of the entire canal. Furthermore, around 36 m of the part of the canal located within the construction footprint is in poor condition as it is extremely shallow due to erosion. The section within the construction footprint which is in better condition is very similar to those sections that are outside the construction footprint. The wooden features of the canal structure that have the potential to yield information about the construction of the canal are located outside the construction footprint.

*The following aspects of the project could detrimentally impact on heritage significance. The reasons are explained as well as the measures to be taken to minimise impacts:*

As identified above, although around 9.68 ha of native vegetation would be removed by the project, this is equivalent to only around 1.3 per cent of the 726.32 ha of native vegetation on the CHP and is mainly made up of a mix of regrowth natural vegetation communities identified in the HMP as being of moderate natural heritage significance, as well as grassland areas ranked as being of low natural heritage significance (Godden Mackay Logan, 2013). The small patch of relic native trees within the north-western portion of the CHP that would also be impacted by the project has been identified as having moderate natural heritage significance (Godden Mackay Logan, 2013).

The key attributes of natural heritage elements on DEOH are the floristics and structure of the ecological communities, and the existence of the isolated relic trees. Therefore, they have different levels of tolerance for change. The regrowth natural vegetation communities have been identified as having a reasonable tolerance for change, being that this element and its key attributes have relatively little heritage value, but may contribute to the overall significance of the site. In general, the element can be altered to a reasonable degree provided it does not impact the heritage values of the site (Godden Mackay Logan, 2013). In the context of the CHP overall, impacts to regrowth natural vegetation communities as well as grasslands are expected to be minimal and are therefore considered reasonable. Given this and the moderate to low heritage significance of these elements, impacts as a result of the project are not expected to be significant.

Relic native trees have been identified as having a low tolerance for change, being that this element and its key attributes embody heritage values, retaining a high degree of intactness with no major change or alterations, or only minor alterations that do not detract from the heritage values. In general, the element should be retained and conserved (Godden Mackay Logan, 2013). Although impacts to relic native trees in the overall context of the CHP as a result of the project would be minimal, given their moderate natural heritage significance and low tolerance for change, impacts to this element as a result of the project are considered moderate.

The project could potentially introduce invasive weed and pest species. There may be regular mobilisation of typical roadside maintenance fertilisers, herbicides or other chemicals that may stunt the regrowth of native vegetation. However this would be managed through the implementation of effective weed and pest management measures as outline in the Biodiversity Assessment (Section 7.3).

The project would result in an increase in the rate and volume of flow discharging to three Blaxland Creek tributaries and existing dams within the Blaxland Creek catchment within the DEOH site. As a result, the scour potential along these drainage lines would increase and ground conditions would become wetter. However as identified above, impacts to the aquatic areas mapped as

moderate to high significance in the DEOH site would be negligible due to the distance of the works from these areas and the implementation of effective mitigation measures.

In relation to the canal, which is ranked as being of high significance in the HMP (Godden Mackay Logan, 2013), only 2.43 per cent of the entire canal extent associated with the DEOH is situated within the construction footprint and would therefore be subject to direct physical impact during construction. The remaining sections of the canal within the study area would potentially be subject to damage or destruction from the use of construction machinery and vehicles if not managed appropriately during construction; however this is not expected given the implementation of mitigation measures as outlined in Section 8.1.6.

Around 36 m of the canal within the construction footprint area is extremely shallow and eroded while the more intact section is similar to the other sections which would not be impacted, therefore it has limited potential to yield information just from that section. Overall the proposed works would have minimal impact to the significance of the site.

Furthermore, there are other remnants of the canal located to the west of The Northern Road about one kilometre south-west of the DEOH site which is listed on the PLEP as a locally significant archaeological heritage item (A-137).

The Heritage Management Plan for the DEOH site (Godden Mackay Logan, 2013:152-155) outlines management guidelines for the DEOH, including those related to managing impacts to the natural heritage values within Sectors B and H and historic heritage values associated with the canal in Sector H as follows:

- New development in Sectors B and H should be located so as to avoid impacts on natural heritage. These sectors have a low tolerance for change in relation to new development
- New development in Sector H should not be planned for the southwest area where the Mulgoa Irrigation Scheme (the canal) is located. This southwest area of Sector H has a low tolerance for change in relation to new development
- Demolition and remediation relating to whole of DEOH land – Remediation should aim to avoid all heritage items and values. If heritage sites cannot be avoided as a consequence of remediation, then heritage mitigation measures should be implemented. Remediation that impacts heritage values must be subject to assessment, development of a HIA, heritage impact mitigation and Defence approval
- Demolition and remediation relating to Sector H (location of canal) - consideration of proposals for demolition of built elements should take into account the heritage value of the element and its tolerance for change, as well as its relationship to other, related elements of heritage value and the number of its type remaining. Demolition of elements of moderate and high heritage value should be avoided. Sector H has a low tolerance for change.

### ***Summary of impacts***

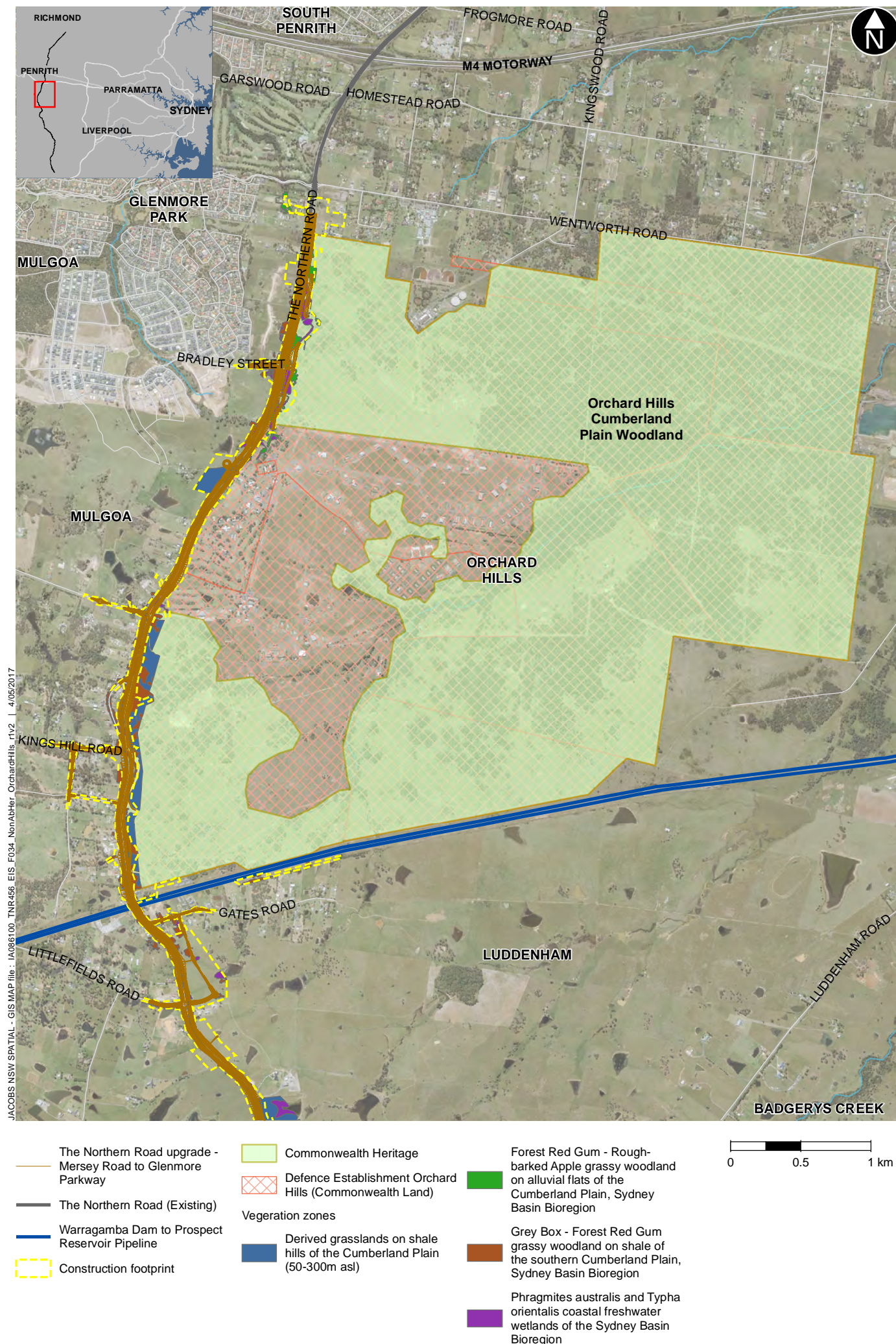
As discussed above, some impacts would occur to both the natural and historic heritage values of the site as a result of the project which are unavoidable. However these impacts would be limited to areas of low to moderate natural heritage significance with a reasonable to low tolerance for change. No areas of high natural heritage significance would be impacted by the project. Additionally, in relation to historic heritage, given the project is impacting a small proportion of the overall canal, and that the section being impacted is of relatively poor quality due to erosion, the overall impact on the historic heritage values of the CHP as a result of the project are also not considered to be significant.

This is subject to the implementation of relevant mitigation measures, including for natural heritage the measures identified in the Biodiversity assessment (Section 7.3.7), the Hydrology and flooding assessment (Section 8.1.6) and the Soils, water and contamination assessment (Section 8.2.8). Additionally by implementing the following mitigation measures the potential impacts on the canal would be minimised:

- An archival photographic recording would be made of the extent of the canal to be impacted by the works, in accordance with the Heritage Division of the OEH guidelines (Heritage Council of NSW, 2006) prior to its demolition
- The section of the canal outside the construction footprint would need to be protected from accidental or incidental damage during construction. Protective barrier fencing would be constructed along the construction footprint boundary in the vicinity of the canal prior to construction commencing and would remain in place until the conclusion of the works, at which time it would be removed.

Impacts for this item have also been assessed against the Significant Impact Guidelines 1.2 (Department of Sustainability Environment Water Population and Communities, 2013) (Appendix N). In summary, the project is not expected to have a significant impact on the natural or non-Aboriginal heritage values of the CHP given the heritage significance of these elements, their tolerance for change and proposed implementation of effective mitigation measures.









JACOBS NSW SPATIAL - GIS MAP file: IA086100\_TNR456\_EIS\_F008\_NonAbHer\_Canal\_2v4 | 4/05/2017

**Figure 8-13** | Location of Orchard Hills Cumberland Plain Woodland (Chaffey Brothers Irrigation Scheme Canal)(item 2) in relation to proposed works



### **Item 3: Warragamba Dam to Prospect Reservoir pipeline (Lot A DP341629 and Lot A DP341893)**

#### ***Proposed works***

Construction of carriageway, associated drainage works and fill slope to the west of The Northern Road (current) overlaps with the pipeline alignment to the west of The Northern Road.

#### ***Impact assessment***

The following aspects of the project respect or enhance the heritage significance of the item for the following reasons:

The carriageway is located over the section of pipeline that is below the ground to the west of The Northern Road and would avoid direct impact to the pipeline. In addition the proposed works include fill slopes within the pipeline corridor.

The following aspects of the project could detrimentally impact on heritage significance. The reasons are explained as well as the measures to be taken to minimise impacts:

There is a potential for physical damage to the pipeline from road construction machinery, vehicles or other activities accidentally occurring outside the project area. However, measures outlined in The Guidelines for development adjacent to the Upper Canal and Warragamba Pipelines (Sydney Catchment Authority, 2012) sets out guidelines when designing, planning or assessing development on land adjacent to this pipeline. The document outlines potential impacts to the pipeline through construction works in the vicinity. A Construction Environmental Management Plan is recommended for major development projects (Sydney Catchment Authority, 2012:9).

The two concrete culverts located within a proposed access track and drainage works area would be directly impacted by the proposed works. However, removal of the culverts would not impact on the significance of the pipeline because they do not contribute to the historical significance of the site, nor demonstrate the technological significance of the pipeline.

#### ***Summary of impacts***

Impacts to this heritage item can be summarised as follows:

- Vibration – unlikely due to the application of the measures outlined in The Guidelines for development adjacent to the Upper Canal and Warragamba Pipelines (Sydney Catchment Authority, 2012) and the guidelines and associated safe working distances to be adhered to for heritage structures as outlined in the Noise and vibration assessment (Appendix H of this EIS)
- Demolition – the pipeline would not be demolished. The two concrete culverts located within a proposed access track and drainage works area would be demolished and would not impact on the significance of the heritage item
- Archaeological disturbance – not applicable
- Altered historical arrangements and access – the heritage item is located within WaterNSW land and is therefore subject to restricted access
- Landscape and vistas – the landscape and vistas of the heritage item would not be impacted
- Architectural noise treatment – not relevant to this heritage item.

By implementing the proposed mitigation measures for this item as summarised in Section 8.4.6, the potential impacts to this heritage item would be minimised. Additionally the implementation of these management measures would allow as much information as possible about the site to be preserved, which would contribute to our knowledge of the item and its significance.

Overall, there would be no impact to heritage Item 3 during construction or operation.





**Figure 8-14** | Location of Warragamba Dam to Prospect Reservoir pipeline (WaterNSW supply pipelines) (item 3) in relation to proposed works



## **Item 9: Miss Lawson's Guesthouse site (Lot 1 DP90157)**

### ***Proposed works***

Construction of dual carriageway and cut slopes, which overlap with the Miss Lawson's Guesthouse site.

### ***Impact assessment***

The following aspects of the project respect or enhance the heritage significance of the item for the following reasons:

While the project would have a direct impact on archaeological deposits of the guesthouse site, the opportunity for undertaking a detailed archaeological investigation of the site prior to its destruction may enhance its significance through the realisation of its research potential. Undertaking archaeological investigation of the site under a well-structured research design by an appropriately qualified historical archaeologist would reveal information and answer questions particularly in relation to the early settlement of Luddenham and the hotel and inn industry in the early 20th century.

The following aspects of the project could detrimentally impact on heritage significance. The reasons are explained as well as the measures to be taken to minimise impacts:

The construction of The Northern Road upgrade would have a direct impact on all surface features identified at the site, and on potential subsurface archaeological deposits from the construction. To minimise impacts and maximise the opportunity for realising research potential at the site the following actions would be undertaken:

- Salvage excavation to be undertaken in accordance with the Heritage Division of OEH guidelines including an appropriate research design and methodology in order to best realise the research potential of this area of the site
- Salvage excavation would be undertaken under the supervision of an appropriately qualified and experienced historical archaeologist in accordance with the Heritage Division of OEH criteria.

### ***Summary of impacts***

Impacts to this heritage item can be summarised as follows:

- Vibration – this heritage item would not be impacted by vibration due to the archaeological nature of the site
- Demolition – the entire heritage item would be demolished; however, mitigation measures would minimise these impacts
- Archaeological disturbance – the entire heritage item would be subject to archaeological disturbance; however, mitigation measures would minimise these impacts
- Altered historical arrangements and access – not relevant to this heritage item, as the entire site would be impacted
- Landscape and vistas – Not relevant to this heritage item
- Architectural noise treatment – not relevant to this heritage item.

By implementing the proposed mitigation measures for this item as summarised in Section 8.4.6, including archaeological salvage, the potential impacts to this heritage item would be minimised. Additionally the implementation of these management measures would allow as much information as possible about the site to be preserved, which would contribute to our knowledge of the item and its significance.

Overall impact to item 9 would be physical damage to the whole site.



JACOBS NSW SPATIAL - GIS MAP file : JA086100\_TNR456\_EIS\_F010\_NonAbHer\_LawsonsGH\_12v4 | 4/05/2017

**Figure 8-15** | Location of Miss Lawson's Guesthouse Site (Item 9) in relation to proposed works



## **Item 10: Lawson's Inn Site (Lot 2 DP623457) (LLEP 53)**

### ***Proposed works***

Construction of new dual carriageway including two cul-de-sacs on the existing Eaton Road, one to the west and one to the east of the new The Northern Road. The southern sections of the cul-de-sacs extend into the inn site. The site would potentially be partially impacted by one of the proposed construction compound and laydown areas.

### ***Impact assessment***

The following aspects of the project respect or enhance the heritage significance of the item for the following reasons:

While the project would have a direct impact on archaeological deposits of the inn, the opportunity for undertaking a detailed archaeological investigation of the site prior to its destruction may enhance knowledge of the site through the realisation of its research potential. Undertaking archaeological investigation of the site under a well-structured research design by an appropriately qualified historical archaeologist would reveal information and answer questions particularly in relation to the early settlement of Luddenham, and the hotel and inn industry related to use of early roads in NSW.

The following aspects of the project could detrimentally impact on heritage significance. The reasons are explained as well as the measures to be taken to minimise impacts:

The construction of The Northern Road upgrade would directly impact on the entire curtilage of the site, including the potential archaeological deposits. To minimise impacts and maximise the opportunity for realising research potential at the site the following actions would be undertaken:

- Salvage excavation to be undertaken in accordance with the Heritage Division of OEH guidelines including an appropriate research design and methodology in order to best realise the research potential of this area of the site
- Salvage excavation would be undertaken under the supervision of an appropriately qualified and experienced historical archaeologist in accordance with the Heritage Division of OEH criteria.

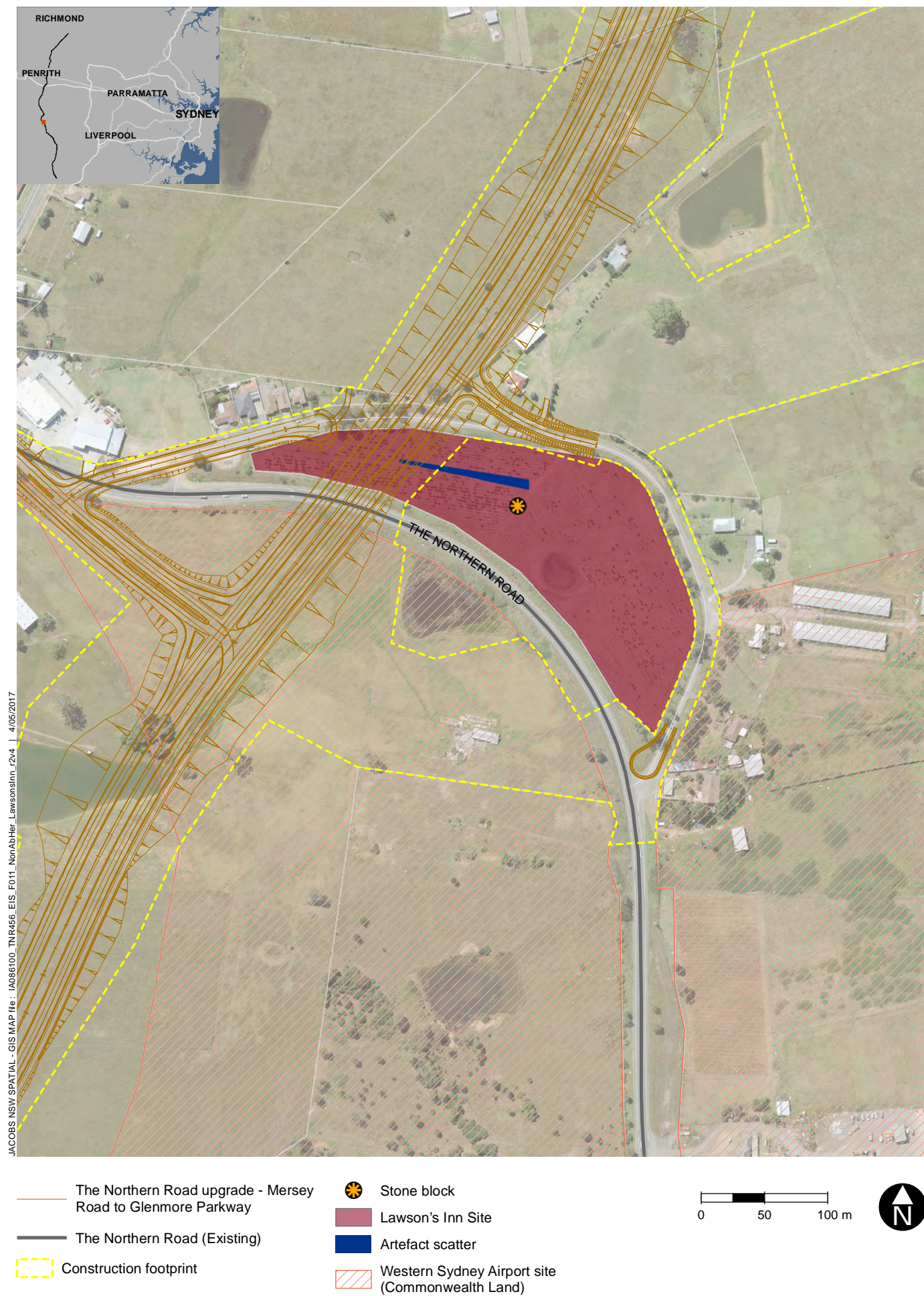
### ***Summary of impacts***

Impacts to this heritage item can be summarised as follows:

- Vibration – this heritage item is not anticipated to be impacted by vibration due to the archaeological nature of the site
- Demolition – part of this heritage item would be demolished; however, mitigation measures would minimise these impacts
- Archaeological disturbance – part of the heritage item would be subject to archaeological disturbance; however, mitigation measures would minimise these impacts
- Altered historical arrangements and access – the historical arrangements and access would not change for the remaining part of the heritage item which would not be impacted
- Landscape and vistas – not relevant to this heritage item
- Architectural noise treatment – not relevant to this heritage item.

By implementing the proposed mitigation measures for this item as summarised in Section 8.4.6, including archaeological salvage, the potential impacts to this heritage item would be minimised. Additionally the implementation of these management measures would allow as much information as possible about the site to be preserved, which would contribute to our knowledge of the item and its significance.

Overall impact to item 10 would be physical damage to part of the site.



**Figure 8-16** | Location of Lawson's Inn Site (Item 10) in relation to proposed works



#### 8.4.5 Summary of potential impacts to the environment of Commonwealth land

A summary of potential impacts to the environment of Commonwealth land as a result of construction and operation of the project is provided in this section.

Potential construction related non-Aboriginal heritage impacts are outlined in Section 8.4.4. This includes impacts to four identified heritage items. One of these items, the Orchard Hills Cumberland Plain Woodland is located on Commonwealth land and is listed for both its natural heritage values as well as historic heritage values associated with the Chaffey Brothers Irrigation Scheme Canal. Impacts to this heritage item would occur as a result of construction of the carriageway and fill slope including some drainage and flood retardation work to the east of the existing The Northern Road, some of which would overlap with the western periphery of the Orchard Hills Cumberland Plain Woodland site.

Impacts to the natural heritage values of the site would be limited to areas of moderate to low natural heritage significance (Godden Mackay Logan, 2013), with a reasonable to low tolerance for change. Impacts to the historic non-Aboriginal heritage values of the site would be limited to the western-most section of the canal at two locations. The canal has been identified as being of high significance, with a low tolerance for change (Godden Mackay Logan, 2013). However as identified above, there would be minimal impact to the overall heritage values of the site as much of it is situated outside the project's construction footprint and the areas of most significance both from a natural and historic heritage perspective are generally not located within the project footprint.

Impacts to this heritage item would be mitigated through the measures outlined in Section 8.4.6 as well as the relevant mitigation measures identified in Section 7.3.7, 8.1.6 and 8.2.8 for natural heritage values. Overall impacts to this heritage item as a result of the project are not expected to be significant.

In summary, the potential non-Aboriginal heritage impacts to the environment of Commonwealth land are not anticipated to be greater or different to those outlined above, limited to the identified heritage item on Commonwealth land. Additionally the residual impacts are considered to be consistent with those outlined in Section 8.4.8.

#### 8.4.6 Environmental management measures

##### **Expected environmental outcomes**

Project specific environmental management measures identified in Table 8-30 have been developed with the aim of minimising or mitigating, as far as practical, the potential impacts described in this chapter.

The expected environmental outcomes of the environmental management measures are to avoid or minimise disturbance, possible damage to heritage items or loss of cultural heritage within the scope permitted by the planning approval. Specific outcomes that would be achieved through the implementation of environmental management measures include:

- Minimising or avoiding impacts on known non-Aboriginal heritage sites
- Undertake all works in accordance with the provisions of cultural heritage management plans
- Provide appropriate archival photographic recording of heritage items impacted by the project
- Detailed salvage archaeological investigation of the site as outlined in this EIS
- Follow correct procedure to ensure notification of any non-Aboriginal heritage objects/places uncovered during construction
- Compliance with the relevant legislative requirements and project conditions of approval.

#### 8.4.7 Expected effectiveness

Roads and Maritime have experience in managing potential impacts to Non-Aboriginal heritage as a result of road developments of similar scale and scope to this project. It is noted that no

operational impacts have been identified as a result of the project, therefore these management measures relate to construction impacts only.

A Construction Cultural Heritage Management Plan (CCHMP) would be prepared as part of the CEMP prior to construction in consultation with the NSW Heritage Division of OEH. The CHMP would be prepared to address the requirements of the project approvals, the environmental management measures outlined in this EIS and all applicable legislation. Should all works be undertaken in accordance with the provisions of Cultural Heritage Management Plans the impacts to non-aboriginal heritage beyond those outlined in this chapter are expected to be negligible.

Where unexpected finds are identified during construction of the project, this would be managed and potential impacts mitigated through the implementation of an unexpected finds procedure developed as part of the CHMP. This would include a stop works protocol in the event of an unexpected find and the requirement to notify relevant project environmental staff. An appropriately qualified heritage consultant would be engaged as required to determine the potential find and outline any specific management measures to be implemented prior to the works recommencing. The procedure would outline the appropriate reporting procedures to be followed to appropriately manage and record the find.

Archival photographic recording would be made of the extent of the canal, including the section outside the project area, in accordance with the Heritage Division of the OEH guidelines (Heritage Council of NSW, 2006) prior to its demolition.

Salvage excavation would be carried out under the supervision of an appropriately qualified and experienced historical archaeologist in accordance with the Heritage Division of OEH guidelines including an appropriate research design and methodology in order to best realise the research potential of this area of the site. This would ensure sufficient recovery of data about the site, or elements of the site before it is impacted by the works, which would contribute to our knowledge and understanding of these sites.

Audits and reporting of the effectiveness of environmental management measures is generally carried out to show compliance with management plans and other relevant approvals and would be outlined in detail in the CEMP and CHMP prepared for the project. Reporting and management requirements included in the RMS Standard Procedure – Unexpected Archaeological Finds in the event of unexpected finds would also be implemented as required.

Table 8-30 outlines environmental management measures that have been developed to specifically manage potential impacts which have been predicted as a result of the project. In relation to potential impacts to the natural heritage values identified for the Orchard Hills Cumberland Plain Woodland CHP, the relevant measures identified in the Biodiversity Assessment (Section 7.3.7), the Hydrology and flooding assessment (Section 8.1.6) and the Soils, water and contamination assessment (Section 8.2.8) would be implemented.

Table 8-30 Non-Aboriginal heritage environmental management measures

Impact	Ref #	Environmental management measures	Responsibility	Timing	Effectiveness of measures
Construction impacts to non-Aboriginal heritage items and places	NAH-1	<p>A Construction Cultural Heritage Management Plan would be prepared as part of the CEMP prior to construction in consultation with the NSW Heritage Division of OEH. As a minimum, the plan would include the following:</p> <ul style="list-style-type: none"> <li>• Induction protocols for staff and project personnel to undertake a cultural heritage induction, to assist them in understanding and complying with their legal obligations</li> <li>• A list, plan and GIS layer showing the location of identified heritage items</li> <li>• A significance assessment and statement of significance for each item</li> <li>• Detail the mitigation measures identified and when the measures are to be implemented</li> <li>• Provide protocols and procedures to be enacted during construction to ensure the protection of items of heritage significance</li> <li>• An unexpected finds procedure in the event that further sites are identified during works</li> <li>• The separate procedure for the discovery of skeletal remains (highly effective).</li> </ul>	Construction contractor	Pre-construction	<p>Proven to be effective.</p> <p>Monitoring and reporting requirements of the CHMP to confirm effectiveness of measures.</p> <p>Specific measures carried out in accordance with agreed guidelines and by qualified archaeologists.</p>
Orchard Hills Cumberland Plain Woodland	NAH-2	Archival photographic recording in accordance with the Heritage Division of the OEH guidelines. This would include:	Construction contractor	Construction	<p>Proven to be effective.</p> <p>An archival photographic</p>

Impact	Ref #	Environmental management measures	Responsibility	Timing	Effectiveness of measures
(Chaffey Brothers Irrigation Scheme Canal)		<ul style="list-style-type: none"> <li>Report (paper), thumbnails, CD-R and prints (10.5x14.8cm) to NSW Heritage Office</li> <li>Report (paper), thumbnails and CD-R to State Library of NSW</li> <li>Report (paper), thumbnails and CD-R to Owner/client</li> <li>Report (paper), thumbnails and CD-R to Local Council</li> <li>Report (paper), thumbnails and CD-R to Local Council Library.</li> </ul>			recording would be made of the extent of the canal, including the section outside the project area, in accordance with the <i>Heritage Division of the OEH guidelines</i> (Heritage Council of NSW, 2006) prior to its demolition
Miss Lawson's Guesthouse site	NAH-3	Detailed salvage archaeological investigation of the site	Roads and Maritime	Pre - construction	Expected to be effective.
Lawson's Inn site	NAH-4	Detailed salvage archaeological investigation of the site	Roads and Maritime	Pre - construction	<p>Salvage excavation would be carried out in accordance with the Heritage Division of OEH guidelines including an appropriate research design and methodology in order to best realise the research potential of this area of the site.</p> <p>Salvage excavation would be undertaken under the supervision of an appropriately qualified and experienced historical archaeologist in accordance with the Heritage Division of OEH criteria.</p>

Impact	Ref #	Environmental management measures	Responsibility	Timing	Effectiveness of measures
Unexpected impacts on heritage values	NAH-5	The project's Construction Environmental Management Plan would include 'unexpected finds' procedures to guide the management of any archaeological sites identified during construction. The management response would vary depending on the nature of the find, its significance and likely impacts.	Construction contractor	Construction	Expected to be effective if carried out in accordance with procedures outlined in CHMP.