Report Attachment:

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Indigenous Heritage Assessment Project: Austral & Leppington North Precincts, South West Growth Centres	Australian Museum Business Services	June 2012
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Indigenous Heritage Assessment Project: Austral & Leppington North Precincts, South West Growth Centres

Prepared by Australian Museum Business Services
for NSW Department of Planning and Infrastructure

Volume 1 Report: Main Report (for Public Exhibition)

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Executive Summary

Australian Museum Business Services (AMBS) has been commissioned by NSW Department of Planning and Infrastructure (DP&I), to prepare an Aboriginal (Indigenous) heritage assessment for the Austral and Leppington North Precincts of the South West Growth Centres (SWGC). This report will inform the Urban Form Analysis, and development of the project footprint.

Approximately 28% of the study area was surveyed; however, there was an extreme lack of visibility owing to higher than average rainfall throughout the region in the months prior to survey. The location of one previously recorded Aboriginal site was identified during the survey, and six new Aboriginal heritage sites were recorded. Thirty-four other sites that had been previously recorded in the study area were not able to be located. Areas of archaeological sensitivity were identified along creeklines and ridges, and in an area with the least disturbance in the study area. The effects of previous disturbance on these areas of sensitivity were also broadly estimated.

The following recommendations are made for the management of Aboriginal heritage for the project:

- Areas of moderate and high archaeological sensitivity should be incorporated into conservation zones where possible, particularly areas outside of Sydney Water's proposed pipelines. Where this is not possible, detailed Aboriginal heritage impact assessment of specific proposed development should be undertaken, and archaeological test excavations under the Code of Practice may be required, to determine the artefactual assemblages that are present and the nature of Aboriginal activities in these areas.
- Areas for conservation of Aboriginal cultural heritage must be considered as part of the future development of the Precinct. Conservation areas should be within areas of high and moderate sensitivity, preferably within the less disturbed parts of these areas. Impacts to these conservation areas (e.g. drainage infrastructure, sporting fields, footpaths and other facilities/landscaping) should be avoided.
- Where impacts will occur in areas of moderate and high archaeological sensitivity that are to be included within riparian corridors/open space, detailed Aboriginal heritage impact assessment of specific proposed development should be undertaken, and archaeological test excavations under the Code of Practice may be required to determine the artefactual assemblages that are present and the nature of Aboriginal activities in these areas.
- For any specific proposed development to areas without an ascribed archaeological sensitivity, assessment of Aboriginal heritage should be undertaken in accordance with the *National Parks & Wildlife Act* 1974 (Amended 2010) and *National Parks & Wildlife Amendment Regulation* 2010, as per the OEH guidelines.
- Impact should be avoided to sites ALN-IF-01, ALN-IF-05–ALN-IF-06, SWRL Sites 3–4, SWRL Sites 11–12, LP-3, TLC1 and GLC2. Where this is not possible, detailed Aboriginal heritage impact assessment, in accordance with the Code of Practice, should be undertaken for any specific proposed development in the vicinity of these sites, and an AHIP may be required.
- Where impacts are likely to occur to sites ALN-IF-01, ALN-IF-05–ALN-IF-06, SWRL Sites 3–4, SWRL Sites 11–12, LP-3, TLC1 and GLC2, detailed Aboriginal heritage impact assessment of specific proposed development should be undertaken, and AHIPs may be required.
- Should sites 2016-5, 2021-5, BRP-IF-06 – BRP-IF-09, BRP-S-11 – BRP-S-13, BRP-S-19, SWRL Site 7, SWRL Site 10, SWRL Site 13, LP-4 and LIF-1 not have been destroyed by other developments, impacts to these sites should be avoided. Where this is not possible, detailed Aboriginal heritage impact assessment, in accordance with the Code of

Practice, should be undertaken for any specific proposed development in the vicinity of these sites, and an AHIP may be required for those sites that have not yet been destroyed by other development.

- Where impacts are likely to occur to sites 2016-5, 2021-5, BRP-IF-06 – BRP-IF-09, BRP-S-11 – BRP-S-13, BRP-S-19, SWRL Site 7, SWRL Site 10, SWRL Site 13, SW1, LP-4 and LIF-1, detailed Aboriginal heritage impact assessment of specific proposed development should be undertaken, and AHIPs may be required.
- Impact should be avoided to sites ALN-IF-03 and SWRL Site 9. Where this is not possible, detailed Aboriginal heritage impact assessment, in accordance with the Code of Practice, should be undertaken for any specific proposed development in the vicinity of these sites, and archaeological test excavations under the Code of Practice may be required, to determine the artefactual assemblages that are present and the nature of Aboriginal activities in these areas.
- Where impacts are likely to occur to sites ALN-IF-03 and SWRL Site 9, detailed Aboriginal heritage impact assessment of specific proposed development should be undertaken, and AHIPs may be required.
- Should sites 2014-46, 2015-46, 2017-6, 2018-6, 2019-6, 2020-6, 2024-46, 2032-6, 2063-6, BRP-S-10/BRP-S-10 PAD/BRP-PAD-01 and TP25 not have been destroyed or excavated by other developments, impacts to these sites should be avoided. Where this is not possible, detailed Aboriginal heritage impact assessment, in accordance with the Code of Practice, should be undertaken for any specific proposed development in the vicinity of these sites, and archaeological test excavations under the Code of Practice may be required, to determine the artefactual assemblages that are present and the nature of Aboriginal activities in these areas.
- Where impacts are likely to occur to sites 2014-46, 2015-46, 2017-6, 2018-6, 2019-6, 2020-6, 2024-46, 2032-6, 2063-6, BRP-S-10/BRP-S-10 PAD/BRP-PAD-01 and TP25, detailed Aboriginal heritage impact assessment of specific proposed development should be undertaken, and AHIPs may be required.
- Impact to site 2005-846 should be avoided. Where this is not possible, detailed Aboriginal heritage impact assessment, in accordance with the Code of Practice, should be undertaken for any specific proposed development in the vicinity of this site, and appropriate mitigation strategies will need to be determined in consultation with the relevant local Aboriginal community groups.
- There should be no impact to sites ALN-IF-02 and ALN-IF-04 as a result of the Precinct Planning.

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1 Introduction

1.1 Preamble

Australian Museum Business Services (AMBS) has been commissioned by NSW Department of Planning and Infrastructure (DP&I), to prepare an Aboriginal (Indigenous) heritage assessment for the Austral and Leppington North Precincts of the South West Growth Centres (SWGC). This report will inform the Urban Form Analysis, and development of the project footprint.

1.2 Study Area

The Austral and Leppington North Precincts (the study area) comprise part of the NSW Government's SWGC land release. DP&I is currently undertaking Precinct Planning for these precincts. The Austral and Leppington North Precincts are second release precincts in the SWGC. The precincts fall within the boundaries of the Camden and Liverpool Local Government Areas (LGAs) and are located in the central eastern portions of the SWGC.

The study area is located approximately 50km west of Sydney, and the precincts comprise a total area of approximately 2,025 hectares, with a target population of 50,000 people. The Austral Precinct covers an area of approximately 930 hectares and is expected to contain around 8,000 dwellings. The Leppington North Precinct covers an area of approximately 1090 hectares (including land recently added as a result of the Boundary Review process and investigation areas as described below) and is expected to contain approximately 12,000 dwellings. The Leppington North Precinct also contains the proposed Leppington Town Centre, identified as a major centre under the Sydney Metropolitan Strategy as providing for commercial, retail, employment, government and high density residential uses.

During the Boundary Review process, two investigation areas (additional lands that may be included in the Precincts) were identified. The first has an area of approximately 100 hectares and is located to the east of the Leppington North Precinct. This land was previously included within the Western Sydney Parklands. However, access to and use of the land will be impacted by the extension of the South West Rail Line to Leppington and major upgrades to Bringelly Road and Camden Valley Way. As such, alternative suitable uses of the land are to be investigated through the Precinct Planning process. The second investigation area is located at the south east corner of the Austral Precinct and is approximately 4.5 hectares.

This Aboriginal Heritage Assessment addresses all lands in the Austral and Leppington North Precincts, and the two investigation areas (see Figure 1.1).

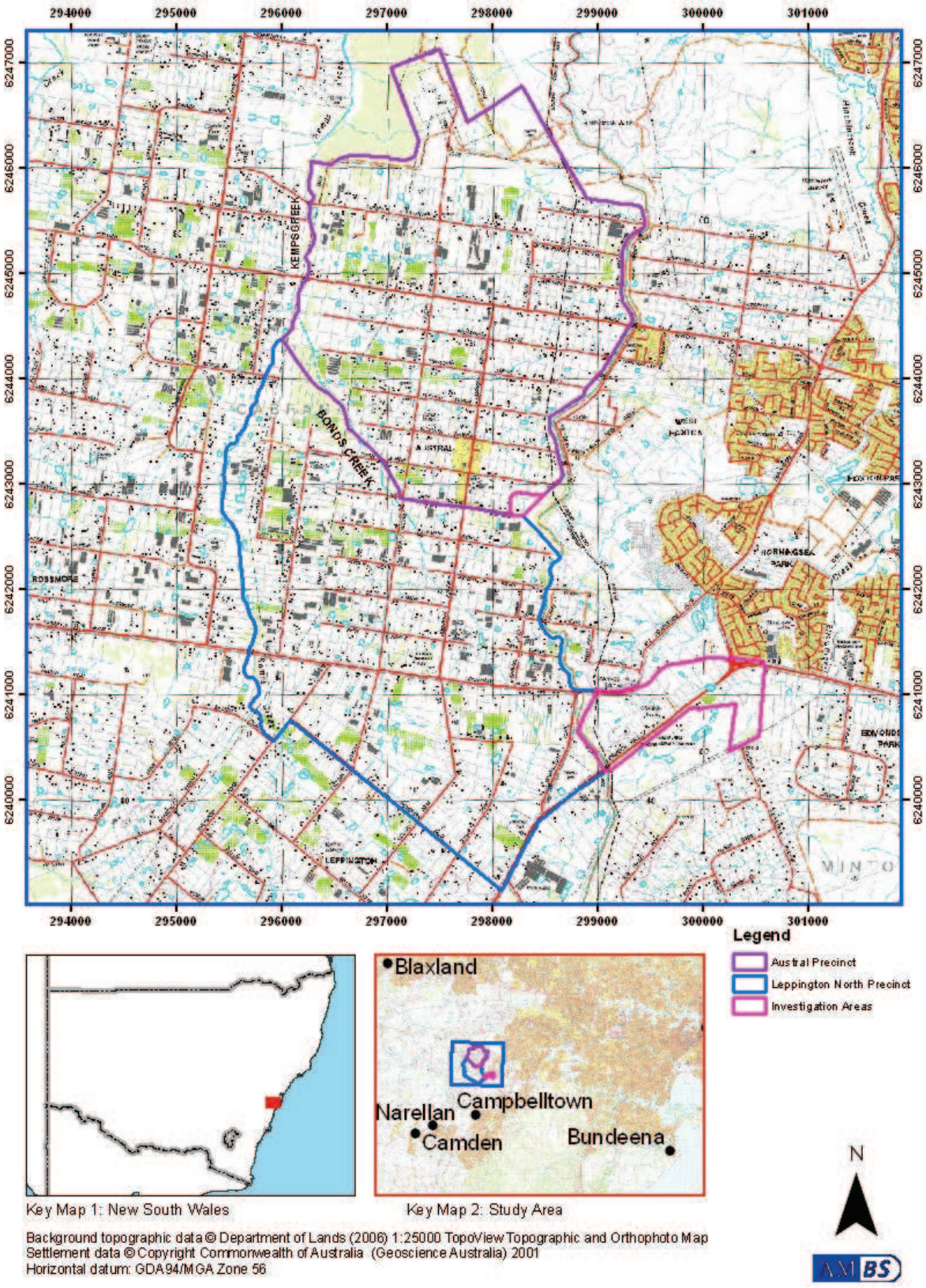

Figure 1.1 Location of the study area.

1.3 Methodology

This Heritage Assessment is broadly consistent with the processes and principles set out in the Australia ICOMOS Burra Charter (*The Australia ICOMOS charter for the conservation of places of cultural significance*).

This assessment follows the methodologies and protocols for heritage assessment developed by the former NSW Growth Centres Commission (now the Strategies and Land Release Office of the NSW Department of Planning and Infrastructure) and the Department of Environment and Climate Change (now the Office of Environment and Heritage [OEH]; formerly Department of Environment, Climate Change and Water [DECCW]); *The Consultants Brief for Identifying and Assessing Aboriginal Cultural Heritage in the Sydney Growth Centres* (Context 2006) and its two Appendices:

- *Appendix A: Protocol for Aboriginal Stakeholder involvement in the assessment of Aboriginal Cultural Heritage in the Sydney Growth Centres*; and
- *Appendix B: Precinct Assessment Method for Aboriginal Cultural Heritage in the Sydney Growth Centres*.

The Precinct Assessment Method outlines the following steps to be undertaken:

- Step 1 – gather and analyse existing information;
- Step 2 – identify and assess Aboriginal cultural heritage and values;
  - 2a – undertake investigations;
  - 2b – assess significance;
- Step 3 – develop land use and management options; and
- Step 4 – input into Precinct Planning.

This report has been prepared to fulfil Step 1 of the Method, which involves collating, reviewing and synthesising available relevant information, including social/cultural, landscape and environmental, historical and ethno-historical and archaeological information and data. The aim of this step is to identify any information gaps that need to be addressed to adequately undertake the Aboriginal cultural heritage values identification and assessment in later steps of the Precinct Assessment Method.

The primary tasks in Step 1 are:

- Scope and gather existing information and knowledge from previous studies, reports, academic work, and knowledge holders. Preliminary overview field survey might be also be undertaken where appropriate.
- Stakeholder Aboriginal Communities invited to identify known sources of information and information gaps.
- Summarise existing information and collate data in a usable form as a basis for the subsequent steps (and to inform other Precinct studies).
- Identify data gaps and prioritise further research to be undertaken in order to adequately identify and assess the Aboriginal cultural heritage values present within the Precinct. This may include development of a preliminary sensitivity map that will identify areas with potential Aboriginal cultural heritage value and significance.
- Prepare a Step 1 report which details and justifies the proposed fieldwork and investigations in Step 2.
- Invite Stakeholder Aboriginal Communities to review and comment on Step 1 Report.

Steps 2-4 are to be undertaken at a later stage. This report will inform those Steps.

1.3.1 Aboriginal Community Consultation

Aboriginal community consultation is an integral part of the assessment of Aboriginal cultural heritage significance. Consultation was undertaken in accordance with the Growth Centres consultation guidelines and its two Appendices, particularly Appendix A (see above).

The aims of this consultation process were to:

- ensure that places of importance to the stakeholder Aboriginal communities are identified and taken into consideration during project development;
- ensure that values and places and importance to Aboriginal culture and community identity are clearly identified and articulated;
- identify and document those cultural values held by the Aboriginal groups and people which may not have been identified during the archaeological investigation or historical research; and
- provide an understanding of the cultural values of information obtained during archaeological investigation or historical research and other investigations.

An advertisement advising of the commencement of Aboriginal heritage assessments for the Austral and Leppington North Precincts was placed in the South Western Rural Advertiser (SWRA) on 8 and 15 September 2010. The stakeholder Aboriginal communities identified in Appendix A were contacted, as was DECCW (now OEH), the Registrar of Aboriginal Owners (RAO), the National Native Title Tribunal (NNTT) and the local councils (Liverpool and Camden). Stakeholders were invited to identify whether they were interested in having primary involvement (that is, active involvement in heritage identification, assessment, and management) or general involvement (that is, only to be kept informed about the process and outcomes).

The stakeholder Aboriginal communities identified for this project are:

- Aboriginal Elder's Group at Hoxton Park (AEGHP);
- Cubbitch Barta Native Title Claimants Aboriginal Corporation (CBNTCAC);
- Darug Aboriginal Cultural Heritage Assessments (DACHA);
- Darug Aboriginal Land Care Inc (DALCI);
- Darug Custodian Aboriginal Corporation (DCAC);
- Darug Land Observations (DLO);
- Darug Tribal Aboriginal Corporation (DTAC);
- Gandangara Local Aboriginal Land Council (GLALC);
- Liverpool Aboriginal Consultative Committee (LACC; Liverpool City Council [LCC]);
- Northern Illawarra Aboriginal Collective (NIAC);
- Tharawal Local Aboriginal Land Council (TLALC); and
- Yarrawalk (a division of Tocomwall Pty Ltd).

The Aboriginal heritage assessment was undertaken in consultation with all identified Aboriginal community groups. An initial consultation meeting, to discuss the project and the proposed survey methodology, was undertaken on 26 November 2010, to which all Aboriginal parties were invited. Representatives from CBNTCAC, DACHA, DALCI and DCAC attended the meeting. Those groups which had identified an interest to have primary involvement were then invited to participate in the preliminary field assessment. Aboriginal community groups who participated in the fieldwork are listed in Table 1.1.

Table 1.1 Aboriginal community fieldwork participants.

Aboriginal community organisation	Field representative	Sections of study area surveyed
CBNTCAC	Glenda Chalker	South of Bringelly Road
DACHA	Gordon Morton	All
DALCI	Ken Adolfson	All
DCAC	Leanne Watson, Rhiannon Wright	All
DLO	Ron Workman	All
DTAC	John Reilly	All
GLALC	Steve Randall	North of Bringelly Road
Yarrawalk	Brian Grant	All

Information provided by the Aboriginal community groups during consultation and field survey, has been integrated into the assessment where appropriate.

This draft Aboriginal heritage assessment report has been provided to each group for review and comment, and feedback received is attached in Appendix A. A meeting was also arranged to discuss further Aboriginal social/cultural values, and these have also been integrated into the report.

A concern raised during the consultation process was that Aboriginal sites should be protected so that they could not be identified in the public exhibition report by using site coordinates or showing sites on maps. As such, site coordinates and maps showing Aboriginal sites have been removed to a second volume, Volume 2, of the report, which should not be put on public exhibition.

1.4 Limitations

The survey was undertaken after several months of higher than average rainfall. As such, the majority of the properties within the study area were covered in long grass; in addition to trees, market gardens, dams and buildings, resulting in limited ground surface being visible for inspection.

1.5 Authorship & Acknowledgements

This report has been prepared by AMBS Project Officer Jenna Weston. AMBS Project Manager, Chris Langeluddecke, provided technical advice and reviewed the report. AMBS Senior Project Manager, Jennie Lindbergh, reviewed the report for consistency and quality.

2 Statutory Context

2.1 Preamble

The conservation and management of heritage items takes place in accordance with relevant Commonwealth, State or local government legislation. Non-statutory heritage lists, ethical charters, conservation policies, organisational policies, and community attitudes and expectations can also have an impact on the management, use, and development of heritage assets. Listings relevant to the study area are summarised below.

2.2 *Environment Protection & Biodiversity Conservation Act* 1999

The Australian Government Department of Sustainability, Environment, Water, Population and Communities (DSEWPC, formerly the Department of Environment, Water, Heritage and the Arts) is responsible for the implementation of national policy, programs and legislation to protect and conserve Australia's environment and heritage. Under the provisions of the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act) the National Heritage List (NHL) was established to protect places that have outstanding value to the nation, and the Commonwealth Heritage List (CHL) has been established to protect items and places owned or managed by Commonwealth agencies. Approval from the Minister is required for controlled actions which will have a significant impact on items and places included on the NHL or CHL.

The Register of the National Estate (RNE) was originally established under the *Australian Heritage Commission Act 1975*. Since the establishment of the NHL and CHL, there is now a significant level of overlap between the RNE and heritage lists at the national, state and territory, and local government levels. To address this situation, the Register has been frozen since February 2007, meaning that no places can be added or removed. The RNE should be understood as an information resource only. Where an action has been referred to the Minister, in accordance with the EPBC Act, concerning World Heritage, National Heritage, Wetlands, endangered communities, or Commonwealth lands, the RNE may be used as a reference, where appropriate.

There are no Aboriginal heritage sites or places within the study area included on the NHL, CHL or RNE.

2.3 *National Parks & Wildlife Act* 1974 (Amended 2010) and *National Parks & Wildlife Amendment Regulation* 2010

Under the provisions of the *National Parks & Wildlife Act* 1974 (NPW Act), the Director-General of DECCW (now Chief Executive of OEH) is responsible for the care, control and management of all national parks, historic sites, nature reserves, state conservation areas, karst conservation reserves and regional parks. The Director-General is also responsible, under this legislation, for the protection and care of native fauna and flora, and Aboriginal places and objects throughout NSW.

All Aboriginal Objects are protected regardless of their significance or land tenure under the NPW Act. Aboriginal Objects can include pre-contact features such as scarred trees, middens and open campsites, as well as physical evidence of post-contact use of the area such as Aboriginal built fencing and fringe camps. The NPW Act also protects Aboriginal Places, which are defined as 'is or was of special significance with respect to Aboriginal culture'. Aboriginal Places can only be declared by the Minister administering the NPW Act.

Under Section 90 of the Act, it is an offence for a person to destroy, deface, damage or desecrate an Aboriginal Object or Aboriginal Place without the prior issue of an Aboriginal Heritage Impact Permit (AHIP). The Act requires a person to take reasonable precautions and due diligence to avoid impacts

on Aboriginal Objects. AHIPs may only be obtained from the Environmental Protection and Regulation Division (EPRD) of OEH.

The National Parks and Wildlife Amendment Regulation 2010 commenced on 1 October 2010. This Regulation excludes activities carried out in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* from the definition of harm in the Act. That is, test excavations may be carried out in accordance with this Code of Practice, without requiring an AHIP. The Regulation also specifies Aboriginal community consultation requirements (*Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010*). In addition, the Regulation adopts a Due Diligence Code of Practice which specifies activities that are low impact, providing a defence to the strict liability offence of harming an Aboriginal object.

Part of the regulatory framework for the implementation of the NPW Act is the Aboriginal Heritage Information Management System (AHIMS), maintained by OEH. AHIMS includes a database of Aboriginal heritage sites, items, places and other objects that have been reported to the OEH. Also available through AHIMS are site cards, which describe Aboriginal sites registered in the database, as well as Aboriginal heritage assessment reports, which contribute to assessments of scientific significance for Aboriginal sites. The AHIMS is not a comprehensive list of all Aboriginal heritage in NSW, rather it reflects information which has been reported to OEH. As such, site co-ordinates in the database vary in accuracy depending on the method used to record their location. Heritage consultants are obliged to report Aboriginal sites identified during field investigations to OEH, regardless of land tenure, or whether such sites are likely to be impacted by a proposed development. The results of a site search for the local area are presented in Section 4.2.2.

2.4 *Environmental Planning & Assessment Act* 1979

The *Environmental Planning and Assessment Act* 1979 (EP&A Act) is the principal act regulating land use planning and development in NSW, and requires consideration to be given to the environment as part of the land use planning process. Projects are considered under different parts of the Act, including:

- Major projects, requiring the approval of the Minister for Planning and which are regional or State significant are undertaken under Part 3A of the Act.
- Minor or routine development projects, requiring local council consent are usually undertaken under Part 4. In limited circumstances, projects may require the Minister's consent.
- Projects which do not fall under Part 4 or Part 3A are undertaken under Part 5. These are often infrastructure projects approved by local councils or the State agency undertaking the project.

The EP&A Act also controls the making of environmental planning instruments (EPIs). Two types of EPIs can be made: Local Environmental Plans (LEPs), covering local government areas; and State Environment Planning Policies (SEPPs), covering areas of State or regional environmental planning significance. LEPs commonly identify, and have provisions for the protection of, local heritage items and heritage conservation areas. The study area is located in the Liverpool and Camden LGAs.

2.4.1 State Environmental Planning Policy (Western Sydney Parklands) 2009

Part 2, Clause 15 'Heritage Conservation' of the State Environmental Planning Policy (Western Sydney Parklands) 2009 provides for the protection of Aboriginal items, places and archaeological sites within the Western Sydney Parklands area. There are no Aboriginal items or places listed on Schedule 1 'Heritage items', within the study area, or its vicinity.

2.4.2 Liverpool LEP 2008

Part 5.10 'Heritage conservation' of the Liverpool LEP is consistent with current heritage best practice guidelines, providing for the protection of heritage items, places and archaeological sites.

Schedule 5, Part 1 'Heritage items' does not include any Aboriginal items or places within the study area, or its vicinity.

2.4.3 Camden LEP 2010

Part 5.10 'Heritage conservation' of the Camden LEP is consistent with current heritage best practice guidelines, providing for the protection of heritage items, places and archaeological sites.

Schedule 5, Part 1 'Heritage items' does not include any Aboriginal items or places within the study area, or its vicinity.

2.5 Heritage Act 1977

In NSW the Heritage Act provides protection for heritage places, buildings, works, relics, moveable objects or precincts that are important to the people of NSW. These include items of Aboriginal and non-Aboriginal heritage significance. Where these items or places have particular importance to the State of NSW, they are listed on the State Heritage Register (SHR).

No Aboriginal items or places within the study area are listed on the SHR or the subject of an Interim Heritage Order.

Under Section 170A(2) the government instrumentalities are required to maintain a register of heritage assets; a Heritage and Conservation Register, also known as a Section 170 Register. Items and places entered on a Section 170 Register are to be managed in accordance with State Owned Heritage Management Principles.

2.5.1 NSW Roads & Traffic Authority Heritage & Conservation Register (RTA Section 170 Register)

There are no identified Aboriginal items or places within the study area or its vicinity.

2.5.2 The National Trust of Australia (NSW)

The National Trust of Australia has no statutory authority; however, it does have a role in raising public awareness of heritage issues. No Aboriginal heritage items are listed by the National Trust within the study area, or its vicinity.

3 Environmental Context

An understanding of environmental factors within the local landscape provides a context for past human occupation and history of an area. The analysis of environmental factors contributes to the development of the predictive modelling of archaeological sites, but it also is required to contextualise archaeological material and to interpret patterns of past human behaviour. In particular, the nature of the local landscape including topography, geology, soils, hydrology and vegetation are factors which affect patterns of past human occupation. Current land use practices have the potential to affect the visibility of archaeological material; they may obscure, or expose archaeological sites. In addition, previous disturbances may have also exposed archaeological material, such as excavation for dams or other ground disturbance. It is important that such factors are also considered in making assessments of archaeological resources in an area and understanding the distribution of observed sites.

3.1 Geology & Soils

The study area comprises a gently undulating landscape. There is a narrow, north-trending main ridgeline following the eastern study area boundary, with the Sydney Water Supply Upper Canal generally following the crest of this ridgeline. Slopes within the study area are generally less than 6 degrees, with localised steep slopes (> 6 degrees). The south-westerly facing slopes are generally steeper than the north-eastern facing slopes, and steep terrain (> 12 degrees) is present on the eastern side of the Sydney Water Supply Upper Canal at the south-eastern corner of the study area, which is 92m above sea level (asl). There is generally a drop, in a north-western direction, to 78m asl at the south western corner, and to 61m asl at the north-western corner of the study area (GeoEnviro Consultancy 2011:3). A map of the topography and areas subject to 1 in 100 year flood events is provided in Figure 3.1.

Within the study area, three soil landscapes are present (see Figure 3.2). The Luddenham soil landscape and is present on the eastern side of the Sydney Water Supply Upper Canal at the south eastern steeper corner of the study area. The soil generally comprises dark podsolic soil or earthy clays on the crest, and yellow podsolic and prairie soils on the lower slopes. This erosional soil is generally characterised as having high erosion hazards, impermeable soil, high plasticity and moderate reactivity. The Blacktown soil landscape occurs on the upper slopes away from the creeks, and genereally consists of low permeability, highly plastic and moderately reactive soil of residual origin. The South Creek landscape is present at the lower slopes and along the creeks and drainage lines, and generally consists of red and yellow podsolic soils and yellow solodic soils of alluvial origin (GeoEnviro Consultancy 2011:3). The potential for stratified or *in situ* archaeological deposits is most likely in the fluvial South Creek soils which underlie Kemps and Bonds Creeks.

The underlying geology of the study area comprises fluvial deposits consisting of sands, silts and clays beneath the South Creek soil landscape, and underlying bedrock of Bringelly Shale of the Winamatta Group (consisting of Shale, carbonaceous claystone, claystone, laminite, fine to medium grained lithic sandstone, rare coal and tuff) beneath the Blacktown and Luddenham soil landscapes (GeoEnviro Consultancy 2011:4).

3.2 Hydrology & Drainage

The study area is within the upper catchment area of the Hawkesbury River system. Surface runoff and groundwater in the area generally flows to the north west into Kemps and Bonds Creeks, thence flowing to South Wianamatta Creek (approximately 7km away), and eventually flowing into the Hawkesbury River (10-15km away; GeoEnviro Consultancy 2011:4). Kemps Creek forms the western boundary of the study area, and several tributaries of this creek extend throughout the study area, of varying stream order. Although minor tributaries are unlikely to have provided permanent water, they would have been seasonal water sources for Aboriginal people in the past. Bonds Creek,

which is to the east of Kemps Creek, also flows diagonally through roughly the middle of the study area. There is therefore, a high likelihood that Aboriginal sites may be present throughout the area.

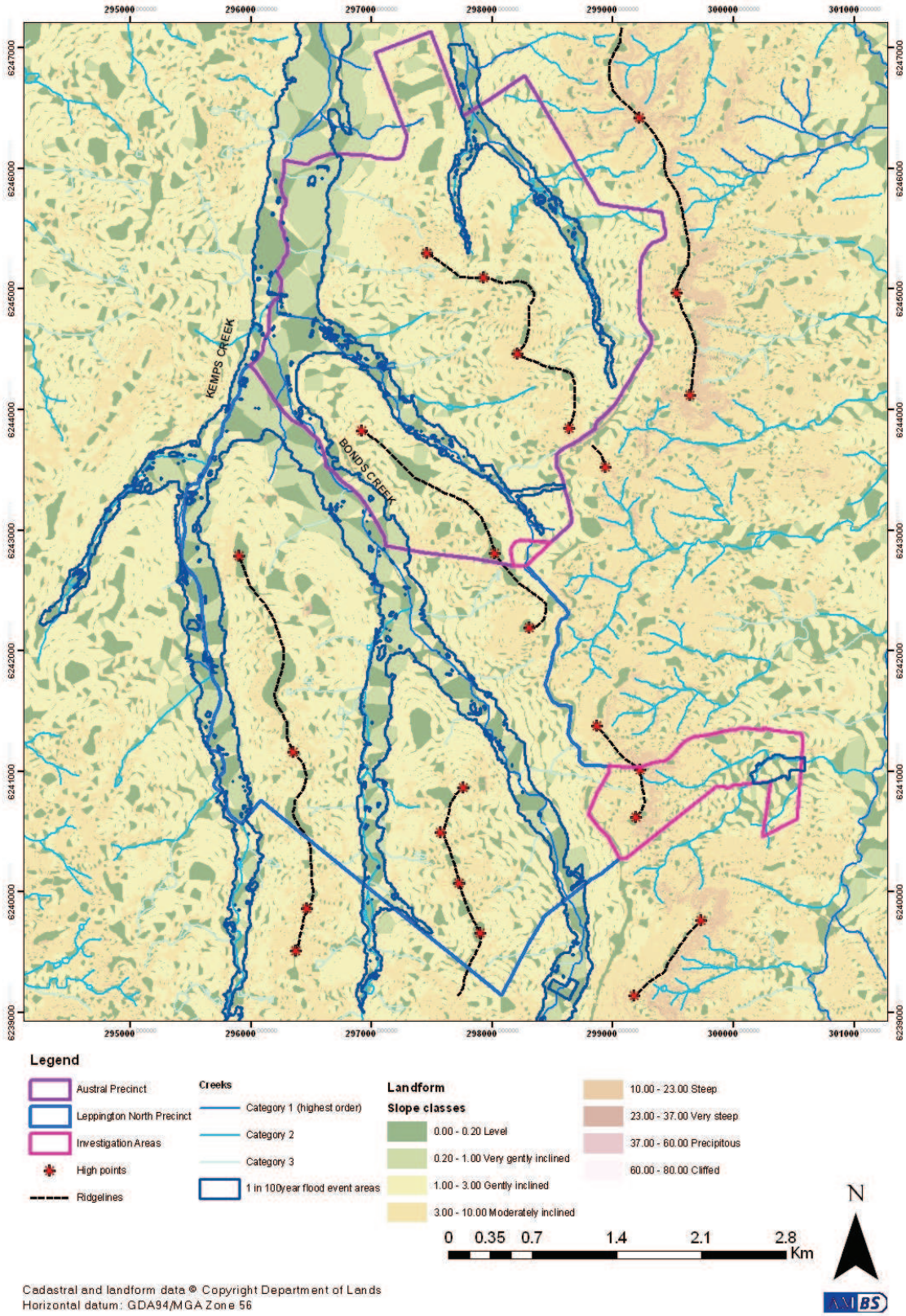

Figure 3.1 Topographic details of the study area, including areas prone to 1 in 100 year flood events.

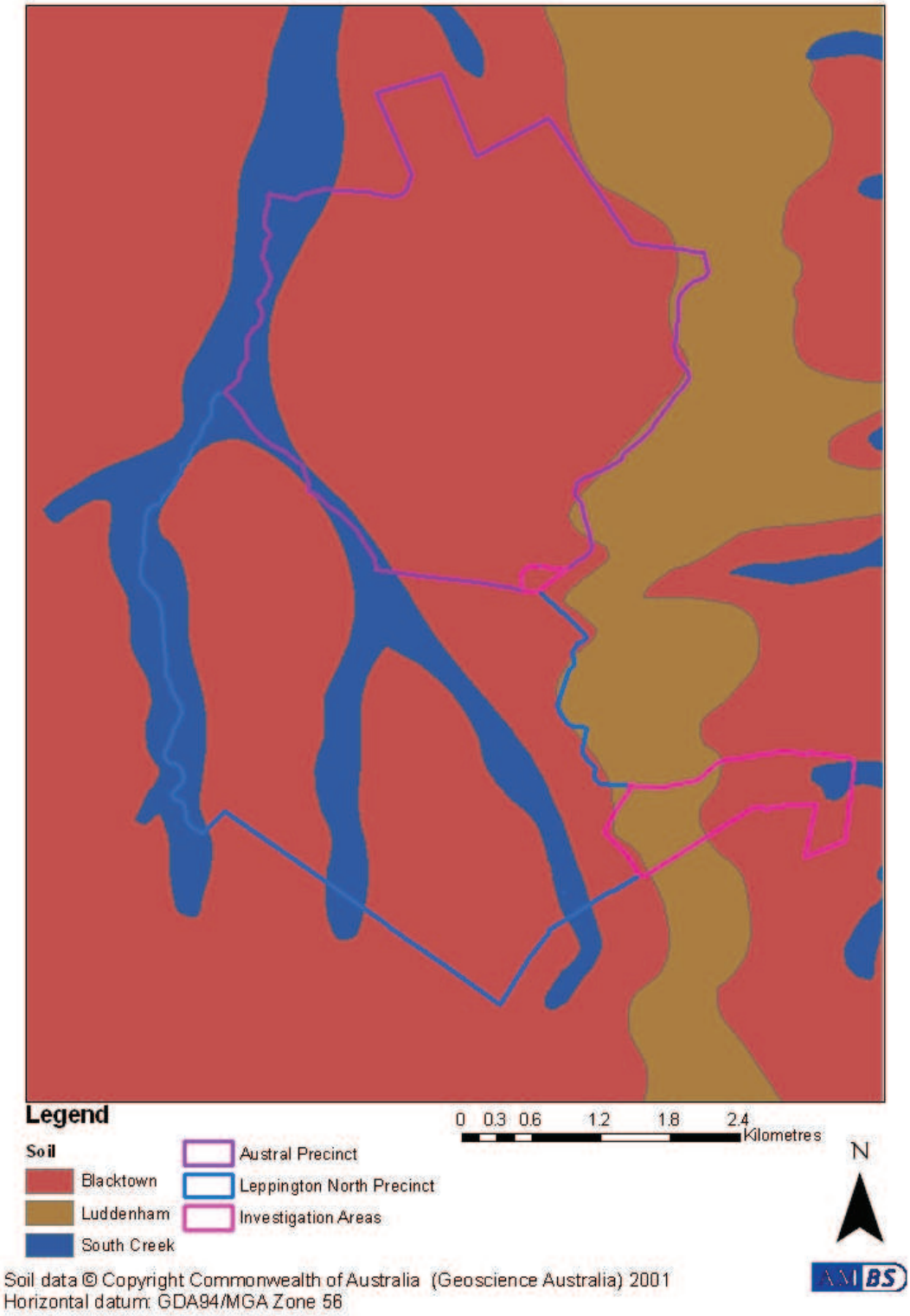

Figure 3.2 Soils within the study area.

3.3 Vegetation

According to Cardno (2011:12-13, 26), the vegetation communities within the study area include Shale-Gravel Transitional Forest (dominated by Broad-leaved ironbark [*Eucalyptus fibrosa*] and associated with Grey box [*E. moluccana*] and Forest red gum [*E. tereticornis*], Sydney Coastal River Flat Forest – Alluvial Woodland (Cabbage gum [*E. amplifolia*], *E. tereticornis* and Swamp oak

[*Casuarina glauca*]) and Cumberland Plain Woodland – Shale Plains Woodland (*E. moluccana*, *E. tereticornis*, Spotted gum [*Corymbia maculate*] and Thin-leaved stringybark [*E. eugenioides*]). Native vegetation communities in the vicinity of the study area are predominantly regrowth, as the area has been extensively cleared since European settlement. It has been noted by Cardno that "several areas of vegetative regrowth have been heavily recolonised by *Casuarina glauca* following clearing, to the extent that the previous habitat (typically more diverse) has been unable to, and is unlikely to, establish itself without revegetation and management) (2001:73). Such clearing also impacts the integrity of archaeological deposits, and will have removed trees modified (scarred or carved) by Aboriginal people in the past; although it is possible that some such trees may remain in the study area from pre-European times.

3.4 Land Use & Disturbance

Land use within the study area is dominated by pastoralism, agriculture, horticulture and residential developments. A small township is located on Edmondson Avenue, between Ninth and Eleventh Avenues, and there are some small industrial areas in the precincts (Figure 3.3).

The various land use activities have resulted in the majority of the study area having been extensively cleared of its original vegetation, particularly mature trees. Further disturbance has resulted from the development of infrastructure associated with the construction of roads, electricity and telecommunications transmission lines, and water/sewage pipelines. Road carriageways within the study area are provided in Table 3.1.

Table 3.1 Road easements within the study area.

Ingleburn Road	Fifth Avenue
Bringelly Road	Sixth Avenue
Eastwood Road	Seventh Avenue
Dickson Road	Eighth Avenue
Rickard Road	Ninth Avenue
Byron Road	Tenth Avenue
Cowpasture Road	Eleventh Avenue
Camden Valley Way	Twelfth Avenue
Boyd Street	Thirteenth Avenue
Little Street	Fourteenth Avenue
Kelly Street	Fifteenth Avenue
Fourth Avenue	Sixteenth Avenue
Edmondson Avenue	Seventeenth Avenue
Browns Road	Eighteenth Avenue
Twenty-Seventh Avenue	Gurner Avenue

The construction of residential areas and road networks are likely to have affected the integrity of the archaeological resource, particularly subsurface deposits in the above-mentioned areas, as well as intact *in situ* archaeological deposits (see also Figure 5.22 for an estimate of previous disturbance). A number of large infrastructure developments are currently proposed in the study area and surrounds, such as the Bringelly Road and Camden Valley Way upgrades, the South West Rail Link, and water infrastructure for the South West Growth Centres and Edmondson Park precinct (see Section 4.2.3 and 4.2.4). At this stage the timing for delivery of some of this infrastructure has yet to be determined, and therefore it will not be discussed in this section on current land use and disturbance.

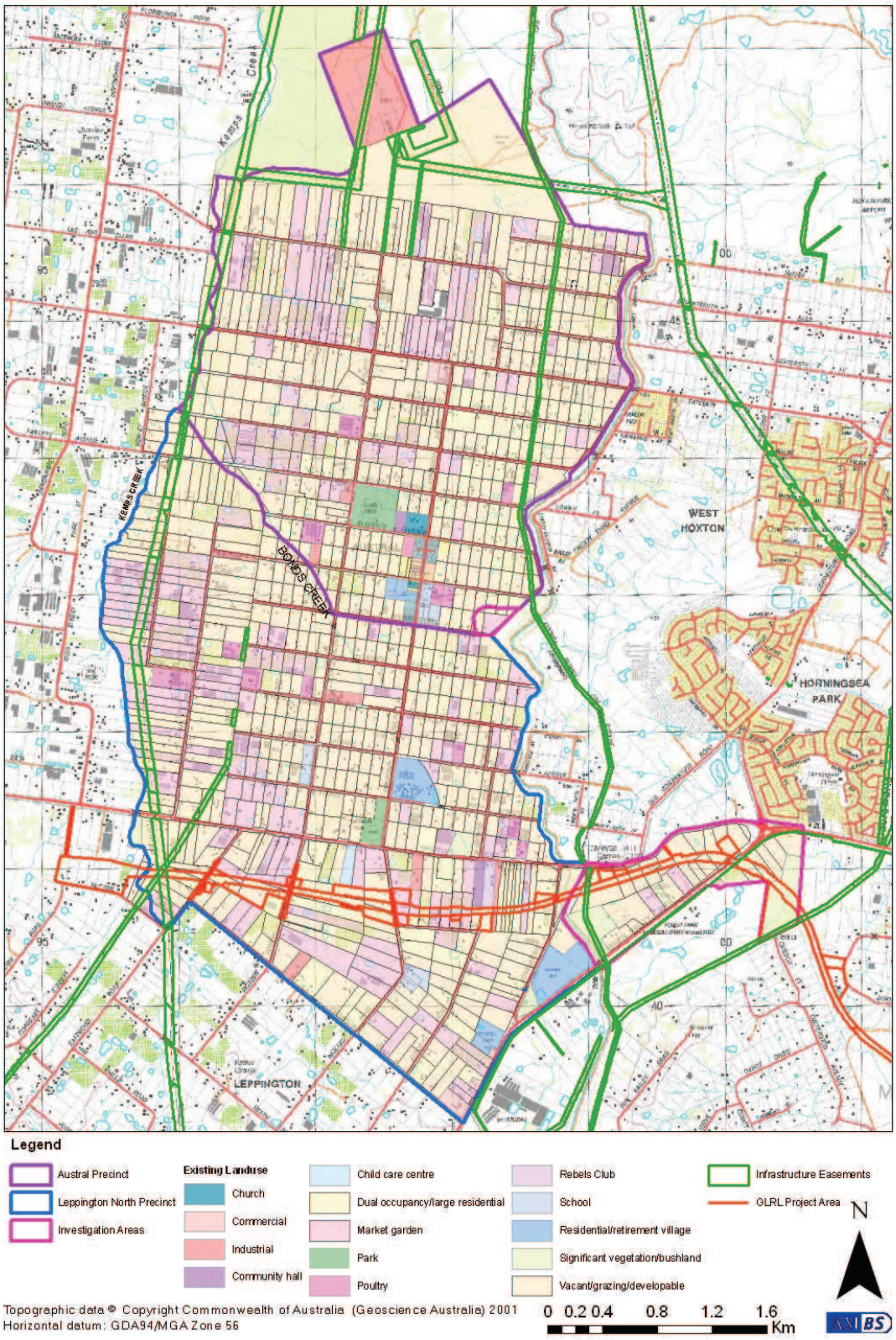

Figure 3.3 Existing land use in the study area.

4 Aboriginal Archaeological Context

This chapter describes the nature of the known Aboriginal archaeology of the study area, based upon a review of relevant archaeological reports and publications, and a search and review of previously recorded sites in the OEH Aboriginal Heritage Information Management System (AHIMS). This review and discussion allows for the development of a predictive model for potential Aboriginal sites within the study area, and establishes context for a comparative significance assessment. Summary descriptions of site types are provided in Table 4.1 below.

Table 4.1 Summary descriptions of Aboriginal site types referred to in this report.

Site Type	Details
Open Camp Sites/ Stone Artefact Scatters/ Isolated Finds	Open camp sites represent past Aboriginal subsistence and stone knapping activities, and include archaeological remains such as stone artefacts and hearths. This site type usually appears as surface scatters of stone artefacts in areas where vegetation is limited and ground surface visibility increases. Such scatters of artefacts are also often exposed by erosion, agricultural events such as ploughing, and the creation of informal, unsealed vehicle access tracks and walking paths. These types of sites are often located on dry, relatively flat land along or adjacent to rivers and creeks. Camp sites containing surface or subsurface deposit from repeated or continued occupation are more likely to occur on elevated ground near the most permanent, reliable water sources. Flat, open areas associated with creeks and their resource-rich surrounds would have offered ideal camping areas to the Aboriginal inhabitants of the local area. Isolated finds may represent a single item discard event, or be the result of limited stone knapping activity. The presence of such isolated artefacts may indicate the presence of a more extensive, in situ buried archaeological deposit, or a larger deposit obscured by low ground visibility. Isolated artefacts are likely to be located on landforms associated with past Aboriginal activities, such as ridgelines that would have provided ease of movement through the area, and level areas with access to water, particularly creeks and rivers.
Scarred Trees	Tree bark was utilised by Aboriginal people for various purposes, including the construction of shelters (huts), canoes, paddles, shields, baskets and bowls, fishing lines, cloaks, torches and bedding, as well as being beaten into fibre for string bags or ornaments. The removal of bark exposes the heart wood of the tree, resulting in a scar. Over time the outer bark of the tree grows across the scar (overgrowth), producing a bulging protrusion around the edges of the scar. Trees may also have been scarred in order to gain access to food resources (e.g. cutting toe-holds so as to climb the tree and catch possums or birds), or to mark locations such as tribal territories. The locations of scarred trees often reflect historical clearance of vegetation rather than the actual pattern of scarred trees. Unless the tree is over 150 years old, scarring is not likely to be of Aboriginal cultural origin; therefore, these sites most often occur in areas with mature, remnant native vegetation.
Axe Grinding Grooves	Grinding grooves are the physical evidence of tool making or food processing activities undertaken by Aboriginal people. The manual rubbing of stones against each other creates grooves in the rock, which are usually found on flat areas of soft rock such as sandstone, in areas of creek beds and other water sources. They are often associated with rock pools in creek beds and on platforms to enable the wet-grinding technique.
Quarries	Aboriginal quarry sites are sources of raw materials, primarily for the manufacture of stone tools, but also for ochre procurement. They are only found where raw materials (stone or ochre) occur within the landscape, and where these have been exploited in the past. Such sites are often associated with stone artefact scatters and stone knapping areas. Loose or surface exposures of stone or cobbles may be coarsely flaked for removal of portable cores. Raw materials can be sourced to these sites and provide evidence for Aboriginal movement and/or exchange.
Rock Engravings	Rock engravings are a type of Aboriginal art, and are often located on high vantage points along ridge lines at the headwaters of creeks, but can be located on any suitable fine grained stone surface.
Shelter Sites with Art (Engraving, Painting or Drawing) or Occupation Deposit	These are art or occupation sites located in areas where suitable rock outcrops and surfaces occur, where weathering has resulted in suitable overhangs or recesses in boulder outcrops or cliff-lines.

Middens	Shell middens result from Aboriginal exploitation and consumption of shellfish, in marine, estuarine or freshwater contexts. Middens may also include faunal remains such as fish or mammal bone, stone artefacts, hearths, charcoal and occasionally, burials. They are usually located on elevated dry ground close to the aquatic environment from which the shellfish has been exploited and where fresh water resources are available. Deeper, more compacted, midden sites are often found in areas containing the greatest diversity of resources, such as river estuaries and coastal lagoons.
Bora/Ceremonial	Aboriginal ceremonial sites are locations that have spiritual or ceremonial values to Aboriginal people. Aboriginal ceremonial sites may comprise natural landforms and, in some cases, will also have archaeological material. Bora grounds are a ceremonial site type, usually consisting of a cleared area around one or more raised earth circles, and often comprised two circles of different sizes, connected by a pathway, and accompanied by ground drawings or mouldings of people, animals or deities, and geometrically carved designs on the surrounding trees. Unfortunately, the raised earth features are easily destroyed by agricultural and pastoral activities, vegetation growth and exposure to weather.
Stone Arrangements	Stone arrangements usually consist of geometric arrangements of portable stone on prominent rock outcrops, such as vantage points along escarpments where other key landmarks are visible. Some stone arrangements also include circles and pathways. They are thought to be ceremonial in nature, and may have also sometimes been used for corroborees (dances), fights or judicial meetings. Stone arrangements are often isolated from known camp site areas.
Natural Mythological (Ritual) Sites	These types of sites are usually identified by the local Aboriginal community as locations of cultural significance, and they may not necessarily contain material evidence of Aboriginal associations with the place.
Carved Trees	Carved trees generally marked areas for ceremonial purposes, or the locations of graves.
Burial Sites	Aboriginal burial of the dead often took place relatively close to camp site locations. This is due to the fact that most people tended to die in or close to camp (unless killed in warfare or hunting accidents), and it is difficult to move a body long distances. Soft, sandy soils on, or close to, rivers and creeks allowed for easier movement of earth for burial; and burials may also occur within rockshelters or middens. Aboriginal burial sites may be marked by stone cairns, carved trees or a natural landmark. Burial sites may also be identified through historic records, or oral histories.
Contact/ Historical Sites	These types of sites are most likely to occur in locations of Aboriginal and settler interaction, such as on the edge of pastoral properties or towns. Artefacts located at such sites may involve the use of introduced materials such as glass or ceramics by Aboriginal people, or be sites of Aboriginal occupation in the historical period.

4.1 Regional Archaeological Context

At the time of European settlement, the Aboriginal people of the Sydney region were organised into named territorial groups. Groups local to the study area are likely to have belonged to the Darug (Dharug), Gundundurra and the Dharawal (Thurrawal) language groups (Attenbrow 2010: 221,222).

Aboriginal occupation of the Sydney region is likely to have spanned at least 20,000 years, although dates of more than 40,000 years have been claimed for artefacts found in gravels of the Cranebrook Terrace on the Nepean River (Nanson et al. 1987; Stockton 1993; Stockton & Holland 1974). Late Pleistocene occupation sites have been identified on the fringes of the Sydney basin and from rock shelter sites in adjoining areas. Dates obtained from these sites were 14,700 years Before Present (BP) at Shaws Creek in the Blue Mountain foothills (Kohen et al. 1984), c.11,000 BP at Loggers Shelter in Mangrove Creek (Attenbrow 1981, 2004), and c.20,000 BP at Burrill Lake on the South Coast (Lampert 1971). The majority of sites in the Sydney region, however, date to within the last 3,000 to 5,000 years, with many researchers proposing that occupation intensity increased from this period (Kohen 1986; McDonald 1994; McDonald & Rich 1993). This increase in sites may reflect an intensity of occupation which was influenced by rising sea levels, which stabilised approximately 6,500 years ago. Older occupation sites along the now submerged coastline would have been flooded, with

subsequent occupation concentrating on and utilising resources along the current coastlines and in the changing ecological systems of the hinterland (Attenbrow 2003).

The spread of urban development across the Cumberland Plain, particularly over the last few decades, has meant that archaeological investigations have intensified with the need for environmental impact assessments. Most archaeological investigations conducted within this framework have been restricted by small study areas (as defined by individual developments) and limited project briefs. As a result, the Cumberland Plain has become the most intensively investigated archaeological landscape in Australia. The studies carried out over these decades of development in the west provide a broad picture of the archaeological context of the region.

A number of predictive models relating to Aboriginal occupation patterns and site locations have been formulated through archaeological investigations in the Cumberland Plain (Dallas 1989a; Haglund 1980; Kohen 1986; Smith 1989). More recent works have contributed to refining these models (AMBS 2000a, 2002; Jo McDonald Cultural Heritage Management [JMCHM] 1997, 1999, 2001a; McDonald 1999). However, it should be noted that archaeological investigations still reveal site information in contradiction to the current, general predictive model for the area, and it is expected that further archaeological work will continue to refine the model.

The most common site types found on the Cumberland Plain are open artefact scatters/open camp sites, followed by scarred trees and isolated finds. Shelter sites and grinding grooves are also found, although mainly around the periphery of the Plain in sandstone geology. Key trends are summarized below:

- site frequency and density are directly related to the location of sites within the landscape;
- complex sites are usually located close to permanent water sources, with major confluences being a key requirement for occupation sites, and would have been used intensively by larger groups, or used repeatedly by smaller groups over a longer period of time;
- sites with large numbers of artefacts can occur on ridge tops and hill crests;
- sites situated in alluvial soils retain the potential for stratified deposits;
- Potential Archaeological Deposits (PADs) are most likely to be located along valley floors and low slopes in well-drained areas; and surface artefact distribution does not accurately reflect the composition or density of subsurface archaeological deposits. Some areas with few or no surface manifestations have often been shown to contain subsurface archaeological deposits.
- artefact scatters are most commonly linked to the close proximity of permanent water sources in areas such as creek and river banks and alluvial flats. The majority of these sites are located within 100m of permanent fresh water;
- artefact assemblages generally comprise a small proportion of formal tool types with the majority of assemblages dominated by unretouched flakes and debitage;
- high concentrations of artefacts are more likely to be located within resource rich areas;
- silcrete is the dominant raw material used for tool manufacture, followed by chert (also known as tuff). Silcrete sources are located in the north western Cumberland Plain at places such as St Marys, Plumpton Ridge, Marsden Park, Schofields, Riverstone, Deans Park, Llandilo and Ropes Creek (the closest source to the study area, approximately 5.5 km north). Other raw materials include indurated mudstone from Nepean River gravels, quartz, porphyry and hornfels which may be derived from Rickabys Creek gravels, and basalt;
- stands of remnant old growth vegetation retain the potential for scarred trees to be present; however, large scale land clearance of the plain in general means that such stands of vegetation are rare; and
- evidence of post-contact camp sites may be located in close proximity to early European houses and farms, or official buildings.

4.1.1 The Current Regional Model

Regional trends indicate that Aboriginal sites are most frequently located in close proximity to permanent water courses; on creek banks and alluvial flats, or on high ground, and within range of food resources and the raw materials for tool making. However, some exceptions have been demonstrated in excavations at Mungerie Park and Parklea Leisure Centre, where large artefact scatters were identified up to 200-250m from major watercourses (AMBS 2000a). McDonald suggested that this site distribution pattern may be due to surface visibility and site formation processes, rather than a true depiction of the cultural distribution of artefacts across the landscape (1994, cited in Mills & Kelton 2002). In 2009, ENSR Australia Pty Ltd (ENSR) undertook excavations at the Oran Park and Turner Road Land Release Precincts, approximately 9km south west of the project study area, and concluded that:

> *The archaeological landscape revealed by this investigation suggests that archaeological models derived from other regions or other areas should not be applied uncritically. There was no evidence for greater complexity (defined as intricacy) associated with confluences. There was no evidence of greater densities of archaeological material associated with higher order watercourses. Instead it appears that archaeological deposit in the south west [Cumberland Plain] is of relatively low density with occasional clusters in association with all areas of reliable water regardless of stream order. Future assessments in south west Sydney would benefit from paying greater attention to the investigation of areas within 300 m of all reliable watercourses (i.e. more than the conventional 50 m vicinity of watercourses) (ENSR 2009:66).*

ENSR also found that large sites tend to be located in elevated areas with a good outlook over surrounding major creek valleys, at a distance of over 150m from creeks. It was suggested that this may reflect strategic defensive positioning of camp sites within a cultural interaction zone between three different language groups; the Darug, Gundungurra and Tharawal speaking peoples (ENSR 2009). It should be noted that the ENSR excavations were concerned with testing archaeological patterning throughout a large landscape; however, this type of landscape model has not been extensively tested in other archaeological studies, and further work is needed to determine whether this pattern is seen in other areas. It is also possible that the 'strategic defensive positioning' of sites will not be seen in areas that were not major cultural interaction zones between Aboriginal groups.

Previous studies have also highlighted the problems inherent in characterising archaeological sites on the Cumberland Plain solely by the presence of visible surface stone artefacts, and the importance of test excavation in establishing the nature and density of archaeological material in the Cumberland Plain. Studies have demonstrated that the average ratio of subsurface artefacts to those found at surface could be 25:1, with more recent work indicating this could be as much as 2,000:1 in some locations (JMCHM 2001a). Further, the detection of sites is often influenced by factors such as previous land-use and disturbance, and location within the landscape (JMCHM 2003). A high proportion of sites located in the region are found in disturbed contexts (e.g. Smith 1989).

4.1.2 Archaeological Excavations in the Vicinity of Austral & Leppington North

Although Sections 4.2.3 and 4.2.4 provide a review of archaeological investigations within the Austral and Leppington North Precincts study area and its near vicinity, there are several archaeological excavations which have been undertaken within the wider vicinity of the study area, which have relevance to predictive modelling in the area.

Navin Officer 1993

Navin Officer undertook test excavations on the banks and flats of Maxwells Creek, near the intersection of the M5/M7 and Camden Valley Way (approximately 3km east of the current study

area; Figure 4.1), in accordance with recommendations made by Haglund & Associates in 1992. Although no artefacts were recovered in the 57 pits excavated by spade, it is estimated that only 0.016% of the three testing areas was excavated. Further, the excavated soil was not completely sieved in order to recover artefacts, with Navin Officer noting that 'soil was hand-crumbled into a 5mm mesh but, in most localities, was too damp to sieve' (1993:9). Navin Officer found that the areas had been affected by considerable disturbance and regular flooding in the past, and considered that the potential for significant, *in situ* sites was low; instead, they postulated that a background scatter of artefacts was likely to be present in this location, which was unlikely to be discovered by test pit sampling (1993:13). Therefore, although the tested areas were in close proximity to the reliable water of Maxwells Creek, no large sites were found; however, this result may have been affected by the limited excavation area and, limitations in the excavation methodology.

Figure 4.1 Test areas (1, 2 and 3) excavated by Navin Officer (1993:Figure 2).

Rich & McDonald 1995

Rich and McDonald undertook excavations near a fairly reliable tributary of Cabramatta Creek in West Hoxton, at site WH3 (approximately 1km east of the current study area; Figure 4.2). Despite the fact that mechanical grader scrapes were used for the excavation, a total of 3,686 artefacts were recovered. This was interpreted as resulting from two silcrete knapping floors.

Figure 4.2 Site WH3 excavated by Rich & McDonald (1995:Figure 2).

Navin Officer 1998

Following their survey of The Crossroads in 1997, Navin Officer undertook test excavations on the banks and flats of Maxwells Creek (approximately 3km east of the current study area; Figure 4.3), approximately 200m south of the 1993 Navin Officer excavations (see above). While no artefacts had been recovered from the 1993 excavations, Navin Officer considered this area to be relatively undisturbed, and identified it as having archaeological potential, although ground visibility was too low to identify any surface artefacts. Therefore, mechanical excavation of the area by backhoe was undertaken. Although only 0.12% of the area of archaeological potential was excavated (of which only a sample was sieved), 92 artefacts were recovered (an average of almost two artefacts per square metre of the excavated area). Navin Officer interpreted the site as representing background scatter. Although the tested area was in close proximity to the reliable water of Maxwells Creek, no large sites were found; however, this result may have been affected by the limited excavation area and, limitations in the excavation methodology.

Figure 4.3 General study area (top) and area of archaeological potential (bottom; area outlined in red) excavated by Navin Officer (1998:Figures 1 and 2).

AMBS 2000b

AMBS undertook salvage excavations in an area of PAD near site MC-1, on the bank of Maxwells Creek in a relatively undisturbed area of Cumberland Plain Woodland (approximately 5.5km east of the current study area; Figure 4.4). Three areas of the PAD were excavated, by hand and mechanically, resulting in the recovery of 151 artefacts from 78m^2 (an average of almost two artefacts per square metre that was excavated). The site was interpreted as evidence of low-density/background artefact scatter throughout the area. It was noted that undisturbed Aboriginal sites are thought to be rare on Maxwells Creek, due to extensive development along the creek line (AMBS 2000b:15).

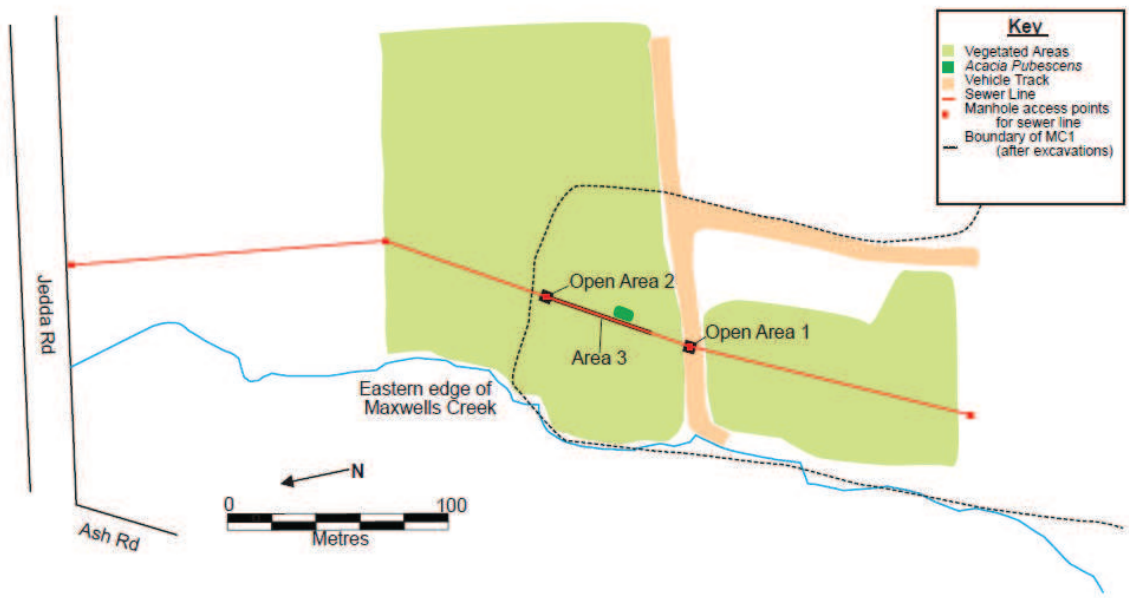

Figure 4.4 Location of MC-1 excavated by AMBS (2000b:Figure 11).

Dallas 2000

Dallas undertook test excavation of an area of PAD that had been identified as potentially representing Aboriginal occupation focused around a bend of Bunbury Curran Creek, near Macquarie Fields House (approximately 4.5km south east of the current study area; Figure 4.5). The test excavations consisted of 17 1m^2 backhoe trenches in an area proposed to be impacted by a perimeter road and house blocks, and four backhoe trenches in landfill within the PAD. The excavations revealed a low density background scatter of stone artefacts, of types common in the region, and hence considered to be of low archaeological significance (Dallas 2000).

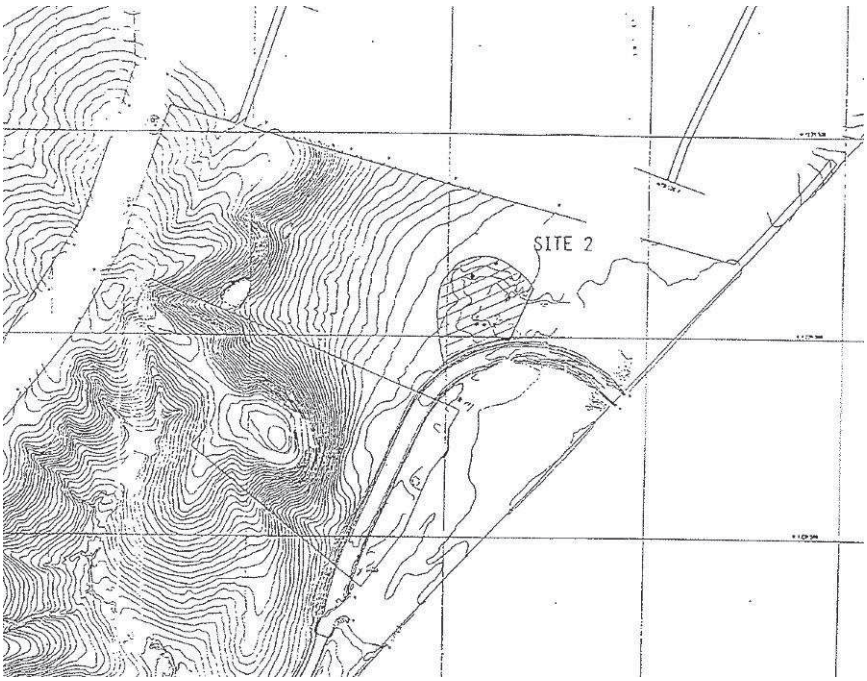

Figure 4.5 Location of MFH#2 and area of PAD (cross-hatching) excavated by Dallas in 2000 (Source: Dallas 1989b:Map 3).

Mills & Kelton 2002

Mills and Kelton undertook test excavation of 16 PADs along the alignment of the Western Sydney Orbital (now known as the M7) in 2002 (no map was available from the report; however, the M7 is approximately 1.5-3km east of the current study area). These excavations located 556 artefacts within 1876 test pits. Mills and Kelton considered that the 82 artefacts recovered from 456 pits at PAD1 demonstrate that there was more intense occupation at Maxwells Creek than in other areas.

Central West Archaeological and Heritage Services 2003

Central West Archaeological and Heritage Services (CWAHS) undertook test excavations of a PAD (WSO PAD 6) that had been identified during the M7 assessments, on the western flood-prone creek bank of Maxwells Creek (no map was available from the report; however, the site is in the vicinity of MC-1, approximately 5.5km east of the current study area; see Figure 4.4). Only four stone artefacts were recovered from the 21 50 x 50 cm pits that were excavated, and it was concluded that flooding of the site had impacted any archaeological deposit that may have been located there.

Haglund & Associates 2007

Haglund & Associates undertook test excavations along The Horsley Drive, between the M7 and Cowpasture Road, at Horsley Park (approximately 7.5km north east of the current study area; Figure 4.6). Six landforms along a 2.4 km long section of the road were excavated, including areas on each side of Eastern Creek, which had been assessed as having particularly high archaeological potential.

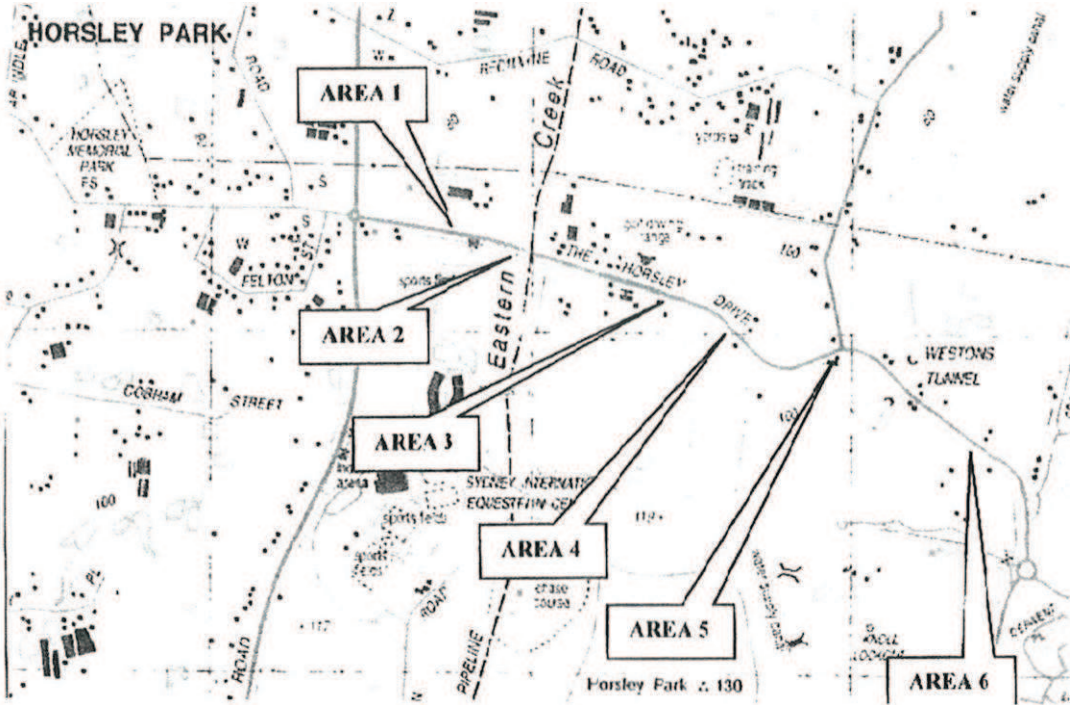

Figure 4.6 Areas excavated by Haglund & Associates (2007:Figure B).

Few Aboriginal artefacts were recovered from five of the areas, which had been affected by cultivation and disturbance down to the basal clay level; these landforms comprised an east-facing slope 130m from Eastern Creek, a mid-lower hill slope overlooking a first order watercourse, a mid-lower slope to first order creek line, a northward-running ridge crest with upper lopes off a ridge and mid-hill slope near an east-west drainage depression. However, excavation of a lower hill slope to the Eastern Creek flat recovered 191 artefacts, including geometric microliths, a silcrete core and silcrete and silicified tuff microblades. The area was described as having retained its *stratigraphic integrity*, and the variation in reduction technologies was assessed as indicating usage of the site over a period of time. Therefore,

the area was assessed as having some research potential, particularly with regards to the shift from silcrete to silicified tuff, and it was recommended it be fully salvaged prior to any development of the site. It was also noted that other undisturbed deposits may be present of outside the impact zone.

4.1.3 Summary

Excavations in this region of the Cumberland Plain have predominantly concentrated on the major creeks (particularly Eastern, Hinchinbrook, Cabramatta and Maxwells), and have found extensive deposits representing repeated use of the area for occupation or resource use within c.100m of these permanent water sources and their reliable tributaries (e.g. Haglund & Associates 2007; Mills & Kelton 2002; Rich & McDonald 1995). Low densities of artefacts representing one-off resource use or infrequent occupation have also been located near reliable water sources, although prior disturbance of these sites is often a factor in the low density of artefacts found (e.g. AMBS 1996; Haglund & Associates 2007; Mills & Kelton 2002; Navin Officer 1993, 2007a). Sites or PADs in the vicinity of less reliable, ephemeral creeks are generally considered likely to have low-to-moderate density archaeological deposits (more than background scatter, which may be defined as an average of 0.01 artefacts/m^2). Low-lying, flood prone areas are also unlikely to have been used extensively for camping (CWAHS 2003); higher areas overlooking creeks are more likely to have been suitable locations for repeated use by Aboriginal people camping in the area (ENSR 2009). However, it may be seen from Section 4.1.2 that archaeological investigations of areas considered to have archaeological potential may have results which are contrary to expectations, based on the current predictive model. Further, there has been limited archaeological investigation undertaken in the study area and its immediate vicinity (AMBS 2010a; Environmental Resources Management [ERM] 2005, 2007; Navin Officer 2007; Rich & McDonald 1995). It is clear that further excavation of the area is required in order to refine predictive modelling.

4.2 Local Archaeological Context

4.2.1 Ethnographic Context

The Aboriginal history of the Campbelltown/Liverpool area was compiled as a Bicentennial project by Liston (1988). This study documents interactions between Europeans and the Tharawal people from the early 18th century. Traditionally, this area was thought to be close to the intersection of a number of language group (tribal) boundaries. Language groups include the Dharug who inhabited much of the Cumberland Plain between the Blue Mountains and the coast, the Tharawal who ranged from the coast westwards towards Camden, and the Gandangara who inhabited areas westward and southwest of the Tharawal and into the Blue Mountains. The Tharawal people and other Aboriginal groups continue to be active in the Campbelltown area (Liston 1988).

4.2.2 Site Types

A search of the AHIMS database was undertaken on 1 November 2010, and 86 registered Aboriginal sites were identified within a search centred on the study area, with a buffer zone of approximately 1km. The search results are summarised in Table 4.2 and presented in Figure 4.7.

Table 4.2 Summary of Aboriginal sites previously recorded near the study area.

Site Type	Number Present	Percentage (to 2 decimal places)
Open Camp Site	39	45.35%
Isolated find	37	43.02%
PAD	8	9.3%
Scarred Tree	2	2.33%
Total	**86**	**100%**
Results of OEH AHIMS search undertaken on 1 November 2010		

Figure 4.7 Location of registered AHIMS sites in the vicinity of the study area (based on a search of the AHIMS database on 1 November 2010) (see Volume 2 of the report).

Previous archaeological investigations have recorded Aboriginal heritage items within and near the study area. There are 34 previously recorded sites located within the study area, two sites immediately adjacent to the study area, and seven more sites in its vicinity (within 100 metres). A summary of recorded sites that are relevant to the current study area, including sites that have not yet been registered on the AHIMS, is provided in Table 4.3 (organised according to distance from the study area, and roughly north to south and east to west) and Figure 4.8. It should be noted that sites identified by Kelleher Nightingale (KN) were not registered at the time of the AHIMS search, but were registered after the current survey was undertaken.

Table 4.3 Sites within 100m of the study area (includes all sites recorded previously).

Site	AHIMS No.	Site Type	Location	Recorder/report
2014-46	N/A	Artefact scatter and PAD	Within study area, on boundary of Lot 10 DP 771080 and Lot 15 DP 831988.	Archaeological and Heritage Management Solutions (AHMS) (in prep.) – South West Growth Centre (SWGC) water pipelines
2015-46	N/A	Artefact scatter and PAD	Within study area, at back of properties at 35-45 Gurner Ave.	AHMS (in prep.) – SWGC water pipelines
GLC2	45-5-2560	Open Camp Site – 4 artefacts (red silcrete - 2 flakes, 1 retouched flake, 1 backed blade)	Within study area. Artefacts described as scattered on each side of small drainage line at base of hill. AHIMS coordinates plot the site within the property at 5 Gurner Ave; but the site card describes the site as being located 0.5km north of 18th Ave, in the existing gas pipe-line easement. This places it within the area of land south-east of Transgrid substation.	Annie Nicholson – AASC report on Wilton-Horsley Park section of Eastern Gas Pipeline (report not available from AHIMS)
2017-6	N/A	PAD	Within study area, along front of properties at 205-225 and 210 Gurner Ave.	AHMS (in prep.) – SWGC water pipelines
2016-5	N/A	Isolated find	Within study area. Corner of Fourth and Gurner Ave, on property at 95 Gurner Ave.	AHMS (in prep.) – SWGC water pipelines
2018-6	N/A	PAD	Within study area. At front of properties at 590-610 and 645-655 Fifteenth Ave.	AHMS (in prep.) – SWGC water pipelines
2021-5	N/A	Isolated find	Within study area. On property at 225 Tenth Ave.	AHMS (in prep.) – SWGC water pipelines
2019-6	45-5-4018	PAD	Within study area. On properties at 140-150 Seventh Ave.	AHMS (in prep.) – SWGC water pipelines
2020-6	45-5-4019	PAD	Within study area. On properties at 130-140 Seventh Ave.	AHMS (in prep.) – SWGC water pipelines
BRP-IF-09	45-5-3858	Isolated Find – mudstone flake	Within study area. On road verge in front of 431 Bringelly Road.	Austral Archaeology (AA) (2010) – Bringelly Road upgrade
BRP-S-13	45-5-3868	Open Camp Site - 3 artefacts (1 mudstone and 2 silcrete flakes)	Within study area. On road verge c. 115m east of the front of 431 Bringelly Road.	AA (2010) – Bringelly Road upgrade
2024-46	45-5-4023	Artefact scatter and PAD	Within study area. At front of properties at 532-543 and 419 Bringelly Road.	AHMS (in prep.) – SWGC water pipelines
BRP-S-12	45-5-3898	Open Camp Site – 2 artefacts (silcrete core and flake)	Within study area. In front yard of 112 (or 419) Bringelly Road.	AA (2010) – Bringelly Road upgrade

BRP-S-11	45-5-3897	Open Camp Site – 5 artefacts (1 quartz and 4 silcrete flakes)	Within study area. Between fence and 100m into property at 14 Eastwood Road.	AA (2010) – Bringelly Road upgrade
BRP-S-10/ BRP-S-10 PAD (or BRP-PAD-01)	45-5-3887/ 45-5-3900 (one site, registered twice)	Open Camp Site and PAD – 32 artefacts	Within study area. On slope down to Bonds Creek at 444 Bringelly Road.	AA (2010) – Bringelly Road upgrade
2032-6	45-5-4031	PAD	Within study area. At front of properties at 532-543 and 419 Bringelly Road.	AHMS (in prep.) – SWGC water pipelines
BRP-IF-06	45-5-3855	Isolated Find – red silcrete flake	Within study area. Near tree 10m from road, 120m west of intersection of Bringelly Road and Edmondson Avenue.	AA (2010) – Bringelly Road upgrade
BRP-IF-07	45-5-3856	Isolated Find – silcrete flake	Within study area. Near tree opposite benches, 2m from fence of Scott Memorial Oval, 70m north of intersection of Bringelly Road and Edmondson Avenue.	AA (2010) – Bringelly Road upgrade
BRP-IF-08	45-5-3857	Isolated Find – silcrete flake	Within study area. In disused garden bed, 217 Bringelly Road (corner of Rickard Road).	AA (2010) – Bringelly Road upgrade
SWRL Site 4	45-5-3536	Isolated Find –red silcrete flake	Within study area. In soil from trenching for a gas pipeline; 40m south of Bringelly Road, 100m west of the Upper Canal, within Lot 18 DP19406.	AMBS (2010b) – survey for South West Rail Link (SWRL)
SWRL Site 3	45-5-3537	Open Camp Site – 8 artefacts (1 mudstone and 7 red silcrete broken/ whole flakes, flaked pieces and heat shatters)	Within study area. Near old corral and property fenceline, 200m south of the junction of Camden Valley Way and Bringelly Road, within Lot 3 DP205472.	AMBS (2010b) – survey for SWRL
SWRL Site 12	45-5-3906	Isolated Find – quartz broken flake	Within study area. Adjacent to a stand of trees, in a horse paddock, within Lot 1 D513403.	AMBS (2010b) – survey for SWRL
BRP-S-19	45-5-3874	Open Camp Site – 2 artefacts (silcrete flakes)	Within study area. On access track 20m east of Upper Canal, 70m east of Cowpasture Road, 200m south of Bringelly Road.	AA (2010) – Bringelly Road upgrade
SWRL Site 7	N/A	Open Camp Site – 4 artefacts (1 mudstone and 3 silcrete broken flake, flaked pieces and heat shatter)	Within study area. On access track immediately east of Upper Canal.	AMBS (2010b) – survey for SWRL
TP25	N/A - test pit dug by AMBS (2010b)	Open Camp Site – 7 artefacts (3 silcrete, 2 silicified wood and 2 mudstone broken/ whole flakes)	Within study area. On grazing land at back of 50 Eastwood Road.	AMBS (2010a) - preliminary test excavations for SWRL
SWRL Site 9	45-5-3532	Open Camp Site – 3 artefacts (red silcrete broken/ whole flakes)	Within study area. At base of electricity transmission line poles, 5m west of Kemps Creek, 200m north east of McCann Road, within Lot 102 DP736147.	AMBS (2010b) – survey for SWRL
SWRL Site 13 (2 locations)	45-5-3907	Open Camp Site – 7 artefacts (1 mudstone and 6 silcrete broken/ whole flakes)	Within study area. On old vehicle tracks on gentle slope c.250-350m west of a small second order tributary of Kemps Creek, within Lot 2 DP1082805.	AMBS (2010b) – survey for SWRL
SW1	N/A	Isolated find (1 quartz artefact)	Within study area. Low slope of a closed depression.	Heritage Concepts (2006) – survey for SWRL
SWRL Site 10 (three locations)	45-5-3903	Open Camp Site – 14 artefacts (1 quartz, 2 silcrete	Within study area. In powerline easement adjacent to the end of Cassidy Street, and on track	AMBS (2010b) – survey for SWRL

		and 11 mudstone flaked pieces, flakes and heat shatter)	downslope into vegetated area.	
2063-6	N/A	PAD	Within study area. On back of properties at 61-71 Cowpasture Road.	AHMS (in prep.) – SWGC water pipelines
TLC1	45-5-2559	Open Camp Site – 2 artefacts (red silcrete flake, quartz retouched flake)	Within study area. 400m north of Camden Valley Way; in existing gas pipeline easement. Artefacts on rise 200m south of narrow creek line.	Annie Nicholson - report on Wilton-Horsley Park section of Eastern Gas Pipeline (report not available from AHIMS)
LIF-1	45-5-3300	Isolated Find – silcrete flaked piece	AHIMS coordinates plot the site outside the study area; but the site card shows the site to be within the additional investigation area. In horse paddock, north of Camden Valley Way, between Upper Canal and Cowpasture Road.	Navin Officer (2006) - Leppington Caravan Park redevelopment
LP-3	45-5-3946	Isolated Find – silcrete retouched flake	Within study area. On western side of Camden Valley Way, between Upper Canal and Bringelly Road.	KN (2010) – Camden Valley Way upgrade
LP-4	45-5-3947	Open Camp Site – 2 artefacts (broken silcrete flakes)	Within study area. In Lochie's Hotel carpark at corner of Ingleburn Road and Camden Valley Way.	KN (2010) – Camden Valley Way upgrade
2005-846	N/A	Artefact scatter, PAD and cultural site	Adjacent to north western edge of study area, on Kemps Creek, at back of property at 225 Gurner Ave.	AHMS (in prep.) – SWGC water pipelines
SWRL Site 11	45-5-3905	Isolated Find –red silcrete flake	Immediately adjacent to south eastern section study area. On dirt track adjacent to old property boundary fenceline, next to BMX bike jumps, within Lot 7 DP 205472.	AMBS (2010b) – survey for SWRL
2013-6	N/A	PAD	10m north of northern point of study area.	AHMS (in prep.) – SWGC water pipelines
LP-1	45-5-3944	Isolated Find – silcrete flaked piece/heat shatter	10m south east of study area at Leppington. On eastern side of Camden Valley Way between Bonds Creek and Upper Canal.	KN (2010) – Camden Valley Way upgrade
LP-2	45-5-3943	Open Camp Site – 5 artefacts (flaked silcrete and silicified tuff; backed artefact)	40m south east of study area On eastern side of Camden Valley Way, north of Upper Canal.	KN (2010) – Camden Valley Way upgrade
SWRL Site 6	45-5-3534	Open Camp Site – 13 artefacts (4 mudstone and 9 silcrete broken/ whole flakes, flaked pieces and heat shatters)	65m east of study area. At back of Adventureland property, 550m south of Camden Valley Way, within Lot 2A DP365586.	AMBS (2010b) – survey for SWRL
TP49v	N/A - test pit dug by AMBS (2010b)	Open Camp Site – 30 artefacts (3 mudstone and 27 silcrete broken/ whole flakes, flaked pieces, heat shatters and core fragment)	75m west of study area. On grazing land at back of Lot 214 McCann Road.	AMBS (2010b) - preliminary test excavations for SWRL
BRP-IF-05	45-5-3854	Isolated Find – red silcrete flake	90m west of study area. Within llama enclosure, 620 Bringelly Road.	AA (2010) – Bringelly Road upgrade
PP-F3	45-5-3298	Isolated Find – red silcrete core fragment	AHIMS coordinates plot the site 20m east of the study area; but the site card describes the site as being on a ridge top on a vehicle	Mark Rawson (2006) - pedestrian/cycle path (report not available from

			track, 290m north of 27th & McIver Avenues, which is approximately 200m east of the study area.	AHIMS)

Figure 4.8 Location of all known previously identified sites in the vicinity of the study area (sites with incorrect co-ordinates in AHIMS have been moved to fit the description of the site given in the site card) (see Volume 2 of the report).

4.2.3 Previous Archaeological Investigations within the Austral & Leppington North Precincts

There have been a number of archaeological investigations in the general vicinity of the study area; however it appears that the majority of the land within the study area, particularly to the north of Bringelly Road, has not been previously subject to Aboriginal heritage survey or assessment. The information in the following sections is based on reports that have been registered with the OEH AHIMS, and which are most relevant and informative to archaeological background of the current project.

Kemps Creek Substation, 1979

Haglund undertook a survey of the area proposed for Kemps Creek Substation, including the access road between the substation and Fourth Avenue/Gurner Avenue (no map was available in the report). No sites were identified, and the area was considered to have low archaeological potential, given its location on a hill exposed to cold southerly winds.

South West Growth Centres

Archaeological and Heritage Management Solutions (AHMS) (in prep.) recently undertook investigations of the North West Growth Centres (NWGC) and the South West Growth Centres (SWGC) for the Sydney Water Corporation (SWC). The report has not yet been completed; however, given the relevance to the Austral and Leppington North Precincts within the SWGC, some completed sections of the report were obtained by DP&I.

In comparing the two Growth Centres, AHMS states that their archaeological investigations in the NWGC area suggest that stone raw material for tool manufacture was transported to the SWGC area, due to the lack of naturally occurring material in its vicinity, and the disproportionate core-to-flake ratio, lack of cortex and small size of stone tools seen in artefact assemblages (AHMS in prep:83, 85). Further, in the SWGC, sites were generally located near watercourses, and stream order does not appear to have a predictable influence on site size, density or complexity; sites with greater frequency, size and complexity are found 120m-180m from creeklines on gentle slopes and hillcrests, and within 500m of watercourses on ridgelines and their associated mid to lower slopes (AHMS in prep:84).

The survey undertaken by AHMS for the SWGC included parts of the current study area; mainly creeks and roads where SWC propose to install infrastructure (Figure 4.9). A total of 65 sites were identified in the area, comprising four artefact scatters, 17 artefact scatters with associated PAD, 25 PADs, one scarred tree, 19 isolated finds and two cultural sites. All sites were affected to various degrees by disturbance. Eleven of these sites are within the current study area, and an additional two are within the immediate vicinity (see Table 4.3 for details).

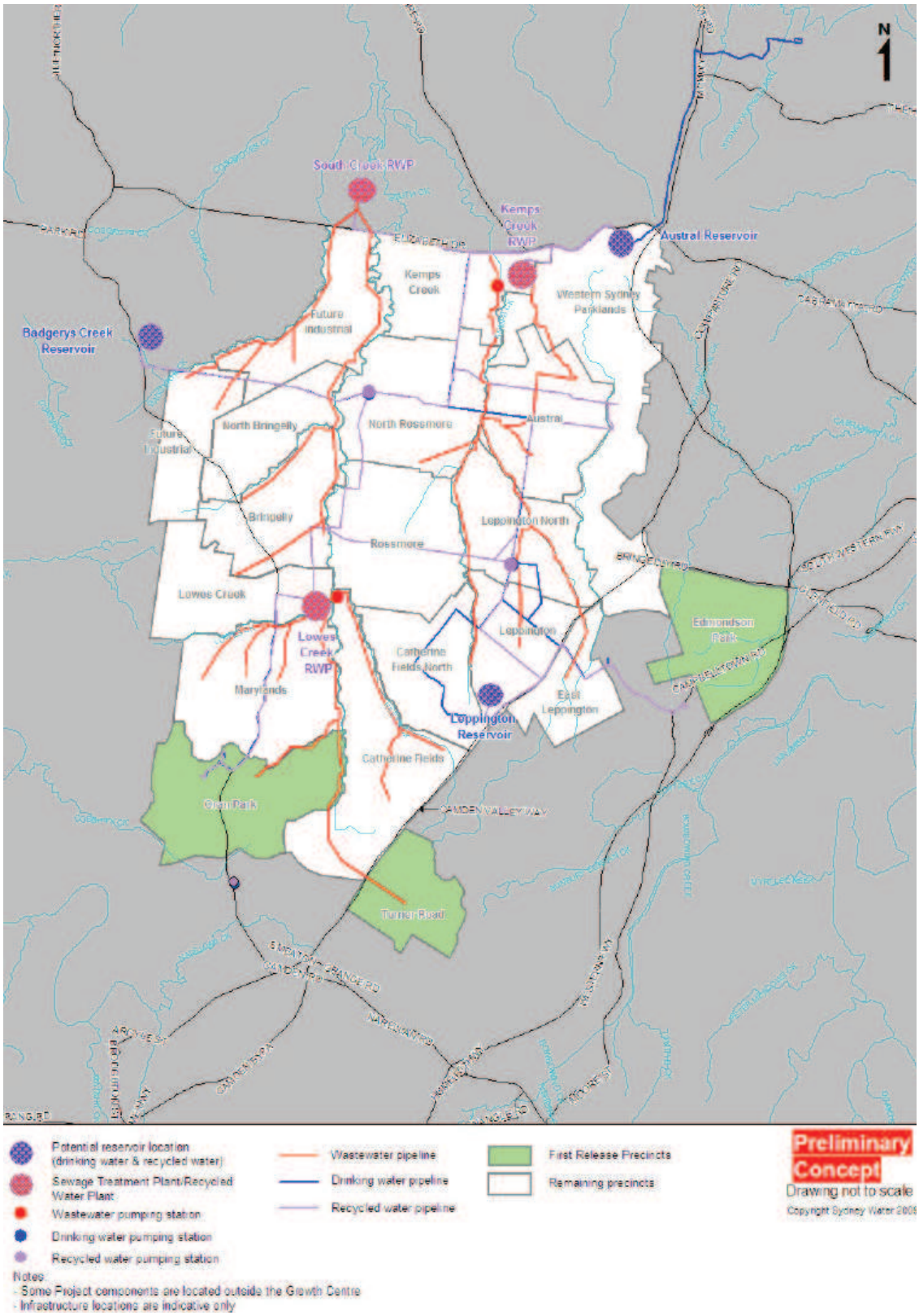

Figure 4.9 Preliminary concept locations of SWGC pipelines (SWC 2011:Figure 4.2).

Bringelly Road

Austral Archaeology (AA) recently undertook the Phase 1 assessment for the upgrade of Bringelly Road, between Camden Valley Way (Leppington) and the North Road (Bringelly), approximately half of which is within the current study area (AA 2010). Although the site cards are available in the OEH

AHIMS (19 of which were identified during an AHIMS search for the study area and its vicinity), the report (including map) has not yet been released.

Glenfield-Leppington South West Rail Link

Heritage Concepts (2006) undertook the Stage 1 preliminary archaeological assessment of the South West Rail Link (SWRL; now known as the Glenfield to Leppington Rail Line [GLRL]), an 11km rail alignment extending from south west of the existing Glenfield Rail Station to a proposed train stabling facility at Rossmore (the western end of which extends into the current study area). Heritage Concepts identified two artefact scatters, four isolated artefacts and one possible scarred tree (see Table 4.4 and Figure 4.10). Further assessment of all of the sites identified by Heritage Concepts was recommended, which was undertaken by AMBS in 2008 and 2010 as part of Stages 2 and 3 of the SWRL assessment.

Table 4.4 Summary of Aboriginal sites located by Heritage Concepts (2006).

Site Name	Site Type	Material	Landform
SWST1	Possible scarred tree	Grey box eucalypt	Flat ground, c.500 from creekline
SW1	Isolated find	1 quartz artefact	Low slope of a closed depression
SW2	Artefact scatter c.50mx10m	Mudstone, silcrete and quartz artefacts	Low slope adjacent to creekline
SW3	Isolated find	1 silcrete artefact	Creek flat
SW4	Isolated find	1 mudstone artefact	Creek flat
SW5	Artefact scatter	2 mudstone artefacts	Ridge near creekline
SW6	Isolated find	1 red-grey silcrete artefact, quartz inclusions	Ridge near creekline

Figure 4.10 Aboriginal heritage sites recorded by Heritage Concepts (Source: Heritage Concepts 2006:50) (see Volume 2 of the report).

Of the sites recorded by Heritage Concepts, the possible scarred tree and isolated find SW1 are within the current study area (however, neither has been registered on the AHIMS). The possible scarred tree was inspected by AMBS and Aboriginal community representatives in 2010, and the scar on the tree was determined not to be of Aboriginal origin; rather, it appeared to be the result of damage from a horse (such as from a bite). A nearby tree was observed to have a similar scar (AMBS 2010b:62-63). Site SW1 was unable to be found during the AMBS survey, but this is not unexpected given that the site comprises a single artefact.

The AMBS surveys identified 14 new sites (SWRL Sites 1-14) and located five previously recorded sites (Figure 4.11). SWRL Sites 3-4, 7 and 9-13 are within the current study area, with SWRL Site 6 located adjacent to the easternmost section of the study area (Table 4.5). However, AMBS identified areas of archaeological sensitivity within the current study area and its vicinity (Figure 4.11), and recommended test excavations in the following areas:

- land between Cabramatta and Maxwells Creeks, including Ingleburn, which was considered to have moderate-high archaeological sensitivity, for the potential to reveal a continuity of activity in the landscape around Cabramatta and Maxwells Creeks;
- land adjacent to Kemps Creek, which was considered likely to have high archaeological sensitivity; and
- an elevated area in the landscape at the back of a property at 511 Bringelly Road, in the immediate vicinity of a tributary of Kemps Creek, which was considered to have moderate archaeological sensitivity.

Table 4.5 Summary of Aboriginal heritage sites identified during AMBS SWRL surveys, which are within the current study area and its immediate vicinity.

Site Name	Type	Landform	Details
SWRL Site 3	Stone Artefact Scatter	Creek flat	8 artefacts recorded
SWRL Site 4	Isolated Artefact	Mid-slope	1 artefact recorded
SWRL Site 6	Stone Artefact Scatter	Flat/gentle slope	13 artefacts recorded
SWRL Site 7	Stone Artefact Scatter	Flat	4 artefacts recorded
SWRL Site 9	Stone Artefact Scatter	Creek flat	3 artefacts recorded
SWRL Site 10	Stone Artefact Scatter	Flat/gentle slope	15 artefacts recorded
SWRL Site 11	Isolated Artefact	Flat	1 artefact recorded
SWRL Site 12	Isolated Artefact	Ridge	1 artefact recorded
SWRL Site 13	Stone Artefact Scatter	Slope	7 artefacts recorded
SWRL Site 14	Stone Artefact Scatter	Flat/gentle slope	4 artefacts recorded

AMBS completed preliminary test excavations in June–July 2010. The location of the excavation areas was determined by geotechnical testing requirements and environmental constraints, and as such, pits were not necessarily placed in locations most likely to contain archaeological deposit. The largest numbers of excavated artefacts were recovered from lower slopes and flats within 300m of significant water resource zones in the region, just outside the flood inundation zones of the creeks (Figure 4.12). Within the current study area, these water resources include Kemps Creek at Leppington/Rossmore; 30 artefacts were recovered from TP49v located immediately to the west of the Kemps Creek (and the boundary of the current study area), and seven artefacts were recovered from TP25, within the current study area (see Figure 4.8). Although few artefacts were recovered along elevated landforms in the GLRL study area, this may be a result of an increase in previous impacts and associated erosion affecting site integrity, and may not reflect past Aboriginal land use.

Figure 4.11 Identified sites and areas of archaeological sensitivity identified for the SWRL corridor (AMBS 2010c:Figure 3.14) (see Volume 2 of the report).

Preliminary analysis of the results of the test excavation suggests that there is potential for significant Aboriginal archaeological deposits to be present within the identified areas of high archaeological sensitivity in the GLRL corridor, particularly in association with creeks and swamp areas.

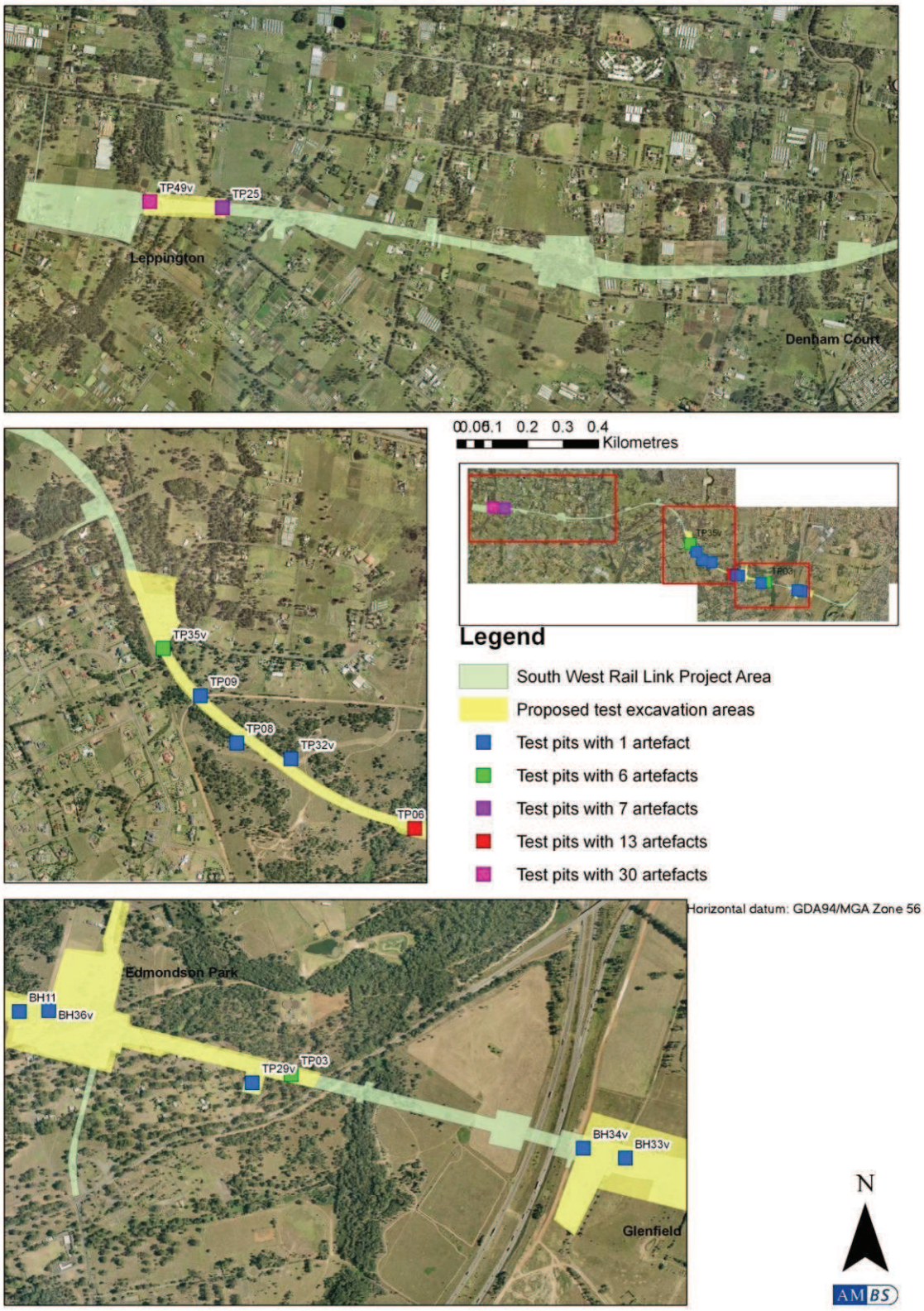

Figure 4.12 SWRL preliminary test excavation artefact distribution (AMBS 2010a:Figure 6.1).

Leppington Caravan Park, 2006

Navin Officer undertook a survey as part of the proposed redevelopment of Leppington Caravan Park, Camden Valley Way, Leppington, which is within the current study area. Navin Officer's study area

comprised the approximately 8.1ha caravan park, and an additional 2.2ha of undeveloped land (Figure 4.13).

Figure 4.13 Location of Leppington Caravan Park and undeveloped land (outlined in green), surveyed by Navin Officer (2006:Figure 1.1).

The caravan park area was found to comprise heavily disturbed and modified ground, sealed roads, kerb and guttering and associated electricity, sewerage and drainage infrastructure. The survey therefore focussed on the 2.2ha of undeveloped land; however, despite excellent visibility, only one artefact was identified. Based on the lack of associated material in the study area and vicinity, the site was assessed as being of low archaeological significance, and indicative of low archaeological potential for the study area.

Camden Valley Way, 2010

Kelleher Nightingale undertook a survey of Camden Valley Way between Cobbitty Road and Cowpasture Road, which includes part of the current study area (Figure 4.14). The road corridor, adjacent property boundaries and creeklines which were to be affected by the road upgrade were

inspected. Fourteen sites were identified, comprising ten artefact scatters, two isolated finds and two scarred trees. Within the vicinity of the current study area, isolated finds LP-1 and LP-3 and artefact scatter LP-4 were assessed as having low archaeological potential and significance, while artefact scatter LP-2 was assessed as having high archaeological potential and significance. A Section 90 was recommended for LP-1 and LP-4, while LP-2 and LP-3 were able to be avoided by the development.

Figure 4.14 Area of Camden Valley Way surveyed by Kelleher Nightingale (2010:Figure 2).

4.2.4 Previous Archaeological Investigations in close proximity to the Austral & Leppington North Precincts

Kemps Creek Transmission Line, 1980

Koettig surveyed a transmission line extending from the Kemps Creek Substation, to Eraring near Newcastle (Figure 4.15). A total of 34 sites were identified. The sites in closest proximity to the study area were found in the vicinity of South Creek.

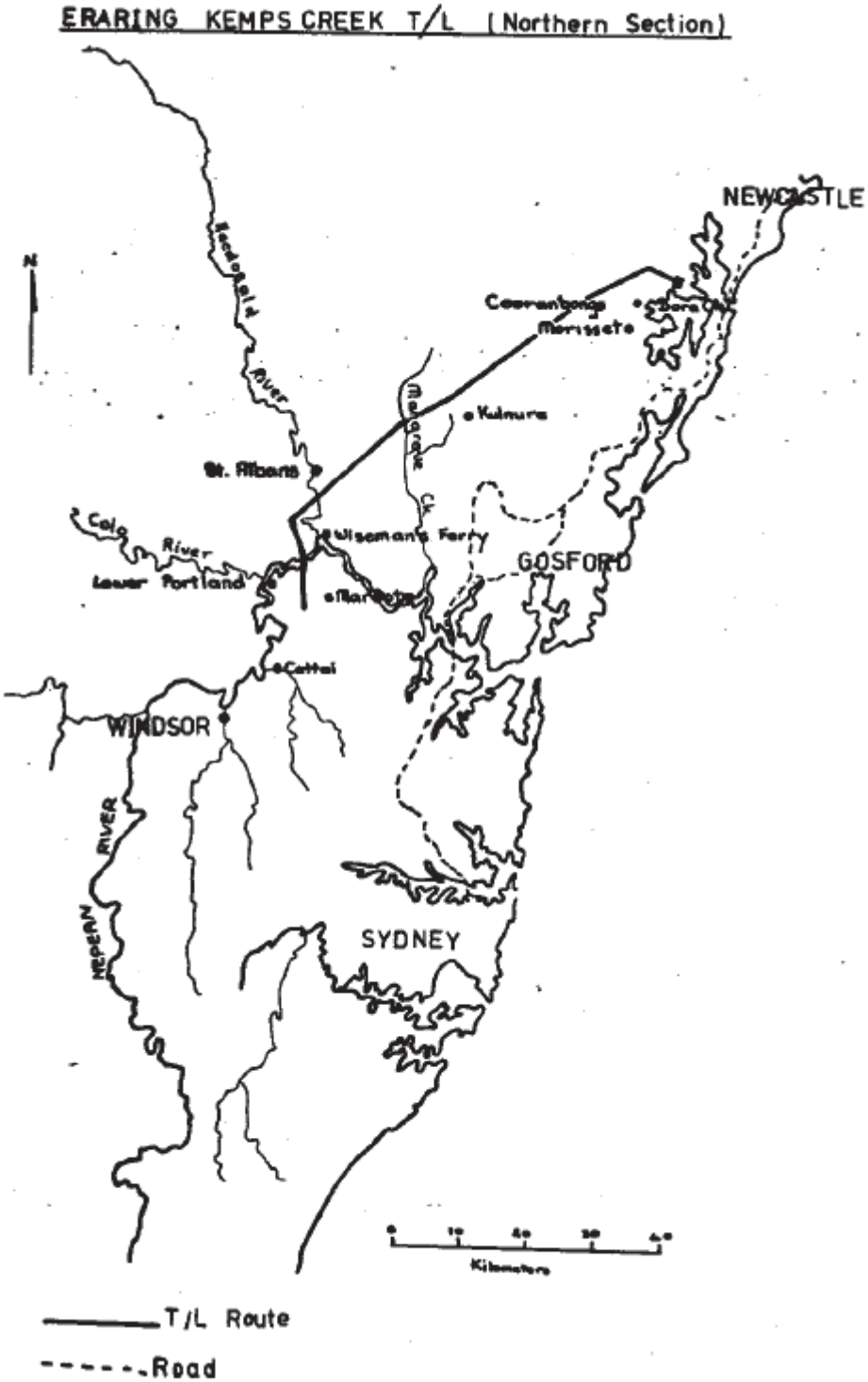

Figure 4.15 Study area assessed by Koettig (1980:Map 1).

Cowpasture Road, 2004

AHMS undertook an Aboriginal archaeological assessment for the proposed upgrade of Cowpasture Road between Main Street and Camden Valley Way, the southern end of which adjoins the current study area (Figure 4.16). The study area comprised land adjacent to the road corridor, and was found to have been significantly disturbed by the construction of Cowpasture Road. No sites were located, and the corridor was considered to have low archaeological potential. AHMS considered that no further archaeological work was necessary prior to the upgrade.

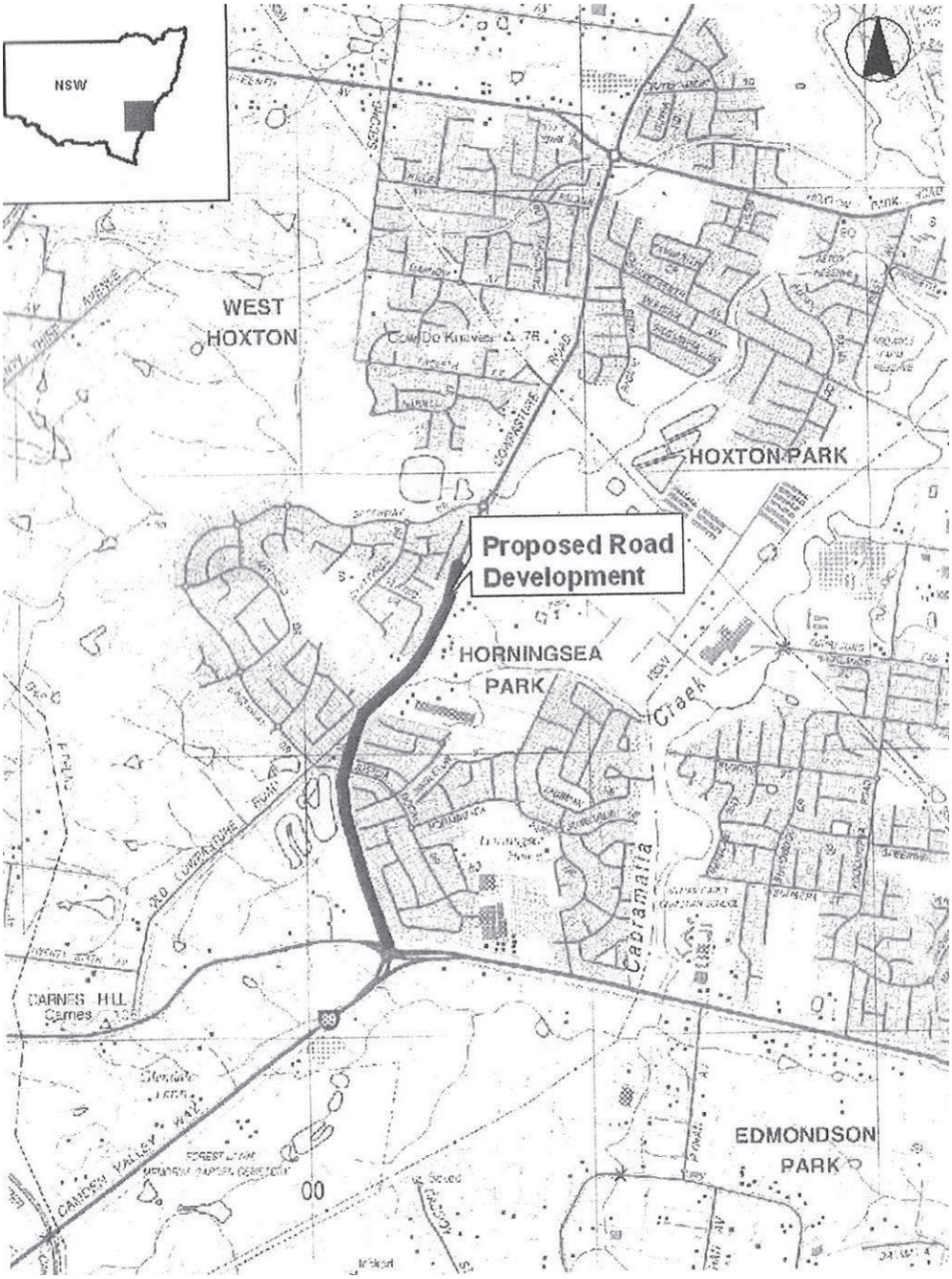

Figure 4.16 Study area investigated by AHMS (2004:Figure 1.1).

Edmondson Park

AMBS undertook surveys of the Edmondson Park area (which adjoins the easternmost extent of the current study area) as part of the Edmondson Park Composite Site (EPCS) Master Plan in 2003. It was noted that 13 artefact scatters and five isolated finds had previously been recorded across the

EPCS, comprising a total of 276 artefacts, and that *[m]ost sites were located in areas of low or moderate disturbance along tributaries of Maxwells Creek, either on the alluvial flats immediately adjacent to the creekline or on the associated elevated, gently sloping undulating rises above the creeks* (AMBS 2003:10). The survey covered a large part of the study area and identified 15 new stone artefact sites (EPCS1 – EPCS15), comprising a total of 32 artefacts (see Figure 4.17).

Figure 4.17 Location of sites in Edmondson Park Composite Site (AMBS 2003:Figure 6) (see Volume 2 of the report).

AMBS identified several areas of sensitivity where *in situ* archaeological deposits were considered likely to remain. Most areas of sensitivity are associated with known surface archaeological manifestations or landforms conducive to Aboriginal occupation. Areas were divided into four categories in accordance with their estimated archaeological potential:

- areas of high sensitivity are those where the original landscape has not been significantly disturbed and include locations conducive to Aboriginal occupation. These locations have either surface archaeological evidence and/or have the potential to yield substantial subsurface archaeological deposits based on landform and degree of disturbance;
- areas of moderate sensitivity are those where the original landscape has been partially disturbed by past land uses, although subsurface archaeological deposits are likely to remain intact to some degree. These locations have been identified by surface archaeological evidence or their potential to yield subsurface archaeological deposits based on landform and degree of disturbance;
- areas of low sensitivity are those where the original landscape has been more substantially disturbed by past land uses and subsurface archaeological deposits are likely to remain intact to a lesser degree. Locations were identified by surface evidence or their potential to yield subsurface archaeological deposits based on landform; and
- the remainder of the site has been categorised as disturbed landscape because of the substantial degree of previous land disturbance that has taken place. While the presence of archaeological material within these zones cannot be ruled out, it is considered unlikely that intact archaeological deposits would still be present (AMBS 2003:27-30) (see Figure 4.18).

Figure 4.18 Archaeological sensitivity zones within EPCS (AMBS 2003:Figure 4) (see Volume 2 of the report).

Navin Officer undertook test excavations on a rise overlooking Cabramatta Creek, adjacent to the easternmost extent of the current study area. A total of 68 test pits, in areas of least disturbance, were mechanically excavated throughout the area, including site EPCS5 (see Figure 4.19). Only 0.008% of the area of archaeological potential was excavated (of which only a sample was sieved, 'equivalent to the in situ deposit that would be recovered from an excavation area of 100 x 48 cm'; Navin Officer 2007a:5). A low density of artefacts was recovered, 33 in total from the 68 pits (an average of 1.3 artefacts per square metre that was excavated), with the majority on a low slope near the banks of a second order tributary of Cabramatta Creek. All finds were within the site designated as EPCS5 except for one isolated artefact (LLB1). Navin Officer recommended that this area did not require further archaeological assessment (Navin Officer 2007a).

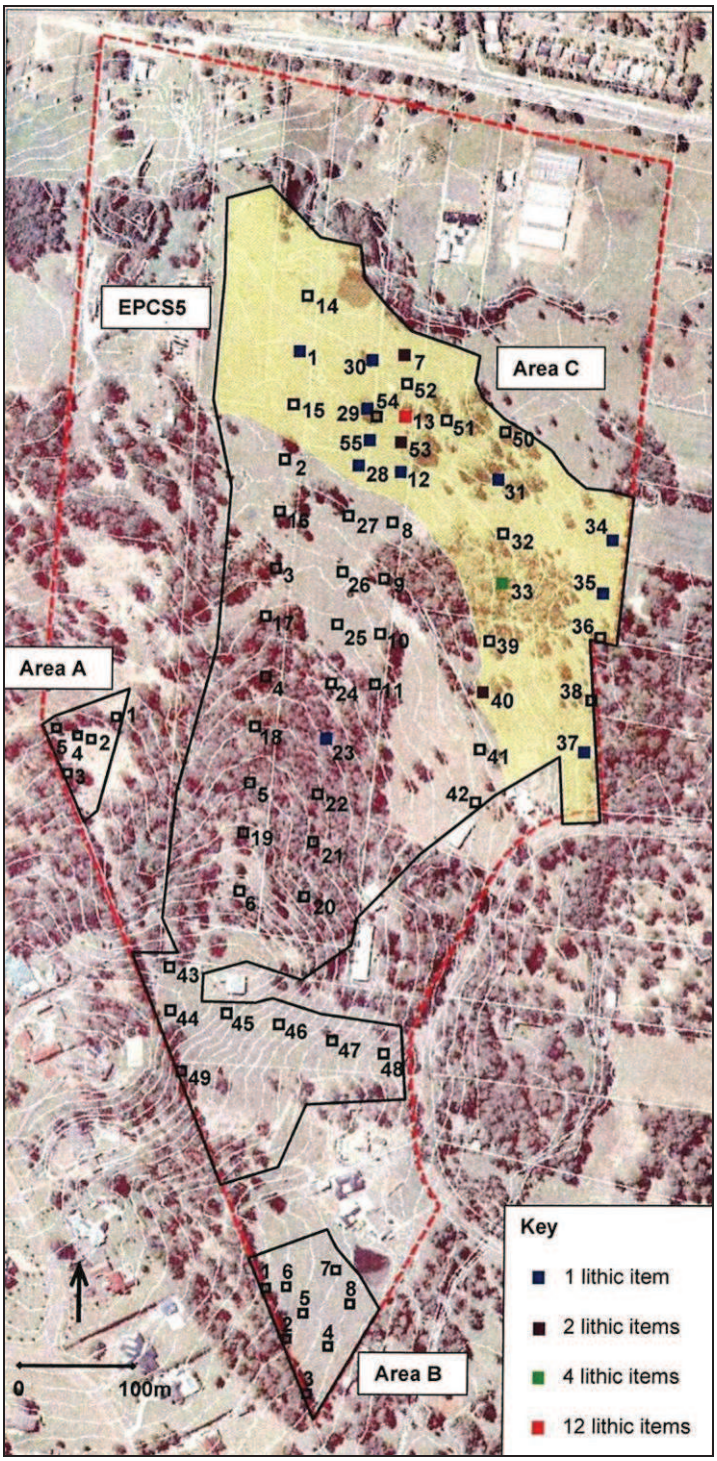

Figure 4.19 Location of test pits excavated by Navin Officer (2007a:27).

Based on the results of this subsurface archaeological testing, Navin Officer revised the areas of archaeological potential identified by AMBS within Edmondson Park. Navin Officer's justification for the reassessment of the entire Edmondson Park precinct was that 'the subsurface investigation [at LLB1] found that soils within the test area were very shallow, with minimal subsurface deposits. Consequently the overall archaeological potential of the area was downgraded. There are now four areas of moderate archaeological potential and three areas of low archaeological potential in the area' (Navin Officer2007b:5). However, it should be noted that this is based on the excavation of a very small percentage (0.008%) of the area considered by AMBS in 2003, to have high sensitivity, particularly as only a sample of excavated soil was sieved. Given the contradictions between excavations in the vicinity of the area (see Section 4.1.3), it is inadequate to attempt to reassess all sites

throughout the Edmondson Park precinct, sight unseen, based on the results of one small-scale excavation.

In 2009, AA undertook an archaeological risk assessment of 20 route options, as part of a wastewater planning study of the Edmondson Park area. The assessment was desktop-based, with a limited site inspection undertaken off Rynan Avenue (approximately 400m west of the current study area; see Figure 4.20). No new sites were identified during the inspection; however, it was noted that ground surface visibility was limited. Further, AA considered that most areas close to creeks, particularly those that are relatively undisturbed, were likely to contain Aboriginal archaeological deposits.

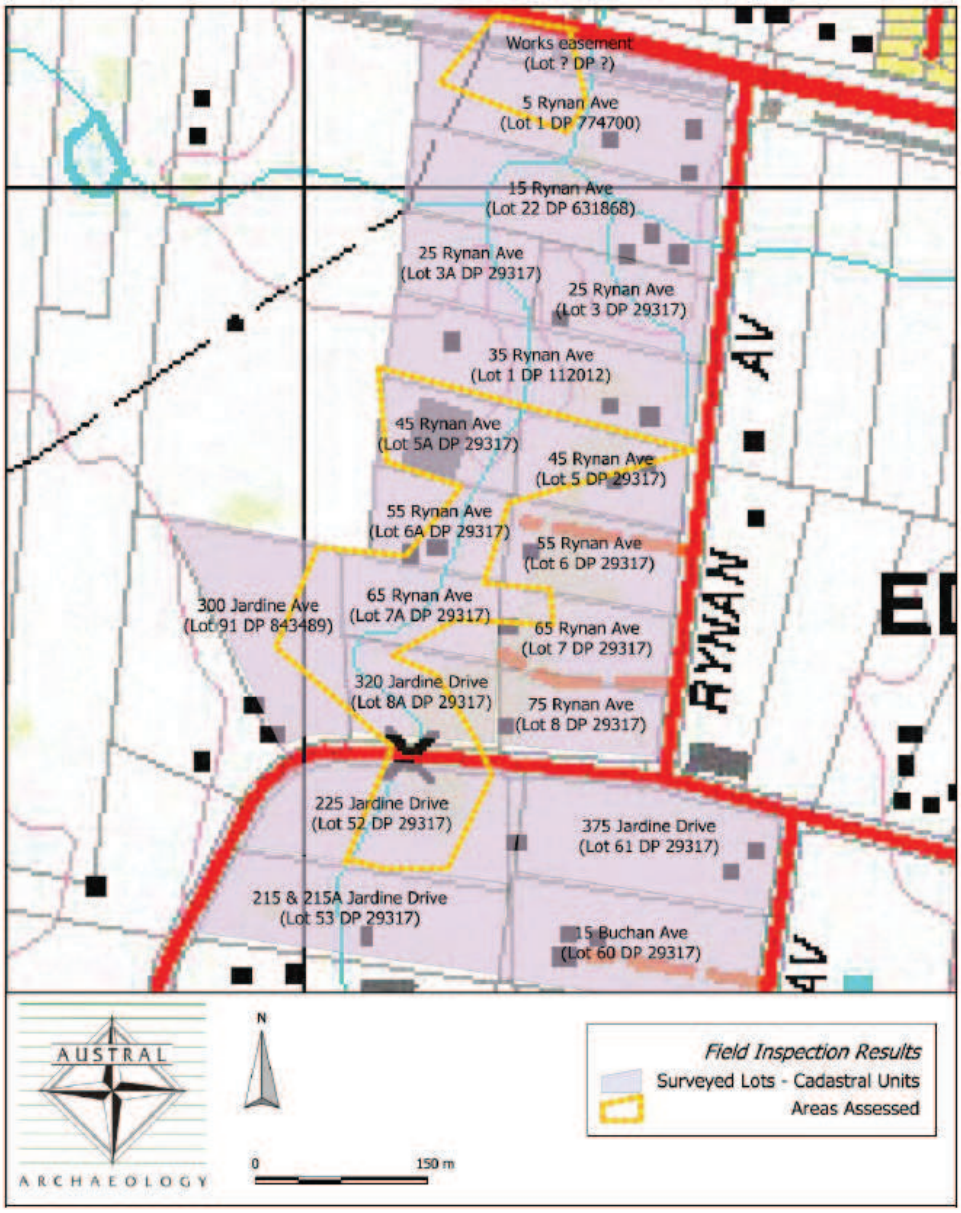

Figure 4.20 Area subject to site inspection by AA (2009:Figure 5.3).

AMBS (2011) recently undertook a survey of the proposed trunk water, wastewater and recycled water infrastructure for the Edmondson Park Release Area; however, no sites or areas of archaeological sensitivity were identified in the immediate vicinity of the current study area (Figure 4.21).

Figure 4.21 Identified sites and areas of archaeological sensitivity identified for water infrastructure at Edmondson Park, in closest proximity to the current study area (AMBS 2011:Figure 9.1) (see Volume 2 of the report).

Gas Pipeline, 1994

English undertook a survey of the proposed Moomba to Sydney ethane pipeline, between Wilton and Botany. A sample of the pipeline area was surveyed, with sampled areas chosen on the basis of landform and previous landuse/disturbance. One of the surveyed sections extended from Denham Court Road to Camden Valley Way, which is adjacent to the current study area (Figure 4.22). Only two isolated finds were identified during the survey of nine sample sections, one of which (IF2) is located approximately 250m south of the current study area (although the AHIMS data plots the site approximately 300m south of the location recorded in English's report).

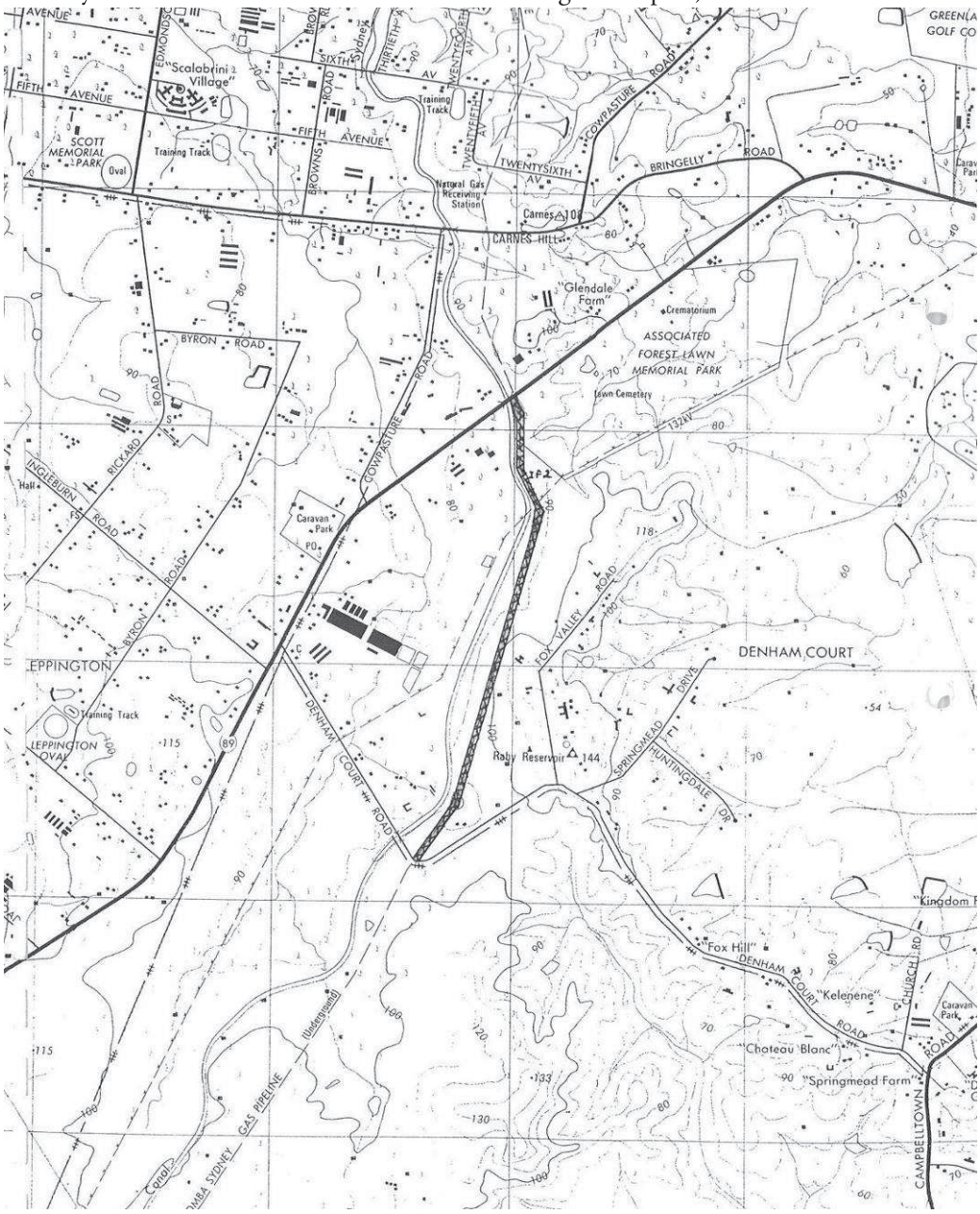

Figure 4.22 Survey Section 4 and site IF2, identified by English (1994:Figure 4).

Middleton Grange, 2001

JMCHM investigated an area approximately 500m east of the current study area as part of the South Hoxton Park Aerodrome Master Plan. This preliminary archaeological assessment confirmed the location of one previously recorded site (PCP5) and identified two open camp sites and nine PADs in relatively undisturbed areas along the northern, central and southern creek and their tributaries (see

Figure 4.23 and Figure 4.24). Test excavation was recommended for any of the sites or PADs proposed to be impacted, in order to accurately assess their significance.

Further survey of this area was undertaken by ERM in 2004. This survey identified one flaked silcrete artefact at the northern edge of JMCHM's (2001b) PAD1. It was predicted that within the Middleton Grange landscape, the highest densities of Aboriginal stone artefacts would occur along the fourth order Hinchinbrook Creek (approximately 2.5km east of the current study area), where camping would have been the most intensive (see Figure 4.24). Camping would also have been frequent along the third order tributary of Hinchinbrook Creek (approximately 500m east of the current study area), with evidence of knapping floors predicted. Middle-low density deposits representing occasional food-gathering were predicted along the northern, central and southern second order creek tributaries, with background scatter present throughout the remaining area (ERM 2004).

Figure 4.23 Location of all sites and PADs identified by JMCHM (2001b:Figure 2) (see Volume 2 of the report).

Test excavations in the vicinity of the third order tributary, and the hill and slopes to the south (north of the central creek tributary) were subsequently undertaken by ERM (2005). This area had been recorded as PAD9 by JMCHM (2001b) and was renamed SH4 by ERM (2005). Although conducted within a relatively intact landscape, these excavations revealed lower densities of artefacts than had been predicted. No knapping floors were identified along the third order tributary, and artefact density was only slightly higher along this creek than on the slopes and crest of the hill. The artefacts were considered to represent low density archaeological deposit within 50m of the creek, and background scatter further than 50m from the creek. Based on these results, it was anticipated that archaeological deposit along the central and southern creek tributaries would be of low density, and would not make any important contribution to archaeological knowledge of Aboriginal occupation of the local area.

Further assessment of the area was undertaken for a Water Cycle Management Plan (ERM 2006). At this time it was recommended that monitoring and salvage of artefacts be undertaken for any impacts on SHMP1, SHMP2, SH4 and PAD1 (which was recommended to be reclassified as the boundary of site SH1).

Most recently, construction of a bridge across the central creek tributary involved impact to the area of inferred archaeological deposit associated with site SHMP1. As such, a Section 90 permit was obtained, and archaeological monitoring of topsoil stripping in this area was undertaken (ERM 2007). JMCHM (2001b) identified this area as likely to be associated with complex or extensive archaeological material, and it was predicted that if this was the case, artefacts would be found during monitoring. Based on subsequent investigations in the area, ERM (2007) anticipated a low density of archaeological material in this area, which may not be revealed by monitoring. It was anticipated that the results of the monitoring would be "useful in clarifying models of Aboriginal site location, specifically the association of Aboriginal sites with low order creek confluences, particularly where higher order creeks are present in the wider area" (ERM 2007:20). No archaeological deposits were identified during the monitoring, which supported the model predicting low density artefact distribution in this area.

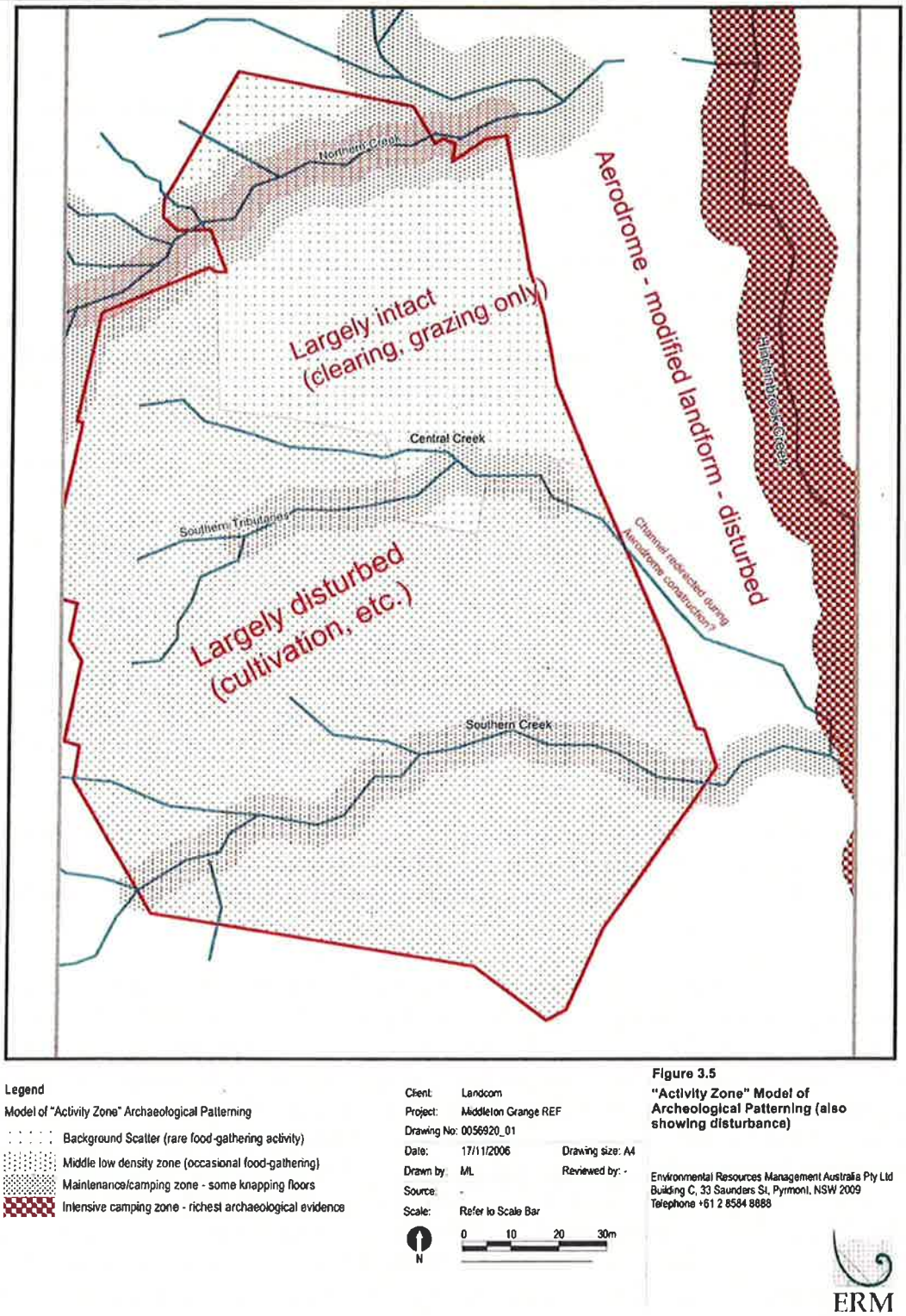

Figure 4.24 Predicted archaeological patterning in Middleton Grange (Source: ERM 2007:Figure 3.5).

AMBS (2008) also recently undertook a survey for the Middleton Grange Landscape Transition Zone (LTZ). Three stone artefact scatters were located during the survey (see Table 4.6 and Figure 4.25). Although sites LTZ2 and LTZ3 are within close proximity of each other (c.80m apart), they are located on separate landforms and are considered to have differing subsurface expressions, and therefore were recorded as separate sites. Site LTZ3 was considered to have the highest archaeological

sensitivity, given its visible surface expression, its relatively undisturbed state and its location on a raised area of land adjacent to (within 15m of) a second order creek tributary.

Table 4.6 Summary of Aboriginal heritage sites identified during AMBS LTZ survey.

Site Name	Type	Landform	Details
LTZ1	Stone Artefact Scatter	Ridge	2 artefacts recorded
LTZ2	Stone Artefact Scatter	Slope	2 artefacts recorded
LTZ3	Stone Artefact Scatter	Ridge	15 artefacts recorded

Figure 4.25 Study area and sites identified by AMBS (2008:Figure 6.2) (see Volume 2 of the report).

Hoxton Park

In 2005, AA undertook a field survey for SWC for the Hoxton Park Recycled Water Scheme. Changes were required for the Scheme and AA prepared a revised report in 2006 (AA 2006; see Figure 4.26). The initial survey identified three areas of PAD (F, D, and E) approximately 2km from the current study area, near minor tributaries of Maxwells Creek (Figure 4.27). During the survey of the revised route, seven additional areas of PAD (G, H, I, J, K, L and M) were identified between approximately 0.5km (PADs I and K) and 3km (PADs G and H) west of the current study area (Figure 4.28). PADs G, I, J and M were in the vicinity of Cabramatta Creek, with PAD L on a tributary of this creek. PAD H was located near a tributary of Maxwells Creek and PAD K was on a tributary of Hinchinbrook Creek (the southern creek, as per ERM's terminology). PADs J and L were considered to have the most potential for significant archaeological deposit, followed by PADs H, I and K. PAD M was not surveyed, but was estimated to have high potential based on available information (AA 2006:55-56). It was recommended that the PADs be avoided by the proposed development, or subject to test excavation if avoidance was not possible.

In August 2008, AA undertook field surveys for an updated report for the Hoxton Park Recycled Water Scheme (AA 2008a; see Figure 4.29). Eight survey units were delineated for fieldwork across the Hoxton Park/Glenfield region; however, no new Aboriginal sites were recorded by the survey teams.

Due to the high level of disturbance the 2008, the AA report concluded that the Hoxton Park/Glenfield site represented low archaeological potential. Of the survey units in closest proximity to the current study area (1 and 2), area 1 was described as having absent archaeological potential, while area 2, located near PAD L, was assessed as having low-moderate potential, and moderate/severe disturbance levels (AA 2008a:55).

In October 2008, AA mechanically excavated 12 1m x 1.2m test pits at PAD L, which was renamed HP PAD2 (AA 2008b; see Figure 4.27). A very low density of artefacts (33, manufactured predominantly on silcrete, tuff and quartz) was located on both sides of an unnamed first-order tributary of Cabramatta Creek, and it was concluded that insufficient artefacts were retrieved to "warrant further works or in-depth artefact analysis" (AA 2008b:ii-iii,5). The site was registered as an artefact scatter and renamed HP AD1 (AA 2008b:58), and a Section 90 AHIP was issued.

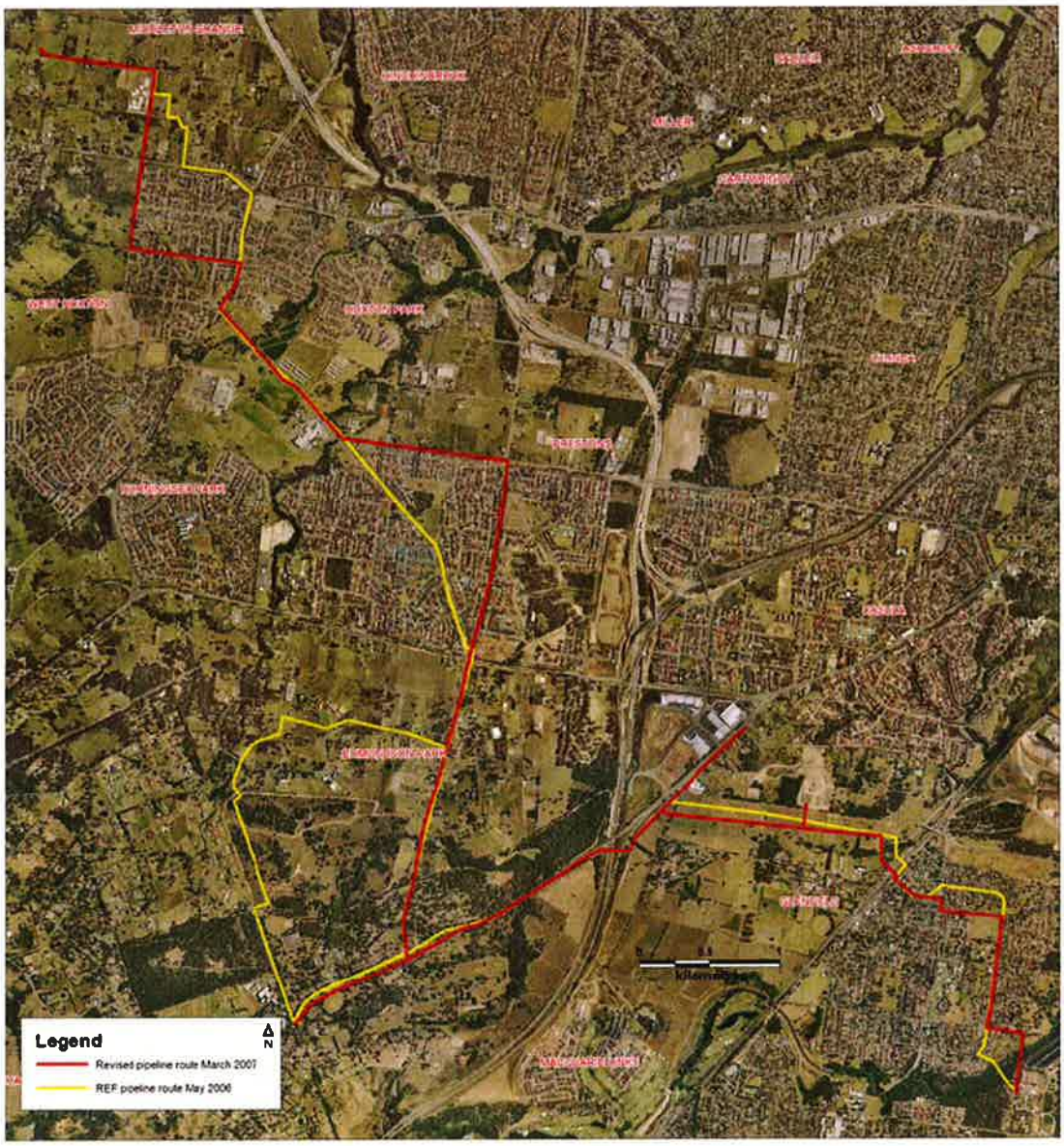

Figure 4.26 Location of original and revised recycled water routes assessed by AA (SWC 2007:14).

Figure 4.27 Location of PADs D, E and F, identified by AA (SWC 2007:20) (see Volume 2 of the report).

Figure 4.28 Location of PADs identified for the Hoxton Park Recycled Water Scheme by AA (AA 2006:Figures 5.2 and 5.3) (see Volume 2 of the report).

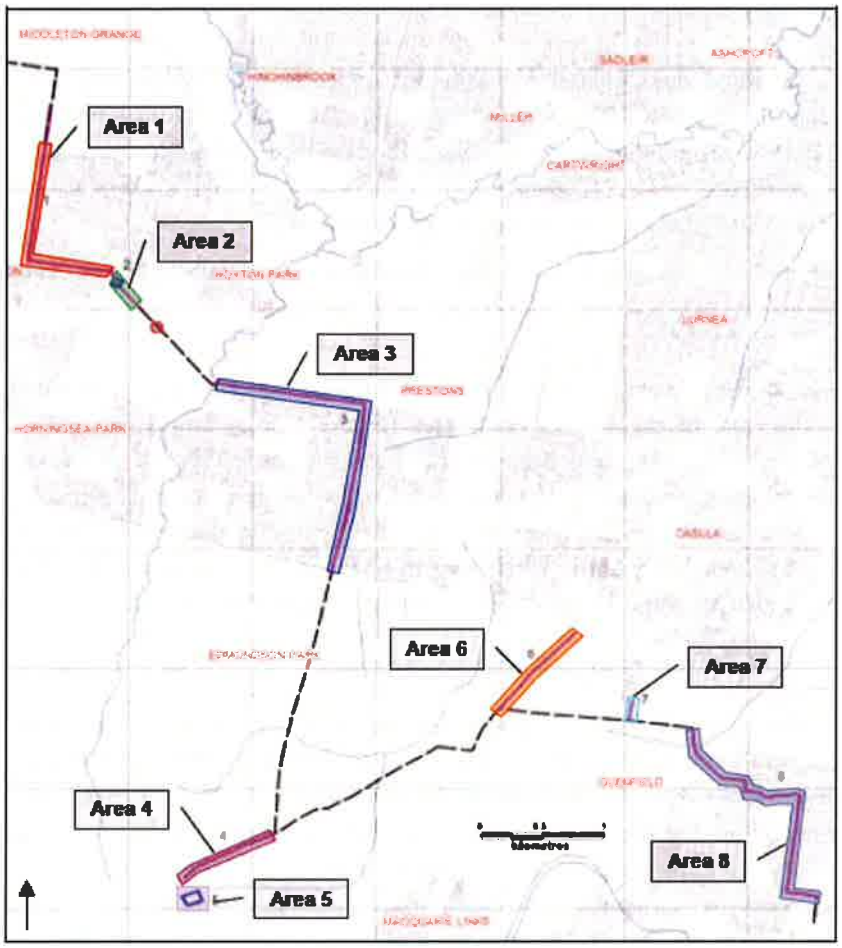

Figure 4.29 Additional areas surveyed by AA (2008a:Figure 15).

Horningsea Park, 2003

A survey for a proposed school site at Horningsea Park, approximately 500m north east of the current study area was undertaken by Hardy (Figure 4.30). Although no sites were identified during the survey, ground surface visibility was low. Given the location of the area c.500m from Cabramatta Creek and 100-200m from one of its tributaries, Hardy recommended that test excavation should be undertaken prior to development.

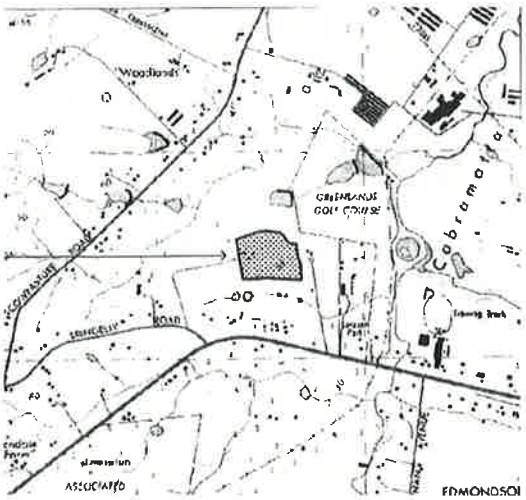

Figure 4.30 Study area (arrowed) investigated by Hardy (2003:Figure 1).

McCann Road, 2001

A survey for a proposed residential subdivision was undertaken by White, between Bringelly and McCann Roads, approximately 600m west of the current study area. White's study area was located on a ridge top between South and Kemps Creeks, and six isolated finds and one PAD were identified during the survey (Figure 4.31). The PAD was located on hillslopes adjacent to a creek, and test excavation was recommended prior to any impact in that area.

Figure 4.31 Study area and sites identified by White (2001:Figure 1) (see Volume 2 of the report).

Liverpool Release Areas, 1989

Smith surveyed approximately 2700ha in the Liverpool Release Areas, which includes land approximately 1km east of the current study area (Figure 4.30). Smith targeted a representative sample of landscape units, topographic features and land use areas (1989:22). Smith assessed the areas of highest archaeological potential to be within 50-100m of permanent creek lines and swamps, including the headwaters of permanent creeks, and relatively undisturbed areas along Maxwells Creek; with the banks of all temporary creeks considered to have moderate archaeological potential, and hill tops and slopes also having some archaeological potential (Smith 1989:70-71).

4.2.5 Aboriginal Heritage Site Prediction Modelling

On the basis of the registered archaeological sites in the region, and review of previous archaeological studies, the following conclusions can be drawn regarding the potential presence and location of Aboriginal heritage sites within the landscape of the study area:

- stone artefact sites are the most common site type occurring across the landscape, and are the most likely site type to be present in the study area. This site type usually appears as low density open artefact scatters or isolated finds, although high density scatters may also be present. Stone artefact sites are found in all environmental contexts, but are most readily identified in areas where vegetation is limited and ground surface is visible. Larger sites with higher densities of artefacts tend to be found close to stream confluences and permanent water sources, such as Kemps Creek; and
- sites situated on relatively undisturbed alluvial soils have the potential to be associated with stratified subsurface archaeological deposits. Excavations within the region indicate that high densities of artefacts can be present up to 250m from water sources, and that subsurface material may be much greater than indicated by surface numbers of artefacts.

On the basis of the archaeological sites registered in the region and review of previous archaeological studies, the following types of site are unlikely to be present in the study area:

- stone quarry sites, axe grinding grooves, stone engravings/art and shelter sites will not be found in the study area because of the lack of suitable stone outcrops;
- scarred or carved trees are unlikely to be present in the study area as the majority of the study area has been extensively cleared of vegetation for past agricultural practices, transport corridors and residential developments resulting in a lack of mature trees; and
- burials and ceremonial sites (including stone arrangements) are unlikely to be present in the area given the disturbance caused by early pastoralism, agriculture, roads and more recent development.

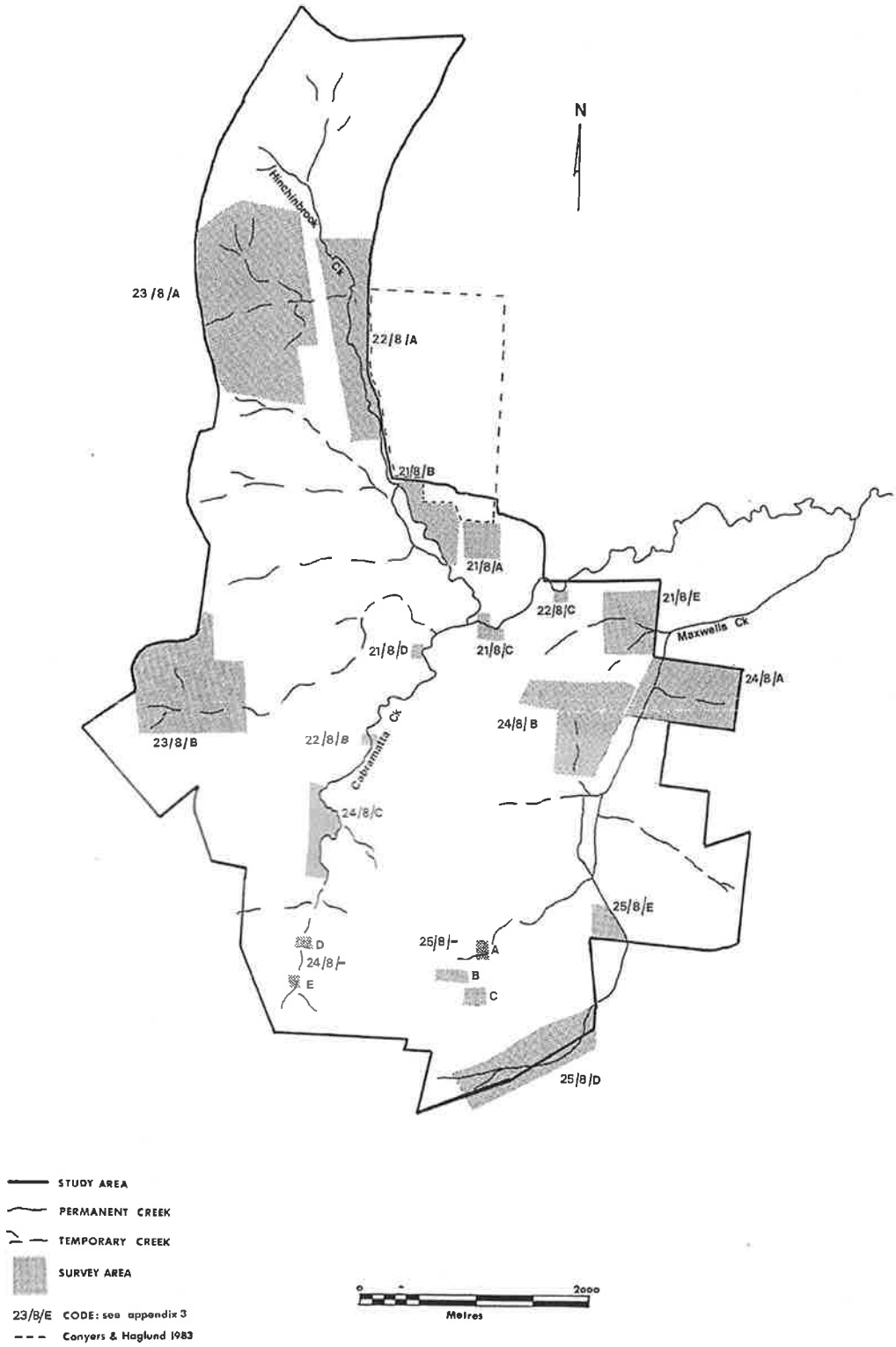

Figure 4.32 Areas surveyed by Smith (1989:Figure 4).

5 Field Survey

5.1 Survey Methodology

The field survey of the section of the study area to the north of Bringelly Road was undertaken on 1-6 December 2010. As the section of the study area to the south of Bringelly Road is within a different LALC boundary (Tharawal, rather than Gandangara), the field survey of this area was undertaken on 14 December 2010; however, a TLALC representative was unexpectedly unable to attend on this day.

The field survey was undertaken by AMBS archaeologists Jenna Weston and Deborah Farina, accompanied by Aboriginal community representatives (see Table 1.1). The field work methodology, overall project and available maps were discussed with, and reviewed by, the Aboriginal community representatives prior to, and during field work.

The Austral and Leppington North development is currently at the Precinct Planning stage, and given the area's large size and the lack of specific heritage impacts requiring assessment, the survey aimed to identify as many Aboriginal sites and areas of potential Aboriginal heritage sensitivity as possible. In order to achieve this, the survey methodology concentrated on areas of highest archaeological sensitivity: major creeks, ridges and high points. Within these locations, the focus was on areas of least disturbance and highest percentage of ground surface exposure, to allow the greatest opportunity of identifying sites. A map of existing land use, and aerial photography on the nearmap website (http://www.nearmap.com/ photography current to 15 July 2010 at the time of survey), were used to guide the assessment of disturbance and exposure levels.

However, the months subsequent to publication of the aerial photographs have been characterised by higher than average rainfall throughout the Sydney region. As a consequence, a majority of the properties within the study area were densely vegetated, particularly along creeklines. Therefore, the few remaining areas with greater ground visibility were surveyed, including areas not assessed as being of high archaeological sensitivity (for example, along the road verges). The survey was also hampered by access restrictions. The majority of properties are privately owned, and, although DP&I sent an initial letter, and follow-up letter, to property owners, many did not respond to the request for access. During the survey, access was requested directly of residents; however, where residents were absent or had not provided prior permission, properties were not accessed. Some of the property owners responded to the request for access providing that certain conditions were met; for example, several property owners requested that they be contacted beforehand so that they could be present on site during the survey. Some property owners refused access in response to the letters, and these properties were therefore not included in the survey. A map identifying the properties that were surveyed is provided in Figure 5.1 (those that were actually entered for survey are shown in Figure 5.2).

Photographs of the study area were taken using a Canon 300D digital camera and a Sony DSC-V3 digital camera. Track logs and Geocentric Datum of Australia (GDA94) site co-ordinates were recorded using a Garmin Oregon 300 handheld GPS. Where Aboriginal artefacts were encountered, notes were made regarding their type, size, and material; and descriptions of the site were recorded including the environmental setting and details of any disturbance to archaeological material in the site's vicinity. Where older mature native trees were observed within the study area, they were examined for the presence of Aboriginal cultural scarring.

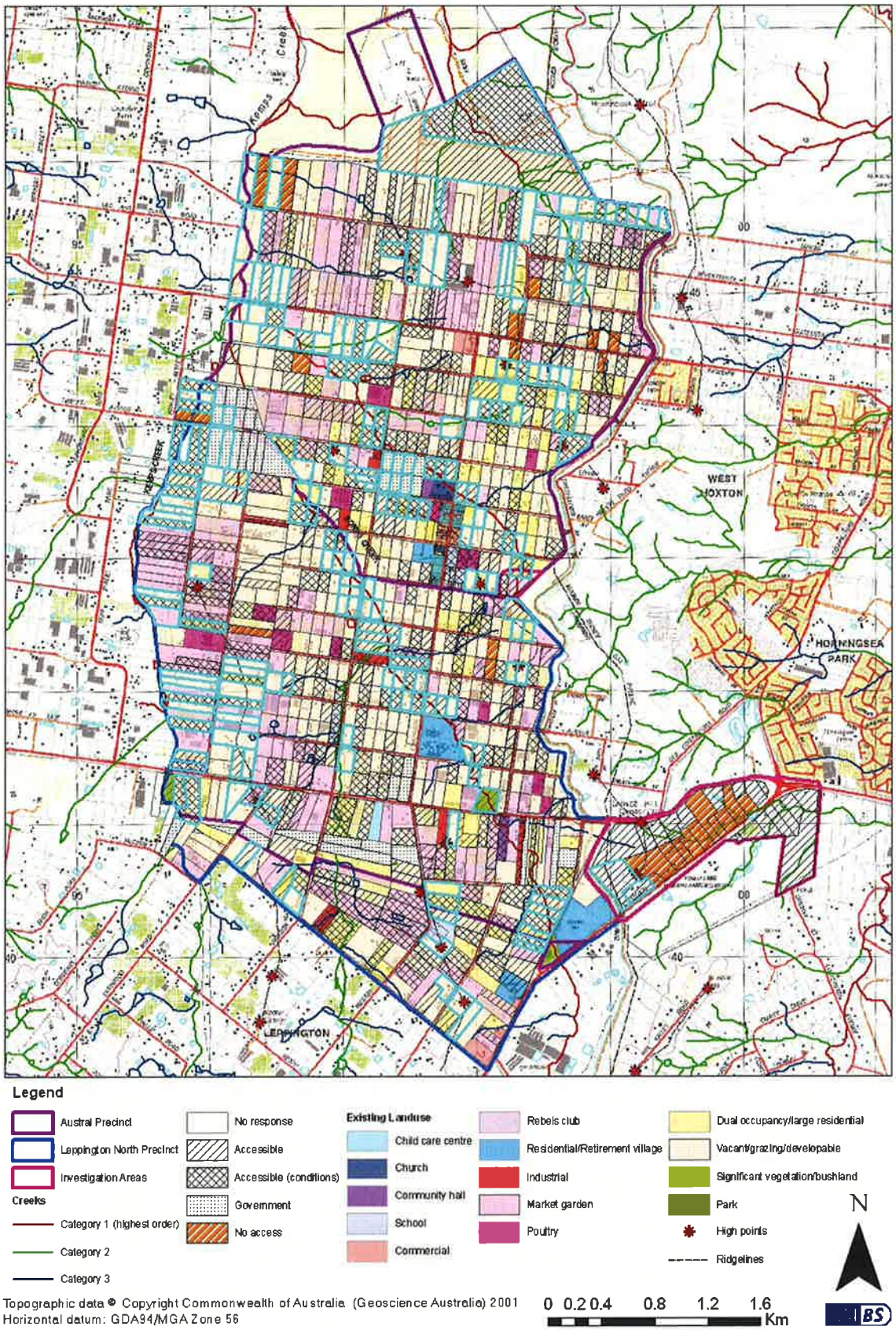

Figure 5.1 Properties subject to survey within the study area (outlined in blue). Due to lack of visibility, many properties were traversed only along the road verge (see Appendix B for details of pedestrian survey). The only properties entered for survey were 300-310 Bringelly Road; 20 Craik Ave; 485-495, 494-500 Fourth Ave; the western end of Sixth Ave; Craik Park Oval (Eleventh Ave); government land on Twelfth Ave; 95 Thirteenth Ave; 520 Fifteenth Ave; 55 Sixteenth Ave; 65-67 Seventeenth Ave; 21-27, 45, 71-85, 80-90 Eighteenth Ave; 5, 14, 20, 80, 205 Gurner Ave; and unoccupied land south-east of the Transgrid substation.

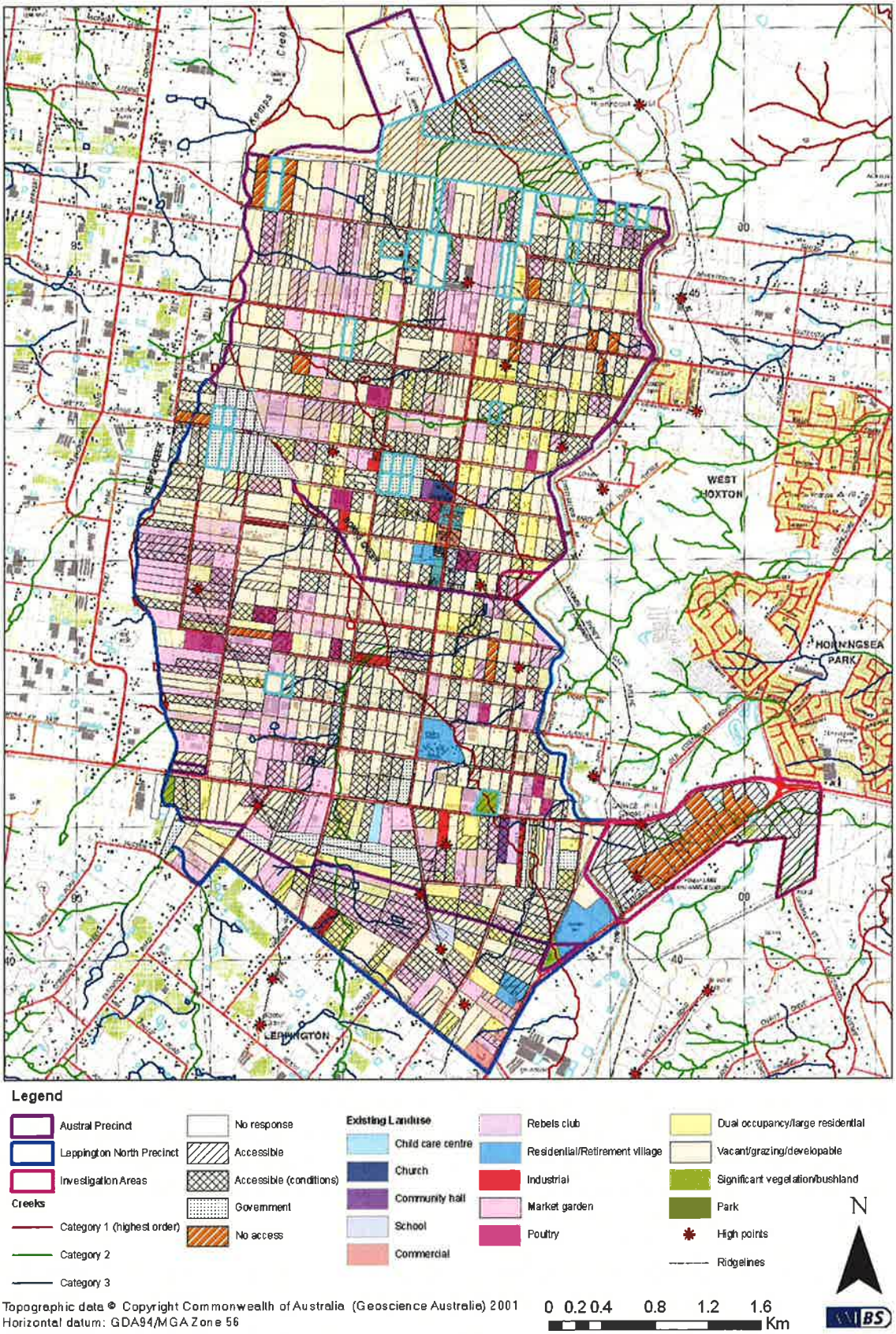

Figure 5.2 Properties entered for survey within the study area (outlined in blue).

5.2 Survey Results

Survey coverage data was gathered during the archaeological field survey to allow quantification of ground exposure and visibility, as adverse observation conditions can affect the detection of Aboriginal sites and material. This data does not reflect the extent of the area that was physically surveyed, but represents an estimate of the area of ground surface examined, and presents an estimate of the effectiveness of the survey, given environmental conditions and ground visibility. Survey coverage and disturbance data is presented in accordance with the OEH guidelines, in Appendix B, Table 5.1, Table 5.2 and Table 5.3. The area covered during the survey was considered adequate for the purposes of this preliminary heritage assessment, which is to feed into the precinct planning.

Table 5.1 Landform summary for sampled areas.

Landform	Landform sample area (m^2)	Sample area effectively surveyed (m^2)	% of landform sample effectively surveyed	Number of sites	Number of features
Creek flat	2955550	15262.755	0.52%	12 (4 new)	5 PADs; 5 isolated finds; 1 artefact scatter & PAD; 1 artefact scatter, PAD & cultural site
Slope	2488360	7228.638	0.29%	4* (2 new)	2 artefact scatter & PADs; 2 artefact scatters; 2 isolated finds
Ridge	169690	1228	0.72%	3* (no new)	2 artefact scatters; 1 artefact scatter & PAD

*The artefact scatter and PAD 2024-46 was present on both slope and ridge landforms

Table 5.2 Landform summary for total study area.

Landform	Estimated total landform area (m^2)	Landform sample area (m^2)	% of total landform area sampled	Sample area effectively surveyed (m^2)	% of total landform effectively surveyed
Creek flat	5303356	2955550	55.7%	15262.755	0.29%
Slope	14112107	2488360	17.6%	7228.638	0.05%
Ridge	584537	169690	29%	1228	0.2%

Table 5.3 Disturbance summary for total study area.

Landform	Estimated total landform area (m^2)	Estimated area with gross disturbance (m^2)	Estimated area with gross disturbance (%)	Estimated area with moderate disturbance (m^2)	Estimated area with moderate disturbance (%)	Estimated area with minimal disturbance (m^2)	Estimated area with minimal disturbance (%)
Creek flat	5303356	1490529	28.1%	442973	8.4%	3369854	63.5%
Slope	14112107	5817172	41.2%	1262307	8.9%	7032628	49.8%
Ridge	584537	234795	40.2%	65715	11.2%	284027	48.6%

5.2.1 Aboriginal Heritage Sites

Approximately 28% of the study area was surveyed for this assessment (5,605,350m^2 of approximately 20,000,000m^2). As discussed in Section 5.1 above, the properties chosen for this sample were considered to have the highest potential to contain Aboriginal heritage sites. It was considered that surveying the entire study area would not provide any more meaningful archaeological results, given the extreme lack of visibility (effective coverage being estimated at 0.42% of the properties chosen for survey).

The location of one previously recorded Aboriginal site (2014-46) was verified during the archaeological survey of the study area, and six new Aboriginal heritage sites (ALN-IF-01 to ALN-IF-06) were identified and recorded. Other previously recorded sites in the vicinity of the study area (see Section 5.2.2) are not addressed in this section, as no evidence of these sites was seen during the survey; nor was it expected that the sites would be verified, given the lack of visibility.

The new sites comprised six isolated stone artefacts. The six new sites are referred to in this report as AL-IF-01 to AL-IF-06, dependent upon the order in which they were recorded. A summary of sites identified during the survey is presented in Table 5.4 (in the order in which they were identified during the field survey), and their location relative to the study area is presented in Figure 5.3. Specific details on each site are provided below.

Table 5.4 Summary of Aboriginal heritage sites identified during survey (see Volume 2 of the report for full table).

Site	Type	Property	Landform	Details
AL-IF-01	Isolated find	205 Gurner Ave	Creek flat	1 chert retouched flake
2014-46	Artefact scatter and PAD	Lot 10 DP 771080 and Lot 15 DP 831988	Creek flat	2 artefacts previously recorded by AHMS (in prep.) 3 artefacts recorded during the current study
AL-IF-02	Isolated find	Property immediately east of Lot 15 DP 831988	Slope	1 silcrete retouched flake
AL-IF-03	Isolated find	Lot 15 DP 831988	Slope	1 silcrete proximal flake
AL-IF-04	Isolated find	Property immediately north of Lot 10 DP 771080	Creek flat	1 silcrete flake
AL-IF-05	Isolated find	5 Gurner Ave	Creek flat	1 silcrete medial flake
AL-IF-06	Isolated find	94 Boyd St	Creek flat	1 chert distal flake

Figure 5.3 Location of Aboriginal sites recorded during the survey (see Volume 2 of the report).

ALN-IF-01 – Isolated find

Landform: Creek flat
Site Size: N/A
Exposure: Unsurfaced vehicle/dirt bike track at back of property
Property: 205 Gurner Avenue (Lot 20 DP 3403)
Site description: This site, comprising an isolated chert retouched flake, is located c.60m north of an ephemeral tributary of Kemps Creek, and c.220m east of Kemps Creek, on a vehicle/dirt bike track at the back of the property at 205 Gurner Avenue, Austral (see Table 5.5, Figure 5.5). The property owner identified that the back of the property floods in heavy rain; and such flooding was present at the time of the survey (Figure 5.4). The back of the property has been disturbed by tree clearing, the construction of a dam, and use of the track area by vehicles and dirt bikes. The track had exposed the clay of the area, indicating a lack of potential artefact-bearing topsoil. Further, as the creek flat on which the artefact was found is quite low-lying and prone to flooding in heavy rain, with the creek being of low order, it is unlikely that the area was used extensively by past Aboriginal people. Rather, it is considered that more intensive use was made of Kemps Creek to the west.

Table 5.5 ALN-IF-01 artefact details.

Material	Colour	Max. length (mm)	Max. width (mm)	Max. thickness (mm)	Artefact type
Chert	Cream/grey	30	20	10	Retouched flake

Figure 5.4 Exposure at ALN-IF-01, view to east.

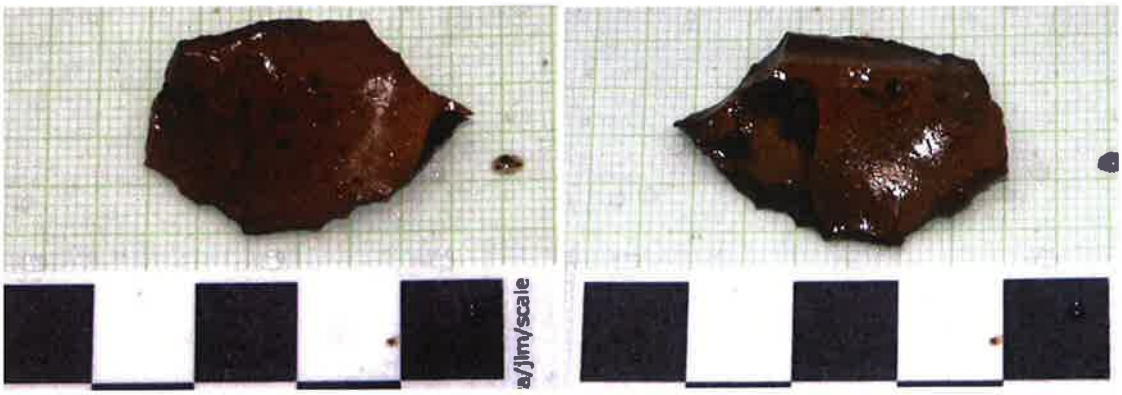

Figure 5.5 ALN-IF-01 chert artefact, ventral (left) and dorsal (right) surfaces.

2014-46 – Artefact scatter and PAD

Landform: Creek flat
Site Size: Approximately 100m x 30m
Exposure: Unsurfaced vehicle and walking tracks near gate and creek
Property: On boundary of Lot 10 DP 771080 and Lot 15 DP 831988
Site description: The site is approximately 20-50m north of a major tributary of Kemps Creek, on the boundary of Lot 10 DP 771080 and Lot 15 DP 831988 (see Figure 5.3, Figure 5.6). AHMS (in prep.) recorded site 2014-46 as comprising two small red silcrete pieces on an exposed track within a transmission line easement, with an adjacent area of PAD on either side of the track and easement. During the current survey, one chert and two silcrete artefacts were located on the same landform, in approximately the same location, on the track adjacent to the creek (Table 5.6, Figure 5.8). AHMS (in prep.:102-3) considered that the integrity, landform and soil profile at this site indicated a potential for additional buried material in an undisturbed context, with which AMBS concurs.

Table 5.6 2014-46 artefact details (see Volume 2 of the report for full table).

Material	Colour	Max. length (mm)	Max. width (mm)	Max. thickness (mm)	Artefact type	Source of Information
Silcrete	Red	15	10	5	Flaked piece	AHMS (in prep.)
Silcrete	Red	10	10	5	Flaked piece	AHMS (in prep.)
Silcrete	Red	20	15	5	Proximal flake	Current survey
Silcrete	Cream	20	20	5	Flaked piece	Current survey
Chert	Orange	15	10	10	Medial flake	Current survey

Figure 5.6 View from location of silcrete artefacts, towards chert artefact to the south, at 2014-46.

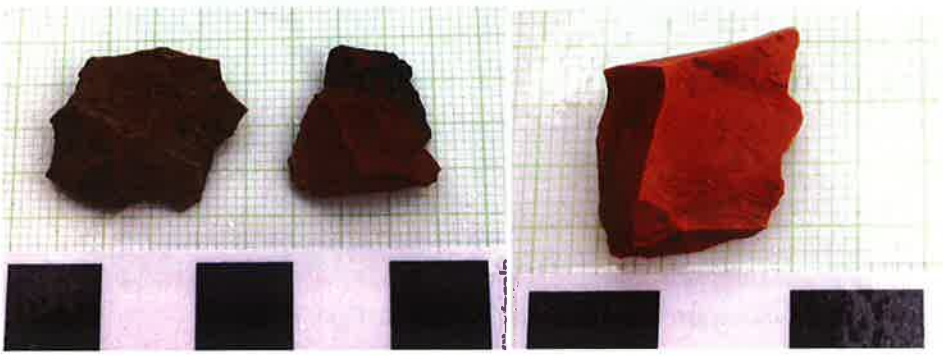

Figure 5.7 Site 2014-46 silcrete (left) and chert (right) artefacts, identified during AMBS survey.

Figure 5.8 Location of site 2014-46 as recorded by AHMS (in prep.) and identified during the current survey (see Volume 2 of the report).

ALN-IF-02 – Isolated find

Landform: Slope
Site Size: N/A
Exposure: Unsurfaced vehicle track between gas pipeline and Sydney Water Supply Upper Canal
Property: Property immediately east of Lot 15 DP 831988
Site description: This site, comprising an isolated silcrete retouched flake, is located on a track upslope, to the east of, a series of fenced structures associated with a gas pipeline, to the west of the Sydney Water Supply Upper Canal (see Table 5.7, Figure 5.10). It is located approximately 75m south of an unnamed tributary of Kemps Creek, and c.700m east of a major tributary of Kemps Creek (Figure 5.3, Figure 5.9). Given the slope landform and the eroded vehicle track on which the artefact is located, it is considered unlikely that the site has the potential to contain intact subsurface deposit. The location and nature of the site (an isolated artefact) is suggestive of sporadic camping or travel through the area, rather than frequent or recurring use of the place.

Table 5.7 ALN-IF-02 artefact details.

Material	Colour	Max. length (mm)	Max. width (mm)	Max. thickness (mm)	Artefact type
Silcrete	Red/grey	20	20	5	Retouched flake

Figure 5.9 ALN-IF-02, view to north east.

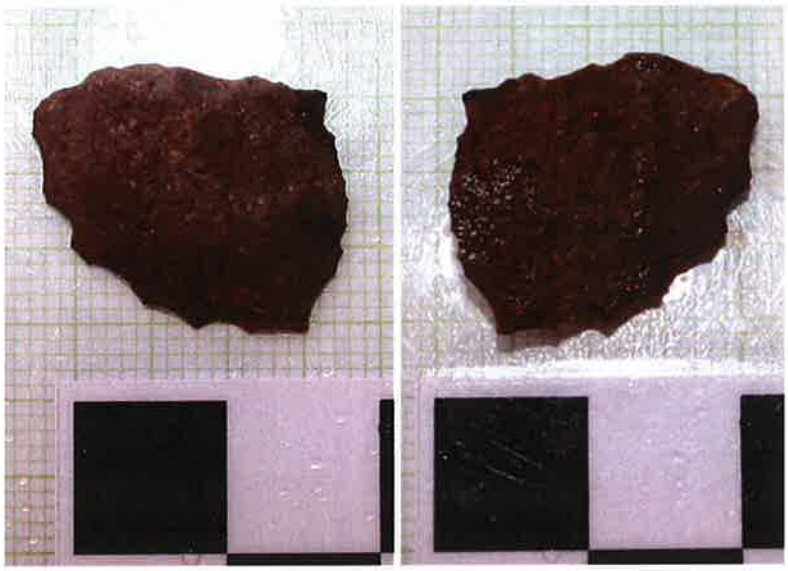

Figure 5.10 ALN-IF-02 silcrete artefact, ventral (left) and dorsal (right) surfaces.

ALN-IF-03 – Isolated find

Landform: Slope
Site Size: N/A
Exposure: Unsurfaced vehicle track between gas pipeline and gate near Kemps Creek tributary
Property: Lot 15 DP 831988
Site description: This site, comprising an isolated silcrete proximal flake, is located on a track upslope, to the east of, a gate near a crossing of a major tributary of Kemps Creek, on Lot 15 DP 831988 (see Table 5.8, Figure 5.12). The track follows a transmission line, and leads to a series of fenced structures associated with a gas pipeline (Figure 5.3, Figure 5.11). The site is located approximately 130m east of the major Kemps Creek tributary, and c.115m north west of an unnamed tributary of Kemps Creek. Given the slope landform and the eroded vehicle track on which the artefact is located, it is considered unlikely that the site has the potential to contain intact subsurface deposit. The location and nature of the site (an isolated artefact) is also suggestive of sporadic camping or travel through the area, rather than frequent or recurring use of the place.

Table 5.8 ALN-IF-03 artefact details.

Material	Colour	Max. length (mm)	Max. width (mm)	Max. thickness (mm)	Artefact type
Silcrete	Red/cream	20	20	10	Proximal flake

Figure 5.11 ALN-IF-03, view to east.

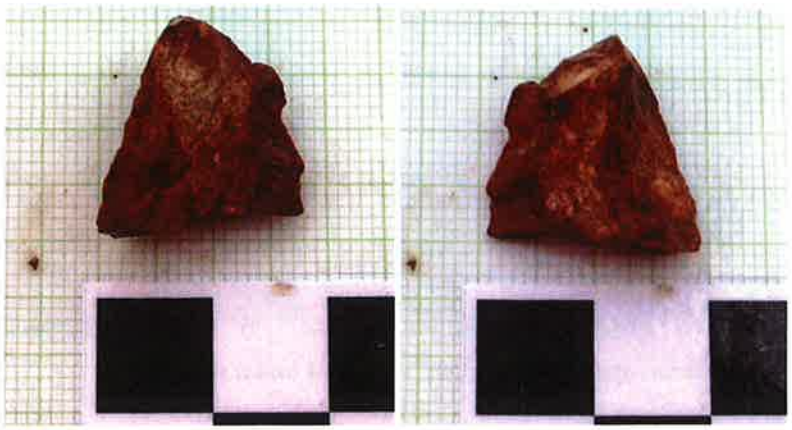

Figure 5.12 ALN-IF-03 silcrete artefact, ventral (left) and dorsal (right) surfaces.

ALN-IF-04 – Isolated find

Landform: Creek flat
Site Size: N/A
Exposure: Unsurfaced vehicle track along transmission line
Property: Property immediately north of Lot 10 DP 771080
Site description: This site, comprising an isolated silcrete flake, is located on a track c.70m east of a major tributary of Kemps Creek, along a transmission line easement, on the property immediately north of Lot 10 DP 771080 (see Table 5.9, Figure 5.2, Figure 5.13, Figure 5.14). Although the track and transmission line have caused some disturbance, the general area around the site is considered to have potential to contain intact subsurface deposit of some extent, given its location on the flats adjacent to a major creek tributary.

Table 5.9 ALN-IF-04 artefact details

Material	Colour	Max. length (mm)	Max. width (mm)	Max. thickness (mm)	Artefact type
Silcrete	Cream/red	10	10	5	Flake

Figure 5.13 ALN-IF-04, view to south east.

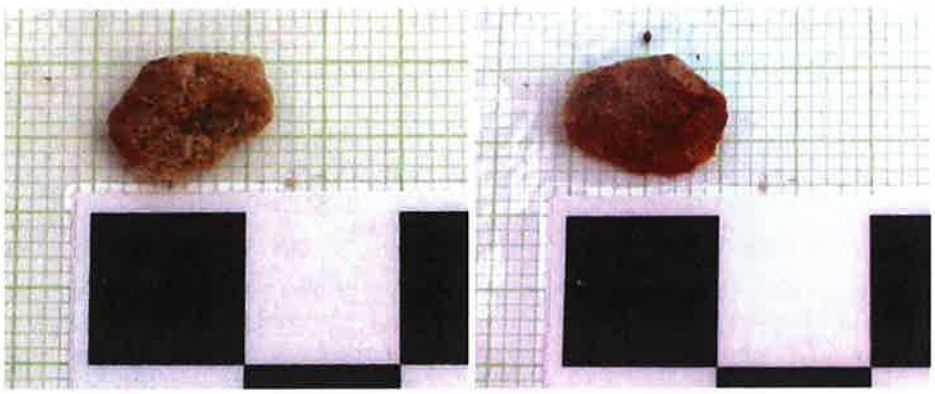

Figure 5.14 ALN-IF-04 silcrete artefact, ventral (left) and dorsal (right) surfaces.

ALN-IF-05 – Isolated find

Landform: Creek flat
Site Size: N/A
Exposure: Dam constructed at back of property
Property: 5 Gurner Avenue (Lot 1 DP 3403)
Site description: This site, comprising an isolated silcrete medial flake, is located adjacent to a recently constructed dam at the back of the property at 5 Gurner Avenue, Austral (Table 5.10, Figure 5.3, Figure 5.15, Figure 5.16). The site is c.75m south west of an unnamed tributary of Kemps Creek, and c.215m south east of a major tributary of Kemps Creek. The construction of the dam has severely impacted the site, and the artefact is unlikely to be *in situ*. However, the site is c.30m from the back of the property, which is adjacent to the relatively undisturbed land to the south east of the Transgrid substation. The proximity of a number of creeks in the vicinity suggests that this area may have been used with some frequency, for camping and travelling, by Aboriginal people in the past.

Table 5.10 ALN-IF-05 artefact details.

Material	Colour	Max. length (mm)	Max. width (mm)	Max. thickness (mm)	Artefact type
Silcrete	Red	10	5	5	Medial flake

Figure 5.15 ALN-IF-05, view to north.

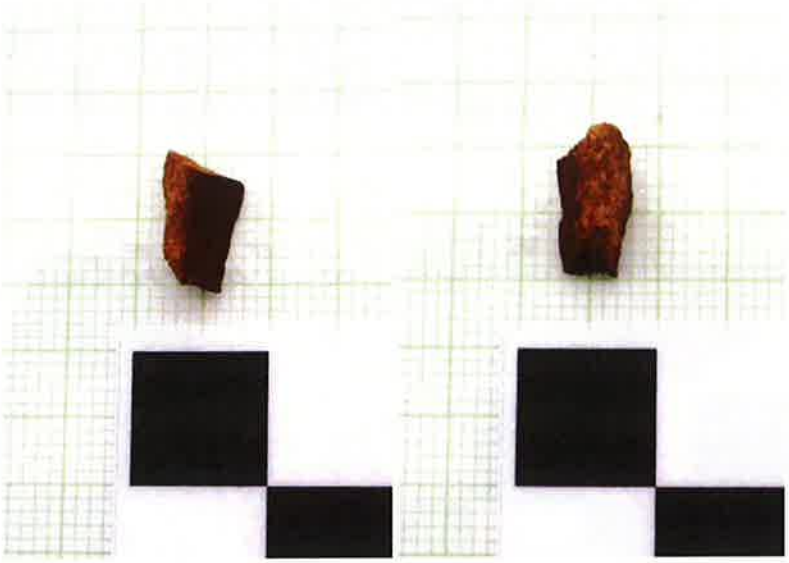

Figure 5.16 ALN-IF-05 silcrete artefact, ventral (left) and dorsal (right) surfaces.

ALN-IF-06 – Isolated find

Landform: Creek flat
Site Size: N/A
Exposure: Cutting for road
Property: 94 Boyd Street (Lot 87 DP 740973)
Site description: This site, comprising an isolated chert distal flake is located within a cutting for the creation of Boyd Street, in front of the property at 94 Boyd Street, Austral (see Table 5.11, Figure 5.3, Figure 5.17, Figure 5.18). The site is c.300m east of Kemps Creek. The construction of the road has severely impacted the site, and the artefact is unlikely to be *in situ*. Apart from cutting to form the road, the front of the property has been disturbed by tree clearing and the construction of fencing. Although it is considered that this area near Kemps Creek was used extensively by past Aboriginal people, the cutting has exposed the clay of the site area, indicating a lack of potential artefact-bearing topsoil. It is considered that the area closer to the creek, to the west, may have more deposit, but this also has been disturbed by the construction of a house, sheds and market gardens.

Table 5.11 ALN-IF-06 artefact details.

Material	Colour	Max. length (mm)	Max. width (mm)	Max. thickness (mm)	Artefact type
Chert	Cream	15	10	5	Distal flake

Figure 5.17 ALN-IF-06, view to south.

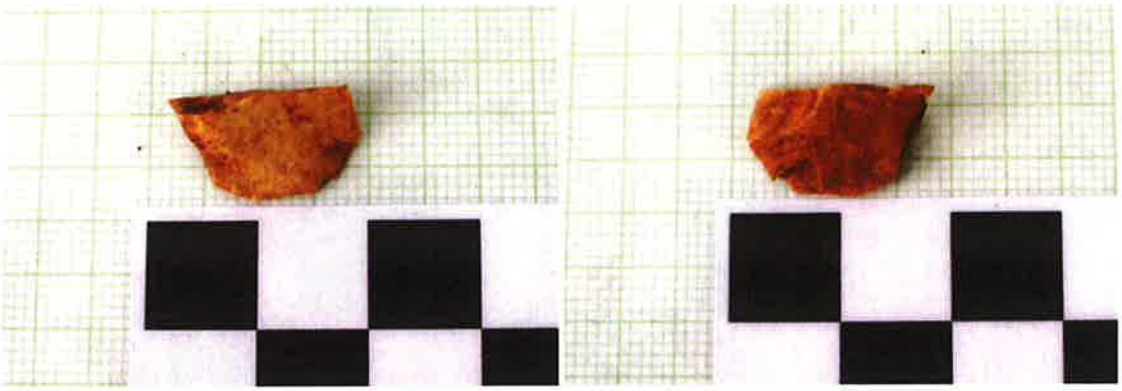

Figure 5.18 ALN-IF-06 chert artefact, ventral (left) and dorsal (right) surfaces.

5.2.2 Recorded Aboriginal Sites Not Located during the Current Survey

Sites that have been previously recorded within the current study area (of which there are 34, and two immediately adjacent), but which were **not** located during the current survey (of which there are 33 within and two immediately adjacent), are summarised in Table 5.12 below, with the sites located immediately adjacent to the study area but not seen during the survey summarised in Table 5.13.

Although no evidence of these 35 sites (33 within and two immediately adjacent) was seen during the survey, it was not expected that the sites would be verified, given the lack of visibility. Further, the majority of these sites have been recorded in the last year, and it therefore considered that the site location information, including GPS co-ordinates, provided on the AHIMS site cards and in the associated reports is up-to-date, and easily verifiable when visibility is greater.

Table 5.12 Sites previously recorded within the study area, not located during the current survey.

Site	AHIMS No./ Reference	Site Type	Location
2015-46	N/A AHMS (in prep.)	Artefact scatter and PAD	At back of properties at 35-45 Gurner Ave.
GLC2	45-5-2560	Open Camp Site (4 artefacts)	Concluded to be within the area of land south-east of Transgrid substation. Artefacts scattered on each side of small drainage line at base of hill, 0.5km north of 18th Ave, in existing gas pipeline easement.
2017-6	N/A AHMS (in prep.)	PAD	Along front of properties at 205-225 and 210 Gurner Ave.
2016-5	N/A AHMS (in prep.)	Isolated find	On corner of Fourth and Gurner Ave, on property at 95 Gurner Ave.
2018-6	N/A AHMS (in prep.)	PAD	At front of properties at 590-610 and 645-655 Fifteenth Ave.
2021-5	N/A AHMS (in prep.)	Isolated find	On property at 225 Tenth Ave.
2019-6	45-5-4018 AHMS (in prep.)	PAD	On properties at 140-150 Seventh Ave.
2020-6	45-5-4019 AHMS (in prep.)	PAD	On properties at 130-140 Seventh Ave.
BRP-IF-09	45-5-3858 AA (2010)	Isolated Find	On road verge in front of 431 Bringelly Road.
BRP-S-13	45-5-3868 AA (2010)	Open Camp Site (3 artefacts)	On road verge c. 115m east of the front of 431 Bringelly Road.
2024-46	45-5-4023 AHMS (in prep.)	Artefact scatter and PAD	At front of properties at 532-543 and 419 Bringelly Road.
BRP-S-12	45-5-3898 AA (2010)	Open Camp Site (2 artefacts)	In front yard of 419 Bringelly Road.
BRP-S-11	45-5-3897 AA (2010)	Open Camp Site (5 artefacts)	Between fence and 100m into property at 14 Eastwood Road.
BRP-S-10/ BRP-S-10 PAD (or BRP-PAD-01)	45-5-3887/ 45-5-3900 AA (2010)	Open Camp Site and PAD (32 artefacts)	On slope down to Bonds Creek at 444 Bringelly Road.
2032-6	45-5-4031 AHMS (in prep.)	PAD	At front of properties at 532-543 and 419 Bringelly Road.
BRP-IF-06	45-5-3855 AA (2010)	Isolated Find	Near tree 10m from road, 120m west of intersection of Bringelly Road and Edmondson Avenue.
BRP-IF-07	45-5-3856 AA (2010)	Isolated Find	Near tree opposite benches, 2m from fence of Scott Memorial Oval, 70m north of intersection of Bringelly Road and Edmondson Avenue.
BRP-IF-08	45-5-3857 AA (2010)	Isolated Find	In disused garden bed, 217 Bringelly Road (corner of Rickard Road).
SWRL Site 4	45-5-3536 AMBS (2010a)	Isolated Find	In soil from trenching for a gas pipeline; 40m south of Bringelly Road, 100m west of the Upper Canal, within Lot 18 DP19406.
SWRL Site 3	45-5-3537 AMBS (2010a)	Open Camp Site (8 artefacts)	Near old corral and property fenceline, 200m south of the junction of Camden Valley Way and Bringelly Road, within Lot 3 DP205472.
SWRL Site 12	45-5-3906 AMBS (2010a)	Isolated Find	Adjacent to a stand of trees, in a horse paddock, within Lot 1 D513403.
BRP-S-19	45-5-3874 AA (2010)	Open Camp Site (2 artefacts)	On access track 20m east of Upper Canal, 70m east of Cowpasture Road, 200m south of Bringelly

			Road.
SWRL Site 7	N/A AMBS (2010a)	Open Camp Site (4 artefacts)	On access track immediately east of Upper Canal.
TP25	N/A AMBS (2010b)	Open Camp Site (7 artefacts)	On grazing land at back of 50 Eastwood Road.
SWRL Site 9	45-5-3532 AMBS (2010a)	Open Camp Site (3 artefacts)	At base of electricity transmission line poles, 5m west of Kemps Creek, 200m north east of McCann Road, within Lot 102 DP736147.
SWRL Site 13	45-5-3907 AMBS (2010a)	Open Camp Site (7 artefacts)	On old vehicle tracks on gentle slope c.250-350m west of a small second order tributary of Kemps Creek, within Lot 2 DP1082805.
SW1	N/A Heritage Concepts (2006)	Isolated Find	On low slope of a closed depression.
LP-3	45-5-3946 KN (2010)	Isolated Find	On western side of Camden Valley Way, between Upper Canal and Bringelly Road.
SWRL Site 10	45-5-3903 AMBS (2010a)	Open Camp Site (14 artefacts)	In powerline easement adjacent to the end of Cassidy Street, and on track downslope into vegetated area.
2063-6	N/A AHMS (in prep.)	PAD	On back of properties at 61-71 Cowpasture Road.
TLC1	45-5-2559	Open Camp Site (2 artefacts)	400m north of Camden Valley Way; in existing gas pipeline easement. Artefacts on rise 200m south of narrow creek line.
LIF-1	45-5-3300 Navin Officer (2006)	Isolated Find	In horse paddock, north of Camden Valley Way, between Upper Canal and Cowpasture Road.
LP-4	45-5-3947 KN (2010)	Open Camp Site (2 artefacts)	In Lochie's Hotel carpark at corner of Ingleburn Road and Camden Valley Way.

Table 5.13 Sites previously recorded immediately adjacent to the study area, not located during the current survey.

Site	AHIMS No./ Reference	Site Type	Location
2005-846	N/A AHMS (in prep.)	Artefact scatter, PAD & cultural site	Adjacent to north western edge of study area, on Kemps Creek, at back of property at 225 Gurner Ave.
SWRL Site 11	45-5-3905 AMBS (2010a)	Isolated Find	Adjacent to south eastern section of study area. On dirt track adjacent to old property boundary fenceline, next to BMX bike jumps, within Lot 7 DP205472.

5.2.3 Areas of Potential Aboriginal Archaeological Sensitivity

Given the lack of ground surface visibility and resulting difficulty in identifying Aboriginal heritage sites during the archaeological survey, an archaeological sensitivity map has been developed to facilitate a clearer understanding of the constraints and opportunities associated with the Austral and Leppington North Precincts.

The results of the field survey and previous archaeological investigations have informed an estimate of potential Aboriginal archaeological sensitivity for landforms within the study area, which is presented in Figure 5.19 (and see also Figure 5.21). This estimate considers both the predictive model for Aboriginal heritage and the recorded Aboriginal sites. For the purposes of this assessment, which is intended to provide a guide for the precinct planning, archaeological sensitivity is defined as areas in which sites are known to occur, or which have the potential to contain undetected buried Aboriginal archaeological deposits. Definitions of levels of archaeological sensitivity are presented in Table 5.14. Note that areas that have not been identified as having moderate or high sensitivity may contain Aboriginal sites, but these sites are more likely to represent background scatter, rather than extensive or *in situ* sites.

Table 5.14 Definition of levels of archaeological sensitivity.

Level	Definition
Moderate Sensitivity	Artefacts in detectable densities known to occur in the area, or in similar environmental/ landscape contexts within the region
High Sensitivity	Artefacts known to occur in high densities in the area, or are consistently identified in similar environmental/landscape contexts, and are highly likely to be detected and disturbed during ground disturbance works and archaeological excavations

An estimate of previous disturbance has also been made, based on the existing landuse mapping (Figure 5.22; see also Figure 5.22). Areas identified as having gross disturbance include road corridors, underground gas pipelines, dams, and properties classified as child care centres, churches, commercial, community halls, industrial, market gardens, poultry, Rebels club, residential/retirement village and schools, as well as the SWRL corridor which will be constructed in the near future. Areas identified as having moderate disturbance include transmission lines and properties classified as dual occupancy/large residential. Areas identified as having minimal disturbance include properties classified as parks, significant vegetation/bushland, and vacant/grazing/developable.

Figure 5.19 Identified Aboriginal sites and areas of archaeological sensitivity (see Volume 2 of the report).

Figure 5.20 Level of disturbance impacting upon archaeological sensitivity within the study area. NB. Minimal disturbance is considered not to impact upon the sensitivity; moderate disturbance has some impact; and gross disturbance has a major impact, effectively cancelling (or "whiting-out") sensitivity (see Volume 2 of the report).

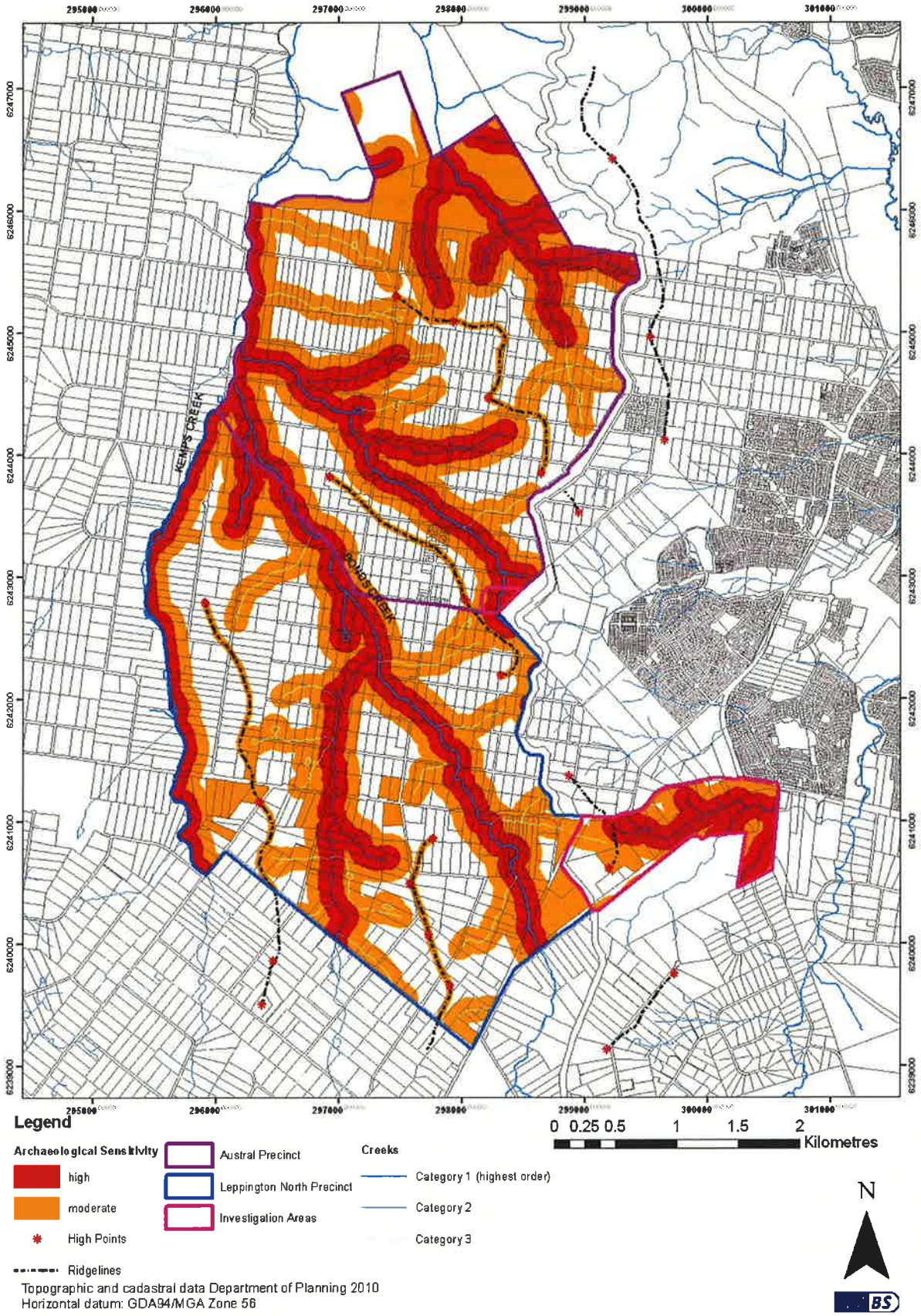

Figure 5.21 Identified areas of archaeological sensitivity for public exhibition.

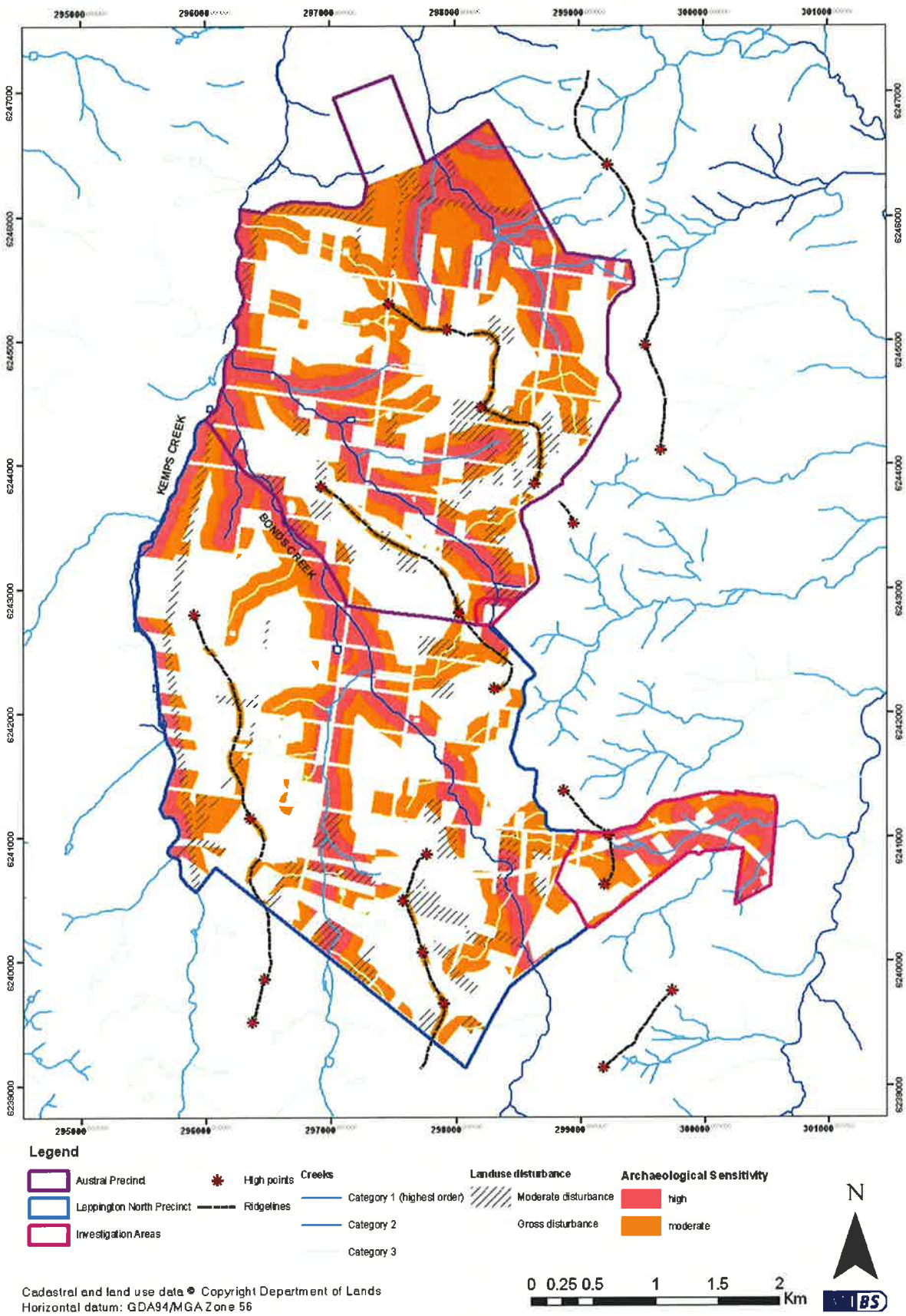

Figure 5.22 Level of disturbance impacting upon archaeological sensitivity (suitable for public exhibition) within the study area. NB. Minimal disturbance is considered not to impact upon the sensitivity; moderate disturbance has some impact; and gross disturbance has a major impact, effectively cancelling (or "whiting-out") sensitivity.

6 Assessing Heritage Significance

6.1 Preamble

The assessment of Aboriginal cultural heritage significance has been undertaken in accordance with OEH guidelines. The criteria for assessing Aboriginal significance are derived from the Burra Charter criteria of aesthetic, historic, scientific, social or spiritual value for assessing cultural significance for past, present and future generations.

Not all sites are equally significant and not all are worthy of equal consideration and management. The significance of a site is not fixed for all time; what is considered as significant at the time of assessment may change as similar items are located, more research is undertaken and community values change. This does not lessen the value of the heritage approach, but enriches both the process and the long-term outcomes for future generations as the nature of what is conserved and why also changes over time (Pearson and Sullivan 1995:7).

6.2 Aboriginal Heritage Significance

6.2.1 OEH Aboriginal Heritage Significance Criteria

OEH professional guidelines for the assessment of significance of Aboriginal sites, objects and places identify two types of significance: cultural significance and archaeological significance (*NPWS Aboriginal Heritage Guidelines* 1997:5-11).

Cultural Significance

This area of assessment concerns the value(s) of a site or feature to a particular community group – in this case the local Aboriginal community or communities. Aspects of social significance are relevant to sites, items and landscapes that are important, or have become important, to the local Aboriginal community. This importance involves both traditional links with specific areas as well as an overall concern by Aboriginal people for sites and landscapes generally and their continued protection. Aboriginal cultural significance may include social, spiritual, historic and archaeological values. Aboriginal cultural significance assessments can only be made by the relevant Aboriginal communities.

This area of assessment is consistent with *Criterion d* of the Heritage Branch guidelines, which includes any or all aspects of social, cultural or spiritual values held by a community or group.

Scientific Significance

Scientific significance is assessed using criteria to evaluate the contents of a site, state of preservation, integrity of deposits, representativeness of the site type, rarity/uniqueness and potential to answer research questions on past human behaviour (NPWS 1997:5). The 1997 OEH guidelines recommend the following criteria for assessing archaeological significance:

- *Archaeological Research Potential* – significance may be based on the potential of a site or landscape to explain past human behaviour. It can incorporate the intactness, stratigraphic integrity or state of preservation of a site, the association of the site to other sites in the region or a datable chronology. This area of assessment is consistent with *Criterion e* of the Heritage Branch guidelines;
- *Representativeness* – all sites are representative of those in their class (site type/subtype); however, this issue relates to whether particular sites should be conserved to ensure that a representative sample of the archaeological record is retained. Representativeness is based on an understanding of the regional archaeological context in terms of site variability in and around the Study Area, the resources already conserved and the relationship of sites

across the landscape. This area of assessment is consistent with *Criterion g* and aspects of *Criterion a* of the Heritage Branch guidelines; and

- *Rarity* – defines how distinctive a site may be, based on an understanding of what is unique in the archaeological record and consideration of key archaeological research questions (i.e. some sites are considered more important due to their ability to provide scientific or cultural information). It may be assessed at local, regional, state and national levels. This area of assessment is consistent with *Criterion f* and aspects of *Criterion a* of the Heritage Branch guidelines.

The SWGC guidelines detailed in the *Precinct Assessment Method for Aboriginal Cultural Heritage in the Sydney Growth Centres* (Context 2006:17-19), require that assessments of significance are undertaken in accordance with the SHR criteria as defined in *Assessing Heritage Significance* (NSW Heritage Office 2001). The 2010 OEH *Code of Practice for Aboriginal Investigation of Aboriginal Objects in New South Wales*, states that archaeological values should be identified and their significance assessed using criteria reflecting best practice assessment processes as set out in the Burra Charter. The SHR criteria reflect the Burra Charter assessment criteria, and are consistent with the OEH 1997 guidelines.

6.3 Assessment against Criteria

The following assessment of heritage values against the Heritage Branch criteria is informed by the results of the background and environmental review, the predictive model for Aboriginal sites in the region, and the results of the Aboriginal heritage field assessment and assessment of archaeological potential. The significance of sites within the study area which have been recorded and assessed previously, but which were not verified during the current survey, are not included in this assessment.

The following is an assessment of the Aboriginal archaeological heritage significance.

Criterion a) an item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area)

Aboriginal stone artefact sites identified during the survey are representative of similar Aboriginal sites across the Cumberland Plain and of NSW, and as such, do not meet the threshold for inclusion for this criterion.

Criterion b) an item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local area)

Aboriginal stone artefact sites identified during the survey are representative of activity by the local Darug/Tharawal/Gandangara people. Although such deposits retain cultural significance, a sense of place, and heritage value for the local Aboriginal people, and are representative of the daily lives of their ancestors, individually they are not rare at a local or regional level; and as such, do not meet the threshold for inclusion for this criterion.

Criterion c) an item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area)

Aboriginal stone artefact sites identified during the survey are representative of similar Aboriginal sites across the Cumberland Plain and the rest of NSW, and as such, do not meet the threshold for inclusion for this criterion.

Criterion d) an item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons. **(Complies with OEH's criterion for Cultural Significance)**

Aboriginal communities consulted with throughout this project have indicated that, while all Aboriginal heritage sites recorded contain intrinsic cultural significance, there are no further specific cultural significances attached to the sites which were identified during the current survey. As such, the Aboriginal stone artefact sites identified during the survey do not meet the threshold for this Criterion.

Criterion e) an item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area). **(Complies with OEH's criterion for Scientific Significance –Archaeological Research Potential)**

The Aboriginal cultural deposits located in the Austral and Leppington North precincts have archaeological research potential. Key research questions to be addressed have the potential to add insight into the cultural history of the Darug/Tharawal/Gandangara people. The levels of potential for in situ archaeological deposits to be present at Aboriginal stone artefact sites identified during the survey are summarised below.

ALN-IF-01

ALN-IF-01 is an isolated artefact on a vehicle/dirt bike track on the creek flat of an ephemeral stream, over 200m from Kemps Creek. The creek flat is flood-prone, the creek is of low order, and clay was exposed on the track, indicating a lack of potential artefact-bearing topsoil. As such, the site is considered to have low potential for *in situ* subsurface deposit, and therefore has **low** research potential.

2014-46

Creek lines in the region are likely to contain evidence of past Aboriginal activity. Although the number of surface artefacts identified at this site is comparatively low, the creek is a major water source, and the flat is relatively undisturbed and is likely to contain *in situ* archaeological deposit. Further, the site is located in one of the least disturbed sections of the Precincts. As such, this site is considered to have **high** research potential.

ALN-IF-02 and ALN-IF-03

ALN-IF-02 and ALN-IF-03 are two isolated artefacts located on infrastructure access tracks on slopes. The location and disturbance of the sites indicates that the landforms are unlikely to contain undisturbed *in situ* archaeological deposits. In addition, the number and type of artefacts recorded at these sites is not indicative of complex archaeological deposits. As such, the sites are likely to represent incidental, background Aboriginal activity within the region. However, the sites are located in one of the least disturbed sections of the Precincts, and this section has the potential to reveal use of the landscape in this area, on the slopes and flats around a number of Kemps Creek tributaries. Assessed within this context, these sites are considered to have **moderate** research potential.

ALN-IF-04

Creek lines in the region are likely to contain evidence of past Aboriginal activity. Although this site contained one surface artefact, the surrounding area was heavily vegetated, and this is likely to have prevented identification of further artefacts. Further, the creek is a major water source, and although the track and transmission line have caused some disturbance, the general area around the site is considered to have potential to contain intact subsurface deposit of some extent. As such, this site is considered to have **moderate** research potential.

ALN-IF-05

ALN-IF-05 is an isolated artefact adjacent to a dam, and is unlikely to be *in situ* or have undisturbed archaeological deposit in the immediate area. As such, the site is considered to have **low** research potential. Conversely, the area to the north of the property at the back is one of the least disturbed sections of the Precincts and is contains numerous creeks, and is likely to have more archaeological potential.

ALN-IF-06

ALN-IF-06 is an isolated artefact located in the cutting adjacent to Boyd Street, 300m from Kemps Creek. The construction of the road and a fence has severely impacted the site, and the artefact is unlikely to be *in situ*. The cutting has exposed the clay of the site area, indicating a lack of potential artefact-bearing topsoil. As such, the site is considered to have low potential for *in situ* subsurface deposit, and therefore has **low** research potential.

***Criterion f) an item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area).* (Complies with OEH's criterion for Scientific Significance – Rarity)**

The Aboriginal stone artefact sites identified during the survey may be regarded as being relatively common in the local region. Such sites are the most common site type both locally and regionally, and are therefore not considered to have archaeological rarity.

***Criterion g) an item is important in demonstrating the principal characteristics of a class of NSW's Cultural or natural places or environments (or in the local area).* (Complies with OEH's criterion for Scientific Significance –Representativeness)**

Aboriginal stone artefact sites identified during the survey are representative of similar Aboriginal sites across the Cumberland Plain and the rest of NSW. Stone artefact sites are the most common type of site previously recorded in the local region. Such site types represent a continuity of use of water resources across the study area. It is considered likely that a background scatter of such artefacts is present throughout similar landforms in the region. Sites ALN-IF-01–ALN-IF-03 and ALN-IF-05–ALN-IF-06 are likely to represent such incidental, background Aboriginal activity in the region, while sites 2014-46 and ALN-IF-04 are likely to represent archaeological deposits of some complexity, though still representative of Aboriginal use of the area. All identified sites are considered to be representative of the local archaeology, although sites ALN-IF-01 and ALN-IF-05–ALN-IF-06 have low site integrity. As such, Aboriginal stone artefact sites identified during the survey do not meet the threshold for this Criterion.

6.3.1 Summary Statement of Significance

Aboriginal stone artefact sites identified during the survey are representative of similar Aboriginal sites across the Cumberland Plain and the rest of NSW.

Site 2014-46 has potential to contain in situ subsurface archaeological deposits, and is therefore considered to be of high local significance due to its research potential. Isolated artefact sites identified during the survey have potential to contain disturbed subsurface archaeological deposits, and are therefore of low to moderate local significance due to their research potential. Aboriginal communities consulted throughout this project have indicated that, while all Aboriginal heritage sites recorded contain intrinsic moderate cultural significance, there are no further specific cultural significances attached to the identified sites.

The current evidence indicates that Aboriginal stone artefact sites ALN-IF-01 and ALN-IF-05–ALN-IF-06 have **low significance.** Sites ALN-IF-02–ALN-IF-04 are regarded as being of **moderate significance** due to their location within one of the least disturbed sections of the Precincts and their potential to reveal a continuity of use of this landscape as a part of a complex of sites. Site 2014-46 is considered to have **high significance.** A summary of the assessed levels of archaeological significance for identified sites is presented in Table 6.1 below.

Table 6.1 Assessed levels of significance for identified sites.

Assessed Site	Archaeological Research Potential			Representativeness	Rarity	Overall Significance
	Low	Moderate	High			
ALN-IF-0 1	✓			Local	No	Low
2014-46			✓	Local	No	High
ALN-IF-0 2		✓		Local	No	Moderate
ALN-IF-0 3		✓		Local	No	Moderate
ALN-IF-0 4		✓		Local	No	Moderate
ALN-IF-0 5	✓			Local	No	Low
ALN-IF-0 6	✓			Local	No	Low

A summary of the significance of all known Aboriginal archaeological sites within the study area (of which there are 37) is provided in Table 6.2 below, with the significance of sites immediately adjacent to the study area (of which there are two) summarised in Table 6.3. As discussed in Section 5.2.2 above, due to the lack of visibility, the majority of these sites could not be verified during the current survey. Therefore, the significance of these sites reflects the indicated significance contained in the relevant archaeological assessment reports; or where these are unavailable, significance has been inferred from information provided in the AHIMS site card.

Table 6.2 Overall significance of all known sites recorded within the study area.

Site	AHIMS No.	Site Type	Source of Assessment	Significance
2014-46	45-5-3969	Artefact scatter and PAD (5 artefacts)	AHMS (in prep.) Current report	**High**
ALN-IF-03	45-5-3965	Isolated find	Current report	**Moderate**
2015-46	N/A	Artefact scatter and PAD	AHMS (in prep.)	**High**
ALN-IF-01	45-5-3963	Isolated find	Current report	**Low**
ALN-IF-05	45-5-3967	Isolated find	Current report	**Low**
GLC2	45-5-2560	Open Camp Site (4 artefacts)	Site card (report not available)	Site disturbed by construction of pipeline and vehicle access. No significance defined, but considered **low-moderate** given the presence of a backed blade.
2017-6	N/A	PAD	AHMS (in prep.)	**Moderate**
2016-5	N/A	Isolated find	AHMS (in prep.)	**Low**
2018-6	N/A	PAD	AHMS (in prep.)	**Moderate**
2021-5	N/A	Isolated find	AHMS (in prep.)	**Low**
ALN-IF-06	45-5-3968	Isolated find	Current report	**Low**
2019-6	45-5-4018	PAD	AHMS (in prep.)	**Moderate**
2020-6	45-5-4019	PAD	AHMS (in prep.)	**Moderate**
BRP-IF-09	45-5-3858	Isolated Find	Site card (AA 2010 report not available)	No significance defined, but considered **low** given that no further archaeological investigation was recommended.
BRP-S-13	45-5-3868	Open Camp Site (3 artefacts)	Site card (AA 2010 report not available)	No significance defined, but considered **low** given that no further archaeological investigation was recommended.
2024-46	45-5-4023	Artefact scatter and PAD	AHMS (in prep.)	**Moderate**
BRP-S-12	45-5-3898	Open Camp Site (2 artefacts)	Site card (AA 2010 report not available)	No significance defined, but considered **low** given that no further archaeological investigation

				was recommended.
BRP-S-11	45-5-3897	Open Camp Site (5 artefacts)	Site card (AA 2010 report not available)	No significance defined, but considered **low** given that no further archaeological investigation was recommended.
BRP-S-10/ BRP-S-10 PAD (or BRP-PAD-01)	45-5-3887/ 45-5-3900	Open Camp Site and PAD (32 artefacts)	Site card (AA 2010 report not available)	No significance defined, but considered **moderate-high** given that test excavation was recommended.
2032-6	45-5-4031	PAD	AHMS (in prep.)	**Moderate**
BRP-IF-06	45-5-3855	Isolated Find	Site card (AA 2010 report not available)	No significance defined, but considered **low** given that no further archaeological investigation was recommended.
BRP-IF-07	45-5-3856	Isolated Find	Site card (AA 2010 report not available)	No significance defined, but considered **low** given that no further archaeological investigation was recommended.
BRP-IF-08	45-5-3857	Isolated Find	Site card (AA 2010 report not available)	No significance defined, but considered **low** given that no further archaeological investigation was recommended.
SWRL Site 4	45-5-3536	Isolated Find	AMBS (2010a)	**Low**
SWRL Site 3	45-5-3537	Open Camp Site (8 artefacts)	AMBS (2010a)	**Low**
SWRL Site 12	45-5-3906	Isolated Find	AMBS (2010a)	**Low**
BRP-S-19	45-5-3874	Open Camp Site (2 artefacts)	AA (2010)	No significance defined, but considered **low** given that no further archaeological investigation was recommended.
SWRL Site 7	N/A	Open Camp Site (4 artefacts)	AMBS (2010a)	**Low**
TP25	N/A	Open Camp Site (7 artefacts)	AMBS (2010a)	**High**
SWRL Site 9	45-5-3532	Open Camp Site (3 artefacts)	AMBS (2010a)	**Moderate**
SWRL Site 13	45-5-3907	Open Camp Site (7 artefacts)	AMBS (2010a)	**Low**
SW1	N/A	Isolated Find	Heritage Concepts (2006)	No significance defined, but considered **low** given nature of artefacts.
SWRL Site 10	45-5-3903	Open Camp Site (14 artefacts)	AMBS (2010a)	**Low**
LP-3	45-5-3946	Isolated Find	KN (2010)	**Low**
2063-6	N/A	PAD	AHMS (in prep.)	**Moderate**
TLC1	45-5-2559	Open Camp Site (2 artefacts)	Site card (report not available)	Site disturbed by construction of pipeline. No significance defined, but considered **low** given nature of artefacts.
LIF-1	45-5-3300	Isolated Find	Navin Officer (2006)	**Low**
LP-4	45-5-3946	Open Camp Site (2 artefacts)	KN (2010)	**Low**

Table 6.3 Overall significance of all known sites immediately adjacent to the study area.

Site	AHIMS No.	Site Type	Source of Assessment	Significance
2005-846	N/A	Artefact scatter, PAD & cultural site	AHMS (in prep.)	**Very high** (cultural values)
SWRL Site 11	45-5-3905	Isolated Find	AMBS (2010a)	**Low**

7 Conclusion

7.1 Preamble

As part of the NSW government's land release program, the DP&I is carrying out precinct planning to inform the rezoning of the Austral and Leppington North Precincts in the South West Growth Centres. The aim of the Aboriginal heritage assessment is to inform the Urban Form Analysis and land use planning regarding constraints and opportunities associated with Aboriginal heritage.

A number of large infrastructure developments are currently proposed in the study area and surrounds (such as the Bringelly Road and Camden Valley Way upgrades, the South West Rail Link, and water infrastructure for the South West Growth Centres and Edmondson Park precinct), although at this stage the timing for delivery of some of this infrastructure has yet to be determined. Should additional archaeological investigations, including excavation, be undertaken in the local area, their results may assist in refining constraints and recommendations during future detailed assessments for the Austral and Leppington North Precincts, and should be considered during any major future planning for the Project.

The following recommendations are based on the results of the background research, Aboriginal community consultation, archaeological field survey, and significance assessment as described in this report. Given the area's large size and the lack of ground surface visibility during the survey, these recommendations have been based on a landscape-based model of past Aboriginal use of the study area, and identify preliminary Aboriginal heritage constraints.

Conservation or avoidance of identified Aboriginal sites and areas of moderate and high archaeological sensitivity is the preferred heritage option. As precinct planning is essentially rezoning the land within the precincts and establishing new development controls, there is an opportunity to avoid impact to some areas or sites identified as having archaeological sensitivity when further detailed site planning is conducted at the Development Application stage. Where this is not possible due to design or engineering constraints, other mitigation measures may be appropriate; such as archaeological test excavations under OEH's *Code of Practice for Aboriginal Investigation of Aboriginal Objects in New South Wales* (Code of Practice) in areas of moderate and high archaeological sensitivity, and an application for an AHIP to allow direct impacts to identified Aboriginal heritage sites. However, it is anticipated that individual development proposals within the Precincts will be required to comply with the Development Application process, which will include preparation of detailed Aboriginal heritage impact assessments. Site specific recommendations to mitigate and offset proposed impacts to Aboriginal heritage would be included in these heritage assessments.

7.1.1 Cumulative Impacts

The Austral and Leppington North Precincts are part of the South West Growth Centres (Figure 7.1). The first release precincts of the SWGC, Edmondson Park, Oran Park and Turner Road, are currently being developed, as is the South West Rail Link. Thirteen other precincts are planned to be released for Precinct Planning progressively. In total, the SWGC is approximately 17,000 hectares and has capacity for around 110,000 new dwellings for 300,000 people (although it must be noted that these dwelling numbers are approximate and will be confirmed during Precinct Planning). Although it is understood that development of the SWGC is to take into consideration Aboriginal heritage (among other environmental issues) in its broad scale planning, the eventual urban development of these Precincts, along with the remainder of the SWGC and associated developments, will have a cumulative negative impact on Aboriginal heritage of South West Sydney and the South West Cumberland Plain (Figure 7.1).

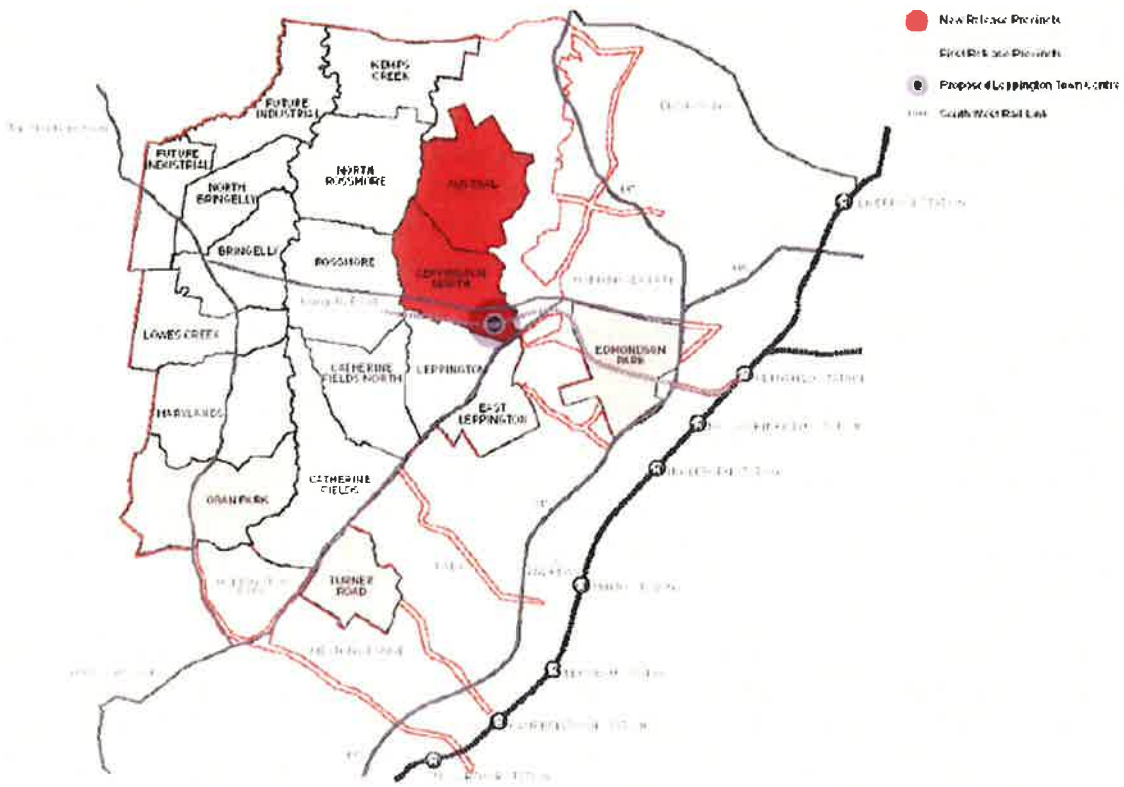

Figure 7.1 Indicative map of the SWGC precincts.

AMBS' predictive modelling outlined in Section 4.2.5 identifies stone artefact sites as the most common Aboriginal heritage site type occurring in the local landscape. A review of the environmental and historic context of the local area suggests that the majority of such sites are likely to have been previously impacted and disturbed by past land clearing, development, construction and agricultural practices. As such, is has been determined that there is a low likelihood that *in situ* stone artefacts are present in the local region. This means that areas of archaeological sensitivity in areas that have been subject to minimal previous disturbance are of increasing value, and worthy of conservation.

Current and future developments in the local area are likely to impact primarily upon previously disturbed stone artefact sites, as well as PADs with varying degrees of previous disturbance, where it is not possible to avoid such impacts within their development planning and methodology. Recommendations discussed below take into account the scientific significance of similar site types identified within and adjacent to the Precincts, and make appropriate recommendations based upon the cumulative impacts of associated developments and regional rarity and representativeness.

7.2 Areas of Potential Archaeological Sensitivity

As discussed in Section 5.2.3 and presented in Figure 5.21 and Figure 5.22, an estimate of potential Aboriginal archaeological sensitivity for landforms within the study area has been developed. These estimates of sensitivity relate to the potential for sites to be present or absent, and are not closely related to site integrity, archaeological research potential, or the archaeological or cultural significance of the sites, which would need to be the subject of future assessments; however, Figure 5.22 provides a preliminary consideration of the effects of disturbance. For example, some of the previously recorded sites which are present within areas of high or moderate sensitivity have been previously assessed as having low significance, due to disturbance of the site or a lack of remaining topsoil. Nevertheless, it must be noted that this is merely an estimate of previous disturbance, based on the existing landuse data; it is not a detailed estimate of disturbance, as would be gained from extensive pedestrian survey.

7.2.1 Areas of Moderate and High Archaeological Sensitivity

Areas of moderate and high archaeological sensitivity are located in areas which have the potential to contain sub-surface Aboriginal archaeological deposits; but which may have no archaeological exposure or visibility. The majority of the previously recorded sites in the study area are located in these areas; the remainder of the sites, which are not located in these areas of sensitivity, are sites with few artefacts, most likely representing background scatter.

Avoidance of impacts to areas of moderate and high archaeological sensitivity is recommended, through their incorporation into conservation corridors, particularly riparian areas. This may be feasible for areas of high archaeological sensitivity, which are generally aligned along major creeklines; however, it is noted that Sydney Water are currently undertaking assessments for installation of pipelines along many of these creeklines (Figure 7.2 includes indicative locations of the pipeline infrastructure, and the potential resulting impact upon the areas of sensitivity). This gives greater importance to conserving as much as possible of the remainder of the sensitive areas. Where this is not possible due to design or engineering constraints, detailed Aboriginal heritage impact assessment of specific proposed development should be undertaken, and archaeological test excavations under the Code of Practice may be required to determine the artefactual assemblages that are present and the nature of Aboriginal activities in these areas.

Recommendation 1

Areas of moderate and high archaeological sensitivity should be incorporated into conservation zones where possible, particularly areas outside of Sydney Water's proposed pipelines. Where this is not possible, detailed Aboriginal heritage impact assessment of specific proposed development should be undertaken, and archaeological test excavations under the Code of Practice may be required, to determine the artefactual assemblages that are present and the nature of Aboriginal activities in these areas.

An Indicative Layout Plan (ILP), drafted 16 June 2011, indicates many of the areas identified as being sensitive as being within riparian corridors/open space. Areas for conservation of Aboriginal cultural heritage must be considered as part of the future development of the Precinct, and these conservation areas should be within areas of high and moderate sensitivity, preferably within the less disturbed parts of these areas (see Figure 7.2, Figure 5.19 and Figure 5.20). It should be noted that there may be impacts in the areas designated as riparian corridors/open space, arising from works such as the installation of Council stormwater and detention infrastructure along creeks, development of sporting fields, and other open space facilities such as footpaths, benches, play equipment, landscaping etc. These will adversely impact on the conservation of sensitive areas.

Where any such impacts will occur within areas of sensitivity, detailed Aboriginal heritage impact assessment of specific proposed development should be undertaken. Archaeological test excavations under the Code of Practice may be required to determine the artefactual assemblages that are present and the nature of Aboriginal activities in these areas. Conservation of these areas for their Aboriginal cultural heritage values, without such impacts, should be considered as part of the future development of the Precinct.

Recommendation 2

Areas for conservation of Aboriginal cultural heritage must be considered as part of the future development of the Precinct. Conservation areas should be within areas of high and moderate sensitivity, preferably within the less disturbed parts of these areas. Impacts to these conservation areas (e.g. drainage infrastructure, sporting fields, footpaths and other facilities/landscaping) should be avoided.

Recommendation 3

Where impacts will occur in areas of moderate and high archaeological sensitivity within riparian corridors/open space, detailed Aboriginal heritage impact assessment of specific proposed development should be undertaken. Archaeological test excavations under the Code of Practice may be required, to determine the artefactual assemblages that are present and the nature of Aboriginal activities in these areas.

7.2.2 Areas without an ascribed Archaeological Sensitivity

As discussed in Section 5.2.3, areas that have not been identified as having moderate or high sensitivity may still contain Aboriginal sites, but these sites are more likely to represent background scatter, rather than extensive or *in situ* sites. As all Aboriginal heritage is protected under the *National Parks & Wildlife Act* 1974 (Amended 2010) and *National Parks & Wildlife Amendment Regulation* 2010, Aboriginal heritage assessment of specific proposed development in accordance with OEH guidelines should be undertaken in these areas, to identify any surface sites which may not have been visible during the current survey, and to identify appropriate mitigation strategies for the proposed development.

Recommendation 4

For any specific proposed development to areas without an ascribed archaeological sensitivity, assessment of Aboriginal heritage should be undertaken in accordance with the National Parks & Wildlife Act 1974 (Amended 2010) and National Parks & Wildlife Amendment Regulation 2010, as per the OEH guidelines.

7.3 Sites with Low or Low-Moderate Significance

As summarised in Table 6.2 and Table 6.3, there are 26 identified Aboriginal sites within the study area and its immediate vicinity, which are considered to have low archaeological significance, and one site considered to have low-moderate archaeological significance. These are sites ALN-IF-01, ALN-IF-05–ALN-IF-06, 2016-5, 2021-5, BRP-IF-06–BRP-IF-09, BRP-S-11–BRP-S-13, BRP-S-19, SWRL Sites 3–4, SWRL Site 7, SWRL Sites 10–13, SW1, LP-3–LP-4, TLC1, LIF-1 and GLC2.

7.3.1 Sites ALN-IF-01, ALN-IF-05–ALN-IF-06, SWRL Sites 3–4, SWRL Sites 11–12, LP-3, TLC1 & GLC2

There are 26 sites with low or low-moderate significance within the study area and its immediate vicinity, ten of which were not to be impacted by previous developments, and which therefore should not yet have been destroyed. These are sites ALN-IF-01, ALN-IF-05–ALN-IF-06, SWRL Sites 3–4, SWRL Sites 11–12, LP-3, TLC1 and GLC2. Impact to these sites should be avoided as a first option in the Precinct Planning. However, where this is not possible due to design or engineering constraints, detailed Aboriginal heritage impact assessment of specific proposed development should be undertaken, in accordance with the Code of Practice, and an AHIP for the sites may be required prior to impact.

Recommendation 5

Impact should be avoided to sites ALN-IF-01, ALN-IF-05–ALN-IF-06, SWRL Sites 3–4, SWRL Sites 11–12, LP-3, TLC1 and GLC2. Where this is not possible, detailed Aboriginal heritage impact assessment, in accordance with the Code of Practice, should be undertaken for any specific proposed development in the vicinity of these sites, and an AHIP may be required.

The ILP currently identifies the following land uses for the areas in which these sites are located: active open space (ALN-IF-01); passive open space (GLC2); drainage (SWRL Site 3); road easements (ALN-

IF-06, TLC1); environmental living (ALN-IF-05, SWRL Site 12, LP-3); and environmental conservation (SWRL Site 4 and 11). Thus, it may be possible to conserve seven of these ten sites; however, it should be noted that there may be impacts in these areas arising from open space development including footpaths, benches, play equipment, landscaping and rural land uses. Where any such impact will occur within these areas, and to the other four sites in this category, detailed Aboriginal heritage impact assessment of specific proposed development should be undertaken, and AHIPs may be required.

Recommendation 6

Where impacts are likely to occur to sites ALN-IF-01, ALN-IF-05–ALN-IF-06, SWRL Sites 3–4, SWRL Sites 11–12, LP-3, TLC1 and GLC2, detailed Aboriginal heritage impact assessment of specific proposed development should be undertaken, and AHIPs may be required.

7.3.2 Sites 2016-5, 2021-5, BRP-IF-06–BRP-IF-09, BRP-S-11–BRP-S-13, BRP-S-19, SWRL Site 7, SWRL Site 10, SWRL Site 13, SW1, LP-4 & LIF-1

There are 26 sites with low or low-moderate significance within the study area and its immediate vicinity, 16 of which may be impacted by other developments. These are sites 2016-5, 2021-5, BRP-IF-06–BRP-IF-09, BRP-S-11–BRP-S-13, BRP-S-19, SWRL Site 7, SWRL Site 10, SWRL Site 13, SW1, LP-4 and LIF-1. As such, some or all of these sites may have been destroyed prior to the current study being undertaken; and others may be destroyed in the near future, as part of other developments in the study area. This should be determined during detailed Aboriginal heritage impact assessment of specific proposed developments.

In the event that sites have not been destroyed by previous development works, impact to these sites should be avoided as a first option in the Precinct Planning. However, where this is not possible due to design or engineering constraints, detailed Aboriginal heritage impact assessment of specific proposed development should be undertaken, in accordance with the Code of Practice, and an AHIP for the sites may be required prior to impact.

Recommendation 7

Should sites 2016-5, 2021-5, BRP-IF-06 – BRP-IF-09, BRP-S-11 – BRP-S-13, BRP-S-19, SWRL Site 7, SWRL Site 10, SWRL Site 13, SW1, LP-4 and LIF-1 not have been destroyed by other developments, impacts to these sites should be avoided. Where this is not possible, detailed Aboriginal heritage impact assessment, in accordance with the Code of Practice, should be undertaken for any specific proposed development in the vicinity of these sites, and an AHIP may be required for those sites that have not yet been destroyed by other development.

The ILP currently identifies the following land uses for the areas in which these sites are located: road easements (BRP-IF-06, BRP-IF-09, BRP-S-11, SW1, LIF-1, LP-4, part of 2016-5); drainage (2021-5); low density residential (part of 2016-5); civic precinct (BRP-IF-07 – BRP-IF-08); commuter carparking (SWRL Site 13); light industrial (BRP-S-12 – BRP-S-13); Canal land (BRP-S-19, SWRL Site 7); and environmental conservation (SWRL Site 10). Thus, it may be possible to conserve three of these 16 sites; however, it should be noted that there may still be impacts in these areas, arising from open space developments including footpaths, benches, play equipment, landscaping and Canal land uses. Where any such impact will occur within these areas, and to the other 13 sites in this category, detailed Aboriginal heritage impact assessment of specific proposed development should be undertaken, and AHIPs may be required.

Recommendation 8

Where impacts are likely to occur to sites 2016-5, 2021-5, BRP-IF-06 – BRP-IF-09, BRP-S-11 – BRP-S-13, BRP-S-19, SWRL Site 7, SWRL Site 10, SWRL Site 13, SW1, LP-4 and LIF-1, detailed Aboriginal heritage impact assessment of specific proposed development should be undertaken, and AHIPs may be required.

7.4 Sites with Moderate or High Significance

As summarised in Table 6.2 and Table 6.3 there are nine identified Aboriginal sites considered to have moderate archaeological significance, one site considered to have moderate-high archaeological significance, and three sites considered to have high archaeological significance, within the study area and its immediate vicinity. These are sites ALN-IF-03, 2014-46, 2015-46, 2017-6, 2018-6, 2019-6, 2020-6, 2024-46, 2032-6, 2063-6, BRP-S-10/BRP-S-10 PAD/BRP-PAD-01, SWRL Site 9 and TP25.

7.4.1 Sites ALN-IF-03 & SWRL Site 9

There are 13 sites with moderate or high significance within the study area and its immediate vicinity, of which earlier assessments had identified two which were not to be impacted by development, and which therefore should be extant. These are sites ALN-IF-03 and SWRL Site 9. Impact to these sites should be avoided as a first option in the Precinct Planning. However, where this is not possible due to design or engineering constraints, detailed Aboriginal heritage impact assessment of specific proposed development should be undertaken, and archaeological test excavations under the Code of Practice may be required to determine the artefactual assemblages that are present and the nature of Aboriginal activities in these areas.

Recommendation 9

Impact should be avoided to sites ALN-IF-03 and SWRL Site 9. Where this is not possible, detailed Aboriginal heritage impact assessment, in accordance with the Code of Practice, should be undertaken for any specific proposed development in the vicinity of these sites, and archaeological test excavations under the Code of Practice may be required, to determine the artefactual assemblages that are present and the nature of Aboriginal activities in these areas.

The ILP currently identifies that rural land use will be retained at site ALN-IF-03, with drainage and environmental conservation at SWRL Site 9. Thus, it may be possible to conserve all or part of these two sites; however, it should be noted that there may still be impacts in these areas from rural land uses, and from drainage. Where any such impact will occur within these areas, detailed Aboriginal heritage impact assessment of specific proposed development should be undertaken, and AHIPs may be required.

Recommendation 10

Where impacts are likely to occur to sites ALN-IF-03 and SWRL Site 9, detailed Aboriginal heritage impact assessment of specific proposed development should be undertaken, and AHIPs may be required.

7.4.2 Sites 2014-46, 2015-46, 2017-6, 2018-6, 2019-6, 2020-6, 2024-46, 2032-6, 2063-6, BRP-S-10/BRP-S-10 PAD/BRP-PAD-01 & TP25

There are 13 sites with moderate or high significance within the study area and its immediate vicinity, of which 11 may already have been impacted by development. These are sites 2014-46, 2015-46, 2017-6, 2018-6, 2019-6, 2020-6, 2024-46, 2032-6, 2063-6, BRP-S-10/BRP-S-10 PAD/BRP-PAD-01 and TP25. As such, some or all of these sites may have been destroyed prior to the current study

being undertaken; and others may be destroyed in the near future, as part of other developments in the study area. This should be determined during detailed Aboriginal heritage impact assessment of specific proposed developments, and recommendations developed accordingly.

In the event that one or more of these sites has not been destroyed by previous development works, impact to these sites should be avoided as a first option in the Precinct Planning. However, where this is not possible due to design or engineering constraints, detailed Aboriginal heritage impact assessment of specific proposed development should be undertaken, and archaeological test excavations under the Code of Practice may be required to determine the artefactual assemblages that are present and the nature of Aboriginal activities in these areas.

Recommendation 11

Should sites 2014-46, 2015-46, 2017-6, 2018-6, 2019-6, 2020-6, 2024-46, 2032-6, 2063-6, BRP-S-10/BRP-S-10 PAD/BRP-PAD-01 and TP25 not have been destroyed or excavated by other developments, impacts to these sites should be avoided. Where this is not possible, detailed Aboriginal heritage impact assessment, in accordance with the Code of Practice, should be undertaken for any specific proposed development in the vicinity of these sites, and archaeological test excavations under the Code of Practice may be required, to determine the artefactual assemblages that are present and the nature of Aboriginal activities in these areas.

The ILP currently identifies the following land uses for the areas in which these sites are located: road easements (part of 2014-46, part of 2015-46, part of 2017-6, part of 2018-6, part of 2024-46, part of 2032-6, part of 2063-6); environmental conservation (part of 2014-46, part of 2018-6); low density residential (part of 2015-46); rural (part of 2014-46, part of 2017-6, part of 2018-6); active open space (part of 2019-6); drainage (part of 2019-6, 2020-6, part of 2063-6); medium density residential (part of 2024-46, BRP-S-10/BRP-S-10 PAD/BRP-PAD-01); light industrial (part of 2024-46, part of 2032-6); substation (part of 2032-6) and the SWRL corridor (TP25). Thus, it may be possible to conserve part of four of these 11 sites; however, it should be noted that there may still be impacts in these areas, arising from the installation of Council stormwater and detention infrastructure along creeks, rural land uses, developing sporting fields, and other open space development including footpaths, benches, play equipment and landscaping. Where any such impact will occur within these areas, and to the other sites and parts of sites in this category, detailed Aboriginal heritage impact assessment of specific proposed development should be undertaken, and AHIPs may be required.

Recommendation 12

Where impacts are likely to occur to sites 2014-46, 2015-46, 2017-6, 2018-6, 2019-6, 2020-6, 2024-46, 2032-6, 2063-6, BRP-S-10/BRP-S-10 PAD/BRP-PAD-01 and TP25, detailed Aboriginal heritage impact assessment of specific proposed development should be undertaken, and AHIPs may be required.

7.5 Site 2005-846

Site 2005-846 was assessed by AHMS (in prep.) as having very high significance, given the cultural values associated with the site. The site is located immediately adjacent to the north western part of the current study area, on the western side of Kemps Creek, and north of Gurner Avenue. Given that the site is not within the Austral and Leppington North Precincts, avoidance of impact to the site should be achievable, which is the preferred option for the Precinct Planning. Should this is not be possible due to design or engineering constraints, detailed Aboriginal heritage impact assessment of specific proposed development should be undertaken, and appropriate mitigation strategies will need to be determined in consultation with the relevant local Aboriginal community groups.

Recommendation 13

Impact to site 2005-846 should be avoided. Where this is not possible, detailed Aboriginal heritage impact assessment, in accordance with the Code of Practice, should be undertaken for any specific proposed development in the vicinity of this site, and appropriate mitigation strategies will need to be determined in consultation with the relevant local Aboriginal community groups.

7.6 Sites ALN-IF-02 & ALN-IF-04

Sites ALN-IF-02 and ALN-IF-04 were identified during the current survey, but are located outside of the current study area. As such, no recommendations need to be made, because there should be no impact to these sites as a result of the Precinct Planning.

Recommendation 14

There should be no impact to sites ALN-IF-02 and ALN-IF-04 as a result of the Precinct Planning.

7.7 Summary of Constraints

A summary of constraints, comprising the 38 sites that have been identified within the study area, including their assessed significance and mitigation recommendations (previously, or as part of the current assessment), is provided in Table 7.1 below. The two additional sites identified during the current survey which are outside the study area are also included in this table, as they have not previously been assessed in any other report. Constraints for the two sites that have been identified immediately adjacent to the study area, and which should be considered during future assessments for the Austral and Leppington North Precincts, are summarised in Table 7.2. Constraints for the areas of archaeological sensitivity within the study area, identified in this report, are summarised in Table 7.3. This information is presented visually in Figure 5.19 and Figure 5.20 (and see also Figure 5.21 and Figure 5.22).

The ILP currently identifies the conservation of 11, and part of four, of the 38 sites within the study area, and portions of the areas of high and moderate sensitivity. A map of sites and areas of archaeological sensitivity, overlain on the ILP, is provided in Figure 7.3.

Table 7.1 Summary of constraints – sites within the study area (and sites identified during the current survey).

Site	AHIMS No.	Site Type	Assessed Archaeological Sensitivity of Surrounding Area	Significance and Recommendations	Proposed impact in ILP
ALN-IF-01	45-5-3963	Isolated find	Moderate	Significance assessed in current report as low. Avoid impact; otherwise an AHIP may be required prior to impact.	Active open space
ALN-IF-02	45-5-3964	Isolated find	N/A (outside study area)	Significance assessed in current report as moderate when considered in context of area of low disturbance within the Precincts. Site is outside of the current study area and therefore should not be impacted.	N/A (outside study area)
ALN-IF-03	45-5-3965	Isolated find	Moderate	Significance assessed in current report as moderate when considered in context of area of low disturbance within the Precincts. Avoid impact; otherwise further investigation of the area may be required in accordance with OEH's Code of Practice, prior to impact.	Rural transition

ALN-IF-04	45-5-3966	Isolated find	N/A (outside study area)	Significance assessed in current report as moderate when considered in context of area of low disturbance within the Precincts. Site is outside of the current study area and therefore should not be impacted.	N/A (outside study area)
ALN-IF-05	45-5-3967	Isolated find	High	Significance assessed in current report as low. Avoid impact; otherwise an AHIP may be required prior to impact.	Environmental living
ALN-IF-06	45-5-3968	Isolated find	None ascribed	Significance assessed in current report as low. Avoid impact; otherwise an AHIP may be required prior to impact.	Road easement; adjacent to environmental living
2014-46	45-5-3969	Artefact scatter and PAD (5 artefacts)	High	Significance assessed by AHMS (in prep.) as high. No recommendations available from AHMS (in prep.). Significance assessed in current report as high when considered in context of area of low disturbance within the Precincts. In the event that the site has not been destroyed or excavated by the pipeline works, avoid impact; otherwise further investigation of the area may be required in accordance with OEH's Code of Practice, prior to impact.	Environmental conservation with environmental protection overlay, road easement, rural transition
2015-46	N/A	Artefact scatter and PAD	Moderate	Significance assessed by AHMS (in prep.) as high. No recommendations available from AHMS (in prep.). In the event that the site has not been destroyed or excavated by the pipeline works, avoid impact; otherwise further investigation of the area may be required in accordance with OEH's Code of Practice, prior to impact.	Road easement, low density residential
2016-5	N/A	Isolated find	Moderate	Significance assessed by AHMS (in prep.) as low. No recommendations available from AHMS (in prep.). In the event that the site has not been destroyed by the pipeline works, avoid impact; otherwise an AHIP may be required prior to impact.	Road easement, low density residential
2017-6	N/A	PAD	Moderate-high	Significance assessed by AHMS (in prep.) as moderate. No recommendations available from AHMS (in prep.). In the event that the site has not been destroyed or excavated by the pipeline works, avoid impact; otherwise further investigation of the area may be required in accordance with OEH's Code of Practice, prior to impact.	Road easement, rural transition

2018-6	N/A	PAD	Moderate-high	Significance assessed by AHMS (in prep.) as moderate. No recommendations available from AHMS (in prep.). In the event that the site has not been destroyed or excavated by the pipeline works, avoid impact; otherwise further investigation of the area may be required in accordance with OEH's Code of Practice, prior to impact.	Road easement, rural transition, environmental conservation with environmental protection overlay
2019-6	45-5-4018	PAD	High	Significance assessed by AHMS (in prep.) as moderate. No recommendations available from AHMS (in prep.). In the event that the site has not been destroyed or excavated by the pipeline works, avoid impact; otherwise further investigation of the area may be required in accordance with OEH's Code of Practice, prior to impact.	Active open space, drainage (partly with environmental protection overlay)
2020-6	45-5-4019	PAD	High	Significance assessed by AHMS (in prep.) as moderate. No recommendations available from AHMS (in prep.). In the event that the site has not been destroyed or excavated by the pipeline works, avoid impact; otherwise further investigation of the area may be required in accordance with OEH's Code of Practice, prior to impact.	Drainage (with environmental protection overlay)
2021-5	N/A	Isolated find	High	Significance assessed by AHMS (in prep.) as low. No recommendations available from AHMS (in prep.). In the event that the site has not been destroyed by the pipeline works, avoid impact; otherwise an AHIP may be required prior to impact.	Drainage (with environmental protection overlay)
2024-46	45-5-4023	Artefact scatter and PAD	Moderate	Significance assessed by AHMS (in prep.) as moderate. No recommendations available from AHMS (in prep.). In the event that the site has not been destroyed or excavated by the pipeline works, avoid impact; otherwise further investigation of the area may be required in accordance with OEH's Code of Practice, prior to impact.	Road easement, medium density residential, light industrial
2032-6	45-5-4031	PAD	Moderate	Significance assessed by AHMS (in prep.) as moderate. No recommendations available from AHMS (in prep.). In the event that the site has not been destroyed or excavated by the pipeline works, avoid impact; otherwise further investigation of the area may be required in accordance with OEH's Code of Practice, prior to impact.	Road easement, light industrial, substation

2063-6	N/A	PAD	High	Significance assessed by AHMS (in prep.) as moderate. No recommendations available from AHMS (in prep.). In the event that the site has not been destroyed or excavated by the pipeline works, avoid impact; otherwise further investigation of the area may be required in accordance with OEH's Code of Practice, prior to impact.	Drainage (mostly with environmental protection overlay), road easement
BRP-IF-06	45-5-3855	Isolated Find	None ascribed	AA (2010) report not available. AHIMS site card does not provide level of significance, but it is considered low given that no further archaeological investigation was recommended. Recommended collection and relocation of surface artefacts if site to be disturbed. In the event that the site has not been destroyed by the upgrade works, avoid impact; otherwise an AHIP may be required prior to impact.	Road easement
BRP-IF-07	45-5-3856	Isolated Find	None ascribed	AA (2010) report not available. AHIMS site card does not provide level of significance, but it is considered low given that no further archaeological investigation was recommended. Recommended collection and relocation of surface artefacts if site to be disturbed. In the event that the site has not been destroyed by the upgrade works, avoid impact; otherwise an AHIP may be required prior to impact.	Civic precinct
BRP-IF-08	45-5-3857	Isolated Find	None ascribed	AA (2010) report not available. AHIMS site card does not provide level of significance, but it is considered low given that no further archaeological investigation was recommended. Recommended collection and relocation of surface artefacts if site to be disturbed. In the event that the site has not been destroyed by the upgrade works, avoid impact; otherwise an AHIP may be required prior to impact.	Civic precinct
BRP-IF-09	45-5-3858	Isolated Find	None ascribed	AA (2010) report not available. AHIMS site card does not provide level of significance, but it is considered low given that no further archaeological investigation was recommended. Recommended collection and relocation of surface artefacts if site to be disturbed. In the event that the site has not been destroyed by the upgrade works, avoid impact; otherwise an AHIP may be required prior to impact.	Road easement; adjacent to light industrial

BRP-S-10/ BRP-S-10 PAD (or BRP-PAD-01)	45-5-3887/ 45-5-3900	Open Camp Site and PAD (32 artefacts)	Moderate	AA (2010) report not available. AHIMS site card does not provide level of significance, but it is considered moderate-high given that test excavation was recommended to clarify the archaeological potential of the site, if area to be disturbed. In the event that the site has not been destroyed or excavated by the upgrade works, avoid impact; otherwise further investigation of the area may be required in accordance with OEH's Code of Practice, prior to impact.	Medium density residential
BRP-S-11	45-5-3897	Open Camp Site (5 artefacts)	Moderate	AA (2010) report not available. AHIMS site card does not provide level of significance, but it is considered low given that no further archaeological investigation was recommended. Recommended collection and relocation of surface artefacts if site to be disturbed. In the event that the site has not been destroyed by the upgrade works, avoid impact; otherwise an AHIP may be required prior to impact.	Road easement
BRP-S-12	45-5-3898	Open Camp Site (2 artefacts)	Moderate	AA (2010) report not available. AHIMS site card does not provide level of significance, but it is considered low given that no further archaeological investigation was recommended. Recommended collection and relocation of surface artefacts if site to be disturbed. In the event that the site has not been destroyed by the upgrade works, avoid impact; otherwise an AHIP may be required prior to impact.	Light industrial
BRP-S-13	45-5-3868	Open Camp Site (3 artefacts)	None ascribed	AA (2010) report not available. AHIMS site card does not provide level of significance, but it is considered low given that no further archaeological investigation was recommended. Recommended collection and relocation of surface artefacts if site to be disturbed. In the event that the site has not been destroyed by the upgrade works, avoid impact; otherwise an AHIP may be required prior to impact.	Light industrial; adjacent to road easement
BRP-S-19	45-5-3874	Open Camp Site (2 artefacts)	None ascribed	AA (2010) report not available. AHIMS site card does not provide level of significance, but it is considered low given that no further archaeological investigation was recommended. Recommended collection and relocation of surface artefacts if site to be disturbed. In the event that the site has not been destroyed by the upgrade works, avoid impact; otherwise an AHIP may be required prior to impact.	Canal land; adjacent to SWRL corridor

SWRL Site 3	45-5-3537	Open Camp Site (8 artefacts)	High	Significance assessed by AMBS (2010a) as low. No recommendation, as site was not to be impacted by the proposed development. Avoid impact; otherwise an AHIP may be required prior to impact.	Drainage with environmental protection overlay
SWRL Site 4	45-5-3536	Isolated Find	Moderate	Significance assessed by AMBS (2010a) as low. No recommendation, as site was not to be impacted by the proposed development. Avoid impact; otherwise an AHIP may be required prior to impact.	Environmental conservation
SWRL Site 7	N/A	Open Camp Site (4 artefacts)	None ascribed	Significance assessed by AMBS (2010a) as low. Recommended collection and relocation of surface artefacts if site to be disturbed. In the event that the site has not been destroyed by the SWRL works, avoid impact; otherwise an AHIP may be required prior to impact.	Canal land; adjacent to SWRL corridor
SWRL Site 9	45-5-3532	Open Camp Site (3 artefacts)	High	Significance assessed by AMBS (2010a) as moderate. Site was outside the impact area, and test excavation of the property behind the site was recommended to clarify the archaeological potential of the area. Avoid impact; otherwise further investigation of the area may be required in accordance with OEH's Code of Practice, prior to impact.	Drainage, environmental conservation with environmental protection overlay
SWRL Site 10	45-5-3903	Open Camp Site (14 artefacts)	High	Significance assessed by AMBS (2010a) as low. Recommended collection and relocation of surface artefacts if site to be disturbed. In the event that the site has not been destroyed by the SWRL works, avoid impact; otherwise an AHIP may be required prior to impact.	Environmental conservation (mostly with environmental protection overlay)
SWRL Site 12	45-5-3906	Isolated Find	High	Significance assessed by AMBS (2010a) as low. No recommendation, as site was not to be impacted by the proposed development. Avoid impact; otherwise an AHIP may be required prior to impact.	Environmental living
SWRL Site 13	45-5-3907	Open Camp Site (7 artefacts)	High	Significance assessed by AMBS (2010a) as low. Recommended collection and relocation of surface artefacts if site to be disturbed. In the event that the site has not been destroyed by the SWRL works, avoid impact; otherwise an AHIP may be required prior to impact.	Commuter carparking

SW1	N/A	Isolated Find	High	Heritage Concepts (2006) does not provide level of significance, but it is considered low given the nature of the artefacts. Recommended collection and relocation of surface artefacts if site to be disturbed. In the event that the site has not been destroyed by the SWRL works, avoid impact; otherwise an AHIP may be required prior to impact. Artefact unlikely to be relocated for collection.	Road easement
LP-3	45-5-3946 KN (2010)	Isolated Find	None ascribed	Significance assessed by KN (2010a) as low. Site was able to be avoided by the impact. Avoid impact; otherwise an AHIP may be required prior to impact.	Environmental living
LP-4	45-5-3947 KN (2010)	Open Camp Site (2 artefacts)	None ascribed	Significance assessed by KN (2010a) as low. An AHIP for the site was recommended prior to impact. In the event that the site has not been destroyed by the upgrade works, avoid impact; otherwise an AHIP may be required prior to impact.	Road easement
TP25	N/A	Open Camp Site (7 artefacts)	Moderate	Significance assessed by AMBS (2010b) as high. Recommended further test/salvage excavation. In the event that the site has not been destroyed or salvaged by the SWRL works, avoid impact; otherwise further investigation of the area may be required in accordance with OEH's Code of Practice, prior to impact.	SWRL corridor
GLC2	45-5-2560	Open Camp Site (4 artefacts)	Moderate	No previous report available. AHIMS site card does not provide level of significance, but it is considered low-moderate given the presence of a backed blade. Site card identifies that the site had been disturbed by the construction of the pipeline and vehicle access, but would not be impacted by construction of the new pipeline. Avoid impact; otherwise an AHIP may be required prior to impact. Artefacts unlikely to be relocated for collection.	Passive open space
TLC1	45-5-2559	Open Camp Site (2 artefacts)	None ascribed	No previous report available. AHIMS site card does not provide level of significance, but it is considered low given the nature of the artefacts. Site card identifies that the site had been disturbed by the construction of the pipeline, but would not be impacted by construction of the new pipeline. Avoid impact; otherwise an AHIP may be required prior to impact. Artefacts unlikely to be relocated for collection.	Road easement; adjacent to low density residential

LIF-1	45-5-3300	Isolated Find	Moderate	Significance assessed by Navin Officer (2006) as low. Recommended collection and relocation of the artefact if Aboriginal community wishes to do so. In the event that the site has not been destroyed by the redevelopment works, avoid impact; otherwise an AHIP may be required prior to impact.	Road easement; adjacent to low density residential

Table 7.2 Summary of constraints – sites previously recorded immediately adjacent to the study area.

Site	AHIMS No.	Site Type	Significance and Recommendations	Proposed impact in ILP
2005-846	N/A	Artefact scatter, PAD & cultural site	Significance assessed by AHMS (in prep.) as very high (cultural values). No recommendations available from AHMS (in prep.). Avoid impact; otherwise appropriate mitigation strategies will need to be determined during future assessments, in consultation with the relevant local Aboriginal community groups.	N/A; adjacent to environmental conservation/ drainage with environmental protection overlay
SWRL Site 11	45-5-3905	Isolated Find	Significance assessed by AMBS (2010a) as low. No recommendation, as site was not to be impacted by the proposed development. Avoid impact; otherwise an AHIP may be required prior to impact.	N/A; adjacent to environmental conservation with environmental protection overlay

Table 7.3 Summary of constraints – areas of archaeological sensitivity within the study area.

Area	Recommendations	Proposed impact in ILP
Areas of high archaeological sensitivity	Incorporate these areas into conservation corridors and avoid impact; otherwise further investigation of these areas may be required in accordance with OEH's Code of Practice, prior to impact.	Various
Areas of moderate archaeological sensitivity	Incorporate these areas into conservation corridors and avoid impact; otherwise further investigation of these areas may be required in accordance with OEH's Code of Practice, prior to impact.	Various

Figure 7.2 Level of disturbance impacting upon archaeological sensitivity within the study area, including potential impact of proposed Sydney Water infrastructure. NB. Minimal disturbance is considered not to impact upon the sensitivity; moderate disturbance has some impact; and gross disturbance (including the potential Sydney Water infrastructure) has a major impact, effectively cancelling (or "whiting-out") sensitivity (see Volume 2 of the report).

Figure 7.3 Aboriginal sites and areas of archaeological sensitivity, overlain on the ILP (see Volume 2 of the report).

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Appendix A

Aboriginal Community Consultation

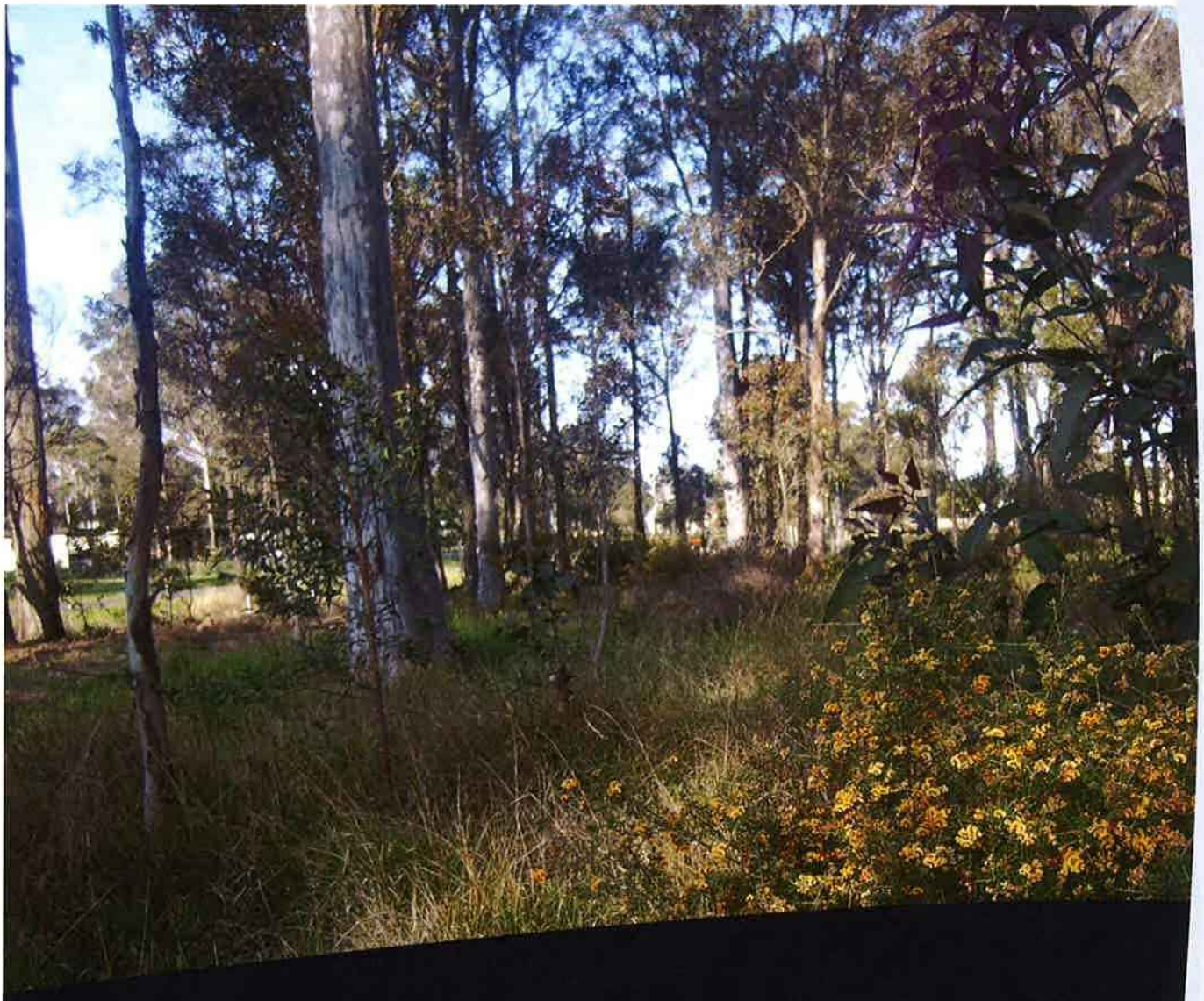
See Volume 2 of the report.

Appendix B

Effective Coverage Table

See Volume 2 of the report.

Cardno
Shaping the Future



Austral-Leppington North Precinct

Biodiversity Conservation Assessment

600288/R2678v7

Prepared by Cardno for the Department of Planning

August 2012

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Cover Photograph – Open eucalypt woodland within Austral Precinct (November 2010)

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Executive Summary

The precincts of Austral and Leppington North are currently subject to a planning process to inform the orderly development of the South West Growth Centre. As part of the establishment of the Sydney Growth Centres, Biodiversity Certification was conferred on lands within the Centres. This certification applies to a large proportion of the land within the Austral and Leppington North Precincts. The Biodiversity Certification provides a regional offset scheme to allow for the loss of native vegetation (in particular threatened species and communities) within "certified" land, without triggering further assessment requirements under the *Threatened Species Conservation* Act 1995.

The Ministerial order conferring the Biodiversity Certification included the provision of a series of requisite conditions ("Relevant Biodiversity Measures", RBMs (**Appendix A**)). The Biodiversity Certification can be suspended or revoked should the RBMs fail to be met. A key RBM relevant to the Austral and Leppington North Precincts is the permanent protection of 2000 hectares of existing native vegetation within the entire Growth Centres area (either within certified or non-certified areas).

The purpose of this Biodiversity Conservation Assessment is primarily to assess the existing condition and value of terrestrial and aquatic habitat within the Precincts, and to determine associated conservation values in order to provide planning and management recommendations for the Precinct Planning Process. In particular, to ensure that the Precinct Planning Process is consistent with the requirements issued under the Growth Centres State Environment Planning Policy (SEPP) Biodiversity Certification, and the Strategic Assessment undertaken for the Growth Centres under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The long history of anthropological disturbances in the area (primarily small scale agriculture), has resulted in the degradation of nearly all vegetative communities and riparian systems. The presence of weeds, isolation of vegetation patches and lack of significant diversity within the majority of sites has led to a generally low ecological value across the site. In support of this assessment, extensive fieldwork was undertaken in 2010 to allow comparison of vegetation present with existing National Parks and Wildlife Service mapping. During this fieldwork, all terrestrial vegetation on site was characterised in comparison to reference locations of known high quality vegetation.

In terms of terrestrial ecology, the current vegetation communities within the Precincts are composed of three Threatened Ecological Communities associated with the Cumberland Plain:

- Shale-Gravel Transitional Forest;
- Sydney Coastal River Flat Forest – Alluvial Woodland; and
- Cumberland Plain Woodland – Shale Plains Woodland (including both Shale hills and Shale Plains Woodland).

Only one threatened flora species (*Acacia pubescens*) and no threatened fauna species were observed during field surveys of these vegetation communities. The field surveys undertaken within the study site identified 96 flora species, including 57 native species and 39 exotic species. Opportunistic sightings identified 19 fauna species.

Two Hundred and Sixty individual vegetation communities within the Austral and Leppington North precincts were classified as being of High, Medium or Low Total Ecological Value. This assessment found 51% of vegetation (by area) to be high quality, 48% to be medium quality and 1% to be low quality. The majority of the High Quality and Medium Quality vegetation was found to lie within non-certified land. It is recommended that all vegetation having a high total ecological value and any vegetation within non-certified land should be zoned for environmental protection.

A comparison of the native vegetation on non-certified land mapped by Cardno in 2010 and 2012 (during the ground truthing survey) and the Existing Native Vegetation (ENV) mapping (DoPI, 2011) found that the ground truthing survey recorded 43.58ha more native vegetation, 19.13ha of which is currently on non-certified land, than is mapped under the conservation plan.

ENV is defined as areas of indigenous trees (including any sapling) that:

(a) Have 10% or greater over-storey canopy cover present;

(b) Are equal to or greater than 0.5 ha in area; and

(c) Are identified as "vegetation" on maps 4 and 5 of the draft Growth Centres Conservation Plan.

Although the additional 43.58ha of native vegetation mapped by Cardno meets criteria (a) and (b) above, the vegetation cannot be classed as ENV, since it does not also meet criteria (c). The additional 43.58ha of native vegetation identified by the Cardno survey has been termed "Additional High Conservation Value Vegetation (AHCVV)", and is not eligible to be counted toward the 2000 ha of ENV that is to be protected. However, it is recommended that these areas of vegetation be retained where possible.

Some vegetation which Cardno had previously reported as present in 2010 has since been cleared. Cardno undertook further ground truthing at a number of sites in May 2012 in response to submissions made during the exhibition period. This report has been updated to account for the vegetation that was found to be cleared.

The report has also been updated to consider approved vegetation clearance of 2.24ha of ENV (of which 0.52ha is in currently non-certified areas) for the construction of the South West Rail Link (SWRL). Although present at the time of the ground truthing work undertaken by Cardno, this vegetation has not been included in calculations of the amount of ENV in the precincts due to the expectation that it will be cleared in the near future.

The conditions of Biodiversity Certification Order require that a total of 107.14ha of ENV be protected. This comprises:

- 48ha of ENV be protected in Austral;
- 52ha in Leppington North; and
- 7.14ha in investigation areas (details of investigations areas can be found in **Section 1.1**).

The SWRL development would offset the amount of non-certified ENV that would be impacted, and therefore, the amount of ENV within the Precincts that requires protection under the Biodiversity Certification Order has been reduced by 0.52ha. This results in a revised total of 106.62ha of ENV requiring protection under the Biodiversity Certification Order.

Ground truthing indicates that the actual area of ENV in non-certified lands is approximately 101.58ha, of which, 0.52ha of ENV on non-certified land is known to be impacted by the approved South West Rail Link (SWRL).

Any development of land within the area of the non-certified ENV communities would be required to comply with the relevant provisions of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and the *Threatened Species Conservation Act 1995* (TSC Act).

The 2012 Indicative Layout Plan for the Austral and Leppington North Precinct (herein referred to as the ILP and shown in Annex B of **Appendix M**), proposes the protection of approximately 116.62ha of ENV within both Precincts. This is 10.00ha more than is required to be protected by the Biodiversity Certification Order (Annex C in **Appendix M**). To achieve this it is proposed that the boundaries of the non-certified areas are changed (refer to Annex E in **Appendix M**), mostly based on the 1:100 year floodline, and to ensure that vegetation to be protected outside floodprone land is also on non-certified land.

Table 1.1 presents the results of the Biodiversity Conservation Assessment.

Table 1.1: Key statistics of the Biodiversity Conservation Assessment.

	Key Statistics	Data source / comment	Area of ENV (ha)
A	ENV required by the Biodiversity Certification Order to be protected within Austral and Leppington North Precincts and investigation areas prior to the impact from the SWRL	48ha in Austral, 52ha in Leppington North, and 7.14ha in Investigation Areas	107.14ha
B	Approved Impacts on ENV by SWRL in non-certified areas	Calculated from Cardno's ground truthed ENV as per Figure 4.4 and maps provided	0.52ha
C	ENV required by the Biodiversity Certification to be protected within Austral and Leppington North Precincts and investigation areas	Requirement of Biodiversity Conservation Order =A-B	106.62ha
D	Total ENV protected within Austral and Leppington North precincts under the Proposed Non-Certified land boundaries	Calculated from Cardno's ground truthed ENV as per Figure 4.4 and Proposed Non-certified Area in (Appendix M Annex E)	116.62ha
E	**Total ENV to be protected beyond the Biodiversity Certification Order requirement**	**=D-C**	**10.00ha**

Consideration should be given to the potential to utilise the quantity of ENV identified on site as offset areas for removal of ENV elsewhere within the Sydney Growth Centres area in accordance with the issued Biodiversity Certification and RBMs.

In terms of aquatic habitat, the creek systems present on site were seen to be typically highly disturbed and in poor condition. Only eight native fish species (three of which are pest species) were observed within the creek systems, reflecting the observed poor water quality and the presence of minor algal blooms at some locations. The riparian banks were typically observed to be degraded and eroding, while the in-stream habitat was found to typically lack complex structure or habitat.

While largely degraded, both the terrestrial and aquatic habitats are considered to represent a significant opportunity for rehabilitation. In particular the importance of riparian corridors and associated vegetation is recognised. The riparian corridors contain much of the higher quality vegetation and act as the primary wildlife corridors within the Precincts.

It is recommended that a management plan be established for all areas of vegetation to be retained. In particular, land uses surrounding non-certified areas will need to be carefully managed in order to avoid negatively affecting the ecological integrity of the protected areas.

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Glossary

AHCVV	Additional High Value Conservation Value Vegetation
Aesthetic Quality	A perception of the beauty of a natural or cultural landscape.
Air Quality	Measure of the health-related and visual characteristics of the air, often derived from quantitative measurements of the concentrations of specific injurious or contaminating substances.
AHD	Australian Height Datum
Amenity	Those features of an area that foster its use for various purposes.
Best Management Practice	A practice or combination of practices determined by an agency to be the most effective and practical means (technological, economic, and institutional) of controlling point and non point source pollutants at levels compatible with environmental quality.
Biodiversity	The range of organisms present in a given ecological community or system, which can be measured by the numbers and types of different species, or the genetic variations within and among species.
Biodiversity Corridor	A river corridor or wildlife corridor identified in the Spatial Plan, Territory Plan or in a nature conservation strategy, or action plan under the *Nature Conservation Act 1980*.
Buffer	A vegetation strip or management zone of varying size, shape, and character maintained along a stream, lake, road, recreation site, or different vegetation zone to mitigate the impacts of actions on adjacent lands, to enhance aesthetic values, or as best practice management.
Catchment	The land area draining through the main stream, as well as tributary streams, to a particular site. It always relates to an area above a specific location.
Certified Area/Land	An area marked as certified on a biodiversity certification map. If land is identified as 'Certified' in the Biodiversity Certification Order, it will not need to go through any further threatened species assessments for development proposals.
Critical Habitat	Habitats of threatened or endangered species as designated by the EPBC Act.

Critically Endangered Ecological Community	An ecological community facing an extremely high risk (50%) of extinction in the wild in the immediate future (EPBC Act) An ecological community facing an extremely high risk of extinction in New South Wales in the immediate future as determined by the Scientific Committee (TSC Act)
DA	Development Application
DCP	Development Control Plan
Development	The erection of a building or the carrying out of work; or the use of land or of a building or work; or the subdivision of land.
DSEWPAC	Department of Sustainability, Environment, Water Population and Communities
Domestic Water Supply Catchment	A domestic water supply catchment identified in the Territory Plan.
EA	Environmental Assessment
EIA	Environmental Impact Assessment
Ecosystem	The complex of a community of organisms and its environment functioning as an ecological unit.
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
Endangered ecological community	An ecological community facing a very high risk (20%) of extinction in the wild in the near future (EPBC Act) An ecological community that is facing a very high risk of extinction in New South Wales in the near future as determined by the Scientific Committee (TSC Act)
Endangered species	A species facing likely extinction unless the circumstances and factors threatening its abundance, survival or evolution cease, or where the reduction of its numbers of habitats to such a level that the species is in immediate danger of extinction.
Environmental Management Plan	A document setting out the management, control and monitoring measures to be implemented during construction and/or operation of a development, to avoid or minimise the potential environmental impacts identified during an environmental impact

	assessment process.
ENV	"Existing Native Vegetation" means areas of indigenous trees (including any sapling) that: (a) had 10% or greater over-storey canopy cover present, (b) were equal to or greater than 0.5 ha in area, and (c) were identified as "vegetation" on maps 4 and 5 of the draft *Growth Centres Conservation Plan*
EPA	Environment Protection Authority (ACT)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ESCP	Erosion and Sediment Control Plan
Exotic	An ecological term that describes the introduction of a species from another place or region.
Fauna	The wildlife or animals of a specified region or time.
Flora	Plant life, especially all the plants found in a particular country, region, or time regarded as a group. Also, a systematic set of descriptions of all the plants of a particular place or time.
GIS	Geographical Information Systems
FM Act	Fisheries Management Act 1994
Growth Centres SEPP	A State Environmental Planning Policy certified by the NSW State Government defining the legislative requirements in regards to planning and development of areas within the Sydney Growth Centres defined boundaries.
Habitat	The places in which an organism lives and grows.
Impact	A modification in the status of the environment brought about by a proposed action.
Investigation Areas	Investigation areas adjoin the Austral and Leppington North Precincts. Approximately 100 hectares of land (bordered by Bringelly Road, Camden Valley Way and Cowpasture Road, and land between Camden Valley Way and Edmondson Park) was formerly part of the Western Sydney Parklands but has since been excised from the Parklands. This land retains a rural zoning

	under Liverpool LEP. A second area comprises 4.5 hectares of residual land north of Ninth Avenue, Austral.
LEP	Local Environmental Plan
LGA	Local Government Plan
Mitigate	To alleviate, reduce, or render less intense or severe. Mitigation Action taken to avoid, reduce the severity of, or eliminate and adverse impact.
NES	Matters of National Environmental Significance
Non-Certified Area/Land	An area marked as a non-certified area on a biodiversity certification map.
NPWS	National Parks and Wildlife Service
NSW	New South Wales
Protected	A species is protected if the species is a protected fish, protected invertebrate, protected native animal or protected native plant under the *Nature Conservation Act 1980*.
RBM	Relevant Biodiversity Measure
Region	A large tract of land generally recognised as having similar character types and physiographic types.
SEPP	State Environmental Planning Policy
Threatened Ecological Community	Endangered, critically endangered or vulnerable ecological community listed in the TSC Act and/or EPBC Act
Threatened species	Rare, vulnerable or endangered species.
Threatening process	In relation to a species or ecological community, means a process that threatens, or may threaten the survival, abundance or evolution of the species or community and includes the spreading of a pest animal or pest plant.
Topography	A surface which defines the ground level of a chosen area.
Tributary	Catchment, stream or river which flows into a larger river, lake or water body.

Vegetation community	Species of plants that commonly live together in the same region or ecotone.
Vulnerable Ecological Community	An ecological community facing a high risk (10%) of extinction in the wild in the medium-term future (EPBC Act) An ecological community facing a high risk of extinction in New South Wales in the medium-term future as determined in accordance with criteria prescribed by the regulations (TSC Act)
Vulnerable	In relation to a species, means a species that within the next 25 years is likely to become endangered unless the circumstances and factors threatening its abundance, survival or evolution cease.
Vulnerable species	Species likely to become endangered within the foreseeable future throughout all or a significant part of its range.

1 Introduction

Cardno was engaged by the NSW Department of Planning (DoP) to undertake a Biodiversity Conservation Assessment within the Austral and Leppington North Precincts (ALNP) which form part of Sydney's South West Growth Centre. The assessment was conducted for both Terrestrial and Aquatic habitat within the area and with reference to the Growth Centres SEPP and issued Biodiversity Certification conditions.

1.1 Background – Growth Centres and Precinct Planning

In 2005 the NSW Government identified two regions, one in Sydney's northwest and one in Sydney's southwest, of largely undeveloped land as the potential location for development of new communities. Combined these two growth areas are capable of accommodating 500,000 people and have been named the North West Growth Centre and the South West Growth Centre respectively. Each growth centre is divided up into a number of Precincts that will drive the staged development of each Growth Centre.

In order to prioritise and facilitate the development of the Precincts within the Growth Centres the NSW Government passed *State Environmental Planning Policy (Sydney Region Growth Centres)* 2006 (referred to as 'Growth Centres SEPP'). The Growth Centres SEPP primarily expedites the Precinct planning and rezoning processes that most developments are required to undergo in accordance with the *Environmental Planning and Assessment Act 1979 (EP&A Act)*. The Growth Centres SEPP establishes the planning rules and objectives for the Growth Centres.

In November 2010 the Commonwealth Environment Minister endorsed the NSW Government's Sydney Growth Centres Strategic Assessment Program. Through the Strategic Assessment, the Commonwealth Government has worked with partners such as the NSW and local governments to ensure that nationally protected matters are adequately safeguard for the long term through the implementation of a policy, plan or program.

Nationally protected matters which are protected through this process include:

- World heritage properties;
- National heritage places;
- Wetlands of international importance;
- Listed threatened species and ecological communities;
- Migratory species protected under international agreements;
- Commonwealth marine areas;
- The Great Barrier Reef Marine Park;
- Nuclear actions (including uranium mines).

The completion of the strategic assessment and issuing of approvals means that individual proponents will not have to seek approval under the EPBC Act from the Commonwealth

Government, as long as they undertake their projects in accordance with the endorsed policy, plan or program.

Each Precinct is required to undergo a Precinct Planning Process, which brings together State government agencies and local councils to coordinate the provision of infrastructure and social services within each of the Precincts. Integral to this stage is the assessment of appropriate land use options within each of the Precincts (e.g. key transport routes, residential housing, commercial areas, and biodiversity conservation). As such, the Precinct Planning Process involves detailed investigations into environmental constraints which will help determine the development potential within any area. The need to conserve and enhance biodiversity and existing environmental values is a stated aim of the Growth Centres SEPP. The Precinct Planning Process is integral to the control and management of development to ensure these aims are met. This Biodiversity Conservation Assessment assesses the terrestrial and aquatic ecological constraints within the Austral and Leppington North Precincts.

By identifying and planning around constraints at a Precinct level, the need for further assessments at the Development Application (DA) stage is significantly reduced It should be noted, that in terms of ecological studies, the Precinct Planning Process removes the requirement for assessment of potential threatened species impacts at the DA stage in certified lands.

Ultimately the environmental constraints identified within a Precinct are combined to prepare an Indicative Layout Plan, which is placed on public exhibition along with supporting documents (the Precinct Planning Package). Following receipt of submissions, the Minister for Planning may approve the Precinct Planning Package, rezoning the land within the Precinct. Following rezoning, Development Applications may then be lodged.

This Biodiversity Conservation Assessment has been undertaken as part of the Precinct Planning Process for the Austral and Leppington North Precincts, within the South West Growth Centre. The Austral Precinct has an area of approximately 930 hectares and is expected to accommodate around 8,000 dwellings and 22,000 residents. The Leppington North Precinct (located immediately south of Austral Precinct) has an area of approximately 1100 ha and is expected to accommodate around 12,000 dwellings and 30,000 residents. The location of these two Precincts is illustrated in **Figure 1.1**.[1]

[1] In August 2010, the NSW Department of Planning updated the boundary of Leppington North to include a small northern section of the Leppington Precinct. See **Figure 1.2** for new boundary lines.

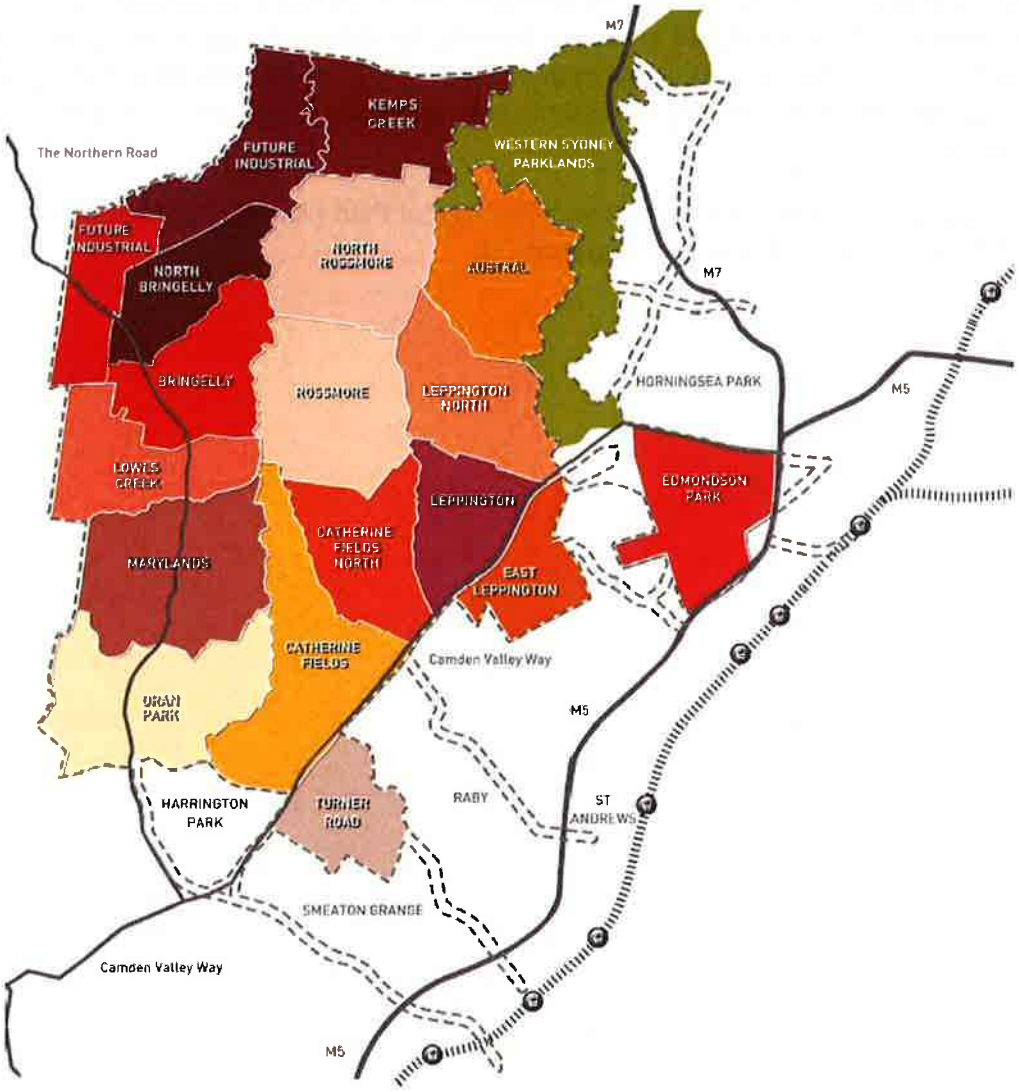

Figure 1.1 Location of Southwest Growth Centre (NSW DoP, 2010)

The Precinct Boundary Review Process (PBRP) is a publicly transparent process to consider changes to Precinct boundaries in the North West and South West Growth Centres. The review process concluded that the boundary of the Leppington North Precinct should be extended south to Ingleburn Road. Based on this finding, the Minister for Planning, in August 2010, approved a partial release of land in the Leppington Precinct north of Ingleburn Road. The Precinct Plan will apply to this land in addition to land within the Austral and Leppington North Precincts as originally defined.

The Boundary Review process also identified two investigation areas, located within the South West Growth Centre but not in a Precinct. These two investigation areas adjoin the Austral and Leppington North Precincts. Approximately 100 hectares of land (bordered by Bringelly Road, Camden Valley Way and Cowpasture Road, and land between Camden Valley Way and Edmondson Park) was formerly part of the Western Sydney Parklands but has since been excised from the Parklands. This land retains a rural zoning under Liverpool

LEP. The second area comprises 4.5 hectares of residual land north of Ninth Avenue, Austral. Both have been investigated as part of the Precinct Planning process and the draft Precinct Plans include proposed planning controls for these investigation areas. When Precinct Planning is finalised the Precinct boundaries are to be formally amended to include these investigation areas in the Precincts, and therefore, have been included in this assessment.

This assessment is based on the final Indicative Layout Plan (June 2012) (herein referred to as the ILP and shown in Annex B of **Appendix M**).

1.2 Background – Biodiversity Certification and Strategic Assessment

The NSW Government amended the *Threatened Species Conservation Act 1995* (TSC Act) to incorporate 'Biodiversity Certification'. Biodiversity Certification allows for the Minister for Environment to certify that the application of an Environmental Planning Instrument (EPI) (e.g. a Local Environmental Plan or State Environmental Planning Policy) will lead to an overall maintenance or improvement in biodiversity values on land to which that EPI applies. By certifying that the Minister is satisfied that biodiversity values will be maintained or improved, Biodiversity Certification consequently dictates that any development of certified land will not significantly impact threatened species or communities. As such, certification removes the need for any development applications under the relevant EPI to address threatened species considerations (e.g. assessment of significance or species impacts statements under the EP&A or TSC Act).

Following submission of a Growth Centres Conservation Plan detailing how development of the Growth Centres could improve or maintain biodiversity values (Eco Logical, 2007), Biodiversity Certification was conferred upon the Growth Centres SEPP under Section 126G of the TSC Act in December 2007.

It should be noted that the Growth Centres Conservation Plan (upon which certification was granted) did not apply for certification across all growth centre lands, but only those considered potentially developable. As such the Biodiversity Certification does not apply to a range of lands within the Growth Centres, including:

- Lands identified in the SEPP as environment conservation (including flood-prone lands and transitional lands) or public recreation zonings;
- Lands identified as offsets to the Western Sydney Orbital (Colebee, Kemps Creek and Rouse Hill);
- Lands zoned for regional park or environmentally significant land overlay at Edmondson Park; or
- Lands within the Western Sydney Parklands.

Any development within these lands within the Growth Centres would be required to comply with the TSC Act and the relevant provisions of the EP&A Act. The areas within the Austral and Leppington North Precincts to which the Biodiversity Certification does not apply are shown in **Figure 1.2**. The majority of non-certified lands within the Austral and Leppington North Precincts are associated with flood-prone lands or land that was formerly intended to be within the Western Sydney Parklands. The Growth Centres SEPP requires Council approval for the removal of any native vegetation from properties within the flood-prone lands.

Figure 1.2 Non-Certified areas of Austral and Leppington North Precincts

The Ministerial order conferring the Biodiversity Certification included the provision of a series of requisite conditions ("Relevant Biodiversity Measures", RBMs (**Appendix A**)). The Biodiversity Certification can be suspended or revoked should the RBMs fail to be met. Key RBMs relevant to the Austral and Leppington North Precincts include:

- The permanent protection of 2000 hectares of existing native vegetation within the Growth Centres (either within certified or non-certified areas).
- The establishment by the NSW Government of a $530 million conservation fund to protect areas of biodiversity value (derived in part from infrastructure contributions) generated within the Growth Centres. Part of these funds is to go towards purchase of areas of high conservation value within and outside the Growth Centres to offset any negative impacts.
- Clearing of existing native vegetation in non-certified areas during Precinct Planning or Development may be permissible (subject to other approvals), however any such clearance must also demonstrate how the loss of vegetation will be offset either by protection of an equal or greater area of existing native vegetation, or rehabilitation/restoration of an approved area.
- Ground-truthing during the Precinct Planning Process can verify the occurrence of existing native vegetation within the precinct. The RBMs relating to existing native vegetation will relate only to the area of confirmed existing native vegetation.
- A survey for the presence of *Acacia pubescens* in the area adjacent to Thirty-Second Avenue, Austral (outside the precincts).
- If *Acacia pubescens* is present, the Precinct Planning Process shall incorporate suitable habitat protection of this species.

The final two points above were addressed in a separate report prepared by Cardno in 2011.

1.3 Aims and Objectives

This Biodiversity Conservation Assessment has two broad aims:

- To assess the existing condition and value of terrestrial and aquatic habitat on site and to determine associated conservation values in order to provide planning and management recommendations to assist DoP during its Precinct Planning Process and formation of the Indicative Layout Plan; and
- To ensure Precinct Planning and formation of the Indicative Layout Plan is consistent with statutory requirements, in particular the RBMs issued under the Growth Centres SEPP Biodiversity Certification, and the Growth Centres Conservation Plan.

1.4 Document Structure

This report is structured to demonstrate the achievement of these aims, and to provide practical recommendations which can be incorporated into the Precinct Planning Process. As such the report is comprised of the following sections:

- **Section 1**: Introduction – a brief overview of the context to the Biodiversity Conservation Assessment and its purpose.

- **Section 2**: Study site – a description of the key environmental factors within the Austral and Leppington North Precincts including a summary of known ecological issues within the area.
- **Section 3**: Legislative Context – a summary of the relevant statutory requirements for ecological planning within the Precincts.
- **Section 4 and 5**: Methodology - the methodology adopted to assess ecological and conservation values for both terrestrial and aquatic ecosystems.
- **Sections 6 and 7**: Results – a description of the results of the assessment for both terrestrial and aquatic ecosystems.
- **Section 8**: Discussion – a discussion of the results and provision of recommendations in terms of ecological constraints and values which can be incorporated within the Indicative Layout Plan, whilst ensuring consistency with all statutory requirements.
- **Section 9**: References – a list of reference documents used in preparing this report.
- **Appendices A – Q**: these appendices provide information supporting this assessment.

For the purpose of this Biodiversity Conservation Assessment, the Austral and Leppington North Precincts have been considered as one unit of assessment. Recommendations are provided assuming that the rezoning of these precincts is undertaken collectively.

2 Study Site

2.1 Location and Site Descriptions

The precincts of Austral and Leppington North (**Figure 1.1**) (the "site") are located in the south west of Sydney within the Cumberland Plain. Both precincts are typified by rural residential housing with small scale agriculture (predominantly vegetable crops and poultry farms). A small number of light industrial and commercial areas occur within each precinct. Aerial imagery indicates that approximately 85% of the land area encompassed by Austral and Leppington North has been cleared of native vegetation to permit development.

Kemps Creek flows north along the western boundary of both Austral and North Leppington (**Figure 2.1**). Kemps Creek is a fourth order stream and is fed by a number of tributaries including Bonds Creek and Scalabrini Creek. The precincts are bordered to the east by the Sydney Water Supply Canal and to the north by the Kemps Creek Nature Reserve (**Figure 2.1**) and Western Sydney Parklands. The precincts are bordered by a Transgrid Electricity Substation to the north and the southern border runs along Ingleburn Road.

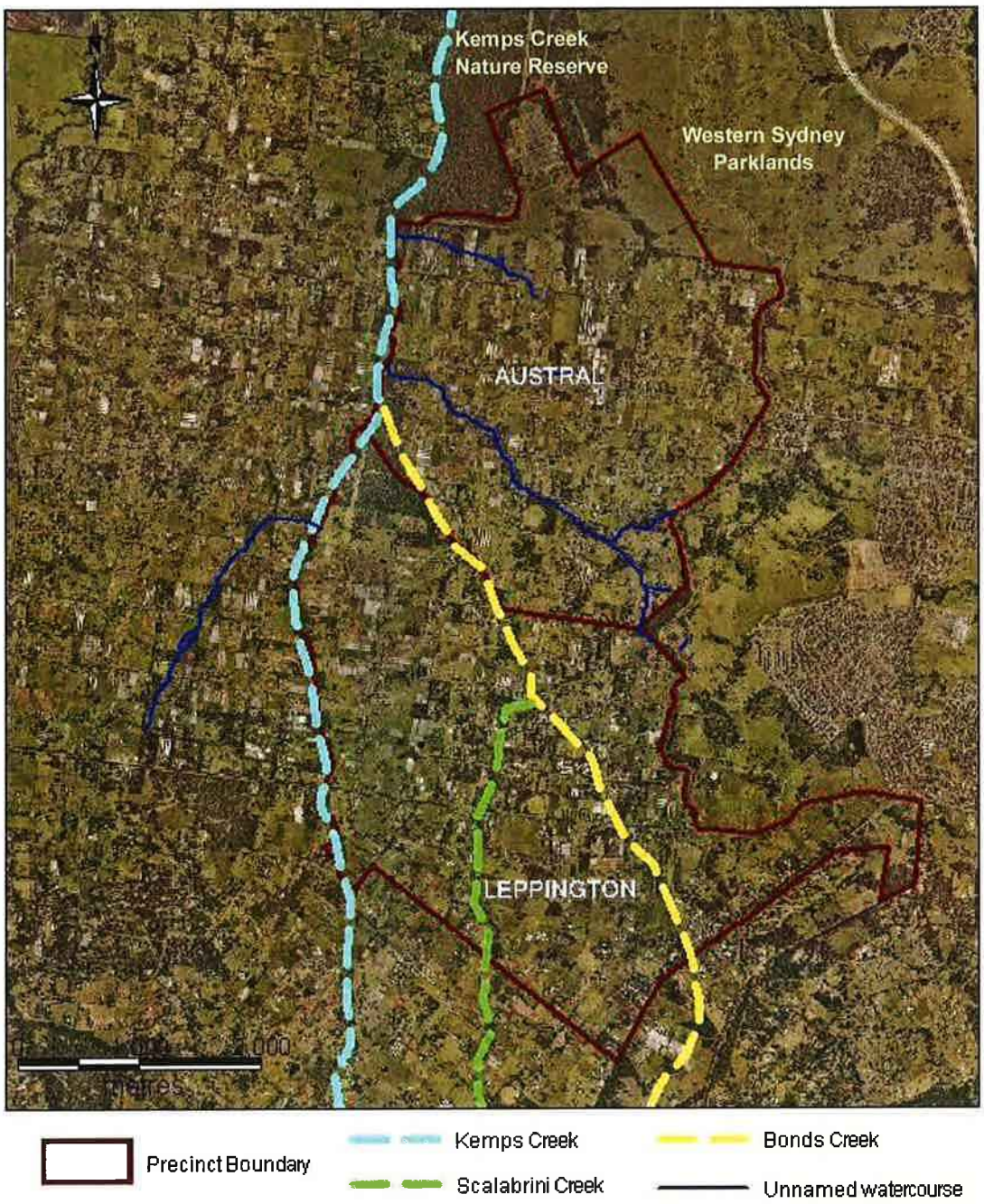

Figure 2.1 Study Area showing Kemps Creek and major adjoining tributaries

The Austral Precinct covers an area of 932.5 ha while the Leppington North Precinct covers an area of 1096 ha. The topography of the site is typically quite flat, composed of rolling plains, with an overall decline to the north east. The site has a maximum and minimum height of 100 m and 50 m AHD respectively. No significant hills or ridge terrain are located within the study site. Inspection of the Penrith Soil Landscape Series Sheet (1:100,000) (Hazelton *et al.* 1989) indicates the site to be primarily underlain by the Blacktown Soil Landscape Group; shallow to moderately deep red and brown podzolic soils over Wianamatta Group shales. Such soils are typically of low fertility, poor drainage, and are frequently vegetated with tall open-forest dry sclerophyll eucalypt woodland. The soils surrounding the creek lines within the site are composed of soils from the South Creek Soil

Landscape Group; typically deep layered sediments over bedrock. Such soils have a significant erosion hazard.

On the eastern boundary of the study site, the soils landscape shifts to the Luddenham Soil Landscape Group, reflecting the increase in elevation and number of hills and ridges. Luddenham Soils are typically associated with wet sclerophyll forest.

2.2 Existing Ecological Surveys

A number of ecological studies have been conducted within and in close proximity to Austral and Leppington North. Most significantly these include:

- Parsons Brinckerhoff (2010) South West Rail Link Environmental Assessment Biodiversity Technical Paper. Prepared for TIDC.
- Cumberland Ecology (2010) Ecological Assessment – Part 3A Project: Water Related Service for the Northwest and Southwest Growth Centres. Currently being prepared for Sydney Water Corporation.

Both these studies undertook extensive field survey within and around the Austral and Leppington North Precincts and were utilised as points of comparison within this assessment.

In addition to these studies a number of related biodiversity studies and biodiversity plans exist and relate to the Precincts including:

- Growth Centres Conservation Plan, Exhibition Draft (Eco Logical Australia, 2007).
- Western Sydney Growth Centres: An assessment of the proposal to confer biodiversity certification on State Environmental Planning Policy (Sydney Region Growth Centres) 2006 under section 126G of the Threatened Species Conservation Act 1995 (Department of Environment and Climate Change 2007).
- Order to confer biodiversity certification on the State Environmental Planning Policy (Sydney Region Growth Centres) 2006 (Minister for Climate Change Environment and Water 2007).
- Liverpool City Council Biodiversity Strategy (Eco Logical, 2003).
- NPWS (2002) Native Vegetation of the Cumberland Plain.

2.2.1 Bioregion

Bioregions and associated subregions are the reporting units utilised in assessing the status of native ecosystems and their protection under the National Reserve System (the network of protected native ecosystems across Australia). The Austral and Leppington North Precincts fall with the Sydney Basin bioregion (Cumberland subregion). The Sydney Basin bioregion has one of the highest levels of protected areas (comprising nearly 40% of the region area (Parsons Brinckerhoff, 2010)) across Australia.

No areas managed by the Department of Environment, Climate Change and Water (i.e. protected areas within the Sydney Basin bioregion) occur within the Precincts of Austral and Leppington North. However, immediately to the north west of the site is the Kemps Creek

Nature Reserve while to the northeast and east are the lands maintained by the Western Sydney Parklands Trust.

2.2.2 Mitchell Landscape

The Mitchell Landscape mapping is a system of ecosystem classification based on variation in geology, geomorphology, topography, soils and geodiversity across NSW. According to DECCW, Mitchell Landscape mapping (DECC, 2003), both the Austral and Leppington North Precincts are classified as Cumberland Plain (**Section 2.2.3**). This landscape occurs solely within the bounds of the Hawkesbury Nepean Catchment Management Authority.

2.2.3 Cumberland Plain

Cumberland Plain is characterised by the presence of low rolling hills and valleys within the rain shadow area between the Blue Mountains and the east coast of Australia. The geology of this area consists primarily of horizontal Triassic shales and lithic sandstones, with the occasional occurrence of volcanic vents, and partly covered by Tertiary river gravels and sands of the Hawkesbury-Nepean Terrace Gravels landscape. The watercourses within this landscape are typically bounded by Quaternary alluvium (DECCW, 2009).

Typical flora communities and species occurring within the Cumberland Plain include woodlands and open forest characterised by:

- Grey box (*Eucalyptus moluccana*);
- Forest red gum (*Eucalyptus tereticornis*);
- Narrow-leaved ironbark (*Eucalyptus crebra*);
- Thin-leaved stringybark (*Eucalyptus eugenioides*);
- Cabbage gum (*Eucalyptus amplifolia*);
- Broad-leaved apple (*Angophora subvelutina*);
- Australian boxthorn (*Bursaria spinosa*);
- Swamp oak (*Casuarina glauca*); and
- Paperbarks (*Melaleuca spp.*).

The DECCW (2008) Vegetation Types Database estimates that 89% of the native Cumberland Plain landscape has been cleared. This is a significant level of clearance and highlights the need for conservation management of the remaining vegetation communities in the landscape. It should be noted that typically under the *NSW Native Vegetation Act 2003*, landscapes that are more than 70% cleared are considered to be "overcleared" and further clearance is not allowed except when the vegetation is assessed as being in low condition.

The Cumberland Plain landscape is considered to be composed of 18 distinct community types (**Table 2.1**). As a result of historic clearing and associated land management practices, a number of these communities have been listed as threatened under either the *NSW Threatened Species Conservation Act 1995 (TSC Act)* or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*.

It should be noted that the *TSC Act* and *EPBC Act* maintain differing definitions in regards to the qualification of a vegetation community as threatened (i.e. a community may be considered to represent a threatened EEC under the *TSC Act* but not under the *EPBC Act* due to the condition and composition of the vegetation patch).

Table 2.1 Cumberland Plain landscape community types and their current conservation status (NPWS, 2002)

Vegetation Community	Conservation Status
Agnes Banks Woodland	Endangered Ecological Community (TSC Act)
Blue Gum High Forest	Critically Endangered Ecological Community (TSC Act, EPBC Act)
Castlereagh Swamp Woodland	Endangered Ecological Community (TSC Act)
Castlereagh Scribbly Gum Woodland	Vulnerable Ecological Community (TSC Act)
Cooks River / Castlereagh Ironbark Forest	Endangered Ecological Community (TSC Act)
Cumberland Plain Woodland – Shale Hills Woodland	Critically Endangered Ecological Community (EPBC Act, TSC Act)
Cumberland Plain Woodland – Shale Plains Woodland	Critically Endangered Ecological Community (EPBC Act, TSC Act))
Elderslie Banksia Scrub Forest	Endangered Ecological Community (TSC Act)
Freshwater Wetlands	Endangered Ecological Community (TSC Act)
Moist Shale Woodland	Endangered Ecological Community (TSC Act)
Shale-Gravel Transition Forest	Critically Endangered Ecological Community (EPBC Act) Endangered Ecological Community (TSC Act)
Shale-Sandstone Transition Forest – Low Sandstone Influence	Endangered Ecological Community (TSC Act and EPBC Act)
Shale-Sandstone Transition Forest – High Sandstone Influence	Endangered Ecological Community (TSC Act and EPBC Act)
Sydney Coastal River Flat Forest – Riparian Forest	Endangered Ecological Community (TSC Act)
Sydney Coastal River Flat Forest – Alluvial Woodland	Endangered Ecological Community (TSC Act)
Sydney Turpentine Ironbark Forest	Endangered Ecological Community (TSC Act) Critically Endangered Ecological Community (EPBC Act)
Sydney Turpentine Ironbark Forest – Margin Forest	Endangered Ecological Community (TSC Act) Critically Endangered Ecological Community (EPBC Act)
Western Sydney Dry Rainforest	Endangered Ecological Community (TSC Act)

Clearing within the Austral and Leppington North Precincts has been primarily driven through agricultural development (since the 1800s) and more recently industrial and residential development. The Cumberland Plain vegetation communities that have been identified within Austral – Leppington North are discussed in **Section 2.2.5**.

2.2.4 Local Connectivity

Connectivity reflects the degree to which an area (or areas) of native vegetation is linked to other areas of vegetation (DECCW, 2009). Typically, within urban areas, connectivity is established/maintained through the presence of wildlife corridors; linear habitat areas of sufficient width and condition to facilitate migration of species and individuals. The Austral – Leppington North Precincts are not known to contain any formalised regional habitat corridors. However, at a local level the riparian habitats and associated alluvial woodlands along Kemps Creek are considered to play an important role in local connectivity, particularly for more mobile species. In particular, the riparian corridors connect up with the Kemps Creek Nature Reserve to the north of the Austral Precinct (**Figure 2.1**). This reserve and its surrounds have been marked within the Growth Centres Conservation Plan (Eco Logical, 2007) as Higher Long Term Management Viability and as such are areas to be retained and protected.

Parsons Brinckerhoff (2010) note that within the Cumberland Plain, the presence of remnant trees in agricultural paddocks can also be important in terms of fauna conservation by providing stepping-stone habitats for highly mobile fauna species. However, within the Austral – Leppington North Precincts there are few clearly defined non-riparian wildlife corridors between larger areas of wildlife habitat.

2.2.5 Local Vegetation Communities

The NPWS (2002) mapping survey identified the potential presence of four vegetation community types within the Austral – Leppington North Precincts (**Figure 2.2**). These include:

Cumberland Plain Woodland - Shale Plains Woodland: Shale Plains Woodland is the more common form of Cumberland Plain Woodland. Occurring on the gently undulating Wianamatta Shale plains of the Cumberland Plain, Shale Plain Woodlands are typified by the presence of Grey box (*E.moluccana*), Forest red gum (*E.tereticornis*), Spotted gum (*Corymbia maculata*) and Thin-leaved stringybark (*E.eugenioides*) in the overstorey. The shrub layer is typically dominated by *Bursaria spinosa* and the understorey is generally associated with grasses (e.g. *Themeda australis*, *Microlaena stipoides* var *stipoides*) and herbs (e.g. *Dichondra repens*, *Brunonniella australis*, *Desmodium varians*).

Cumberland Plain Woodland - Shale Hills Woodland: The Shale Hills Woodland is similar to the Shale Plains Woodland, particularly in terms of its understorey layer. The key difference between the two lies in the tendency for Shale Hills Woodland to be located upon elevated and sloping terrain, as opposed to the flat undulating terrain occupied by Shale Plains Woodland. The canopy layer also differs between the two with Shale Hills Woodland being typified by additional presence of the Narrow-leaved ironbark (*E. crebra*).

Sydney Coastal River Flat Forest – Alluvial Woodland: This community is typically located along minor watercourses and terraces adjacent to riparian forests. While comprised of many species found within Cumberland Plain Woodland, Alluvial Woodland is

characterised by the presence of Cabbage gum (*E. amplifolia*), Forest red gum (*E. tereticornis*) and Swamp oak (*Casuarina glauca*).

Shale-Gravel Transitional Forest: This transitional forest typically grades into Cumberland Plain woodland communities as gravel content decreases. The canopy of Shale-Gravel Transitional Forest is dominated by the Broad-leaved ironbark (*E.fibrosa*) and associated with the presence of Grey box (*E.moluccana*) and Forest red gum (*E.tereticornis*). Below the canopy layer paperbarks (*Melaleuca decora*) are common.

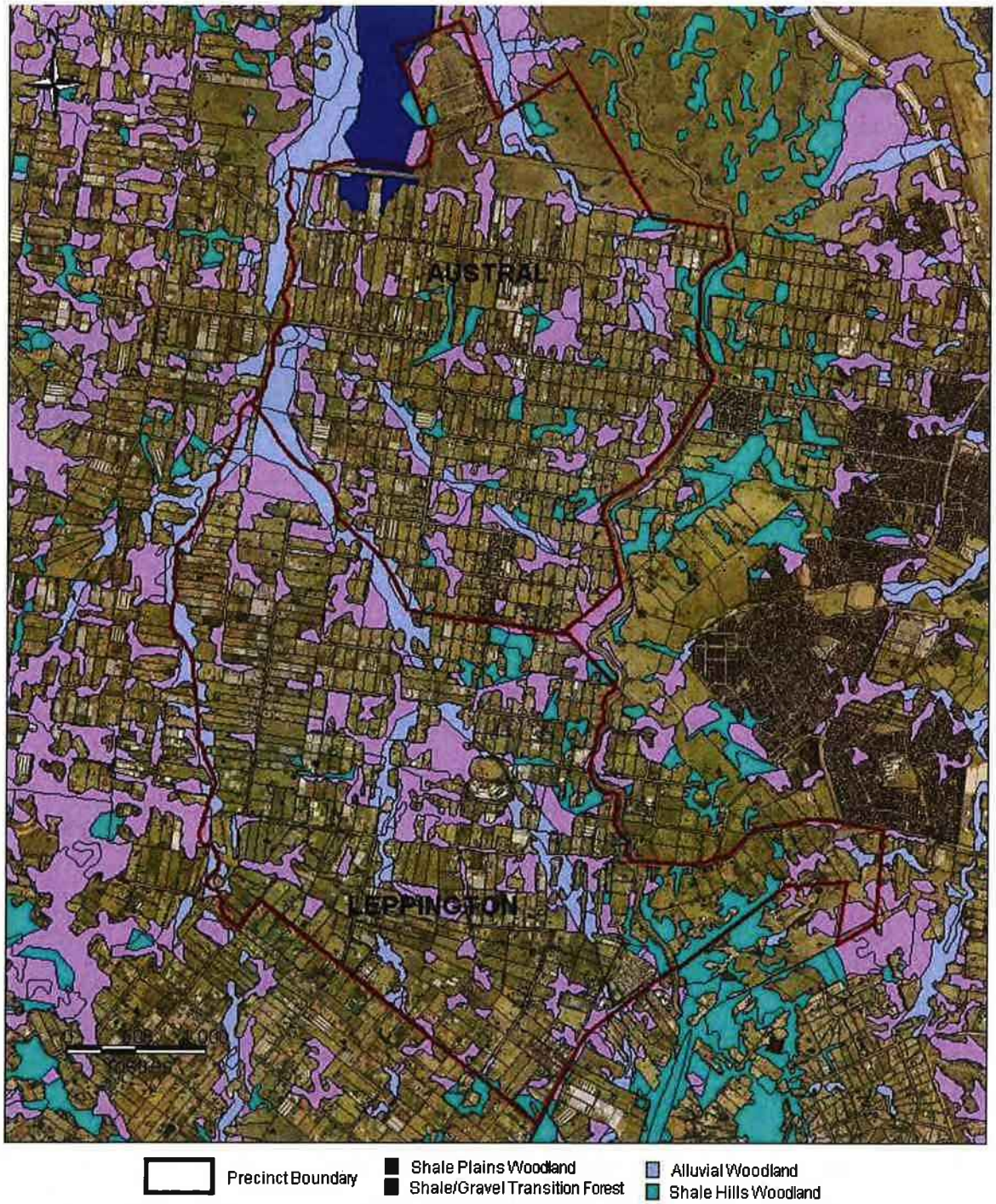

Figure 2.2 NPWS Vegetation community types within the Austral – Leppington North Precincts.

2.2.5.1 General Vegetative Condition

The Existing Native Vegetation (ENV) mapping survey (in the draft Growth *Centres Conservation Plan*) also provides preliminary vegetation community information, canopy cover and understorey condition for all vegetation patches within the study site. Mapping of ENV has been updated by DoPI in 2011 through analysis of aerial imagery.

ENV as defined in the RBMs are areas of indigenous trees (including any sapling) that:

- Has 10% or greater over-storey canopy cover present;
- Are equal to or greater than 0.5 ha in area; and
- Are identified as "vegetation" on maps 4 and 5 of the draft *Growth Centres Conservation Plan*.

Table 2.2 outlines the various vegetation categories and classification rules adopted by NPWS (2002b) mapping as well as indicating the relative proportion of each category present within the Austral – Leppington North Precincts.

Table 2.2 Polygon classification codes and canopy cover*

Vegetation Quality	Condition Code	Description	Patch Area (ha)	Canopy Cover (%)	Proportion of Vegetation within the Site
Higher Quality	A	Dominant canopy species, understorey characteristics, disturbance and reliability all coded.	>0.5	>10	39%
↕	B	Tree cover species only with some overstorey and/or understorey integrity. Dominant canopy species and reliability coded. May have understorey code.	>5	<10	9%
	C	As for "A" or "B" except the dominant canopy species are non-eucalypts species.		<10	0.2%
	Tx	Tree cover only with agriculture but no major urban or suburban development. Most have dominant canopy species coded.	>0.5	<10	33.8%
	Txr	Tree cover only with rural residential development. Most have dominant canopy species coded.	>0.5	<10	18%
	Txu	Tree cover only with urban development. Most have	>0.5	<10	0%

Vegetation Quality	Condition Code	Description	Patch Area (ha)	Canopy Cover (%)	Proportion of Vegetation within the Site
Lower Quality		dominant canopy species coded.			
	X	No Tree Cover	>0.5	<10	0%

*This table is a modification of Table 4 in the *Interpretation Guidelines for the Native Vegetation Maps of the Cumberland Plain, Western Sydney* (NPWS, 2002).

2.2.6 Key Species – Flora

The previous studies and database searches have identified the potential for key threatened flora species (both Commonwealth and State listed) to occur within the Austral – Leppington North Precincts. The key threatened flora species with potential to be present are:

- *Acacia pubescens*;
- *Pimelea spicata*; and
- *Pultenaea pendunculata*.

2.2.7 Key Species - Fauna

The previous studies and database searches have identified the potential for key threatened (both Commonwealth and State listed) fauna species to occur within the Austral – Leppington North Precincts. The key threatened fauna species with potential to be present are:

- Common (Eastern) Bentwing Bat (*Miniopterus schreibersii oceanensis)*;
- Large-footed Myotis (*Myotis macropus*);
- Eastern Freetail Bat (*Mormopterus norfolkensis*);
- Greater Broad-nosed bat (*Scoteanax rueppellii*);
- Grey-headed Flying Fox (*Pteropus poliocephalus*);
- Barking Owl (*Ninox connivens*);
- Masked Owl (*Tyto novaehollandiae*);
- Yellow-bellied Sheathtail bat (*Saccolaimus flaviventris*);
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*);
- Cumberland Land Snail (*Meridolum corneovirens*); and
- Green and Golden Bell Frog (*Litoria aurea*).

3 Legislative Context

A range of international, national, state and local legislation and policy is applicable to the Austral – Leppington North area. This statutory context requires consideration in the planning and management of ecological values within the study site. For the purposes of this Biodiversity Conservation Assessment, the relevant applicable statutory documents were reviewed to assist in the identification of key constraints to be considered within the Precinct Planning Process.

The relevant legislation and policies identified are listed below and summarised in **Appendix L**. The legislation identified is relevant when considering both this Biodiversity Conservation Assessment (as the legislative requirements in regards to species, communities and habitat will inform conservation values), and the Precinct Planning Process as a whole.

- International
  - Japan – Australia Migratory Bird Agreement (JAMBA)
  - China – Australia Migratory Bird Agreement (CAMBA)
  - Republic of Korea – Australia Migratory Bird Agreement (ROKAMBA)
- Commonwealth
  - *Environment Protection & Biodiversity Conservation Act 1999* (*EPBC Act*), and Strategic Assessment which falls under the EPBC Act.
- State
  - *Environmental Planning and Assessment Act 1979 (EP&A Act)*
  - *Threatened Species Conservation Act 1995 (TSC Act)*
  - State Environmental Planning Policy (Sydney Region Growth Centres) 2006 (Growth Centres SEPP)
  - Environmental Planning and Assessment Amendment (Sydney Region Growth Centres) Regulation 2006
  - *Threatened Species Conservation Amendment (Special Provisions) Act 2008*
  - *Fisheries Management Act 1994 (FM Act)*
  - *Water Management Act 2000 (WM Act)*
  - *Noxious Weeds Act 1993*
  - Planning for Bushfire Protection 2006
  - *Protection of the Environment Operations Act 1997*
  - *Catchment Management Authorities Act 2003*
  - Sydney Regional Environmental Plan No 20 – Hawkesbury-Nepean River (No 2 - 1997)
  - State Environmental Planning Policy No.19 – Bushland in Urban Areas
  - Growth Centres Development Code 2006
  - Growth Centres Conservation Plan 2007
- Local
  - Liverpool Local Environment Plan 2008
  - Camden Local Environment Plan 2010.

4 Methodology – Terrestrial Habitat Assessment

In order to demonstrably fulfil the project aims (**Section 1.3**), a staged methodology was adopted. This methodology involved the following:

- Literature and Database Searches (**Section 4.1**).
- Field Survey – Identification and Evaluation of Vegetation Reference Sites (**Section 4.2**).
- Field Survey – Rapid Condition Assessment of Existing Vegetation and Habitat (**Section 4.3**).
- Field Survey – Threatened Flora Survey (**Section 4.4**).
- Evaluation of Total Ecological Value (**Section 4.5**).
- Vegetative Mapping (**Section 4.6**).
- Recommendation of Conservation and Management Measures (**Section 4.7**).
- Consistency Assessment against Relevant Biodiversity Measures (**Section 4.8**).

4.1 Literature and Database Searches

A desktop literature and database study was undertaken to identify flora, fauna, and ecological communities known to occur or have previously occurred within the study site and to identify the quantity and quality of ecological information previously gathered for the Austral – Leppington North Precincts and surrounding locality. In particular the desktop study focussed on the potential presence of threatened species, populations and ecological communities as listed under both State and Commonwealth legislation.

In addition to the studies and documents listed in **Section 2.2**, the following databases were assessed as part of the desktop study:

- Australian Faunal Directory;
- Australian Weeds Database;
- BioBanking Threatened Species Profile Database;
- Birds Australia Atlas (August, 2010);
- DSEWPC's EPBC online Protected Matters Database Search (August, 2010);
- NSW DECCW Wildlife Atlas database (August, 2010);
- NSW DECCW Register of Critical Habitat;
- NSW DECCW Threatened Species Profiles; and
- PlantNet Flora Online Database (August, 2010).

The EPBC online Protected Species Profile Database identifies Commonwealth protected species that are considered as potentially occurring within the area based on estimated

geographic ranges and known habitat. In contrast, the NSW DECCW Wildlife Atlas reports the location of known threatened species (under the *TSC Act*) sightings over a significant time period. As such, neither of these databases necessarily declares threatened species to currently be present within the search area. To determine the likelihood of these listed threatened species occurring within the Austral – Leppington North Precincts, a Likelihood of Occurrence rating was determined for each species identified within these database searches.

For the purposes of this assessment, species were classified as follows:

- Present: Recent surveys (within the last 5 year) have identified the species as occurring on site.
- Highly likely: Has been previously observed on site.
- Likely: The habitat is such that based on species ecology it is reasonable to expect the species is present.
- Possible: The habitat is such that, based on species ecology, the species may occur on site.
- Unlikely: The habitat is such that based on species ecology, the species is not expected to occur on site.
- Absent: The habitat is such that, based on species ecology, the species should not occur on site.

The results of these database searches and the determined Likelihood of Occurrence were utilised during the field inspections in terms of preparation and site selection. Species identified as having "Likely" or greater probability of occurring, but not observed during field inspections, were also considered in the provision of management and conservation recommendations (**Section 8**).

4.2 Identification and Evaluation of Vegetation Reference Sites

To compare and contrast the quality of existing habitat and provide meaningful management and conservation recommendation measures, a field survey was undertaken to identify and characterise the vegetation communities on site. This process involved:

- The identification of Reference Sites representing high quality ecological communities;
- Detailed evaluation of the Reference Sites;
- Rapid evaluation of the condition of existing vegetation and habitat through comparison to the Reference Sites (**Section 4.3**); and
- A targeted survey for *Acacia pubescens* (**Section 4.4**).

A field survey across the study site was completed on 20 – 23 September (spring) 2010 for the establishment of Reference Sites. Rapid evaluation of the existing vegetation on site was completed on 24 and 25 of September 2010 as well as 16 – 18 November 2010. All field work was undertaken by ecologists Dr Monica Campbell, Leonard Drynan and Dr Caroline

Bathje from Cardno. In total, approximately 200 person field hours were spent in undertaking the survey. Weather conditions during field days were predominantly fine with temperatures averaging around 22°C. The only precipitation during field inspection was a light rain shower on the afternoon of 22 September.

High quality Reference Sites for all vegetation communities expected to occur within the Austral-Leppington North Precincts were established where possible, as detailed below and shown in **Figure 6.3**:

- Shale-Gravel Transitional Forest – one Reference Site established;
- Sydney Coastal River Flat Forest – Alluvial Woodland – three Reference Sites established;
- Cumberland Plain Woodland - Shale Hills Woodland – no communities observed on site (**Section 6.3.2**); and
- Cumberland Plain Woodland - Shale Plains Woodland - three Reference Sites established.

Within each Reference Site, the structural and floristic elements were quantified using:

- A full floristic survey;
- Assessment of community structure; and
- Assessment of fauna habitat values.

4.2.1 Full Floristic Survey

Sampling was undertaken within quadrats (20m x 20m) randomly placed within each Reference Site. Within each quadrat all vascular flora species present within the quadrat were recorded. The relative abundance and cover of each identified species within each quadrat was estimated using a modified Braun-Blanquet scoring system (**Table 4.1**).

Table 4.1 Modified Braun-Blanquet scoring system

Score	Projected Foliage Cover
1	Species comprises 0 – 5% of cover with few individual plants present
2	Species comprises 0 – 5% of cover with many individual plants present
3	Species comprises 5 – 25% of cover
4	Species comprises 25 – 50% of cover
5	Species comprises 50 – 75% of cover
6	Species comprises 75-100% of cover

All quadrats were geo-referenced using a hand-held GPS and a photographic log created to allow visual comparison.

The floristic data and relative abundances were compared against the diagnostic species and abundances described for the relevant vegetation communities provided under Commonwealth and State legislation.

While every attempt was made to identify all vascular flora species present within the quadrats it should be noted that species occurring with low frequency and cryptic species may have not been recorded. Further, species occurring outside the quadrats were not recorded, however data collected is considered to be representative of the broader vegetation types present.

4.2.2 Community Structure Assessment

The structural elements of vegetation within each Reference Site were assessed within a 50 x 20 metre quadrat. Within each quadrat the presence/absence of the following strata were determined:

- Emergents;
- T1 (canopy trees);
- T2 (sub canopy understory trees);
- S1 (shrub strata 2-4m);
- S2 (shrub strata 0.5-1.5m); and
- Ground (0-0.5m).

An example of the delineation of community strata is provided in **Figure 4.1**.

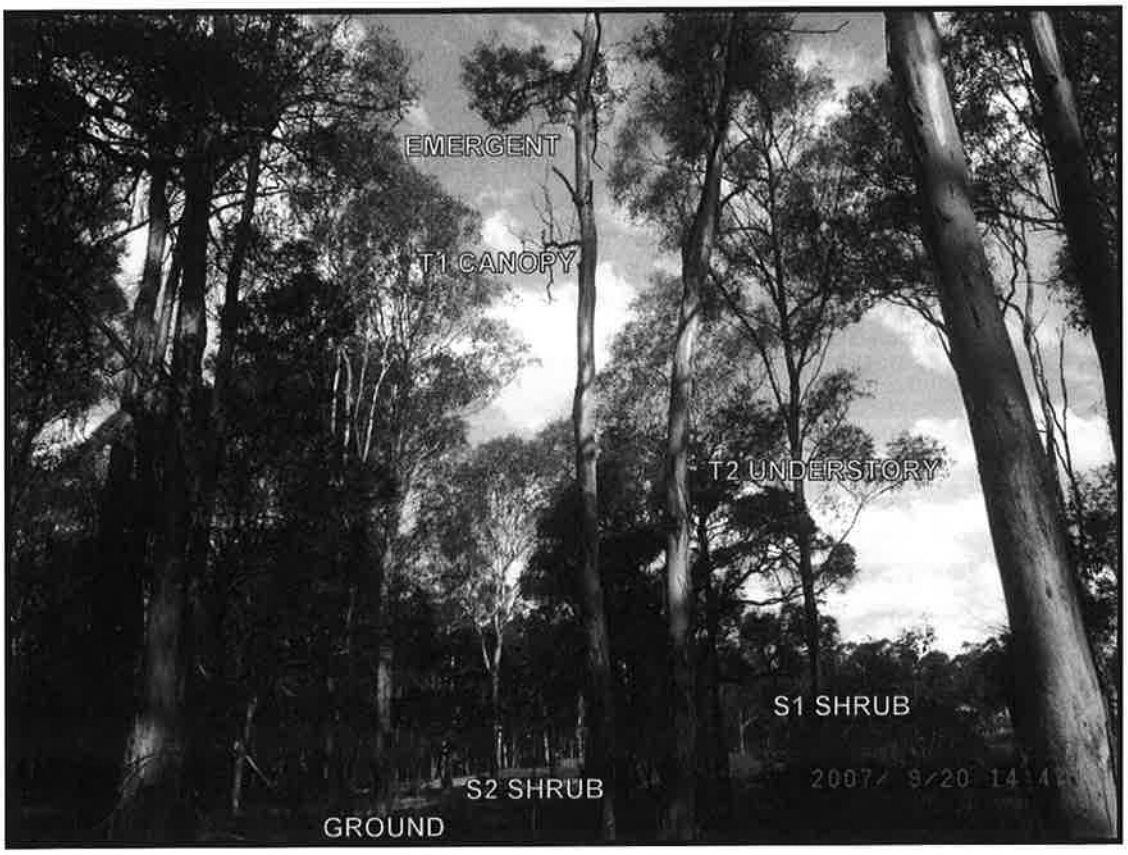

Figure 4.1 Vegetation community structure

For each stratum, the following data was collected:

- Key species;
- Dominance of key species (Dominant, Co-Dominant, Associated, Suppressed);
- Density of each stratum (Sparse – Dense);
- Vegetative cover (%); and
- Weed species dominance, density and cover.

4.2.3 Fauna Habitat Values

To assess the fauna habitat values of each Reference Site vegetation community, evidence of fauna activity in the area and key habitat characteristics of value to fauna species were assessed within 50 x 20m quadrats. Fauna habitat features recorded included:

- Hollow bearing trees;
- Fallen logs/hollow stumps;
- Diggings;
- Scratch marks on tree trunks;
- Scats; and
- Nests.

No targeted field surveys for fauna species were undertaken. Opportunistic sightings of fauna species were recorded throughout all field work. The potential for threatened fauna species to occur on site following vegetation and habitat characterisation was determined through utilisation of the Likelihood of Occurrence assessment (**Appendix E**).

4.3 Rapid Condition Assessment of Existing Vegetation and Habitat

Given the extent of vegetated area within the combined Austral-Leppington North Precincts (approximately 1,930 ha of vegetation) a Rapid Condition Assessment methodology was developed to allow for comparison of the smaller vegetative communities present against the Reference Sites. Given the size of the Austral-Leppington North Precincts and property access issues, implementation of a Rapid Condition Assessment that could be employed remotely was considered to be the most effective means of evaluating the vegetation within the Precincts. It is noted that using this method does not enable boundaries of vegetation patches to be recorded as accurately as if access to the vegetation patch was possible, to enable recording of the position with a GPS device (**Section 6.6.1).**

Where possible, all stands were assessed in-situ. Vegetation communities requiring assessment from greater than 20m distance, have been noted and taken into consideration in the results. For the purposes of this report, vegetation communities assessed under this methodology are termed "Remote Sites" (*c.f.* Reference Sites).

The methodology consisted of an assessment of community structure. For each community stratum the following elements were assessed:

- Presence/absence of strata (i.e. Emergent, T1, T2, S1, S2, G);
- Percentage cover of each stratum;
- Estimated species richness (ground species were estimated within ranges);
- Key species present within each layer;
- Estimated non-native cover; and
- The proportion of cover within each layer represented by native tree saplings.

4.3.1 Scoring of Sites

Using the information collected in the Rapid Condition Assessment and the Reference Site data, a comparative scoring system was developed to calculate an overall score for the condition of each of the vegetative layers present within the Remote Sites. Taken cumulatively these vegetative layer scores provided an overall habitat condition score for each Remote Site as a whole.

The Reference Site data was utilised to develop a benchmark score for each of the EECs present within the Precincts. For each vegetative layer (**Figure 4.1**) an EEC benchmark was established based on the following elements:

- Community strata present;
- Percentage cover of each stratum;
- Observable species richness (Ground species were estimated within ranges);
- Key species present within each layer; and
- Estimated non-native cover.

A series of rules were then developed to contrast the vegetation layers within the Remote Sites (**Section 4.3**) to the relevant identified EEC benchmarks. For example, a remote site classified as Shale Plains Woodland under NPWS (2002) mapping was compared to the benchmark data generated for the Shale Plains Woodland community (**Section 4.2**). The vegetative layer elements and the scoring rules adopted are provided in **Table 4.2**.

Table 4.2 Remote Site vegetative layer elements and scoring system

Present/ Absent	Difference Between Observed % Cover and Benchmark	Species Richness	Dominant Species	Non-Native Cover
Present = 1 point Absent = 0 points	Plus/Minus 10% = 3 points Plus/Minus 20% = 2 points Plus/Minus 30% = 1 point >30% = 0 points	Difference between observed species number and Reference Site species number.	One point for every similar species observed that is part of the EEC species listing.	< Benchmark = 3 points +10% = 2 points +20% = 1 point >20% = 0 points

The assigned scores for each vegetative layer were summed to provide a total site score for each of the five elements assessed. These cumulative scores were then scaled to provide an equal weighting for each of the five elements (i.e. a score out of 10) and then summed to provide a final score out of 50 for each remote site.

4.4 Threatened Flora Survey

A targeted survey for *Acacia pubescens* (Downy Wattle or Hairy Stemmed Wattle) was completed in accordance with Condition 17 of the Relevant Biodiversity Measures for the *Biodiversity Certification for the South West Growth Centres*. The targeted surveys were conducted using meandering transects within remaining bushland habitat along and adjoining the Thirty-Second Avenue road reserve located near (but not within) the Austral Precinct (**Figure 6.4**). The location of individuals identified in the field as *Acacia pubescens* were marked in the field using a hand-held GPS and a sample was taken for confirmation by the NSW Herbarium. These findings have been reported separately as they are not within the Austral – Leppington North Precincts.

4.5 Evaluation of Total Ecological Value

The ecological value of any one vegetative community is a function of both its existing vegetative structure and characteristics and its current and potential future contribution to the habitat of the locality/region as a whole. Based on common methodologies adopted within Western Sydney (e.g. Eco Logical (2003), Eco Logical (2009), a total ecological value was predominantly determined based on the following three elements.

1. **Functional Conservation Value** (**Section 4.5.1**) – this captures the conservation value of the individual patch in terms of its:
    - Site condition (the species composition, complexity, and condition of the communities);
    - Geospatial characteristics (the patch area and perimeter/area ratios); and
    - Connectivity (the quantity of adjacent habitat area).
2. **Threatened Status** (**Section 4.5.2**) – the likelihood of threatened species or communities to occur within the individual patch.
3. **Recovery Potential** (**Section 4.5.3**) – the perceived potential for the patch to improve in value over time as indicated by:
    - The extent of juvenile / regrowth;
    - Land use and disturbance history;
    - Connectivity to surrounding patch areas; and
    - The extent of non-native weed present.

This is graphically depicted in **Figure 4.2**.

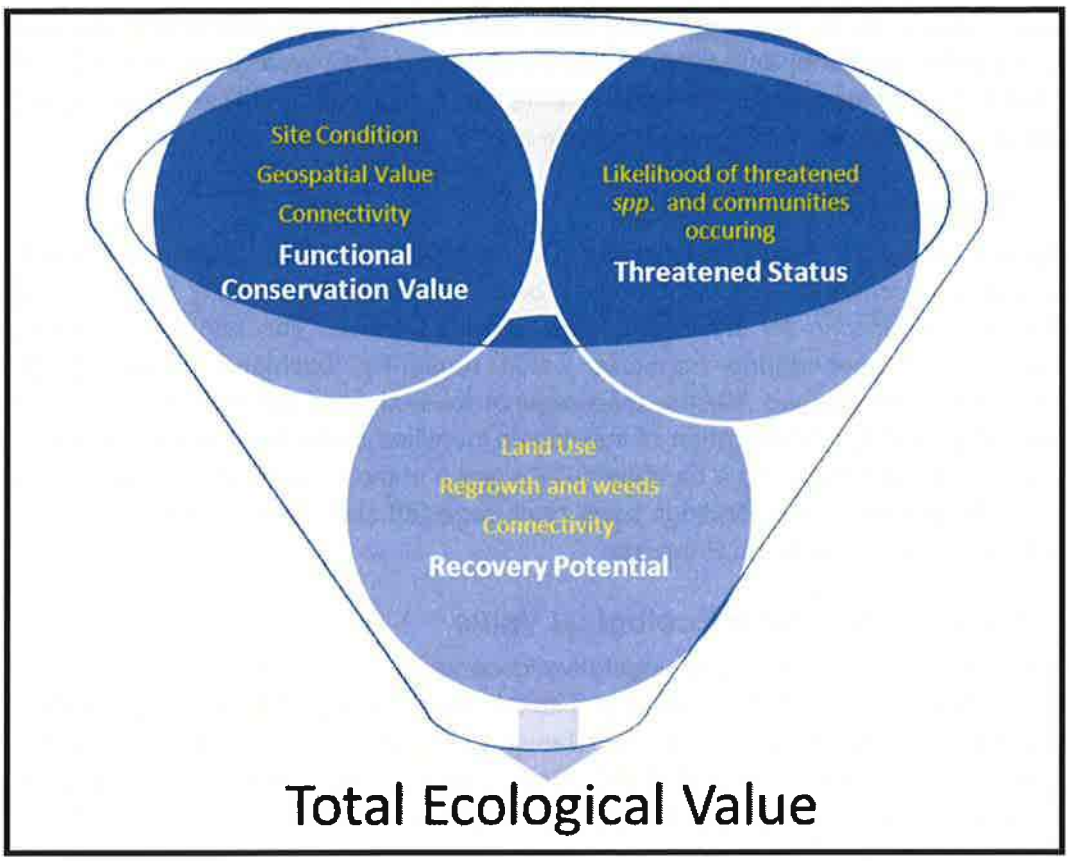

Figure 4.2 Composition of Total Ecological Value

4.5.1 Functional Conservation Value

The Site Condition value of all the vegetation patches (both Remote and Reference Sites) within the Precincts was estimated through the Rapid Condition Assessment and scoring process outlined in **Section 4.3**. All sites were assigned a relative habitat value score out of 50.

The geospatial characteristics were established through GIS analysis of the NPWS (2002) mapping, combined with approximate ground-truthing undertaking during the field inspections (**Section 4.2**). For each vegetation community assessed, community area and the community perimeter to area ratio were determined. For both these elements a relative community ranking was determined, and a proportionate score assigned out of 25, to provide an overall relative geospatial score out of 50.

The connectivity values associated with each individual community was determined through GIS analysis of community distribution. In accordance with DECCW (2008) (for woody ecosystems), adjoining vegetation was considered to be all communities separated by a distance of 100m or less. Based on the observed area of adjoining vegetation, communities were assigned a ranking and a proportionate score out of 50.

Combining these three aspects (equally weighted), provided an overall estimate of the Functional Conservation Value for each site (i.e. a score out of 150).

4.5.2 Threatened Status

All vegetation communities (i.e. Remote and Reference Sites) within the Precincts were seen to represent either:

- Shale-Gravel Transitional Forest;
- Sydney Coastal River Flat Forest – Alluvial Woodland; or
- Cumberland Plain Woodland – Shale Plains Woodland (including both Shale hills and Shale Plains Woodland).

All of these are listed as Threatened Ecological Communities under the TSC Act and are protected under existing legislation. Further, it is noted that due to the extent of historic clearing of the community across the state, Cumberland Plain Woodland – Shale Plains Woodland is formally listed under Schedule 1A of the TSC Act (1995) as a Critically Endangered Ecological Community and is considered to be more vulnerable to extinction if not appropriately managed. Consequently, while all the vegetation communities present on site are of conservation value, vegetation patches corresponding to Cumberland Plain are particularly recognised as being of conservation importance.

In order to incorporate the relative threatened status value of the vegetation communities into the Total Ecological Value an estimate of conservation significance was developed based on the significance categories provided in NPWS (2002c), including:

- Core Habitat: Areas that constitute the backbone of a viable conservation network across the landscape; or areas where the threatened ecological communities are at imminent risk of extinction.
- Support for Core Habitat: Areas that provide a range of support value to the Core Habitat, including increasing remnant size, buffering from edge effects and providing corridor connections.
- Other Remnant Vegetation: All native vegetation that does not fall within the above significance categories.

Consistent with other ecological assessments undertaken within south-western Sydney, all vegetation communities identified within the precinct were assigned a conservation significance based on the methodology outlined in NPWS (2002b). This methodology combines the community type, condition, patch size, and connectivity of the vegetation patches. The condition assessment utilised the NPWS (2002a) mapping classifications which were adjusted accordingly following ground truthing. The associated decision matrix adopted is shown in **Table 4.3**. Based on the assigned conservation significance a score out of 75 was attributed to each vegetation patch assessed (the greater the conservation significance the higher the score) (**Table 4.3**).

Table 4.3 Conservation significance decision matrix

Community Type	Condition Code*	Patch Size	Connectivity	Code	Conservation Significance	Score
Critically Endangered Ecological Community	ABC, TX, or Txr	Any	Any	C3	Core	75
	Txu	Any	Any	URT	URT	25
Endangered	ABC (with understory in	>10 ha	Any	C1	Core	65

Community Type	Condition Code*	Patch Size	Connectivity	Code	Conservation Significance	Score
Ecological Community	good or moderate condition)	<10 ha	Adjacent to C1 or CEEC	C2	Core	55
			Adjacent S1	S2	Support for Core	50
			None	O	Other Remnant Vegetation	37.5
	Tx or Txr, ABC (with poor understory condition)	Any	Adjacent to any Core	S1	Support for Core	50
			None	O	Other Remnant Vegetation	37.5
	Txu	Any	Any	O	Other Remnant Vegetation	37.5
Non – Endangered Community	-	Any	Any	NE	Low Conservation Significance	12.5

*Condition Codes were adopted consistent with NPWS (2002c) where:

- **A** = canopy density > 10% with relatively intact native tree canopy;
- **B** = canopy density < 10% with larger areas of remnant vegetation with a low or discontinuous canopy;
- **C** = canopy density < 10% with areas of native vegetation that do not have a Eucalypt canopy cover.
- **TX** = canopy density < 10% Areas of native trees with very discontinuous canopy cover.
- **TXR** = canopy density < 10% Areas of TX located in areas where there is a combination of urban and rural activities.
- **TXU** = canopy density < 10% with areas of TX located where the dominant land use is urban.

Just as the conservation significance of the vegetation communities varied across the Precincts, it was also considered that the potential for threatened individual flora and fauna species to occur was likely to vary between the communities present. The threatened species likelihood of occurrence assessment (**Appendices E** and **G**) identified a large number of species which may occur and utilise the Precincts for either breeding or foraging. In particular, a significant number of potentially occurring threatened species typically associated with the presence of riparian and wetland areas were identified. Consistent with similar studies undertaken within Western Sydney (e.g. Eco Logical 2009), the potential for threatened species to occur on site was determined based on:

- Field observations of flora and fauna;
- Historic sightings of flora and fauna;
- The threatened species likelihood of occurrence assessment (**Section 6.1**, **Appendix E**);
- The determined Functional Conservation Value; and
- Specific community characteristics (e.g. wetland or riparian vegetation).

Table 4.4 describes the decision matrix adopted to categorise the potential for threatened flora or fauna species within each identified community and the subsequent score assigned.

Table 4.4 Threatened flora and fauna decision matrix

Threatened Spp. last recorded within the community	Functional Conservation Value	Habitat Type	Potential for threatened species	Assigned Score
≤5 years	Any	Any	High	75
>5 years	High (>100)	Any	High	75
	Medium (50 – 100)	Any	High	75
	Low (<5)	Any	Medium	50
No Species Recorded	High (>100)	Wetland	Medium	50
		Riparian	Medium	50
		Terrestrial	Medium	50
	Medium (50 -100)	Wetland	Medium	50
		Riparian	Medium	50
		Terrestrial	Low	25
	Low (<50)	Wetland	Medium	50
		Riparian	Low	25
		Terrestrial	Low	25

Combining the conservation significance score (**Table 4.3**) and threatened flora and fauna score (**Table 4.4**), provided an overall estimate of the Threatened Status Value for each site (i.e. a score out of 150).

4.5.3 Recovery Potential

For the purposes of this report, recovery potential is defined to be the perceived capacity for a disturbed area to improve its condition to a state representative of its condition prior to disturbance (assuming no further disturbance or active management). Estimation of recovery potential is difficult, due to the variety of site specific factors which influence vegetative growth (e.g. soil quality, light infiltration, hydrology etc.). In general, it can be seen that recovery potential is influenced by the extent of prior/on-going disturbance, the existing and potential supplementation to the seed bank, connectivity, and the competition due to non-native species. For the vegetation of the Cumberland Plain, the restoration of characteristic canopy species is a significant factor in condition improvement. As such the presence of saplings within the communities is considered a key indicator of recovery potential.

Table 4.5 outlines the decision rules adopted in determining the recovery potential for each vegetation patch observed within the precincts, resulting in a ranking of 1 – 6 where 1 has the least recovery potential and 6 has the best chance for native vegetation recovery.

Table 4.5 Recovery potential decision matrix

Current Condition and Land Use	Connectivity*	Saplings cover**	Non-Native Cover**	Recovery Potential
Highly Disturbed (e.g. no continuous canopy, intensive grazing, planted gardens)	High	<10%	High	1
			Low	3
		10-30%	High	2
			Low	4
		>30%	High	3
			Low	4
	Medium	<10%	High	1
			Low	2
		10-30%	High	1
			Low	3
		>30%	High	2
			Low	3
	Low	<10%	High	1
			Low	1
		10-30%	High	1
			Low	2
		>30%	High	1
			Low	2
Wooded, native canopy present or regenerating	High	<10%	High	3
			Low	4
		10-30%	High	4
			Low	5
		>30%	High	4
			Low	6
	Medium	<10%	High	2
			Low	3
		10-30%	High	3
			Low	4
		>30%	High	4
			Low	5
	Low	<10%	High	2
			Low	3
		10-30%	High	3
			Low	4
		>30%	High	4
			Low	5

*As determined by the connectivity rankings determined in Section 0 ("High" – the top third ranked sites, "Medium" – the middle third ranked sites, "Low" – the bottom third ranked sites).
**Data obtained during the rapid characterisation field inspections (Section 4.3).

4.5.4 Total Ecological Value

Based on the rankings determined (**Sections 4.5.3**), the Recovery Potential scores for each vegetation patch were scaled to provide scores out of 150. As described in **Sections 4.5.1** and **4.5.2** the Functional Conservation Value and Threatened Statue Value for each vegetation community was also evaluated out of possible score of 150. All three of these ecological value elements (**Figure 4.2**) were then combined to provide an equally weighted score out of 450 for each of the discrete vegetation patches identified (i.e. the community Total Ecological Value).

To aid in Precinct Planning, based on the observations made during the field survey and Cardno's professional experience it was considered appropriate to further categorise the Total Ecological Values into "High" (Total Ecological Values greater than 300), "Medium" (Total Ecological Values from 150 to 300) or "Low" (Total Ecological Values less the 150) value classes.

4.6 Vegetative Mapping

Utilising the existing ENV mapping (DoPI, 2011) and field survey ground-truthing, the vegetative communities on site (i.e. Remote and Reference Sites) were mapped with GIS, and assigned the relevant determined ecological value score and classification. The maps and values assigned were revised following:

- The public exhibition period, and
- Additional fieldwork carried out in direct response to the comments received during public exhibition.

The resulting maps were compared and contrasted against the ENV mapping and certified/non-certified area mapping to aid in the formation of an Indicative Layout Plan that accurately incorporates biodiversity values.

Figure 4.3 shows the distribution of existing ENV as provided by DoPI in 2011. In total, (and including 3.45ha of ENV within the area of Kemps Creek Nature Reserve which is within the precincts), this figure shows approximately 212.15ha of ENV comprised of 102.73ha of ENV on certified land, and 109.42ha on non-certified land.

Some areas of ENV shown by the DoPI mapping in **Figure 4.3** were found by the Cardno Ground Truthing not to be ENV as they did not meet one of the three criteria for ENV shown in **Section 2.2.5.1. Figure 4.4** shows the distribution of ENV corrected by Cardno in light of the ground truthing exercises and the approved vegetation clearance to accommodate the SWRL. The area of ENV in the revised mapping is reduced by 16.45ha to 195.70ha, with the areas of difference being identified by orange shading in **Figure 6.9.** This corresponds to 94.12ha of ENV on certified land, and 101.58ha on non-certified land. The corrected ENV data as ground truthed by Cardno has been used for all further calculations and mapping within this report.

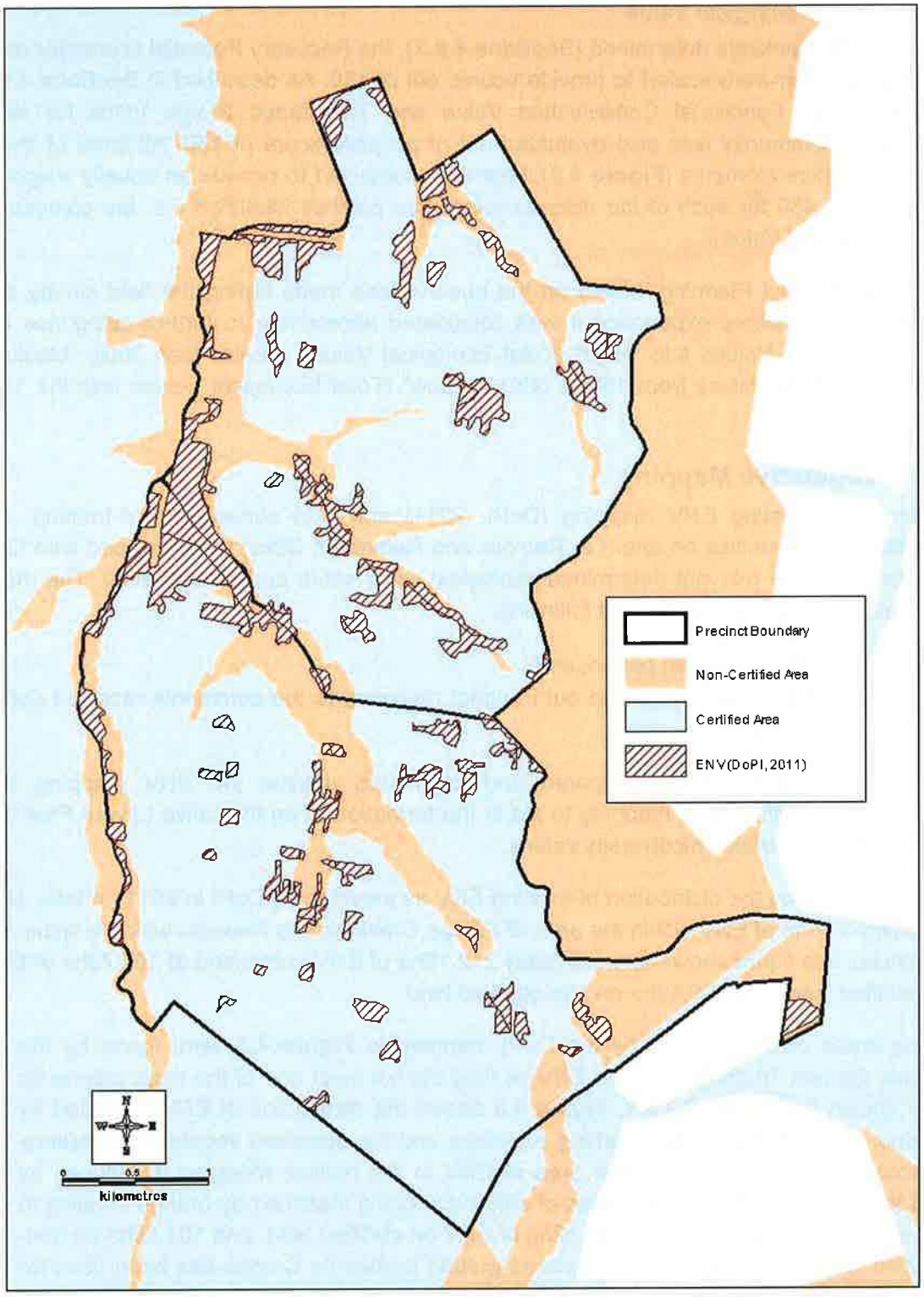

Figure 4.3 Existing Native Vegetation (DoPI, 2011) 102.73ha on Certified and 109.42ha on Non-Certified land.

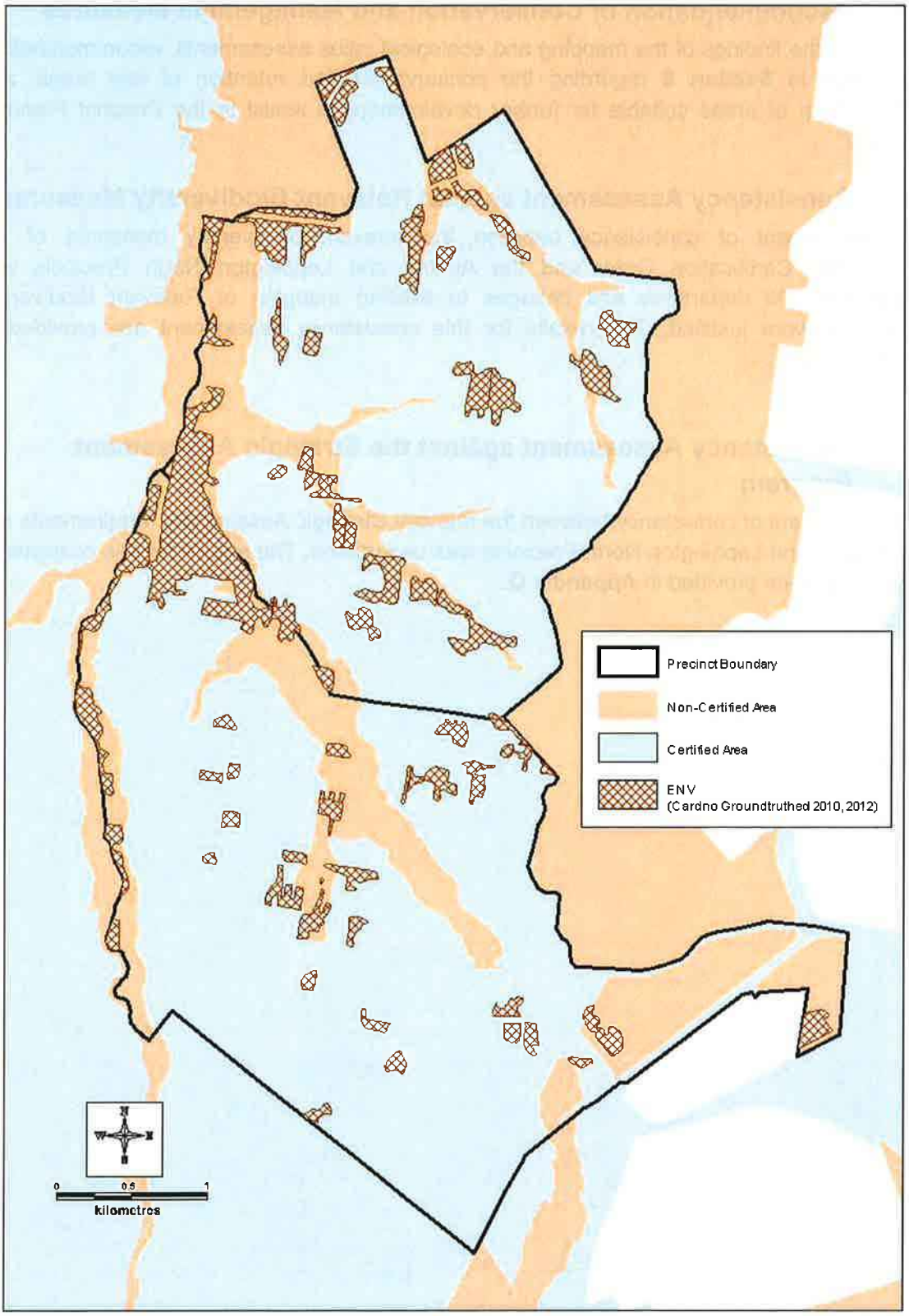

Figure 4.4 Existing Native Vegetation (DoPI, 2011, amended to show results of 2010 and 2012 ground truthing and SWRL impacts) 94.12ha on Certified and 101.58ha on Non-Certified land.

4.7 Recommendation of Conservation and Management Measures

Based on the findings of the mapping and ecological value assessments, recommendations are made in **Section 8** regarding the conservation and retention of key areas, and identification of areas suitable for further development to assist in the Precinct Planning process.

4.8 Consistency Assessment against Relevant Biodiversity Measures

An assessment of consistency between the relevant biodiversity measures of the Biodiversity Certification Order and the Austral and Leppington North Precincts was undertaken. All departures and changes to existing mapping or Relevant Biodiversity Measures were justified. The results for this consistency assessment are provided in **Appendix M**.

4.9 Consistency Assessment against the Strategic Assessment Program

An assessment of consistency between the relevant Strategic Assessment requirements and the Austral and Leppington North Precincts was undertaken. The results for this consistency assessment are provided in **Appendix Q**.

5 Methodology – Aquatic Ecology Assessment

The specific objectives of this study relating to aquatic ecology were to:

- Identify aquatic species, populations or ecological communities that occur or for which potential habitat occurs within Austral and Leppington North Precincts;
- Describe existing aquatic habitats and determine the occurrence of aquatic plants, aquatic macroinvertebrates and fish, including those regarded as threatened or noxious species;
- Identify the location of any threatened species found on site, areas of habitat value for threatened and regionally significant species, the biodiversity and habitat values of the site and areas of high conservation value.

In order to achieve these objectives, the following methodology was implemented:

- Literature and database searches (**Section 5.1**);
- Aquatic habitat field surveys (**Section 5.2**),
- Water quality sampling and assessment (**Section 5.3**);
- Aquatic flora surveys (**Section 5.4**);
- Aquatic fauna surveys (**Section 5.5**);
- Recommendation of conservation and management measures (**Section 5.6**).

All field investigations undertaken as part of the aquatic biodiversity assessment for the site (i.e. aquatic habitat surveys, water quality sampling, aquatic flora surveys, and aquatic fauna surveys) were undertaken on 19 August 2010. The survey commenced in the morning after approximately 2.2mm of rain had fallen. As the survey was restricted to one day, it provides a "snapshot" of the state of the waterways and their biota.

Thirteen sites distributed across the waterways present on site were surveyed. Aquatic habitat, water quality, and the occurrence of macrophytes (aquatic plants) were assessed at all sites. However, aquatic fauna (macroinvertebrates and fish) were sampled only where there was suitable aquatic habitat (**Section 5.5**). The position of the thirteen study sites surveyed is shown in **Figure 5.1** and their geographic coordinates are listed in **Table 5.1**

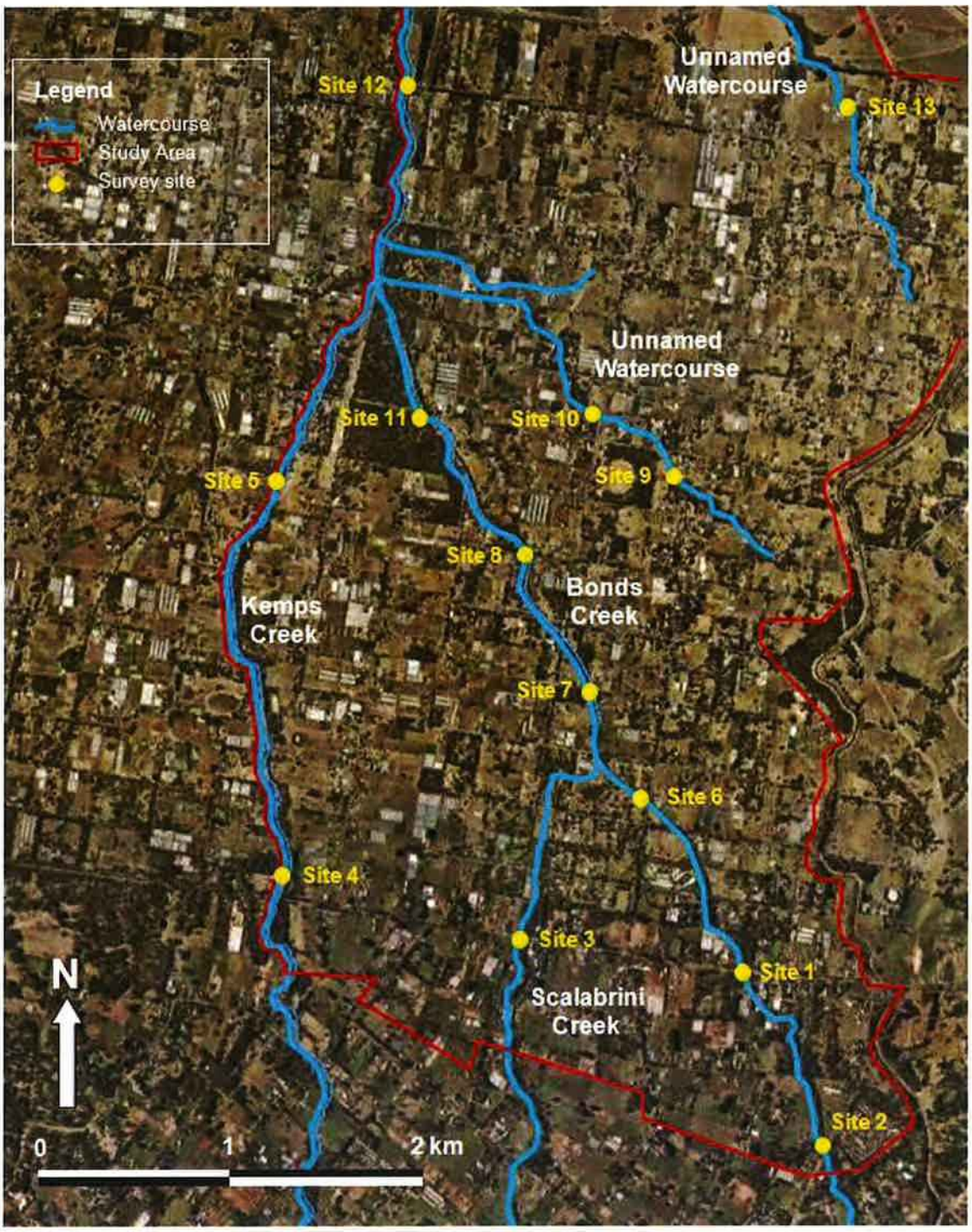

Figure 5.1 Location of the aquatic ecology survey sites within the Study site. Image source: Google Earth.

Table 5.1 GPS coordinates for each of the 13 sites surveyed within the Study site. Datum: UTM WGS 84 Zone: 56H.

Site	Easting	Northing	Waterway
1	0298132	6241075	Bonds Creek
2	0298573	6240189	Bonds Creek
3	0296968	6241237	Scalabrini Creek
4	0295719	6241505	Kemps Creek
5	0295662	6243569	Kemps Creek
6	0297594	6241941	Bonds Creek
7	0297296	6242516	Bonds Creek
8	0296937	6243217	Bonds Creek
9	0297825	6243549	Unnamed
10	0297280	6243961	Unnamed
11	0296402	6243943	Bonds Creek
12	0296262	6245662	Kemps Creek
13	0298552	6245602	Unnamed

5.1 Literature and database searches

Existing information on aquatic habitats and associated biota within the region of the Study Area was obtained by searching for relevant literature using the internet. Threatened species, populations and ecological communities that occur or for which potential habitat occurs within the study site were identified by reviewing the current listings on databases maintained by the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPC), Industry and Investment NSW (I&I NSW) and NSW Department of Environment, Climate Change and Water (DECCW). Database searches were made on 17 August 2010.

The DSEWPC Environmental Reporting Tool was used to determine whether any matters of National Environmental Significance (NES) listed under the schedules of the *EPBC Act* are likely to occur in the Study site. The search for matters of NES was limited to frogs, ray-finned fish and aquatic plants (macrophytes) and encompassed the entire Kemps Creek catchment.

The I&I NSW Threatened and Protected Species Record Viewer was used to search for records of threatened and protected species listed by Schedules 4, 4A and 5 of the *FM Act* occurring in the Penrith Local Government Area and the broader Hawkesbury – Nepean Catchment.

The DECCW Geographic Region Search was used to determine whether any aquatic threatened plant and frog species listed under the *TSC Act* were present in the Cumberland CMA sub-region of the Hawkesbury - Nepean Catchment Management Authority (HNCMA) Area, which encompasses the Study site.

Searches were also done for the presence of significant or critical aquatic habitat present within the region of the study site, such as RAMSAR wetlands.

The following reports relating to the aquatic ecology of the region were also reviewed:

- Managing Sydney's Urban Growth: Aquatic Biodiversity Values (Bioanalysis, 2003);
- South West Rail Link: Environmental Assessment Biodiversity Technical Paper (Parsons Brinckerhoff, 2010);
- Freshwater Fishes of South-Eastern Australia (McDowall, 1996);
- Carp in NSW: Assessment of distribution, fishery and fishing methods (Graham et al., 2005); and
- I&I NSW survey of Penrith Lakes for the Penrith Lakes Development Corporation (I&I NSW 2009).

5.2 Aquatic Habitat Field Survey

At each survey site, a standardised description of adjacent land and condition of riverbanks, channel and bed was recorded using the 'Riparian, Channel and Environmental Inventory' (RCE), developed by DECCW (previously the NSW Environment Protection Authority). RCE is used to scale and quantify the environmental state of particular locations for use in management decisions. The RCE score for each site is calculated by summing the scores for each descriptor noted (**Appendix B**). The highest score (52) would be assigned to a stream with no obvious physical disruption. The lowest score (13) would be assigned to a heavily disturbed stream without any riparian vegetation. Habitat descriptors included:

- Geomorphological characteristics of the waterways;
- Land use along the waterway (e.g. industries associated with the river, recreational uses);
- Riparian vegetation and instream vegetation (e.g. presence/absence, native or exotic, condition); and
- Channel substratum type (e.g. rock, sand, gravel, alluvial substrata).

The fish habitat potential at each site was assessed in accordance with *NSW Policy and Guidelines: Aquatic Habitat Management and Fish Conservation* (Smith and Pollard 1999) and *Guidelines and Policies for Fish Friendly Road Crossings* (Fairfull and Witheridge 2003). The criteria for the fish habitat classifications are given in **Appendix C**. The assessment of impacts assumed that any waterway crossing required in the proposed works would be designed and built to comply with these guidelines and policies.

General observations, including water characteristics such as flow rates and colour, the presence of spawning areas (e.g. gravel beds, aquatic vegetation), refuge (e.g. deep pools,

snags) and natural or artificial barriers to fish passage (e.g. weirs, dams, culverts etc) and the type of existing waterway crossing if present, were also recorded.

5.3 Water Quality Sampling and Assessment

Water quality was measured at each site using a Yeo-Kal 611 probe. Physical-chemical properties measured included: electrical conductivity (µs/cm); salinity (ppt); temperature (°C); turbidity (NTU); dissolved oxygen (mg/L and % saturation); pH; and ORP (Oxidation Reduction Potential: mV). Two replicate measures of each variable were taken from just below the water surface at each site.

The in situ water quality readings were used to assess water quality within the study site by comparison with the Australia, New Zealand Environment Conservation Council (ANZECC/ARMCANZ 2000) guidelines for lowland rivers in south-eastern Australia.

5.4 Aquatic Flora (Macrophytes)

The instream macrophyte (aquatic plants) taxa occurring at all sites were recorded. The presence of threatened species, the condition and contribution to the overall habitat of the species present was also noted. Results are shown in **Section 7.4**.

5.5 Aquatic Fauna

5.5.1 Aquatic Macroinvertebrates

Based on the observed availability of suitable habitat, macroinvertebrates associated with edge habitat were sampled at Sites 1, 3, 4, 5, 7, 11 and 12 (**Figure 5.1,** and **Table 5.2**). Edge habitat is defined as areas along creek banks with little or no flow, including alcoves and backwaters, with abundant leaf litter, fine sediment deposits, macrophyte beds, overhanging banks and areas with trailing bank vegetation (Turak *et al.* 2004). Samples were collected over a total length of 10 m of edge habitat usually in 1-2m sections, ensuring that all significant sub-habitats within each site were sampled (Turak *et al.* 2004).

Table 5.2 Sampling undertaken at each aquatic site surveyed within the study site

Site	Waterway	Aquatic Habitat Assessment	Water Quality	Macrophyte	Macroinvertebrate	Fish
1	Bonds Creek	✓	✓	✓	✓	✓
2	Bonds Creek	✓	✓	✓		✓
3	Scalabrini Creek	✓	✓	✓	✓	✓
4	Kemps Creek	✓	✓	✓	✓	✓
5	Kemps Creek	✓	✓	✓	✓	✓
6	Bonds Creek	✓	✓	✓		
7	Bonds Creek	✓	✓	✓	✓	✓
8	Bonds Creek	✓	✓	✓		✓

Site	Waterway	Aquatic Habitat Assessment	Water Quality	Macrophyte	Macroinvertebrate	Fish
9	Unnamed	✓	✓	✓		
10	Unnamed	✓	✓	✓		
11	Bonds Creek	✓	✓	✓	✓	✓
12	Kemps Creek	✓	✓	✓	✓	✓
13	Unnamed	✓	✓	✓		✓

Dip nets with a mesh size of 250µm were used to collect the macroinvertebrates. The dip net was first used to disturb animals by agitating bottom sediments and suspending invertebrates into the water column. The net was then swept through this cloud of material to collect suspended and surface dwelling animals. Each macroinvertebrate sample was rinsed in the net with local water to minimise fine particles and placed into a white sorting tray. Animals were removed from the tray using forceps and pipettes. Trained staff removed animals for a minimum period of forty minutes. Thereafter, removals were performed in ten minute periods to a total of one hour, at which time removals would cease if no new taxa were found in a ten minute period. The animals collected were placed inside a labelled jar containing 70% ethanol for laboratory identification.

Animals in the macroinvertebrate samples were removed, identified using a binocular microscope, and up to a maximum of ten animals from each taxon were counted. Taxa were identified to family level except for Aranaea, Cladocera, Copepoda, Hydracarina, Nematoda, Nemertea, Oligochaeta and Ostracoda which were identified to species level where possible. Chironomidae were identified to sub-family level. Identification of animals was validated by a second experienced scientist performing QA checks on each sample.

Macroinvertebrates are useful indicators of the ecological health of freshwater systems. Some macroinvertebrates are more tolerant to pollution and disturbance than others therefore if a waterway is polluted and/or disturbed its macroinvertebrate assemblages should generally be characterised by pollution-tolerant taxa. Conversely, a healthy or pristine habitat should have a greater proportion of pollution-sensitive taxa than an unhealthy habitat. The SIGNAL (Stream Invertebrate Grade Number – Average Level) score provides a measure of environmental health based on the composition of the macroinvertebrate assemblages and the sensitivity of individual taxa to pollution and disturbance. SIGNAL grades for each taxon range from 1 (most tolerant) to 10 (most sensitive). Subsequently, the average SIGNAL score for the taxa found at each site was also used to assess the habitat value (**Section 5.2**) environmental health, with

- SIGNAL higher than 6 = healthy habitat;
- SIGNAL between 5 and 6 = mild pollution and/or disturbance;
- SIGNAL between 4 and 5 = moderate pollution and/or disturbance;
- SIGNAL less than 4 = severe pollution and/or disturbance.

5.5.2 Fish

Fish and large mobile macroinvertebrates occurring at ten sites were sampled by back-pack electrofishing. This is a commonly used, effective non-destructive technique for sampling fish in freshwater habitats such as creeks, drainage ditches and streams. The technique involves discharging an electric pulse into the water which stuns fish, allowing them to be easily netted, counted, identified and released. Electrofishing was done in appropriate habitat such as shallow pools and beneath overhanging banks and vegetation. One staff member used the electrofisher, whilst a second equipped with a dip net was responsible for capture of stunned fish. Captured fish were placed into a fish box filled with stream water for identification and subsequent release. All native species were returned to the water unharmed, but introduced pest species, such as mosquito fish (*Gambusia holbrooki*) and goldfish (*Carassius auratus*), were euthanized humanely with benzocaine.

The entire length of each site was electrofished and the duration of fishing was recorded. The amount of fishable habitat varied among sites and therefore the time fished also varied. Fishing power (amps) was standardised across sites by adjusting voltage output according to the electrical conductivity of the water.

It should be noted that frog species were not sampled, as the survey was undertaken outside their peak activity period.

Results are shown in **Section 7.5**.

5.6 Recommendation of Conservation and Management Measures

Based on the habitat, water quality, aquatic flora and fauna results each of the sites assessed (**Figure 5.1**) and their respective creeks were evaluated in terms of its ecological value and significance. Recommendations in regards to aquatic ecology are made in **Section 8** regarding the conservation and retention of key areas, and identification of areas suitable for further development to assist in the Precinct Planning process.

6 Results – Terrestrial Ecology

6.1 Literature and Database Searches Results for Fauna

A search of the relevant online databases identified 466 fauna species occurring in Liverpool and Camden LGAs. These species included 28 amphibians, 312 birds, 4 Gastropods, 79 mammals, and 43 reptiles. A holistic fauna list and threatened species fauna list for the Liverpool and Camden LGAs is presented in **Appendix D**. 55 species are listed under either the *TSC Act* or the *EPBC Act.*

Appendix E contains the results of the fauna Likelihood of Occurrence assessment (**Section 4.1**). Based on the outcomes of this assessment the 44 threatened fauna species known, likely or having the potential to occur on site are shown in **Table 6.1**.

Figure 6.1 shows the location of threatened fauna species known to have occurred in the vicinity of the site.

Table 6.1 Threatened fauna species that are known, likely or have the potential to occur on site.

Species Name	*Common Name*	*EPBC Act 2000*	*TSC Act 1995 Classification*
Amphibia			
Litoria aurea	Green and Golden Bell Frog	Vulnerable	Endangered
Heleioporus australiacus	Giant Burrowing Frog	Vulnerable	Vulnerable
Pseudophryne australis	Red-crowned Toadlet	-	Vulnerable
Aves			
Stictonetta naevosa	Freckled Duck	-	Vulnerable
Anthochaera phrygia	Regent Honeyeater	Endangered	Endangered
Pyrrholaemus saggitatus	Speckled Warbler	-	Vulnerable
Circus assimilis	Spotted Harrier	-	Vulnerable
Stagonopleura guttata	Diamond Firetail	-	Vulnerable
Haliaeetus leucogaster	White-bellied Sea-Eagle	Marine, Migratory	-
Hieraaetus morphnoides	Little Eagle	-	Vulnerable
Lophoictinia isura	Square-tailed Kite	-	Vulnerable
Burhinus grallarius	Bush Stone-curlew	-	Endangered
Callocephalon fimbriatum	Gang-gang Cockatoo	-	Vulnerable
Calyptorhynchus lathami	Glossy Black-Cockatoo	Endangered (SA)	Vulnerable
Merops ornatus	Rainbow Bee-eater	Marine, Migratory	-
Monarcha melanopsis	Black-faced Monarch	Marine, Migratory	-

Species Name	Common Name	EPBC Act 2000	TSC Act 1995 Classification
Myiagra cyanoleuca	Satin Flycatcher	Marine, Migratory	-
Rhipidura rufifrons	Rufous Fantail	Marine, Migratory	-
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	-	Vulnerable
Daphoenositta chrysoptera	Varied Sittella	-	Vulnerable
Apus pacificus	Fork-tailed Swift	Marine, Migratory	-
Melanodryas cucullata	Hooded Robin	-	Vulnerable
Petroica boodang	Scarlet Robin	-	Vulnerable
Petroica phoenicea	Flame Robin	Marine	Vulnerable
Glossopsitta pusilla	Little Lorikeet	-	Vulnerable
Lathamus discolor	Swift Parrot	Endangered	Endangered
Ardea alba (or Ardea modesta)	Eastern Great Egret, White Egret	Marine, Migratory	-
Ardea ibis	Cattle Egret	Marine, Migratory	-
Gallinago hardwickii	Latham's Snipe, Japanese Snipe	Marine, Migratory	-
Rostratula benghalensis australis (or Rostratula australis)	Australian Painted Snipe	Vulnerable, Marine, Migratory	Endangered
Ninox connivens	Barking Owl	-	Vulnerable
Tyto novaehollandiae	Masked Owl	-	Vulnerable
Ninox strenua	Powerful Owl	-	Vulnerable
Gastropoda			
Meridolum corneovirens	Cumberland Plain Land Snail	-	Endangered
Mammalia			
Cercartetus nanus	Eastern Pygmy-possum	-	Vulnerable
Dasyurus maculatus	Spotted-tailed Quoll	Endangered	Vulnerable
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	-	Vulnerable
Mormopterus norfolkensis	Eastern Freetail-bat	-	Vulnerable
Petaurus norfolcensis	Squirrel Glider	-	Vulnerable
Phascolarctos cinereus	Koala	-	Vulnerable
Pteropus poliocephalus	Grey-headed Flying-fox	Vulnerable	Vulnerable

Species Name	*Common Name*	*EPBC Act 2000*	*TSC Act 1995 Classification*
Falsistrellus tasmaniensis	Eastern False Pipistrelle	-	Vulnerable
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	-	Vulnerable
Myotis macropus	Southern Myotis or Large-footed Myotis	-	Vulnerable
Scoteanax rueppellii	Greater Broad-nosed Bat	-	Vulnerable

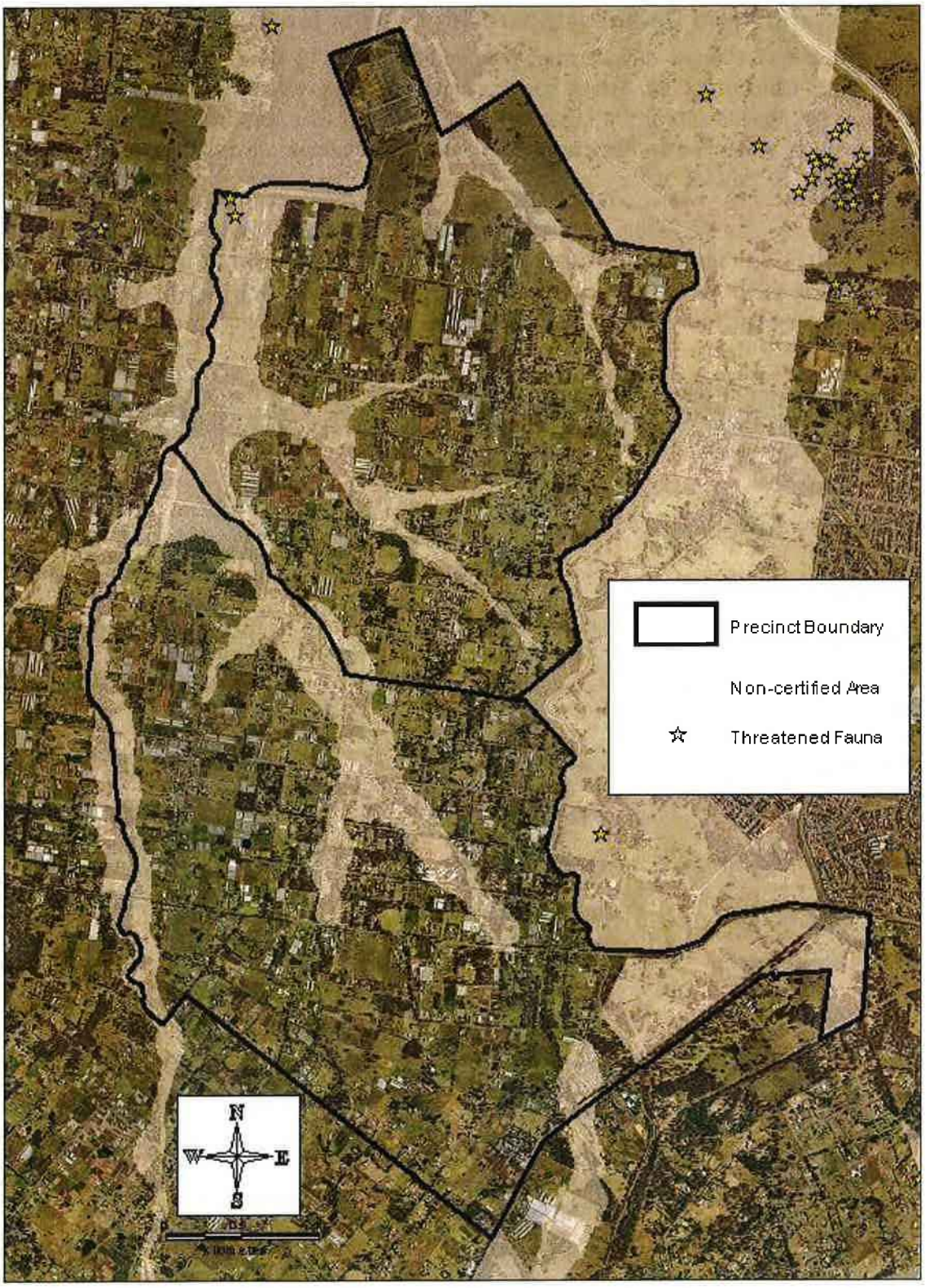

Figure 6.1 Map of threatened fauna recordings* within and surrounding the study site (NPWS, 2010).
*it is noted that multiple species sightings are recorded at the individual locations identified by NPWS (2010).

6.2 Literature and Database Searches Results for Flora

A search of the relevant online databases identified 2,178 flora species occurring in Liverpool and Camden LGAs. These species included 1,536 native species and 642 exotic species. A full floristic list for the Liverpool and Camden LGAs and a listing of threatened flora species is presented in **Appendix F**. Twenty-five species are listed under either the *TSC Act* or the *EPBC Act*.

Appendix G contains the results of the flora Likelihood of Occurrence assessment (**Section 4.1**). Based on the outcomes of this assessment the 17 threatened flora species known, likely or having the potential to occur on site are shown in **Table 6.2**. **Figure 6.2** shows the location of threatened fauna species known to have occurred in the vicinity of the site.

Table 6.2 Threatened flora species that are known, likely or have the potential to occur on site.

Species Name	Common Name	*EPBC Act 2000 Classification*	*TSC Act 1995 Classification*
Marsdenia viridiflora subsp. viridiflora		-	Endangered Population
Cynanchum elegans	White-flowered Wax Plant	Endangered	Endangered
Allocasuarina glareicola		Endangered	Endangered
Dillwynia tenuifolia	Dillwynia tenuifolia, Kemps Creek	-	Endangered Population
Pultenaea parviflora		Vulnerable	Endangered
Pultenaea pedunculata	Matted Bush-pea	-	Endangered
Acacia pubescens	Downy Wattle	Vulnerable	Vulnerable
Eucalyptus benthamii	Camden White Gum	Vulnerable	Vulnerable
Eucalyptus scoparia	Wallangarra White Gum	Vulnerable	Endangered
Melaleuca deanei	Deane's Paperbark	Vulnerable	Vulnerable
Pterostylis saxicola	Sydney Plains Greenhood	Endangered	Endangered
Grevillea juniperina subsp. juniperina	Juniper-leaved Grevillea	-	Vulnerable
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	Vulnerable	Vulnerable
Pomaderris brunnea	Brown Pomaderris	Vulnerable	Vulnerable
Persoonia hirsuta	Hairy Geebung	Endangered	Endangered
Persoonia nutans	Nodding Geebung	Endangered	Endangered
Pimelea spicata	Spiked Rice-flower	Endangered	Endangered

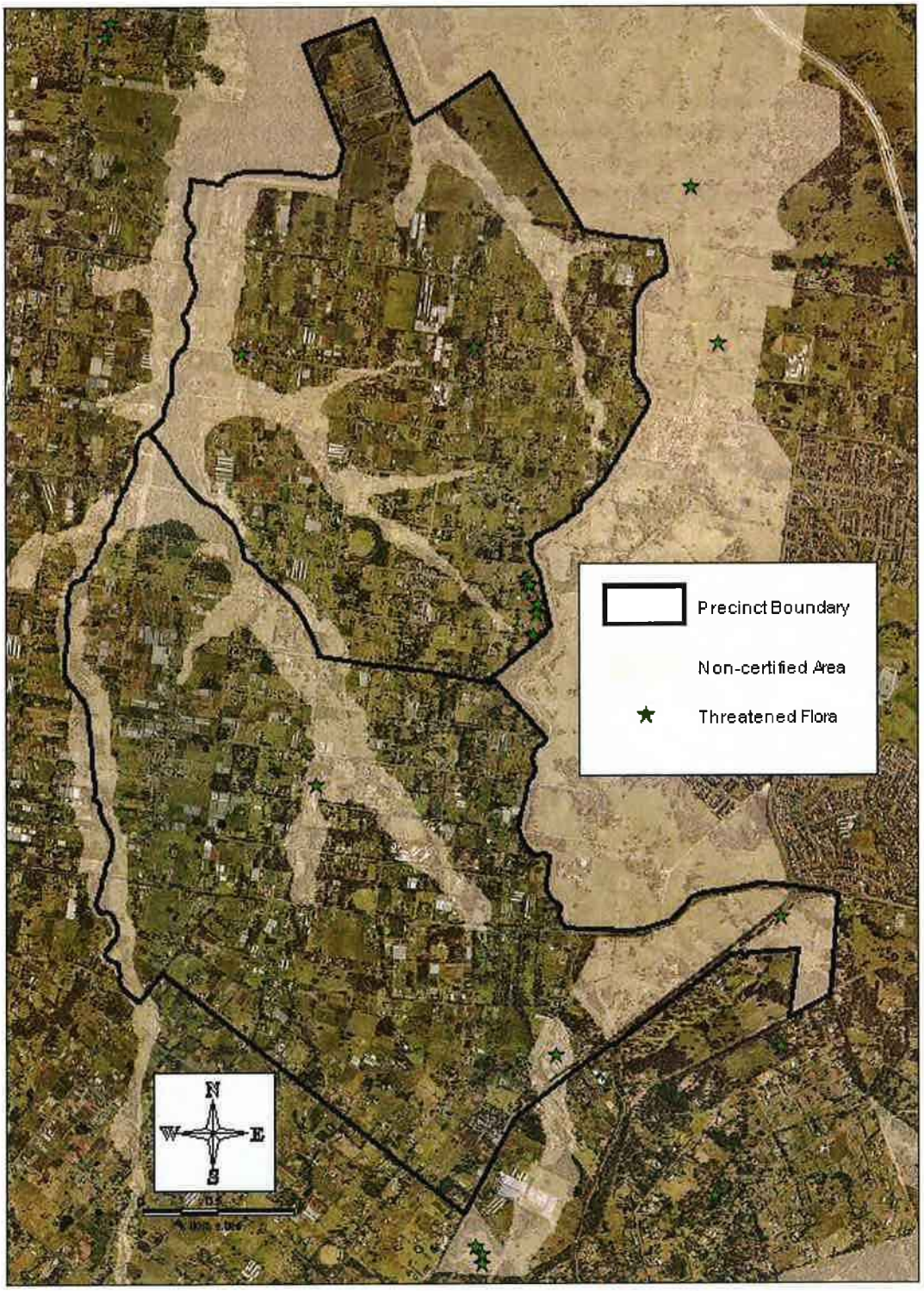

Figure 6.2 Threatened flora species located within and surrounding the study site (NPWS, 2010).
*it is noted that multiple species sightings may be recorded at the individual locations identified by NPWS (2010).

6.3 Results - Identification and Assessment of Benchmark Vegetation and Habitat

The identification and assessment of high quality vegetation areas capable as acting as benchmark Reference Sites within the precincts was difficult due to the lack of undisturbed remnant vegetation present. The majority of areas identified as Existing Native Vegetation (ENV) under the Biodiversity Certification, while seen to be consistent with the RBMs definition of ENV (i.e. greater than 10% canopy cover, a patch area of greater than 0.5ha and identified as vegetation in the draft *Growth Centres Conservation Plan*), were typically found to be lacking understory and groundcover components. The presence of characteristic groundcover and understory species are key elements of the Threatened Ecological Communities identified as occurring on site (**Section 2.2.5**). Consequently, the field studies included significant time in establishing the relative condition of vegetation and identifying potential benchmark areas.

The selected benchmark sites are shown in **Figure 6.3**. The majority of these are located within allocated nature reserves and on undeveloped flood prone land.

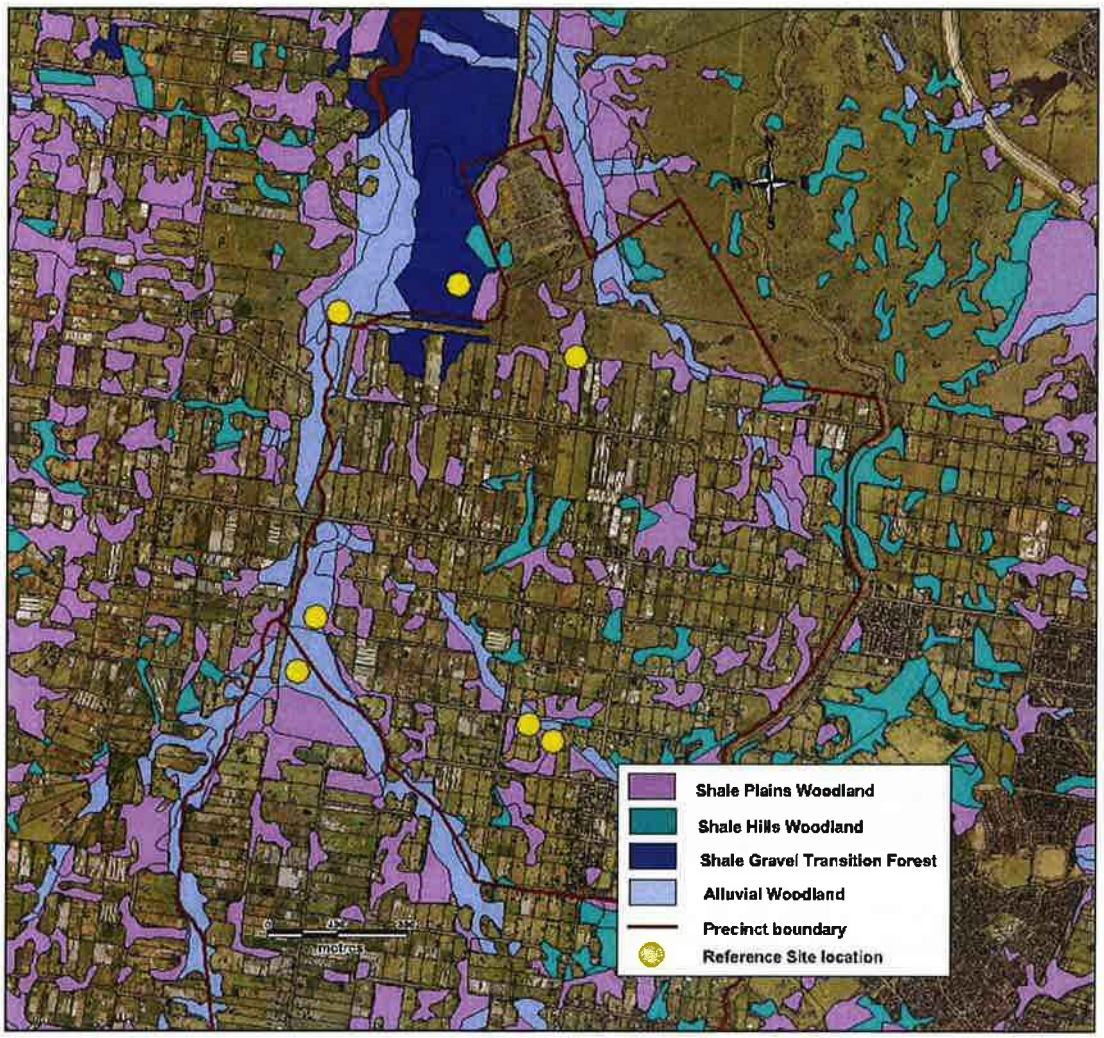

Figure 6.3 Location of Reference Sites

6.3.1 Full Floristic Diversity Field Survey Results

The field survey undertaken within the study site identified 96 flora species across the entire site. The species included 57 native species (i.e. 60%) and 39 exotic species (i.e. 40%). The full list of species recorded in the study site is in **Appendix H**.

The floristic results for the Reference Sites were seen to generally correspond to the characteristic species for the appropriate respective communities. For all three Threatened Ecological Communities present, the Reference Sites corresponded strongly in terms of the over-story, but varied significantly in terms of the understory and groundcover. The different community types (i.e. Alluvial Woodland, Shale Plains Woodland, and Shale Transition Forest) were distinguishable in terms of species composition (a maximum of 51% similarity was observed in terms of species composition between the Shale Plains Woodland and Alluvial Woodland Ecological Communities). The majority of exotic species were present within the ground and shrub layers, while the over-story layers were generally intact and dominated by native species.

A total of 12 species recorded in the study site are listed as noxious weeds, these are:

- *Araujia sericifera* (Moth Plant);
- *Asparagus asparagoides* (Bridal Creeper);
- *Eragrostis curvula* (African Lovegrass);
- *Ligustrum sinense* (Small-leaved Privet);
- *Lycium ferocissimum* (African Boxthorn)
- *Olea europaea* (Olive);
- *Onopordum acanthium* (Scotch Thistle)
- *Opuntia stricta* (Prickly Pear);
- *Senecio madagascariensis* (Fireweed);
- *Sida rhombifolia* (Common Sida)
- *Sonchus spp.* (Milk Thistle); and
- *Tredescantia albiflora* (Wandering Jew).

No threatened species were observed during the floristic diversity surveys.

6.3.2 Reference Site Community Structure Assessment Results

Vegetation communities encompassed by each Reference Site supported at least three community strata. The density and floristic diversity within each strata were influenced by the prevailing land management practices (i.e. biodiversity conservation versus cattle grazing).

Surveys revealed little difference in the structure and composition of vegetation identified by NPWS (2002) as Shale Hills Woodland or Shale Plains Woodland (**Figure 2.2**). Furthermore, elevation mapping done in GIS confirmed no significant elevation differences between the two vegetation communities. Therefore, Shale Hills and Shale Plains

Woodlands were grouped as one category (Shale Plains Woodland) as a Reference Site and this category was used for the Rapid Condition Assessments (i.e. Remote Sites identified as Shale Hills Woodland were compared against the Shale Plains Woodland Reference Site).

Detailed results of the assessments can be found in **Appendix I**.

As per **Table 6.3**, high quality Shale Plains Woodlands are comprised of eucalypt species in the T1 and T2 layers, while the shrub layer (S1) supported eucalypt saplings and *Bursaria spinosa*. The ground layer consists of various grass species and *Pratia purpurascens*. Across the three sites sampled, an average of 47% of species identified were weed species. This indicates that even the Reference Sites (the best habitat areas identified within the site) are disturbed and do not reflect the highest quality Shale Plains Woodland communities.

Table 6.3 Shale Plains Woodland Reference Site benchmark scores

Shale Plains Woodland					
Vegetation Layer	Present/ Absent	% Cover	Species Richness	Dominant Species	Non-Native Cover
T1	P	50%	2	Cm,Ec,Em, Et, Ee	0
T2	P	10%	2	Cm,Ec,Em, Et, Ee	0
Shrub	P	30%	5	Em,Cm, Bs	0
Ground	P	80%	20-25	Grass, Pp, Ta *Dichondra spp.*, *Desmodium spp.*	15%

Cm = *Corymbia maculata* Em = *Eucalyptus moluccana* Ec = *Eucalyptus crebra*
Et = *Eucalyptus tereticornis* Ee = *Eucalyptus eugenioides* Bs = *Bursaria spinosa*
Pp = *Pratia purpurascens* Ta = *Themeda australis*

High quality Alluvial Woodland sites (**Table 6.4**) are predominantly composed of eucalypt and She-oaks in the T1 and T2 layers. The shrub layers are comprised of *Acacia* species, *Melaleuca decora* and *Bursaria spinosa*, while the ground layer supports a variety of grass species. The Alluvial Woodland sites varied significantly in the proportionate contribution of non-native species to species richness (approximately 10% - 60% of species richness was composed of non-native species). The Alluvial Woodland habitat showing just 10% presence of non-native species was located within the Kemps Creek Nature Reserve immediately to the north of the Austral precinct (i.e. within vegetation classified as Higher Long Term Management Viability vegetation under the Growth Centres Conservation Plan (Eco Logical, 2007)).

Table 6.4 Alluvial Woodland Reference Site benchmark scores

Alluvial Woodland					
Vegetation Layer	Present/ Absent	% Cover	Species Richness	Dominant Species	Non-Native Cover
T1	P	50%	3	Em, Ea, Et, Cg	0
T2	P	40%	2	Md, Em, Ea, Et, Cg	0
Shrub	P	20%	4	Md, Bs, *Acacia spp.*	0
Ground	P	90%	15-20	Grass, Ta, Ma	15%

Ea = *Eucalyptus amplifolia* Cg = *Casuarina glauca* Em = *Eucalyptus moluccana*
Et = *Eucalyptus tereticornis* Md = *Melaleuca decora* Bs = *Bursaria spinosa*
Ta = *Themeda australis* Ma = *Microlaena australis*

High quality Shale Transition Forests (**Table 6.5**) are comprised of mostly eucalypts and *Melaleuca* species in the T1 and T2 layers. The shrub layer contains *Dillwynia sieberi*, *Melaleuca decora*, *Bursaria spinosa*, *Daviesia ulicifolia* and Lisanthe species. The ground layer consists of various grasses. Only a single patch of High quality Shale Transition forest was observed within or in close proximity to the study site; a site within the Kemps Creek Nature Reserve to the north of the Austral precinct. In terms of species richness this site had a 15% presence of non-native species.

Table 6.5 Shale Transition Forest Reference Site benchmark scores

Shale Transition Forest					
Vegetation Layer	Present/ Absent	% Cover	Species Richness	Dominant Species	Non-Native Cover
T1	P	40%	2	Em,Ef, Et, Md	0
T2	P	50%	2	Em,Ef, Et, Md	0
Shrub	P	20%	6	Ds,Md, Bs, Du, *Lissanthe spp.*	0
Ground	P	50%	20-25	Grass, Ta, Mss, *Lomandra spp.*,	15%

Ef = *Eucalyptus fibrosa* Em = *Eucalyptus moluccana* Et = *Eucalyptus tereticornis*
Md = *Melaleuca decora* Ds = *Dillwynia sieberi* Bs = *Bursaria spinosa*
Du = *Daviesia ulicifolia* Wg = *Wahlenbergia gracilis* Mss = *Microlaena stipoides var stipoides*
Ta = *Themeda australis*

Tables 6.3 – 6.5 provide details of the average results for the five elements (i.e. presence/absence, percentage cover, species richness, dominant species, non-native cover) assessed within each vegetative layer. These averages were utilised as the benchmarks for comparison for the Remote Site Assessment.

6.3.3 Remote Site Assessment Results

Appendix J contains the full results of the remote site assessment surveys across the 260 vegetation patches present. 151 different vegetation compositions were identified (i.e.

several of the Remote Sites were considered to have the same vegetative composition as other Remote Sites).

In terms of the presence / absence of vegetation layers, it was seen that across all vegetation community types approximately 56% of Remote Sites contained at least some vegetation within all four vegetation layers identified within the Reference Sites. The high proportion of Remote Sites in which a vegetation layer was absent (44%) reflects the agricultural and cleared nature of the area. Predominantly, the T2 and Shrub layers were identified as the absent layers.

In terms of percentage cover, it was found that across all vegetation community types only 2% of Remote Sites had a cover within 10% of the cover at the Reference Sites for all vegetation layers. The majority of sites received a percentage cover score of between 5 and 7.5, indicating a close similarity within one or two layers (typically the T1 layer and ground cover) while diverging in regards to the T2 and Shrub layers.

In terms of species richness, it was found that across all vegetation community types only ten Remote Sites demonstrated the same level of species richness as the Reference Sites and only three Remote Sites had an overall greater species richness than the Reference Sites. Within this species richness, the Dominant Species data indicated that on average the sites shared 5 common dominant species (across all layers (**Tables 6.3 – 6.5**)) with the Reference Sites. All sites were found to share at least 1 dominant species with the relevant Reference Site.

Non-native cover was difficult to assess in the Remote Assessment, particularly for the ground cover which utilised best judgement estimates. However, differences in comparison to the Reference sites were observed through the presence of non-native species in the canopy and shrubs layers which were more readily identifiable. Only 4% of Remote Sites had an equal or lesser cover of non-native species that the Reference Sites. This supports the identification of the Reference Sites as representative of high quality vegetation within the study site.

Combining these five elements (i.e. presence/absence, percentage cover, species richness, dominant species, non-native cover) together provided an overall Site Condition Value for each Remote Site out of 50 (Reference Sites were assigned a score of 50). The highest Site Condition Value of the Remote Sites assessed was 44.36, and the lowest 12.92. The majority of the Remote Sites received a score of at least 25 (65%). Only 5% of Remote Sites were assigned a score greater than 40. Site condition values of the communities assessed provide a critical element in evaluating the communities Functional Conservation Value (**Figure 4.2, Section 6.4.1**).

6.3.4 Fauna Habitat Assessment

The only fauna sampling undertaken during this study was opportunistic sightings during site inspection. No threatened species were observed to occur on site. The following species were observed during the course of the Remote and Reference Site Assessments:

Aves

- Noisy Miner (*Manorina melanocephala*);
- Bell Miner (*Manorina melanophrys*);

- Australian Magpie (*Cracticus tibicen*);
- Laughing Kookaburra (*Dacelo novaeguineae*);
- Galah (*Cacatua roseicapilla*);
- Sulphur Crested Cockatoo (*Cacatua galerita*);
- Yellow-tailed Black Cockatoo (*Calyptorhynchus funereus*);
- Red-rumped Parrot (*Psephotus haematonotus*);
- Magpie-lark (*Grallina cyanoleuca*);
- White-faced Heron (*Ardea novaehollandiae*);
- Torresian Crow (*Corvus orru*);
- Superb Fairy-wren (*Malurus cyaneus*);

Reptilia

- Red-bellied Black Snake (*Pseudechis porphyriacus*);
- Common Garden Skink (*Lampropholis guichenoti*);
- Eastern Water Skink (*Eulamprus quoyii*);
- Bluetongue lizard (*Tiliqua scincoides scincoides*);
- Eastern Water Dragon (*Physignathus lesueurii lesueurii*);
- Lace monitor (*Varanus varius*); and

Mammalia

- Fox (*Vulpes vulpes*).

In addition to the opportunistic sightings, a fauna habitat assessment was undertaken. The full results of the habitat assessment are provided in **Appendix K**.

Across all seven Reference Sites (**Figure 6.3**) assessed for fauna habitat, habitat features recorded included, 2 hollow bearing trees, 17 fallen logs, 9 hollow stumps, 1 digging (most likely rabbit), 10 scats, 2 tree hollows at the base of trees, and 1 Eastern Dwarf Tree Frog (*Littoria fallax*) call.

The single Shale Transition Forest Reference Site (within the Kemps Creek Nature Reserve) had the most number of fauna habitat features recorded with 2 hollow bearing trees, 3 fallen logs, 4 hollow stumps, and 4 varieties of scat (most likely including Brushtail Possum (*Trichosaurus vulpecula*), rabbit spp. and wallaby spp.).

6.3.5 Threatened Flora Survey Results

Condition 17 of the Relevant Biodiversity Measures for the Biodiversity Certification for the South West Growth Centres requires that potential populations of *Acacia pubescens* are

surveyed at Thirty-Second Avenue, Austral (**Figure 6.4**). A targeted survey was conducted to confirm and record the presence of this species and determine its habitat quality.

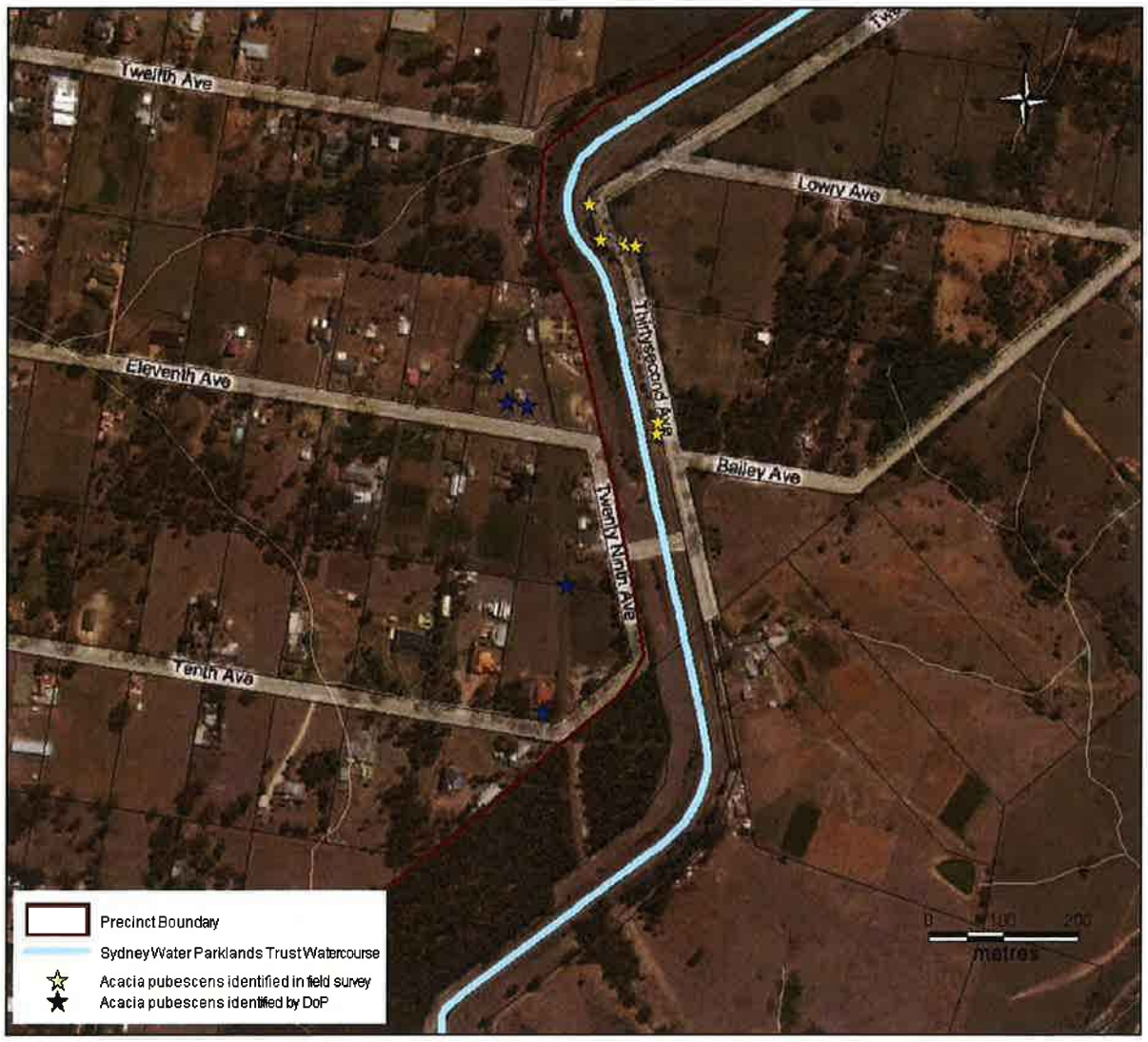

Figure 6.4 *Acacia pubescens* field survey results

During the field survey, six individual *Acacia pubescens* specimens were recorded (see **Figure 6.4**). The shrubs were located in a highly disturbed area adjacent to Thirty-Second Avenue in Austral. Four of the shrubs were situated alongside the Sydney Catchment Authority Upper Canal, and two shrubs were located on neighbouring farmland. The land surrounding the canal and the farmland were both cleared of much of the vegetation apart from other shrubs growing alongside the *Acacia pubescens*. Further details of the investigations into *Acacia pubescens* have been provided in a separate report.

As shown in **Figure 6.4**, the land surrounding the *Acacia pubescens* populations previously identified by the DoP, is also markedly disturbed and cleared of most vegetation.

No other threatened flora species were observed during any of the field work undertaken during the site assessment.

6.4 Results of Ecological Value Assessment

The Ecological Value ascribed to all 260 sites was determined through the cumulative sum of three components (**Section 4.5**):

- Functional Conservation Value;
- Threatened Status Value; and
- Recovery Potential Value.

Appendix N provides the full results of the Ecological Value assessment.

6.4.1 Functional Conservation Value

The Functional Conservation Value was composed of the Site Condition Value (**Section 6.3.3)** as well as estimations of the geospatial character (i.e. patch size and perimeter / area ratio) and connectivity of the Remote and Reference Sites (**Section 4.5.1**). Combined, these elements provided a score out of 150 for each Remote and Reference Site.

Of the 260 individual communities, only 24% of sites were found to have Functional Conservation Values of over 100. The majority of these sites were those associated with Kemps Creek due to:

- Larger patch sizes;
- The undeveloped / undisturbed nature of the riparian vegetation; and
- The continuity of vegetated areas along the creek line.

The majority of the Remote Sites scored between 50 and 100 (68%) with only 7% scoring less than 50. The majority of sites scoring less than 50 consisted of communities with small patch areas and were typically isolated pockets of roadside vegetation.

6.4.2 Threatened Status Value

The assessment of Threatened Status Value (**Section 4.5.2**) incorporated the known presence of the threatened species of flora or fauna, the Functional Conservation Value (**Section 6.4.1**), a threatened species likelihood of occurrence assessment and the specific habitat type of the vegetation patch in question. The decision matrix utilised to assign value is provided in **Section 4.5.2**.

Of the 260 distinct vegetation communities assessed, only 6 received the highest rating. The majority of sites (65%) received a mid range score, reflecting the number of threatened species known to occur within the study site and the generally low-medium Functional Conservation Values (**Section 6.4.1**).

6.4.3 Recovery Potential Value

The assessment of Recovery Potential (**Section 4.5.3**) was based upon the known land use and condition within the vegetation community of interest, its connectivity to surrounding vegetation, and the presence of saplings and weeds within the community. A decision matrix

(**Section 4.5.3**) was utilised to assign each patch a score from 1 – 6 (scaled to 25 – 150 for equal weighting with the Threatened Status Value and Functional Conservation Value).

Only 2 of the 260 identified vegetation communities were assigned a value of 150, with a further 23 scoring 125. Approximately 30% of the vegetation communities assessed received values of 50 or less (i.e. the lowest two scores within the decision matrix), and in one case, a vegetation community was assigned a score of zero reflecting that the vegetation community was identified to be on a site of an electrical easement which is regularly cleared for operational reasons. Due to the systematic clearing of vegetation, the recovery potential of this site is considered to be nil.

6.4.4 Total Ecological Value

Combining these three (**Section 6.4.1** – **Section 6.4.3**) elements together provided a Total Ecological Value score out of 450 for each of the 260 identified vegetation communities (**Appendix N**). To allow ease of comparison, vegetation communities with a score greater than or equal to 300 were classified as "High Quality", while communities with a score greater than or equal to 150 but less than 300 were classified as "Medium Quality". Vegetation communities with a score less than 150 were classified as "Low Quality".

The number of vegetation communities with Total Ecological Values of High, Medium and Low, and the total area of these classifications are as follows:

Total Ecological Value	Number of patches	% of Patches	Total Area (Ha)	% of Area
High	57	22%	332.99	51.08%
Medium	195	75%	315.21	48.35%
Low	8	3%	3.72	0.57%
TOTAL	**260**	**100%**	**651.92**	**100%**

It is considered that communities classified as having a High total ecological value should be conserved where possible as they represent the most valuable communities within the local region and they may be able to contribute toward the 2000 ha of ENV that is to be protected as one of the conditions for Biodiversity Certification. (**Figure 6.5** shows the distribution of high, medium and low quality vegetation in the Austral and Leppington North precincts). Medium Quality communities are considered to form an important part of the local ecosystem which, with appropriate management, can provide valuable natural habitat and social recreation opportunities (particularly where large areas of Medium Quality vegetation are in close proximity to each other). Low Quality communities are considered to be severely degraded through clearing, disturbance or isolation. Such communities are considered to contribute little benefit to the overall ecological value of the area.

The abundance of communities with a Medium total ecological value reflects the partial degradation of vegetation observed in site inspections whereby agricultural grazing and clearing of the shrub and ground cover has diminished the ecological value of the vegetation, while the canopy layer has remained largely intact.

6.5 Vegetation Mapping

The distribution of the vegetation community classes (i.e. High, Medium or Low Quality total ecological value) across the precincts was mapped in GIS and is shown in **Figure 6.5**.

The majority of high ecological value vegetation occurs within the riparian corridors associated with Kemps Creek and its tributaries (*c.f.* **Figure 2.1**). **Figure 6.5** indicates that the majority of high ecological value vegetation also falls within non-certified land (**Section 1.2**). Any clearance of land within these areas would require further assessment.

Figure 6.5 also shows low ecological value vegetation present is typically comprised of small, isolated areas of vegetation with little connectivity, particularly within the Leppington North Precinct.

Figure 6.6 shows all vegetation ground truthed by Cardno as well as vegetation identified as ENV by Cardno (c.f. **Figure 4.4**).

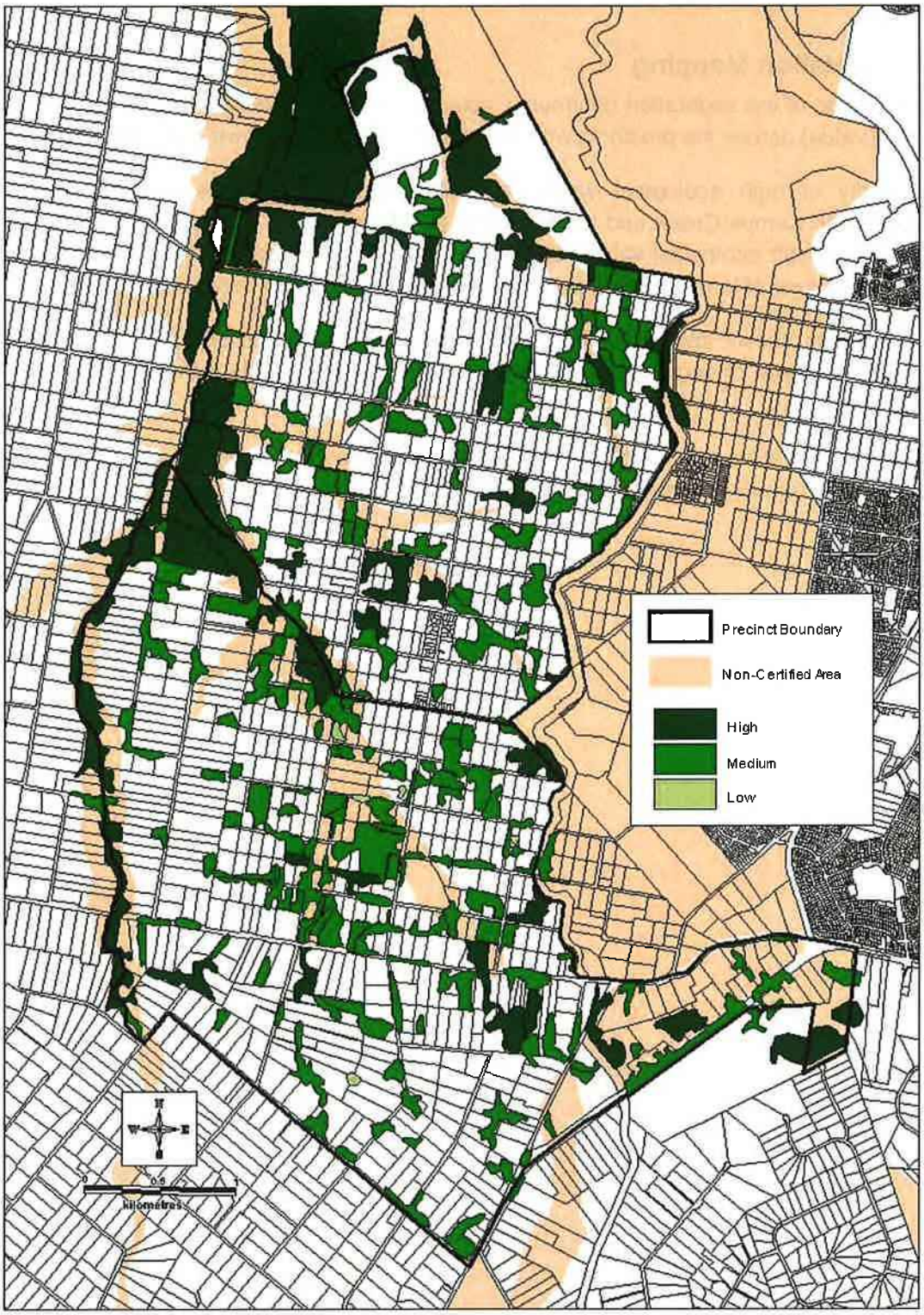

Figure 6.5 Ground truthed (Cardno, 2010, 2012) vegetation results showing communities with high, medium and low total ecological value vegetation quality results within the study site within certified and non-certified areas.

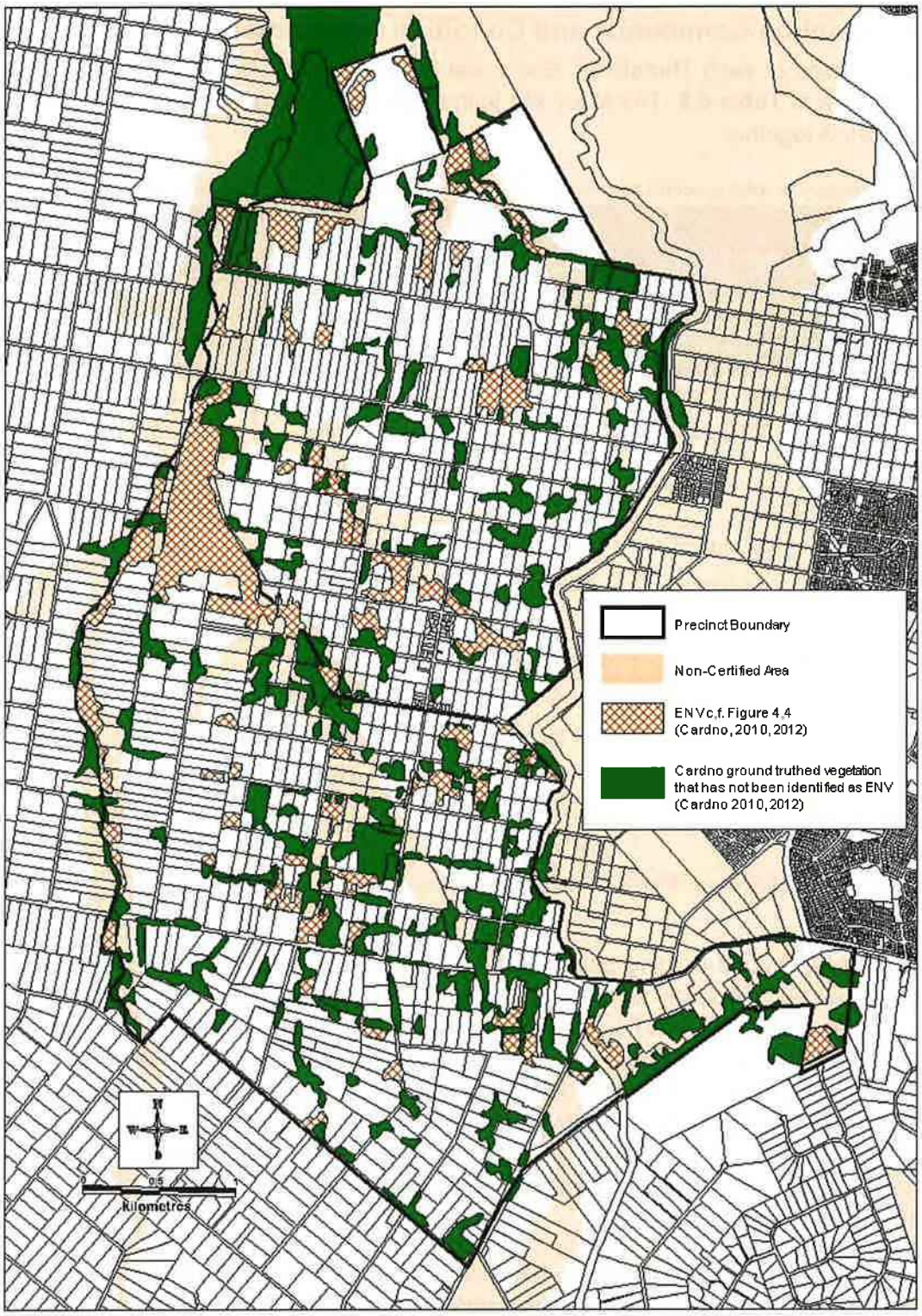

Figure 6.6 All Cardno ground truthed vegetation showing ENV and non ENV.

6.6 Vegetation Community and Condition Assessment

Area calculations of each Threatened Ecological Community type within the study site are provided below in **Table 6.6**. The study site is the total land area of Austral and Leppington North precincts together.

Table 6.6 Summary of total precinct area occupied by Threatened Ecological Communities

Community	Condition Code as defined by NPWS	Total Hectares as defined by NPWS	% of Study site as defined by NPWS	Field Survey Vegetation Quality (Ecological Value) Results	Total Hectares	% of Study site
Shale Plains Woodland	ABC (good)		6.4	Low	0.91	0.04
	TX (poor)	250.47	12.3	Medium	267.85	13.21
				High	113.06	5.57
Total		381.11	**18.7**	**Total**	**381.8**	**18.8**
Alluvial Woodland	ABC (good)	114.43	5.6	Low	2.81	0.14
	TX (poor)	52.74	2.6	Medium	38.24	1.89
				High	82.46	4.07
Total		167.17	**8.2**	**Total**	**123.5**	**6.1**
Shale/Gravel Transition Forest	ABC (good)	10.46	0.52	Low	0.00	0.00
	TX (poor)	0.00	0	Medium	0.00	0.00
				High	3.38	0.17
Total		10.46	**0.52**	**Total**	**3.4**	**0.2**
Total		**558.75**	**27.42**		**508.7**	**25.1**

Refer to **Section 2.2.5.1 for explanation of condition codes assigned.

The field survey ground truthing undertaken for this study and the NPWS (2002a) survey both show that approximately 25% of the study site supports an EEC under the *TSC Act*. The field survey results indicate only a small percentage (in terms of total EEC area) of the EECs are of low quality (0.73%) and the majority of the EECs are comprised of medium quality vegetation (approximately 60.17%) and high quality vegetation (approximately 39.10%). This differs from the percentage distribution of classes by number of communities (e.g. 3% of communities are of Low Quality (**Section 6.4.4**)). This difference reflects the tendency for High Quality vegetation to have larger patch areas, and Low Quality vegetation to have smaller patch areas.

Additionally, there was a difference in identification of Shale/Gravel Transition Forest areas and Shale Plains Woodland areas. The NPWS (2002) survey identified approximately 7.08ha more of the Shale/Gravel Transition Forest than the ground truthing survey. This has been attributed to contradictory identification of an area of EEC in the northwest corner of Austral (**Figure 6.7**) The ground truthing survey has identified this area as Shale Plain Woodland, while the NPWS survey identified it as Shale/Gravel Transition Forest.

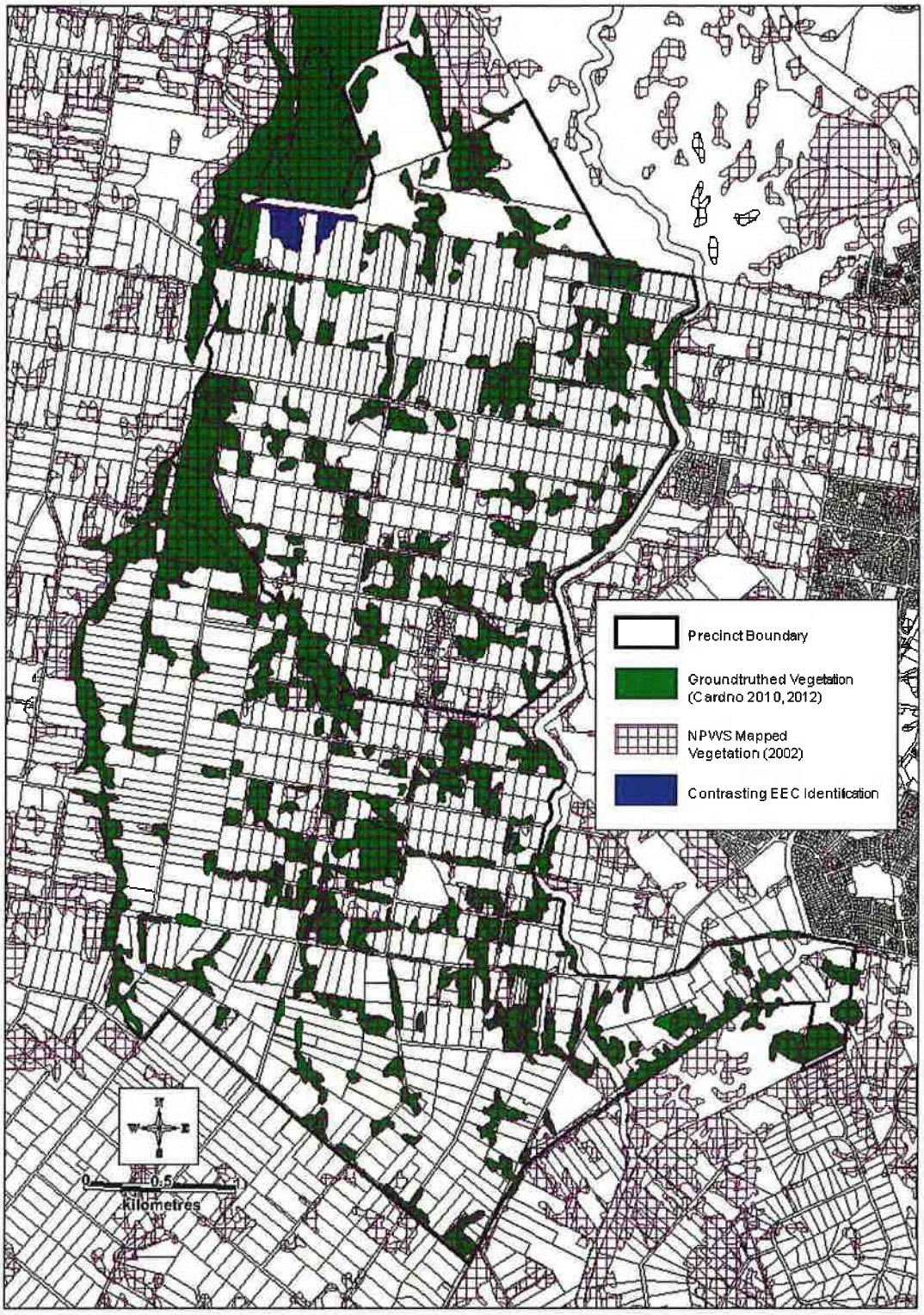

Figure 6.7 Comparison of ground truthed vegetation extents with NWPS extents, showing contrasting EEC types.

Table 6.7 reports the area composition of the various EECs within the Biodiversity Certified areas of the precincts. In comparison to the results of **Table 6.6**, which covers the entire Precinct area, it can be seen there is a significant reduction in the amount of High Ecological Value Vegetation and a corresponding increase in the proportion of Medium Ecological Value Vegetation. The amount of Alluvial Woodland within Biodiversity Certified Land is minimal.

Table 6.7 Summary of area occupied by EECs and their condition within Certified Land

Community	Field Survey Vegetation Quality (Ecological Value) Results	Total Hectares Within Certified Areas	% of Study Site (the total land area of Austral and Leppington North precincts).
Shale Plains Woodland	Low	0.90	0.04
	Medium	222.14	10.95
	High	66.56	3.28
	Total	**289.60**	**14.27**
Alluvial Woodland	Low	1.20	0.06
	Medium	10.75	0.53
	High	8.34	0.41
	Total	**20.29**	**1.00**
Shale/Gravel Transition Forest	Low	0.00	0.00
	Medium	0.00	0.00
	High	1.36	0.07
	Total	**1.36**	**0.07**
	Total	**311.25**	**15.3**

The results also show that the most dominant EEC within the certified land area is the Shale Plains Woodland type, making up approximately 14% of the study site (**Table 6.7**). The Shale Plains Woodland communities also comprise the highest percentage of high quality areas within certified land areas covering approximately 3.28% (66.56ha) of the study site. Shale/Gravel Transition Forest communities are sparsely located on certified land and only make up a small percentage of the study site with approximately 0.07% (**Table 6.7**).

6.6.1 Consistency of Existing Native Vegetation

A comparison of the native vegetation, on non-certified land, mapped by Cardno in 2010 and 2012 during the ground truthing survey (**Section 4.2**) to ENV (as identified by DoPI 2011[2]) on non-certified land, shows a difference between the data sources. Discrepancies are largely attributed to the fact that vegetation is known to have been cleared since Cardno's groundtruthing in 2010 which DoPI has mapped in their annual vegetation reporting, and the

[2] ENV as defined by the RBMs means areas of indigenous trees (including any sapling) that:
(a) has 10% or greater over-storey canopy cover present;
(b) is equal to or greater than 0.5 ha in area; and
(c) is identified as "vegetation" on maps 4 and 5 of the draft *Growth Centres Conservation Plan*

granting of approval to clear vegetation during construction of the SWRL. These known vegetation changes have been accounted for in Cardno's ground truthed ENV mapping, and the calculations presented in this report. The results from the ground truthing survey found approximately 120.71ha of native vegetation on non-certified land which meets the ecological criteria for ENV[3], while the ENV on non-certified land shown in the draft *Growth Centres Conservation Plan* (revised following Cardno Ground Truthing) displays approximately 101.58ha of ENV (**Table 6.8**). The ground truthing survey recorded a 43.58ha increase of native vegetation, of which 19.13ha is on non-certified land, which has been termed "Additional High Conservation Value Vegetation" or AHCVV (**Figure 6.8**). Whilst AHCVV meets the ecological criteria for ENV, these additional areas are not eligible to be counted toward the 2000 ha of ENV that is to be protected because one of the conditions for Biodiversity Certification is that areas must be identified in the draft *Growth Centres Conservation Plan*.

Table 6.8 Comparison of Native Vegetation identified in the ground truthing field survey and ENV identified in the draft *Growth Centres Conservation Plan*.

ENV on non-certified land as identified in the RBMs (Reduced following Cardno Ground Truthing)	Ground Truthing Field Survey of native vegetation which meets the ecological criteria for ENV on non-certified land	AHCVV on non-certified land	Areas previously identified as ENV which field survey identified as non-ENV within non-certified land
101.6ha	120.7ha	19.1ha	16.5ha
22.0% of non-certified land	**26.2%** of non-certified land	**4.2%** of non-certified land	**3.6%** of non-certified land

Figure 6.9 shows areas of vegetation identified as ENV in the draft *Growth Centres Conservation Plan* that the ground truthing survey found not to be ENV within certified land.

The differences between ground truth mapping and the ENV identified in the RBMs are considered to be principally due to the following reasons:

- Differences in survey methodologies: To support this report, Cardno ecologists conducted on-site field surveys to estimate canopy cover and ground-truthing of vegetation extents to verify patch size, whereas the ENV survey provided by DoPI is primarily based on remote aerial imaging.
- Access to subject sites was not always possible during the ground truthing, with the result that some of the ground truth mapping was conducted remotely as described in **Section 4.3.** This means that the accuracy with which each parcel of land can be mapped was partly dependent on the view which could be obtained in the field at the time of mapping.
- Due to the requirement for vegetation to be a minimum path size of 0.5ha in order to be classified as ENV, the exact location of a patch boundary can influence whether or not vegetation is classified as ENV. In particular, in the case where patches of vegetation are in close proximity, mapping them as two discrete patches could mean that the vegetation does not meet the definition of ENV, whereas mapping them as one larger patch may lead to a combined area >0.5 ha, and classification as ENV.

[3] Ecological criteria for ENV only needs to meet criteria (a) and (b) of the RBMs definition of ENV and does not need to be identified on maps 4 and 5 of the draft *Growth Centres Conservation Plan*.

In general the field survey results are considered to be relatively consistent with the aerial maps of ENV. It is noted that any inaccuaracy in boundaries of vegetation which is not classified as ENV will not affect the results or conclusions of the report, since only land meeting the definition of ENV is used when calculating the area of ENV which will be protected within the precincts.

The conditions of Biodiversity Certification Order require that a total of 107.14ha of ENV be protected. This comprises:

- 48ha of ENV be protected in Austral;
- 52ha in Leppington North; and
- 7.14ha in investigation areas (details of investigations areas can be found in **Section 1.1**).

Ground truthing indicates that the actual area of ENV in non-certified lands is 101.58ha. This has incorporated the 0.52ha of ENV on non-certified land known to be impacted by the approved South West Rail Link (SWRL). The SWRL development would offset the amount of non-certified ENV that would be impacted, and therefore, the amount of ENV within the Precincts that requires protection under the Biodiversity Certification Order has been reduced by 0.52ha. This results in a revised total of 106.62ha of ENV requiring protection under the Biodiversity Certification Order.

Any development of land within the area of the non-certified ENV communities would be required to comply with the relevant provisions of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and the *Threatened Species Conservation Act 1995* (TSC Act).

The Austral and Leppington North Precinct Plan proposes the protection of 116.62ha of ENV within both Precincts. This is 10.00ha more than is required to be protected by the Biodiversity Certification Order.

It is proposed that the boundaries of the non-certified areas are changed (refer to Annex E in **Appendix M**), mostly based on the 1:100 year floodline, and to ensure that vegetation to be protected outside floodprone land is also on non-certified land. Under the proposed new boundary lines, the ground truthing indicates the area of ENV in non-certified areas would be approximately 116.62ha. This is 10.00ha more than is required to be protected by the Biodiversity Certification Order (Annex C in **Appendix M**).

Table 6.9 presents the results of the Biodiversity Conservation Assessment for the currently proposed non-certified land boundaries under the final Precinct Plan.

	Key Statistics	Data source / comment	Area of ENV (ha)
A	ENV required by the Biodiversity Certification Order to be protected within Austral and Leppington North Precincts and investigation areas prior to the impact from the SWRL	48ha in Austral, 52ha in Leppington North, and 7.14ha in Investigation Areas	107.14ha
B	Approved Impacts on ENV by SWRL in non-certified areas	Calculated from Cardno's ground truthed	0.52ha

	Key Statistics	Data source / comment	Area of ENV (ha)
		ENV (Figure 4.4) and maps provided	
C	ENV required by the Biodiversity Certification to be protected within Austral and Leppington North Precincts and investigation areas	Requirement of Biodiversity Conservation Order =A-B	106.62ha
D	ENV which is currently in non-certified areas which will become certified following the proposed certified land boundary changes	Calculated from Cardno's ground truthed ENV (Figure 4.4), current and proposed non-certified area (Appendix M Annex E)	4.03ha
E	ENV which is currently in certified areas which will become non-certified following the proposed certified land boundary changes	Calculated from Cardno's ground truthed ENV (Figure 4.4), current and proposed non-certified area (Appendix M Annex E)	22.48ha
F	Total ENV protected within Austral and Leppington North precincts under the Proposed Non-Certified Land Boundaries	Calculated from Cardno's ground truthed ENV (Figure 4.4), and proposed non-certified area (Appendix M Annex E)	116.62ha
G	**Total ENV to be protected beyond the Biodiversity Certification Order requirement**	**=F-C**	**10.00ha**

It is recommended that non-certified ENV areas are avoided for any development proposals and that non-certified areas recorded as ENV (as mapped in both the draft *Growth Centres Conservation Plan* and identified during the ground truthing surveys) are retained to the greatest extent practical.

Consideration should also be given to the potential to utilise the quantity of ENV identified on site as offset areas for removal of other communities within ENV elsewhere within the Sydney Growth Centres area in accordance with the issued Biodiversity Certification and RBMs.

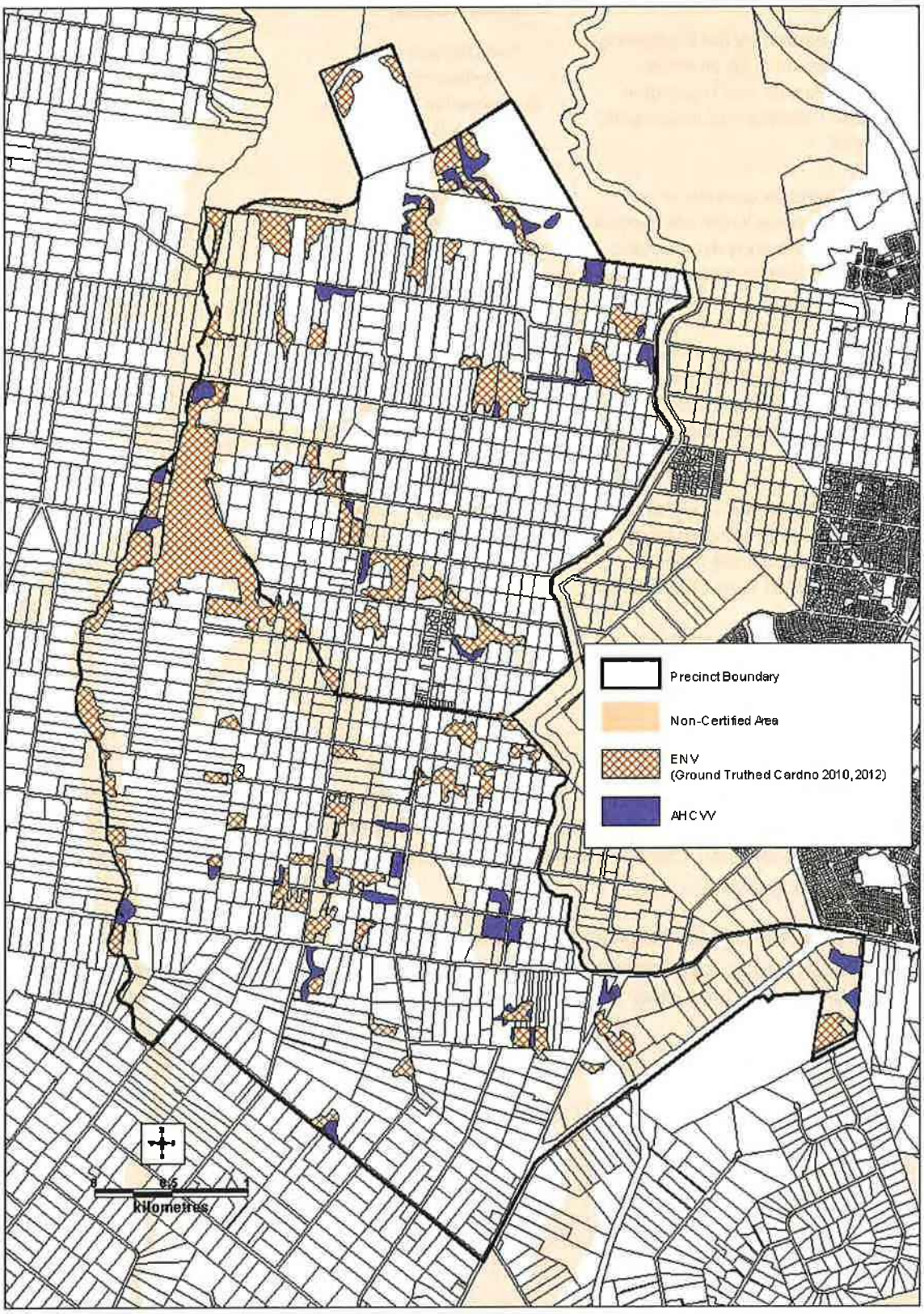

Figure 6.8 Vegetation ground truthed (Cardno, 2010 2012) which meet the ecological criteria for ENV, termed "Additional High Conservation Value Vegetation" (AHCVV)

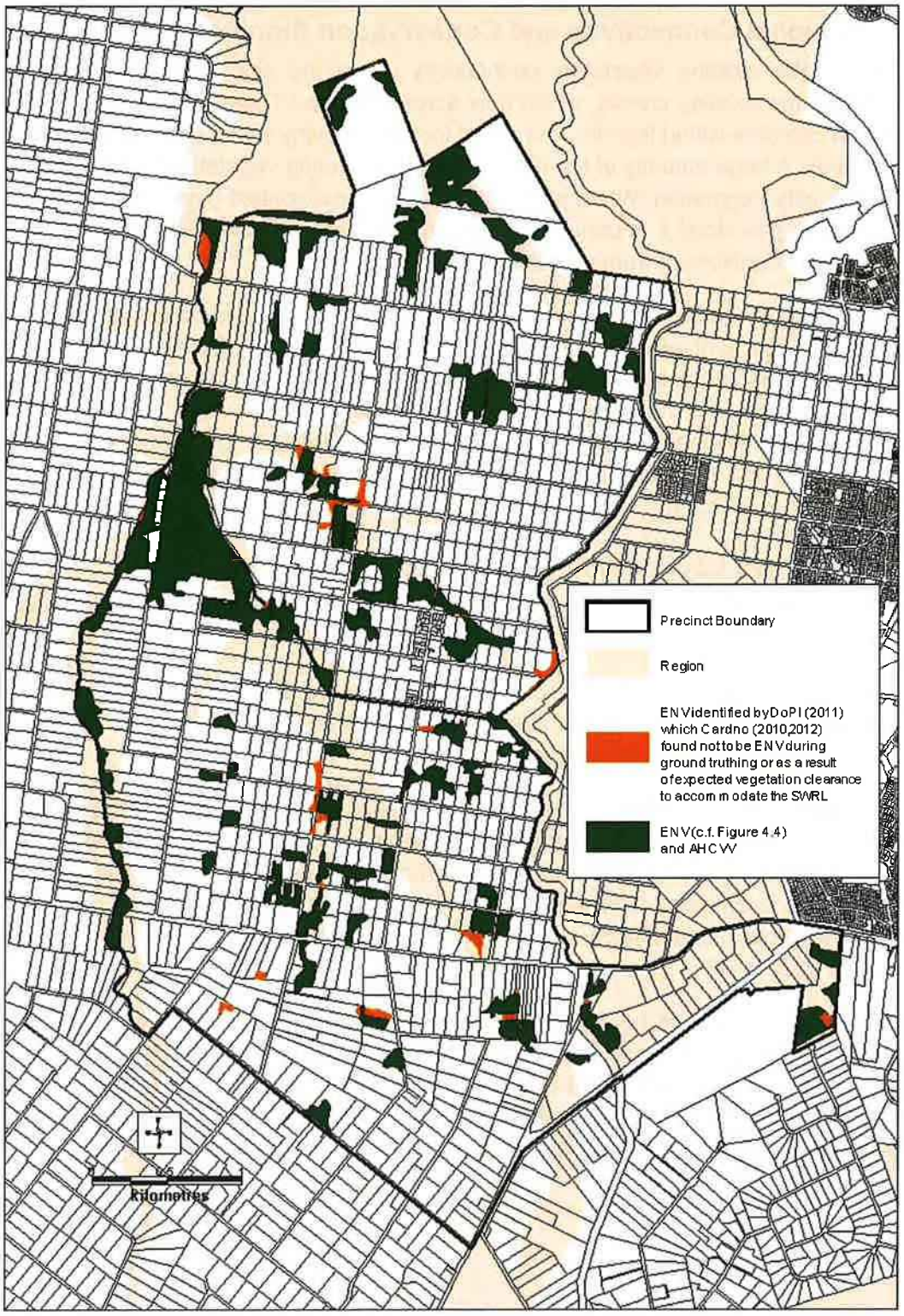

Figure 6.9 ENV identified by DoPI which Cardno identified not to be ENV following the ground truth survey (Cardno, 2010, 2012), or as a result of expected vegetation clearance to accommodate the SWRL.

6.7 Regional Connectivity and Conservation Significance

In general, the existing vegetative connectivity within the site is provided through the alignment of the existing creeks, which flow across the site. There are no other continuous vegetation corridors within the site. It is noted that, particularly within Leppington North along Bonds Creek, a large quantity of the riparian and surrounding vegetation has been classified Medium Quality Vegetation. When placed within a regional context (i.e. connectivity to areas outside of the precincts) it is considered that these Medium Quality Vegetation areas may take on higher significance from an ecological point of view.

It should also be recognised that a significant amount of revegetation work has been undertaken to the northeast of the study site, within the Western Sydney Parklands, which may provide valuable habitat connectivity into the future. Similarly, the existing Kemps Creek Nature Reserve in the northwest corner of the study site provides the highest quality vegetation within the region and has some existing connectivity to vegetation communities within the study site (**Figure 6.5**). It is considered that these connections are of high value and should be conserved.

6.8 Indicative Layout Plan Consistency Assessment

The ILP, in its current form, will conform to the Biodiversity Certification Order through the retention of the vegetation within the non-certified areas.

The Precinct Plan proposes new certified land boundaries and other mechanisms that will protect a total of 116.62ha of ENV over both Precincts and the investigation areas. This is 10.00ha more than required by the Biodiversity Order.

In comparison to the original ENV mapping provided by OEH and shown in the draft *Growth Centres Conservation Plan*, the ground truthing survey recorded a 43.58ha increase of native vegetation, of which 19.13ha is in currently non-certified areas. The extra native vegetation has been termed "Additional High Conservation Value Vegetation" or AHCVV as it meets the ecological definition of ENV (i.e. a greater than 0.5 patch area, and a canopy cover of at least 10%).

The total ENV required to be protected by the Biodiversity Certification within Austral and Leppington North Precincts is 106.62ha. Under the proposed non-certified land boundary lines (Annex E of **Appendix M**), the ground truthing indicates the area of ENV in the non-certified areas is approximately 116.62ha. This is 10.00ha more than is required to be protected by the Biodiversity Certification Order (Annex C in **Appendix M**).

7 Results – Aquatic Habitats

7.1 Literature and Database Searches

The literature and database searches undertaken identified a range of fish species as likely or known to occur within the site. A list of these species is provided in **Table 7.1**. Only two threatened fish species, five threatened amphibian species, two insects and one plant species were considered as potentially occurring on site.

Table 7.1 Aquatic species list of species likely or known to occur on-site

Species Name	Common Name	*EPBC Act 2000 Classification*	*TSC Act 1995 Classification*
Fish			
Mordacia mordax	Shortheaded lamprey		
Anguilla australis	Shortfinned eel		
Anguilla reinhardtii	Longfinned eel		
Potamalosa richmondia	Freshwater herring		
Galaxias maculatus	Common jollytail		
Retropinna semoni	Australian smelt		
Prototroctes maraena	Australian grayling	Vulnerable	Protected***
Carassius auratus	Goldfish*		
Cyprinus carpio	Common carp*		
Tandanus tandanus	Freshwater catfish**		
Gambusia holbrooki	Mosquito fish*		
Psuedomugil signifer	Pacific blue-eye		
Notesthes robusta	Bullrout		
Ambassis agassizii	Olive perchlet**		
Macquaria australasica	Macquarie perch	Endangered	Vulnerable
Macquaria novemaculeata	Australian bass		
Myxus petardi	Freshwater mullet		
Mugil cephalus	Sea mullet		
Philypnodon grandiceps	Flathead gudgeon		
Philypnodon sp.	Dwarf flathead gudgeon		
Gobiomorphus coxii	Cox's gudgeon		
Gobiomorphus australis	Striped gudgeon		
Hypseleotris compressa	Empire gudgeon		
Hypseleotris galii	Firetailed gudgeon		
Hypseleotris klunzingeri.	Western carp gudgeon**		
Macrophytes			
Typha orientalis	Cumbungi		
Phragmites australis	Common reed		
Persicaria elatior	Tall knotweed	Vulnerable	Vulnerable
Amphibians			
Crinia signifera	Common eastern froglet		
Limnodynastes tasmaniensis	Spotted marsh frog		
Limnodynastes peronii	Stripped marsh frog		
Litoria verreauxi	Verreaux's tree frog		
Litoria fallax	Dwarf tree frog		

Species Name	Common Name	*EPBC Act 2000 Classification*	*TSC Act 1995 Classification*
Heleioporus australicus	Giant burrowing frog	Vulnerable	Vulnerable
Litoria aurea	Green and Golden bell frog	Vulnerable	Endangered
Litoria raniformis	Growling grass frog	Vulnerable	Vulnerable
Litoria littlejohni	Heath frog	Vulnerable	Vulnerable
Mixophyes balbus	Stuttering frog	Vulnerable	Endangered
Mixophyes iteratus	Giant barred frog	Endangered	Endangered
Pseudophryne australis	Red-crowned toadlet		Vulnerable
Insects			
Austrocordulia leonardi	Sydney hawk dragonfly		Endangered***
Archaeophya adamsi	Adam's emerald dragonfly		Endangered***

* = introduced species, ** = translocated native species outside of its natural range , *** = vulnerable species under the FM Act 1994.

It is considered unlikely that all the threatened species listed in **Table 7.1** would occur in the site, either due to a lack of suitable habitat or the highly modified nature of their preferred habitat. From the Hawkesbury River upstream to South Creek and eventually to Kemps Creek and Bonds Creek the composition of fish assemblages is likely to change, due to differences in habitat, species interactions, physical tolerances, the presence of barriers to passage and localised disturbance. In particular, with regard to the two threatened fish species identified as potentially occurring (i.e. Macquarie Perch and Australian Grayling) it is considered that the study site is outside of the current known distribution of these species.

7.2 Aquatic Habitat Assessment

Kemps Creek is nominally the major waterway within the Study Area and flows from south to north along the western boundaries of the Austral and Leppington North precincts, with a number of additional tributaries (including Bonds Creek, Scalabrini Creek and a number of unnamed waterways (**Figure 5.1**) providing aquatic habitat. It is noted that Kemps Creek continues in a northerly direction outside the study area and has been artificially impounded just upstream of its confluence with South Creek. This large earth embankment represents a considerable barrier to flows and fish passage. South Creek continues to the north and eventually discharges into the Hawkesbury River just downstream of Windsor.

In general the watercourses present were found to be significantly degraded and their riparian zones were narrow and fragmented or absent. The channel banks were frequently steep, unstable and held together by pasture grasses. The channel beds lacked complex structure and were composed primarily of fine silts and clay. Submerged large woody debris, an important fish habitat, was scarce. The watercourses were dominated by long pool sections while little natural riffle habitat was observed. In addition to the lack of natural habitat, many instream barriers were identified as modifying the natural flow regime within the study site (e.g. inappropriate road crossings, fences and car bodies) and reducing the aquatic habitat value of the site.

Table 7.2 summarises the results of the "Riparian, Channel and Environmental Inventory" (RCE) score assessment (**Section 5.5.1**) as well as the SIGNAL habitat condition results (**Section 5.4**) for each of the 13 study sites assessed (**Figure 5.1**).

Table 7.2 Habit Assessment Scores

Site	Easting	Northing	Waterway	RCE Score*	Avg SIGNAL Fish Habitat Score**
1	0298132	6241075	Bonds Creek	25	3.4
2	0298573	6240189	Bonds Creek	23	-
3	0296968	6241237	Scalabrini Creek	26	3.0
4	0295719	6241505	Kemps Creek	24	3.4
5	0295662	6243569	Kemps Creek	29	3.5
6	0297594	6241941	Bonds Creek	21	-
7	0297296	6242516	Bonds Creek	21	2.7
8	0296937	6243217	Bonds Creek	21	-
9	0297825	6243549	Unnamed	19	-
10	0297280	6243961	Unnamed	19	-
11	0296402	6243943	Bonds Creek	20	2.4
12	0296262	6245662	Kemps Creek	27	3.2
13	0298552	6245602	Unnamed	17	-

*RCE scores range can from 13 (a heavily disturbed stream with no riparian vegetation) to 52 (a stream with no obvious physical disruption).
SIGNAL scores less than four signify the presence of macroinvertebrate assemblages (Section 7.5**) typical of severely polluted or disturbed habitats. SIGNAL scores were only able to be calculated at sites amenable to macroinvertebrate sampling (Table 5.2).

None of the creeks present on site recorded RCE scores greater than 30 or SIGNAL scores greater than four, indicating a consistently low quality of habitat across all creeks. The habitat characteristics of the major creeks sampled (**Figure 5.1**) are as follows:

- **Kemps Creek** (Site 4,5, and 12) - The riparian habitat present was relatively narrow and completeness varied amongst sites. Riparian vegetation was composed of young Casuarina trees and pasture grasses. The channel banks were frequently steep, unstable and erosion was common. The channel substratum was composed primarily of clay and silt and was relatively featureless. Barriers to upstream passage were observed at Sites 5 (dumped car bodies and corrugated iron) and 12 (steep drop downstream of the Gurner Avenue road crossing). It is considered that the potential fish habitat within Kemps Creek is of moderate quality.
- **Bonds Creek** (Sites 1,2,6,7,8 and 11) - The Bonds Creek waterway was found to be highly degraded. Riparian habitat was either absent or narrow and incomplete, and was composed of planted Casuarina trees and pasture grasses. Channel banks were generally steep and unstable and erosion was common. Although nominally a tributary of Kemps Creek, Bonds Creek was considerably wider and often deeper

than Kemps Creek. The channel substratum was similar to that of Kemps Creek being composed primarily of clay and silt and relatively featureless. Bonds Creek contained moderate to minimal fish habitat with barriers to upstream passage including road crossings, fences and shallow channel sections choked by dense cumbungi beds.

- **Scalabrini Creek** (Site 3) - Riparian vegetation was composed of Casuarina trees and pasture grasses. Channel banks were undercut and pasture grasses had colonised the shallow sections of the channel downstream of the Bringelly Road, indicating that this section of channel probably flows intermittently. The creek provides minimal fish habitat and the pools present were either choked with cumbungi or were featureless with little woody debris. The channel immediately downstream of the road crossing was very shallow and would probably represent a barrier to fish passage for a range of flow conditions.

- **Unnamed Watercourse** (Sites 9 and 10) - The unnamed watercourse surveyed at Sites 9 and 10 joins Kemps Creek just downstream of its confluence with Bonds Creek (**Figure 5.1**). The watercourse was ephemeral and had negligible flow despite significant recent rainfall in the catchment at the time of site inspection. The channel was relatively indistinct and is colonised by pasture grasses. There was not enough aquatic habitat to sample for macroinvertebrates and the waterway was considered unlikely to be fish habitat.

- **Unnamed Watercourse** (Site 13) - The unnamed watercourse surveyed at Site 13 (**Figure 5.1**) joins Kemps Creek channel to the north of the site. The watercourse was ephemeral and had negligible flow. There was no riparian habitat. The channel had been straightened and extensively modified for local drainage and flood mitigation. Pooling water was observed to have accumulated in depressions either side of a culvert at the Eighteenth Avenue road crossing. These ephemeral pools supported small stands of cumbungi and pasture grasses.

These findings are consistent with those of previous aquatic habitat assessments done within the local area. Bioanalysis (2003) inspected a number of study sites within in the South West Growth Centre and noted the following:

- Catchments within this area were highly degraded as a result of intensive agriculture and poor land use practices;

- The riparian zones along many of the creeks were highly degraded; and

- The flow along some of the creeks was disrupted by road crossings, culverts and other structures, all of which hinder fish passage.

Two of the sites inspected under the Bioanalysis (2003) study are of particular interest, as they were located on two of the major watercourses that flow through the both Austral and Leppington North precincts. Bioanalysis noted that within Austral, significant quantities of emergent aquatic vegetation were observed along the channel of Bonds Creek. At Leppington North, the aquatic habitat in Kemps Creek was degraded with the filamentous green algae *Enteromorpha* sp., floating rubbish and the introduced mosquito fish, *Gambusia holbrooki* being common.

It is also noted that there are numerous farm dams in the area which may provide additional aquatic habitat, particularly for frog species. Field survey undertaken as part of this assessment did not review these habitat areas. However, Parsons Brinckerhoff (2010) note that the condition of these habitats is generally poor with limited or no emergent aquatic vegetation and poorly-developed terrestrial vegetation buffers.

7.3 Water Quality Sampling Results

The water quality within the site was observed to be below average, consistent with a disturbed freshwater ecosystem. **Table 7.3** summarizes the water quality results obtained through sampling. The full water quality sampling results are provided in **Appendix O**.

Table 7.3 Comparison of in situ water quality measurements taken at each site with ANZECC/ARMCANZ (2000) guidelines for lowland watercourses in south-east Australia

Site	Waterway	Conductivity (us/cm)	pH	Dissolved Oxygen (% sat.)	Turbidity (NTU)
	Guideline	*125 - 2200*	*6.50 - 8.50*	*85 - 110*	*6 - 50*
1	Bonds Creek	↑	✓	↓	✓
2	Bonds Creek	✓	✓	↓	✓
3	Scalabrini Creek	✓	✓	↓	✓
4	Kemps Creek	↑	✓	↓	✓
5	Kemps Creek	↑	✓	↓	✓
6	Bonds Creek	↑	✓	↓	✓
7	Bonds Creek	↑	✓	✓	✓
8	Bonds Creek	↑	✓	✓	✓
9	unnamed	✓	✓	↓	✓
10	unnamed	✓	✓	✓	✓
11	Bonds Creek	↑	✓	↓	✓
12	Kemps Creek	↑	✓	↓	✓
13	unnamed	✓	✓	↓	↓

↓ = below guidelines, ↑ = above guidelines, ✓ = within guidelines

It can be seen that the majority of sites and waterways were consistent with the ANZECC/ARMCANZ (2000) guidelines for lowland watercourses in south-east Australia in regards to pH and turbidity. However, the dissolved oxygen levels observed were generally below guideline levels, while conductivity typically exceeds the guideline levels. Low dissolved oxygen concentrations (i.e. below 40% saturation) in particular can indicate poor creek health. However, none of the sites sampled recorded dissolved oxygen concentrations of less than 48% (Appendix O). It should be noted that dissolved oxygen levels can vary significantly over the course of a day (typically higher in the morning) and are typically higher following rainfall events. Further sampling would be required to accurately establish the baseline water quality conditions within the site.

7.4 Aquatic Flora Survey Results

The aquatic flora present within the creeks was seen to be highly limited and weed infested. The diversity of the macrophyte assemblages was low with stands of cumbungi with epiphytic filamentous green algae predominating, particularly in reaches with little or no riparian habitat to shade the channel. **Table 7.4** summarizes the flora species observed onsite at each of the 13 sites sampled. The most common species observed included:

- *Typha orientalis* (Cumbungi);
- *Rumex crispus* (Curled doc); and
- *Rorippa nasturtium aquaticum* (Watercress).

Of these, both Curled doc and Watercress are introduced species. The abundance of weeds within the watercourses reflects the low aquatic habitat scores observed and the history of disturbance and development within the site.

Table 7.4 Macrophytes observed during site survey (weeds marked in bold)

Species Name	Common Name	Bonds Creek	Bonds Creek	Scalabrini Creek	Kemps Creek	Kemps Creek	Bonds Creek	Bonds Creek	Bonds Creek	Unnamed	Unnamed	Bonds Creek	Kemps Creek	Unnamed
		Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13
Alternanthera philoxeroides	**Alligator weed**			✓	✓	✓		✓						
Azolla filiculoides	Pacific azolla				✓			✓						
Azolla pinnata	Ferny azolla				✓			✓						
Cotula coronopifolia	Waterbuttons					✓			✓			✓	✓	
Cyperus eragrostis	**Umbrella sedge**			✓							✓			
Eleocharis sphacelata	Tall spikerush	✓												
Myriophyllum aquaticum	**Parrots feather**						✓							
Persicaria decipiens	Slender knotweed	✓		✓			✓			✓	✓			
Potamogeton crispus	Curly pondweed					✓								
Potamogeton ochreatus	Blunt pondweed				✓									
Rorippa nasturtium aquaticum	**Watercress**				✓		✓	✓				✓	✓	
Rumex crispus	**Curled doc**	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	
Spirodella sp.	Duckweed					✓								
Triglochin procerum	Water ribbons					✓								
Typha orientalis	Cumbungi	✓	✓	✓	✓		✓	✓	✓	✓		✓		✓

Of particular concern is the presence of Alligator Weed (*Alternanthera philoxeroides*). Alligator weed is a Weed of National Significance (DWESPC/DAFF2009). It poses a significant environmental and economic threat and is highly invasive. Infestations can take over wetlands such as creeks and drainage channels, displacing native vegetation, preventing flow and reducing oxygen exchange. It can also invade land and displace or cause the failure of agricultural crops. Alligator weed does not produce viable seed in Australia, but instead grows through vegetative reproduction and is spread easily from fragments. It has been spread in landfill and attached to machinery and vehicles (e.g. bulldozers).

Alligator weed was observed in the Study Area in Scalabrini Creek, Bonds Creek and Kemps Creek. Alligator weed has been declared a noxious weed in the Liverpool City Council and Camden Council areas, which cover the sections of the Study Area north and south of Bringelly Road, respectively. It is considered a Class 3 weed in both council areas and as such must be fully and continuously suppressed and destroyed.

No threatened aquatic macrophyte species were found on site.

7.5 Aquatic Fauna Survey Results

The results of the electrofishing undertaken to characterise the fish and large macroinvertebrate populations within the creeks are summarised in **Table 7.5**. It can be seen that Site 12 within Kemps creek had the highest diversity and abundance of species. However, across all sites and creeks the dominant species identified were seen to be the invasive Mosquito fish (*Gambusia holbrooki*) along with species of freshwater shrimp.

Table 7.5 Number of fish species observed within field survey sites

Species Name	Common Name	Number of Individuals Records									
		Site 1	Site 2	Site 3	Site 4	Site 5	Site 7	Site 8	Site 11	Site 12	Site 13
Anguilla reinhardtii	Longfinned eel	1			1					3	
Anguilla australis	Shortfinned eel				2					1	
Cyprinus carpio	Common carp*							1			
Carassius auratus	Goldfish*					2				1	
Gambusia holbrooki	Mosquito fish*	9	7	5	10	8	7	12	25	22	4
Philypnodon grandiceps	Flathead gudgeon									6	
Philypnodon sp.	Dwarf flathead gudgeon						3			2	

Species Name	Common Name	Number of Individuals Records									
		Site 1	Site 2	Site 3	Site 4	Site 5	Site 7	Site 8	Site 11	Site 12	Site 13
Hypseleotris compressa	Empire gudgeon	1									
	Freshwater shrimp	> 50	> 20	> 50	> 50	> 50	> 50	> 50	> 50	> 50	

*invasive or pest species

Overall the fish and macroinvertebrate fauna observed was not diverse. Only eight species of fish were observed over the entire study area, three of which (carp, goldfish and mosquito fish) were introduced. Predation by the mosquito fish has been listed as a key threatening process on Schedule 3 of the TSC Act, as it has been implicated in the decline of a number of threatened Litorid frog species, including the Green and Golden Bell Frog. The presence of instream barriers, changes to the natural flow regime and degradation of riparian and aquatic habitats are likely to have contributed to the low fish diversity.

No threatened aquatic fauna species were observed on site. In general it is considered that the habitat present is not typical of core species habitat for the threatened species identified and it is considered unlikely that any of the threatened species identified as potentially occurring within the region (**Table 7.1**) would occur within the site. However, it is noted that the habitat present is largely consistent with the habitat requirements of the Green and Golden Bell Frog (*Litoria aurea*). Within NSW the species has been commonly observed to occupy disturbed habitats and frequently breed in ephemeral ponds adjacent to grassy areas. The presence of the Mosquito fish (*Gambusia holbrooki*) has been implicated in the decline of Green and Golden Bell frog populations through predation. However, it is equally noted that populations of the frog have been known to persist with the presence of the Mosquito fish under favourable site conditions.

Appendix P provides detail as to the ecological characteristics of the potentially occurring threatened species and their suitability to occur onsite given the findings of the habitat assessment (**Section 7.2**).

8 Terrestrial and Aquatic Ecology Discussion

The terrestrial and aquatic ecology study undertaken show the site as a whole to be of relatively low biodiversity and conservation value. Long term disturbance through agricultural grazing and clearing has left the majority of habitat areas within the precincts devoid of understory and dominated by non-native species. This is significant in that the conservation and rehabilitation potential for many of the sites is highly dependent upon the existence of a viable native seed bank and the ability to control weed species.

However, it is noted that over-story species remain intact across the study site, with very few instances of non-natives occurring within the canopy layer. The presence of a strong canopy layer is vital as it provides considerable niche habitat for fauna species, which in turn play a significant role in the ecological dispersal of native shrub and ground cover. The canopy layer also plays a significant role in the formation of suitable climate / habitat of ground and shrub species of the Cumberland Plain. Consequently, it is considered that the presence of the over-story layer does provide potential for re-establishment of high quality vegetation at several locations around the study site.

The connectivity of the terrestrial vegetation within the site is largely confined to the riparian corridors. The mapping of the vegetation shows a strong link between the quality of vegetation and the proximity to watercourses. This is thought to primarily be driven by development restrictions around watercourses. As a result of this, the quantity of high quality Alluvial Woodland (being a primarily riparian community) within the study site is higher than that of Shale Plains Woodland. It is considered that the existing connectivity present on site should be retained and extended as far as practicable. In particular, providing connection between the few remnant isolated pockets of high quality Shale Plains Woodland, will allow for these areas to contribute to the overall improvement of Biodiversity within the precincts. If high quality vegetation communities remain isolated their ability to sustainably host a high diversity of fauna is limited (particularly as all isolated vegetation communities assessed within this precincts were relatively small (i.e. < 5 ha)). Consideration should be given to the conservation of the Medium Quality Vegetation along Bonds Creek. Similarly, the vegetation associated with Scalabrini Creek (although more disturbed) should be considered for conservation.

The presence of a large area of high quality vegetation immediately to the north of the Austral precinct (Kemps Creek Nature Reserve) is of high value and appropriate developmental buffer areas should be provided to limit disturbance and the potential for weed infestation. Where possible, connectivity to this high quality area should be prioritised.

Riparian vegetation is also important ecologically as it provides a source of organic matter; shade and a source of large woody debris to both terrestrial and aquatic systems. From an aquatic point of view it also stabilises river beds and banks, protecting the channels against erosion and acts as a filter for sediments and nutrients entering watercourses. The riparian vegetation along all the watercourses surveyed was significantly degraded and often narrow and fragmented or absent. Channel banks were seen to be steep, relatively unstable and usually only held in place by pasture grasses.

Within the creeks themselves, the channel bed was typically found to lack complex structure and had a narrow range of sediment sizes, being composed primarily of fine silts and clay. There was little submerged large woody debris ('snags'), which normally provides complex habitat for aquatic macroinvertebrates and fish, including refugia from predation and habitat for prey. The watercourses were dominated by long pool sections. No natural riffle habitat was observed.

The flow regime is a key driver of river ecology and changes to flow can alter the geomorphological process of sediment erosion, transport and deposition that structure a variety of important channel habitat forms, change macrophyte communities, influence water properties important to biological assemblages and alter in-stream connectivity. The natural flow regime within the Study site has been significantly modified by the presence of instream barriers, such as road crossings, fences, car bodies.

The poor flow regime and riparian vegetation was reflected in the poor water quality within the study site. Conductivity levels were generally very high and exceeded the ANZECC/ARMCANZ (2000) upper threshold limits for the protection of aquatic ecosystems at most sites while dissolved oxygen levels were mostly below the ANZECC/ARMCANZ (2000) lower threshold limits. This poor quality was also reflected in the nearly ubiquitous presence of algae and weeds and very low number of native fish species.

Overall it is considered that, while in poor condition, there is significant rehabilitation potential given the nature of the remnant vegetation and patches of remnant high quality vegetation. As such, future development of the study site represents an opportunity to rehabilitate the degraded terrestrial, riparian and aquatic habitats.

8.1 Recommendations for Conservation and Management Measures

The issue of Biodiversity Certification for the Austral and Leppington North Precincts removes the majority of the ecological constraints from the Precincts. There is a significant quantity of ENV present within the certified area. However, the results of this assessment indicate that the majority of this area is of relatively low – medium quality vegetation.

Consistent with the issued Biodiversity Certification Order and the Growth Centres Development Code, it is noted that open space areas and other sympathetic land uses (e.g. stormwater detention) should be located such they optimize the retention of native vegetation. **Figure 8.1** indicates the key vegetation communities which we recommend are retained, as well as the non-certified areas of vegetation which would require further assessment prior to any development approval.

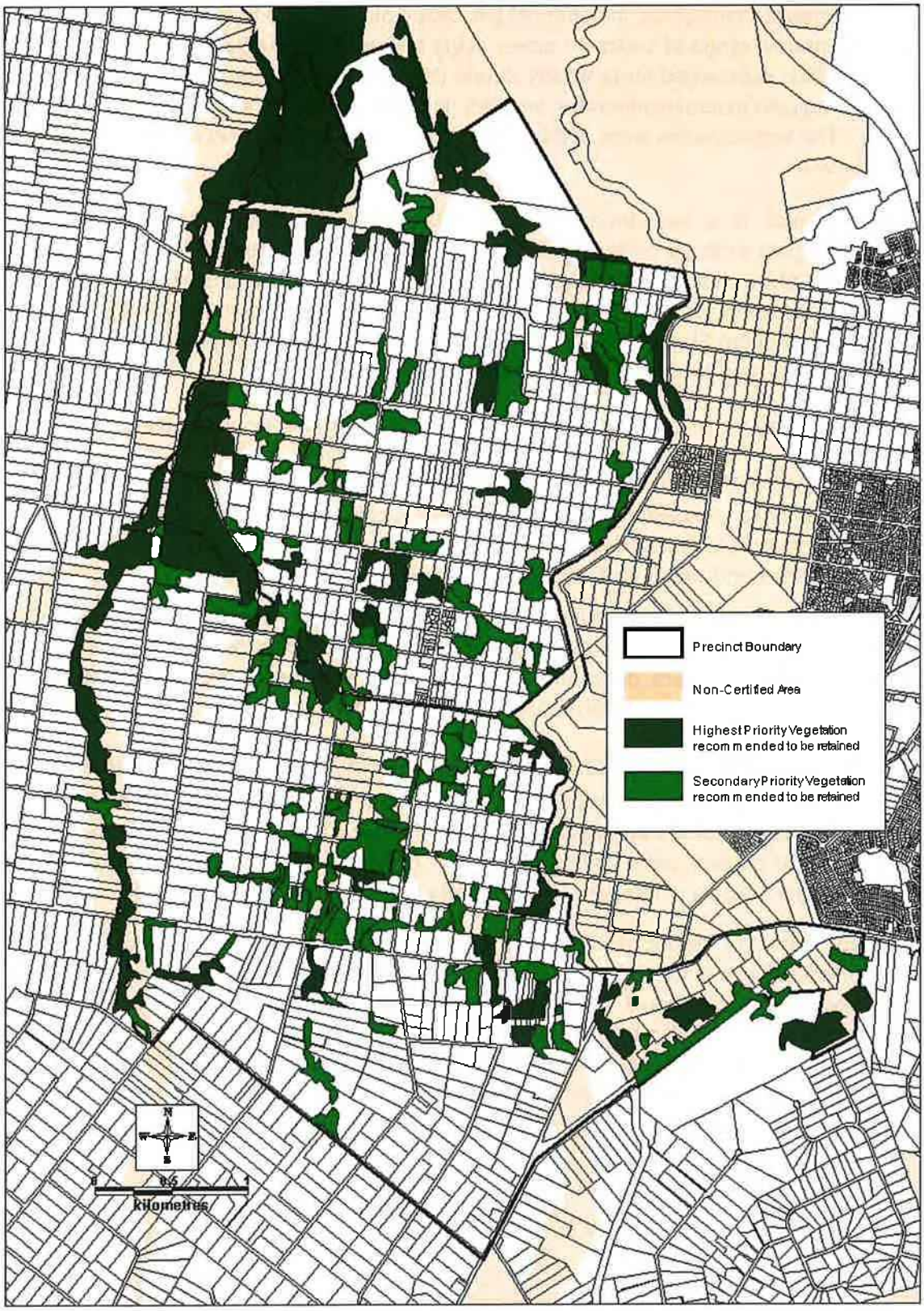

Figure 8.1 Recommended areas for vegetation protection

The majority of the vegetation recommended for retention is riparian in nature, although there are a number of more isolated pockets of existing remnant vegetation. In general, the riparian vegetation was seen to be of moderate condition, often dominated by weeds. Several areas of vegetative regrowth have been heavily recolonised by *Casuarina glauca* following clearing, to the extent that the previous habitat (typically more diverse) has been unable to, and is unlikely to, establish itself without revegetation and management.

The key to conserving the identified communities is provision of connectivity where possible. Primarily, this will be through the retention of appropriate riparian corridor widths in accordance with stream order. Where possible, the streams within the site should be provided with a 40m core riparian zone and additional 10m buffer. The potential connectivity to key habitat areas to the north of the site (i.e. Western Sydney Parklands and the Kemps Creek Nature Reserve) should also be recognised and enhanced where possible.

Very few threatened species have been previously identified on site and only one threatened species (*Acacia pubescens*) was identified during the site surveys for both the aquatic and terrestrial assessment components. The level of disturbance within the site and low connectivity values indicate that the likelihood of significant threatened species populations occurring on site is low. This is particularly so for the biodiversity certified areas which typically do not contain riparian habitat and where vegetation communities are typically isolated through historic clearing.

However, the presence of *Acacia pubescens* is of significance, and should be considered in development planning for the precincts. The species is known to be associated with a number of ecological communities including Alluvial Woodland, Shale/Gravel Transition Forest, and Shale Plains Woodlands. As such, it is considered that many of the vegetation communities recommended for retention (**Figure 8.1**), would also be suitable habitat for the growth of this species. Implementation of planting and rehabilitation programs should be considered as part of on-going ecological management of the precincts. Areas known to contain *Acacia pubescens* are included within the recommended vegetation communities to be retained. It should be noted that *Acacia pubescens* is a clonal species and as such a high number of sightings within an area may over-estimate the number of genetically distinct individuals and the robustness of a community. Typically, plants within 300m of each other are defined as being within one population, reflecting the ability for *Acacia spp.* to disperse.

Although it is considered unlikely that the Green and Golden Bell Frog is present within the study site, appropriate targeted frog surveys should be carried out as a precautionary measure for specific developments as the observed habitat is considered suitable for this species. Certified areas are not required to be surveyed.

Where required, the guidelines on survey methodology for this species recommend that a field survey be done either in conjunction with or after a habitat assessment and should:

- Include a combination of visual encounter, call and night drive survey techniques;
- Include a minimum of four nights sampling to increase the detection rate;
- Take place between September and March, at the time of peak activity for the species;
- Occur during warm and windless weather conditions following rainfall;

- Include use of a nearby reference site that supports a population of green and golden bell frogs to confirm that green and golden bell frogs are active and calling on that particular night;
- Be done by a suitably qualified person with experience in frog surveys; and
- Include connected and surrounding suitable habitats during field surveys.

With the exception of *Acacia pubescens*, the Cumberland Land Snail and the Green and Golden Bell Frog discussed above, no other threatened species are considered likely to be present at the site.

Overall, it is considered that the future development of the study site represents an opportunity to rehabilitate the degraded terrestrial, riparian and aquatic habitat. Priorities should include (but not be limited to):

- Regeneration and revegetation of native vegetation and removal of exotics;
- Establishment of vegetation corridors between areas of high quality vegetation;
- Riparian bank stabilisation;
- Removal of instream barriers to improve passage and rehabilitation of existing road crossings to permit connectivity over the major range of watercourse flows; and
- Design all works in and around creeks in a manner which will improve riparian aquatic habitat.

In conclusion, the terrestrial and aquatic biodiversity and conservation value of the study site is relatively low at present due to surrounding land use practices, clearing, disturbance to riparian vegetation, degradation of aquatic habitat and presence of in-stream barriers. The Precinct Planning Process for the study site represents an opportunity to rehabilitate these degraded communities and preserve the few remaining areas of High Quality Vegetation.

8.2 Impact Assessment

As the Austral and Leppington North Precincts have Biodiversity Certification, there is no further requirement under the TSC Act to conduct threatened species assessments for works on certified areas. It is recommended that the non-certified areas be protected and managed in accordance with the requirements of the Biodiversity Certification Order.

In particular, land uses surrounding non-certified areas will need to be carefully managed in order to not negatively affect the ecological integrity of the protected areas.

It is recommended that a management plan be established for all areas to be retained for biodiversity certification.

It was found that according to the proposed vegetation clearing within the ILP and with consideration of the offsetting mechanisms under the certification, the EECs located in the study area would not suffer significant adverse impacts.

Additionally, the proposed non-certified boundary lines will protect 10.00ha more ENV than required by the Biodiversity Certification Order, (Annex C in **Appendix M**).

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Appendix A

Relevant Biodiversity Measures (RBMs)

THREATENED SPECIES CONSERVATION ACT 1995

Order to confer biodiversity certification on the State Environmental Planning Policy (Sydney Region Growth Centres) 2006

I, Verity Firth, Minister Assisting the Minister for Climate Change, Environment and Water (Environment), do by this order confer biodiversity certification on the State Environmental Planning Policy (Sydney Region Growth Centres) 2006 (the SEPP) for the purposes of the *Threatened Species Conservation Act 1995* (the Act).

I am satisfied that the SEPP, and other relevant measures, will lead to the overall improvement or maintenance of biodiversity values.

Pursuant to section 126H of the Act, the biodiversity certification of the SEPP is subject to the conditions listed in Schedules 1, 2, 3 and 4 below. The conditions are necessary to ensure that the SEPP and other relevant measures will lead to the overall improvement or maintenance of biodiversity values, including the limiting of certification to specified lands, procedures for the allocation of conservation funding for offsets, and mechanisms for the on-going review of progress in delivering offsets.

This order is made under section 126G(1) of the Act.

This order is to take effect on and from the date of its publication in the Government Gazette.

Pursuant to section 126J of the Act, biodiversity certification of the SEPP shall remain in force from the date the biodiversity certification order takes effect until 30 June 2025.

VERITY FIRTH, M.P.
Minister Assisting the Minister for Climate Change,
Environment and Water (Environment)

Signed at Sydney, this 11th day of December 2007.

SCHEDULE 1 – CONDITIONS OF BIODIVERSITY CERTIFICATION

Definitions

In Schedules 1 to 4:

- "Act" means the *Threatened Species Conservation Act 1995*.

- "biodiversity certification maps" means the maps marked "North West Growth Centre – Biodiversity Certification" and "South West Growth Centre – Biodiversity Certification" dated November 2007 and included in Schedule 2.

- "biodiversity values" has the same meaning as in the Act.

- "certified area" means an area marked as a certified area on a biodiversity certification map.

- "clearing" of existing native vegetation means any one or more of the following:

  (a) cutting down, felling, thinning, logging or removing existing native vegetation in whole or in part,
  (b) killing, destroying, poisoning, ringbarking, uprooting or burning existing native vegetation in whole or in part.

- "conditions of biodiversity certification" means Schedules 1 to 4.

- "conservation agreement" means:

  (a) a conservation agreement under the *National Parks and Wildlife Act 1974*,
  (b) a biobanking agreement under Part 7A of the Act,
  (c) a planning agreement under the *Environmental Planning and Assessment Act 1979*, where the agreement provides for the conservation and/or enhancement of the biodiversity values of an area of land to which the agreement relates, or
  (c) a legally binding agreement that provides for the conservation and/or enhancement of the biodiversity values of an area of land.

- "Conservation Fund" means the Fund referred to in condition 21.

- "conservation value" includes, but is not limited to, vegetation type, condition and rarity.

- "draft Growth Centres Conservation Plan" means the document titled "Growth Centres Conservation Plan Exhibition Draft" prepared by the GCC dated February 2007 and placed on public exhibition in February 2007.

- "existing native vegetation" means areas of indigenous trees (including any sapling) that:

  (a) had 10% or greater over-storey canopy cover present,
  (b) were equal to or greater than 0.5 ha in area, and
  (c) were identified as "vegetation" on maps 4 and 5 of the draft Growth Centres Conservation Plan,

at the time the biodiversity certification order took effect, subject to condition 13.

- "DECC" means the Director-General of the Department of Environment and Climate Change.

- "financial year" means the twelve month period from 1 July to 30 June.

- "GCC" means the Growth Centres Commission constituted under the *Growth Centres (Development Corporations) Act 1974*.

- "Growth Centre" has the same meaning as in the SEPP.

- "Growth Centres Development Code" means the document with that title produced by the GCC (dated October 2006) as updated and in force from time to time.

- "Minister" means the Minister administering the Act.

- "Minister for Planning" means the Minister administering the *Environmental Planning and Assessment Act 1979*.

- "non-certified area" means an area marked as a non-certified area on a biodiversity certification map.

- "plan of management" means:

  (a) a plan of management adopted under the *National Parks and Wildlife Act 1974* or *Local Government Act 1993*, or
  (b) a plan that provides for the management and protection of biodiversity values to the satisfaction of the DECC.

- "precinct" has the same meaning as "growth centre precinct" in the SEPP.

- "precinct plan" has the same meaning as in the Growth Centres Development Code.

- "protected area network" means a system of lands especially dedicated to the protection and maintenance of biodiversity, and of natural and associated cultural resources, and managed through legal or other effective means.

- "protection" or "protected" in relation to land means land that is protected by a land use zoning under an environmental planning instrument or public ownership arrangements that provide for the protection of biodiversity values as a priority, or another arrangement that provides in-perpetuity security for biodiversity on the subject land.

- "Report on Public Submissions" means the document titled "Growth Centres Draft Conservation Plan - Report on Public Submissions" prepared by the GCC and dated July 2007.

- "SEPP" means *State Environmental Planning Policy (Sydney Region Growth Centres) 2006*.

- "Special Infrastructure Contribution Practice Note" means the document with that title prepared by the GCC (dated December 2006) as updated and in force from time to time.

- "threatened species" and "threatened species, populations and ecological communities" have the same meaning as in the Act.

Explanatory notes

A. Nothing in this biodiversity certification order:

   i. restricts any future decisions that may be made by the Minister under Part 7, Division 5 of the Act,

   ii. removes, alters or over-rides any requirement to obtain any necessary approvals under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

B. In accordance with section 126K of the Act, following any review of the SEPP under the *Environmental Planning and Assessment Act 1979* or any rezoning of land to which the SEPP applies, the Minister is to reassess the grant of biodiversity certification to determine whether it should be maintained or modified.

General

1. In the event of any inconsistency between the draft Growth Centres Conservation Plan, the Report on Public Submissions and the conditions of biodiversity certification, the conditions of biodiversity certification shall prevail.

2. This biodiversity certification order does not affect any consent or approval granted under Part 3A, Part 4 or Part 5 of the *Environmental Planning and Assessment Act 1979* before the order took effect, or any development or activity carried out in accordance with such a consent or approval.

3. The Minister, from time to time and as considered appropriate, may amend the conditions of biodiversity certification in accordance with the Act to address anomalies, errors, boundary revisions and/or to take into account new information, but only if the Minister is satisfied that any amendments will not detract from the ability of the SEPP, and other relevant measures, to lead to the overall improvement or maintenance of biodiversity values. Amendments may include, but are not limited to, boundary revisions to reflect updated flood mapping and the outcomes of the assessments completed under conditions 14, 17 and 18. The Minister may, but is not required to, provide for any such amendments to be exhibited for public comment.

4. Copies of all final reports, maps, reviews, plans and monitoring data referred to in the conditions of biodiversity certification must be held by the GCC and made publicly available, either on request and/or by a mechanism that is broadly publicly accessible. This does not apply to material that is commercially sensitive or contains sensitive information regarding the location of threatened species, populations or ecological communities or their habitat.

Areas subject to biodiversity certification

5. Pursuant to section 126H of the Act, the biodiversity certification of the SEPP is limited to the certified areas.

   Note: Pursuant to section 126I of the Act, developments or activities proposed to be undertaken within the certified areas do not need to undertake assessment of impacts on threatened species, populations and ecological communities, or their habitats, that would normally be required by Part 4 or 5 of the *Environmental Planning and Assessment Act 1979*.

Native vegetation to be retained within the Growth Centres

6. A minimum of 2,000 hectares of existing native vegetation must be retained and protected within the Growth Centres, either within the certified areas and/or the non-certified areas, subject to conditions 7 to 13 below.

- **Retention of existing native vegetation during precinct planning**

7. During the precinct planning process, the GCC may determine to make areas of existing native vegetation within the non-certified areas available for development if the clearance of such vegetation is considered necessary for either the provision of essential infrastructure and/or to meet the required Development Parameters specified in the Growth Centres Development Code.

8. In making a determination under condition 7, the GCC must demonstrate by way of information provided during the public exhibition of the precinct plan (where that exhibition occurs after this order takes effect) that the clearing of any existing native vegetation in the non-certified areas will be offset by:

    a. the protection of an equal or greater area of existing native vegetation elsewhere in the Growth Centres; and/or

    b. the revegetation and/or restoration of an area of land elsewhere in the Growth Centres, subject to satisfying the following,

        i. that the clearance of existing native vegetation in the non-certified areas will not affect the capacity to achieve overall improvement or maintenance of biodiversity values for threatened species, populations and ecological communities and their habitats,
        ii. the revegetated and/or restored areas will be protected,
        iii. the extent of revegetation and/or restoration compared to clearing of existing native vegetation must be undertaken at a ratio of at least 3:1 (to reflect the greater ecological risks relative to retaining existing native vegetation),
        iv. areas subject to revegetation and/or restoration must be of a suitable boundary configuration and design to support long-term management,
        v. revegetation and/or restoration of the proposed areas would not be undertaken under another scheme or regulatory requirement already in operation at the time that the clearing is approved (this includes but is not limited to any approvals, and associated conditions of such approvals, that may be required under the *Rivers and Foreshores Improvement Act 1948* and *Water Management Act 2000*),
        vi. revegetation and/or restoration will be undertaken by suitably qualified and experienced persons using indigenous plant stock, and
        vii. sufficient resources will be made available to undertake the revegetation and/or restoration and any necessary follow-up maintenance and monitoring for a minimum period of 5 years following the commencement of the revegetation and/or restoration.

9. Revegetation and/or restoration may be partly counted towards meeting the overall requirement to protect 2,000 hectares of existing vegetation required in condition 6. The amount that may be counted shall be calculated by dividing the total area of revegetation and/or restoration required under condition 8b(iii) by 3.

    Note: for example, if 9 hectares of revegetation is undertaken then 3 hectares may be counted.

- **Retention of existing native vegetation during development**

10. In the non-certified areas, proposals to clear existing native vegetation shall be subject to the relevant development controls in the SEPP and *Sydney Regional Environmental Plan No. 31 – Regional Parklands*, and the requirements of the *Environmental Planning and Assessment Act 1979*.

11. Where there are essential infrastructure proposals, including but not limited to proposals under Part 3A of the *Environmental Planning and Assessment Act 1979*, that involve clearing of existing native vegetation in the non-certified areas and that do not require development consent under the SEPP, such clearing must be offset by applying the same requirements specified in condition 8 above.

    In this case the offsets may be located outside of the Growth Centres (but within the Cumberland Plain of Western Sydney, as defined in condition 32) if the GCC is satisfied that there are no practicable offset options within the Growth Centres and all other requirements of condition 8 will be met. However, any offsets outside the Growth Centres cannot be counted towards meeting the requirements of condition 6.

- **Retention of existing native vegetation shown in areas marked with red hatching**

12. Notwithstanding any other conditions of biodiversity certification, in the lands marked by a red hatching on the biodiversity certification maps existing native vegetation must not be cleared unless it is in accordance with a plan of management or unless such clearance has been agreed to by the DECC.

- **Ground-truthing of existing native vegetation**

13. If new information becomes available after the biodiversity certification order took effect that demonstrates that the vegetation within an area does not otherwise meet the definition of existing native vegetation, then for the purposes of conditions 7 to 8 and condition 11 to 12 only the area of confirmed existing native vegetation shall be considered.

Additional conservation actions within the Growth Centres – native vegetation

14. During or before the preparation of the relevant precinct plan(s) under the Growth Centres Development Code, a further detailed assessment must be undertaken of the areas adjoining or proximate to the Shanes Park Air Services Australia site marked in blue hatching on the biodiversity certification maps.

15. The assessment referred to in condition 14 must examine whether the areas meet the criteria specified in Schedule 3.

16. Based on the outcomes of the assessment the DECC shall provide advice to the Minister on whether the areas should be included within the certified areas or the non-certified areas shown on the biodiversity certification maps.

Additional conservation actions within the Growth Centres – plants

17. During or before the preparation of the relevant precinct plan(s) under the Growth Centres Development Code relating to the areas referred to in the table below, the following actions must be undertaken:

Species	**Required action**
Acacia pubescens	Potential populations at Cross Street, Kemps Creek and Thirty-second Avenue, Austral – as shown in black hatching on the biodiversity certification maps: • survey to confirm the presence of the species, and

	• if the species is present, provide for the protection of the area of suitable habitat for the species to the satisfaction of the DECC.
Pimelea spicata	Potential populations at Denham Court Road - as shown in black hatching on the biodiversity certification maps: • survey to confirm the presence of species, and • if the species is present, provide for the protection of the area of suitable habitat for the species to the satisfaction of the DECC.
Persoonia hirsuta	Potential populations at North Kellyville – as shown in black hatching on the biodiversity certification maps: • survey to confirm the presence of the species, and • if the species is present, provide for the protection of the area of suitable habitat for the species to the satisfaction of the DECC.
Leucopogon fletcheri	Known population at North Kellyville - as shown in black hatching on the biodiversity certification maps: • survey to confirm the extent of the population, and • provide for the protection of the population to the satisfaction of the DECC.
Darwinia biflora *Hibbertia superans* *Epacris purpurascens var purpurascens* *Eucalyptus sp "Cattai"*	Known populations at North Kellyville - as shown in black hatching on the biodiversity certification maps: • survey to confirm the extent of the populations, and • provide for the protection of the populations to the satisfaction of the DECC.

Note: On completion of the above actions the Minister may decide that it is appropriate to amend the boundaries of the area subject to biodiversity certification, in accordance with condition 3.

Additional conservation actions within the Growth Centres – animals

18. During or before the preparation of the relevant precinct plan(s) under the Growth Centres Development Code relating to the area referred to in the table below, the following actions must be undertaken:

Species	**Required action**
Green and Golden Bell Frog	Potential population at Riverstone - as shown in black hatching on the biodiversity certification maps: **Option 1** • survey to confirm the presence of the species, and • if the species is present, provide protection of the area of suitable habitat for the species to the satisfaction of the DECC. **Option 2** • if the species is present at Riverstone but cannot be adequately protected to the satisfaction of the DECC,

	then: (a) undertake targeted survey to confirm the presence of the species elsewhere in the Growth Centres, and (b) if the species is present elsewhere in the Growth Centres, provide for the protection of an area(s) of suitable habitat for the species to the satisfaction of the DECC.

Note: On completion of the above actions the Minister may decide that it is appropriate to amend the boundaries of the area subject to biodiversity certification, in accordance with condition 3.

Additional conservation actions within the Growth Centres – development sites

19. Within twelve months of the biodiversity certification order taking effect, the GCC (in consultation with the DECC) must put in place procedures so that all future precinct plans (excluding any plans that were publicly exhibited before the biodiversity certification order took effect), where practicable, provide for the appropriate re-use of:

    a. native plants (including but not limited to seed collection) and the re-location of native animals from development sites, prior to development commencing; and

    b. top soil from development sites that contain known or potential native seed bank.

    For the purposes of condition 19a and 19b appropriate uses may include, but are not limited to, application in re-vegetation or restoration works and landscaping in the Growth Centres.

Conservation Fund

20. For the purposes of the conditions of biodiversity certification, references to dollar values are taken to be 2005/2006 values. All values shall be indexed in accordance with the "land index" to be published by the GCC, as detailed in the Special Infrastructure Contribution Practice Note.

21. Over the life of the development of the Growth Centres funding shall be provided to establish a Conservation Fund of at least $530 million to be used for biodiversity conservation and regional open space purposes. $397.5 million of the Conservation Fund is planned to be used to acquire lands and/or enter into conservation agreements over lands that are outside of the Growth Centres for the primary purpose of biodiversity conservation.

Timing and delivery of conservation funding

22. For that portion of the Conservation Fund that is to be used to fund the purchase and/or entering into conservation agreements over lands that are outside the Growth Centres, the following conditions apply:

    a. commencing in the 2008/2009 financial year, and continuing every financial year thereafter until the Conservation Fund is exhausted, the

GCC must work with DECC to arrange for the provision of an annual contribution to fund these actions outside the Growth Centres in accordance with an indicative ten-year timetable of payments to be submitted by the GCC for approval of the Minister within six months of the date of this certification order. Once approved, the indicative timetable shall be incorporated as Schedule 4 of the biodiversity certification order in accordance with condition 3;

b. the indicative ten-year timetable of payments is to be generally prepared by determining the proportion of total remaining lot production in the Growth Centres that is expected to occur within a given financial year and to then allocate for that financial year the same proportion of the remaining amount of the planned $397.5 million funding that has not been previously allocated;

c. to ensure adequate tracking of payments against the planned $397.5 million allocation, the GCC must ensure that the indicative ten-year payment timetable identifies the payments in both current and equivalent 2005/06 dollar values;

d. an updated indicative ten-year payment timetable (to provide details of the payments for the subsequent ten years) must be provided annually (by June of each financial year) by the GCC to the DECC;

e. the annual contributions must be used for the purposes detailed in conditions 23 and 24 below;

f. notwithstanding conditions 22a to 22e inclusive, if requested by the DECC the GCC must use its best endeavours to support the provision of additional funding contributions to accelerate land acquisition and/or conservation agreements over land outside the Growth Centres in any given financial year. The following conditions also apply,

    i. if an additional contribution is obtained in a given financial year, the GCC and DECC shall determine how subsequent annual contributions are to be reduced to account for the additional contributions in that financial year, and
    ii. if, despite best endeavours, an additional contribution is not obtained, the provisions of condition 27 will not be triggered with respect to this additional amount.

<u>Use of conservation funding</u>

23. As stated in condition 21, $397.5 million of the Conservation Fund is planned to be used by the DECC to arrange for the purchase and/or establishment of conservation agreements over lands <u>outside</u> the Growth Centres for the primary purpose of biodiversity conservation. This portion of the Conservation Fund must be allocated in accordance with the preferences for location and conservation values that are detailed in conditions 32, 33 and 34.

24. As part of the use of funds under condition 23, the DECC may arrange for allocation of a reasonable proportion towards the administration costs of purchasing land and/or entering into conservation agreements, and for the initial management costs of purchased land. However, from the commencement of the 2012/2013 financial year any such allocations must not exceed 5% of the annual

contribution from the Conservation Fund for the purchase and/or establishment of conservation agreements over lands outside the Growth Centres in any single financial year.

25. Funding that is planned to be allocated from the Conservation Fund within the Growth Centres shall be used to fund the purchase of lands as identified in the SEPP (as gazetted in July 2006), or the establishment of conservation agreements over an area or areas of land within the Growth Centres.

Timing of expenditure

26. The DECC must use its best endeavours to ensure that funds allocated within a financial year for the purchase and/or establishment of conservation agreements over lands outside the Growth Centres are allocated for those purposes as expeditiously as possible.

Non-delivery of funding

27. Despite the requirements of condition 22, if in any financial year ("the first financial year") the full annual contribution is not provided then:

    a. the Minister must consult with the Minister for Planning regarding the continued operation of section 126I of the Act in relation to the certified areas; and

    b. based on the outcomes of that consultation, if the Minister is satisfied that appropriate arrangements have been put in place to rectify the funding shortfall then section 126I shall continue to have effect for the certified areas; or

    c. the Minister shall determine whether to suspend or revoke the biodiversity certification order in accordance with the Act.

28. If no decision has been made in accordance with conditions 27b or 27c within six months of the end of the relevant financial year, then the provisions of section 126I of the Act are taken to no longer have effect in relation to the certified areas, until such time as the outstanding contribution is provided or the Minister is satisfied that appropriate arrangements have been put in place to rectify the funding shortfall. This condition does not affect any consent or approval granted under Part 3A, Part 4 or Part 5 of the *Environmental Planning and Assessment Act 1979* before the condition took effect, or any development or activity carried out in accordance with such a consent or approval.

    For the purposes of condition 27 and 28, "rectify" means amending the indicative timetable referred to in condition 22 to ensure that within four financial years of the first financial year the level of funding provided will be at least equal to the amount of funding that would otherwise have been provided by that time under the provisions of condition 22, or achievement of a comparable or better conservation outcome to the satisfaction of the Minister.

29. Conditions 27 and 28 do not have effect where the annual contribution required under condition 22 has not been provided because the balance of unspent funding being held in the Conservation Fund for the purchase and/or establishment of conservation agreements over lands outside the Growth Centres has reached a limit to be determined by the Minister.

Reporting

30. Commencing at the end of the 2008/2009 financial year, and at the end of every financial year thereafter until the Conservation Fund is exhausted, the GCC must provide the following information to the DECC within 2 months of the end of the relevant financial year:

    a. an estimate of the amount of existing native vegetation, specified by vegetation community type, that has been cleared within the Growth Centres. This may be based on, but is not limited to, the use of information on subdivision development approvals as a surrogate measurement for clearing, or some other basis agreed between the GCC and DECC.

31. Commencing at the end of the 2008/2009 financial year, and at the end of every financial year thereafter until the Conservation Fund is exhausted, the DECC must arrange for the publication of a report detailing the following matters:

    a. the information provided in condition 30;

    b. the amount of funding provided from the Conservation Fund in the financial year for the purchase and/or establishment of conservation agreements over lands outside the Growth Centres;

    c. the amount expended in the financial year, including the amount spent on land purchase, conservation agreements, administration and initial management costs for purchased land;

    d. a summary of the conservation outcomes achieved by that expenditure; and

    e. the predicted funding provision for the program for the next 10 years.

Location of expenditure of funds

32. The funding identified in condition 23 must be spent within the following locations in the order of preference identified below.

    First Preference: Priority areas within the Cumberland Plain

    a. First preference shall be allocated every financial year to the purchase of land and/or entering into conservation agreements over land that is:

        - identified as "Regional Biodiversity Corridors" and "Western Sydney Priority Areas" on the map labelled "Regional Biodiversity Corridors and priority fauna habitats" in the Hawkesbury Nepean Catchment Action Plan; AND

        - also occurs within the Cumberland Plain of Western Sydney; AND

        - generally meets the criteria specified in condition 33.

Where there is insufficient available land, or the cost-effectiveness of purchasing and/or entering into conservation agreements over lands in the above category is considered by the DECC to be too low, or the criteria in condition 33 cannot be met, then the funding may be allocated by DECC to be used on lands in accordance with condition 32b below.

Second Preference: Priority areas within the Hawkesbury Nepean Catchment

b. As second preference, funding shall be allocated every financial year to the purchase of land and/or entering into conservation agreements over land that is:

- identified as "Regional Biodiversity Corridors" and "Western Sydney Priority Areas" on the map labelled "Regional Biodiversity Corridors and priority fauna habitats" in the Hawkesbury Nepean Catchment Action Plan; AND
- is not identified in condition 32a; AND
- generally meets the criteria specified in condition 33.

Where there is insufficient available land, or the cost-effectiveness of purchasing and/or entering into conservation agreements over lands in the above category is considered by the DECC to be too low, or the criteria in condition 33 cannot be met, then the funding may be allocated by DECC to be used on lands in accordance with condition 32c below.

Third Preference: Grassy Woodlands within the Hawkesbury Nepean Catchment

c. As third preference, funding shall be allocated every financial year to the purchase of land and/or entering into conservation agreements over lands that:

- contain grassy woodlands within the Hawkesbury Nepean Catchment; AND
- are not identified in conditions 32a or 32b; AND
- generally meets the criteria specified in condition 33.

Where there is insufficient available land, or the cost-effectiveness of purchasing and/or entering into conservation agreements over lands in the above category is considered by the DECC to be too low, or the criteria in condition 33 cannot be met then the funding may be allocated by DECC to be used on lands in accordance with condition 32d below.

Fourth Preference: Grassy Woodlands within the Sydney Basin

d. As fourth preference, funding shall be allocated every financial year to the purchase of land and/or entering into conservation agreements over lands that satisfy the following criteria:

- land containing grassy woodlands within the Sydney Basin; AND
- that is not identified in conditions 32a, 32b or 32c; AND
- generally meets the criteria specified in condition 33.

Where there is insufficient available land, or the cost-effectiveness of purchasing and/or entering into conservation agreements over lands in the above category is considered too low, or the criteria in condition 33 cannot be met, then the funding may be allocated by DECC to be used on lands in accordance with condition 32e below.

Fifth Preference: other lands identified by the DECC

e. As fifth preference, funding shall be allocated every financial year to the purchase of land and/or entering into conservation agreements over land that is:

- within the Sydney Basin; AND
- is not identified in conditions 32a, 32b, 32c or 32d; AND
- generally meets the criteria specified in condition 33.

For the purposes of condition 32:

- "cost-effectiveness" means a consideration of the conservation objectives that would be achieved by purchasing or entering into a conservation agreement for a parcel of land and the cost of the purchase and/or conservation agreement, relative to the cost of achieving the same or similar conservation objectives on other parcels of land within the Sydney Basin.
- "Cumberland Plain of Western Sydney" means the geographic area by that name as identified in National Parks and Wildlife Service (2000), *The native vegetation of the Cumberland Plain, Western Sydney – Technical Report*, NSW NPWS, Hurstville.
- "grassy woodlands" mean the vegetation formation by that name as defined in Keith, D. (2004), *Ocean shores to desert dunes: the native vegetation of New South Wales and the ACT*. NSW Department of Environment and Conservation. Hurstville, NSW.
- "Hawkesbury Nepean Catchment" means the area of land described in the Hawkesbury Nepean Catchment Action Plan.
- "Hawkesbury Nepean Catchment Action Plan" means the *Hawkesbury-Nepean Catchment Action Plan 2007-2016* published by the Hawkesbury-Nepean Catchment Management Authority (October 2006).

- "Sydney Basin" means the areas as defined by Environment Australia (2000), *Revision of the Interim Biogeographic Regionalisation for Australia (IBRA) and development of Version 5.1 – Summary Report.* Department of Environment and Heritage, Canberra.

Conservation values to be protected through the expenditure of funds

33. Within each area specified in condition 32, the lands to be targeted for purchase and/or conservation agreement outside the Growth Centres shall be guided by consideration of the following criteria:

    - large remnants of intact native vegetation with the greatest potential for retaining biodiversity values over time;
    - vegetation communities that are under-represented in the protected area network;
    - areas of equivalent or better conservation value to that which are to be cleared within the Growth Centres;
    - areas that contain habitat for threatened species, including but not limited to species to be affected by development of the Growth Centres;
    - areas that have the highest cost effectiveness;
    - conservation reserve design principles, such as size, boundary configuration and landscape context;
    - previous land uses;
    - likely threats (such as existing or future adjoining land uses); and
    - availability (including the willingness of landowners to either sell land or place it under a conservation agreement). For the purpose of clarification, no land is intended to be compulsory acquired in order to meet any of the conditions of biodiversity certification.

    For the purposes of this condition, and the avoidance of doubt, the above attributes are to be considered and applied as a guide only.

34. The lands to be targeted for purchase and/or conservation agreement outside the Growth Centres must include a known population(s) or suitable habitat for the plant species *Cynanchum elegans*.

    Note: this action is required to ensure an appropriate improve or maintain outcome for this species, which occurs in the Growth Centres but is not currently protected by measures under the Growth Centres SEPP.

Future precinct plans

35. During the preparation of future precinct plans (excluding any precinct plans already publicly exhibited before this order took effect) the GCC must undertake and make publicly available an assessment of the consistency of the proposed precinct plan with the conditions of biodiversity certification. This may occur during or before any public exhibition of future draft precinct plans.

Future threatened species listings or discoveries

36. Where a preliminary determination is made under the Act to list a species, population or ecological community, and that species, population or ecological

community may or is known to occur within the Growth Centres, then the GCC must (as soon as practicable) provide advice to the DECC on whether:

a. the species, population or ecological community is known or likely to be present in the Growth Centres;
b. it was considered during the preparation of the draft Growth Centres Conservation Plan by the GCC; and
c. whether the SEPP, and related measures, provides adequate protection for the species, population or ecological community.

37. Based on the information provided in accordance with condition 36, and any other relevant matters, the DECC shall advise the Minister on whether to formally review, maintain, modify, suspend or revoke the biodiversity certification of the SEPP if the species, population or ecological community is listed under the Act.

Review

38. A review of the biodiversity certification of the SEPP must be undertaken by the DECC every four years after the biodiversity certification order takes effect (to be completed within two months of each four year anniversary). The timing of the review may be adjusted by DECC to coincide with any planned review of the operation of the Special Infrastructure Contribution within the Growth Centres.

39. The purpose of the review is to assess progress in achieving an overall improvement or maintenance of biodiversity values, including review of the arrangements for the provision of funds to the Conservation Fund and the allocation of those funds within and outside of the Growth Centres.

40. To assist in the review required under condition 38, the GCC must provide the following information to the DECC in a timely manner:

a. an estimate of the amount of existing native vegetation, specified by vegetation community type, that has been cleared within the Growth Centres, including maps of known locations, within the four year period (or adjusted period);

b. progress in achieving the requirements of condition 6, including the following,

i. the amount of existing native vegetation that has been retained and protected within planning precincts,

ii. the amount of revegetation and/or restoration that has occurred (or is planned to occur) within planning precincts,

iii. an indicative estimate of the amount of existing native vegetation, and the amount of revegetated and/or restored areas, planned to be protected in the remaining precincts within the Growth Centres that are yet to be released;

c. an overview of any amendments to the SEPP or related measures that have occurred within the four year period (or adjusted period);

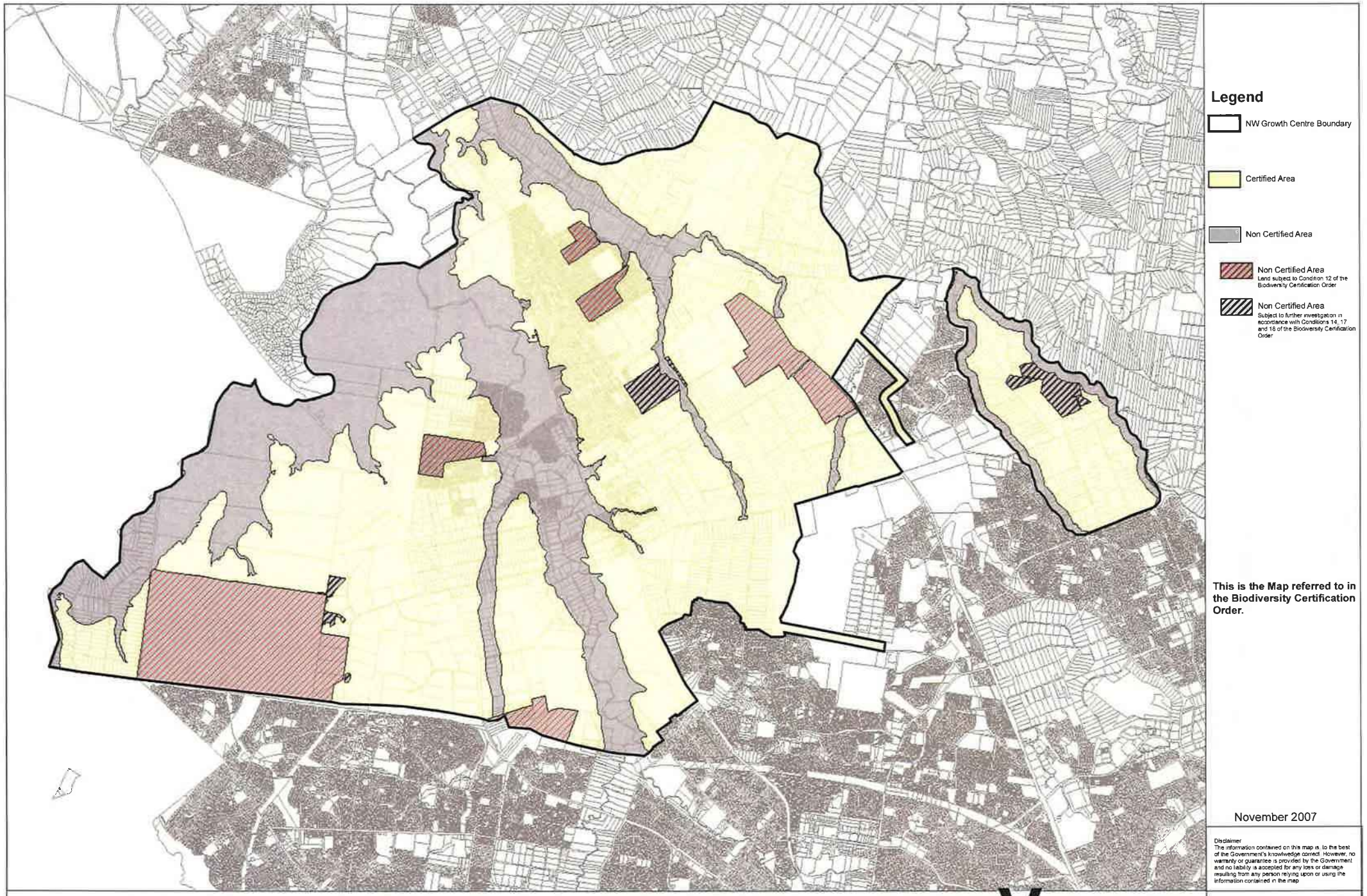
d. any recommendations that would improve the operation of the conditions of biodiversity certification including, but not limited to, any modifications

or revisions to the conditions themselves and the arrangements for management and allocation of funds from the Conservation Fund; and

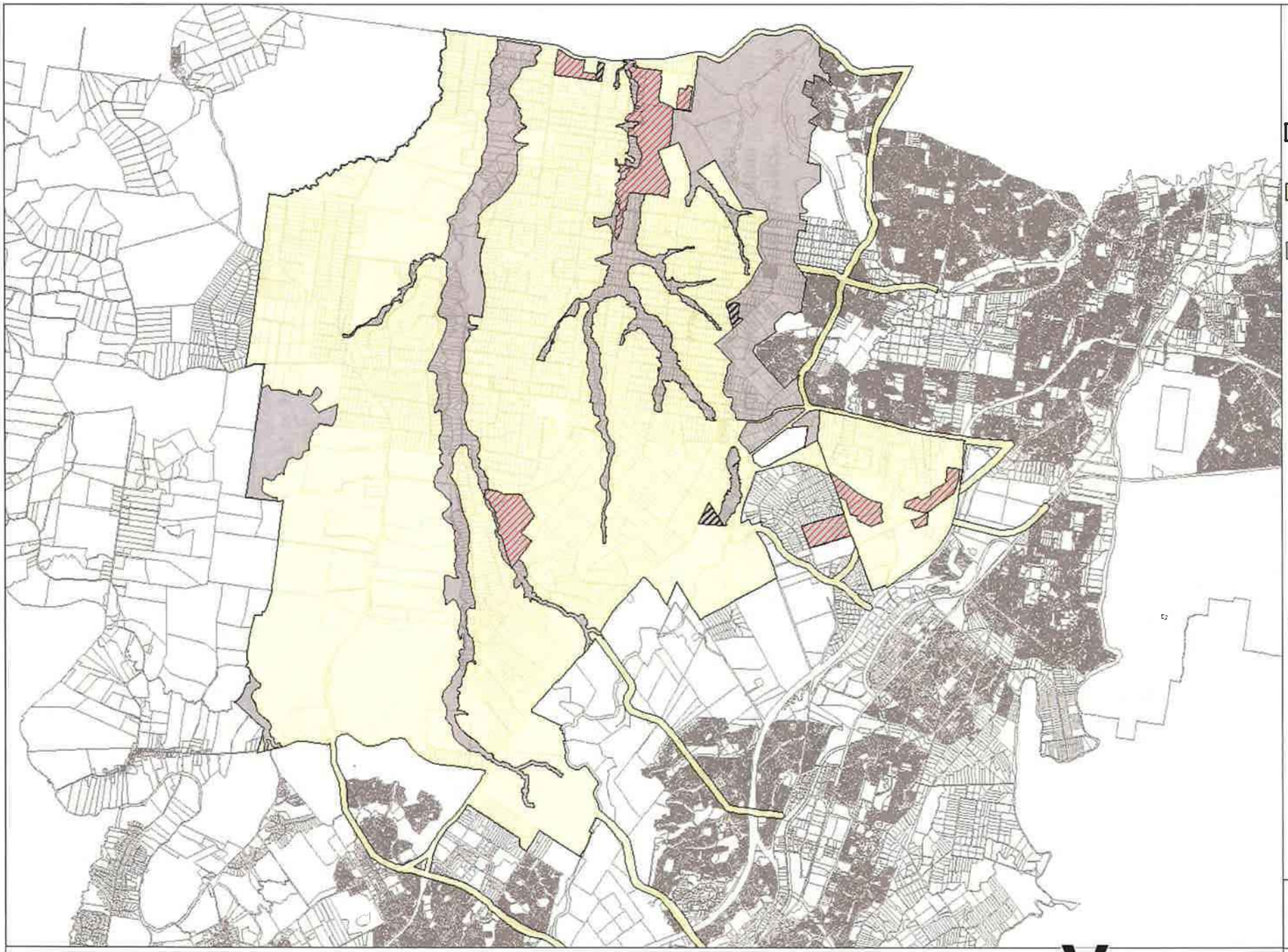
e. any other information that is considered relevant by the DECC to assist in reviewing whether the SEPP, and any other relevant measures, will continue to lead to the overall improvement or maintenance of biodiversity values.

41. Based on the information provided under condition 40, and any other relevant matters, the DECC shall advise the Minister on whether biodiversity certification should be maintained, modified, suspended or revoked.

SCHEDULE 2 – BIODIVERSITY CERTIFICATION MAPS



North West Growth Centre - Biodiversity Certification



Legend

- SW Growth Centre Boundary
- Certified Area
- Non Certified Area
- Non Certified Area
  Land subject to Condition 12 of the Biodiversity Certification Order
- Non Certified Area
  Subject to further investigation in accordance with Conditions 14, 17 and 18 of the Biodiversity Certification Order

This is the Map referred to in the Biodiversity Certification Order.

November 2007

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South West Growth Centre - Biodiversity Certification

Y

SCHEDULE 3 – CRITERIA REFERRED TO IN CONDITION 15

The following are the criteria referred to in condition 15 of Schedule 1.

Whether the areas:

a. contain an endangered ecological community as listed under the Act;

b. are contiguous with the existing native vegetation on the Air Services Australia site;

c. are equal to or greater than 4 hectares;

d. have 10% or greater canopy cover;

e. have 30% or greater vegetation cover within,

   i. a 0.55 kilometre radius (for local connectivity), and
   ii. a 1.75 kilometre radius (for regional connectivity),

   as measured from the approximate centre point of each area;

f. have a perimeter to area ratio that is conducive to on-going conservation management; and

g. whether after applying a 50 metre disturbance buffer to the edge of each area (where that edge is likely to be made available for future urban development as identified in the SEPP), the overall size of the area then falls below 4 hectares.

SCHEDULE 4 – INDICATIVE TEN YEAR PAYMENT TIMETABLE

The following timetable is that referred to in condition 22 of Schedule 1.

Financial year	Amount in current dollars ($ million)	Amount in 2005/06 dollars ($ million)
2008/09	1.0	1.0
2009/10	3.0	3.0
2010/11	5.8	5.8
2011/12	8.8	8.8
2012/13	10.4	10.4
2013/14	12.1	12.1
2014/15	12.9	12.9
2015/16	14.1	14.1
2016/17	15.1	15.1
2017/18	15.8	15.8

Appendix B

Riparian, Channel and Environmental Inventory' (RCE) Scores

River descriptors, categories and values used in the modified riparian, channel and environmental inventory (RCE) from Chessman *et al.* (1997).

Descriptor and category	Score
1. Land use pattern beyond the immediate riparian zone	
Undisturbed native vegetation	4
Mixed native vegetation and pasture/exotics	3
Mainly pasture, crops or pine plantation	2
Urban	1
2. Width of riparian strip of woody vegetation	
More than 30 m	4
Between 5 and 30 m	3
Less than 5 m	2
No woody vegetation	1
3. Completeness of riparian strip of woody vegetation	
Riparian strip without breaks in vegetation	4
Breaks at intervals of more than 50 m	3
Breaks at intervals of 10 - 50 m	2
Breaks at intervals of less than 10 m	1
4. Vegetation of riparian zone within 10 m of channel	
Native tree and shrub species	4
Mixed native and exotic trees and shrubs	3
Exotic trees and shrubs	2
Exotic grasses / weeds only	1
5. Stream bank structure	
Banks fully stabilised by trees, shrubs etc	4
Banks firm but held mainly by grass and herbs	3
Banks loose, partly held by sparse grass etc	2
Banks unstable, mainly loose sand or soil	1

Descriptor and category	Score
6. Bank undercutting	
None, or restricted by tree roots	4
Only on curves and at constrictions	3
Frequent along all parts of stream	2
Severe, bank collapses common	1
7. Channel form	
Deep: width / depth ratio < 7:1	4
Medium: width / depth ratio 8:1 to 15:1	3
Shallow: width / depth ratio > 15:1	2
Artificial: concrete or excavated channel	1
8. Riffle / pool sequence	
Frequent alternation of riffles and pools	4
Long pools with infrequent short riffles	3
Natural channel without riffle / pool sequence	2
Artificial channel; no riffle / pool sequence	1
9. Retention devices in stream	
Many large boulders and/or debris dams	4
Rocks / logs present; limited damming effect	3
Rocks / logs present, but unstable, no damming	2
Stream with few or no rocks / logs	1
10. Channel sediment accumulations	
Little or no accumulation of loose sediments	4
Some gravel bars but little sand or silt	3
Bars of sand and silt common	2
Braiding by loose sediment	1
11. Stream bottom	

Descriptor and category	Score
Mainly clean stones with obvious interstices	4
Mainly stones with some cover of algae / silt	3
Bottom heavily silted but stable	2
Bottom mainly loose and mobile sediment	1
12. Stream detritus	
Mainly unsilted wood, bark, leaves	4
Some wood, leaves etc. with much fine detritus	3
Mainly fine detritus mixed with sediment	2
Little or no organic detritus	1
13. Aquatic vegetation	
Little or no macrophyte or algal growth	4
Substantial algal growth; few macrophytes	3
Substantial macrophyte growth; little algae	2
Substantial macrophyte and algal growth	1

Appendix C

Criteria for the fish habitat classifications

Classification	Characteristics of Waterway Type	Minimum Recommended Crossing Type
Class 1 – Major Fish Habitat	Major permanently or intermittently flowing waterway (e.g. river or major creek), habitat of a threatened fish species.	Bridge, arch structure or tunnel.
Class 2 – Moderate fish habitat	Named permanent or intermittent stream, creek or waterway with clearly defined bed and banks and with semi-permanent to permanent waters in pools or in connected wetland areas. Marine or freshwater aquatic vegetation is present. Known fish habitat and / or fish observed inhabiting the area.	Bridge, arch structure, culvert or ford.
Class 3 – Minimal fish habitat	Named or unnamed waterway with intermittent flow and potential refuge, breeding or feeding areas for some aquatic fauna (e.g. fish, yabbies). Semi-permanent pools form within the waterway or adjacent wetlands after a rain event. Otherwise, any minor waterway that interconnects with wetlands or recognised aquatic habitats.	Culvert or ford
Class 4 – Unlikely fish habitat	Named or unnamed watercourse with intermittent flow during rain events only, little or no defined drainage channel, little or no free standing water or pools after rain event (e.g. dry gullies or shallow floodplain depression with no permanent wetland aquatic flora present).	Culvert, causeway or ford

Appendix D

Fauna Species Lists

A search of the *NSW Wildlife Atlas Database*, the *EPBC Protected Matters Database* and the *Birds Australia Atlas Database* undertaken in August 2010, identified 466 fauna species occurring in Liverpool and Camden LGAs. These species included 28 amphibians, 312 birds, 4 Gastropods, 79 mammals, and 43 reptiles (**Table D1**). A threatened species fauna list for the Liverpool and Camden LGAs is presented in the **Table D2**.

Table D1 List of fauna species occurring in Liverpool and Camden LGAs.

Scientific Name	Common Name	Last Sited
Amphibia		
Crinia parinsignifera	Eastern Sign-bearing Froglet	25/10/1999
Crinia signifera	Common Eastern Froglet	7/09/2009
Heleioporus australiacus	Giant Burrowing Frog	4/04/2005
Limnodynastes dumerilii	Eastern Banjo Frog	25/03/1999
Limnodynastes fletcheri	Long-thumbed Frog	9/04/1983
Limnodynastes ornatus	Ornate Burrowing Frog	12/04/2005
Limnodynastes peronii	Brown-striped Frog	9/02/2009
Limnodynastes tasmaniensis	Spotted Grass Frog	5/09/2007
Litoria aurea	Green and Golden Bell Frog	22/03/1999
Litoria caerulea	Green Tree Frog	12/05/2005
Litoria dentata	Bleating Tree Frog	31/08/2007
Litoria ewingii	Brown Tree Frog	20/05/1996
Litoria fallax	Eastern Dwarf Tree Frog	15/10/2008
Litoria freycineti	Freycinet's Frog	13/11/1998
Litoria latopalmata	Broad-palmed Frog	15/11/2001
Litoria lesueuri	Lesueur's Frog	2/04/2005
Litoria peronii	Peron's Tree Frog	18/03/2008
Litoria raniformis	Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog	Unknown
Litoria tyleri	Tyler's Tree Frog	21/01/2004
Litoria verreauxii	Verreaux's Frog	18/03/2008
Litoria verreauxii verreauxii	Verreaux's Tree Frog (subsp)	5/09/2007
Litoria wilcoxii		27/04/2007
Mixophyes iteratus	Southern Barred Frog, Giant Barred Frog	unknown
Pseudophryne australis	Red-crowned Toadlet	30/08/2005
Pseudophryne bibronii	Bibron's Toadlet	7/07/2006
Rhinella marina	Cane Toad	30/06/2006
Uperoleia laevigata	Smooth Toadlet	29/04/2008
Uperoleia sp.		5/09/2007
Aves		
Acanthiza chrysorrhoa	Yellow-rumped Thornbill	7/09/2009
Acanthiza chrysorrhoa leighi		12/11/1989
Acanthiza lineata	Striated Thornbill	6/07/2006

Scientific Name	Common Name	Last Sited
Acanthiza nana	Yellow Thornbill	7/09/2009
Acanthiza pusilla	Brown Thornbill	7/09/2009
Acanthiza reguloides	Buff-rumped Thornbill	27/06/2006
Acanthiza sp.	Unidentified Thornbill	10/02/2009
Acanthorhynchus tenuirostris	Eastern Spinebill	26/11/2008
Accipiter cirrocephalus	Collared Sparrowhawk	18/03/2008
Accipiter fasciatus	Brown Goshawk	31/08/2007
Accipiter novaehollandiae	Grey Goshawk	5/09/2007
Acrocephalus australis	Australian Reed-Warbler	26/11/2008
Actitis hypoleucos	Common Sandpiper	2/01/1988
Aegotheles cristatus	Australian Owlet-nightjar	18/05/2006
Aerodramus terraereginae	Australian Swiftlet	29/07/1984
Alauda arvensis	Eurasian Skylark	22/02/2006
Alisterus scapularis	Australian King-Parrot	29/04/2008
Anas castanea	Chestnut Teal	15/10/2008
Anas gracilis	Grey Teal	26/11/2008
Anas platyrhynchos	Mallard	26/11/2008
Anas rhynchotis	Australasian Shoveler	30/07/2007
Anas superciliosa	Pacific Black Duck	29/04/2008
Anhinga novaehollandiae	Australasian Darter	15/10/2008
Anthochaera carunculata	Red Wattlebird	7/09/2009
Anthochaera chrysoptera	Little Wattlebird	26/11/2008
Anthochaera phrygia	Regent Honeyeater	Unknown
Anthus novaeseelandiae	Australian Pipit	12/10/2009
Apus pacificus	Fork-tailed Swift	1/12/1987
Aquila audax	Wedge-tailed Eagle	1/06/2009
Ardea ibis	Cattle Egret	1/06/2009
Ardea intermedia	Intermediate Egret	29/08/2007
Ardea alba (or Ardea modesta)	Eastern Great Egret, White Egret	26/07/2007
Ardea pacifica	White-necked Heron	2/08/2002
Ardenna bulleri	Buller's Shearwater	19/01/1992
Ardenna creatopus	Pink-footed Shearwater	22/03/1986
Ardenna grisea	Sooty Shearwater	15/11/1990
Ardenna pacificus	Wedge-tailed Shearwater	24/02/1990
Artamus cyanopterus	Dusky Woodswallow	18/09/2007
Artamus personatus	Masked Woodswallow	20/10/2004
Artamus superciliosus	White-browed Woodswallow	15/11/1991
Aviceda subcristata	Pacific Baza	6/12/2007
Aythya australis	Hardhead	18/03/2008
Barnardius zonarius	Australian Ringneck	30/08/1988
Biziura lobata	Musk Duck	31/10/1991
Burhinus grallarius	Bush Stone-curlew	31/12/1950

Scientific Name	Common Name	Last Sited
Butorides striatus	Striated Heron	5/09/2007
Cacatua galerita	Sulphur-crested Cockatoo	1/06/2009
Cacatua sanguinea	Little Corella	7/09/2009
Cacatua tenuirostris	Long-billed Corella	15/10/2008
Cacomantis flabelliformis	Fan-tailed Cuckoo	7/09/2009
Cacomantis pallidus	Pallid Cuckoo	5/09/2007
Cacomantis variolosus	Brush Cuckoo	20/12/2001
Callocephalon fimbriatum	Gang-gang Cockatoo	27/04/2006
Calonectris leucomelas	Streaked Shearwater	29/04/1992
Calyptorhynchus funereus	Yellow-tailed Black-Cockatoo	26/11/2008
Calyptorhynchus lathami	Glossy Black-Cockatoo	12/04/2006
Carduelis carduelis	European Goldfinch	18/09/2007
Catharacta skua	Great Skua	29/08/1992
Centropus phasianinus	Pheasant Coucal	5/04/2005
Ceyx azureus	Azure Kingfisher	27/04/2007
Chalcites basalis	Horsfield's Bronze-Cuckoo	18/09/2007
Chalcites lucidus	Shining Bronze-Cuckoo	31/08/2007
Chenonetta jubata	Australian Wood Duck	7/09/2009
Cheramoeca leucosterna	White-backed Swallow	25/01/1983
Chlidonias leucopterus	White-winged Black Tern	28/11/1989
Chloris chloris	European Greenfinch	23/09/1981
Chroicocephalus novaehollandiae	Silver Gull	30/07/2007
Cinclosoma punctatum	Spotted Quail-thrush	16/06/2006
Circus approximans	Swamp Harrier	30/07/2007
Circus assimilis	Spotted Harrier	19/02/1991
Cisticola exilis	Golden-headed Cisticola	15/10/2008
Colluricincla harmonica	Grey Shrike-thrush	10/06/2008
Columba livia	Rock Dove	15/10/2008
Coracina novaehollandiae	Black-faced Cuckoo-shrike	7/09/2009
Coracina novaehollandiae melanops		1/08/1993
Coracina papuensis	White-bellied Cuckoo-shrike	30/07/2007
Corcorax melanorhamphos	White-winged Chough	18/03/2008
Cormobates leucophaea	White-throated Treecreeper	7/09/2009
Corvus coronoides	Australian Raven	12/10/2009
Corvus mellori	Little Raven	1/06/2009
Coturnix pectoralis	Stubble Quail	15/03/2001
Coturnix ypsilophora	Brown Quail	10/02/2009
Cracticus nigrogularis	Pied Butcherbird	26/11/2008
Cracticus tibicen	Australian Magpie	12/10/2009
Cracticus tibicen tibicen		3/11/2002
Cracticus torquatus	Grey Butcherbird	7/09/2009
Cracticus torquatus torquatus		1/08/1993

Scientific Name	Common Name	Last Sited
Cygnus atratus	Black Swan	9/02/2009
Dacelo novaeguineae	Laughing Kookaburra	7/09/2009
Daphoenositta chrysoptera	Varied Sittella	7/09/2009
Daption capense	Cape Petrel	24/06/1990
Dicaeum hirundinaceum	Mistletoebird	5/09/2007
Dicrurus bracteatus	Spangled Drongo	30/07/2007
Diomedea epomophora	Royal Albatross	25/10/1986
Diomedea exulans	Wandering Albatross	29/11/1992
Egretta garzetta	Little Egret	25/05/2006
Egretta novaehollandiae	White-faced Heron	1/06/2009
Elanus axillaris	Black-shouldered Kite	6/12/2007
Elseyornis melanops	Black-fronted Dotterel	30/07/2007
Eolophus roseicapillus	Galah	7/09/2009
Eolophus roseicapillus albiceps		19/03/1994
Eopsaltria australis	Eastern Yellow Robin	7/09/2009
Eopsaltria australis australis		1/08/1993
Epthianura albifrons	White-fronted Chat	18/11/1996
Eudynamys orientalis	Eastern Koel	15/10/2008
Eurystomus orientalis	Dollarbird	6/12/2007
Falco berigora	Brown Falcon	7/09/2009
Falco cenchroides	Nankeen Kestrel	12/10/2009
Falco longipennis	Australian Hobby	18/03/2008
Falco peregrinus	Peregrine Falcon	18/03/2008
Falco subniger	Black Falcon	13/03/2000
Falcunculus frontatus frontatus	Eastern Shrike-tit	27/06/2006
Fregetta grallaria	White-bellied Storm-Petrel	28/05/1989
Fregetta tropica	Black-bellied Storm-Petrel	26/11/1989
Fulica atra	Eurasian Coot	18/03/2008
Fulmarus glacialoides	Southern Fulmar	22/08/1987
Gallinago hardwickii	Latham's Snipe	31/10/1991
Gallinula tenebrosa	Dusky Moorhen	10/06/2008
Gallirallus philippensis	Buff-banded Rail	30/07/2007
Garrodia nereis	Grey-backed Storm-Petrel	27/07/1985
Gelochelidon nilotica	Gull-billed Tern	27/11/1988
Geopelia cuneata	Diamond Dove	24/10/1992
Geopelia humeralis	Bar-shouldered Dove	10/06/2006
Geopelia striata	Peaceful Dove	12/06/2006
Gerygone albogularis	White-throated Gerygone	31/08/2007
Gerygone fusca	Western Gerygone	2/01/1982
Gerygone mouki	Brown Gerygone	15/10/2008
Gliciphila melanops	Tawny-crowned Honeyeater	16/06/2006
Glossopsitta concinna	Musk Lorikeet	1/08/2007

Scientific Name	Common Name	Last Sited
Glossopsitta pusilla	Little Lorikeet	1/08/2007
Grallina cyanoleuca	Magpie-lark	7/09/2009
Gygis alba	White Tern	4/06/1989
Haliaeetus leucogaster	White-bellied Sea-Eagle	15/10/2008
Haliastur sphenurus	Whistling Kite	25/05/2006
Hieraaetus morphnoides	Little Eagle	31/08/2007
Himantopus himantopus	Black-winged Stilt	30/07/2007
Hirundapus caudacutus	White-throated Needletail	20/03/2005
Hirundo neoxena	Welcome Swallow	12/10/2009
Hydroprogne caspia	Caspian Tern	30/07/2007
Hylacola pyrrhopygia	Chestnut-rumped Heathwren	28/02/1995
Ixobrychus dubius	Australian Little Bittern	26/02/1989
Lalage sueurii	White-winged Triller	7/09/2009
Larus pacificus	Pacific Gull	30/06/1988
Lathamus discolor	Swift Parrot	12/06/2006
Leucosarcia picata	Wonga Pigeon	10/06/2006
Lichenostomus chrysops	Yellow-faced Honeyeater	5/09/2007
Lichenostomus fuscus	Fuscous Honeyeater	31/08/2007
Lichenostomus leucotis	White-eared Honeyeater	7/07/2006
Lichenostomus melanops	Yellow-tufted Honeyeater	27/04/2007
Lichenostomus penicillatus	White-plumed Honeyeater	15/10/2008
Lonchura castaneothorax	Chestnut-breasted Mannikin	8/05/1993
Lonchura punctulata	Nutmeg Mannikin	10/06/2006
Lophoictinia isura	Square-tailed Kite	16/06/2006
Lopholaimus antarcticus	Topknot Pigeon	15/03/2000
Macronectes giganteus	Southern Giant Petrel	26/07/1992
Macronectes halli	Northern Giant-Petrel	21/09/1985
Macropygia amboinensis	Brown Cuckoo-Dove	27/04/2007
Malacorhynchus membranaceus	Pink-eared Duck	26/07/2007
Malurus cyaneus	Superb Fairy-wren	7/09/2009
Malurus lamberti	Variegated Fairy-wren	7/07/2006
Manorina melanocephala	Noisy Miner	12/10/2009
Manorina melanophrys	Bell Miner	7/09/2009
Megalurus gramineus	Little Grassbird	30/07/2007
Megalurus timoriensis	Tawny Grassbird	26/11/2008
Melanodryas cucullata	Hooded Robin	6/01/1998
Meliphaga lewinii	Lewin's Honeyeater	17/07/2008
Melithreptus brevirostris	Brown-headed Honeyeater	31/08/2007
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	30/07/2007
Melithreptus lunatus	White-naped Honeyeater	30/07/2007
Menura novaehollandiae	Superb Lyrebird	5/09/2007

Scientific Name	Common Name	Last Sited
Merops ornatus	Rainbow Bee-eater	24/02/2006
Microcarbo melanoleucos	Little Pied Cormorant	31/08/2007
Microeca fascinans	Jacky Winter	7/09/2009
Milvus migrans	Black Kite	7/08/1983
Monarcha melanopsis	Black-faced Monarch	27/02/2006
Morus serrator	Australasian Gannet	18/06/1967
Myiagra cyanoleuca	Satin Flycatcher	15/10/2008
Myiagra inquieta	Restless Flycatcher	7/09/2009
Myiagra rubecula	Leaden Flycatcher	16/04/2006
Myiagra sp.	unidentified Flycatcher	15/11/2001
Myzomela sanguinolenta	Scarlet Honeyeater	23/03/2009
Neochmia modesta	Plum-headed Finch	14/05/1996
Neochmia temporalis	Red-browed Finch	26/11/2008
Ninox connivens	Barking Owl	31/12/1903
Ninox novaeseelandiae	Southern Boobook	31/08/2007
Ninox strenua	Powerful Owl	30/07/2007
Numenius phaeopus	Whimbrel	26/11/2008
Nycticorax caledonicus	Nankeen Night Heron	30/07/2007
Nymphicus hollandicus	Cockatiel	10/06/2006
Oceanites oceanicus	Wilson's Storm-Petrel	29/11/1992
Ocyphaps lophotes	Crested Pigeon	12/10/2009
Origma solitaria	Rockwarbler	3/02/1999
Oriolus sagittatus	Olive-backed Oriole	7/09/2009
Oxyura australis	Blue-billed Duck	7/04/1980
Pachycephala pectoralis	Golden Whistler	26/11/2008
Pachycephala rufiventris	Rufous Whistler	7/09/2009
Pachyptila belcheri	Slender-billed Prion	1/08/1992
Pachyptila desolata	Antarctic Prion	24/06/1990
Pachyptila turtur	Fairy Prion	29/08/1992
Pardalotus punctatus	Spotted Pardalote	7/09/2009
Pardalotus striatus	Striated Pardalote	18/03/2008
Passer domesticus	House Sparrow	26/11/2008
Pelagodroma marina	White-faced Storm-Petrel	29/11/1992
Pelecanus conspicillatus	Australian Pelican	22/07/2009
Petrochelidon ariel	Fairy Martin	15/10/2008
Petrochelidon nigricans	Tree Martin	20/10/2004
Petroica boodang	Scarlet Robin	16/06/2006
Petroica goodenovii	Red-capped Robin	25/09/1982
Petroica phoenicea	Flame Robin	13/01/2004
Petroica rosea	Rose Robin	31/08/2007
Phaethon lepturus	White-tailed Tropicbird	12/03/1989
Phaethon rubricauda	Red-tailed Tropicbird	24/02/1991

Scientific Name	Common Name	Last Sited
Phalacrocorax carbo	Great Cormorant	5/09/2007
Phalacrocorax sulcirostris	Little Black Cormorant	17/07/2008
Phalacrocorax varius	Pied Cormorant	15/10/2008
Phaps chalcoptera	Common Bronzewing	27/06/2006
Phaps elegans	Brush Bronzewing	8/09/1983
Philemon citreogularis	Little Friarbird	14/01/2005
Philemon corniculatus	Noisy Friarbird	31/08/2007
Phoebetria fusca	Sooty Albatross	25/05/1985
Phoebetria palpebrata	Light-mantled Sooty Albatross	27/10/1985
Phylidonyris niger	White-cheeked Honeyeater	15/10/2008
Phylidonyris novaehollandiae	New Holland Honeyeater	26/11/2008
Platalea flavipes	Yellow-billed Spoonbill	27/06/2006
Platalea regia	Royal Spoonbill	18/03/2008
Platycercus elegans	Crimson Rosella	26/11/2008
Platycercus eximius	Eastern Rosella	12/10/2009
Podargus strigoides	Tawny Frogmouth	6/12/2007
Podiceps cristatus	Great Crested Grebe	2/10/1997
Poliocephalus poliocephalus	Hoary-headed Grebe	27/04/2006
Porphyrio porphyrio	Purple Swamphen	7/09/2009
Porzana pusilla	Baillon's Crake	2/10/1997
Porzana tabuensis	Spotless Crake	30/07/2007
Procellaria aequinoctialis	White-chinned Petrel	29/11/1992
Procellaria parkinsoni	Black Petrel	19/11/1992
Procelsterna cerulea	Grey Ternlet	24/02/1990
Psephotus haematonotus	Red-rumped Parrot	7/05/2010
Pseudobulweria rostrata	Tahiti Petrel	20/11/1991
Psophodes olivaceus	Eastern Whipbird	1/06/2009
Pterodroma arminjoniana	Herald Petrel	17/04/1988
Pterodroma cervicalis	White-necked Petrel	16/02/1992
Pterodroma cookii	Cook's Petrel	27/10/1985
Pterodroma externa	Juan Fernandez Petrel	10/08/1981
Pterodroma inexpectata	Mottled Petrel	19/01/1992
Pterodroma lessonii	White-headed Petrel	26/07/1992
Pterodroma leucoptera leucoptera	Gould's Petrel	19/01/1992
Pterodroma macroptera	Great-winged Petrel	29/11/1992
Pterodroma mollis	Soft-plumaged Petrel	23/10/1988
Pterodroma neglecta neglecta	Kermadec Petrel (west Pacific subspecies)	24/02/1990
Pterodroma nigripennis	Black-winged Petrel	26/11/1989
Pterodroma solandri	Providence Petrel	29/11/1992
Ptilonorhynchus violaceus	Satin Bowerbird	15/10/2008
Puffinus assimilis	Little Shearwater	28/05/1989

Scientific Name	Common Name	Last Sited
Puffinus carneipes	Flesh-footed Shearwater	27/11/1988
Puffinus gavia	Fluttering Shearwater	29/08/1992
Puffinus huttoni	Hutton's Shearwater	15/11/1990
Puffinus lherminieri	Audubon's Shearwater	28/02/1987
Purnella albifrons	White-fronted Honeyeater	18/09/1985
Pycnonotus jocosus	Red-whiskered Bulbul	7/09/2009
Pyrrholaemus saggitatus	Speckled Warbler	27/06/2006
Recurvirostra novaehollandiae	Red-necked Avocet	30/07/2007
Rhipidura albiscapa	Grey Fantail	7/09/2009
Rhipidura leucophrys	Willie Wagtail	7/09/2009
Rhipidura rufifrons	Rufous Fantail	27/02/2006
Rostratula benghalensis australis (or Rostratula australis)	Australian Painted Snipe	unknown
Scythrops novaehollandiae	Channel-billed Cuckoo	16/03/2005
Sericornis citreogularis	Yellow-throated Scrubwren	3/02/1994
Sericornis frontalis	White-browed Scrubwren	26/11/2008
Sericornis magnirostra	Large-billed Scrubwren	28/02/1995
Smicrornis brevirostris	Weebill	31/08/2007
Sphecotheres vieilloti	Australasian Figbird	11/11/1984
Stagonopleura bella	Beautiful Firetail	20/01/1994
Stagonopleura guttata	Diamond Firetail	2/06/1990
Stercorarius longicaudus	Long-tailed Jaeger	29/11/1992
Stercorarius maccormicki	South Polar Skua	20/06/1990
Stercorarius pomarinus	Pomarine Jaeger	15/11/1990
Sterna fuscata	Sooty Tern	24/11/1991
Sterna paradisaea	Arctic Tern	24/09/1989
Sterna striata	White-fronted Tern	29/08/1987
Stictonetta naevosa	Freckled Duck	19/02/2003
Stipiturus malachurus	Southern Emu-wren	15/11/2001
Strepera graculina	Pied Currawong	1/06/2009
Strepera versicolor	Grey Currawong	30/04/1996
Streptopelia chinensis	Spotted Turtle-Dove	7/09/2009
Sturnus tristis	Common Myna	7/09/2009
Sturnus vulgaris	Common Starling	7/09/2009
Sula leucogaster	Brown Booby	15/11/1990
Tachybaptus novaehollandiae	Australasian Grebe	18/03/2008
Taeniopygia bichenovii	Double-barred Finch	26/11/2008
Taeniopygia guttata	Zebra Finch	20/02/2006
Thalassarche bulleri	Buller's Albatross	14/11/1991
Thalassarche cauta	Shy Albatross	29/11/1992
Thalassarche chlororhynchos	Yellow-nosed Albatross	3/07/1988
Thalassarche chrysostoma	Grey-headed Albatross	26/05/1985

Scientific Name	Common Name	Last Sited
Thalassarche melanophris	Black-browed Albatross	29/11/1992
Threskiornis molucca	Australian White Ibis	26/11/2008
Threskiornis spinicollis	Straw-necked Ibis	18/03/2008
Todiramphus pyrrhopygius	Red-backed Kingfisher	20/11/1991
Todiramphus sanctus	Sacred Kingfisher	31/08/2007
Trichoglossus chlorolepidotus	Scaly-breasted Lorikeet	7/09/2009
Trichoglossus haematodus	Rainbow Lorikeet	7/09/2009
Tringa nebularia	Common Greenshank	26/04/2006
Turdus merula	Eurasian Blackbird	15/10/2008
Turnix varius	Painted Button-quail	12/06/2006
Tyto javanica	Eastern Barn Owl	15/06/2006
Tyto novaehollandiae	Masked Owl	Unknown
Vanellus miles	Masked Lapwing	7/09/2009
Vanellus miles novaehollandiae	[Spur-winged Plover]	1/08/1993
Vanellus tricolor	Banded Lapwing	3/07/2000
Xanthomyza phrygia	Regent Honeyeater	15/01/1991
Zoothera sp.	unidentified ground thrush	25/05/1996
Zosterops lateralis	Silvereye	7/09/2009
Gastropoda		
Bradybaena similaris	Asian trampsnail	15/12/2001
Helix aspersa	Brown gardensnail	18/03/2008
Limax maximus	Giant Garden Slug	10/07/2003
Meridolum corneovirens	Cumberland Plain Land Snail	31/12/1889
Mammalia		
Antechinus sp.	Unidentified Antechinus	4/04/2005
Antechinus stuartii	Brown Antechinus	20/04/2006
Arctocephalus forsteri	New Zealand Fur-seal	22/08/1997
Bettongia penicillata penicillata	Brush-tailed Bettong (South-East Mainland)	12/12/1857
Bos taurus	European cattle	12/10/2009
Canis lupus	Dingo, domestic dog	30/06/2006
Canis lupus familiaris	Dog	17/01/2008
Capra hircus	Goat	27/06/2006
Cercartetus nanus	Eastern Pygmy-possum	27/11/1993
Cervus elaphus	Red Deer	10/06/2006
Cervus sp.	Unidentified Deer	30/06/2006
Cervus timorensis	Rusa Deer	5/09/2007
Chalinolobus dwyeri	Large-eared Pied Bat	15/12/2001
Chalinolobus gouldii	Gould's Wattled Bat	7/09/2009
Chalinolobus morio	Chocolate Wattled Bat	7/09/2009
Dama dama	Fallow Deer	8/04/2005
Dasyuridae sp.	unidentified dasyurid	29/03/2005

Scientific Name	Common Name	Last Sited
Dasyurus maculatus	Spotted-tailed Quoll	31/12/2004
Dolphin sp.	Unidentified Dolphin	26/09/1998
Equus caballus	Horse	19/09/2006
Falsistrellus tasmaniensis	Eastern False Pipistrelle	7/08/2007
Felis catus	Cat	26/11/2008
Hydromys chrysogaster	Water-rat	8/07/1998
Lepus capensis	Brown Hare	12/10/2009
Macropod sp.	unidentified macropod	17/04/2006
Macropus giganteus	Eastern Grey Kangaroo	31/08/2007
Macropus robustus	Common Wallaroo	27/06/2006
Macropus rufogriseus	Red-necked Wallaby	30/04/1996
Macropus sp.	kangaroo / wallaby	5/09/2007
Megaptera novaeangliae	Humpback Whale	26/09/1998
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	18/03/2008
Mormopterus "Species 2"	Undescribed Freetail Bat	18/03/2008
Mormopterus norfolkensis	Eastern Freetail-bat	7/09/2009
Mormopterus norfolkensis/sp 1	Unidentified Mastiff-bat	14/10/1997
Mormopterus sp.	mastiff-bat	7/08/2007
Mus musculus	House Mouse	5/09/2007
Myotis macropus	Southern Myotis	18/03/2008
Nyctophilus geoffroyi	Lesser Long-eared Bat	6/12/2007
Nyctophilus gouldi	Gould's Long-eared Bat	26/04/2006
Nyctophilus sp.	long-eared bat	7/09/2009
Ornithorhynchus anatinus	Platypus	30/06/2006
Oryctolagus cuniculus	Rabbit	7/09/2009
Ovis aries	Sheep (feral)	18/03/2008
Perameles nasuta	Long-nosed Bandicoot	15/11/2001
Petauroides volans	Greater Glider	12/04/2006
Petaurus breviceps	Sugar Glider	26/11/2008
Petaurus norfolcensis	Squirrel Glider	26/04/2006
Petaurus sp.	glider	4/07/2003
Petrogale penicillata	Brush-tailed Rock-wallaby	30/11/1996
Potorous tridactylus tridactylus	Long-nosed Potoroo	Unknown
Phascolarctos cinereus	Koala	29/11/2009
Pseudocheirus peregrinus	Common Ringtail Possum	26/11/2008
Pteropus poliocephalus	Grey-headed Flying-fox	17/06/2009
Pteropus scapulatus	Little Red Flying-fox	6/12/2007
Rattus fuscipes	Bush Rat	17/03/2005
Pseudomys novaehollandiae	New Holland Mouse	Unknown
Rattus lutreolus	Swamp Rat	28/06/1991
Rattus norvegicus	Brown Rat	15/12/2001
Rattus rattus	Black Rat	18/03/2008

Scientific Name	Common Name	Last Sited
Rattus sp.	rat	27/04/2006
Rhinolophus megaphyllus	Eastern Horseshoe-bat	23/02/1994
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	6/06/2003
Scoteanax rueppellii	Greater Broad-nosed Bat	18/03/2008
Scotorepens orion	Eastern Broad-nosed Bat	10/02/2009
Sminthopsis murina	Common Dunnart	15/11/2001
Sus scrofa	Pig	9/02/2009
Tachyglossus aculeatus	Short-beaked Echidna	18/03/2008
Tadarida australis	White-striped Freetail-bat	7/09/2009
Trichosurus caninus	Short-eared Possum	23/02/1994
Trichosurus sp.	brushtail possum	30/06/2006
Trichosurus vulpecula	Common Brushtail Possum	9/02/2009
Vespadelus darlingtoni	Large Forest Bat	18/03/2008
Vespadelus pumilus	Eastern Forest Bat	21/11/2005
Vespadelus regulus	Southern Forest Bat	21/11/2005
Vespadelus sp.	Unidentified Eptesicus	22/11/2005
Vespadelus vulturnus	Little Forest Bat	7/09/2009
Vombatus ursinus	Common Wombat	29/04/2008
Vulpes vulpes	Fox	9/02/2009
Wallabia bicolor	Swamp Wallaby	29/04/2008
Reptilia		
Acritoscincus platynota	Red-throated Skink	15/03/2000
Amphibolurus muricatus	Jacky Lizard	31/08/2007
Cacophis squamulosus	Golden-crowned Snake	7/07/2006
Chelodina longicollis	Eastern Snake-necked Turtle	15/10/2008
Cheloniidae sp.	unidentified sea turtle	1/12/2002
Cryptoblepharus virgatus	Cream-striped Shinning-skink	18/09/2007
Ctenotus robustus	Robust Ctenotus	5/09/2007
Ctenotus taeniolatus	Copper-tailed Skink	15/08/2006
Demansia psammophis	Yellow-faced Whip Snake	10/05/2006
Dendrelaphis punctulatus	Common Tree Snake	29/04/2008
Diplodactylus vittatus	Wood Gecko	16/06/2006
Egernia cunninghami	Cunningham's Skink	8/04/2005
Emydura macquarii	Murray Turtle	27/08/2007
Eulamprus heatwolei	Yellow-bellied Water-skink	9/01/2000
Eulamprus quoyii	Eastern Water-skink	15/10/2008
Eulamprus tenuis	Barred-sided Skink	30/07/2007
Furina diadema	Red-naped Snake	30/08/2005
Hemiaspis signata	Black-bellied Swamp Snake	19/01/1999
Hoplocephalus bungaroides	Broad-headed Snake	Unknown
Hydrophis elegans	Elegant Seasnake	28/02/1982
Lampropholis delicata	Dark-flecked Garden Sunskink	12/10/2009

Scientific Name	Common Name	Last Sited
Lampropholis guichenoti	Pale-flecked Garden Sunskink	1/06/2009
Lampropholis sp.	Unidentified grass skink	18/12/2008
Lygisaurus foliorum	Tree-base Litter-skink	30/08/2007
Morelia spilota	Carpet & Diamond Pythons	19/03/2005
Notechis scutatus	Tiger Snake	30/08/2007
Oedura lesueurii	Lesueur's Velvet Gecko	27/09/2004
Phyllurus platurus	Broad-tailed Gecko	30/03/2005
Physignathus lesueurii	Eastern Water Dragon	7/08/2007
Pogona barbata	Bearded Dragon	18/03/2008
Pseudechis porphyriacus	Red-bellied Black Snake	15/10/2008
Pseudonaja textilis	Eastern Brown Snake	21/10/2009
Pygopus lepidopodus	Common Scaly-foot	19/03/2005
Ramphotyphlops nigrescens	Blackish Blind Snake	10/02/2009
Rankinia diemensis	Mountain Dragon	6/04/2005
Saiphos equalis	Three-toed Skink	30/07/2007
Saproscincus mustelinus	Weasel Skink	26/04/2006
Tiliqua nigrolutea	Blotched Blue-tongue	17/09/1975
Tiliqua scincoides	Eastern Blue-tongue	1/06/2009
Underwoodisaurus milii	Thick-tailed Gecko	31/12/1992
Varanus sp.	Unidentified Goanna	15/11/2001
Varanus varius	Lace Monitor	1/04/2005
Vermicella annulata	Bandy-bandy	7/02/1999

Table D2 List of threatened fauna species occurring in Liverpool and Camden LGAs.

Species Name	Common Name	*EPBC Act 2000*	*TSC Act 1995 Classification*
Amphibia			
Litoria aurea	Green and Golden Bell Frog	Vulnerable	Endangered
Heleioporus australiacus	Giant Burrowing Frog	Vulnerable	Vulnerable
Litoria raniformis	Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog	Vulnerable	Endangered
Mixophyes iterates	Southern Barred Frog, Giant Barred Frog	Endangered	Endangered
Pseudophryne australis	Red-crowned Toadlet	-	Vulnerable
Aves			
Oxyura australis	Blue-billed Duck	-	Vulnerable
Stictonetta naevosa	Freckled Duck	-	Vulnerable

Anthochaera phrygia	Regent Honeyeater	Endangered	Endangered
Rostratula australis	Australian Painted Snipe	Vulnerable	Endangered
Pyrrholaemus saggitatus	Speckled Warbler	-	Vulnerable
Circus assimilis	Spotted Harrier	-	Vulnerable
Stagonopleura guttata	Diamond Firetail	-	Vulnerable
Haliaeetus leucogaster	White-bellied Sea-Eagle	Marine, Migratory	-
Hirundapus caudacutus	White-throated Needletail	Marine, Migratory	-
Hieraaetus morphnoides	Little Eagle	-	Vulnerable
Lophoictinia isura	Square-tailed Kite	-	Vulnerable
Burhinus grallarius	Bush Stone-curlew	-	Endangered
Callocephalon fimbriatum	Gang-gang Cockatoo	-	Vulnerable
Calyptorhynchus lathami	Glossy Black-Cockatoo	Endangered (SA)	Vulnerable
Merops ornatus	Rainbow Bee-eater	Marine, Migratory	-
Monarcha melanopsis	Black-faced Monarch	Marine, Migratory	-
Myiagra cyanoleuca	Satin Flycatcher	Marine, Migratory	-
Rhipidura rufifrons	Rufous Fantail	Marine, Migratory	-
Epthianura albifrons	White-fronted Chat	-	Vulnerable
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	-	Vulnerable
Daphoenositta chrysoptera	Varied Sittella	-	Vulnerable
Apus pacificus	Fork-tailed Swift	Marine, Migratory	-
Melanodryas cucullata	Hooded Robin	-	Vulnerable
Petroica boodang	Scarlet Robin	-	Vulnerable
Petroica phoenicea	Flame Robin	Marine	Vulnerable
Glossopsitta pusilla	Little Lorikeet	-	Vulnerable
Lathamus discolour	Swift Parrot	Endangered	Endangered
Ardea modesta (or Ardea alba)	Eastern Great Egret, White Egret	Marine, Migratory	-
Ardea ibis	Cattle Egret	Marine, Migratory	-

Gallinago hardwickii	Latham's Snipe, Japanese Snipe	Marine, Migratory	-
Ninox connivens	Barking Owl	-	Vulnerable
Tyto novaehollandiae	Masked Owl	-	Vulnerable
Ninox strenua	Powerful Owl	-	Vulnerable
Gastropoda			
Meridolum corneovirens	Cumberland Plain Land Snail	-	Endangered
Mammalia			
Cercartetus nanus	Eastern Pygmy-possum	-	Vulnerable
Dasyurus maculates	Spotted-tailed Quoll	Endangered	Vulnerable
Pseudomys novaehollandiae	New Holland Mouse	Vulnerable	-
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	-	Vulnerable
Petrogale penicillata	Brush-tailed Rock-wallaby	Vulnerable	Endangered
Potorous tridactylus tridactylus	Long-nosed Potoroo	Vulnerable	Vulnerable
Mormopterus norfolkensis	Eastern Freetail-bat	-	Vulnerable
Petaurus norfolcensis	Squirrel Glider	-	Vulnerable
Phascolarctos cinereus	Koala	-	Vulnerable
Pteropus poliocephalus	Grey-headed Flying-fox	Vulnerable	Vulnerable
Falsistrellus tasmaniensis	Eastern False Pipistrelle	-	Vulnerable
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	-	Vulnerable
Myotis macropus	Southern Myotis or Large-footed Myotis	-	Vulnerable
Scoteanax rueppellii	Greater Broad-nosed Bat	-	Vulnerable
Chalinolobus dwyeri	Large-eared Pied Bat	Vulnerable	Vulnerable
Reptilia			
Hoplocephalus bungaroides	Broad-headed Snake	Vulnerable	Endangered

Appendix E

Threatened Fauna Likelihood of Occurrence Table

The table below shows species listed under the *TSC Act* or the *EPBC Act*

Species Name	Common Name	Habitat	*EPBC Act 2000*	*TSC Act 1995 Classification*	Likelihood of Occurrence
Amphibia					
Litoria aurea	Green and Golden Bell Frog	Large permanent freshwater wetlands, with dense stands of reeds.	Vulnerable	Endangered	Possible
Heleioporus australiacus	Giant Burrowing Frog	Found in heath, woodland and open forest with sandy soils and will travel several hundred metres to creeks to breed.	Vulnerable	Vulnerable	Possible
Litoria raniformis	Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog	Usually found in or around permanent or ephemeral Black Box/Lignum/Nitre Goosefoot swamps, Lignum/Typha swamps and River Red Gum swamps or billabongs along floodplains and river valleys.	Vulnerable	Endangered	Absent
Mixophyes iteratus	Southern Barred Frog, Giant Barred Frog	Forage and live amongst deep, damp leaf litter in rainforests, moist eucalypt forest and nearby dry eucalypt forest, at elevations below 1000 m.	Endangered	Endangered	Absent
Pseudophryne australis	Red-crowned Toadlet	Usually found as small colonies scattered along ridges coinciding with the positions of suitable refuges near breeding sites. Occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones.	-	Vulnerable	Present
Aves					
Oxyura australis	Blue-billed Duck	Well vegetated freshwater swamps, large dams, lakes. In winter more open waters.	-	Vulnerable	Unlikely
Stictonetta naevosa	Freckled Duck	Prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds.	-	Vulnerable	Possible
Anthochaera phrygia	Regent Honeyeater	Densely timbered woodlands and forests, particularly ironbark, yellow box, yellow gum.	Endangered	Endangered	Likely

Species Name	Common Name	Habitat	*EPBC Act 2000*	*TSC Act 1995 Classification*	Likelihood of Occurrence
Pyrrholaemus saggitatus	Speckled Warbler	Lives in a wide range of eucalypt dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy.	-	Vulnerable	Present
Circus assimilis	Spotted Harrier	Occurs in grassy open woodland including acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.	-	Vulnerable	Possible
Stagonopleura guttata	Diamond Firetail	Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum Eucalyptus pauciflora Woodlands. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland.	-	Vulnerable	Likely
Haliaeetus leucogaster	White-bellied Sea-Eagle	Established pairs usually maintain a territory in coastal areas or flooded inland swamps, lagoons and floodplains. Also often occur far inland along major rivers.	Marine, Migratory	-	Present
Hirundapus caudacutus	White-throated Needletail	Occupy high open spaces of sky above a variety of habitats including oceans. Often fly ahead of unsettled weather preceding thunderstorms.	Marine, Migratory	-	Unlikely
Hieraaetus morphnoides	Little Eagle	Open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living rees within a remnant patch, where pairs build a large stick nest in winter.	-	Vulnerable	Present
Lophoictinia isura	Square-tailed Kite	Diverse habitats from woodlands to timbered watercourses.	-	Vulnerable	Likely
Burhinus grallarius	Bush Stone-curlew	Open forests and woodlands with a sparse grassy groundlayer and fallen timber.	-	Endangered	Possible
Callocephalon fimbriatum	Gang-gang Cockatoo	Occurs within a variety of forest and woodland types.	-	Vulnerable	Highly Likely

Species Name	Common Name	Habitat	*EPBC Act 2000*	*TSC Act 1995 Classification*	Likelihood of Occurrence
Calyptorhynchus lathami	Glossy Black-Cockatoo	She-oaks in forests, woodlands, timbered watercourses.	Endangered (SA)	Vulnerable	Present
Merops ornatus	Rainbow Bee-eater	Open country in a variety of habitat including open woodland, open forest, semi-arid scrub, grasslands, clearings in more wooded areas and farmland.	Marine, Migratory	-	Present
Monarcha melanopsis	Black-faced Monarch	Occurs in a range of habitats including rainforests, mangroves, forests and woodlands. A summer migrant to the south.	Marine, Migratory	-	Present
Myiagra cyanoleuca	Satin Flycatcher	Favours dense wet sclerophyll forest during the breeding season and mangrove, coastal heath, woodland and forests outside of the breeding season. A summer breeding migrant to south eastern Australia	Marine, Migratory	-	Present
Rhipidura rufifrons	Rufous Fantail	A summer breeding migrant in the south east of Australia. Occurs in rainforest as well as dense wet eucalypt forest, paperbark forests, mangrove swamps and riverside vegetation. Occupies open country during summer migration.	Marine, Migratory	-	Present
Epthianura albifrons	White-fronted Chat	Along the coastline, it is found predominantly in saltmarsh vegetation but also in open grasslands and sometimes in low shrubs bordering wetland areas. Usually found foraging on bare or grassy ground in wetland areas, singly or in pairs.	-	Vulnerable	Absent
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark, White Box, Inland Grey Box, Yellow Box (and Forest Red Gum. Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks and tea-trees.	-	Vulnerable	Present
Daphoenositta chrysoptera	Varied Sittella	Eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland	-	Vulnerable	Present

Species Name	Common Name	Habitat	*EPBC Act 2000*	*TSC Act 1995 Classification*	Likelihood of Occurrence
Apus pacificus	Fork-tailed Swift	Utilises low to very high airspace over varied habitat from rainforest to semi-desert. Foragers ahead of summer storms.	Marine, Migratory	-	Possible
Melanodryas cucullata	Hooded Robin	Drier eucalypt forests, woodlands and scrubs with fallen logs and debris.	-	Vulnerable	Likely
Petroica boodang	Scarlet Robin	Forests and woodlands, but some adults and young birds disperse to more open habitats after breeding. Found in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs.	-	Vulnerable	Present
Petroica phoenicea	Flame Robin	Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. Prefers clearings or areas with open understoreys. In winter lives in dry forests, open woodlands and in pastures and native grasslands, with or without scattered trees.	Marine	Vulnerable	Possible
Glossopsitta pusilla	Little Lorikeet	Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophoras, Melaleucas and other tree species.	-	Vulnerable	Present
Lathamus discolor	Swift Parrot	Breeds in Tasmania, but winters on mainland in diverse timbered habitats, including forests, woodlands, plantations, banksias, street trees and gardens.	Endangered	Endangered	Present
Ardea alba (or Ardea modesta)	Eastern Great Egret, White Egret	A common and widespread species that utilises any suitable permanent or temporary habitat. Inhabits wetlands and flooded pastures, dams, estuarine mudflats, mangroves and reefs.	Marine, Migratory	-	Present
Ardea ibis	Cattle Egret	Forages in moist pasture with tall grass as well as shallow open wetlands and margins. Also utilises mudflats.	Marine, Migratory	-	Present
Gallinago hardwickii	Latham's Snipe, Japanese Snipe	Occupies low vegetation around wetlands in shallows, sedges, reeds, heaths salt marsh and irrigated crops.	Marine, Migratory	-	Possible
Rostratula benghalensis australis	Australian Painted Snipe	Well-vegetated shallows and margins of wetlands, dams, sewerage	Vulnerable, Marine,	Endangered	Possible

Species Name	Common Name	Habitat	*EPBC Act 2000*	*TSC Act 1995 Classification*	Likelihood of Occurrence
(or Rostratula australis)		ponds, wet pastures, marshy areas, open timber.	Migratory		
Tyto novaehollandiae	Masked Owl	Extends from the coast where it is most abundant to the western plains. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting. Lives in dry eucalypt forests and woodlands from sea level to 1100 m.	-	Vulnerable	Likely
Ninox connivens	Barking Owl	Open forests, woodlands, dense scrubs, other large trees near watercourses. Nest in tree hollow.	-	Vulnerable	Possible
Ninox strenua	Powerful Owl	Pairs occupy large, probably permanent home ranges in forests to woodlands. Nest in large hollow.	-	Vulnerable	Present
Gastropoda					
Meridolum corneovirens	Cumberland Plain Land Snail	Primarily inhabits Cumberland Plain Woodland (anendangered ecological community). This community is grassy, open woodland with occasional dense patches of shrubs.	-	Endangered	Present
Mammalia					
Cercartetus nanus	Eastern Pygmy-possum	Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred.	-	Vulnerable	Possible
Dasyurus maculatus	Spotted-tailed Quoll	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline.	Endangered	Vulnerable	Possible
Pseudomys novaehollandiae	New Holland Mouse	Known to inhabit open heathlands, open woodlands with a heathland understorey, and vegetated sand dunes.	Vulnerable	-	Unlikely
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	In almost all habitats from wet and dry sclerophyll forests, open	-	Vulnerable	Possible

Species Name	Common Name	Habitat	*EPBC Act 2000*	*TSC Act 1995 Classification*	Likelihood of Occurrence
		woodland, Acacia shrubland, mallee, grasslands and desert.			
Petrogale penicillata	Brush-tailed Rock-wallaby	Rocky areas of sclerophyll forest of inland and subcoastal south-eastern Australia.	Vulnerable	Endangered	Absent
Potorous tridactylus tridactylus	Long-nosed Potoroo	Known from coastal healthy woodland but also occurs in rainforest, wet sclerophyll and coastal wallum. Dense cover for shelter adjacent to open areas for foraging.	Vulnerable	Vulnerable	Unlikely
Mormopterus norfolkensis	Eastern Freetail-bat	Evidence suggests that the species depends on hollows and tree fissures for roosting sites.	-	Vulnerable	Present
Petaurus norfolcensis	Squirrel Glider	Mostly in dry sclerophyll forest on inland slopes and nearby riverine corridors. Also in damp coastal eucalypt/banksia forest and woodland.	-	Vulnerable	Highly Likely
Phascolarctos cinereus	Koala	Swamp Mahogany and Tallowwood are of primary importance to this Koala population. Other local native tree species used by Koalas include Broad-leaved Paperbark, Blackbutt, Red Bloodwood, Flooded Gum and Smooth barked Apple.	-	Vulnerable	Present
Pteropus poliocephalus	Grey-headed Flying-fox	Roosts in large camps in Botanic Gardens.	Vulnerable	Vulnerable	Present
Falsistrellus tasmaniensis	Eastern False Pipistrelle	Usually roosts in tree hollows in the higher rainfall forests within its range.	-	Vulnerable	Present
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	Forages above the canopy and eats mostly moths. Roosts in caves, old mines, road culverts.	-	Vulnerable	Present
Myotis macropus	Southern Myotis or Large-footed Myotis	Roost close to water in caves, mine shafts, hollow-bearing trees, and storm water channels, buildings, under bridges and in dense foliage.	-	Vulnerable	Present
Scoteanax rueppellii	Greater Broad-nosed Bat	Moist gullies in mature coastal forests or rainforests. Roosts in hollow tree trunks and branches.	-	Vulnerable	Present

Species Name	Common Name	Habitat	*EPBC Act 2000*	*TSC Act 1995 Classification*	Likelihood of Occurrence
Chalinolobus dwyeri	Large-eared Pied Bat	Uncommon but observed in wet and dry eucalypt forests.	Vulnerable	Vulnerable	Unlikely
Reptilia					
Hoplocephalus bungaroides	Broad-headed Snake	Occur under large exfoliating slabs of sandstone and rock crevices in areas of undisturbed bushland, usually on tops of cliffs.	Vulnerable	Endangered	Unlikely

Appendix F

Flora List

A search of the *NSW Wildlife Atlas Database*, the *EPBC Protected Matters Database* and the *Botanic Gardens Trust PlantNet Database* undertaken in August 2010, identified 2,178 flora species occurring in Liverpool and Camden LGAs. These species included 1,536 native species and 642 exotic species (**Table F1**). A list of the threatened flora species is presented in **Table F2**. Twenty-five species are listed under either the *TSC Act* or the *EPBC Act*.

Table F1 Full floristic list for the Liverpool and Camden LGAs.

Scientific Name	Common Name	Native or Exotic	Last Sited
Avicennia marina subsp. australasica	Grey Mangrove	Native	17/09/2008
Brunoniella australis	Blue Trumpet	Native	23/07/2009
Brunoniella pumilio	Dwarf Blue Trumpet	Native	25/10/2004
Pseuderanthemum variabile	Pastel Flower	Native	5/09/2007
Thunbergia alata	Black-eyed Susan	Exotic	26/03/2007
Adiantum aethiopicum	Common Maidenhair	Native	17/07/2008
Adiantum atroviride		Native	27/05/1987
Adiantum diaphanum	Filmy Maidenhair	Native	17/07/2008
Adiantum formosum	Giant Maidenhair	Native	4/03/2008
Adiantum hispidulum	Rough Maidenhair	Native	27/02/2004
Adiantum hispidulum var. hispidulum	Rough Maidenhair	Native	4/03/2008
Adiantum hispidulum var. hypoglaucum		Native	4/03/2008
Adiantum silvaticum		Native	30/06/1895
Cheilanthes austrotenuifolia	Rock Fern	Native	13/01/2004
Cheilanthes distans	Bristly Cloak Fern	Native	30/09/1897
Cheilanthes sieberi	Rock Fern	Native	23/07/2009
Cheilanthes sieberi subsp. sieberi	Rock Fern	Native	13/03/2008
Pellaea calidirupium		Native	20/07/1990
Pellaea falcata	Sickle Fern	Native	17/07/2008
Sambucus australasica	Native Elderberry	Native	31/05/1896
Sambucus gaudichaudiana	White Elderberry	Native	30/06/1913
Viburnum suspensum		Exotic	1/06/2009
Agave americana	Century Plant	Exotic	1/06/2009
Aptenia cordifolia	Heartleaf Ice Plant	Exotic	25/10/2004
Carpobrotus glaucescens	Pigface	Native	17/09/2008
Tetragonia tetragonioides	New Zealand Spinach	Native	20/03/1894
Alisma plantago-aquatica	Water Plantain	Native	25/05/2006
Damasonium minus	Starfruit	Native	22/10/2004
Sagittaria platyphylla	Sagittaria	Exotic	24/11/1985
Allium triquetrum	Three-corned Garlic	Exotic	1/06/2009
Nothoscordum borbonicum	Onion Weed	Exotic	1/06/2009
Alstroemeria pulchella	Parrot Alstroemeria	Exotic	29/11/1969
Alternanthera denticulata	Lesser Joyweed	Native	22/01/1895
Alternanthera nana	Hairy Joyweed	Native	14/01/2005
Alternanthera philoxeroides	Alligator Weed	Exotic	13/03/2008
Alternanthera pungens	Khaki Weed	Exotic	14/03/2008
Alternanthera sp. A		Native	1/03/1992
Amaranthus albus	Tumbleweed	Exotic	17/03/1968
Amaranthus deflexus	Spreading Amaranth	Exotic	1/01/1966
Amaranthus hybridus	Slim Amaranth	Exotic	20/10/2004
Amaranthus macrocarpus var. macrocarpus		Native	22/03/1974
Amaranthus mitchellii	Boggabri Weed	Native	2/03/1969
Amaranthus powellii	Powell's Amaranth	Exotic	11/05/1982

Scientific Name	Common Name	Native or Exotic	Last Sited
Amaranthus retroflexus	Redroot Amaranth	Exotic	15/04/1968
Amaranthus spp.	Amaranth	Native	20/12/2005
Amaranthus viridis	Green Amaranth	Exotic	13/03/2008
Deeringia amaranthoides		Native	28/05/1996
Gomphrena celosioides	Gomphrena Weed	Exotic	13/03/2008
Nyssanthes diffusa	Barbwire Weed	Native	15/11/1985
Crinum pedunculatum	Swamp Lily	Native	19/11/2004
Prunus persica		Exotic	11/10/1969
Prunus spp.		Exotic	17/01/2008
Schinus areira	Pepper Tree	Exotic	1/06/2009
Schinus spp.		Exotic	2/04/2004
Schinus terebinthifolius	Brazilian Pepper Tree	Exotic	14/03/2008
Alania endlicheri		Native	31/03/1897
Arthropodium milleflorum	Pale Vanilla-lily	Native	16/05/2006
Arthropodium minus	Small Vanilla Lily	Native	14/07/2009
Arthropodium sp. B		Native	13/03/2008
Arthropodium spp.		Native	6/06/2008
Caesia parviflora	Pale Grass-lily	Native	5/09/2007
Caesia parviflora var. parviflora		Native	31/12/1896
Caesia parviflora var. vittata		Native	13/01/1999
Chlorophytum comosum	Spider Plant	Exotic	1/06/2009
Dichopogon fimbriatus	Nodding Chocolate Lily	Native	17/09/2008
Laxmannia gracilis	Slender Wire Lily	Native	03/11/1881
Thysanotus juncifolius		Native	18/01/2005
Thysanotus tuberosus	Common Fringe-lily	Native	22/12/2003
Thysanotus tuberosus subsp. tuberosus		Native	14/12/1998
Tricoryne elatior	Yellow Autumn-lily	Native	23/07/2009
Tricoryne simplex		Native	22/12/2003
Tricoryne spp.		Native	14/04/2004
Aphanopetalum resinosum	Gum Vine	Native	30/09/1886
Actinotus helianthi	Flannel Flower	Native	30/11/1893
Actinotus minor	Lesser Flannel Flower	Native	5/09/2007
Ammi majus	Bishop's Weed	Exotic	31/03/1980
Apium australe		Native	24/04/1965
Apium graveolens	Celery	Exotic	24/01/2005
Apium prostratum	Sea Celery	Native	5/06/1996
Apium prostratum var. prostratum		Native	2/11/1997
Centella asiatica	Indian Pennywort	Native	23/07/2009
Centella spp.		Native	7/01/2004
Conium maculatum	Hemlock	Exotic	26/11/1966
Cyclospermum leptophyllum	Slender Celery	Exotic	23/07/2009
Daucus carota	Wild Carrot	Exotic	13/03/2008
Daucus glochidiatus	Native Carrot	Native	25/11/1998
Foeniculum vulgare	Fennel	Exotic	1/06/2009
Hydrocotyle bonariensis		Exotic	17/09/2008
Hydrocotyle geraniifolia	Forest Pennywort	Native	1/03/2002
Hydrocotyle laxiflora	Stinking Pennywort	Native	1/03/2002
Hydrocotyle peduncularis	A Pennywort	Native	14/07/2009
Hydrocotyle sp. aff. acutiloba		Native	3/07/1977
Hydrocotyle spp.		Exotic	6/06/2003

Scientific Name	Common Name	Native or Exotic	Last Sited
Hydrocotyle tripartita	Pennywort	Native	24/01/1970
Hydrocotyle verticillata	Shield Pennywort	Native	27/02/1997
Lilaeopsis polyantha	Lilaeopsis	Native	10/04/1993
Platysace ericoides		Native	25/11/1988
Platysace lanceolata	Shrubby Platysace	Native	07/01/1888
Platysace linearifolia		Native	17/09/2008
Platysace spp.		Native	1/08/2003
Trachymene incisa	Trachymene	Native	7/08/2002
Trachymene incisa subsp. incisa		Native	31/05/1898
Trachymene spp.	Trachymene	Native	30/11/2000
Xanthosia pilosa	Woolly Xanthosia	Native	30/11/1898
Xanthosia stellata	Star Xanthosia	Native	28/09/1968
Xanthosia tridentata	Rock Xanthosia	Native	5/09/2007
Araujia sericifera	Moth Vine	Exotic	1/06/2009
Cynanchum elegans	White-flowered Wax Plant	Native	4/03/2008
Gomphocarpus fruticosus	Narrow-leaved Cotton Bush	Exotic	17/02/1894
Gomphocarpus physocarpus	Balloon Cotton Bush	Exotic	5/09/2007
Marsdenia flavescens	Hairy Milk Vine	Native	12/03/1976
Marsdenia lloydii	Corky Marsdenia	Native	4/03/2008
Marsdenia rostrata	Milk Vine	Native	12/03/1976
Marsdenia suaveolens	Scented Marsdenia	Native	1/03/2002
Marsdenia viridiflora subsp. viridiflora	Marsdenia viridiflora R. Br. subsp. viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	Native	20/02/2009
Nerium oleander	Oleander	Exotic	1/06/2009
Parsonsia lanceolata	Rough Silkpod	Native	16/07/1990
Parsonsia straminea	Common Silkpod	Native	31/12/1895
Tylophora barbata	Bearded Tylophora	Native	12/03/1976
Vinca major	Periwinkle	Exotic	17/09/2008
Typhonium brownii		Native	29/02/1896
Zantedeschia aethiopica	Arum Lily	Exotic	1/06/2009
Astrotricha floccosa		Native	1/03/2002
Astrotricha latifolia		Native	1/03/2002
Astrotricha longifolia		Native	1/03/2002
Polyscias sambucifolia	Elderberry Panax	Native	5/09/2007
Polyscias sambucifolia subsp. sambucifolia		Native	23/11/1965
Archontophoenix alexandrae	Alexandra Palm	Exotic	2/04/2004
Livistona australis	Cabbage Palm	Native	3/04/2005
Phoenix canariensis	Canary Island Date Palm	Exotic	1/06/2009
Asparagus aethiopicus	Asparagus Fern	Exotic	14/11/2005
Asparagus asparagoides	Bridal Creeper	Exotic	1/06/2009
Asparagus officinalis	Asparagus	Exotic	20/03/2009
Asparagus plumosus	Climbing Asparagus Fern	Exotic	13/01/2004
Asparagus virgatus	Asparagus Fern	Exotic	14/11/2005
Myrsiphyllum spp.		Exotic	6/06/2003
Aloe maculata	Common Soap Aloe	Exotic	13/03/2008
Aloe spp.		Exotic	24/01/2005
Asphodelus fistulosus	Onion Weed	Exotic	26/03/2007
Bulbine bulbosa	Bulbine Lily	Native	11/11/2003

Scientific Name	Common Name	Native or Exotic	Last Sited
Trachyandra divaricata		Exotic	4/03/2008
Asplenium australasicum	Bird's Nest Fern	Native	1/03/2002
Asplenium difforme		Native	2/08/1987
Asplenium flabellifolium	Necklace Fern	Native	4/03/2008
Ageratina adenophora	Crofton Weed	Exotic	1/06/2009
Ageratina riparia	Mistflower	Exotic	22/09/1955
Ageratum houstonianum		Exotic	25/03/1971
Ambrosia artemisiifolia	Annual Ragweed	Exotic	13/03/2008
Ambrosia tenuifolia	Lacy Ragweed	Exotic	9/04/2001
Arctotheca calendula	Capeweed	Exotic	16/11/1893
Artemisia verlotiorum	Chinese Wormwood	Exotic	20/10/2004
Aster spp.		Exotic	1/06/2009
Aster subulatus	Wild Aster	Exotic	20/03/2009
Bidens pilosa	Cobbler's Pegs	Exotic	1/06/2009
Bidens subalternans	Greater Beggar's Ticks	Exotic	17/09/2008
Bidens tripartita	Burr Marigold	Exotic	1/06/2009
Brachyscome angustifolia		Native	7/08/2002
Brachyscome linearifolia		Native	26/11/1998
Calendula arvensis	Field Marigold	Exotic	23/11/1919
Calomeria amaranthoides	Incense Plant	Native	26/03/1921
Calotis cuneifolia	Purple Burr-Daisy	Native	5/09/2007
Calotis dentex	Burr-daisy	Native	31/10/1893
Calotis hispidula	Bogan Flea	Native	30/09/1913
Calotis lappulacea	Yellow Burr-daisy	Native	13/03/2008
Carduus pycnocephalus	Slender Thistle	Exotic	15/11/1985
Carthamus lanatus	Saffron Thistle	Exotic	25/10/2004
Cassinia aculeata	Dolly Bush	Native	22/10/2004
Cassinia arcuata	Sifton Bush	Native	17/01/2008
Cassinia aureonitens		Native	16/12/1963
Cassinia compacta		Native	25/10/2004
Cassinia denticulata		Native	27/02/2004
Cassinia longifolia		Native	27/11/1886
Cassinia quinquefaria		Native	15/07/1992
Cassinia spp.		Native	7/08/2002
Cassinia trinerva		Native	14/01/1994
Cassinia uncata	Sticky Cassinia	Native	5/09/2007
Centaurea melitensis	Maltese Cockspur	Exotic	12/09/1954
Centaurea solstitialis	St Barnabys Thistle	Exotic	2/03/1962
Centaurea spp.	Thistle	Exotic	30/03/1999
Centipeda cunninghamii	Common Sneezeweed	Native	3/01/1970
Centipeda minima	Spreading Sneezeweed	Native	22/10/2004
Centipeda minima var. minima		Native	31/05/1893
Centipeda nidiformis		Native	1/06/1968
Centipeda pleiocephala		Native	8/04/1967
Chondrilla juncea	Skeleton Weed	Exotic	27/01/1969
Chrysanthemoides monilifera subsp. monilifera	Boneseed	Exotic	4/03/2008
Chrysanthemoides monilifera subsp. rotundata	Bitou Bush	Exotic	17/09/2008
Chrysocephalum apiculatum	Common Everlasting	Native	25/11/1892
Chrysocephalum semipapposum	Clustered Everlasting	Native	28/03/1991

Scientific Name	Common Name	Native or Exotic	Last Sited
Cichorium intybus	Chicory	Exotic	30/04/1894
Cirsium vulgare	Spear Thistle	Exotic	23/07/2009
Conyza bonariensis	Flaxleaf Fleabane	Exotic	1/06/2009
Conyza canadensis var. canadensis	Canadian Fleabane	Exotic	3/04/2005
Conyza parva	Fleabane	Exotic	13/03/2008
Conyza spp.	A Fleabane	Exotic	20/03/2009
Conyza sumatrensis	Tall fleabane	Exotic	23/07/2009
Coreopsis lanceolata	Coreopsis	Exotic	17/09/2008
Coronidium scorpioides	Button Everlasting	Native	31/08/1899
Cotula australis	Common Cotula	Native	11/03/1971
Cotula coronopifolia	Water Buttons	Exotic	03/11/1894
Craspedia variabilis	Common Billy-buttons	Native	24/10/1964
Crassocephalum crepidioides	Thickhead	Exotic	18/06/2003
Cymbonotus lawsonianus	Bear's Ear	Native	16/07/2009
Cynara scolymus	Globe Artichoke	Exotic	25/01/1969
Delairea odorata	Cape Ivy	Exotic	5/09/2007
Dittrichia graveolens	Stinkwort	Exotic	5/04/1949
Eclipta platyglossa	Yellow Twin-heads	Native	16/05/2006
Eclipta prostrata		Native	9/05/2006
Epaltes australis	Spreading Nut-heads	Native	25/10/2004
Erigeron karvinskianus	Bony-tip Fleabane	Exotic	23/02/1991
Euchiton gymnocephalus	Creeping Cudweed	Native	22/10/2004
Euchiton involucratus	Star Cudweed	Native	1/06/2009
Euchiton sphaericus	Star Cudweed	Native	14/07/2009
Facelis retusa		Exotic	25/10/2004
Galinsoga parviflora	Potato Weed	Exotic	20/10/2004
Gamochaeta americana	Cudweed	Exotic	14/07/2009
Gamochaeta antillana		Exotic	30/09/1984
Gamochaeta calviceps	Cudweed	Exotic	21/01/1999
Gamochaeta pensylvanica	Cudweed	Exotic	21/10/1893
Gamochaeta spicata	Cudweed	Exotic	20/03/2009
Gazania spp.		Exotic	15/11/2006
Glossocardia bidens	Cobbler's Tack	Native	28/02/1879
Gymnocoronis spilanthoides	Senegal Tea	Exotic	28/02/1991
Hedypnois rhagadioloides subsp. cretica	Cretan Weed	Exotic	1/11/1969
Helianthus annuus	Common Sunflower	Exotic	1/06/1968
Helianthus tuberosus	Jerusalem Artichoke	Exotic	25/03/1971
Helichrysum spp.		Native	18/01/2005
Hypochaeris glabra	Smooth Catsear	Exotic	1/06/2009
Hypochaeris microcephala var. albiflora	White Flatweed	Exotic	19/11/2004
Hypochaeris radicata	Catsear	Exotic	31/10/1893
Lactuca serriola	Prickly Lettuce	Exotic	16/07/2009
Lagenophora gracilis	Slender Lagenophora	Native	13/01/1999
Lagenophora stipitata	Common Lagenophora	Native	25/10/2004
Leontodon taraxacoides subsp. taraxacoides	Lesser Hawkbit	Exotic	13/01/2004
Leptorhynchos nitidulus		Native	21/09/1992
Ligularia tusseloginea		Exotic	30/04/1989
Olearia microphylla		Native	20/10/2004
Olearia quercifolia	Oak-leaved Olearia	Native	22/08/1989
Olearia tomentosa	Toothed Daisy-bush	Native	1/03/2002

Scientific Name	Common Name	Native or Exotic	Last Sited
Olearia viscidula	Wallaby Weed	Native	28/08/2004
Onopordum acanthium subsp. acanthium	Scotch Thistle	Exotic	17/09/2008
Osteospermum ecklonis	Cape Daisy	Exotic	7/08/2007
Ozothamnus adnatus	Winged Everlasting	Native	15/01/2002
Ozothamnus diosmifolius	White Dogwood	Native	20/03/2009
Ozothamnus rufescens		Native	22/08/1894
Picris hieracioides	Hawkweed Picris	Exotic	23/07/2009
Podolepis jaceoides	Showy Copper-wire Daisy	Native	16/09/1967
Pseudognaphalium luteoalbum	Jersey Cudweed	Native	15/03/1890
Rhodanthe anthemoides		Native	10/12/1993
Rhodanthe chlorocephala subsp. rosea		Native	14/09/1966
Roldana petasitis		Exotic	11/10/1969
Senecio angulatus		Exotic	20/12/2005
Senecio bipinnatisectus		Native	1/02/1965
Senecio diaschides		Native	24/01/1989
Senecio hispidulus	Hill Fireweed	Native	13/03/2008
Senecio lautus	Variable Groundsel	Native	11/03/1971
Senecio linearifolius var. arachnoideus		Native	21/10/1893
Senecio linearifolius var. glaucus ms.		Native	29/04/1967
Senecio madagascariensis	Fireweed	Exotic	23/07/2009
Senecio minimus		Native	31/12/1891
Senecio prenanthoides		Native	22/10/1966
Senecio pterophorus		Exotic	23/02/1995
Senecio quadridentatus	Cotton Fireweed	Native	19/11/2004
Senecio queenslandicus		Native	23/10/1965
Senecio spp.	Groundsel, Fireweed	Exotic	17/09/2008
Senecio vagus subsp. eglandulosus		Native	17/10/1896
Sigesbeckia orientalis subsp. orientalis	Indian Weed	Native	1/06/2009
Sigesbeckia spp.		Native	25/10/2004
Silybum marianum	Variegated Thistle	Exotic	15/11/1985
Solenogyne bellioides	Solengyne	Native	03/05/1899
Solenogyne dominii		Native	7/03/2005
Solidago canadensis var. scabra	Goldenrod	Exotic	27/04/1969
Soliva anthemifolia	Dwarf Jo-jo	Exotic	21/11/1969
Soliva sessilis	Bindyi	Exotic	14/07/2009
Soliva stolonifera	Jo-jo	Exotic	30/08/1955
Sonchus asper subsp. glaucescens	Prickly Sowthistle	Exotic	20/03/2009
Sonchus oleraceus	Common Sowthistle	Exotic	21/10/1893
Sonchus spp.	Sowthistle	Exotic	6/06/2003
Tagetes minuta	Stinking Roger	Exotic	1/06/2009
Tagetes patula		Exotic	26/03/1971
Taraxacum officinale	Dandelion	Exotic	1/06/2009
Tolpis umbellata		Exotic	6/12/1963
Tragopogon porrifolius	Salsify	Exotic	31/10/1893
Triptilodiscus pygmaeus	Common Sunray	Native	1/12/2003
Vernonia cinerea		Native	23/07/2009
Vernonia cinerea var. cinerea		Native	13/01/2004
Vittadinia cervicularis var. subcervicularis		Native	6/09/1964
Vittadinia cuneata	A Fuzzweed	Native	16/07/2009
Vittadinia cuneata var. cuneata	A Fuzzweed	Native	13/03/2008

Scientific Name	Common Name	Native or Exotic	Last Sited
Vittadinia gracilis	Woolly New Holland Daisy	Native	20/10/1946
Vittadinia muelleri	A Fuzzweed	Native	13/03/2008
Vittadinia pustulata	Fuzzweed	Native	21/02/2003
Vittadinia spp.	Fuzzweed	Native	27/04/2004
Vittadinia sulcata		Native	11/10/1899
Xanthium occidentale	Noogoora Burr	Exotic	20/03/2009
Xanthium spinosum	Bathurst Burr	Exotic	25/10/2004
Xerochrysum bracteatum	Golden Everlasting	Native	13/01/1999
Xerochrysum viscosum	Sticky Everlasting	Native	23/02/1991
Azolla filiculoides	Pacific Azolla	Native	15/11/2006
Azolla pinnata		Native	4/03/2008
Impatiens spp.		Exotic	22/12/2003
Impatiens walleriana		Exotic	6/06/2003
Anredera cordifolia	Madeira Vine	Exotic	1/06/2009
Pandorea pandorana	Wonga Wonga Vine	Native	9/07/2009
Pandorea pandorana subsp. pandorana	Wonga Wonga Vine	Native	28/05/1991
Blandfordia nobilis	Christmas Bells	Native	19/11/1966
Blechnum camfieldii		Native	30/06/1901
Blechnum cartilagineum	Gristle Fern	Native	5/09/2007
Blechnum indicum	Swamp Water Fern	Native	30/11/1899
Blechnum minus	Soft Water Fern	Native	17/07/2008
Doodia aspera	Prickly Rasp Fern	Native	4/03/2008
Doodia australis	Common Rasp Fern	Native	17/03/1976
Doodia caudata	Small Rasp Fern	Native	1/03/2002
Amsinckia intermedia	Common Fiddleneck	Exotic	27/10/1903
Buglossoides arvensis	Sheepweed	Exotic	4/11/1967
Cynoglossum suaveolens	Sweet Hound's-tongue	Native	1/11/1969
Echium plantagineum	Patterson's Curse	Exotic	19/11/2004
Ehretia acuminata var. acuminata	Koda	Native	12/03/1976
Heliotropium amplexicaule	Blue Heliotrope	Exotic	16/07/2009
Heliotropium europaeum	Potato Weed	Exotic	11/04/1969
Brassica fruticulosa	Twiggy Turnip	Exotic	1/06/2009
Brassica juncea	Indian Mustard	Exotic	13/03/2008
Brassica napus	Canola	Exotic	21/10/1972
Brassica rapa subsp. sylvestris	Turnip	Exotic	15/11/2006
Brassica spp.	Brassica	Exotic	17/09/2008
Cakile maritima	Sea Rocket	Exotic	17/09/2008
Capsella bursa-pastoris	Shepherd's Purse	Exotic	16/05/2006
Cardamine flexuosa	Wood Bittercress	Exotic	24/03/1971
Cardamine paucijuga		Native	6/06/2008
Coronopus didymus	Lesser Swinecress	Exotic	16/07/2009
Diplotaxis muralis	Wall Rocket	Exotic	12/09/1954
Hirschfeldia incana	Buchan Weed	Exotic	7/12/1987
Lepidium africanum	Common Peppercress	Exotic	1/06/2009
Lepidium bonariense	Argentine Peppercress	Exotic	26/04/1971
Lepidium campestre	Field Cress	Exotic	4/03/2008
Lepidium draba	Hoary Cress, White Weed	Exotic	15/09/1968
Lepidium pseudohyssopifolium	Peppercress	Native	17/01/2008
Lepidium spp.	A Peppercress	Exotic	1/06/2009
Lobularia maritima	Sweet Alyssum	Exotic	9/04/1966

Scientific Name	Common Name	Native or Exotic	Last Sited
Raphanus raphanistrum	Wild Radish	Exotic	18/10/1969
Rapistrum rugosum	Turnip Weed	Exotic	18/10/1969
Rorippa gigantea		Native	12/10/1929
Rorippa laciniata		Native	4/03/2008
Rorippa nasturtium-aquaticum	Watercress	Exotic	17/09/2004
Sinapis alba	White Mustard	Exotic	22/02/1968
Sinapis arvensis	Charlock	Exotic	22/09/1954
Sisymbrium irio	London Rocket	Exotic	31/08/1968
Sisymbrium officinale	Hedge Mustard	Exotic	15/10/1967
Sisymbrium orientale	Indian Hedge Mustard	Exotic	25/05/1968
Buddleja madagascariensis		Exotic	20/03/2009
Opuntia aurantiaca	Tiger Pear	Exotic	27/09/1980
Opuntia monacantha	Drooping Pear	Exotic	19/11/2004
Opuntia spp.		Exotic	1/06/2009
Opuntia stricta	Common Prickly Pear, Smooth Pest Pear	Exotic	1/06/2009
Opuntia stricta var. stricta	Common Prickly Pear	Exotic	20/10/2004
Callitriche stagnalis	Common Starwort	Exotic	31/10/1881
Wahlenbergia communis	Tufted Bluebell	Native	1/06/2009
Wahlenbergia gracilis	Sprawling Bluebell	Native	31/03/1898
Wahlenbergia littoricola		Native	6/11/1992
Wahlenbergia luteola	Bluebell	Native	23/07/2003
Wahlenbergia multicaulis	Tadgell's Bluebell	Native	28/11/1998
Wahlenbergia spp.	Bluebell	Native	18/12/2007
Wahlenbergia stricta	Tall Bluebell	Native	20/03/2009
Wahlenbergia stricta subsp. stricta	Tall Bluebell	Native	14/12/1998
Cannabis sativa	Indian Hemp	Exotic	31/10/1975
Canna indica	Tous-les-mois Arrowroot	Exotic	08/04/1867
Lonicera japonica	Japanese Honeysuckle	Exotic	20/03/2009
Arenaria leptoclados	Lesser Thyme-leaved Sandwort	Exotic	2/10/1967
Cerastium glomeratum	Mouse-ear Chickweed	Exotic	1/06/2009
Gypsophila tubulosa	Annual Chalkwort	Native	24/01/1970
Paronychia brasiliana	Chilean Whitlow Wort, Brazilian Whitlow	Exotic	16/07/2009
Petrorhagia nanteuilii	Proliferous Pink	Exotic	17/09/2008
Petrorhagia spp.		Exotic	13/01/1999
Petrorhagia velutina	Velvet Pink	Exotic	5/10/1964
Polycarpaea corymbosa var. minor		Native	10/04/1976
Polycarpon tetraphyllum	Four-leaved Allseed	Exotic	19/11/2004
Sagina apetala	Annual Pearlwort	Exotic	2/10/1967
Scleranthus biflorus	Two-flowered Knawel	Native	24/01/1970
Silene gallica	French Catchfly	Exotic	15/11/1985
Silene gallica var. gallica	French Catchfly	Exotic	10/12/1985
Silene latifolia subsp. alba	White Campion	Exotic	12/11/2001
Silene nocturna		Exotic	6/07/1968
Spergula arvensis	Corn Spurry	Exotic	31/10/1894
Spergularia bocconei	Bocconi's Sand-spurrey	Exotic	23/10/1886
Spergularia diandra	Lesser Sand-spurry	Exotic	31/05/1980
Spergularia levis		Exotic	13/03/2008
Spergularia marina	Lesser Sea-spurrey	Native	15/03/1890
Spergularia rubra	Sandspurry	Exotic	12/03/1962

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Spergularia sp. B		Native	8/04/1967
Stellaria flaccida		Native	1/12/1963
Stellaria media	Common Chickweed	Exotic	7/08/2007
Vaccaria hispanica	Cow Soapwort	Exotic	4/11/1967
Allocasuarina diminuta subsp. diminuta		Native	3/08/1985
Allocasuarina diminuta subsp. mimica		Native	19/06/1992
Allocasuarina distyla		Native	5/09/2007
Allocasuarina glareicola		Native	10/09/1996
Allocasuarina littoralis	Black She-Oak	Native	17/09/2008
Allocasuarina torulosa	Forest Oak	Native	17/09/2008
Casuarina cunninghamiana subsp. cunninghamiana	River Oak	Native	21/08/2008
Casuarina glauca	Swamp Oak	Native	1/06/2009
Casuarina spp.		Native	7/01/2004
Celastrus australis	Staff Climber	Native	12/03/1976
Celastrus subspicata	Large-leaved Staff Vine	Native	15/11/1985
Elaeodendron australe		Native	18/05/1992
Elaeodendron australe var. australe		Native	12/03/1976
Maytenus silvestris	Narrow-leaved Orangebark	Native	1/06/2009
Centrolepis fascicularis		Native	4/03/2008
Centrolepis strigosa subsp. strigosa		Native	15/10/1966
Atriplex australasica		Native	12/04/1987
Atriplex leptocarpa	Slender-fruit Saltbush	Native	30/11/1909
Atriplex prostrata		Exotic	4/03/2008
Atriplex semibaccata	Creeping Saltbush	Native	31/07/1897
Chenopodium album	Fat Hen	Exotic	1/06/2009
Chenopodium curvispicatum		Native	27/11/2003
Chenopodium glaucum		Native	31/12/1893
Chenopodium multifidum	Scented Goosefoot	Exotic	23/01/1954
Chenopodium murale	Nettle-leaf Goosefoot	Exotic	19/11/2004
Chenopodium nitrariaceum	Nitre Goosefoot	Native	8/05/2001
Chenopodium pumilio	Small Crumbweed	Native	8/05/2001
Dysphania glomulifera		Native	25/10/2004
Dysphania littoralis		Native	24/02/1970
Einadia hastata	Berry Saltbush	Native	9/07/2009
Einadia nutans	Climbing Saltbush	Native	1/06/2009
Einadia nutans subsp. linifolia	Climbing Saltbush	Native	11/10/1897
Einadia nutans subsp. nutans	Climbing Saltbush	Native	20/03/2009
Einadia polygonoides	Knotweed Goosefoot	Native	1/06/2009
Einadia trigonos	Fishweed	Native	23/07/2009
Einadia trigonos subsp. stellulata		Native	19/03/1968
Einadia trigonos subsp. trigonos		Native	30/07/2008
Maireana microphylla	Small-leaf Bluebush	Native	7/09/1968
Maireana polypterygia		Exotic	8/05/2001
Rhagodia spinescens	Thorny Saltbush	Native	10/01/1968
Rhagodia ulicina		Native	8/05/2001
Salsola kali var. kali	Buckbush	Native	6/04/1968
Salsola tragus subsp. tragus	Buckbush,Soft Rolpoly, Saltwort	Native	17/04/1969
Sarcocornia quinqueflora subsp. quinqueflora		Native	17/09/2008
Sclerolaena muricata var. semiglabra	Black Rolypoly	Native	25/06/1966

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Sclerolaena muricata var. villosa	Black Rolypoly	Native	5/02/1967
Suaeda australis		Native	31/12/1893
Hypericum gramineum	Small St John's Wort	Native	03/03/1894
Hypericum japonicum		Native	16/07/2009
Hypericum perforatum	St. Johns Wort	Exotic	20/03/2009
Hypericum spp.		Exotic	27/02/2004
Burchardia umbellata	Milkmaids	Native	7/08/2002
Wurmbea dioica subsp. dioica	Early Nancy	Native	23/12/1998
Aneilema acuminatum		Native	20/10/2004
Aneilema biflorum		Native	16/05/1996
Commelina cyanea	Native Wandering Jew	Native	20/03/2009
Tradescantia fluminensis	Wandering Jew	Exotic	20/03/2009
Calystegia marginata		Native	18/06/2003
Calystegia spp.		Exotic	6/06/2008
Convolvulus angustissimus subsp. angustissimus		Native	03/11/1893
Convolvulus arvensis	Field Bindweed	Exotic	14/03/2003
Convolvulus erubescens	Pink Bindweed	Native	30/11/1894
Cuscuta australis	Australian Dodder	Native	2/12/1998
Dichondra repens	Kidney Weed	Native	23/07/2009
Dichondra sp. A	Kidney Weed	Native	16/07/2009
Ipomoea cairica		Exotic	20/03/2009
Ipomoea indica	Morning Glory	Exotic	1/06/2009
Ipomoea purpurea	Common Morning Glory	Exotic	1/06/2009
Ipomoea spp.		Exotic	6/06/2003
Polymeria calycina		Native	01/09/1898
Wilsonia backhousei	Narrow-leafed Wilsonia	Native	18/03/1899
Bryophyllum delagoense	Mother of millions	Exotic	1/06/2009
Bryophyllum pinnatum	Resurrection Plant	Exotic	1/06/2009
Crassula decumbens var. decumbens	Spreading Stonecrop	Native	22/09/1963
Crassula helmsii	Swamp Stonecrop	Native	31/01/1959
Crassula multicava		Exotic	1/06/2009
Crassula ovata	Jade Plant	Exotic	16/05/1966
Crassula peduncularis	Purple Stonecrop	Native	2/11/1963
Crassula sarmentosa var. sarmentosa		Exotic	13/03/2008
Crassula sieberiana	Australian Stonecrop	Native	03/11/1894
Crassula spp.	Stonecrop	Exotic	1/06/2009
Crassula tetragona subsp. robusta		Exotic	1/06/2009
Crassula tetramera		Native	18/06/1966
Sedum praealtum		Exotic	1/11/1970
Citrullus lanatus var. lanatus	Wild Melon, Camel Melon,Bitter	Exotic	1/06/1968
Cucurbita maxima	Ironbark Pumpkin	Exotic	27/04/2004
Cucurbita pepo	field pumpkin	Exotic	16/03/1968
Sicyos australis		Native	12/03/1976
Bauera microphylla		Native	22/09/1888
Bauera rubioides	River Rose	Native	5/09/2007
Callicoma serratifolia	Black Wattle	Native	27/02/2004
Ceratopetalum apetalum	Coachwood	Native	1/03/2002
Ceratopetalum gummiferum	Christmas Bush	Native	30/11/1896
Schizomeria ovata	Crabapple	Native	31/01/1883
Callitris muelleri		Native	27/02/2004

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Callitris rhomboidea	Port Jackson Pine	Native	03/11/1893
Cupressus sempervirens	Italian Cypress	Exotic	14/11/2005
Cupressus spp.		Exotic	19/11/2004
Cyathea australis	Rough Treefern	Native	27/02/2004
Cyathea cooperi	Straw Treefern	Native	27/02/2004
Baumea acuta		Native	31/10/1893
Baumea articulata	Jointed Twig-rush	Native	22/10/2004
Baumea juncea		Native	23/07/1899
Baumea nuda		Native	18/01/2005
Baumea rubiginosa		Native	20/05/1998
Baumea teretifolia		Native	17/09/1981
Bolboschoenus caldwellii		Native	13/03/2008
Carex appressa	Tall Sedge	Native	1/06/2009
Carex breviculmis		Native	23/07/2009
Carex gaudichaudiana		Native	17/11/1996
Carex inversa	Knob Sedge	Native	23/07/2009
Carex longebrachiata		Native	14/01/2005
Carex pumila		Native	18/12/1997
Carex spp.		Native	6/06/2008
Caustis flexuosa	Curly Wig	Native	24/03/1896
Caustis pentandra	Thick Twist Rush	Native	27/02/2004
Caustis recurvata var. hirsuta		Native	31/10/1896
Chorizandra cymbaria		Native	7/08/2002
Chorizandra sphaerocephala	Roundhead Bristle-sedge	Native	16/02/1983
Cladium procerum		Native	31/12/1893
Cyathochaeta diandra		Native	5/09/2007
Cyperus aggregatus		Exotic	14/03/2008
Cyperus brevifolius		Exotic	20/03/2009
Cyperus congestus		Exotic	26/03/2007
Cyperus difformis	Dirty Dora	Native	25/05/2006
Cyperus enervis		Native	13/03/2008
Cyperus eragrostis	Umbrella Sedge	Exotic	20/03/2009
Cyperus flaccidus	Lax Flat-sedge	Native	29/04/1970
Cyperus fulvus	Sticky Sedge	Native	22/01/1989
Cyperus gracilis	Slender Flat-sedge	Native	16/07/2009
Cyperus gunnii subsp. gunnii		Native	31/10/1894
Cyperus haspan subsp. haspan		Native	20/04/1993
Cyperus imbecillis		Native	22/07/1899
Cyperus laevigatus		Native	30/04/1916
Cyperus laevis		Native	31/01/1898
Cyperus leiocaulon		Native	12/05/1977
Cyperus lucidus	Leafy Flat Sedge	Native	31/10/1894
Cyperus polystachyos		Native	31/12/1894
Cyperus reflexus		Exotic	3/01/1993
Cyperus rotundus	Nutgrass	Exotic	20/03/2009
Cyperus sanguinolentus		Native	7/04/1968
Cyperus sesquiflorus		Exotic	20/03/2009
Cyperus sphaeroideus		Native	20/10/2004
Cyperus spp.		Native	22/10/2004
Cyperus tenellus		Exotic	30/11/1969

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Cyperus trinervis		Native	18/03/1967
Eleocharis acuta		Native	16/05/2006
Eleocharis atricha		Native	17/05/1992
Eleocharis cylindrostachys		Native	31/10/1885
Eleocharis dietrichiana		Native	5/02/1980
Eleocharis gracilis		Native	30/11/1997
Eleocharis minuta		Exotic	19/04/1991
Eleocharis parvula		Exotic	22/02/1996
Eleocharis pusilla		Native	29/10/1967
Eleocharis sphacelata	Tall Spike Rush	Native	18/01/2005
Eleocharis spp.	Spike-rush, Spike-sedge	Native	5/08/2003
Ficinia nodosa	Knobby Club-rush	Native	27/02/2004
Fimbristylis dichotoma	Common Fringe-sedge	Native	14/07/2009
Fimbristylis velata		Native	1/06/1968
Fuirena ciliaris		Native	17/05/1992
Gahnia aspera	Rough Saw-sedge	Native	4/03/2008
Gahnia clarkei	Tall Saw-sedge	Native	1/03/2002
Gahnia erythrocarpa		Native	5/09/2007
Gahnia melanocarpa	Black Fruit Saw-sedge	Native	4/03/2008
Gahnia sieberiana	Red-fruit Saw-sedge	Native	4/03/2008
Gahnia spp.		Native	17/07/2008
Gahnia subaequiglumis	Bog Saw-sedge	Native	31/12/1895
Isolepis cernua	Nodding Club-rush	Native	22/10/2004
Isolepis gaudichaudiana	Benambra Club-sedge	Native	3/01/1970
Isolepis hookeriana		Native	26/11/1992
Isolepis inundata	Club-rush	Native	7/08/2002
Isolepis producta		Native	22/10/2004
Isolepis prolifera		Exotic	4/03/2008
Isolepis sepulcralis		Exotic	10/09/1992
Lepidosperma concavum		Native	1/08/2003
Lepidosperma filiforme		Native	4/03/2008
Lepidosperma gunnii		Native	10/08/1994
Lepidosperma laterale	Variable Sword-sedge	Native	31/03/1894
Lepidosperma longitudinale	Pithy Sword-sedge	Native	17/05/1992
Lepidosperma neesii		Native	30/05/1986
Lepidosperma quadrangulatum		Native	7/08/2002
Lepidosperma urophorum		Native	16/07/1966
Lepidosperma viscidum		Native	17/07/2008
Lipocarpha microcephala	Button Rush	Native	10/05/1992
Ptilothrix deusta		Native	5/09/2007
Rhynchospora brownii	Grassy Beak-sedge	Native	13/01/1968
Schoenoplectus erectus		Exotic	17/05/1992
Schoenoplectus mucronatus		Native	11/03/1971
Schoenoplectus subulatus		Native	10/05/1977
Schoenoplectus validus		Native	24/01/2005
Schoenus apogon	Fluke Bogrush	Native	03/11/1897
Schoenus brevifolius		Native	5/09/2007
Schoenus ericetorum		Native	30/04/1891
Schoenus imberbis		Native	5/09/2007
Schoenus melanostachys		Native	5/09/2007

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Schoenus moorei		Native	1/08/2003
Scleria mackaviensis		Native	9/07/2009
Tricostularia pauciflora		Native	27/11/2003
Davallia solida var. pyxidata	Hare's Foot Fern	Native	1/03/2002
Nephrolepis cordifolia	Fishbone Fern	Native	20/03/2009
Dawsonia polytrichoides		Native	27/02/2004
Dennstaedtia davallioides	Lacy Ground Fern	Native	2/05/1942
Histiopteris incisa	Bat's Wing Fern	Native	27/02/2004
Hypolepis muelleri	Harsh Ground Fern	Native	6/06/2003
Pteridium esculentum	Bracken	Native	17/09/2008
Calochlaena dubia	Rainbow Fern	Native	31/03/1894
Hibbertia acicularis		Native	20/01/1894
Hibbertia aspera	Rough Guinea Flower	Native	5/09/2007
Hibbertia bracteata		Native	27/02/2004
Hibbertia circumdans		Native	17/04/1996
Hibbertia cistiflora subsp. cistiflora		Native	27/02/2004
Hibbertia dentata	Twining Guinea Flower	Native	1/10/1966
Hibbertia diffusa	Wedge Guinea Flower	Native	24/11/1893
Hibbertia empetrifolia subsp. empetrifolia		Native	1/08/2003
Hibbertia fasciculata		Native	1/08/2003
Hibbertia hermanniifolia		Native	24/02/1808
Hibbertia linearis		Native	1/03/2002
Hibbertia monogyna		Native	5/09/2007
Hibbertia nitida		Native	4/03/2008
Hibbertia obtusifolia	Hoary guinea flower, Grey Guinea Flower	Native	18/01/2005
Hibbertia pedunculata		Native	4/05/2007
Hibbertia riparia		Native	17/09/2008
Hibbertia scandens	Climbing Guinea Flower	Native	30/11/1892
Hibbertia spp.		Native	30/11/2000
Hibbertia virgata subsp. virgata	Twiggy Guinea Flower	Native	5/09/2007
Doryanthes excelsa	Gymea Lily	Native	20/03/2009
Drosera auriculata		Native	1/08/2003
Drosera binata	Forked Sundew	Native	15/09/1981
Drosera burmanni		Native	10/05/1992
Drosera peltata	A Sundew	Native	5/09/2007
Drosera spatulata		Native	27/02/2004
Cyrtomium falcatum cv. 'Rochfordii'	Holly Fern	Exotic	1/07/1984
Lastreopsis acuminata	Shiny Shield Fern	Native	1/09/1951
Lastreopsis microsora subsp. microsora	Creeping Shield Fern	Native	30/09/1921
Polystichum australiense	Harsh Shield Fern	Native	27/10/1946
Diospyros australis	Black Plum	Native	28/05/1996
Elaeocarpus reticulatus	Blueberry Ash	Native	20/03/2009
Tetratheca ericifolia		Native	27/02/2004
Tetratheca glandulosa		Native	1/08/2003
Tetratheca neglecta		Native	31/08/1888
Tetratheca shiressii		Native	15/09/1981
Elatine gratioloides	Waterwort	Native	24/01/2005
Acrotriche divaricata		Native	1/03/2002
Astroloma humifusum	Native Cranberry	Native	5/09/2007
Astroloma pinifolium	Pine Heath	Native	21/06/1997

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Brachyloma daphnoides	Daphne Heath	Native	17/09/2008
Brachyloma daphnoides subsp. daphnoides		Native	15/08/1997
Dracophyllum secundum		Native	1/03/2002
Epacris calvertiana var. calvertiana		Native	31/10/1897
Epacris calvertiana var. versicolor		Native	30/09/1897
Epacris crassifolia		Native	27/02/2004
Epacris longiflora	Fuchsia Heath	Native	5/09/2007
Epacris microphylla	Coral Heath	Native	31/10/1889
Epacris obtusifolia	Blunt-leaf Heath	Native	30/09/1964
Epacris paludosa	Swamp Heath	Native	4/03/2008
Epacris pulchella	Wallum Heath	Native	17/09/2008
Epacris purpurascens		Native	31/07/1915
Epacris purpurascens var. purpurascens		Native	5/09/1965
Epacris reclinata	Fuchsia Heath	Native	19/08/1989
Leucopogon amplexicaulis	Beard-heath	Native	4/03/2008
Leucopogon ericoides	Pink Beard-heath	Native	5/09/2007
Leucopogon esquamatus		Native	01/08/1888
Leucopogon exolasius	Woronora Beard-heath	Native	30/11/2000
Leucopogon fletcheri subsp. fletcheri		Native	16/09/1989
Leucopogon juniperinus	Prickly Beard-heath	Native	31/07/1896
Leucopogon lanceolatus		Native	17/07/2008
Leucopogon lanceolatus subsp. group F		Native	31/08/1965
Leucopogon lanceolatus var. lanceolatus		Native	5/09/2007
Leucopogon microphyllus		Native	5/09/2007
Leucopogon muticus	Blunt Beard-heath	Native	17/09/2008
Leucopogon setiger		Native	22/09/1889
Leucopogon spp.	A Beard-heath	Native	18/01/2005
Leucopogon virgatus		Native	7/08/2002
Lissanthe sapida	Native Cranberry	Native	30/06/1883
Lissanthe strigosa	Peach Heath	Native	5/09/2007
Lissanthe strigosa subsp. strigosa		Native	16/05/2006
Lissanthe strigosa subsp. subulata	Peach Heath	Native	4/05/2007
Melichrus procumbens	Jam Tarts	Native	7/08/2002
Monotoca elliptica	Tree Broom-heath	Native	5/09/2007
Monotoca ledifolia		Native	31/01/1894
Monotoca scoparia		Native	20/10/2004
Rupicola apiculata		Native	30/09/1897
Sprengelia incarnata	Pink Swamp Heath	Native	5/09/2007
Sprengelia monticola		Native	31/03/1897
Styphelia angustifolia		Native	16/12/2000
Styphelia laeta subsp. laeta		Native	30/09/2001
Styphelia triflora	Pink Five-Corners	Native	5/09/2007
Styphelia tubiflora	Red Five-Corner	Native	27/02/2004
Trochocarpa laurina	Tree Heath	Native	1/03/2002
Woollsia pungens		Native	5/09/2007
Eriocaulon scariosum		Native	31/12/1894
Abrophyllum ornans	Native Hydrangea	Native	29/06/1935
Acalypha australis		Exotic	28/04/1995
Alchomea ilicifolia	Native Holly	Native	12/03/1976
Amperea xiphoclada		Native	1/03/2002

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Amperea xiphoclada var. xiphoclada		Native	20/04/2001
Bertya pomaderroides		Native	4/03/2008
Beyeria viscosa	Sticky Wallaby Bush	Native	18/11/1991
Chamaesyce dallachyana		Native	20/03/2009
Chamaesyce drummondii	Caustic Weed	Native	13/03/2008
Chamaesyce hyssopifolia		Exotic	28/02/1917
Chamaesyce maculata		Exotic	20/03/2009
Chamaesyce prostrata	Red Caustic Weed	Exotic	19/11/2004
Claoxylon australe	Brittlewood	Native	30/11/1933
Croton verreauxii	Green Native Cascarilla	Native	28/05/1991
Euphorbia helioscopia	Sun Spurge	Exotic	20/10/2004
Euphorbia maconochieana		Native	18/11/1992
Euphorbia peplus	Petty Spurge	Exotic	1/06/2009
Euphorbia spp.		Exotic	7/01/2004
Homalanthus populifolius		Native	27/02/2004
Homalanthus stillingiifolius		Native	15/04/1968
Manihot grahamii		Exotic	2/02/1985
Micrantheum ericoides		Native	31/01/1896
Micrantheum hexandrum		Native	31/08/1896
Pseudanthus pimeleoides		Native	6/09/1983
Ricinocarpos pinifolius	Wedding Bush	Native	17/09/2008
Ricinus communis	Castor Oil Plant	Exotic	20/03/2009
Triadica sebifera	Chinese Tallowood	Exotic	20/03/2009
Ceratonia siliqua	Carob	Exotic	14/11/2005
Gleditsia triacanthos	Honey Locust	Exotic	21/08/2008
Senna barclayana	Smooth Senna	Native	17/05/1969
Senna clavigera		Native	21/05/1996
Senna didymobotrya		Exotic	4/02/1967
Senna odorata		Native	4/03/2008
Senna pendula var. glabrata		Exotic	1/06/2009
Senna septemtrionalis	Arsenic Bush	Exotic	29/04/1967
Senna spp.		Exotic	2/10/2002
Almaleea incurvata		Native	31/08/1884
Aotus ericoides		Native	4/03/2008
Bossiaea buxifolia		Native	1/12/1998
Bossiaea ensata	Sword Bossiaea	Native	22/09/1887
Bossiaea heterophylla	Variable Bossiaea	Native	5/09/2007
Bossiaea obcordata	Spiny Bossiaea	Native	30/06/1913
Bossiaea prostrata		Native	11/09/1842
Bossiaea rhombifolia subsp. rhombifolia		Native	4/03/2008
Bossiaea scolopendria		Native	5/09/2007
Bossiaea stephensonii		Native	30/04/1890
Castanospermum australe	Black Bean	Native	2/07/1998
Chorizema parviflorum	Eastern Flame Pea	Native	4/05/2007
Crotalaria spp.		Exotic	5/09/2007
Daviesia acicularis		Native	18/01/2005
Daviesia alata		Native	6/09/1964
Daviesia corymbosa		Native	30/09/1888
Daviesia genistifolia	Broom Bitter Pea	Native	13/03/2008
Daviesia latifolia	Bitter-pea	Native	19/02/1967

Scientific Name	Common Name	Native or Exotic	Last Sited
Daviesia mimosoides subsp. mimosoides		Native	18/10/1969
Daviesia squarrosa		Native	4/11/1966
Daviesia ulicifolia	Gorse Bitter Pea	Native	4/05/2007
Daviesia ulicifolia subsp. ulicifolia		Native	13/03/2008
Desmodium brachypodum	Large Tick-trefoil	Native	28/02/1895
Desmodium gunnii	Slender Tick-trefoil	Native	25/10/2004
Desmodium rhytidophyllum		Native	13/03/2008
Desmodium spp.	Tick-trefoil	Native	17/01/2008
Desmodium varians	Slender Tick-trefoil	Native	23/07/2009
Dillwynia elegans		Native	5/09/2007
Dillwynia ericifolia		Native	16/09/1945
Dillwynia floribunda		Native	7/08/2007
Dillwynia glaberrima		Native	19/12/2003
Dillwynia parvifolia		Native	16/09/1804
Dillwynia retorta		Native	5/09/2007
Dillwynia rudis		Native	4/11/1966
Dillwynia sericea	Egg and Bacon Peas, Parrot Peas	Native	22/08/1993
Dillwynia sieberi		Native	23/07/2009
Dillwynia tenuifolia	Dillwynia tenuifolia, Kemps Creek	Native	5/09/2006
Dipogon lignosus	Dolichos Pea	Exotic	17/09/2008
Erythrina sykesii	Coral Tree	Exotic	14/11/2005
Genista linifolia	Flaxleaf Broom	Exotic	4/03/2008
Genista monspessulana	Montpellier Broom	Exotic	5/09/2007
Genista spp.		Exotic	22/10/2004
Glycine clandestina	Twining glycine	Native	9/07/2009
Glycine microphylla	Small-leaf Glycine	Native	31/01/1896
Glycine spp.		Native	4/05/2007
Glycine tabacina	Variable Glycine	Native	23/07/2009
Glycine tabacina subsp. 'B'		Native	17/12/1985
Glycine tomentella	Woolly Glycine	Native	28/05/1996
Gompholobium glabratum	Dainty Wedge Pea	Native	17/09/2008
Gompholobium grandiflorum	Large Wedge Pea	Native	27/02/2004
Gompholobium huegelii	Pale Wedge Pea	Native	30/11/1893
Gompholobium inconspicuum		Native	7/08/2002
Gompholobium latifolium	Golden Glory Pea	Native	1/03/2002
Gompholobium minus	Dwarf Wedge Pea	Native	31/10/1893
Gompholobium spp.		Native	18/01/2005
Goodia lotifolia var. lotifolia		Native	30/09/1893
Hardenbergia violacea	False Sarsaparilla	Native	20/03/2009
Hovea heterophylla		Native	13/09/1965
Hovea linearis		Native	31/10/1886
Hovea longifolia	Rusty Pods	Native	31/12/1896
Hovea pannosa		Native	1/10/1966
Hovea purpurea		Native	14/09/1966
Hovea speciosa		Native	31/10/1894
Hovea spp.		Native	17/07/2008
Indigofera australis	Australian Indigo	Native	1/06/2009
Jacksonia scoparia	Dogwood	Native	30/11/1899
Kennedia prostrata	Running Postman	Native	04/09/1886
Kennedia rubicunda	Dusky Coral Pea	Native	17/07/2008

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Lathyrus latifolius	Perennial Pea	Exotic	12/01/1966
Lathyrus tingitanus		Exotic	4/11/1967
Lespedeza juncea subsp. sericea		Native	1/04/1996
Lotus angustissimus	Slender Birds-foot Trefoil	Exotic	23/07/2009
Lotus australis	Australian Trefoil	Native	11/11/2004
Lotus corniculatus	Birds-foot Trefoil	Exotic	20/10/2004
Lotus subbiflorus	Hairy Birds-foot Trefoil	Exotic	19/11/2004
Lotus uliginosus	Birds-foot Trefoil	Exotic	1/06/2009
Lupinus angustifolius	Narrow-leaved Lupin	Exotic	11/09/1944
Lupinus cosentinii	Sandplain Lupin	Exotic	17/09/2008
Medicago arabica	Spotted Burr Medic	Exotic	15/11/2006
Medicago intertexta	Calvary Medic	Exotic	30/11/1903
Medicago laciniata var. laciniata		Exotic	3/09/1968
Medicago lupulina	Black Medic	Exotic	4/03/2008
Medicago minima	Woolly Burr Medic	Exotic	20/03/2009
Medicago polymorpha	Burr Medic	Exotic	1/06/2009
Medicago sativa	Lucerne	Exotic	13/03/2008
Medicago spp.	A Medic	Exotic	20/03/2009
Medicago truncatula	Barrel Medic	Exotic	25/10/2004
Melilotus indicus	Hexham Scent	Exotic	19/11/2004
Melilotus spp.		Exotic	24/01/2005
Mirbelia rubiifolia	Heathy Mirbelia	Native	30/11/1899
Mirbelia speciosa		Native	5/09/2007
Mirbelia speciosa subsp. speciosa		Native	13/08/1814
Oxylobium arborescens	Tall Shaggy Pea	Native	20/11/1909
Phyllota grandiflora	Heath Phyllota	Native	4/03/2008
Phyllota phylicoides	Heath Phyllota	Native	31/08/1897
Phyllota squarrosa	Dense Phyllota	Native	5/09/2007
Pisum sativum var. arvense	Field Pea	Exotic	31/10/1967
Platylobium formosum		Native	1/03/2002
Podolobium ilicifolium	Prickly Shaggy Pea	Native	30/09/1897
Podolobium scandens	Netted Shaggy Pea	Native	11/02/1843
Psoralea pinnata	African Scurf-pea	Exotic	5/09/2007
Pultenaea blakelyi		Native	31/10/1897
Pultenaea daphnoides	Large-leaf Bush-pea	Native	17/07/2008
Pultenaea ferruginea		Native	1/03/2002
Pultenaea flexilis		Native	4/03/2008
Pultenaea linophylla		Native	30/09/1888
Pultenaea microphylla	A Bush Pea	Native	7/12/2005
Pultenaea mollis		Native	27/02/2004
Pultenaea paleacea		Native	25/09/1988
Pultenaea parviflora		Native	4/09/2006
Pultenaea pedunculata	Matted Bush-pea	Native	24/01/2005
Pultenaea polifolia	Dusky Bush-pea	Native	31/07/1920
Pultenaea retusa		Native	4/03/2008
Pultenaea scabra		Native	31/10/1886
Pultenaea spinosa	A Bush Pea	Native	30/11/1904
Pultenaea spp.		Native	7/01/2004
Pultenaea stipularis		Native	5/09/2007
Pultenaea tuberculata		Native	30/11/1899

Scientific Name	Common Name	Native or Exotic	Last Sited
Pultenaea villosa	Hairy Bush-pea	Native	4/03/2008
Robinia pseudoacacia	Black Locust	Exotic	13/03/2008
Sphaerolobium minus		Native	31/07/1893
Swainsona monticola		Native	11/09/1965
Tephrosia grandiflora		Exotic	16/10/1989
Trifolium alexandrinum var. serotinum		Exotic	31/10/1941
Trifolium angustifolium	Narrow-leaved Clover	Exotic	20/10/2004
Trifolium arvense	Haresfoot Clover	Exotic	27/11/2003
Trifolium campestre	Hop Clover	Exotic	20/10/2004
Trifolium cernuum	Drooping-flowered Clover	Exotic	28/09/1968
Trifolium dubium	Yellow Suckling Clover	Exotic	13/01/2004
Trifolium fragiferum	Strawberry Clover	Exotic	13/03/2008
Trifolium glomeratum	Clustered Clover	Exotic	25/10/2004
Trifolium incarnatum	Crimson Clover	Exotic	29/09/1965
Trifolium pratense	Red Clover	Exotic	17/01/2008
Trifolium repens	White Clover	Exotic	9/07/2009
Trifolium resupinatum	Shaftal Clover	Exotic	5/05/2002
Trifolium spp.	A Clover	Exotic	7/08/2007
Trifolium striatum	Knotted Clover	Exotic	4/11/1967
Trifolium suffocatum	Suffocated Clover	Exotic	28/12/1968
Trifolium tomentosum	Woolly Clover	Exotic	18/10/1966
Ulex europaeus	Gorse	Exotic	25/08/1966
Vicia hirsuta	Hairy Vetch	Exotic	19/11/2004
Vicia sativa	Common vetch	Exotic	23/07/2009
Vicia sativa subsp. nigra	Narrow-leaved Vetch	Exotic	31/10/1893
Vicia sativa subsp. sativa	Common Vetch	Exotic	29/09/2004
Vicia spp.	Vetch	Exotic	20/03/2009
Vicia tetrasperma	Slender Vetch	Exotic	20/03/2009
Vicia villosa subsp. eriocarpa		Exotic	31/12/1908
Vicia villosa subsp. villosa		Exotic	30/11/1898
Viminaria juncea	Native Broom	Native	18/01/2005
Wisteria sinensis	Chinese wisteria	Exotic	14/11/2005
Zornia dyctiocarpa var. dyctiocarpa	Zornia	Native	14/07/2009
Acacia baileyana	Cootamundra Wattle	Native	14/03/2008
Acacia binervata	Two-veined Hickory	Native	17/07/2008
Acacia binervia	Coast Myall	Native	31/10/1885
Acacia brownii	Heath Wattle	Native	5/09/2007
Acacia buxifolia subsp. buxifolia	Box-leaved Wattle	Native	15/08/1964
Acacia bynoeana	Bynoe's Wattle	Native	30/09/1913
Acacia cremiflora		Native	31/10/1895
Acacia dealbata	Silver Wattle	Native	17/07/2008
Acacia decurrens	Black Wattle	Native	31/08/1896
Acacia echinula	Hedgehog Wattle	Native	4/03/2008
Acacia elata	Mountain Cedar Wattle	Native	20/03/2009
Acacia elongata	Swamp Wattle	Native	30/09/1897
Acacia falcata		Native	30/06/1897
Acacia falciformis	Broad-leaved Hickory	Native	26/03/2007
Acacia fimbriata	Fringed Wattle	Native	1/06/2009
Acacia floribunda	White Sally	Native	30/11/1897
Acacia hispidula		Native	31/05/1893

Scientific Name	Common Name	Native or Exotic	Last Sited
Acacia implexa	Hickory Wattle	Native	9/07/2009
Acacia irrorata	Green Wattle	Native	5/09/2007
Acacia linifolia	White Wattle	Native	05/03/1887
Acacia longifolia		Native	30/09/1846
Acacia longifolia subsp. longifolia	Sydney Golden Wattle	Native	15/08/1896
Acacia longifolia subsp. sophorae	Coastal Wattle	Native	17/09/2008
Acacia longissima	Long-leaf Wattle	Native	17/07/2008
Acacia maidenii	Maiden's Wattle	Native	2/10/2002
Acacia mearnsii	Black Wattle	Native	17/09/2008
Acacia melanoxylon	Blackwood	Native	4/03/2008
Acacia myrtifolia	Red-stemmed Wattle	Native	30/11/1895
Acacia obtusifolia		Native	30/09/1848
Acacia oxycedrus	Spike Wattle	Native	27/02/2004
Acacia paradoxa	Kangaroo Thorn	Native	4/03/2008
Acacia parramattensis	Parramatta Wattle	Native	31/12/1896
Acacia parvipinnula	Silver-stemmed Wattle	Native	31/10/1880
Acacia podalyriifolia	Queensland Silver Wattle	Native	1/06/2009
Acacia prominens	Gosford Wattle	Native	31/07/1898
Acacia pubescens	Downy Wattle	Native	31/10/1886
Acacia saligna	Golden Wreath Wattle	Exotic	20/03/2009
Acacia schinoides	Green Cedar Wattle	Native	13/01/2004
Acacia spectabilis	Mudgee Wattle	Native	24/01/2005
Acacia spp.	Wattle	Native	15/11/2006
Acacia stricta	Straight Wattle	Native	1/08/2003
Acacia suaveolens	Sweet Wattle	Native	27/05/1895
Acacia subtilinervis	Net-veined wattle	Native	17/07/2008
Acacia terminalis	Sunshine Wattle	Native	17/07/2008
Acacia terminalis subsp. angustifolia		Native	17/09/2008
Acacia terminalis subsp. longiaxialis		Native	30/04/1895
Acacia ulicifolia	Prickly Moses	Native	30/09/1886
Acacia vestita	Weeping Boree	Native	31/08/1894
Paraserianthes lophantha subsp. lophantha	Crested Wattle	Exotic	5/09/2007
Quercus robur	English Oak	Exotic	20/03/2009
Quercus spp.		Exotic	15/11/2006
Scolopia braunii	Flintwood	Native	31/12/1899
Fumaria bastardii	Bastards Fumitory	Exotic	7/08/2007
Fumaria capreolata subsp. capreolata	Climbing Fumitory	Exotic	15/10/1967
Fumaria muralis subsp. muralis	Wall Fumitory	Exotic	19/11/2004
Fumaria spp.	Fumitory	Exotic	6/06/2008
Centaurium erythraea	Common Centaury	Exotic	13/03/2008
Centaurium tenuiflorum	Branched Centaury, Slender centaury	Exotic	1/06/2009
Schenkia spicata	Spike Centaury	Native	14/03/2008
Sebaea ovata	Yellow Centaury	Native	31/10/1949
Erodium cicutarium	Common Crowfoot	Exotic	2/08/1988
Erodium crinitum	Blue Crowfoot	Native	25/10/2004
Erodium moschatum	Musky Crowfoot	Exotic	20/10/1964
Geranium homeanum		Native	17/09/2008
Geranium molle subsp. molle	Cranesbill Geranium	Exotic	9/07/2009
Geranium obtusisepalum		Native	1/01/1996
Geranium sessiliflorum subsp. brevicaule		Native	15/02/1989

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Geranium solanderi	Native Geranium	Native	16/11/1893
Geranium solanderi var. solanderi		Native	13/03/2008
Geranium sp. C		Native	27/05/1987
Geranium spp.		Exotic	1/06/2009
Pelargonium australe	Native Storksbill	Native	20/03/2009
Pelargonium capitatum		Exotic	17/09/2008
Pelargonium domesticum	Pelargonium	Exotic	15/11/2006
Pelargonium inodorum		Native	2/12/1998
Dicranopteris linearis var. linearis		Native	27/02/2004
Gleichenia dicarpa	Pouched Coral Fern	Native	5/09/2007
Gleichenia microphylla	Scrambling Coral Fern	Native	4/03/2008
Gleichenia rupestris		Native	4/03/2008
Sticherus flabellatus var. flabellatus	Umbrella Fern	Native	30/06/1889
Dampiera purpurea		Native	30/09/1891
Dampiera stricta		Native	22/09/1888
Goodenia bellidifolia		Native	1/08/2003
Goodenia bellidifolia subsp. bellidifolia		Native	14/01/2005
Goodenia decurrens		Native	11/01/1953
Goodenia hederacea	Ivy Goodenia	Native	1/06/2009
Goodenia hederacea subsp. hederacea		Native	13/03/2008
Goodenia heterophylla		Native	1/03/2002
Goodenia heterophylla subsp. eglandulosa		Native	20/10/2004
Goodenia ovata	Hop Goodenia	Native	6/06/2008
Goodenia paniculata		Native	4/05/2007
Scaevola albida	Pale Fan-flower	Native	31/03/1894
Scaevola albida var. albida		Native	6/06/2008
Scaevola albida var. pallida		Native	3/03/1994
Scaevola ramosissima	Purple Fan-flower	Native	20/10/2004
Grammitis stenophylla	Narrow-leaf Finger Fern	Native	1/03/2002
Gyrostemon thesioides		Native	8/12/1967
Haemodorum corymbosum		Native	4/12/1970
Haemodorum planifolium subsp. planifolium		Native	19/11/1966
Gonocarpus humilis		Native	21/11/1998
Gonocarpus longifolius		Native	4/12/1998
Gonocarpus micranthus		Native	18/01/2005
Gonocarpus micranthus subsp. ramosissimus		Native	24/02/1970
Gonocarpus tetragynus	Poverty Raspwort	Native	7/08/2002
Gonocarpus teucrioides	Germander Raspwort	Native	17/09/2008
Haloragis aspera	Rough Raspwort	Native	30/11/1969
Haloragis heterophylla	Variable Raspwort	Native	26/11/1998
Myriophyllum aquaticum	Parrots Feather	Exotic	30/07/2008
Myriophyllum simulans		Native	25/01/1970
Myriophyllum variifolium		Native	4/03/2008
Liquidambar styraciflua	Sweetgum	Exotic	17/09/2008
Egeria densa	Dense Waterweed	Exotic	11/01/1964
Elodea canadensis	Elodea	Exotic	30/11/1994
Hydrilla verticillata	Hydrilla	Native	27/02/1981
Ottelia ovalifolia subsp. ovalifolia	Swamp Lily	Native	7/04/2003
Vallisneria gigantea	Eelweed	Native	21/08/2008
Hymenophyllum cupressiforme	Common Filmy Fern	Native	1/03/2002

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Hypoxis hygrometrica	Golden Weather-grass	Native	28/01/2004
Hypoxis hygrometrica var. hygrometrica		Native	13/03/2008
Hypoxis hygrometrica var. villosisepala		Native	23/12/1998
Chasmanthe floribunda	African Cornflag	Exotic	1/06/2009
Crocosmia x crocosmiiflora	Montbretia	Exotic	20/10/2004
Freesia hybrid	Freesia	Exotic	17/09/2008
Herbertia lahue subsp. caerulea		Exotic	26/11/1998
Iris germanica	Tall Bearded Iris	Exotic	25/09/1965
Iris spp.		Exotic	14/03/2003
Ixia flexuosa	Corn Lily	Exotic	3/12/1966
Moraea collina		Exotic	31/08/1923
Patersonia glabrata	Leafy Purple-flag	Native	1/08/2003
Patersonia longifolia		Native	27/02/2004
Patersonia sericea	Silky Purple-Flag	Native	17/09/2008
Patersonia spp.		Native	22/12/2003
Romulea rosea var. australis	Onion Grass	Exotic	1/06/2009
Sisyrinchium iridifolium	Blue Pigroot	Exotic	1/06/2009
Sisyrinchium sp. A	Scourweed	Exotic	25/10/2004
Tritonia lineata	Lined Tritonia	Exotic	23/10/1965
Watsonia meriana		Exotic	17/09/2008
Watsonia spp.		Exotic	6/06/2003
Juncus acuminatus		Exotic	4/12/1998
Juncus acutus subsp. acutus	Sharp Rush	Exotic	17/01/2008
Juncus amabilis		Native	5/12/1993
Juncus aridicola	Tussock Rush	Native	3/10/1988
Juncus articulatus	A Rush	Exotic	27/11/2003
Juncus bufonius	Toad Rush	Exotic	1/06/2009
Juncus caespiticius		Native	31/01/1912
Juncus capillaceus		Exotic	18/03/1975
Juncus capitatus		Exotic	2/11/1963
Juncus cognatus		Exotic	7/08/2007
Juncus continuus		Native	17/09/2008
Juncus effusus		Exotic	26/12/1991
Juncus flavidus		Native	26/01/1991
Juncus fockei		Native	2/12/1998
Juncus holoschoenus		Native	21/11/1892
Juncus homalocaulis		Native	25/11/1998
Juncus kraussii subsp. australiensis	Sea Rush	Native	17/09/2008
Juncus microcephalus		Exotic	10/11/1995
Juncus mollis		Native	12/02/1975
Juncus ochrocoleus		Native	22/05/1994
Juncus pallidus		Native	26/01/1899
Juncus planifolius		Native	13/01/2004
Juncus polyanthemus		Native	18/02/1999
Juncus prismatocarpus		Native	18/01/2005
Juncus remotiflorus		Native	23/12/1998
Juncus spp.	A Rush	Native	6/06/2008
Juncus subglaucus	Rush	Native	7/09/1995
Juncus subsecundus	Finger Rush	Native	20/03/2009
Juncus usitatus		Native	20/03/2009

Scientific Name	Common Name	Native or Exotic	Last Sited
Juncus vaginatus		Native	30/09/1893
Luzula densiflora	Woodrush	Native	2/10/1967
Luzula flaccida	Woodrush	Native	17/11/1991
Triglochin microtuberosa		Native	30/07/2008
Triglochin procera	Water Ribbons	Native	20/10/2004
Triglochin rheophila		Native	18/11/1968
Triglochin striata	Streaked Arrowgrass	Native	17/01/2008
Ajuga australis	Austral Bugle	Native	9/07/2009
Chloanthes stoechadis		Native	29/07/1989
Clerodendrum tomentosum	Hairy Clerodendrum	Native	25/11/1892
Clerodendrum tomentosum var. tomentosum		Native	12/08/1994
Glechoma hederacea	Ground Ivy	Exotic	26/10/1976
Hemigenia cuneifolia		Native	31/12/1910
Hemigenia purpurea		Native	5/09/2007
Lamium amplexicaule	Dead Nettle	Exotic	25/08/1966
Lamium purpureum	Red Deadnettle	Exotic	1/06/2009
Lavandula spp.		Exotic	14/04/2004
Lavandula stoechas	Italian Lavender	Exotic	26/03/1967
Lycopus australis	Australian Gipsywort	Native	5/06/1996
Marrubium vulgare	White Horehound	Exotic	15/11/1985
Mentha diemenica	Slender Mint	Native	13/03/2008
Mentha satureioides	Native Pennyroyal	Native	13/03/2008
Mentha spp.		Exotic	25/10/2004
Mentha x piperita	Peppermint	Exotic	11/04/1971
Mentha x spicata	Spearmint	Exotic	16/02/1969
Plectranthus ciliatus		Exotic	17/09/2008
Plectranthus parviflorus		Native	16/07/2009
Plectranthus spp.		Native	1/06/2009
Prostanthera caerulea		Native	19/08/1989
Prostanthera howelliae	Prostanthera	Native	21/09/1952
Prostanthera incisa	Cut-leaved Mint-bush	Native	1/03/2002
Prostanthera linearis	Narrow-leaved Mint-bush	Native	31/10/1896
Prostanthera ovalifolia		Native	1/03/2002
Prostanthera saxicola		Native	31/10/1897
Salvia coccinea		Exotic	2/04/1945
Salvia reflexa	Mintweed	Exotic	3/01/1984
Salvia verbenaca	Vervain	Exotic	22/12/2005
Scutellaria humilis	Dwarf Skullcap	Native	1/06/2009
Scutellaria racemosa		Exotic	21/10/1975
Spartothamnella juncea	Bead Bush	Native	29/06/2005
Stachys arvensis	Stagger Weed	Exotic	30/04/1885
Teucrium argutum		Native	4/03/1993
Westringia fruticosa	Coastal Rosemary	Native	20/03/2009
Westringia longifolia	Long-leaved Westringia	Native	25/09/1897
Westringia spp.		Native	25/10/2004
Cassytha glabella		Native	5/09/2007
Cassytha glabella f. glabella		Native	4/12/1998
Cassytha pubescens	Downy Dodder-laurel	Native	30/09/1897
Cassytha spp.		Native	17/07/2008
Cinnamomum camphora	Camphor Laurel	Exotic	1/06/2009

Scientific Name	Common Name	Native or Exotic	Last Sited
Cryptocarya glaucescens	Jackwood	Native	25/02/1899
Lemna disperma		Native	13/03/2008
Spirodela punctata		Native	14/03/2003
Wolffia australiana		Native	12/08/1988
Utricularia spp.		Native	4/12/1998
Lilium formosanum	Formosan Lily	Exotic	1/06/2009
Linum marginale	Native Flax	Native	13/03/2008
Linum trigynum	French Flax	Exotic	27/10/1894
Linum usitatissimum	Flax	Exotic	25/05/1968
Lindsaea linearis	Screw Fern	Native	5/09/2007
Lindsaea microphylla	Lacy Wedge Fern	Native	17/07/2008
Isotoma axillaris	Showy Isotome	Native	30/11/1899
Isotoma fluviatilis	Swamp Isotome	Native	20/12/1963
Isotoma fluviatilis subsp. borealis		Native	12/04/1987
Lobelia anceps		Native	1/03/2002
Lobelia dentata		Native	5/09/2007
Lobelia gracilis	Trailing Lobelia	Native	28/12/1964
Lobelia spp.		Native	18/01/2005
Monopsis debilis var. depressa		Exotic	4/03/2008
Pratia concolor	Poison Pratia	Native	22/11/1992
Pratia purpurascens	Whiteroot	Native	23/07/2009
Gelsemium sempervirens	Yellow Jessamine	Exotic	15/11/2006
Logania albiflora		Native	31/10/1898
Logania albiflora subsp. IS		Native	14/09/1966
Logania pusilla		Native	09/11/1889
Mitrasacme alsinoides		Native	16/05/2006
Mitrasacme polymorpha		Native	5/09/2007
Lomandra brevis		Native	30/11/1899
Lomandra confertifolia	Matrush	Native	17/09/2008
Lomandra confertifolia subsp. pallida	Matrush	Native	5/09/2007
Lomandra confertifolia subsp. rubiginosa		Native	13/01/1999
Lomandra cylindrica		Native	16/10/1984
Lomandra filiformis	Wattle Matt-rush	Native	23/07/2009
Lomandra filiformis subsp. coriacea	Wattle Matt-rush	Native	5/09/2007
Lomandra filiformis subsp. filiformis		Native	20/03/2009
Lomandra fluviatilis		Native	17/07/2008
Lomandra glauca	Pale Mat-rush	Native	4/05/2007
Lomandra gracilis		Native	17/09/2008
Lomandra longifolia	Spiny-headed Mat-rush	Native	24/11/1893
Lomandra micrantha subsp. tuberculata	Small-flowered Mat-rush	Native	18/01/2005
Lomandra montana		Native	19/08/1989
Lomandra multiflora subsp. multiflora	Many-flowered Mat-rush	Native	17/09/2008
Lomandra obliqua		Native	17/09/2008
Amyema cambagei	Needle-leaf Mistletoe	Native	12/05/1977
Amyema congener subsp. congener		Native	20/10/2004
Amyema gaudichaudii		Native	30/11/1895
Amyema miquelii	Box Mistletoe	Native	14/11/2005
Amyema pendulum		Native	15/11/2006
Amyema pendulum subsp. pendulum		Native	27/12/1918
Amyema spp.	Mistletoe	Native	19/04/2004

Scientific Name	Common Name	Native or Exotic	Last Sited
Atkinsonia ligustrina		Native	31/10/1904
Dendrophthoe vitellina		Native	5/09/2007
Muellerina celastroides		Native	31/12/1896
Muellerina eucalyptoides		Native	13/03/2008
Eustrephus latifolius	Wombat Berry	Native	17/09/2008
Geitonoplesium cymosum	Scrambling Lily	Native	17/09/2008
Lycopodiella cernua	Scrambling Clubmoss	Native	27/02/2004
Lycopodiella lateralis	Slender Clubmoss	Native	27/02/2004
Lagerstroemia indica		Exotic	20/03/2009
Lythrum hyssopifolia	Hyssop Loosestrife	Native	25/10/2004
Cotoneaster glaucophyllus		Exotic	1/06/2009
Cotoneaster pannosus		Exotic	2/04/2004
Cotoneaster spp.		Exotic	22/12/2005
Crataegus monogyna	Hawthorn	Exotic	25/10/2004
Eriobotrya japonica	Loquat	Exotic	19/11/2004
Malus domestica	Apple	Exotic	13/03/2008
Malus spp.		Exotic	18/06/2003
Photinia serratifolia	Chinese Photinia	Exotic	1/06/2009
Pyracantha angustifolia	Orange Firethorn	Exotic	14/03/2008
Pyracantha crenulata		Exotic	1/06/2009
Pyracantha spp.		Exotic	17/09/2008
Rhaphiolepis indica	Indian Hawthorn	Exotic	31/07/1897
Abutilon grandifolium		Exotic	2/11/1997
Abutilon oxycarpum	Straggly Lantern-bush	Native	21/05/1996
Gossypium barbadense	Sea Island Cotton	Exotic	26/04/1969
Hibiscus heterophyllus subsp. heterophyllus	Native Rosella	Native	21/05/1996
Hibiscus spp.		Native	1/06/2009
Hibiscus trionum	Flower-of-an-hour	Native	17/05/1969
Lagunaria patersonia	Norfolk Island Hibiscus	Native	17/09/2008
Malva dendromorpha	Tree Mallow	Exotic	29/10/1966
Malva neglecta	Dwarf Mallow	Exotic	17/09/2008
Malva parviflora	Small-flowered Mallow	Exotic	1/06/2009
Malva spp.	Mallow	Exotic	20/03/2009
Malva sylvestris	Tall Mallow	Exotic	30/07/2008
Modiola caroliniana	Red-flowered Mallow	Exotic	16/07/2009
Pavonia hastata		Exotic	15/02/1888
Sida acuta	Spinyhead Sida	Exotic	1/06/2009
Sida corrugata	Corrugated Sida	Native	13/03/2008
Sida rhombifolia	Paddy's Lucerne	Exotic	23/07/2009
Sida spinosa		Native	13/03/2008
Sida subspicata		Native	27/02/1992
Marsilea hirsuta	Short-fruited Nardoo	Native	24/05/1996
Marsilea mutica		Native	25/10/2004
Pilularia novae-hollandiae	Austral Pillwort	Native	3/01/1966
Melia azedarach	White Cedar	Native	20/03/2009
Synoum glandulosum subsp. glandulosum	Scentless Rosewood	Native	31/07/1898
Toona ciliata	Red Cedar	Native	4/07/1969
Legnephora moorei	Round-leaf Vine	Native	28/05/1996
Sarcopetalum harveyanum	Pearl Vine	Native	1/03/2002
Stephania japonica	Snake vine	Native	17/09/2008

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Nymphoides geminata	Entire Marshwort	Native	7/08/2002
Nymphoides montana	Marshwort	Native	12/10/2005
Villarsia exaltata	Yellow Marsh Flower	Native	20/10/2004
Ficus carica	Common Fig	Exotic	25/02/1970
Ficus coronata	Creek Sandpaper Fig	Native	6/06/2008
Ficus macrophylla		Native	18/12/2007
Ficus macrophylla subsp. macrophylla	Moreton Bay Fig	Native	25/10/2004
Ficus pumila	Creeping Fig	Exotic	21/11/1969
Ficus rubiginosa	Port Jackson Fig	Native	20/03/2009
Ficus rubiginosa f. rubiginosa		Exotic	6/04/1968
Ficus spp.		Exotic	2/07/1998
Maclura cochinchinensis	Cockspur Thorn	Native	17/09/2008
Maclura pomifera	Osage Orange	Exotic	11/04/1971
Morus alba	White Mulberry	Exotic	14/03/2008
Streblus brunonianus	Whalebone Tree	Native	25/05/1996
Eremophila debilis	Amulla	Native	6/06/2008
Myoporum acuminatum	Boobialla	Native	17/09/2008
Myoporum montanum	Western Boobialla	Native	25/10/2004
Aegiceras corniculatum	River Mangrove	Native	05/03/1887
Anagallis arvensis	Scarlet Pimpernel	Exotic	16/07/2009
Myrsine howittiana	Brush Muttonwood	Native	31/07/1896
Myrsine variabilis		Native	1/03/2002
Acmena smithii	Lilly Pilly	Native	20/03/2009
Angophora bakeri	Narrow-leaved Apple	Native	31/01/1897
Angophora costata	Sydney Red Gum	Native	17/09/2008
Angophora crassifolia		Native	18/01/2005
Angophora floribunda	Rough-barked Apple	Native	30/07/2008
Angophora hispida	Dwarf Apple	Native	17/09/2008
Angophora subvelutina	Broad-leaved Apple	Native	31/01/1896
Austromyrtus tenuifolia		Native	30/11/1898
Backhousia myrtifolia	Grey Myrtle	Native	31/01/1896
Baeckea brevifolia		Native	5/09/2007
Baeckea diosmifolia	Fringed Baeckea	Native	2/07/1998
Baeckea imbricata		Native	4/03/2008
Baeckea linifolia	Weeping Baeckea	Native	1/03/2002
Callistemon citrinus	Crimson Bottlebrush	Native	5/09/2007
Callistemon linearifolius	Netted Bottle Brush	Native	3/04/1951
Callistemon linearis	Narrow-leaved Bottlebrush	Native	5/09/2007
Callistemon pinifolius	Pine-leaved Bottlebrush	Native	31/10/1897
Callistemon rigidus	Stiff Bottlebrush	Native	5/09/2007
Callistemon salignus	Willow Bottlebrush	Native	20/03/2009
Callistemon sieberi	River Bottlebrush	Native	2/07/1995
Callistemon spp.		Native	1/06/2009
Callistemon viminalis	Weeping Bottlebrush	Native	20/03/2009
Calytrix tetragona	Common Fringe-myrtle	Native	17/09/2008
Corymbia eximia	Yellow Bloodwood	Native	17/07/2008
Corymbia gummifera	Red Bloodwood	Native	17/09/2008
Corymbia maculata	Spotted Gum	Native	30/04/1810
Darwinia biflora		Native	27/02/2004
Darwinia diminuta		Native	31/07/1999

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Darwinia fascicularis subsp. fascicularis		Native	5/09/2007
Darwinia grandiflora		Native	11/06/1994
Eucalyptus acmenoides	White Mahogany	Native	14/03/2003
Eucalyptus amplifolia	Cabbage Gum	Native	20/03/2009
Eucalyptus amplifolia subsp. amplifolia		Native	6/06/2008
Eucalyptus apiculata		Native	5/06/1996
Eucalyptus baueriana	Blue Box	Native	31/10/1885
Eucalyptus benthamii	Camden White Gum	Native	17/07/2008
Eucalyptus beyeriana		Native	20/12/2003
Eucalyptus bosistoana	Coast Grey Box	Native	30/01/1809
Eucalyptus botryoides	Bangalay	Native	17/09/2008
Eucalyptus botryoides -- saligna		Native	22/09/1952
Eucalyptus bridgesiana	Apple Box	Native	4/03/2008
Eucalyptus camfieldii	Heart-leaved Stringybark	Native	24/08/1952
Eucalyptus capitellata	Brown Stringybark	Native	5/09/2007
Eucalyptus consideniana	Yertchuk	Native	22/12/1974
Eucalyptus crebra	Narrow-leaved Ironbark	Native	08/01/1894
Eucalyptus deanei	Mountain Blue Gum	Native	4/03/2008
Eucalyptus dives	Broad-leaved Peppermint	Native	28/02/1898
Eucalyptus elata	River Peppermint	Native	17/07/2008
Eucalyptus eugenioides	Thin-leaved Stringybark	Native	30/07/2008
Eucalyptus fastigata	Brown Barrel	Native	14/05/1964
Eucalyptus fibrosa	Red Ironbark	Native	23/07/2009
Eucalyptus globoidea	White Stringybark	Native	5/09/2007
Eucalyptus haemastoma	Broad-leaved Scribbly Gum	Native	17/09/2008
Eucalyptus longifolia	Woollybutt	Native	31/10/1886
Eucalyptus luehmanniana	Yellow Top Mallee Ash	Native	31/07/1994
Eucalyptus microcorys	Tallowwood	Native	17/09/2008
Eucalyptus moluccana	Grey Box	Native	31/10/1884
Eucalyptus multicaulis	Whipstick Ash	Native	25/10/1988
Eucalyptus nicholii	Narrow-leaved Black Peppermint	Native	2/07/1998
Eucalyptus oblonga	Stringybark	Native	4/03/2008
Eucalyptus paniculata	Grey Ironbark	Native	18/06/2003
Eucalyptus paniculata subsp. paniculata		Native	20/05/1998
Eucalyptus parramattensis	Parramatta Red Gum	Native	6/07/1988
Eucalyptus parramattensis subsp. parramattensis		Native	24/04/2006
Eucalyptus pilularis	Blackbutt	Native	19/11/1898
Eucalyptus piperita	Sydney Peppermint	Native	17/09/2008
Eucalyptus punctata	Grey Gum	Native	17/07/2008
Eucalyptus punctata subsp. punctata		Native	6/11/1948
Eucalyptus punctata subsp. wianamattica		Native	3/04/1997
Eucalyptus racemosa	Narrow-leaved Scribbly Gum	Native	5/09/2007
Eucalyptus resinifera	Red Mahogany	Native	30/11/2000
Eucalyptus resinifera subsp. resinifera		Native	17/09/2008
Eucalyptus robusta	Swamp Mahogany	Native	17/09/2008
Eucalyptus saligna	Sydney Blue Gum	Native	17/09/2008
Eucalyptus sclerophylla	Hard-leaved Scribbly Gum	Native	31/08/1898
Eucalyptus scoparia	Wallangarra White Gum	Native	14/11/2005
Eucalyptus siderophloia	Grey Ironbark	Native	27/09/1996
Eucalyptus sideroxylon	Mugga Ironbark	Native	31/10/1886

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Eucalyptus sieberi	Silvertop Ash	Native	4/03/2008
Eucalyptus sparsifolia	Narrow-leaved Stringybark	Native	20/10/2004
Eucalyptus spp.		Native	5/09/2007
Eucalyptus squamosa	Scaly Bark	Native	30/12/1892
Eucalyptus tereticornis	Forest Red Gum	Native	1/06/2009
Eucalyptus umbra	Broad-leaved White Mahogany	Native	26/03/2007
Euryomyrtus ramosissima subsp. ramosissima		Native	31/10/1898
Kunzea ambigua	Tick Bush	Native	17/09/2008
Kunzea capitata		Native	7/08/2002
Kunzea parvifolia	Violet Kunzea	Native	12/10/1894
Leptospermum arachnoides		Native	17/09/2008
Leptospermum continentale	Prickly Teatree	Native	15/11/1992
Leptospermum emarginatum	Twin-flower Tea-tree	Native	5/09/1951
Leptospermum grandifolium	Woolly Teatree	Native	30/11/1897
Leptospermum juniperinum	Prickly Tea-tree	Native	31/12/1898
Leptospermum laevigatum	Coast Teatree	Native	17/09/2008
Leptospermum macrocarpum		Native	31/12/1883
Leptospermum morrisonii		Native	21/12/1966
Leptospermum parvifolium		Native	31/10/1885
Leptospermum polygalifolium	Tantoon	Native	17/09/2008
Leptospermum polygalifolium subsp. polygalifolium		Native	30/11/1894
Leptospermum spp.	Tea-tree	Native	18/12/2007
Leptospermum squarrosum		Native	4/03/2008
Leptospermum trinervium	Slender Tea-tree	Native	31/10/1897
Lophostemon confertus	Brush Box	Native	1/06/2009
Melaleuca armillaris subsp. armillaris	Bracelet Honey-myrtle	Native	20/03/2009
Melaleuca deanei	Deane's Paperbark	Native	19/10/1996
Melaleuca decora		Native	31/12/1891
Melaleuca ericifolia	Swamp Paperbark	Native	20/03/2009
Melaleuca erubescens	Pink Honeymyrtle	Native	4/03/2008
Melaleuca hypericifolia	Hillock bush	Native	5/09/2007
Melaleuca linariifolia	Flax-leaved Paperbark	Native	30/11/1889
Melaleuca nodosa		Native	31/10/1893
Melaleuca quinquenervia	Broad-leaved Paperbark	Native	20/03/2009
Melaleuca sieberi		Native	15/12/1922
Melaleuca spp.		Native	20/03/2009
Melaleuca squamea	Swamp Honey-myrtle	Native	15/09/1981
Melaleuca styphelioides	Prickly-leaved Tea Tree	Native	20/03/2009
Melaleuca thymifolia	Thyme Honey-myrtle	Native	21/02/2003
Micromyrtus ciliata	Fringed Heath-myrtle	Native	27/02/2004
Sannantha pluriflora		Exotic	8/12/1995
Syncarpia glomulifera	Turpentine	Native	17/07/2008
Syncarpia glomulifera subsp. glomulifera		Native	31/10/1887
Syzygium francisii	Giant Water Gum	Native	20/03/2009
Syzygium oleosum	Blue Lilly Pilly	Native	31/07/1904
Syzygium paniculatum	Magenta Lilly Pilly	Native	3/07/1977
Tristania neriifolia	Water Gum	Native	31/01/1894
Tristaniopsis collina	Mountain Water Gum	Native	6/06/2008
Tristaniopsis laurina	Kanooka	Native	20/03/2009
Najas tenuifolia	Waternymph	Native	17/05/1992

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Nandina domestica	Japanese Sacred Bamboo	Exotic	1/06/2009
Mirabilis jalapa	Four-o'clock Flower	Exotic	20/03/2009
Ochna serrulata	Mickey Mouse Plant	Exotic	17/01/2008
Olax stricta		Native	17/10/1896
Jasminum polyanthum	White Jasmine	Exotic	15/11/2006
Ligustrum lucidum	Large-leaved Privet	Exotic	1/06/2009
Ligustrum sinense	Small-leaved Privet	Exotic	20/03/2009
Notelaea longifolia	Large Mock-olive	Native	17/09/2008
Notelaea longifolia f. longifolia		Native	30/04/1885
Notelaea venosa	Veined Mock-olive	Native	28/05/1996
Olea europaea	Common Olive	Exotic	17/09/2008
Olea europaea subsp. cuspidata	African Olive	Exotic	22/06/1899
Epilobium billardierianum subsp. billardierianum		Native	7/08/2002
Epilobium billardierianum subsp. cinereum		Native	14/04/2004
Epilobium ciliatum		Exotic	29/09/1971
Epilobium hirtigerum		Native	20/03/2009
Gaura lindheimeri		Exotic	21/10/1969
Ludwigia peploides subsp. montevidensis	Water Primrose	Native	14/03/2008
Ludwigia peruviana		Exotic	4/03/2008
Oenothera affinis		Exotic	20/03/2009
Oenothera indecora subsp. bonariensis		Exotic	5/11/1967
Oenothera longiflora		Exotic	20/10/2004
Oenothera longiflora subsp. longiflora		Exotic	21/10/1893
Oenothera mollissima		Exotic	20/03/2009
Oenothera stricta subsp. stricta		Exotic	14/03/2008
Ophioglossum lusitanicum	Adder's Tongue	Native	8/04/1967
Acianthus caudatus	Mayfly Orchid	Native	15/08/1897
Acianthus exsertus	Mosquito Orchid	Native	30/11/1989
Acianthus fornicatus	Pixie Caps	Native	30/11/1992
Acianthus spp.	Mosquito Orchid	Native	20/05/1998
Bulbophyllum exiguum		Native	1/03/2002
Burnettia cuneata	Lizard Orchid	Native	9/10/1994
Caladenia carnea	Pink Fingers	Native	17/09/1998
Caladenia catenata	White Caladenia	Native	30/11/1992
Caladenia filamentosa	Daddy Longlegs	Native	15/09/1956
Caladenia fuscata	Dusky Fingers	Native	3/09/1955
Caladenia picta		Native	30/11/1989
Caladenia testacea	Honey Caladenia	Native	15/09/1956
Caleana major	Large Duck Orchid	Native	30/11/1992
Caleana spp.		Native	30/11/1989
Calochilus campestris	Copper Beard Orchid	Native	12/09/1897
Calochilus paludosus	Red Beard Orchid	Native	22/10/1966
Calochilus robertsonii	Purplish Beard Orchid	Native	22/09/1949
Calochilus spp.		Native	5/09/2007
Cestichis reflexa		Native	31/05/1893
Chiloglottis formicifera	Ant Orchid	Native	16/09/1990
Chiloglottis reflexa		Native	30/11/1989
Chiloglottis seminuda		Native	19/04/1992
Corybas aconitiflorus	Spurred Helmet Orchid	Native	30/11/1989
Corybas fimbriatus	Fringed Helmet Orchid	Native	31/05/1955

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Corybas pruinosus	Toothed Helmet Orchid	Native	30/11/1989
Cryptostylis erecta	Tartan Tongue Orchid	Native	1/03/2002
Cryptostylis subulata	Large Tongue Orchid	Native	27/02/2004
Cyanicula caerulea	Blue Caladenia	Native	27/08/1899
Cymbidium suave	Snake Orchid	Native	1/03/2002
Cyrtostylis reniformis	Gnat Orchid	Native	05/09/1897
Dendrobium cucumerinum	Cucumber Orchid	Native	17/01/1961
Dendrobium linguiforme	Tongue Orchid	Native	31/10/1894
Dendrobium speciosum	Rock Lily	Native	30/11/1989
Dendrobium striolatum	Streaked Rock Orchid	Native	1/03/2002
Diplodium grandiflorum		Native	30/11/1989
Diplodium obtusum		Native	23/04/1950
Dipodium punctatum		Native	31/12/1982
Dipodium spp.		Native	4/05/2007
Diuris aequalis	Buttercup Doubletail	Native	18/02/1905
Diuris aurea		Native	6/10/1964
Diuris lanceolata	Snake Orchid	Native	3/09/1955
Diuris maculata	Spotted Doubletail	Native	5/09/2007
Diuris pardina	Leopard Orchid	Native	7/08/2002
Diuris punctata	Purple Donkey Orchid	Native	30/11/1992
Diuris punctata var. punctata		Native	11/10/1969
Diuris sulphurea	Tiger Orchid	Native	30/11/1992
Eriochilus cucullatus	Parson's Bands	Native	31/03/1885
Erythrorchis cassythoides	Climbing Orchid	Native	4/03/2008
Gastrodia sesamoides	Cinnamon Bells	Native	24/09/1969
Genoplesium despectans	Sharp Midge Orchid	Native	18/03/1970
Genoplesium filiforme		Native	25/02/1990
Genoplesium fimbriatum	Fringed Midge Orchid	Native	4/03/2008
Genoplesium nigricans	Mallee Midge Orchid	Native	14/02/1956
Genoplesium nudiscapum	Dense Midge Orchid	Native	30/04/1927
Genoplesium rufum	Red Midge Orchid	Native	17/04/1994
Genoplesium woollsii		Native	30/04/1948
Glossodia major	Waxlip Orchid	Native	7/08/2002
Glossodia minor	Small Waxlip Orchid	Native	5/09/2007
Lyperanthus suaveolens	Brown Beaks	Native	30/11/1894
Microtis parviflora	Slender Onion Orchid	Native	28/11/2006
Microtis rara	Scented Onion Orchid	Native	09/11/1881
Microtis rufa		Native	9/10/1989
Microtis unifolia	Common Onion Orchid	Native	09/11/1881
Orthoceras strictum	Bird's-mouth Orchid	Native	31/08/1915
Papillilabium beckleri		Native	17/10/1956
Paracaleana minor	Small Duck Orchid	Native	30/11/1978
Prasophyllum brevilabre	Short-lipped Leek Orchid	Native	31/08/1994
Prasophyllum elatum	Tall Leek Orchid	Native	17/09/1899
Pterostylis acuminata	Pointed Greenhood	Native	30/05/1999
Pterostylis chaetophora		Native	9/10/1989
Pterostylis concinna	Trim Greenhood	Native	6/06/2003
Pterostylis curta	Blunt Greenhood	Native	13/09/1998
Pterostylis erecta	Erect Maroonhood	Native	5/08/1989
Pterostylis gibbosa	Illawarra Greenhood	Native	31/10/1949

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Pterostylis longifolia	Tall Greenhood	Native	6/06/2003
Pterostylis mitchellii	Mitchell's Rustyhood	Native	7/10/1947
Pterostylis mutica	Midget Greenhood	Native	3/09/1955
Pterostylis nigricans	Dark Greenhood	Native	12/03/1967
Pterostylis nutans	Nodding Greenhood	Native	27/09/1890
Pterostylis reflexa	Small Autumn Greenhood	Native	19/04/1992
Pterostylis revoluta		Native	8/04/1950
Pterostylis rufa	Rusty Hood	Native	4/03/2008
Pterostylis saxicola	Sydney Plains Greenhood	Native	6/11/2007
Pterostylis spp.	Greenhood	Native	6/06/2003
Sarcochilus hillii		Native	4/03/2008
Spiranthes australis	Ladies' Tresses	Native	1/04/1990
Thelymitra brevifolia		Native	11/10/1966
Thelymitra carnea	Tiny Sun Orchid	Native	30/11/1992
Thelymitra cyanea	Veined Sun Orchid	Native	4/11/1991
Thelymitra ixioides var. ixioides	Dotted Sun Orchid	Native	30/09/1892
Thelymitra longiloba		Native	31/10/1948
Thelymitra media var. media	Tall Sun Orchid	Native	20/09/1969
Thelymitra pauciflora	Slender Sun Orchid	Native	30/11/1992
Thelymitra peniculata		Native	20/09/1969
Thelymitra spp.		Native	1/08/2003
Todea barbara	King Fern	Native	27/02/2004
Oxalis articulata		Exotic	24/05/1989
Oxalis bifurca		Exotic	3/03/1992
Oxalis bowiei		Exotic	20/04/1962
Oxalis chnoodes		Native	23/01/1995
Oxalis corniculata	Creeping Oxalis	Exotic	1/06/2009
Oxalis debilis var. corymbosa		Exotic	13/03/2008
Oxalis exilis		Native	13/03/2008
Oxalis incarnata		Exotic	18/10/1964
Oxalis latifolia		Exotic	5/09/2007
Oxalis perennans		Native	14/07/2009
Oxalis pes-caprae	Soursob	Exotic	1/06/2009
Oxalis purpurea		Exotic	16/05/1954
Oxalis spp.		Native	6/06/2008
Oxalis thompsoniae		Exotic	16/07/2009
Eschscholzia californica	California Poppy	Exotic	11/10/1969
Papaver dubium	Longhead Poppy	Exotic	4/11/1967
Papaver somniferum subsp. setigerum		Exotic	11/10/1969
Passiflora edulis	Common Passionfruit	Exotic	17/09/2008
Passiflora filamentosa		Exotic	17/11/1983
Passiflora herbertiana		Native	6/06/2003
Passiflora herbertiana subsp. herbertiana	Native Passionfruit	Native	15/08/1997
Passiflora morifolia		Exotic	17/01/2008
Passiflora spp.		Exotic	6/06/2003
Passiflora subpeltata	White Passionflower	Exotic	30/11/1894
Philydrum lanuginosum	Frogsmouth	Native	18/01/2005
Dianella caerulea	Blue Flax-lily	Native	17/09/2008
Dianella caerulea var. assera		Native	1/12/1963
Dianella caerulea var. caerulea		Native	6/06/2008

Scientific Name	Common Name	Native or Exotic	Last Sited
Dianella caerulea var. producta		Native	27/02/2004
Dianella longifolia	Blueberry Lily	Native	14/07/2009
Dianella longifolia var. longifolia	A Blue Flax Lily	Native	31/12/1896
Dianella longifolia var. stenophylla		Native	31/10/1886
Dianella prunina		Native	30/11/1898
Dianella revoluta	Blueberry Lily	Native	17/09/2008
Dianella revoluta var. revoluta	A Blue Flax Lily	Native	16/05/2006
Dianella spp.		Native	17/07/2008
Stypandra glauca	Nodding Blue Lily	Native	30/09/1899
Thelionema caespitosum	Tufted Blue-lily	Native	07/01/1888
Breynia oblongifolia	Coffee Bush	Native	31/10/1890
Glochidion ferdinandi	Cheese Tree	Native	17/07/2008
Glochidion ferdinandi var. ferdinandi	Cheese Tree	Native	17/09/2008
Glochidion ferdinandi var. pubens	Hairy Cheese Tree	Native	18/02/1992
Phyllanthus gunnii		Native	13/01/2004
Phyllanthus hirtellus	Thyme Spurge	Native	17/09/2008
Phyllanthus similis		Native	30/11/1894
Phyllanthus tenellus	Hen and Chicken	Exotic	1/06/2009
Phyllanthus virgatus	Wiry Spurge	Native	23/07/2009
Phyllanthus virgatus complex		Native	12/03/1976
Poranthera corymbosa		Native	24/12/2003
Poranthera ericifolia		Native	3/10/1954
Poranthera microphylla	Small Poranthera	Native	23/07/2009
Phytolacca octandra	Inkweed	Exotic	1/06/2009
Pinus radiata	Radiata Pine	Exotic	2/07/1998
Billardiera mutabilis	Climbing Apple Berry	Native	3/10/1966
Billardiera scandens	Hairy Apple Berry	Native	30/11/1893
Bursaria longisepala		Native	8/05/1976
Bursaria spinosa	Native Blackthorn	Native	23/07/2009
Bursaria spinosa subsp. lasiophylla	Native Blackthorn	Native	31/05/1945
Bursaria spinosa subsp. spinosa	Native Blackthorn	Native	30/07/2008
Hymenosporum flavum	Native Frangipani	Native	2/07/1998
Pittosporum multiflorum	Orange Thorn	Native	18/05/1992
Pittosporum revolutum	Rough Fruit Pittosporum	Native	31/10/1896
Pittosporum undulatum	Sweet Pittosporum	Native	1/06/2009
Rhytidosporum procumbens		Native	31/12/1889
Plantago coronopus subsp. coronopus		Exotic	27/09/1969
Plantago debilis	Shade Plantain	Native	14/07/2009
Plantago gaudichaudii	Narrow Plantain	Native	6/06/2008
Plantago hirtella		Exotic	1/11/1969
Plantago lanceolata	Lamb's Tongues	Exotic	23/07/2009
Plantago major	Large Plantain	Exotic	17/09/2008
Plantago myosuros subsp. myosuros		Exotic	25/10/2004
Plantago varia		Native	24/10/1965
Veronica arvensis	Wall Speedwell	Exotic	7/10/1965
Veronica persica	Creeping Speedwell	Exotic	25/10/2004
Veronica plebeia	Trailing Speedwell	Native	23/07/2009
Agrostis capillaris	Browntop Bent	Exotic	30/01/1964
Agrostis gigantea	Redtop Bent	Exotic	25/12/1966
Agrostis stolonifera	Creeping Bent	Exotic	22/12/2003

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Aira caryophyllea	Silvery Hairgrass	Exotic	4/03/2008
Aira cupaniana	Silvery Hairgrass	Exotic	5/10/1969
Amphibromus nervosus	Swamp Wallaby Grass	Native	1/11/1969
Andropogon virginicus	Whisky Grass	Exotic	1/06/2009
Anisopogon avenaceus	Oat Speargrass	Native	17/09/2008
Aristida benthamii var. benthamii		Native	17/02/1962
Aristida benthamii var. spinulifera		Native	1/08/2003
Aristida calycina		Native	17/09/2008
Aristida echinata		Native	19/03/1984
Aristida jerichoensis var. jerichoensis	Jericho Wiregrass	Native	27/02/2004
Aristida personata		Native	24/02/1967
Aristida ramosa	Purple Wiregrass	Native	23/07/2009
Aristida spp.	A Wiregrass	Native	18/01/2005
Aristida vagans	Threeawn Speargrass	Native	23/07/2009
Aristida warburgii		Native	25/12/1966
Arundo donax	Giant Reed	Exotic	5/09/2007
Austrodanthonia bipartita	Wallaby Grass	Native	14/03/2008
Austrodanthonia fulva	Wallaby Grass	Native	1/06/2009
Austrodanthonia monticola	A Wallaby Grass	Native	7/08/2002
Austrodanthonia pilosa	Smooth-flowered Wallaby Grass	Native	4/03/2008
Austrodanthonia racemosa	Wallaby Grass	Native	31/05/1885
Austrodanthonia racemosa var. racemosa	A Wallaby Grass	Native	14/01/2005
Austrodanthonia setacea	Smallflower Wallaby Grass	Native	23/07/2009
Austrodanthonia spp.	A Wallaby Grass	Native	7/08/2007
Austrodanthonia tenuior	A Wallaby Grass	Native	1/06/2009
Austrostipa aristiglumis	Plains Grass	Native	8/01/1969
Austrostipa nodosa	A Speargrass	Native	16/03/2003
Austrostipa pubescens		Native	4/05/2007
Austrostipa ramosissima	Stout Bamboo Grass	Native	13/03/2008
Austrostipa rudis		Native	19/11/2004
Austrostipa rudis subsp. nervosa	A Speargrass	Native	13/01/1999
Austrostipa rudis subsp. rudis		Native	1/08/2003
Austrostipa scabra	Speargrass	Native	12/10/2005
Austrostipa scabra subsp. falcata	Rough Speargrass	Native	21/02/2003
Austrostipa scabra subsp. scabra	Rough Speargrass	Native	8/01/1969
Austrostipa setacea	Corkscrew Grass	Native	19/11/2003
Austrostipa spp.	A Speargrass	Native	5/09/2007
Austrostipa verticillata	Slender Bamboo Grass	Native	25/10/2004
Avena barbata	Bearded Oats	Exotic	17/09/2004
Avena fatua	Wild Oats	Exotic	17/09/2008
Avena ludoviciana	Ludo Wild Oats	Exotic	29/10/1965
Avena sativa	Oats	Exotic	20/10/2004
Avena spp.	Oats	Exotic	7/08/2007
Axonopus compressus	Broad-leaved Carpet Grass	Exotic	26/03/1973
Axonopus fissifolius	Narrow-leafed Carpet Grass	Exotic	23/07/2009
Bambusa spp.	Unidentified bamboo	Exotic	2/04/2004
Bothriochloa decipiens var. decipiens	Pitted Bluegrass	Native	4/09/2005
Bothriochloa macra	Red Grass	Native	31/05/1885
Bothriochloa spp.	Redgrass, Bluegrass	Exotic	4/06/2004
Brachyachne convergens	Common Native Couch	Native	4/03/2008

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Briza maxima	Quaking Grass	Exotic	1/06/2009
Briza minor	Shivery Grass	Exotic	1/06/2009
Briza subaristata		Exotic	20/03/2009
Bromus catharticus	Praire Grass	Exotic	1/06/2009
Bromus diandrus	Great Brome	Exotic	1/06/2009
Bromus hordeaceus	Soft Brome	Exotic	25/10/2004
Bromus madritensis	Madrid Brome	Exotic	22/10/1967
Bromus molliformis	Soft Brome	Exotic	2/04/2004
Bromus rubens	Red Brome	Exotic	6/11/1965
Capillipedium parviflorum	Scented-top Grass	Native	5/09/2007
Cenchrus caliculatus	Hillside Burrgrass	Native	17/12/1985
Cenchrus echinatus	Mossman River Grass	Exotic	1/03/1992
Chloris divaricata var. divaricata	Slender Chloris	Native	13/03/2008
Chloris gayana	Rhodes Grass	Exotic	1/06/2009
Chloris truncata	Windmill Grass	Native	1/06/2009
Chloris ventricosa	Tall Chloris	Native	23/07/2009
Chloris virgata	Feathertop Rhodes Grass	Exotic	1/06/2009
Cortaderia jubata	Pink Pampas Grass	Exotic	3/04/2005
Cortaderia selloana	Pampas Grass	Exotic	1/06/2009
Cymbopogon refractus	Barbed Wire Grass	Native	23/07/2009
Cynodon dactylon	Common Couch	Native	1/06/2009
Cynodon incompletus		Exotic	23/01/1954
Cynodon nlemfuensis var. nlemfuensis		Exotic	17/02/1954
Dactylis glomerata	Cocksfoot	Exotic	13/03/2008
Dactyloctenium australe	Durban Grass	Exotic	14/01/2005
Dactyloctenium radulans	Button Grass	Native	15/04/1968
Deyeuxia appressa		Native	9/11/1930
Deyeuxia decipiens	Devious Bent-grass	Native	25/12/1966
Deyeuxia nudiflora		Native	21/12/1966
Deyeuxia quadriseta		Native	30/11/1969
Dichanthium sericeum	Queensland Bluegrass	Native	14/03/2008
Dichanthium sericeum subsp. sericeum	Queensland Bluegrass	Native	17/12/1985
Dichelachne crinita	Longhair Plumegrass	Native	17/09/2008
Dichelachne inaequiglumis		Native	23/07/2009
Dichelachne micrantha	Shorthair Plumegrass	Native	21/10/1893
Dichelachne parva		Native	30/04/1894
Dichelachne rara		Native	11/01/2000
Digitaria aequiglumis		Exotic	29/01/1968
Digitaria breviglumis		Native	24/03/1962
Digitaria ciliaris	Summer Grass	Exotic	13/03/2008
Digitaria diffusa	Open Summer-grass	Native	13/03/2008
Digitaria divaricatissima	Umbrella Grass	Native	14/05/2007
Digitaria ischaemum		Exotic	14/03/2008
Digitaria longiflora		Native	27/12/1918
Digitaria parviflora	Small-flowered Finger Grass	Native	4/03/2008
Digitaria sanguinalis	Crab Grass	Exotic	20/03/2009
Digitaria spp.	A Finger Grass	Exotic	14/09/2002
Digitaria violascens		Exotic	14/03/2008
Echinochloa colona	Awnless Barnyard Grass	Native	24/02/1971
Echinochloa crus-galli	Barnyard Grass	Exotic	31/03/1898

Scientific Name	Common Name	Native or Exotic	Last Sited
Echinochloa crus-pavonis	South American Barnyard Grass	Exotic	24/02/1971
Echinochloa esculenta	Japanese Millet	Exotic	31/01/1928
Echinochloa telmatophila	Swamp Barnyard Grass	Native	1/04/1968
Echinopogon caespitosus	Bushy Hedgehog-grass	Native	14/03/2008
Echinopogon caespitosus var. caespitosus	Tufted Hedgehog Grass	Native	13/03/2008
Echinopogon ovatus	Forest Hedgehog Grass	Native	30/11/1894
Echinopogon spp.	A Hedgehog Grass	Native	18/01/2005
Ehrharta erecta	Panic Veldtgrass	Exotic	1/06/2009
Ehrharta longiflora	Annual Veldtgrass	Exotic	31/08/1975
Eleusine indica	Crowsfoot Grass	Exotic	4/03/2008
Eleusine spp.		Exotic	7/01/2004
Eleusine tristachya	Goose Grass	Exotic	14/03/2008
Elymus multiflorus	Philip Island Wheatgrass	Native	4/03/2008
Elymus scaber	Common Wheatgrass	Native	14/03/2003
Elymus scaber var. scaber	Common Wheatgrass	Native	20/10/2004
Enteropogon acicularis	Curly Windmill Grass	Native	15/05/2006
Entolasia marginata	Bordered Panic	Native	1/06/2009
Entolasia spp.		Native	1/08/2003
Entolasia stricta	Wiry Panic	Native	20/03/2009
Entolasia whiteana		Native	31/05/1986
Eragrostis alveiformis		Native	24/03/1967
Eragrostis benthamii		Native	27/02/2004
Eragrostis brownii	Brown's Lovegrass	Native	23/07/2009
Eragrostis cilianensis	Stinkgrass	Exotic	1/06/2009
Eragrostis curvula	African Lovegrass	Exotic	9/07/2009
Eragrostis elongata	Clustered Lovegrass	Native	10/02/1968
Eragrostis lacunaria	Purple Lovegrass	Native	29/02/1880
Eragrostis leptostachya	Paddock Lovegrass	Native	31/03/1894
Eragrostis mexicana	Mexican Lovegrass	Exotic	20/03/2009
Eragrostis parviflora	Weeping Lovegrass	Native	16/03/2003
Eragrostis sororia		Native	5/04/1969
Eragrostis spp.	A Lovegrass	Exotic	20/03/2009
Eriochloa pseudoacrotricha	Early Spring Grass	Native	16/07/2009
Festuca elatior	Tall Fescue	Exotic	25/05/2006
Glyceria australis	Australian Sweetgrass	Native	17/05/1992
Hainardia cylindrica	Common Barbgrass	Exotic	4/03/2008
Hemarthria uncinata	Matgrass	Native	22/10/2004
Hemarthria uncinata var. uncinata		Native	2/12/1998
Holcus lanatus	Yorkshire Fog	Exotic	14/01/2005
Hordeum distichon	Two Row Barley	Exotic	2/10/1967
Hordeum glaucum	Northern Barley Grass	Exotic	2/10/1967
Hordeum leporinum	Barley Grass	Exotic	7/12/1987
Hyparrhenia hirta	Coolatai Grass	Exotic	1/06/2009
Imperata cylindrica	Blady Grass	Native	17/09/2008
Joycea pallida	Silvertop Wallaby Grass	Native	13/01/1999
Lachnagrostis aemula	Blowngrass	Native	20/03/2009
Lachnagrostis filiformis		Native	03/11/1894
Lamarckia aurea	Goldentop	Exotic	23/10/1969
Leptochloa ciliolata	Fine canegrass	Native	4/03/2008
Lolium loliaceum	Stiff Ryegrass	Exotic	29/10/1966

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Lolium multiflorum	Italian Ryegrass	Exotic	20/10/2004
Lolium perenne	Perennial Ryegrass	Exotic	1/06/2009
Lolium rigidum	Wimmera Ryegrass	Exotic	17/09/2008
Lolium spp.	A Ryegrass	Exotic	17/09/2008
Megathyrsus maximus		Exotic	14/03/2008
Melinis repens	Red Natal Grass	Exotic	17/09/2008
Microlaena stipoides	Weeping Grass	Native	23/07/2009
Microlaena stipoides var. stipoides	Weeping Grass	Native	6/06/2008
Nassella neesiana	Chilean Needle Grass	Exotic	1/06/2009
Notodanthonia longifolia	Long-leaved Wallaby Grass	Native	1/02/2005
Notodanthonia semiannularis	Tasmanian Wallaby Grass	Native	13/02/1996
Oplismenus aemulus		Native	20/03/2009
Oplismenus imbecillis		Native	16/07/2009
Panicum bisulcatum	Black-seeded Panic	Native	27/11/2003
Panicum decompositum var. tenuius		Native	12/04/1987
Panicum effusum	Hairy Panic	Native	30/04/1894
Panicum maximum var. trichoglume	Green Panic	Exotic	13/03/2008
Panicum miliaceum	French Millet	Exotic	1/06/1968
Panicum obseptum	White Water Panic	Native	24/03/1967
Panicum simile	Two-colour Panic	Native	5/09/2007
Panicum spp.	Panicum	Native	1/06/2009
Parapholis incurva	Coast Barb Grass	Exotic	26/10/1971
Paspalidium albovillosum		Native	13/01/1999
Paspalidium aversum	Bent Summer Grass	Native	2/12/1998
Paspalidium criniforme		Native	19/04/2004
Paspalidium distans		Native	31/03/1898
Paspalidium gracile	Slender Panic	Native	12/10/2005
Paspalidium spp.		Native	6/06/2003
Paspalum dilatatum	Paspalum	Exotic	14/07/2009
Paspalum distichum	Water Couch	Native	30/07/2008
Paspalum notatum	Bahia Grass	Exotic	4/04/1993
Paspalum orbiculare	Ditch Millet	Native	4/12/1998
Paspalum quadrifarium	Tussock Paspalum	Exotic	5/09/2007
Paspalum urvillei	Vasey Grass	Exotic	20/03/2009
Paspalum vaginatum	Salt-water Couch	Native	02/03/1890
Pennisetum alopecuroides	Swamp Foxtail	Native	14/03/2003
Pennisetum clandestinum	Kikuyu Grass	Exotic	1/06/2009
Pennisetum setaceum	Fountain Grass	Exotic	5/09/2007
Pennisetum villosum	Feathertop	Exotic	25/05/2006
Phalaris aquatica	Phalaris	Exotic	20/10/2004
Phalaris minor	Lesser Canary Grass	Exotic	25/05/2006
Phalaris spp.		Exotic	15/11/2006
Phragmites australis	Common Reed	Native	20/03/2009
Phyllostachys aurea	Fishpole Bamboo	Exotic	14/11/2005
Phyllostachys spp.		Exotic	5/09/2007
Plinthanthesis paradoxa		Native	14/11/1935
Poa affinis		Native	26/03/2007
Poa annua	Winter Grass	Exotic	20/10/2004
Poa labillardierei var. labillardierei	Tussock	Native	30/11/1894
Poa meionectes		Native	16/11/1983

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Poa pratensis	Kentucky Bluegrass	Exotic	14/03/2003
Poa sieberiana	Snowgrass	Native	13/01/2004
Poa spp.		Exotic	15/11/2006
Polypogon lutosus	Perennial Beardgrass	Exotic	31/10/1992
Polypogon monspeliensis	Annual Beardgrass	Exotic	20/10/2004
Pseudoraphis paradoxa	Slender Mudgrass	Native	15/04/1968
Rostraria cristata	Annual Cat's Tail	Exotic	20/10/1894
Sacciolepis indica	Indian Cupscale Grass	Native	31/03/1898
Secale cereale	Cereal Rye	Exotic	3/08/1968
Setaria italica	Foxtail Millet	Exotic	24/02/1962
Setaria parviflora		Exotic	1/06/2009
Setaria pumila	Pale Pigeon Grass	Exotic	13/01/2004
Setaria sphacelata	South African Pigeon Grass	Exotic	13/03/2008
Setaria spp.		Exotic	22/10/2004
Sorghum bicolor	Sorghum	Exotic	1/06/1968
Sorghum bicolor subsp. drummondii		Exotic	1/06/1968
Sorghum halepense	Johnson Grass	Exotic	20/03/2009
Sorghum leiocladum	Wild Sorghum	Native	15/03/2005
Sporobolus africanus	Parramatta Grass	Exotic	14/07/2009
Sporobolus creber	Slender Rat's Tail Grass	Native	9/07/2009
Sporobolus elongatus	Slender Rat's Tail Grass	Native	25/05/2006
Sporobolus fertilis	Giant Parramatta Grass	Exotic	20/03/2009
Sporobolus indicus	Parramatta Grass	Exotic	23/07/2009
Sporobolus spp.	Rat's Tail Couch	Exotic	15/11/2006
Sporobolus virginicus		Native	31/03/1898
Sporobolus virginicus var. minor	Marine Couch	Native	31/03/1899
Stenotaphrum secundatum	Buffalo Grass	Exotic	1/06/2009
Tetrarrhena juncea	Wiry Ricegrass	Native	27/02/2004
Themeda australis	Kangaroo Grass	Native	23/07/2009
Tragus australianus	Small Burrgrass	Native	13/02/2001
Triticum aestivum	Wheat	Exotic	29/10/1966
Urochloa panicoides	Urochloa Grass	Exotic	16/03/2003
Urochloa piligera	Hairy Armgrass	Native	8/02/1981
Vulpia bromoides	Squirrel Tail Fesque	Exotic	18/06/2003
Vulpia myuros	Rat's Tail Fescue	Exotic	25/10/2004
Vulpia spp.	Rat's-tail Fescue	Exotic	22/12/2003
Zea mays	Maize	Exotic	1/06/1968
Zoysia macrantha	Prickly Couch	Native	30/01/1964
Zygochloa paradoxa	Sandhill Canegrass	Native	20/02/2001
Podocarpus spinulosus	Spiny-leaf Podocarp	Native	17/09/2008
Comesperma ericinum	Pyramid Flower	Native	27/02/2004
Comesperma sphaerocarpum		Native	09/11/1889
Comesperma volubile		Native	31/10/1848
Polygala japonica	Dwarf Milkwort	Native	23/07/2009
Polygala myrtifolia		Exotic	19/09/1964
Polygala virgata		Exotic	17/09/2008
Acetosa sagittata	Rambling Dock	Exotic	20/03/2009
Acetosella vulgaris	Sheep Sorrel	Exotic	14/03/2008
Emex australis	Spiny Emex	Exotic	4/03/2008
Fallopia convolvulus	Black Bindweed	Exotic	21/10/1967

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Muehlenbeckia gracillima	Slender Lignum	Native	31/12/1889
Persicaria decipiens	Slender Knotweed	Native	30/07/2008
Persicaria hydropiper	Water Pepper	Native	20/03/2009
Persicaria lapathifolia	Pale Knotweed	Native	13/03/2008
Persicaria orientalis	Princes Feathers	Native	31/03/1893
Persicaria praetermissa		Native	14/03/2008
Persicaria prostrata	Creeping Knotweed	Native	30/06/1895
Persicaria spp.	Knotweed	Exotic	22/12/2005
Persicaria strigosa		Native	5/09/2007
Persicaria subsessilis	Hairy Knotweed	Native	20/03/2009
Polygonum arenastrum	Wireweed	Exotic	14/11/2005
Polygonum aviculare	Wireweed	Exotic	13/03/2008
Polygonum plebeium	Small Knotweed	Native	6/07/1968
Rumex brownii	Swamp Dock	Native	20/03/2009
Rumex conglomeratus	Clustered Dock	Exotic	28/08/2004
Rumex crispus	Curled Dock	Exotic	16/11/1893
Rumex obtusifolius	Broadleaf Dock	Exotic	20/10/2004
Rumex pulcher	Fiddle Dock	Exotic	14/01/2005
Rumex spp.	Dock	Exotic	22/10/2004
Rumex tenax	Shiny Dock	Native	30/11/1895
Microsorum scandens	Fragrant Fern	Native	24/05/1897
Platycerium bifurcatum	Elkhorn Fern	Native	1/03/2002
Pyrrosia rupestris	Rock Felt Fern	Native	16/02/1894
Eichhornia crassipes	Water Hyacinth	Exotic	18/03/1975
Calandrinia pickeringii		Native	15/12/2005
Portulaca oleracea	Pigweed	Native	20/03/2009
Potamogeton cheesemanii		Native	31/10/1964
Potamogeton ochreatus	Blunt Pondweed	Native	13/01/2004
Potamogeton octandrus		Native	21/06/1972
Potamogeton sulcatus		Native	10/12/1987
Potamogeton tricarinatus	Floating Pondweed	Native	13/01/2004
Samolus repens	Creeping Brookweed	Native	20/10/2004
Samolus valerandi	Common Brookweed	Native	10/04/1993
Banksia aemula	Wallum Banksia	Native	4/03/2008
Banksia ericifolia	Heath-leaved Banksia	Native	17/09/2008
Banksia ericifolia subsp. ericifolia		Native	8/04/1905
Banksia integrifolia	Coast Banksia	Native	17/09/2008
Banksia integrifolia subsp. integrifolia	Coastal Banksia	Native	13/03/1899
Banksia marginata	Silver Banksia	Native	5/09/2007
Banksia oblongifolia	Fern-leaved Banksia	Native	5/09/2007
Banksia robur	Swamp Banksia	Native	31/03/1900
Banksia serrata	Old-man Banksia	Native	17/09/2008
Banksia spinulosa	Hairpin Banksia	Native	17/09/2008
Banksia spinulosa var. spinulosa		Native	2/12/1998
Conospermum ellipticum		Native	5/09/2007
Conospermum longifolium	Long Leaf Smoke-bush	Native	1/08/2003
Conospermum longifolium subsp. angustifolium		Native	27/08/1887
Conospermum longifolium subsp. longifolium		Native	17/09/2008
Conospermum taxifolium	Variable Smoke-bush	Native	4/03/2008
Conospermum tenuifolium	Sprawling Smoke-bush	Native	31/10/1915

Scientific Name	Common Name	Native or Exotic	Last Sited
Grevillea arenaria subsp. arenaria	Sand Grevillea	Native	4/03/2008
Grevillea buxifolia	Grey Spider Flower	Native	30/09/1896
Grevillea diffusa		Native	31/10/1894
Grevillea diffusa subsp. constablei		Native	5/09/2007
Grevillea diffusa subsp. diffusa		Native	7/10/2001
Grevillea juniperina subsp. juniperina	Juniper-leaved Grevillea	Native	4/05/2001
Grevillea linearifolia	Linear-leaf Grevillea	Native	27/02/2004
Grevillea longifolia		Native	30/09/1898
Grevillea mucronulata		Native	31/08/1887
Grevillea oleoides	Red Spider Flower	Native	31/10/1894
Grevillea parviflora		Native	31/10/1898
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	Native	30/11/1899
Grevillea phylicoides	Grey Spider Flower	Native	31/08/1915
Grevillea robusta	Silky Oak	Native	1/06/2009
Grevillea sericea	Pink Spider Flower	Native	17/09/2008
Grevillea sericea subsp. sericea		Native	30/09/1893
Grevillea speciosa	Red Spider Flower	Native	1/08/2003
Grevillea sphacelata	Grey Spider Flower	Native	4/03/2008
Grevillea spp.		Native	1/06/2009
Hakea dactyloides	Finger Hakea	Native	17/09/2008
Hakea gibbosa		Native	4/03/2008
Hakea laevipes		Native	1/08/2003
Hakea microcarpa	Small-fruited Hakea	Native	20/04/2001
Hakea propinqua		Native	31/12/1889
Hakea salicifolia	Willow-leaved Hakea	Native	19/11/2004
Hakea salicifolia subsp. angustifolia		Native	19/08/1967
Hakea salicifolia subsp. salicifolia		Native	22/09/1888
Hakea sericea	Needlebush	Native	30/09/1895
Hakea teretifolia	Needlebush	Native	17/09/2008
Hakea teretifolia subsp. teretifolia		Native	3/01/1951
Isopogon anemonifolius	Broad-leaf Drumsticks	Native	17/09/2008
Isopogon anethifolius	Narrow-leaf Drumsticks	Native	1/08/2003
Isopogon dawsonii	Nepean Conebush	Native	5/07/1983
Lambertia formosa	Mountain Devil	Native	5/09/2007
Lomatia myricoides	River Lomatia	Native	31/10/1893
Lomatia silaifolia	Crinkle Bush	Native	07/01/1888
Persoonia acerosa	Needle Geebung	Native	14/02/1990
Persoonia chamaepitys	Mountain Geebung	Native	24/11/1893
Persoonia hirsuta	Hairy Geebung	Native	09/11/1898
Persoonia lanceolata	Lance Leaf Geebung	Native	17/09/2008
Persoonia laurina	Laurel Geebung	Native	7/08/2002
Persoonia laurina subsp. intermedia		Native	28/11/1993
Persoonia laurina subsp. laurina		Native	31/12/1896
Persoonia levis	Broad-leaved Geebung	Native	5/09/2007
Persoonia levis x linearis		Native	4/08/1968
Persoonia linearis	Narrow-leaved Geebung	Native	5/09/2007
Persoonia mollis subsp. leptophylla		Native	4/03/2008
Persoonia mollis subsp. maxima		Native	27/02/2004
Persoonia mollis subsp. mollis		Native	4/03/2008
Persoonia mollis subsp. nectens		Native	2/10/2002

Scientific Name	Common Name	Native or Exotic	Last Sited
Persoonia nutans	Nodding Geebung	Native	30/06/1897
Persoonia oblongata		Native	17/09/2008
Persoonia pinifolia	Pine-leaved Geebung	Native	25/02/1899
Petrophile pedunculata		Native	26/12/1898
Petrophile pulchella	Conesticks	Native	4/03/2008
Petrophile sessilis		Native	17/09/2008
Stenocarpus salignus	Scrub Beefwood	Native	1/03/2002
Symphionema paludosum		Native	1/10/1976
Telopea speciosissima	Waratah	Native	1/08/2003
Xylomelum pyriforme	Woody Pear	Native	5/09/2007
Psilotum nudum	Skeleton Fork-Fern	Native	27/02/2004
Pteris tremula	Tender Brake	Native	27/02/2004
Clematis aristata	Old Man's Beard	Native	17/07/2008
Clematis glycinoides	Headache Vine	Native	30/11/1892
Clematis glycinoides var. glycinoides		Native	6/06/2008
Ranunculus inundatus	River Buttercup	Native	30/07/2008
Ranunculus lappaceus	Common Buttercup	Native	16/11/1889
Ranunculus muricatus	Sharp Buttercup	Exotic	3/10/1963
Ranunculus plebeius	Forest Buttercup	Native	13/02/1966
Ranunculus repens	Creeping Buttercup	Exotic	4/03/2008
Ranunculus sceleratus	Celery Buttercup	Exotic	25/10/2004
Ranunculus sessiliflorus	Small-flowered Buttercup	Native	27/09/1987
Ranunculus sessiliflorus var. sessiliflorus		Native	5/08/2003
Ranunculus spp.		Native	2/10/2002
Reseda luteola	Weld	Exotic	26/06/1968
Baloskion gracile		Native	31/10/1894
Baloskion tetraphyllum subsp. meiostachyum	Plume Rush	Native	5/09/2007
Chordifex dimorphus		Native	1/10/1966
Chordifex fastigiatus		Native	5/09/2007
Empodisma minus		Native	20/10/2004
Eurychorda complanata		Native	23/04/1962
Hypolaena fastigiata		Native	5/09/2007
Leptocarpus tenax		Native	1/08/2003
Lepyrodia muelleri		Native	7/08/2002
Lepyrodia scariosa		Native	5/09/2007
Lepyrodia verruculosa		Native	27/01/1964
Alphitonia excelsa	Red Ash	Native	18/12/2007
Cryptandra amara	Bitter Cryptandra	Native	13/07/1887
Cryptandra amara var. amara		Native	25/05/1993
Cryptandra amara var. longiflora		Native	30/09/1964
Cryptandra ericoides	Heathy Cryptandra	Native	25/02/1899
Cryptandra propinqua		Native	31/05/1895
Cryptandra spinescens		Native	04/08/1894
Pomaderris andromedifolia subsp. andromedifolia		Native	31/10/1895
Pomaderris aspera	Hazel Pomaderris	Native	17/11/1894
Pomaderris brunnea	Brown Pomaderris	Native	31/08/1894
Pomaderris discolor		Native	25/10/2004
Pomaderris elliptica subsp. elliptica		Native	4/03/2008
Pomaderris eriocephala		Native	14/01/2002
Pomaderris ferruginea		Native	02/05/1896

Scientific Name	Common Name	Native or Exotic	Last Sited
Pomaderris intermedia		Native	30/09/1896
Pomaderris lanigera	Woolly Pomaderris	Native	17/07/2008
Pomaderris ledifolia	Sydney Pomaderris	Native	27/09/1987
Pomaderris ligustrina	Privet Pomaderris	Native	7/08/2002
Pomaderris ligustrina subsp. ligustrina		Native	31/10/1895
Pomaderris prunifolia	P. prunifolia in the Parramatta, Auburn, Strathfield and Bankstown Local Government Areas	Native	5/09/2007
Pomaderris vellea		Native	28/05/1996
Rhamnus alaternus	Buckthorn	Exotic	1/06/2009
Acaena agnipila	Hairy Sheep's Burr	Native	23/10/1965
Acaena echinata	Sheep's Burr	Native	25/09/1965
Acaena echinata var. subglabricalyx		Native	31/10/1934
Potentilla indica	Indian Strawberry	Exotic	29/11/1969
Rosa rubiginosa	Sweet Briar	Exotic	14/03/2008
Rosa spp.		Exotic	15/11/2006
Rubus anglocandicans	Blackberry	Exotic	9/12/1985
Rubus fruticosus sp. agg.	Blackberry complex	Exotic	1/06/2009
Rubus parvifolius	Native Raspberry	Native	21/10/1893
Rubus ulmifolius	Blackberry	Exotic	7/08/2002
Asperula conferta	Common Woodruff	Native	19/09/1886
Galium aparine	Goosegrass	Exotic	17/09/2008
Galium binifolium		Native	10/12/1985
Galium gaudichaudii	Rough Bedstraw	Native	14/01/2005
Galium migrans		Native	13/03/2008
Galium propinquum	Maori Bedstraw	Native	16/07/2009
Galium tricornutum	Three-horned Bedstraw	Exotic	6/06/2008
Morinda jasminoides	Sweet Morinda	Native	1/03/2002
Opercularia aspera	Coarse Stinkweed	Native	5/09/2007
Opercularia diphylla	Stinkweed	Native	23/07/2009
Opercularia hispida	Hairy Stinkweed	Native	4/11/1966
Opercularia spp.		Native	13/01/1999
Opercularia varia	Variable Stinkweed	Native	6/06/2003
Pomax umbellata	Pomax	Native	17/09/2008
Richardia brasiliensis	Mexican Clover	Exotic	5/09/2007
Richardia humistrata		Exotic	25/10/2004
Richardia spp.		Exotic	1/06/2009
Richardia stellaris		Exotic	14/07/2009
Sherardia arvensis	Field Madder	Exotic	27/09/1987
Asterolasia buxifolia		Native	4/03/2008
Asterolasia correifolia		Native	30/09/1888
Boronia anemonifolia subsp. variabilis	Coast Boronia	Native	31/08/1894
Boronia floribunda	Pale-pink Boronia	Native	30/09/1889
Boronia fraseri		Native	31/08/1894
Boronia ledifolia	Sydney Boronia	Native	01/10/1894
Boronia mollis	Soft Boronia	Native	30/09/1897
Boronia pinnata		Native	27/02/2004
Boronia polygalifolia	Dwarf Boronia	Native	30/11/1884
Boronia serrulata	Rose Boronia	Native	4/03/2008
Boronia thujona		Native	31/12/1961
Correa reflexa	Native Fuschia	Native	5/09/2007

Scientific Name	Common Name	Native or Exotic	Last Sited
Correa reflexa var. reflexa	Native Fuschia	Native	4/03/2008
Crowea exalata		Native	31/05/1897
Crowea saligna		Native	1/03/2002
Eriostemon australasius		Native	17/09/2008
Geijera salicifolia	Brush Wilga	Native	21/05/1996
Leionema dentatum	Toothed Phebalium	Native	1/03/2002
Leionema diosmeum		Native	5/09/1945
Melicope micrococca	Hairy-leaved Doughwood	Native	28/05/1991
Nematolepis squamea subsp. squamea	Satinwood	Native	28/09/1889
Phebalium squamulosum	Scaly Phebalium	Native	7/08/2002
Phebalium squamulosum subsp. argenteum		Native	30/09/1921
Phebalium squamulosum subsp. squamulosum		Native	30/06/1894
Philotheca hispidula		Native	01/10/1891
Philotheca myoporoides	Long-leaf Wax Flower	Native	17/07/2008
Philotheca myoporoides subsp. myoporoides		Native	30/09/1897
Philotheca reichenbachii		Native	22/09/1888
Philotheca salsolifolia		Native	14/08/2003
Philotheca salsolifolia subsp. salsolifolia		Native	31/10/1956
Philotheca scabra subsp. scabra		Native	31/08/1893
Zieria compacta		Native	11/08/1994
Zieria cytisoides	Downy Zieria	Native	30/09/1894
Zieria laevigata	Smooth Zieria	Native	14/06/1990
Zieria pilosa	Pilose-leafed Zieria	Native	1/03/2002
Zieria smithii	Sandfly Zieria	Native	21/02/2003
Populus alba	White Poplar	Exotic	15/11/2006
Populus nigra	Lombardy Poplar	Exotic	25/10/2004
Populus spp.		Exotic	14/08/2003
Salix alba	White Willow	Exotic	20/03/2009
Salix babylonica	Weeping Willow	Exotic	20/03/2009
Salix cinerea	Pussy Willow	Exotic	26/03/1971
Salix fragilis var. fragilis	Crack Willow	Exotic	13/03/2008
Salix humboldtiana	Pencil Willow	Exotic	19/11/2004
Salix spp.		Exotic	22/12/2005
Salvinia molesta		Exotic	7/08/2002
Choretrum candollei	White Sour Bush	Native	21/08/1940
Exocarpos cupressiformis	Cherry Ballart	Native	17/09/2008
Exocarpos strictus	Dwarf Cherry	Native	30/11/1898
Leptomeria acida	Sour Currant Bush	Native	23/01/1898
Omphacomeria acerba		Native	31/08/1894
Santalum obtusifolium	Sandalwood	Native	30/12/1966
Thesium australe	Austral Toadflax	Native	19/10/1803
Acer negundo	Box Elder	Exotic	20/03/2009
Alectryon subcinereus	Wild Quince	Native	1/09/2005
Cardiospermum grandiflorum	Balloon Vine	Exotic	17/07/2008
Cupaniopsis anacardioides	Tuckeroo	Native	17/09/2008
Dodonaea multijuga		Native	31/10/1899
Dodonaea pinnata		Native	27/02/2004
Dodonaea triquetra	Large-leaf Hop-bush	Native	17/07/2008
Dodonaea truncatiales	Angular Hop-bush	Native	17/07/2008
Dodonaea viscosa	Sticky Hop-bush	Native	30/11/2000

Scientific Name	Common Name	Native or Exotic	Last Sited
Dodonaea viscosa subsp. angustifolia		Native	25/10/2004
Dodonaea viscosa subsp. angustissima	Narrow-leaf Hop-bush	Native	14/03/2003
Dodonaea viscosa subsp. cuneata	Wedge-leaf Hop-bush	Native	13/03/2008
Dodonaea viscosa subsp. cuneata x spatulata		Native	4/03/2008
Dodonaea viscosa subsp. spatulata	Broad-leaf Hopbush	Native	20/10/2004
Guioa semiglauca	Guioa	Native	4/03/2008
Planchonella australis	Black Apple	Native	25/12/1888
Lygodium japonicum		Exotic	4/08/2000
Schizaea bifida	Forked Comb Fern	Native	4/03/2008
Schizaea dichotoma	Branched Comb Fern	Native	1/03/2002
Schizaea rupestris		Native	31/01/1897
Euphrasia collina subsp. speciosa		Native	22/09/1888
Glossostigma elatinoides		Native	31/10/1998
Gratiola pedunculata		Native	19/01/2004
Gratiola peruviana	Australian Brooklime	Native	31/12/1907
Kickxia elatine subsp. elatine	Woolly Toadflax	Exotic	7/03/1993
Kickxia spuria subsp. integrifolia	Round-leaved Toadflax	Exotic	4/03/2008
Limosella australis	Australian Mudwort	Native	12/10/1998
Linaria incarnata		Exotic	3/11/1966
Misopates orontium	Lesser Snapdragon	Exotic	4/06/1975
Nemesia strumosa		Exotic	13/10/1970
Orobanche minor	Broomrape	Exotic	14/10/1999
Parentucellia latifolia	Red Bartsia	Exotic	28/10/1990
Verbascum spp.		Native	28/08/2004
Verbascum virgatum	Twiggy Mullein, Green Mullein	Exotic	20/10/2004
Selago corymbosa		Exotic	21/10/1993
Selaginella uliginosa	Swamp Selaginella	Native	31/03/1897
Ailanthus altissima	Tree of Heaven	Exotic	20/03/2009
Smilax glyciphylla	Sweet Sarsparilla	Native	17/09/2008
Cestrum parqui	Green Cestrum	Exotic	20/03/2009
Cestrum spp.		Exotic	6/06/2003
Cyphanthera scabrella		Native	31/08/1897
Cyphomandra betacea	Tamarillo	Exotic	10/10/1941
Datura ferox	Fierce Thornapple	Exotic	25/05/1968
Datura spp.		Native	14/01/2005
Datura stramonium	Common Thornapple	Exotic	1/06/2009
Duboisia myoporoides	Corkwood	Native	26/11/2007
Lycium barbarum	Chinese Boxthorn	Exotic	19/03/1966
Lycium ferocissimum	African Boxthorn	Exotic	1/06/2009
Lycopersicon esculentum	Tomato	Exotic	27/04/2004
Nicotiana suaveolens	Native Tobacco	Native	24/09/1898
Petunia spp.		Native	25/10/2004
Physalis ixocarpa	Ground Cherry	Exotic	18/05/1971
Solanum americanum	Glossy Nightshade	Native	16/07/2009
Solanum aviculare	Kangaroo Apple	Native	1/08/2003
Solanum campanulatum		Native	30/09/1897
Solanum chenopodioides	Whitetip Nightshade	Exotic	20/03/2009
Solanum cinereum	Narrawa Burr	Native	19/01/2004
Solanum linnaeanum	Apple of Sodom	Exotic	20/03/2009
Solanum mauritianum	Wild Tobacco Bush	Exotic	6/06/2008

Scientific Name	Common Name	Native or Exotic	Last Sited
Solanum nigrum	Black-berry Nightshade	Exotic	1/06/2009
Solanum opacum	Green-berry Nightshade	Native	6/06/2008
Solanum physalifolium var. nitidibaccatum		Exotic	25/10/2004
Solanum prinophyllum	Forest Nightshade	Native	16/07/2009
Solanum pseudocapsicum	Madeira Winter Cherry	Exotic	20/03/2009
Solanum pungetium	Eastern Nightshade	Native	30/11/1899
Solanum radicans		Exotic	26/04/1964
Solanum sisymbriifolium		Exotic	24/01/2005
Solanum spp.		Native	20/03/2009
Solanum stelligerum	Devil's Needles	Native	12/03/1976
Solanum vescum		Native	18/10/1888
Sparganium subglobosum		Native	31/07/1888
Stackhousia muricata	Stackhousia	Native	13/03/2008
Stackhousia viminea	Slender Stackhousia	Native	23/07/2009
Brachychiton acerifolius	Illawarra Flame Tree	Native	2/07/1998
Brachychiton populneus	Kurrajong	Native	14/08/2003
Brachychiton populneus subsp. populneus		Native	1/06/2009
Lasiopetalum ferrugineum		Native	30/09/1895
Lasiopetalum ferrugineum var. ferrugineum		Native	5/09/2007
Lasiopetalum joyceae		Native	27/02/2004
Lasiopetalum macrophyllum		Native	1/03/2002
Lasiopetalum parviflorum		Native	30/09/1803
Lasiopetalum rufum		Native	30/09/1895
Rulingia dasyphylla	Kerrawang	Native	12/09/1893
Rulingia pannosa		Native	7/11/1953
Seringia arborescens		Native	26/07/1982
Stylidium graminifolium	Grass Triggerplant	Native	17/09/2008
Stylidium laricifolium	Tree Triggerplant	Native	4/03/2008
Stylidium productum		Native	27/02/2004
Stylidium spp.		Native	17/07/2008
Symplocos stawellii	White Hazelwood	Native	14/06/1987
Christella dentata		Native	1/03/2002
Pimelea curviflora var. subglabrata		Native	20/02/2002
Pimelea glauca		Native	4/03/2008
Pimelea linifolia	Slender Rice Flower	Native	24/04/2006
Pimelea linifolia subsp. linifolia		Native	31/05/1898
Pimelea linifolia subsp. linoides		Native	28/11/1995
Pimelea spicata	Spiked Rice-flower	Native	31/10/1886
Tropaeolum majus	Nasturtium	Exotic	5/09/2007
Typha domingensis	Narrow-leaved Cumbungi	Native	14/04/2004
Typha orientalis	Broad-leaved Cumbungi	Native	14/03/2008
Typha spp.		Native	15/11/2006
Celtis australis		Exotic	29/04/1971
Celtis occidentalis	Hackberry	Exotic	13/03/2008
Trema tomentosa var. viridis	Native Peach	Native	14/03/2008
Parietaria debilis	Native Pellitory	Native	6/10/1969
Parietaria judaica	Pellitory	Exotic	5/09/2007
Urtica incisa	Stinging Nettle	Native	22/10/2004
Urtica urens	Small Nettle	Exotic	25/10/2004
Schelhammera undulata		Native	4/11/1961

Scientific Name	Common Name	Native or Exotic	Last Sited
Glandularia aristigera	Glandularia	Exotic	14/03/2008
Lantana camara	Lantana	Exotic	1/06/2009
Lantana camara var. camara		Exotic	15/09/1966
Lantana montevidensis	Creeping Lantana	Exotic	20/03/2009
Lantana spp.		Exotic	25/10/2004
Verbena bonariensis	Purpletop	Exotic	21/10/1893
Verbena caracasana	Shore Verbain	Exotic	16/03/1995
Verbena gaudichaudii	Verbena	Native	03/03/1894
Verbena incompta		Exotic	16/03/1995
Verbena litoralis		Exotic	13/03/2008
Verbena officinalis	Common Verbena	Exotic	4/03/2008
Verbena quadrangularis		Exotic	1/06/2009
Verbena rigida var. rigida	Veined Verbena	Exotic	1/06/2009
Verbena spp.		Native	17/07/2008
Hybanthus monopetalus	Slender Violet-bush	Native	19/11/1966
Hybanthus vernonii		Native	1/03/2002
Hybanthus vernonii subsp. vernonii		Native	26/10/2003
Melicytus dentatus	Tree Violet	Native	25/10/2004
Viola banksii		Native	14/10/1899
Viola hederacea	Ivy-leaved Violet	Native	13/01/2004
Viola odorata	Sweet Violet	Exotic	26/06/1985
Viola sieberiana		Native	07/08/1898
Notothixos subaureus	Golden Mistletoe	Native	30/04/1925
Cayratia clematidea	Slender Grape	Native	17/09/2008
Cissus antarctica	Water Vine	Native	31/07/1802
Cissus hypoglauca	Giant Water Vine	Native	31/01/1805
Clematicissus opaca	Pepper Vine	Native	20/01/1992
Tasmannia insipida	Brush Pepperwood	Native	1/03/2002
Xanthorrhoea arborea		Native	20/10/2004
Xanthorrhoea concava		Native	6/11/1914
Xanthorrhoea fulva		Native	27/07/1967
Xanthorrhoea media		Native	17/09/2008
Xanthorrhoea minor subsp. minor		Native	30/11/1897
Xanthorrhoea resinosa		Native	1/08/2003
Xanthorrhoea spp.		Native	4/05/2007
Xyris bracteata		Native	27/02/2004
Xyris gracilis		Native	24/02/1970
Xyris juncea	Dwarf Yellow-eye	Native	31/01/1993
Macrozamia spiralis		Native	5/09/2007
Hedychium gardnerianum	Ginger Lily	Exotic	17/09/2008
Tribulus micrococcus	Yellow Vine, Spineless Caltrop	Native	4/03/2008
Tribulus terrestris	Cat-head	Exotic	5/04/1969

Table F2 List of threatened flora species occurring in Liverpool and Camden LGAs.

Species Name	Common Name	*TSC Act 1995 Classification*	Likelihood of Occurrence
Marsdenia viridiflora subsp. viridiflora	Marsdenia viridiflora R. Br. subsp. viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown,	Endangered Population	Present

Species Name	Common Name	*TSC Act 1995 Classification*	Likelihood of Occurrence
	Fairfield, Holroyd, Liverpool and Penrith local government areas		
Cynanchum elegans	White-flowered Wax Plant	Endangered	Present
Allocasuarina glareicola		Endangered	Possible
Leucopogon exolasius	Woronora Beard-heath	Vulnerable	Unlikely
Leucopogon fletcheri subsp. fletcheri		Endangered	Unlikely
Dillwynia tenuifolia	Dillwynia tenuifolia, Kemps Creek	Endangered Population	Present
Pultenaea parviflora		Endangered	Present
Pultenaea pedunculata	Matted Bush-pea	Endangered	Present
Acacia pubescens	Downy Wattle	Vulnerable	Present
Gyrostemon thesioides		Endangered	Absent
Callistemon linearifolius	Netted Bottle Brush	Vulnerable	Absent
Eucalyptus benthamii	Camden White Gum	Vulnerable	Present
Eucalyptus nicholii	Narrow-leaved Black Peppermint	Vulnerable	Absent
Eucalyptus scoparia	Wallangarra White Gum	Endangered	Present
Melaleuca deanei	Deane's Paperbark	Vulnerable	Possible
Syzygium paniculatum	Magenta Lilly Pilly	Endangered	Unlikely
Diuris aequalis	Buttercup Doubletail	Endangered	Unlikely
Pterostylis nigricans	Dark Greenhood	Vulnerable	Unlikely
Pterostylis saxicola	Sydney Plains Greenhood	Endangered	Present
Grevillea juniperina subsp. juniperina	Juniper-leaved Grevillea	Vulnerable	Highly Likely
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	Vulnerable	Likely
Pomaderris brunnea	Brown Pomaderris	Vulnerable	Possible
Persoonia hirsuta	Hairy Geebung	Endangered	Possible
Persoonia nutans	Nodding Geebung	Endangered	Likely
Pimelea spicata	Spiked Rice-flower	Endangered	Possible

Appendix G

Threatened Flora Likelihood of Occurrence Table

The table below shows species listed under either the *TSC Act* or the *EPBC Act*.

Species Name	Common Name	Habitat	*EPBC Act 2000*	*TSC Act 1995 Classification*	Likelihood of Occurrence
Marsdenia viridiflora subsp. viridiflora	Marsdenia viridiflora R. Br. subsp. viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	Grows in vine thickets and open shale woodland.	-	Endangered Population	Present
Cynanchum elegans	White-flowered Wax Plant	Restricted to eastern NSW where it is distributed from Brunswick Heads on the north coast to Gerroa in the Illawarra region. Usually occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; Coastal Tea-tree *Leptospermum laevigatum* – Coastal Banksia *Banksia integrifolia* subsp. *integrifolia* coastal scrub; Forest Red Gum *Eucalyptus tereticornis* aligned open forest and woodland; Spotted Gum *Eucalyptus maculata* aligned open forest and woodland; and Bracelet Honeymyrtle *Melaleuca armillaris* scrub to open scrub.	Endangered	Endangered	Present
Allocasuarina glareicola		It grows in clay soils derived from alluvial gravels in woodland. Responds to fire by coppicing densely from a lignotuber.	Endangered	Endangered	Possible
Leucopogon exolasius	Woronora Beard-heath	Found along the upper Georges River area and in Heathcote National Park. The plant occurs in woodland on sandstone.	Vulnerable	Vulnerable	Unlikely
Leucopogon fletcheri subsp. fletcheri		Restricted to north-western Sydney between St Albans in the north and Annangrove in the south, within the local government areas of Hawkesbury, Baulkham Hills and Blue Mountains. Occurs in dry eucalypt woodland or in shrubland on clayey lateritic soils, generally on flat to gently sloping terrain along ridges and spurs.	-	Endangered	Unlikely

Dillwynia tenuifolia	Dillwynia tenuifolia, Kemps Creek	The core distribution is the Cumberland Plain from Windsor to Penrith east to Deans Park. Other populations in western Sydney are recorded from Voyager Point and Kemps Creek in the Liverpool LGA, Castlereagh Ironbark Forest to Castlereagh Scribbly Gum Woodland.	-	Endangered Population	Present
Pultenaea parviflora		Endemic to the Cumberland Plain. Core distribution is from Windsor to Penrith and east to Dean Park. Outlier populations are recorded from Kemps Creek and Wilberforce.	Vulnerable	Endangered	Present
Pultenaea pedunculata	Matted Bush-pea	In NSW, it is represented by three disjunct populations, in the Cumberland Plains in Sydney, the coast between Tathra and Bermagui and the Windellama area. Occurs in a range of habitats. NSW populations are generally among woodland vegetation but plants have also been found on road batters and coastal cliffs. It is largely confined to loamy soils in dry gullies in populations in the Windellama area.	-	Endangered	Present
Acacia pubescens	Downy Wattle	Scattered throughout the Cumberland plain where it grows on clay and clay-shale soils.	Vulnerable	Vulnerable	Present
Gyrostemon thesioides		Within NSW, has only ever been recorded at three sites, to the west of Sydney, near the Colo, Georges and Nepean Rivers. Grows on hillsides and riverbanks and may be restricted to fine sandy soils.	-	Endangered	Absent
Callistemon linearifolius	Netted Bottle Brush	Recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW. For the Sydney area, recent records are limited to the Hornsby Plateau area near the Hawkesbury River. Grows in dry sclerophyll forest on the coast and adjacent ranges.	-	Vulnerable	Absent
Eucalyptus benthamii	Camden White Gum	Occurs on the alluvial flats of the Nepean River and its tributaries. Requires a combination of deep alluvial sands and a flooding regime that permits seedling establishment.	Vulnerable	Vulnerable	Present
Eucalyptus nicholii	Narrow-leaved Black Peppermint	Confined to the New England Tablelands of NSW, where it occurs from Nundle to north of Tenterfield, largely on private property. Grows in dry grassy woodland, on shallow and infertile soils, mainly on granite.	Vulnerable	Vulnerable	Absent

Eucalyptus scoparia	Wallangarra White Gum	In NSW it is known from only three locations near Tenterfield, including Bald Rock National Park. Found in open eucalypt forest and woodland on well-drained granite hilltops, slopes and rocky outcrops.	Vulnerable	Endangered	Present
Melaleuca deanei	Deane's Paperbark	Occurs in two distinct areas, in the Ku-ring-gai/Berowra and Holsworthy/Wedderburn areas respectively. The species grows in heath on sandstone.	Vulnerable	Vulnerable	Possible
Syzygium paniculatum	Magenta Lilly Pilly	The Magenta Lilly Pilly is found only in NSW, in a narrow, linear coastal strip from Bulahdelah to Conjola State Forest. On the south coast the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. On the central coast Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities.	Vulnerable	Endangered	Unlikely
Diuris aequalis	Buttercup Doubletail	The Type location (from the 19th Century) is Liverpool, west of Sydney. Recorded in forest, low open woodland with grassy understorey and secondary grassland on the higher parts of the Southern and Central Tablelands (especially on the Great Dividing Range).	Vulnerable	Endangered	Unlikely
Pterostylis nigricans	Dark Greenhood	Occurs in north-east NSW north from Evans Head, and in Queensland. Coastal heathland with Heath Banksia (Banksia ericifolia), and lower-growing heath with lichen-encrusted and relatively undisturbed soil surfaces, on sandy soils.	-	Vulnerable	Unlikely
Pterostylis saxicola	Sydney Plains Greenhood	Most commonly found growing in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines. The vegetation communities above the shelves where *Pterostylis saxicola* occurs are sclerophyll forest or woodland on shale/sandstone transition soils or shade soils.	Endangered	Endangered	Present
Grevillea juniperina subsp. juniperina	Juniper-leaved Grevillea	Grows on reddish clay to sandy soils derived from Wianamatta Shale and Tertiary alluvium (often with shale influence), typically containing lateritic gravels.	-	Vulnerable	Highly Likely
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	Grows in sandy or light clay soils usually over thin shales. Occurs in a range of vegetation types from heath and shrubby woodland to open	Vulnerable	Vulnerable	Likely

		forest. Found over a range of altitudes from flat, low-lying areas to upper slopes and ridge crests often in open, slightly disturbed sites such as along tracks.			
Pomaderris brunnea	Brown Pomaderris	Found in a very limited area around the Colo, Nepean and Hawkesbury Rivers. It grows in moist woodland or forest on clay and alluvial soils of flood plains and creek lines.	Vulnerable	Vulnerable	Possible
Persoonia hirsuta	Hairy Geebung	Has a scattered distribution around Sydney. Is found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone.	Endangered	Endangered	Possible
Persoonia nutans	Nodding Geebung	Restricted to the Cumberland Plain in western Sydney, between Richmond in the north and Macquarie Fields in the south. Is found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone.	Endangered	Endangered	Likely
Pimelea spicata	Spiked Rice-flower	Occurs on undulating topography on substrates derived from Wianamatta Shale in areas of Cumberland Plain Woodland Vegetation Community.	Endangered	Endangered	Possible

Appendix H

Field Survey Flora List

Species	Family	Common Name	Growth form	Endemic or Exotic	Weed or Non-weed
Acacia decurrens	Fabaceae - Mimosoideae	Black Wattle, Green Wattle	Tree	Endemic	Non-weed
Allocasuarina littoralis	Casuarinaceae	Black Sheoak	Tree	Endemic	Non-weed
Araujia sericifera	Asclepiadaceae	Moth vine	Vine	Exotic	Weed
Aristida vagans	Poaceae	Threeawn Speargrass	Graminoid	Endemic	Non-weed
Asparagus asparagoides	Asparagaceae	Bridal Creeper	Vine	Exotic	Weed
Aster subulatus	Asteraceae	Wild Aster or Bushy Starwort	Forb	Exotic	Weed
Astroloma humifusum	Ericaceae - Styphelioideae	Native Cranberry	Shrub	Endemic	Non-weed
Bidens pilosa	Asteraceae	Farmer's Friend	Forb	Exotic	Weed
Bromus catharticus	Poaceae	Prairie Grass	Graminoid	Exotic	Weed
Brunoniella spp.	Acanthaceae	Brunoniella	Forb	Endemic	Non-weed
Bursaria spinosa	Pittosporaceae	Blackthorn , Sweet Bursaria or Christmas bush	Tree	Endemic	Non-weed
Casuarina glauca	Casuarinaceae	Swamp Oak	Tree	Endemic	Non-weed
Cheilanthes sieberi	Pteridaceae-Adiantaceae	Poison Rock Fern or Mulga Fern	Forb	Endemic	Non-weed
Conyza spp.	Asteraceae	Junco, Horsweed or Fleabane	Forb	Exotic	Weed
Conyza sumatrensis	Asteraceae	Tall fleabane, broad-leaved fleabane or White Horseweed	Forb	Exotic	Weed
Corymbia maculata	Myrtaceae	Spotted gum	Tree	Endemic	Non-weed
Cyclospermum leptophyllum	Apiaceae	Slender Celery or Wild Carrot	Forb	Exotic	Weed
Dianella longifolia	Phormiaceae	smooth flax lily	Forb	Endemic	Non-weed
Dichelachne micrantha	Poaceae	Short-hair Plumegrass	Graminoid	Endemic	Non-weed
Dichondra repens	Convolvulaceae	Kidney Weed	Forb	Endemic	Weed
Dillwynia sieberi	Fabaceae	Prickly Parrot Pea or Juniper Pea Bush	Shrub	Endemic	Non-weed
Dodonaea viscosa subsp. cuneata	Sapindaceae	Sticky Hopbush	Shrub	Endemic	Non-weed
Einadia hastata	Chenopodiaceae	Berry Saltbush	Shrub	Endemic	Non-weed
Entolasia marginata	Poaceae	Bordered Panic	Graminoid	Endemic	Non-weed
Entolasia stricta	Poaceae	Wiry Panic	Graminoid	Endemic	Non-weed
Epacrid spp.	Epacridaceae	Australian Heath	Shrub	Endemic	Non-weed
Epaltes australis	Asteraceae	Spreading nut-heads	Forb	Endemic	Non-weed
Eragrostis curvula	Poaceae	African Lovegrass	Graminoid	Exotic	Weed
Eucalyptus acmenoides	Myrtaceae	White mahogany	Tree	Endemic	Non-weed
Eucalyptus crebra	Myrtaceae	Narrow-leaved Ironbark	Tree	Endemic	Non-weed
Eucalyptus eugenioides	Myrtaceae	Thin-leaved Stringy bark	Tree	Endemic	Non-weed
Eucalyptus fibrosa	Myrtaceae	Red Ironbark or Broad-leaved Ironbark	Tree	Endemic	Non-weed
Eucalyptus moluccana	Myrtaceae	Grey Box or Gum-topped box	Tree	Endemic	Non-weed

Species	Family	Common Name	Growth form	Endemic or Exotic	Weed or Non-weed
Eucalyptus platyphylla	Myrtaceae	Cabbage gum or Poplar Gum	Juvenile Tree	Endemic	Non-weed
Eucalyptus spp.	Myrtaceae	Eucalypt sapling with angular stem	Juvenile Tree	Endemic	Non-weed
Eucalyptus spp.	Myrtaceae	Euc seedling - hairy fruit, pleasant smelling	Juvenile Tree	Endemic	Non-weed
Eucalyptus tereticornis	Myrtaceae	Forest Red Gum	Tree	Endemic	Non-weed
Eucalyptus terticornis	Myrtaceae	Forest Red Gum	Tree	Endemic	Non-weed
Geranium spp.	Geraniaceae	garden geranium	Forb	Exotic	Weed
Glycine clandestina	Fabaceae	Twining Glycine or Love Creeper	Vine	Endemic	Non-weed
Gnaphalium americanum	Asteraceae	Cudweed	Forb	Exotic	Weed
Hardenbergia violacea	Fabaceae	Native sarsaparilla or Purple coral pea	Shrub	Endemic	Non-weed
Juncus spp.	Juncaceae	Rush	Shrub	Exotic	Weed
Laxmannia spp.	Anthericaceae		Forb	Endemic	Non-weed
Lepidium africanum	Brassicaceae	Peppergrass	Forb	Exotic	Weed
Lepidosperma gunnii	Cyperaceae	Little or Narrow Sword-sedge	Graminoid	Endemic	Non-weed
Leucopogon juniperinum	Ericaceae - Styphelioideae	Prickly Beard-heath	Shrub	Endemic	Non-weed
Ligustrum sinense	Oleaceae	Small-leaved Privot	Shrub	Exotic	Weed
Lissanthe strigosa	Ericaceae	Peach heath	Shrub	Endemic	Non-weed
Lolium perenne	Poaceae	Perennial Ryegrass	Graminoid	Exotic	Weed
Lomandra filiformis subsp. coriacea	Lomandraceae	Wattle Mat-rush	Forb	Endemic	Non-weed
Lomandra filiformis subsp. filiformis	Lomandraceae - Xanthorrhoeaceae	Wattle Mat-rush	Forb	Endemic	Non-weed
Lomandra longifolia	Lomandraceae - Xanthorrhoeaceae	Spiny-headed Mat-rush or Honey Reed	Forb	Endemic	Non-weed
Lomandra longifolia	Lomandraceae - Xanthorrhoeaceae	Spiny-head Mat Rush or Basket Grass	Forb	Endemic	Non-weed
Lomandra multiflora	Lomandraceae	Matrush	Forb	Endemic	Non-weed
Luzula spp.	Juncaceae	Wood-rush	Forb	Endemic	Non-weed
Lycium ferocissimum	Solanaceae	African Boxthorn	Shrub	Exotic	Weed
Melaleuca decora	Myrtaceae	White Feather Honeymyrtle	Tree	Endemic	Non-weed
Microlaena stipoides	Poaceae	Weeping grass	Graminoid	Endemic	Non-weed
Myrsiphyllum Asparagoides	Asparagaceae	Common Bridal Creeper	Vine	Exotic	Weed
Olea europaea	Oleaceae	African Olive	Shrub	Exotic	Weed
Onopordum acanthium	*Asteraceae*	Scotch Thistle	Forb	Exotic	Weed
Opercularia diphylla	Rubiaceae	Thin Leaf Stink Weed	Forb	Endemic	Weed
Opuntia stricta	Cactaceae	Prickly Pear	Shrub	Exotic	Weed
Oxalis perennans	Oxalidaceae	Grassland Wood-sorrel	Graminoid	Endemic	Non-weed
Ozothamnus	Asteraceae	Sago flower or pill flower	Shrub	Endemic	Non-weed

Species	Family	Common Name	Growth form	Endemic or Exotic	Weed or Non-weed
diosmifolius					
Panicum simile	Poaceae	Two-colour Panic	Forb	Endemic	Non-weed
Parsonsia spp.	Apocynaceae	woody vines/climbers	Vine	Endemic	Non-weed
Paspalum dilatatum	Poaceae	Dallis Grass	Graminoid	Exotic	Weed
Pinus spp.	Pinaceae	Garden Pine - exotic	Juvenile Tree	Exotic	Weed
Plantago debilis	Plantaginaceae	Shade Plantain or Weak Plantain	Forb	Endemic	Weed
Plectranthus parviflorus	Lamiaceae	Cockspur Flower	Shrub	Endemic	Weed
Pratia purpurascens	Lobeliaceae	White Root	Forb	Endemic	Non-weed
Pterostylis concinna	Orchidaceae	Trim Greenhood Orchid	Forb	Endemic	Non-weed
Senecio madagascariensis	Asteraceae	Fireweed	Forb	Exotic	Weed
Senecio vulgaris	Asteraceae	Common Groundsel	Forb	Exotic	Weed
Setaria parviflora	Poaceae	Slender Pigeon Grass	Graminoid	Exotic	Weed
Sida rhombifolia	Malvaceae	Paddy's Lucerne or Arrow-leaf Sida	Shrub	Exotic	Weed
Solanum nigrum sens.lat.	Solanaceae	Blackberry nightshade	Forb	Exotic	Weed
Solanum prinophyllum	Solanaceae	Forest nightshade	Forb	Endemic	Non-weed
Solanum pseudocapsicum	Solanaceae	Madeira Winter Cherry or Jerusalem Cherry	Shrub	Exotic	Weed
Sonchus spp.	Asteraceae	Milk Thistle	Forb	Exotic	Weed
Stellaria media	Caryophyllaceae	Common Chickweed	Forb	Exotic	Weed
Taraxacum officinale	Asteraceae	Dandelion	Forb	Exotic	Weed
Themeda triandra	Poaceae	Kangaroo Grass	Graminoid	Endemic	Non-weed
Tredescantia albiflora	Commelinaceae	Wandering Jew	Forb	Exotic	Weed
Unidentifiable grass	Poaceae	Grass D - round stem	Graminoid	Exotic	Weed
Unidentifiable grass	Poaceae	tiny grass	Graminoid	Exotic	Weed
Unidentifiable grass	Poaceae	Grass F	Graminoid	Exotic	Weed
Unidentifiable grass	Poaceae	blue grass	Graminoid	Exotic	Weed
Unidentifiable plant		(bulby species?)		Exotic	Weed
Unidentifiable plant		opposite-leaved, white hairs & flowers herb	Forb	Exotic	Weed
Unidentifiable plant		Square-stemmed opposite lieaved creeper	Graminoid	Exotic	Weed
Verbena bonariensis	Verbenaceae	Purpletop	Forb	Exotic	Weed
Veronica plebeia	Scrophulariaceae	Trailing Speedwell, Creeping Speedwell	Forb	Endemic	Non-weed
Wahlenbergia gracilis	Campanulaceae	Australian Bluebell	Forb	Endemic	Non-weed

Appendix I

Reference Site Assessments

To compare and contrast the quality of existing habitat and provide meaningful management and conservation recommendation measures, a field survey was undertaken to identify and characterise the vegetation communities on site. The selected benchmark sites are shown in **Figure I1** and the results of the survey are shown in **Tables I1 – I7**.

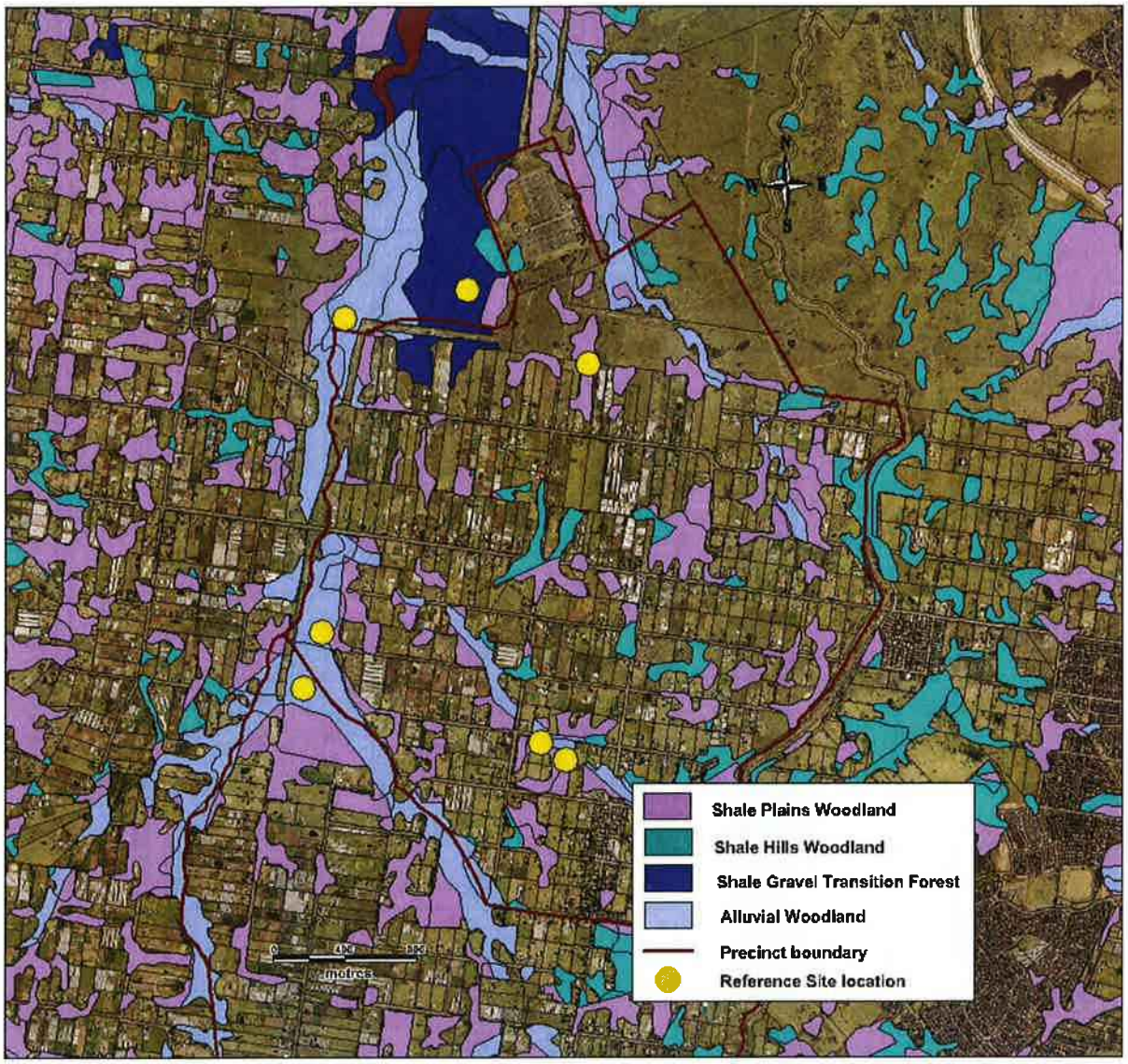


Figure I1 Location of reference sites.

Table Key

Layers
T1 = Canopy trees
T2 = Sub canopy understory trees
S1 = Shrub strata
S2 = Shrub strata
G = Ground

Dominance
D = Dominant
C = Co-dominant
A = Associated
S = Suppressed

Cover = Density of strata

Table I1 Shale Plains Woodland reference site assessment results.

Layer	Species	Family	Common Name	Growth Form	Endemic or Exotic	Weed or Non-weed	Dominance	Median Height	Cover
Site 1 - Shale Plains Woodland									
T1	*Eucalyptus moluccana*	Myrtaceae	Grey Box or Gum-topped box	Tree	Endemic	Non-weed	D	15m	Moderate
T1	*Eucalyptus tereticornis*	Myrtaceae	Forest Red Gum	Tree	Endemic	Non-weed	C	15m	Moderate
T2	*Melaleuca decora*	Myrtaceae	White Feather Honeymyrtle	Tree	Endemic	Non-weed	D	9m	Sparse
S1	*Acacia decurrens*	Fabaceae - Mimosoideae	Black Wattle, Green Wattle	Tree	Endemic	Non-weed	D	2-4m	Sparse
S1	Juvenile *Eucalyptus spp.*	Myrtaceae		Juvenile Tree	Endemic	Non-weed	C	2-4m	Sparse
S2	*Acacia decurrens*	Fabaceae - Mimosoideae	Black Wattle, Green Wattle	Tree	Endemic	Non-weed	C	2-4m	Sparse
S2	Juvenile *Eucalyptus spp.*	Myrtaceae		Juvenile Tree	Endemic	Non-weed	D	0.5-1.5m	Sparse
S2	*Dodonaea viscosa subsp. cuneata*	Sapindaceae	Sticky Hopbush	Shrub	Endemic	Non-weed	S	0.5-1.5m	Sparse
S2	*Pinus spp.*	Pinaceae	Garden Pine - exotic	Juvenile Tree	Exotic	Weed	S	0-1m	Sparse
S2	*Olea europaea*	Oleaceae	African Olive	Shrub	Exotic	Weed	S	0-1m	Sparse
G	*Senecio madagascariensis*	Asteraceae	Fireweed	Forb	Exotic	Weed	S	0-1m	Sparse
G	*Plantago debilis*	Plantaginaceae	Shade Plantain or Weak Plantain	Forb	Endemic	Weed	-	0-1m	Dense
G	*Dichondra repens*	Convolvulaceae	Kidney Weed	Forb	Endemic	Weed	-	0-1m	Dense
G	*Pratia purpurascens*	Lobeliaceae	White Root	Forb	Endemic	Weed	-	0-1m	Dense
G	*Bidens pilosa*	Asteraceae	Farmer's Friend	Forb	Exotic	Weed	-	0-1m	Dense
G	*Sonchus spp*	Asteraceae	Milk Thistle	Forb	Exotic	Weed	-	0-1m	Sparse
G	*Taraxacum officinale*	Asteraceae	Dandelion	Forb	Exotic	Weed	-	0-1m	Dense

Layer	Species	Family	Common Name	Growth Form	Endemic or Exotic	Weed or Non-weed	Dominance	Median Height	Cover
G	Unidentifiable Weed			Forb	Exotic	Weed	-	0-1m	Dense
G	*Wahlenbergia gracilis*	Campanulaceae	Australian Bluebell	Forb	Endemic	Non-weed	-	0-1m	Dense
G	*Onopordum acanthium*	*Asteraceae*	Scotch Thistle	Forb	Exotic	Weed	-	0-1m	Dense
G	*Conyza spp.*	*Asteraceae*	Junco, Horsweed or Fleabane	Forb	Exotic	Weed	-	0-1m	Dense
G	*Sida rhombifolia*	Malvaceae	Paddy's Lucerne or Arrow-leaf Sida	Shrub	Exotic	Weed	-	0-1m	Sparse
G	*Glycine clandestina*	Fabaceae	Twining Glycine or Love Creeper	Vine	Endemic	Non-weed	-	0-1m	Dense
G	*Brunoniella spp.*	Acanthaceae	Brunoniella	Forb	Endemic	Non-weed	-	0-1m	Sparse
G	*Setaria parviflora*	Poaceae	Slender Pigeon Grass	Graminoid	Exotic	Weed	-	0-1m	Dense
G	*Dichelachne micrantha*	Poaceae	Short-hair Plumegrass	Graminoid	Endemic	Non-weed	-	0-1m	Dense
G	*Eragrostis curvula*	Poaceae	African Lovegrass	Graminoid	Exotic	Weed	-	0-1m	Dense
G	*Oxalis perennans*	Oxalidaceae	Grassland Wood-sorrel	Graminoid	Endemic	Non-weed	-	0-1m	Dense
G	*Cyclospermum leptophyllum*	Apiaceae	Slender Celery or Wild Carrot	Forb	Exotic	Weed	-	0-1m	Sparse
G	Unidentifiable Grass	Poaceae		Graminoid	Exotic	Weed	-	0-1m	Dense
G	*Cheilanthes sieberi*	Pteridaceae-Adiantaceae	Poison Rock Fern or Mulga Fern	Forb	Endemic	Non-weed	-	0-1m	Sparse
G	*Dodonaea viscosa subsp. cuneata*	Sapindaceae	Sticky Hopbush	Shrub	Endemic	Non-weed	-	0-1m	Dense
G	*Gnaphalium americanum*	Asteraceae	Cudweed	Forb	Exotic	Weed	-	0-1m	Dense
G	*Einadia hastata*	Chenopodiaceae	Berry Saltbush	Shrub	Endemic	Non-weed	-	0-1m	Dense
G	*Microlaena stipoides*	Poaceae	Weeping grass	Graminoid	Endemic	Non-weed	-	0-1m	Dense
G	Unidentifiable Weed				Exotic	Weed	-	0-1m	Sparse
G	Unidentifiable Grass	Poaceae		Graminoid	Exotic	Weed	-	0-1m	Dense
G	*Lomandra filiformis subsp. coriacea*	Lomandraceae	Wattle Mat Rush	Forb	Endemic	Non-weed	-	0-1m	Dense
G	*Verbena bonariensis*	Verbenaceae	Purpletop	Forb	Exotic	Weed		0-1m	Dense
G	*Asparagus asparagoides*	Asparagaceae	Common Bridal Creeper	Vine	Exotic	Weed	-	0-1m	Dense
G	*Paspalum dilatatum*	Poaceae	Dallis Grass	Graminoid	Exotic	Weed	-	0-1m	Dense

Table I2 Shale Plains Woodland reference site assessment results.

Layer	Species	Family	Common Name	Growth Form	Endemic or Exotic	Weed or Non-weed	Dominance	Median Height	Cover
Site 2 - Shale Plains Woodland									
T1	*Corymbia maculata*	Myrtaceae	Spotted gum	Tree	Endemic	Non-weed	D	≤18m	Moderate
T1	*Eucalyptus crebra*	Myrtaceae	Narrow-leaved Ironbark	Tree	Endemic	Non-weed	C	≤18m	Moderate
T1	*Eucalyptus moluccana*	Myrtaceae	Grey Box or Gum-topped box	Tree	Endemic	Non-weed	A	≤18m	Moderate
T2	*Eucalyptus crebra*	Myrtaceae	Narrow-leaved Ironbark	Tree	Endemic	Non-weed	D	≤8m	Sparse
T2	*Eucalyptus eugenioides*	Myrtaceae	Thin-leaved Stringy bark	Tree	Endemic	Non-weed	S	≤8m	Sparse
S1	*Eucalyptus moluccana*	Myrtaceae	Grey Box or Gum-topped box	Juvenile Tree	Endemic	Non-weed	D	≤2m	Sparse
S1	*Corymbia maculata*	Myrtaceae	Spotted gum	Juvenile Tree	Endemic	Non-weed	D	≤2m	Sparse
G	*Lolium perenne*	Poaceae	Perennial Ryegrass	Graminoid	Exotic	Weed	-	0-1m	Dense
G	*Oxalis perennans*	Oxalidaceae	Grassland Wood-sorrel	Graminoid	Endemic	Non-weed	-	0-1m	Dense
G	Unidentified Grass	Poaceae		Graminoid	Exotic	Weed	-	0-1m	Dense
G	*Einadia hastata*	Chenopodiaceae	Berry Saltbush	Shrub	Endemic	Non-weed	-	0-1m	Moderate
G	*Epaltes australis*	Asteraceae	Spreading nut-heads	Forb	Endemic	Non-weed	-	0-1m	Sparse
G	*Juncus spp.*	Juncaceae	Rush	Shrub	Exotic	Weed	-	0-1m	Sparse
G	*Glycine clandestina*	Fabaceae	Twining Glycine or Love Creeper	Vine	Endemic	Non-weed	-	0-1m	Sparse
G	*Eucalyptus spp.*	Myrtaceae	Euc seedling	Juvenile Tree	Endemic	Non-weed	-	0-1m	Sparse
G	*Lomandra filiformis subsp. coriacea*	Lomandraceae - Xanthorrhoeaceae	Wattle Mat-rush	Forb	Endemic	Non-weed	-	0-1m	Sparse
G	Unidentied Grass	Poaceae		Graminoid	Exotic	Weed	-	0-1m	Sparse
G	*Laxmannia spp.*	Anthericaceae		Forb	Endemic	Non-weed	-	0-1m	Sparse
G	*Plantago debilis*	Plantaginaceae	Shade Plantain or Weak Plantain	Forb	Endemic	Weed	-	0-1m	Sparse
G	*Bidens pilosa*	Asteraceae	Farmer's Friend	Forb	Exotic	Weed	-	0-1m	Sparse
G	*Cyclospermum leptophyllum*	Apiaceae	Slender Celery or Wild Carrot	Forb	Exotic	Weed	-	0-1m	Sparse
G	*Gnaphalium americanum*	Asteraceae	Cudweed	Forb	Exotic	Weed	-	0-1m	Sparse
G	*Conyza sumatrensis*	Asteraceae	Tall fleabane, Broad-leaved Fleabane or White Horseweed	Forb	Exotic	Weed	-	0-1m	Sparse
G	*Senecio madagascariensis*	Asteraceae	Fireweed	Forb	Exotic	Weed	-	0-1m	Sparse
G	*Solanum pseudocapsicum*	Solanaceae	Madeira Winter Cherry or Jerusalem	Shrub	Exotic	Weed	-	0-1m	Sparse

Layer	Species	Family	Common Name	Growth Form	Endemic or Exotic	Weed or Non-weed	Dominance	Median Height	Cover
			Cherry						
G	*Entolasia marginata*	Poaceae	Bordered Panic	Graminoid	Endemic	Non-weed	-	0-1m	Sparse
G	*Panicum simile*	Poaceae	Two-colour Panic	Forb	Endemic	Non-weed	-	0-1m	Sparse
G	Unidentified Grass	Poaceae		Graminoid	Exotic	Weed	-	0-1m	Sparse
G	*Solanum prinophyllum*	Solanaceae	Forest nightshade	Forb	Endemic	Non-weed	-	0-1m	Sparse
G	*Sida rhombifolia*	Malvaceae	Paddy's Lucerne or Arrow-leaf Sida	Forb	Exotic	Weed	-	0-1m	Sparse
G	*Lomandra longifolia*	Lomandraceae	Spiny-headed Mat-rush or Honey Reed	Forb	Endemic	Non-weed	-	0-1m	Sparse

Table I3 Alluvial Woodland Flats reference site assessment results.

Layer	Species	Family	Common Name	Growth Form	Endemic or Exotic	Weed or Non-weed	Dominance	Median Height	Cover
Site 3 - Starr Park - Alluvial Woodland Flats									
T1	*Eucalyptus moluccana*	Myrtaceae	Grey Box or Gum-topped box	Tree	Endemic	Non-weed	D	18-20m	Dense
T1	*Eucalyptus terticornis*	Myrtaceae	Forest Red Gum	Tree	Endemic	Non-weed	D	18-20m	Dense
T2	*Melaleuca decora*	Myrtaceae	White Feather Honeymyrtle	Tree	Endemic	Non-weed	D	8-10m	Moderate
S1	*Melaleuca decora*	Myrtaceae	White Feather Honeymyrtle	Juvenile Tree	Endemic	Non-weed	D	2-4m	Sparse
S1	*Eucalyptus moluccana*	Myrtaceae	Grey Box or Gum-topped box	Juvenile Tree	Endemic	Non-weed	C	2-4m	Sparse
S1	*Bursaria spinosa*	Pittosporaceae	Blackthorn , Sweet Bursaria or Christmas bush	Tree	Endemic	Non-weed	A	2-4m	Sparse
G	*Setaria parviflora*	Poaceae	Slender Pigeon Grass	Graminoid	Exotic	Weed	D	0-1m	Dense
G	*Plectranthus parviflorus*	Lamiaceae	Cockspur Flower	Shrub	Endemic	Weed	C	0-1m	Moderate
G	*Tredescantia albiflora*	Commelinaceae	Wandering Jew	Forb	Exotic	Weed	C	0-1m	Moderate
G	*Lolium perenne*	Poaceae	Perennial Ryegrass	Graminoid	Exotic	Weed	C	0-1m	Dense
G	*Oxalis perennans*	Oxalidaceae	Grassland Wood-sorrel	Graminoid	Endemic	Non-weed	-	0-1m	Sparse
G	*Dichondra repens*	Convolvulaceae	Kidney Weed	Forb	Endemic	Weed	-	0-1m	Sparse
G	*Araujia sericifera*	Asclepiadaceae	Moth vine	Vine	Exotic	Weed	-	0-1m	Sparse
G	*Asparagus asparagoides*	Asparagaceae	Common Bridal Creeper	Vine	Exotic	Weed	-	0-1m	Sparse
G	*Einadia hastata*	Chenopodiaceae	Berry Saltbush	Shrub	Endemic	Non-weed	-	0-1m	Sparse
G	*Sida rhombifolia*	Malvaceae	Paddy's Lucerne or Arrow-leaf Sida	Shrub	Exotic	Weed	-	0-1m	Sparse

Layer	Species	Family	Common Name	Growth Form	Endemic or Exotic	Weed or Non-weed	Dominance	Median Height	Cover
G	*Lomandra longifolia*	Xanthorrhoeaceae	Spiny-head Mat Rush or Basket Grass	Forb	Endemic	Non-weed	-	0-1m	Sparse
G	*Onopordum acanthium*	Asteraceae	Scotch Thistle	Forb	Exotic	Weed	-	0-1m	Sparse
G	*Dianella longifolia*	Phormiaceae	smooth flax lily	Forb	Endemic	Non-weed	-	0-1m	Sparse
G	*Solanum nigrum* sens.lat.	Solanaceae	Blackberry nightshade	Forb	Exotic	Weed	-	0-1m	Sparse
G	*Geranium spp.*	Geraniaceae	garden geranium	Forb	Exotic	Weed	-	0-1m	Sparse
G	Unidentified Weed		opposite-leaved, white hairs & flowers herb	Forb	Exotic	Weed	-	0-1m	Sparse
G	*Lepidium africanum*	Brassicaceae	Peppergrass	Forb	Exotic	Weed	-	0-1m	Sparse
G	*Themeda triandra*	Poaceae	Kangaroo Grass	Graminoid	Endemic	Non-weed	-	0-1m	Sparse
G	Unidentified Grass		blue grass	Graminoid	Endemic	Non-weed	-	0-1m	Sparse
G	*Bromus catharticus*	Poaceae	Prairie Grass	Graminoid	Exotic	Weed	-	0-1m	Sparse
G	*Solanum prinophyllum*	Solanaceae	Forest nightshade	Forb	Endemic	Non-weed	-	0-1m	Sparse
G	*Bidens pilosa*	Asteraceae	Farmer's Friend	Forb	Exotic	Weed	-	0-1m	Sparse
G	*Opuntia stricta*	Cactaceae	Prickly Pear	Shrub	Exotic	Weed	-	0-1m	Sparse
G	*Stellaria media*	Caryophyllaceae	Common Chickweed	Forb	Exotic	Weed	-	0-1m	Sparse

Table I4 Alluvial Woodland Proper Flats reference site assessment results.

Layer	Species	Family	Common Name	Growth Form	Endemic or Exotic	Weed or Non-weed	Dominance	Median Height	Cover
Site 4 - Alluvial Woodland Proper Flats									
T1	*Melaleuca decora*	Myrtaceae	White Feather Honeymyrtle	Tree	Endemic	Non-weed	D	16m	Dense
T1	*Casuarina glauca*	Casuarinaceae	Swamp Oak	Tree	Endemic	Non-weed	C	16m	Dense
T1	*Eucalyptus terticornis*	Myrtaceae	Forest Red Gum	Tree	Endemic	Non-weed	A	16m	Dense
T2	*Casuarina glauca*	Casuarinaceae	Swamp Oak	Tree	Endemic	Non-weed	D	<8m	Sparse
S1	*Ligustrum sinense*	Oleaceae	Small-leaved Privot	Shrub	Exotic	Weed	D	2-4m	Sparse
S1	*Melaleuca decora*	Myrtaceae	White Feather Honeymyrtle	Juvenile Tree	Endemic	Non-weed	D	2-4m	Sparse
S1	*Casuarina glauca*	Casuarinaceae	Swamp Oak	Juvenile Tree	Endemic	Non-weed	A	2-4m	Sparse
G	*Lolium perenne*	Poaceae	Perennial Ryegrass	Graminoid	Exotic	Weed	C		Dense

Layer	Species	Family	Common Name	Growth Form	Endemic or Exotic	Weed or Non-weed	Dominance	Median Height	Cover
G	*Microlaena stipoides*	Poaceae	Weeping grass	Graminoid	Endemic	Non-weed	D	0-1m	Dense
G	*Sonchus spp*	Asteraceae	Milk Thistle	Forb	Exotic	Weed	-	0-1m	Sparse
G	*Myrsiphyllum Asparagoides*	Asparagaceae	Common Bridal Creeper	Vine	Exotic	Weed	-	0-1m	Sparse
G	*Tredescantia albiflora*	Commelinaceae	Wandering Jew	Forb	Exotic	Weed	-	0-1m	Sparse
G	*Sida rhombifolia*	Malvaceae	Paddy's Lucerne or Arrow-leaf Sida	Shrub	Exotic	Weed	-	0-1m	Sparse
G	*Einadia hastata*	Chenopodiaceae	Berry Saltbush	Shrub	Endemic	Non-weed	-	0-1m	Sparse
G	*Geranium spp.*	Geraniaceae	Garden Geranium or Cranebill	Forb	Exotic	Weed	-	0-1m	Sparse
G	Unidentified Weed		opposite-leaved, white hairs & flowers herb	Forb	Exotic	Weed	-	0-1m	Sparse
G	*Solanum nigrum* sens.lat.	Solanaceae	Blackberry nightshade	Forb	Exotic	Weed	-	0-1m	Sparse
G	*Senecio vulgaris*	Asteraceae	Common Groundsel	Forb	Exotic	Weed	-	0-1m	Sparse
G	*Dichondra repens*	Convolvulaceae	Kidney Weed	Forb	Endemic	Weed	-	0-1m	Sparse
G	*Bidens pilosa*	Asteraceae	Farmer's Friend	Forb	Exotic	Weed	-	0-1m	Sparse
G	*Araujia sericifera*	Asclepiadaceae	Moth vine	Vine	Exotic	Weed	-	0-1m	Sparse
G	Unidentified Grass	Poaceae		Graminoid	Exotic	Weed	-	0-1m	Sparse
G	*Aster subulatus*	Asteraceae	Wild Aster or Bushy Starwort	Forb	Exotic	Weed	-	0-1m	Sparse
G	*Onopordum acanthium*	Asteraceae	Scotch Thistle	Forb	Exotic	Weed	-	0-1m	Sparse
G	*Cyclospermum leptophyllum*	Apiaceae	Slender Celery or Wild Carrot	Forb	Exotic	Weed	-	0-1m	Sparse
G	*Oxalis perennans*	Oxalidaceae	Grassland Wood-sorrel	Graminoid	Endemic	Non-weed	-	0-1m	Sparse

Table I5 Shale Plains Woodland Flats reference site assessment results.

Layer	Species	Family	Common Name	Growth Form	Endemic or Exotic	Weed or Non-weed	Dominance	Median Height	Cover
Site 5 - Shale Plains Woodland Flats									
T1	*Corymbia maculata*	Myrtaceae	Spotted gum	Tree	Endemic	Non-weed	D	18m	Moderate
T2	*Eucalyptus moluccana*	Myrtaceae	Grey Box or Gum-topped box	Tree	Endemic	Non-weed	D	14m	Sparse
T2	*Corymbia maculata*	Myrtaceae	Spotted gum	Tree	Endemic	Non-weed	A	14m	Sparse
S1	*Bursaria spinosa*	Pittosporaceae	Blackthorn , Sweet Bursaria or Christmas bush	Tree	Endemic	Non-weed	D	2-4m	Moderate

Layer	Species	Family	Common Name	Growth Form	Endemic or Exotic	Weed or Non-weed	Dominance	Median Height	Cover
S1	*Eucalyptus platyphylla*	Myrtaceae	Cabbage gum or Poplar Gum	Juvenile Tree	Endemic	Non-weed	C	2-4m	Sparse
S1	*Casuarina glauca*	Casuarinaceae	Swamp Oak	Juvenile Tree	Endemic		S	2-4m	Sparse
S2	*Lycium ferocissimum*	Solanaceae	African Boxthorn	Shrub	Exotic	Weed	S	0.5-1.5m	Sparse
S2	*Lissanthe strigosa*	Ericaceae	Peach heath	Shrub	Endemic	Non-weed	D	0.5-1.5m	Sparse
G	*Setaria parviflora*	Poaceae	Slender Pigeon Grass	Graminoid	Exotic	Weed	D	0-1m	Dense
G	*Pratia purpurascens*	Lobeliaceae	White Root	Forb	Endemic	Weed	A	0-1m	Moderate
G	*Brunoniella spp.*	Acanthaceae	Brunoniella	Forb	Endemic	Non-weed	A	0-1m	Sparse
G	*Solanum prinophyllum*	Solanaceae	Forest nightshade	Forb	Endemic	Non-weed	-	0-1m	Sparse
G	*Onopordum acanthium*	Asteraceae	Scotch Thistle	Forb	Exotic	Weed	-	0-1m	Sparse
G	*Sonchus spp*	Asteraceae	Milk Thistle	Forb	Exotic	Weed	-	0-1m	Sparse
G	*Sida rhombifolia*	Malvaceae	Paddy's Lucerne or Arrow-leaf Sida	Shrub	Exotic	Weed	-	0-1m	Sparse
G	*Oxalis perennans*	Oxalidaceae	Grassland Wood-sorrel	Graminoid	Endemic	Non-weed	-	0-1m	Sparse
G	*Dichondra repens*	Convolvulaceae	Kidney Weed	Forb	Endemic	Weed	-	0-1m	Sparse
G	*Plantago debilis*	Plantaginaceae	Shade Plantain or Weak Plantain	Forb	Endemic	Weed	-	0-1m	Sparse
G	*Taraxacum officinale*	Asteraceae	Dandelion	Forb	Exotic	Weed	-	0-1m	Sparse
G	*Glycine clandestina*	Fabaceae	Twining Glycine or Love Creeper	Vine	Endemic	Non-weed	-	0-1m	Sparse
G	Unidentified Grass	Poaceae		Graminoid	Exotic	Weed	-	0-1m	Sparse
G	*Bidens pilosa*	Asteraceae	Farmer's Friend	Forb	Exotic	Weed	-	0-1m	Sparse
G	*Cheilanthes sieberi*	Pteridaceae-Adiantaceae	Poison Rock Fern or Mulga Fern	Forb	Endemic	Non-weed	-	0-1m	Sparse
G	*Geranium spp.*	Geraniaceae	garden geranium	Forb	Exotic	Weed	-	0-1m	Sparse
G	*Paspalum dilatatum*	Poaceae	Dallis Grass	Graminoid	Exotic	Weed	-	0-1m	Sparse
G	*Bromus catharticus*	Poaceae	Prairie Grass	Graminoid	Exotic	Weed	-	0-1m	Sparse
G	*Einadia hastata*	Chenopodiaceae	Berry Saltbush	Shrub	Endemic	Non-weed	-	0-1m	Sparse
G	*Dianella longifolia*	Phormiaceae	smooth flax lily	Forb	Endemic	Non-weed	-	0-1m	Sparse

Table I6 Shale Transition Forest Flats reference site assessment results.

Layer	Species	Family	Common Name	Growth Form	Endemic or Exotic	Weed or Non-weed	Dominance	Median Height	Cover
Site 6 - Shale Transition Forest Flats									
T1	*Eucalyptus fibrosa*	Myrtaceae	Red Ironbark or Broad-leaved Ironbark	Tree	Endemic	Non-weed	A	20-22m	Moderate
T1	*Eucalyptus moluccana*	Myrtaceae	Grey Box or Gum-topped box	Tree	Endemic	Non-weed	D	20-22m	Moderate
T2	*Melaleuca decora*	Myrtaceae	White Feather Honeymyrtle	Tree	Endemic	Non-weed	D	8-10m	Moderate
T2	*Eucalyptus moluccana*	Myrtaceae	Juvenile Grey Box or Gum-topped box	Juvenile Tree	Endemic	Non-weed	S	6-8m	Sparse
S1	*Dillwynia sieberi*	Fabaceae	Prickly Parrot Pea or Juniper Pea Bush	Shrub	Endemic	Non-weed	D	1-2m	Moderate
S1	*Ozothamnus diosmifolius*	Asteraceae	Sago flower or pill flower	Shrub	Endemic	Non-weed	A	1-2m	Moderate
S1	*Melaleuca decora*	Myrtaceae	Juvenile White Feather Honeymyrtle	Juvenile Tree	Endemic	Non-weed	S	1-2m	Moderate
S2	*Leucopogon juniperinum*	Ericaceae - Styphelioideae	Prickly Beard-heath	Shrub	Endemic	Non-weed	A	1-2m	Sparse
S2	*Opuntia stricta*	Cactaceae	Prickly Pear	Shrub	Exotic	Weed	A	0.5-1.5m	Sparse
G	*Themeda triandra*	Poaceae	Kangaroo Grass	Graminoid	Endemic	Non-weed	D	0-1m	Sparse
G	*Dichondra repens*	Convolvulaceae	Kidney Weed	Forb	Endemic	Weed	A	0-1m	Moderate
G	*Lomandra filiformis subsp. coriacea*	Lomandraceae	Wattle Mat Rush	Forb	Endemic	Non-weed	A	0-1m	Moderate
G	*Glycine clandestina*	Fabaceae	Twining Glycine or Love Creeper	Shrub	Endemic	Non-weed	-	0-1m	Sparse
G	*Acacia decurrens*	Fabaceae - Mimosoideae	Black Wattle, Green Wattle	Seedling	Endemic	Non-weed	-	0-1m	Sparse
G	*Cheilanthes sieberi*	Pteridaceae-Adiantaceae	Poison Rock Fern or Mulga Fern	Forb	Endemic	Non-weed	-	0-1m	Sparse
G	*Aristida vagans*	Poaceae	Threeawn Speargrass	Graminoid	Endemic	Non-weed	-	0-1m	Sparse
G	*Brunoniella spp.*	Acanthaceae	Brunoniella	Forb	Endemic	Non-weed	-	0-1m	Sparse
G	*Pratia purpurascens*	Lobeliaceae	White Root	Forb	Endemic	Weed	-	0-1m	Sparse
G	*Solanum prinophyllum*	Solanaceae	Forest nightshade	Forb	Endemic	Non-weed	-	0-1m	Sparse
G	*Oxalis perennans*	Oxalidaceae	Grassland Wood-sorrel	Graminoid	Endemic	Non-weed	-	0-1m	Sparse
G	*Taraxacum officinale*	Asteraceae	Dandelion	Forb	Exotic	Weed	-	0-1m	Sparse
G	*Lomandra multiflora*	Lomandraceae	Matrush	Forb	Endemic	Non-weed	-	0-1m	Sparse
G	Unidentified Grass	Poaceae		Graminoid	Exotic	Weed	-	0-1m	Sparse

Layer	Species	Family	Common Name	Growth Form	Endemic or Exotic	Weed or Non-weed	Dominance	Median Height	Cover
G	*Astroloma humifusum*	Ericaceae - Styphelioideae	Native Cranberry	Shrub	Endemic	Non-weed	-	0-1m	Sparse
G	*Entolasia stricta*	Poaceae	Wiry Panic	Graminoid	Endemic	Non-weed	-	0-1m	Sparse
G	*Einadia hastata*	Chenopodiaceae	Berry Saltbush	Shrub	Endemic	Non-weed	-	0-1m	Sparse
G	Unidentified Weed			Forb	Exotic	Weed	-	0-1m	Sparse
G	*Opercularia diphylla*	Rubiaceae	Thin Leaf Stink Weed	Forb	Endemic	Non-weed	-	0-1m	Sparse
G	*Opercularia diphylla*	Rubiaceae	Thin Leaf Stink Weed	Forb	Endemic	Non-weed	-	0-1m	Sparse
G	*Parsonsia spp.*	Apocynaceae	woody vines/climbers	Vine	Endemic	Non-weed	-	0-1m	Sparse

Table I7 Alluvial Woodland reference site assessment results.

Layer	Species	Family	Common Name	Growth Form	Endemic or Exotic	Weed or Non-weed	Dominance	Median Height	Cover
Site 7 - Alluvial Woodland									
T1	*Eucalyptus moluccana*	Myrtaceae	Grey Box or Gum-topped box	Tree	Endemic	Non-weed	D	16-18m	Moderate
T1	*Eucalyptus acmenoides*	Myrtaceae	White mahogany	Tree	Endemic	Non-weed	A	16-18m	Moderate
T1	*Eucalyptus fibrosa*	Myrtaceae	Red Ironbark or Broad-leaved Ironbark	Tree	Endemic	Non-weed	A	16-18m	Moderate
T2	*Allocasuarina littoralis*	Casuarinaceae	Black Sheoak	Tree	Endemic	Non-weed	A	8-12m	Moderate
T2	*Melaleuca decora*	Myrtaceae	White Feather Honeymyrtle	Tree	Endemic	Non-weed	D	8-12m	Moderate
T2	*Acacia decurrens*	Fabaceae - Mimosoideae	Black Wattle, Green Wattle	Tree	Endemic	Non-weed	A	8-12m	Moderate
S1	*Bursaria spinosa*	Pittosporaceae	Blackthorn , Sweet Bursaria or Christmas bush	Tree	Endemic	Non-weed	D	2-3m	Dense
S1	*Allocasuarina littoralis*	Casuarinaceae	Black Sheoak	Juvenile Tree	Endemic	Non-weed	A	2-4m	Moderate
S1	*Melaleuca decora*	Myrtaceae	White Feather Honeymyrtle	Juvenile Tree	Endemic	Non-weed	C	4m	Moderate
S2	*Dillwynia sieberi*	Fabaceae	Prickly Parrot Pea or Juniper Pea Bush	Shrub	Endemic	Non-weed	A	1-2m	Sparse
S2	*Epacrid spp.*	Epacridaceae	Australian Heath	Shrub	Endemic	Non-weed	D	1-2m	Moderate
G	*Themeda triandra*	Poaceae	Kangaroo Grass	Graminoid	Endemic	Non-weed	D	0-1m	Dense
G	*Lepidosperma gunnii*	Cyperaceae	Little or Narrow Sword-sedge	Graminoid	Endemic	Non-weed	A	0-1m	Dense
G	*Lomandra filiformis subsp. coriacea*	Lomandraceae - Xanthorrhoeaceae	Wattle Mat Rush	Forb	Endemic	Non-weed	A	0-1m	Dense

Layer	Species	Family	Common Name	Growth Form	Endemic or Exotic	Weed or Non-weed	Dominance	Median Height	Cover
G	*Cheilanthes sieberi*	Pteridaceae-Adiantaceae	Poison Rock Fern or Mulga Fern	Forb	Endemic	Non-weed	-	0-1m	Sparse
G	*Dichondra repens*	Convolvulaceae	Kidney Weed	Forb	Endemic	Weed	-	0-1m	Sparse
G	*Lomandra filiformis subsp. filiformis*	Lomandraceae - Xanthorrhoeaceae	Wattle Mat Rush	Forb	Endemic	Non-weed	-	0-1m	Sparse
G	*Pratia purpurascens*	Lobeliaceae	White Root	Forb	Endemic	Non-weed	-	0-1m	Sparse
G	*Opuntia stricta*	Cactaceae	Prickly Pear	Shrub	Exotic	Weed	-	0-1m	Sparse
G	*Lissanthe strigosa*	Ericaceae	Peach heath	Shrub	Endemic	Non-weed	-	0-1m	Sparse
G	*Einadia hastata*	Chenopodiaceae	Berry Saltbush	Shrub	Endemic	Non-weed	-	0-1m	Sparse
G	*Oxalis perennans*	Oxalidaceae	Grassland Wood-sorrel	Graminoid	Endemic	Non-weed	-	0-1m	Sparse
G	*Brunoniella spp.*	Acanthaceae	Brunoniella	Forb	Endemic	Non-weed	-	0-1m	Sparse
G	*Pterostylis concinna*	Orchidaceae	Trim Greenhood Orchid	Forb	Endemic	Non-weed	-	0-1m	Sparse
G	*Myrsiphyllum Asparagoides*	Asparagaceae	Common Bridal Creeper	Vine	Exotic	Weed	-	0-1m	Sparse
G	*Veronica plebeia*	Scrophulariaceae	Trailing Speedwell, Creeping Speedwell	Forb	Endemic	Non-weed	-	0-1m	Sparse
G	*Luzula spp.*	Juncaceae	Wood-rush	Forb	Endemic	Non-weed	-	0-1m	Sparse
G	Unidentified Grass	Poaceae		Graminoid	Exotic	Weed	-	0-1m	Sparse
G	*Glycine clandestina*	Fabaceae	Twining Glycine or Love Creeper	Shrub	Endemic	Non-weed	-	0-1m	Sparse

Appendix J

Remote Site Assessment

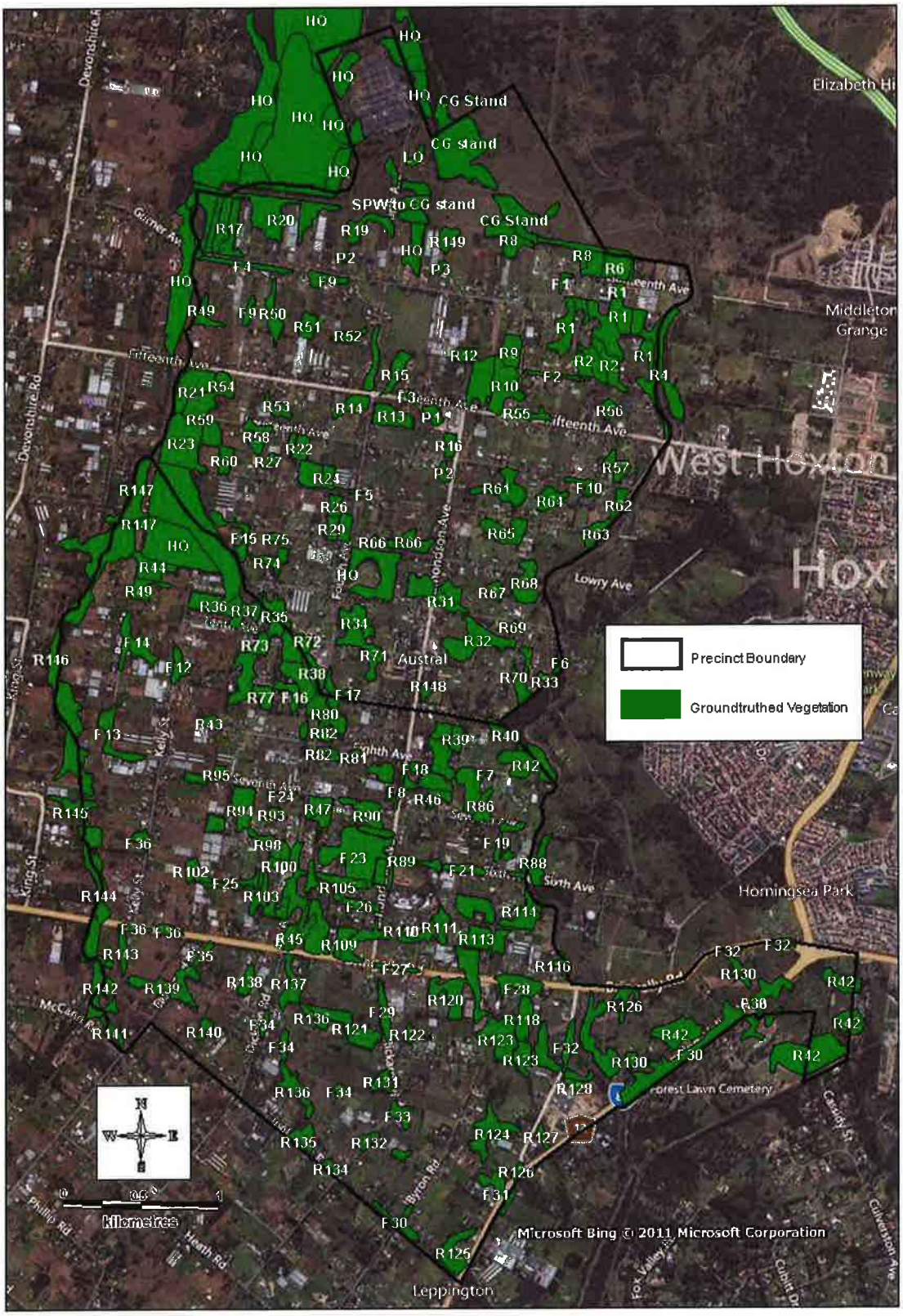
Site Number	Present/Absence Score	Cover Score	Species Richness Score	Dominant Species Score	Non-Native Cover Score	Total Score	Site Condition Value
R1	7.50	6.67	5.38	5.00	5.00	29.55	Medium
R2	10.00	9.17	2.31	3.75	6.67	31.89	Medium
R3	10.00	5.83	6.15	5.00	5.83	32.82	Medium
R4	10.00	7.50	6.92	7.50	8.33	40.26	High
R5	10.00	8.33	5.38	6.25	10.00	39.97	High
R6	7.50	5.00	0.77	2.50	7.50	23.27	Low
R7	10.00	5.00	1.54	2.50	10.00	29.04	Medium
R8	10.00	6.67	5.38	8.75	10.00	40.80	High
R9	7.50	4.17	1.54	3.75	7.50	24.46	Medium
R10	5.00	1.67	0.77	3.75	5.00	16.19	Low
R11	10.00	3.33	3.85	5.00	9.17	31.35	Medium
R12	7.50	5.83	2.31	2.50	6.67	24.81	Medium
R13	7.50	6.67	3.85	3.75	5.00	26.76	Medium
R14	7.50	5.00	3.85	5.00	6.67	28.01	Medium
R15	10.00	5.83	6.15	6.25	7.50	35.74	High
R16	10.00	7.50	3.85	6.25	7.50	35.10	High
R17	10.00	5.00	6.15	5.00	9.17	35.32	High
R18	10.00	4.17	3.08	1.25	7.50	25.99	Medium
R19	10.00	8.33	4.62	6.25	9.17	38.37	High
R20	10.00	5.00	3.85	6.25	7.50	32.60	Medium
R21	10.00	6.67	4.62	6.25	10.00	37.53	High
R22	5.00	4.17	5.38	2.50	2.50	19.55	Low
R23	10.00	8.33	7.69	8.75	7.50	42.28	High
R24	10.00	7.50	5.38	7.50	7.50	37.88	High
R25	10.00	5.83	3.85	3.75	7.50	30.93	Medium
R26	10.00	10.00	3.85	5.00	7.50	36.35	High
R27	10.00	7.50	3.08	5.00	7.50	33.08	Medium
R28	7.50	7.50	2.31	3.75	5.00	26.06	Medium
R29	10.00	6.67	3.85	5.00	6.67	32.18	Medium
R30	10.00	7.50	6.15	6.25	7.50	37.40	High
R31	10.00	6.67	7.69	7.50	5.83	37.69	High
R32	10.00	7.50	3.85	6.25	7.50	35.10	High
R33	10.00	6.67	4.62	5.00	7.50	33.78	Medium
R34	10.00	5.00	3.08	6.25	7.50	31.83	Medium
R35	10.00	8.33	6.15	6.25	7.50	38.24	High
R36	7.50	2.50	2.31	3.75	5.00	21.06	Low
R37	10.00	6.67	6.15	7.50	7.50	37.82	High
R38	10.00	7.50	4.62	6.25	7.50	35.87	High

Site Number	Present/Absence Score	Cover Score	Species Richness Score	Dominant Species Score	Non-Native Cover Score	Total Score	Site Condition Value
R39	7.50	7.50	1.54	3.75	5.00	25.29	Medium
R40	10.00	9.17	3.08	5.00	7.50	34.74	High
R41	10.00	6.67	6.15	5.00	7.50	35.32	High
R42	10.00	6.67	5.38	6.25	8.33	36.63	High
R43	7.50	5.83	1.54	1.25	5.00	21.12	Low
R44	5.00	4.17	0.00	1.25	2.50	12.92	Low
R45	10.00	9.17	6.15	7.50	6.67	39.49	High
R46	7.50	3.33	1.54	2.50	5.00	19.87	Low
R47	10.00	4.17	6.15	3.75	6.67	30.74	Medium
R48	10.00	8.33	5.38	5.00	7.50	36.22	High
R49	7.50	6.67	3.08	5.00	5.83	28.08	Medium
R50	7.50	7.50	2.31	1.25	2.50	21.06	Low
R51	10.00	7.50	4.62	3.75	5.00	30.87	Medium
R52	10.00	10.00	5.38	6.25	6.67	38.30	High
R53	7.50	3.33	2.31	2.50	5.83	21.47	Low
R54	10.00	3.33	3.08	1.25	9.17	26.83	Medium
R55	10.00	5.83	7.69	5.00	1.67	30.19	Medium
R56	10.00	6.67	6.15	5.00	5.00	32.82	Medium
R57	10.00	10.00	6.92	6.25	9.17	42.34	High
R58	7.50	6.67	2.31	3.75	5.00	25.22	Medium
R59	7.50	3.33	4.62	6.25	5.83	27.53	Medium
R60	10.00	6.67	6.15	5.00	7.50	35.32	High
R61	10.00	7.50	3.08	6.25	8.33	35.16	High
R62	10.00	6.67	3.85	2.50	5.00	28.01	Medium
R63	10.00	9.17	3.85	5.00	8.33	36.35	High
R64	7.50	6.67	0.77	2.50	6.67	24.10	Medium
R65	7.50	5.00	3.08	2.50	3.33	21.41	Low
R66	7.50	5.00	3.08	3.75	4.17	23.49	Low
R67	7.50	6.67	2.31	5.00	5.83	27.31	Medium
R68	10.00	5.83	2.31	5.00	10.00	33.14	Medium
R69	5.00	2.50	0.00	2.50	5.00	15.00	Low
R70	10.00	6.67	6.15	6.25	7.50	36.57	High
R71	7.50	4.17	0.77	2.50	4.17	19.10	Low
R72	10.00	6.67	6.92	5.00	8.33	36.92	High
R73	7.50	5.83	5.38	2.50	4.17	25.38	Medium
R74	10.00	6.67	3.08	5.00	7.50	32.24	Medium
R75	10.00	5.83	6.15	3.75	5.00	30.74	Medium
R76	10.00	8.33	5.38	3.75	6.67	34.13	High

Site Number	Present/Absence Score	Cover Score	Species Richness Score	Dominant Species Score	Non-Native Cover Score	Total Score	Site Condition Value
R77	10.00	5.00	5.38	5.00	10.00	35.38	High
R78	10.00	5.83	3.85	0.00	2.50	22.18	Low
R79	10.00	4.17	6.92	5.00	3.33	29.42	Medium
R80	10.00	8.33	6.92	5.00	4.17	34.42	High
R81	10.00	7.50	5.38	7.50	9.17	39.55	High
R82	10.00	3.33	3.85	6.25	6.67	30.0962	Medium
R83	7.50	5.83	0.77	1.25	5.00	20.35	Low
R84	7.50	5.83	0.77	2.50	7.50	24.10	Medium
R85	7.50	5.00	2.31	5.00	5.00	24.81	Medium
R86	7.50	5.00	1.54	3.75	5.00	22.79	Low
R87	7.50	5.83	0.77	5.00	6.67	25.77	Medium
R88	10.00	8.33	6.92	3.75	5.00	34.01	High
R89	10.00	7.50	6.92	7.50	5.00	36.92	High
R90	7.50	3.33	6.92	6.25	5.00	29.01	Medium
R91	10.00	7.50	5.38	8.75	6.67	38.30	High
R92	10.00	6.67	4.62	3.75	7.50	32.53	Medium
R93	10.00	8.33	3.85	5.00	8.33	35.51	High
R94	10.00	9.17	6.15	3.75	7.50	36.57	High
R95	10.00	5.83	3.85	1.25	5.83	26.76	Medium
R96	10.00	7.50	6.15	2.50	3.33	29.49	Medium
R97	7.50	2.50	3.08	3.75	5.00	21.83	Low
R98	7.50	3.33	2.31	1.25	6.67	21.06	Low
R99	10.00	4.17	3.08	2.50	6.67	26.41	Medium
R100	10.00	9.17	3.85	6.25	10.00	39.26	High
R101	7.50	5.00	0.77	2.50	5.00	20.77	Low
R102	10.00	5.83	3.08	3.75	7.50	30.16	Medium
R103	10.00	6.67	4.62	5.00	8.33	34.62	High
R104	10.00	5.83	7.69	6.25	5.00	34.78	High
R105	7.50	6.67	1.54	5.00	7.50	28.21	Medium
R106	10.00	8.33	6.92	7.50	5.83	38.59	High
R107	10.00	5.83	6.92	3.75	5.83	32.34	Medium
R108	7.50	5.00	0.77	3.75	6.67	23.69	Medium
R109	10.00	6.67	3.08	5.00	7.50	32.24	Medium
R110	10.00	6.67	4.62	5.00	9.17	35.45	High
R111	10.00	5.83	7.69	7.50	5.00	36.03	High
R112	7.50	5.00	3.85	3.75	5.83	25.93	Medium
R113	10.00	8.33	6.15	5.00	5.83	35.32	High
R114	10.00	5.83	5.38	3.75	3.33	28.30	Medium

Site Number	Present/Absence Score	Cover Score	Species Richness Score	Dominant Species Score	Non-Native Cover Score	Total Score	Site Condition Value
R115	7.50	5.00	3.08	3.75	5.83	25.16	Medium
R116	10.00	5.83	6.15	3.75	3.33	29.07	Medium
R117	10.00	5.83	6.92	6.25	4.17	33.17	Medium
R118	10.00	4.17	3.08	5.00	9.17	31.41	Medium
R119	10.00	10.00	7.69	6.25	5.83	39.78	High
R120	10.00	7.50	6.92	3.75	6.67	34.84	High
R121	10.00	5.83	5.38	6.25	6.67	34.13	High
R122	5.00	4.17	0.77	3.75	3.33	17.02	Low
R123	10.00	7.50	6.92	8.75	7.50	40.67	High
R124	10.00	6.67	4.62	2.50	8.33	32.12	Medium
R125	7.50	5.83	2.31	2.50	5.83	23.97	Medium
R126	10.00	6.67	5.38	6.25	8.33	36.63	High
R127	10.00	7.50	6.92	5.00	7.50	36.92	High
R128	10.00	6.67	5.38	6.25	7.50	35.80	High
R129	10.00	5.83	5.38	5.00	7.50	33.72	Medium
R130	10.00	7.50	4.62	3.75	9.17	35.03	High
R131	10.00	8.33	3.85	6.25	10.00	38.43	High
R132	10.00	6.67	5.38	5.00	9.17	36.22	High
R133	10.00	6.67	5.38	5.00	9.17	36.22	High
R134	10.00	5.00	6.92	5.00	7.50	34.42	High
R135	10.00	7.50	7.69	10.00	7.50	42.69	High
R136	10.00	8.33	2.31	3.75	6.67	31.06	Medium
R137	10.00	9.17	7.69	7.50	10.00	44.36	High
R138	10.00	8.33	3.85	5.00	9.17	36.35	High
R139	10.00	5.00	4.62	6.25	8.33	34.20	High
R140	10.00	8.33	4.62	6.25	9.17	38.37	High
R141	10.00	6.67	7.69	6.25	5.00	35.61	High
R142	10.00	6.67	7.69	10.00	9.17	43.53	High
R143	10.00	6.67	3.08	5.00	9.17	33.91	Medium
R144	10.00	9.17	9.23	7.50	7.50	43.40	High
R145	7.50	3.33	3.85	6.25	6.67	27.60	Medium
R146	10.00	7.50	8.46	3.75	7.50	37.21	High
R147	10.00	9.17	10.00	6.25	8.33	43.75	High
R148	7.50	5.83	2.31	5.00	7.50	28.14	Medium
R149	10.00	8.33	3.85	5.00	6.67	33.85	Medium
*HQ	10.00	9.17	7.69	7.50	10.00	44.36	High
**LQ	5.00	4.17	0.00	1.25	2.50	12.92	Low
***CG	10.00	9.17	7.69	7.50	10.00	44.36	High

*HQ = high quality site
**LQ = low quality site
*** CG = site with unique stands of *Casuarina glauca* species


Precinct Boundary
Groundtruthed Vegetation
Elizabeth Hi
Middleton Grange
West Hoxton
Hox
Austral
Homingsea Park
Leppington
Forest Lawn Cemetery
Microsoft Bing © 2011 Microsoft Corporation
Kilometres
N
S
E
W

Appendix K

Fauna Habitat Assessment Results

Habitat Feature	No. Encountered	Site No.	Species	Family	Common Name	Comments
Fauna sighting	1	1	*Tiliqua spp.*	Scincidae	Bluetongue	
Scat	1	1	*Oryctolagus spp.*	Leporidae	Rabbit	
Birds		1	*Manorina melanocephala*	Meliphagidae	Noisy Miner	
Fallen logs	3	2				1 hollow
Scat	2	2	*Oryctolagus spp.*	Leporidae	Rabbit	
Birds		2	*Manorina melanocephala*	Meliphagidae	Noisy Miner	
Hollow stumps	3	2				
Fallen logs	3	3				
Scat	1	3		Macropodidae	Wallaby	
Scat	1	3		Canidae	Dog	
Birds		3	*Manorina melanocephala*	Meliphagidae	Noisy Miner	
Birds		3	*Gymnorhina spp*	Cracticidae	Magpie	
Fauna sighting	4	3	*Pseudechis porphyriacus*	Elapidae	Red-bellied Black Snake	
Fauna sighting	>5	3			Skinks	Do not know species
Scat	1	4			Possum	Do not know species
Fauna sighting	1	4	*Vulpes vulpes*	Canidae	Fox	
Birds	>10	4	*Manorina melanocephala*	Meliphagidae	Noisy Miner	
Birds	2		*Grallina cyanoleuca*	Monarchidae	Magpie-lark	
Birds	1	4	*Corvus orru*	Corvidae	Torresian Crow	
Fauna sighting	>5	4			Skinks	Do not know species
Calls	1	4	*Litoria fallax*	Hylidae	Eastern Dwarf Tree Frog	
Tree hollows at base	2	5				
Fallen logs	6	5				

Habitat Feature	No. Encountered	Site No.	Species	Family	Common Name	Comments
Diggings	1	5	*Oryctolagus spp.*	Leporidae	Rabbit	
Hollow bearing trees	2	6				Small 5-10cm diametre
Fallen logs	3	6				
Hollow stumps	4	6				Old
Scat	1	6		Macropodidae	Wallaby	
Scat	1	6			Possum	Do not know species
Scat	1	6	*Oryctolagus spp.*	Leporidae	Rabbit	
Scat	1	6			Rat	Do not know species
Fauna sighting	1	6			dragon lizard	Small - do not know species
Fauna sighting	>5	6			Skinks	Do not know species
Birds		6	Malurus cyaneus	Maluridae	Superb Fairywren	
Fallen logs	2	7				
Hollow stumps	2	7				
Birds	>10	7			wrens	Do now know species

Site 1 = Shale Plains Woodland Site 2 = Shale Plains Woodland Site 3 = Alluvial Woodland Site 4 = Alluvial Woodland Site 5 = Shale Plains Woodland
Site 6 = Shale Transition Forest Site 7 = Alluvial Woodland

Appendix L

Relevant Legislation

Relevant Legislation and Regulations

The following Acts, Regulations and policies inform the manner in which biodiversity within the Austral and Leppington North precincts are required to be managed.

Japan – Australia Migratory Bird Agreement (JAMBA)

The JAMBA agreement is a bilateral agreement between Australia and Japan that provides for the protection and conservation of migratory birds.

There are no JAMBA listed birds in the study area for the development proposal to consider.

China – Australia Migratory Bird Agreement (CAMBA)

The CAMBA agreement is a bilateral agreement between Australia and China that provides for the protection and conservation of migratory birds.

Rostratula benghalensis australis (painted snipe), *Gallinago hardwickii* (Latham's snipe) and *Apus pacificus* (fork-tailed swift) are bird species listed in CAMBA that may occur in Austral and Leppington North precincts. Development proposals must abide by the laws and regulations under the Agreement.

Environment Protection & Biodiversity Conservation Act 1999 (EPBC Act)

The *EPBC Act* provides a statutory framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places defined in the *EPBC Act* as matters of National Environmental Significance (NES) (DEWHA, 1999).

Cumberland Plain Woodland - Shale Plains Woodland, Sydney Coastal River Flat Forest – Alluvial Woodland and the Shale-Gravel Transitional Forest are all listed as critically Endangered Ecological Communities under the *EPBC Act*. Development proposals must normally abide by the regulations under the Act, noting that where Strategic Assessment under the EPBC Act has been undertaken, exemptions may apply.

Strategic Assessment under the Environment Protection & Biodiversity Conservation Act 1999 (EPBC Act)

A Strategic Assessment under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is a big-picture study of an area to assess how national environmental and heritage values can be protected.

The Strategic Assessment process allows for assessment and endorsement of a proposed broad-scale policy, plan or program.

Through Strategic Assessments, the Commonwealth Government works with partners -- such as state or local governments -- to ensure a policy, plan or program will adequately safeguard nationally protected matters for the long term.

Nationally protected matters of relevance to this study are considered to be:

• listed threatened species and ecological communities

• migratory species protected under international agreements

Strategic Assessments reduce red tape by addressing Commonwealth environmental concerns giving greater upfront clarity to developers, landholders, planners, industry, government and the community.

Once a strategic assessment is complete and approvals have been given, individual proponents will not have to seek approval under the EPBC Act from the Commonwealth Government, as long as they undertake their projects in accordance with the endorsed policy, plan or program.

The implications for this study are that within the Austral and Leppington North precincts, proposals do not need to be referred to the Commonwealth Government under the EPBC Act if the proposal is inside the Growth Centres, and in accordance with the endorsed Program, noting that:

- Any proposal to clear land that is **certified** under the Growth Centres Biodiversity Certification is in accordance with the endorsed Program.
- Any proposal to clear land that is **non-certified** must be in accordance with the Relevant Biodiversity Measures (RBMs) of the Growth Centres Biodiversity Certification.
- A number of RBMs apply to specific parcels of land or specific types of development, making it essential to check compliance against the RBMs for any proposal in the non-certified areas.
- The NSW *Threatened Species Conservation Act 1995* (TSC Act) continues to apply to land that is non-certified under the Growth Centres Biodiversity Certification.

Environmental Planning and Assessment Act 1979 (EP&A Act) and Assessment Regulation 2000 (EP&A Regulation)

The *EP&A Act* regulates the implementation and enforcement of planning powers. It establishes provisions for the making of Environmental Planning Instruments (EPIs) such as SEPPs and Local Environmental Plans (LEPs), including the State Environmental Planning Policy (Sydney Region Growth Centres) 2006 (Growth Centres SEPP). The *EP&A Regulation* established additional provisions that provide further guidance on the requirements of the *EP&A Act*. Of particular significance to planning for Sydney's Growth Centres are clause 276 which establishes provisions with respect to the release of Precincts for urban development and clause 275 which requires an assessment of the consistency of certain proposed development with the relevant Growth Centre Structure Plan if a Precinct is released (Eco Logical, 2010).

The *EP&A Act* and the *2000 Regulation* set out amongst other things the:

- Requirements for rezoning land;

- Requirements regarding the preparation of environmental planning instruments;
- Matters for consideration when determining a development application; and,
- Approval permits and/or licences required from other authorities under other legislation.

Section 117 Directions of the *EP&A Act* require councils to address a range of matters when seeking to rezone land. While not directly relevant to the rezoning process adopted for the Growth Centres, these directions have been considered in planning for the Austral-Leppington North Precincts.

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

The Growth Centres SEPP establishes the planning rules and objectives for the Growth Centres and Councils need to apply the SEPP when making decisions about land within the Growth Centres. In particular, the SEPP identifies areas of open space and environment conservation to be protected within the Growth Centres, and areas that are flood prone or major creek lands and transitional lands that need to be further assessed in the Precinct planning process.

Environmental Planning and Assessment Amendment (Sydney Region Growth Centres) Regulation 2006

The Growth Centres Regulation supports the Growth Centres SEPP. The Regulation makes provision for the release of precincts for residential, employment and other urban development in the North West and South West Growth Centres. In particular, it requires the Minister to prepare a Development Code and Infrastructure Plan to assist with the Precinct Planning process.

Threatened Species Conservation (TSC) Act 1995

The Act identifies threatened species and populations, Endangered Ecological Communities (EEC) and critical habitat, as well as key threatening processes. Approval is required in order to:

- Harm any animal or plant that is identified as a threatened species or is part of a threatened population or EEC;
- Damage critical habitat;or,
- Damage the habitat of any threatened species, population or EEC.

The Act also provides for the biodiversity certification of environmental planning instruments such as the Growth Centres SEPP. The Biodiversity Certification Order for the Growth Centres SEPP was gazetted by the Minister for Environment in December 2007.

While development on lands subject to Certification no longer requires assessment under the *TSC Act*, the Austral-Leppington development plan should consider and manage the presence of species, populations and communities listed under the *TSC Act*.

Threatened Species Conservation Amendment (Special Provisions) Act 2008

This Bill was introduced to Parliament in 2008. The object of this Bill is to amend the *TSC Act* to confirm that the Growth Centres SEPP has biodiversity certification under that Act. The Bill also amends the *Local Government Act 1993* to make it clear that, for local government rating purposes, where part of a parcel of land is the subject of a conservation agreement under the *National Parks and Wildlife Act 1974*, the rate payable on the whole parcel is to be proportionately reduced.

Fisheries Management Act 1994 (FM Act)

The *Fisheries Management Act 1994,* administered by the Industry and Investment NSW (I&I NSW) (formerly DPI) applies to any works within aquatic habitats. The *FM Act* aims to conserve, develop and share the fishery resources of NSW for the benefit of present and future generations. It defines 'fish' as any marine, estuarine or freshwater fish or other aquatic animal life at any stage of their life history. This includes insects, molluscs (eg. oysters), crustaceans, echinoderms, and aquatic polychaetes (eg. beachworms), but does not include whales, mammals, reptiles, birds, amphibians or species specifically excluded (eg. some dragonflies are protected under the *TSC Act* instead of the *FM Act*). Under this act, if any activity occurs that will block fish passage, then a permit under this Act will be required.

Water Management Act 2000 (WMA)

The *WMA* regulates construction activities in close proximity to waterways. Principles set out in the Act generally aim to preserve and/or restore water sources, floodplains, and water dependant ecosystems (including groundwater and wetlands). The Act also encompasses the protection of habitats, animals and plants which benefit from water or are potentially affected by managed activities.

One of the aims of the *WMA* is to protect riparian corridors. The ecological assessment completed will aid in identifying riparian zones in the study area that will need to be protected.

Noxious Weeds Act 1993

The *Noxious Weeds Act 1993* was implemented to regulate the impacts and spread of weeds within NSW. The Act governs the control, classification and removal of weeds declared as noxious weeds. Land which is privately occupied requires implementation of appropriate noxious weed controls under Part 4 of the Act. Penalties apply if the occupier fails to comply.

Based on the results of the flora assessment, the restrictions of the *Noxious Weeds Act 1993* will apply to development within the Austral-Leppington North Precincts.

Planning for Bushfire Protection 2006 (PBP 2006)

PBP 2006 has been released and adopted since 1 March 2007 through the Environmental Planning and Assessment Amendment (Planning for Bush Fire Protection) Regulation 2007

and the Rural Fires Amendment Regulation 2007. This new version replaces Planning for Bush Fire Protection, 2001.

This new version of PBP applies to all "development applications" on land that is classified as "bush fire prone land" (BPL), identified on a council's BPL map. For development on BPL specific controls apply to residential/rural residential subdivision and "Special Fire Protection Purposes" (SFPPs) – those types of development specified in the legislation as requiring particular attention (including mandatory involvement of the Rural Fire Service) (NSW Rural Fire Service, 2006).

Protection of the Environment Operations Act 1997 (PoEO Act)

The *PoEO Act* provides a single licensing arrangement to replace the different licences and approvals under existing separate Acts relating to air pollution, water pollution, noise pollution and waste management.

The EPA is made the regulatory authority for:

- Activities listed in Schedule 1 to the Act and the premises where they are carried on;
- Activities carried on by a State or public authority; and,
- Other activities in relation to which a licence regulating water pollution is issued.

In nearly all other cases, the regulatory authority is the relevant local council.

The activities listed in Schedule 1 to the Act (generally activities with potentially significant environmental impacts) require a licence. Licences can also be issued to regulate water pollution from activities that are not in Schedule 1. Licences are on-going but subject to review at least once every 5 years and can be varied, suspended or revoked.

Catchment Management Authorities Act 2003 (CMA)

This Act establishes Catchment Management Authorities (CMAs) and their roles and responsibilities, including the development of catchment action plans.

The Hawkesbury-Nepean Catchment Management Authority (HNCMA) was formed under *Catchment Management Authorities Act*. The primary role of the HNCMA is to fund environmental projects on private land in areas of critical importance. It is a statutory authority with a board that reports directly to the Minister for Environment, Climate Change and Water.

Sydney Regional Environmental Plan (SREP) No 20 – Hawkesbury-Nepean River (No 2 – 1997)

SREP 20 seeks to protect the environment of the Hawkesbury-Nepean River system. Development within the catchment is required to consider the general and specific principles and controls listed in the SREP to ensure the impacts of future land use are considered in a regional context. Kemps Creek is a tributary of the Hawkesbury-Nepean River system. Precinct Planning must consider the impacts of the development on the health of the system.

State Environmental Planning Policy No.19 (SEPP 19) – Bushland in Urban Areas

SEPP 19 seeks to protect and preserve bushland within certain urban areas, as part of the natural heritage or for recreational, educational and scientific purposes. The policy is designed to protect bushland in public open space zones and reservations, and to ensure that bush preservation is given a high priority when local environmental plans for urban development are prepared.

The ecological assessment conducted will aid in identifying bushland in the study area that will need to be protected.

Growth Centres Development Code 2006

The Development Code sets out the processes to be followed during Precinct Planning. The Code helps to implement policies at the regional and neighbourhood levels by, amongst others:

- Providing guidance on the Precinct Planning Process;
- Promoting best practice urban design;
- Increasing housing choices;
- Providing local employment for locals;
- Providing facilities and services at a local level;
- Maintaining the natural environment and visual character of the topography;
- Integrating existing infrastructure; and,
- Providing, protecting and maintaining open space opportunities throughout entire Precincts.

Growth Centres Conservation Plan 2007

This Conservation Plan identifies the existing biodiversity values within the Growth Centres and proposes a suite of mechanisms to achieve positive conservation outcomes for Western Sydney, and more broadly, the Sydney Basin, within the context of streamlining the development assessment process and providing for the future urban growth of Sydney (Eco Logical, 2007).

The objectives of the Conservation Plan are to:

- Outline planning and offsetting proposals for the Growth Centres;
- Assess whether they will improve or maintain regional biodiversity values; and,
- Confirm the outcomes of the assessments under Section 126G of the *TSC Act* so that biodiversity certification may be granted to the Growth Centres SEPP by the Minister for the Environment, Climate Change and Water (Eco Logical, 2007).

Liverpool LEP 2008

This Plan aims to make local environmental planning provisions for land in Liverpool in accordance with the relevant standard environmental planning instrument under section 33A of the *EP& A Act*.

The particular ecologically relevant aims of this Plan are as follows, to:

- Foster economic, environmental and social well-being so that Liverpool continues to develop as a sustainable and prosperous place to live, work and visit;
- Concentrate intensive land uses and trip-generating activities in locations most accessible to transport and centres;
- Promote the efficient and equitable provision of public services, infrastructure and amenities;
- Conserve, protect and enhance the environmental and cultural heritage of Liverpool;
- Protect and enhance the natural environment in Liverpool, incorporating ecologically sustainable development;
- Minimise risk to the community in areas subject to environmental hazards, particularly flooding and bush fires; and,
- Promote a high standard of urban design that responds appropriately to the existing or desired future character of areas.

Camden LEP 2010

This Plan aims to make local environmental planning provisions for land in Camden in accordance with the relevant standard environmental planning instrument under section 33A of the *EP& A Act*.

The particular ecologically relevant aims of this Plan are as follows, to:

- Ensure Camden retains its valued traditional qualities, character and scenic landscapes while providing for sustainable urban growth;
- Ensure that new communities are planned and developed in an orderly, integrated and sustainable manner and contribute to the social, environmental and economic sustainability of Camden;
- Ensure natural assets within Camden are protected and enhanced;
- minimise the impact on existing and future communities of natural hazards such as bush fires and flooding;
- Ensure the agricultural production potential of rural land, and prevent the fragmentation of agricultural holdings;
- ensure that the recreation, cultural and social needs of all existing and future residents of Camden are appropriately planned for;

- Protect and restore the environmental values of land, including waterways and riparian land, as part of the natural systems; and,
- Conserve and enhance the built and landscape heritage of Camden.

Appendix M

Relevant Biodiversity Measures Consistency Report

NSW GOVERNMENT | Planning

Growth Centres Biodiversity Certification

Assessment of Consistency between the Relevant Biodiversity Measures of the Biodiversity Certification Order and Austral and Leppington North Precincts

August 2012

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1. Introduction

In July 2008 an amendment was made under Schedule 7 Part 7 to the *Threatened Species Conservation Act 1995* (TSC Act) to confer biodiversity certification on the *State Environmental Planning Policy (Sydney Region Growth Centres) 2006* (Growth Centres SEPP). Compliance with the relevant biodiversity measures (RBMs) in the biodiversity certification order (dated 14 December 2007) is required to maintain the certification. The RBMs require (among other things) the retention of 2000 hectares of existing native vegetation within the Growth Centres and additional offsetting outside the Growth Centre boundaries.

This report has been prepared to fulfil the requirement of RBM 35 for an assessment of the consistency of proposed precinct plans with the biodiversity certification and the RBMs.

This report has been prepared in a table format and addresses all RBMs that are relevant to precinct planning. It is noted that many of the RBMs are not specific to precinct planning and have therefore not been included in the report.

A complete copy of the biodiversity certification order (including all relevant biodiversity measures) can be found on the Office of Environmental and Heritage website at http://www.environment.nsw.gov.au/biocertification/notcert.htm

Where the report indicates that precinct planning is inconsistent with the biodiversity certification, full justification for the inconsistency is provided as part of the ecological assessment for the precinct.

Definitions

Terms defined below appear in **bold** in the table. Where the terms are also defined in the Biodiversity Certification Order, the definitions provided are consistent with those in the Order.

- *Biodiversity Certification Maps* means the maps marked "North West Growth Centre – Biodiversity Certification" and "South West Growth Centre – Biodiversity Certification" dated November 2007 and included in Schedule 2 of the Biodiversity Certification Order.
- *Certified Area* means an area marked as a certified area on a biodiversity certification map.
- *Clearing* of existing native vegetation means any one or more of the following:

  a) cutting down, felling, thinning, logging or removing existing native vegetation in whole or in part,

  b) killing, destroying, poisoning, ringbarking, uprooting or burning existing native vegetation in whole or in part.
- *Existing Native Vegetation (ENV) means areas of indigenous trees (including any sapling) that:*

  a) had 10% or greater over storey canopy cover present,

  b) were equal to or greater than 0.5 ha in area, and

  c) were identified as "vegetation" on maps 4 and 5 of the draft Growth Centres Conservation Plan.
- *DECCW* means the Department of Environment, Climate Change and Water (which was the former Department of Environment and Climate Change, DECC, and is now the Office of Environment and Heritage (OEH)).
- *DoPI* means the Department of Planning and Infrastructure (which was the former Growth Centres Commission, GCC).
- *Minister* means the Minister administering the TSC Act.
- *Non-certified Area* means an area marked as a non-certified area on a biodiversity certification map.
- *Protection/Protected* in relation to land means land that is protected by a land use zoning under an environmental planning instrument or public ownership arrangements that provide for the protection of biodiversity values as a priority, or another arrangement that provides in perpetuity security for biodiversity on the subject land.
- *Relevant Biodiversity Measures* means the conditions in Schedule 1 of the Biodiversity Certification Order.
- *TSC Act* means the *Threatened Species Conservation Act 1995.*

2. Assessment

Table 1: Assessment of consistency between the relevant biodiversity measures of the Biodiversity Certification Order and Austral and Leppington North Precincts.

	Relevant Biodiversity Measure	Austral and Leppington North Precincts - Comment	Consistent with RBMs and Schedule 7 Part 7 of TSC Act	Justification
General				
4	Copies of all final reports, maps, reviews, plans and monitoring data referred to in the conditions of biodiversity certification must be held by the **DoPI** and made publicly available, either on request and/or by a mechanism that is broadly publicly accessible. This does not apply to material that is commercially sensitive or contains sensitive information regarding the location of threatened species, populations or ecological communities or their habitat.	All information required by the RBMs for the Austral and Leppington North Precincts will be publicly exhibited at a date yet to be determined, and an assessment of consistency (this report) will be updated where necessary after exhibition.	Yes	The following information will be publicly exhibited and available following gazettal: • This report in accordance with RBM 35; • Information required by RBM 8, as contained in this report; • Information as required by RBM 13 (**Figures 1-2** of **Annex A**);
Native vegetation to be retained within the Growth Centres				
6	A minimum of 2,000 hectares of **existing native vegetation** must be retained and **protected** within the Growth Centres, either within the **certified areas** and/or the **non-certified areas**, subject to conditions 7 to 13 below.	The draft Conservation Plan identifies: • 48 ha of ENV to be protected in the Austral Precinct (prior to the impact from the SWRL and excluding ENV in the Kemps Ck Nature Reserve); • 52 ha of ENV to be protected in the Leppington North	Yes	The Biodiversity Certification Map (**Figure 1** of **Annex A**) identifies ENV within the Precincts which is required to be retained. The draft precinct plan (based on the final ILP, at **Figure 1** of **Annex B)** protects 116.62ha of ENV within the Precincts through appropriate zoning of land, mapping of Existing Native Vegetation Areas on the Native Vegetation Protection Map and provisions that prohibit clearing of

	Relevant Biodiversity Measure	Austral and Leppington North Precincts - Comment	Consistent with RBMs and Schedule 7 Part 7 of TSC Act	Justification
		Precinct (prior to the impact from the SWRL); • 7.14ha of ENV in the Investigation Areas is to be protected. This is a total area of 107.14 ha of ENV that is required to be protected across the Precincts to maintain parity with the draft Conservation Plan. • 0.61 ha of ENV in the Investigation areas will be impacted by the South West Rail Link. Of this 0.61 ha, 0.52ha is on land which is currently non-certified and will be separately offset by TfNSW • When the non-certified ENV to be impacted (and offset) by the SWRL is taken into account, the target for protection of ENV to maintain the 2,000 hectares of ENV across the Growth Centres is 106.62 hectares. • The total area of ENV protected in the Precincts and investigation areas is 116.62ha		ENV as mapped. Changes to the non-certified land boundaries (**Annex E**) are also proposed, to be consistent with the ENV to be protected under the Precinct Plan.

	Relevant Biodiversity Measure	Austral and Leppington North Precincts - Comment	Consistent with RBMs and Schedule 7 Part 7 of TSC Act	Justification
Retention of existing native vegetation during precinct planning				
7	During the precinct planning process, the **DoPI** may determine to make areas of **existing native vegetation** within the **non-certified areas** available for development if the clearance of such vegetation is considered necessary for either the provision of essential infrastructure and/or to meet the required Development Parameters specified in the Growth Centres Development Code.	4.03ha of ENV on non-certified land will be removed as per the draft Precinct Plan (**Figure 1** and **Figure 2** of **Annex D**) to enable development parameters to be met and to allow for essential infrastructure.	Yes	The area of non-certified ENV to be removed will be more than offset by the protection of a total of 116.62ha of ENV across the Precincts, 10.00ha more than is required by the biodiversity certification order The total area of currently non-certified ENV proposed to be certified is 4.03ha. The total area of currently certified ENV proposed to be non-certified is 22.48ha. The calculations of protected ENV are based on ground-truthed ENV (see RBM 13) and this explains differences in totals when compared to the amount of ENV required to be protected.
8	In making a determination under condition 7, the **DoPI** must demonstrate by way of information provided during the public exhibition of the precinct plan (where that exhibition occurs after this order takes effect) that the **clearing** of any **existing native vegetation** in the **non-certified areas** will be offset by: (a) the **protection** of an equal or greater area of **existing native vegetation** elsewhere in the Growth Centres; and/or (b) the revegetation and/or restoration of an area of land elsewhere in the Growth Centres, subject to satisfying the following, (i) that the clearance of **existing native vegetation** in the **non-certified areas** will not affect the capacity to achieve overall improvement or maintenance of biodiversity values for threatened species, populations and ecological communities and their habitats, (ii) the revegetated and/or restored areas will be **protected**,	Offsetting of the impacts described for condition 7 will be achieved by the protection of an equal or greater area of ENV in accordance with condition 8(a) (as shown on **Figure 1** and **Figure 2** of **Annex D**).	Yes	The offsetting of impacts on non-certified ENV is required to enable the efficient development of the Precincts, including the provision of essential infrastructure. The 4.03ha of non-certified ENV to be cleared throughout the Precinct will be offset by the protection of an additional 10ha of ENV, above what is required under the draft Conservation Plan. The proposed offsets are in most cases connected with or adjacent to existing non-certified areas along the major creeks to form part of continuous vegetation and habitat

	Relevant Biodiversity Measure	Austral and Leppington North Precincts - Comment	Consistent with RBMs and Schedule 7 Part 7 of TSC Act	Justification
	(iii) the extent of revegetation and/or restoration compared to **clearing** of **existing native vegetation** must be undertaken at a ratio of at least 3:1 (to reflect the greater ecological risks relative to retaining **existing native vegetation**), (iv) areas subject to revegetation and/or restoration must be of a suitable boundary configuration and design to support long-term management, (v) revegetation and/or restoration of the proposed areas would not be undertaken under another scheme or regulatory requirement already in operation at the time that the **clearing** is approved (this includes but is not limited to any approvals, and associated conditions of such approvals, that may be required under the *Rivers and Foreshores Improvement Act 1948* and *Water Management Act 2000*), (vi) revegetation and/or restoration will be undertaken by suitably qualified and experienced persons using indigenous plant stock, and (vii) sufficient resources will be made available to undertake the revegetation and/or restoration and any necessary follow-up maintenance and monitoring for a minimum period of 5 years following the commencement of the revegetation and/or restoration.			links through the Precincts. The offset areas of ENV are to be protected through zoning controls, native vegetation protection provisions and changes to the boundaries of certified and non-certified land as described for RBM 6 above.
9	Revegetation and/or restoration may be partly counted towards meeting the overall requirement to **protect** 2,000 hectares of existing vegetation required in condition 6. The amount that may be counted shall be calculated by dividing the total area of revegetation and/or restoration required under condition 8b (iii) by 3. **Note:** for example, if 9 hectares of revegetation is undertaken then 3 hectares may be counted.	N/A	N/A	N/A

Retention of existing native vegetation shown in areas marked with red hatching				
12	Notwithstanding any other conditions of biodiversity certification, in the lands marked by a red hatching on the **biodiversity certification maps existing native vegetation** must not be **cleared** unless it is in accordance with a plan of management or unless such clearance has been agreed to by the **DECC**.	Part of the Kemps Creek Nature Reserve (covered by Condition 12) is within the Precinct boundary however the Precinct Plan does not apply to this land (as shown on the ILP at **Annex B**). An area that is subject to Condition 12 (but is not part of the Kemps Creek Nature Reserve), is within the Austral Precinct boundary and within the boundary of the draft Precinct Plan (see **Annex A, Figure 1**). No clearing of Existing Native Vegetation is proposed on this land as part of the Precinct Plan. These lands are proposed to be protected by maintaining the status of the land as non-certified, zoning areas that contain ENV as Environmental Conservation, and by applying the provision in the draft SEPP that prohibits clearing of vegetation on areas of ENV mapped under the SEPP.	Yes	Areas subject to condition 12 that are within the boundary of the draft Precinct Plan will be protected by the provisions of the draft SEPP.

	Relevant Biodiversity Measure	Austral and Leppington North Precincts - Comment	Consistent with RBMs and Schedule 7 Part 7 of TSC Act	Justification
Ground-truthing of existing native vegetation				
13	If new information becomes available after the biodiversity certification order took effect that demonstrates that the vegetation within an area does not otherwise meet the definition of **existing native vegetation**, then for the purposes of conditions 7 to 8 and condition 11 to 12 only the area of confirmed **existing native vegetation** shall be considered.	The mapping of ENV (identified on maps 4 and 5 of the draft *Growth Centres Conservation Plan*) generally corresponds with the findings of additional ground truthing investigations completed in 2010 and 2012 to inform the precinct planning process and only minor changes are recommended. **Figure 2** of **Annex A** provides the results of ground truthing of ENV conducted as part of Precinct Planning. The ground truthing has identified 14.81ha of ENV (in both certified and non-certified lands) that is no longer considered to meet the definition of ENV.	Yes	Mapping resulting from ground truthing is provided in **Figure 2** of **Annex A**. The draft conservation plan maps 107.14 ha of ENV within non-certified areas in the Precincts. Field surveys 101.58 Ha of ENV in non-certified areas. 43.6 Ha of additional high conservation value vegetation. (AHCVV) was identified in the Precincts as part of the Precinct Planning investigations. 17.4 Ha of this is in non-certified lands. For the purposes of conditions 7, 8, 11 and 12, only the area of confirmed ENV has been taken into account (as shown at **Annex C**). A total of 3.37ha of ENV is in Kemps Creek Nature Reserve (see Condition 12). Because the Precinct Plan does not apply to this land and no impacts on this vegetation are proposed, this vegetation has been excluded from calculations of protected ENV in this report (as shown on Figure 1 of **Annex C**).

	Relevant Biodiversity Measure	Austral and Leppington North Precincts - Comment	Consistent with RBMs and Schedule 7 Part 7 of TSC Act	Justification
Additional conservation actions within the Growth Centres – native vegetation				
14	During or before the preparation of the relevant precinct plan(s) under the Growth Centres Development Code, a further detailed assessment must be undertaken of the areas adjoining or proximate to the Shanes Park Air Services Australia site marked in blue hatching on the **biodiversity certification maps**.	The study area does not adjoin the Shanes Park Air Services Australia site.	N/A	NA
15	The assessment referred to in condition 14 must examine whether the areas meet the criteria specified in Schedule 3.	The study area does not adjoin the Shanes Park Air Services Australia site.	NA	NA
16	Based on the outcomes of the assessment the **OEH** shall provide advice to the **Minister** on whether the areas should be included within the **certified areas** or the **non-certified areas** shown on the **biodiversity certification maps**.	The study area does not adjoin the Shanes Park Air Services Australia site.	NA	NA
Additional conservation actions within the Growth Centres – plants				
17	During or before the preparation of the relevant precinct plan(s) under the Growth Centres Development Code relating to the areas referred to in the table below, the following actions must be undertaken: ***Species*** *Acacia pubescens* ***Required action*** Potential populations at Cross Street, Kemps Creek and Thirty-second Avenue, Austral – as shown in black hatching on the **biodiversity certification maps**: • survey to confirm the presence of the species, and • if the species is present, provide for the **protection** of the area of suitable habitat for the species to the satisfaction of the **OEH**.	NA (the land that is subject to condition 17 is outside the Austral and Leppington North Precinct boundaries).	Yes	NA

	Relevant Biodiversity Measure		Austral and Leppington North Precincts - Comment	Consistent with RBMs and Schedule 7 Part 7 of TSC Act	Justification
Additional conservation actions within the Growth Centres – animals					
18	During or before the preparation of the relevant precinct plan(s) under the Growth Centres Development Code relating to the area referred to in the table below, the following actions must be undertaken:		N/A	N/A	N/A
	Species	***Required action***			
	Green and Golden Bell Frog	Potential population at Riverstone – as shown in black hatching on the **biodiversity certification maps**: *Option 1* • survey to confirm the presence of the species, and • if the species is present, provide **protection** of the area of suitable habitat for the species to the satisfaction of the **OEH**. *Option 2* • if the species is present at Riverstone but cannot be adequately **protected** to the satisfaction of the **OEH**, then: a) undertake targeted survey to confirm the presence of the species elsewhere in the Growth Centres, and b) if the species is present elsewhere in the Growth Centres, provide for the **protection** of an area(s) of suitable habitat for the species to the satisfaction of the **OEH**.			
	Note: On completion of the above actions the **Minister** may decide that it is appropriate to amend the boundaries of the area subject to biodiversity certification, in accordance with condition 3.				

	Relevant Biodiversity Measure	Austral and Leppington North Precincts - Comment	Consistent with RBMs and Schedule 7 Part 7 of TSC Act	Justification
Additional conservation actions within the Growth Centres – development sites				
19	Within twelve months of the biodiversity certification order taking effect, the **DoPI** (in consultation with the **OEH**) must put in place procedures so that all future precinct plans (excluding any plans that were publicly exhibited before the biodiversity certification order took effect), where practicable, provide for the appropriate re-use of: (a) native plants (including but not limited to seed collection) and the re-location of native animals from development sites, prior to development commencing; and (b) top soil from development sites that contain known or potential native seed bank. For the purposes of condition 19a and 19b appropriate uses may include, but are not limited to, application in revegetation or restoration works and landscaping in the Growth Centres.	These provisions are incorporated into the Development Control Plans (DCP) for the Precincts.	Yes	N/A
Future precinct plans				
35	During the preparation of future precinct plans (excluding any precinct plans already publicly exhibited before this order took effect) the **DoPI** must undertake and make publicly available an assessment of the consistency of the proposed precinct plan with the conditions of biodiversity certification. This may occur during or before any public exhibition of future draft precinct plans.	This assessment of consistency has been prepared to satisfy this RBM. This report will be publicly exhibited with the full precinct planning package.	Yes	This assessment addresses all RBMs applicable to the planning of the Austral and Leppington North Precincts.
Future threatened species listings or discoveries				
36	Where a preliminary determination is made under the Act to list a species, population or ecological community, and that species, population or ecological community may or is known to occur within the Growth Centres, then the **Growth Centres Commission** must (as soon as practicable) provide advice to the **OEH** on whether: (a) the species, population or ecological community is known or	The DoPI is not aware of any subsequent Preliminary determinations that would apply to the Austral and Leppington North Precincts.	Yes	N/A

	Relevant Biodiversity Measure	Austral and Leppington North Precincts - Comment	Consistent with RBMs and Schedule 7 Part 7 of TSC Act	Justification
	likely to be present in the Growth Centres; (b) it was considered during the preparation of the draft Growth Centres Conservation Plan by the **DoPI**; and (c) whether the SEPP, and related measures, provides adequate **protection** for the species, population or ecological community.			
37	Based on the information provided in accordance with condition 36, and any other relevant matters, the **OEH** shall advise the **Minister** on whether to formally review, maintain, modify, suspend or revoke the biodiversity certification of the SEPP if the species, population or ecological community is listed under the Act.	N/A	N/A	N/A

3. Conclusion

This report has undertaken an assessment of the consistency of the Austral and Leppington North Precincts planning with the biodiversity certification and the applicable relevant biodiversity measures.

It is concluded that the Austral and Leppington North Precincts planning is consistent with the biodiversity certification of the Growth Centres SEPP, as follows:

- Under the final Precinct Plan 116.62ha of ENV will be protected within the Austral and Leppington North Precincts and the investigation areas. This is approximately 10.00ha more than required under the Biodiversity Certification Order to contribute to the 2,000ha of ENV to be protected across the Growth Centres.
- ENV will be protected through a number of different zones under the draft Precinct Plan (refer to Figure 2 in **Annex C**), including Environmental Conservation, Public Recreation, and Infrastructure. The reasons for applying the proposed zones are discussed further below.
- Development controls are proposed in the draft SEPP to prohibit the clearing of protected ENV as shown on the Native Vegetation Protection Map.
- The 2010 and 2012 (post-exhibition) ground truthing surveys recorded 101.58 Ha of validated ENV in non-certified areas in the Precincts. Only ground-truthed ENV has been included in the calculation of the total area of ENV to be protected. Figure 2 of **Annex B** shows the results of the ground-truthing.

Amendments to the boundaries of certified and non-certified land are proposed as shown at **Annex E**. The boundary amendments are proposed to reflect the outcomes of Precinct Planning, and to ensure the protection of ENV to maintain consistency with the Certification.

Land use zones have been selected based on advice from the OEH in relation to appropriate zoning of land containing ENV, and with consideration of other land use planning factors, including the future ownership, acquisition and use of land in accordance with the draft Precinct Plan and the EP&A Act. While the use of Environment Protection zones is preferred by OEH, in many cases it is not possible to apply this zoning to land containing ENV because of restrictions on the ability of Council to acquire the land under section 94 of the EP&A Act. In accordance with the hierarchy of land use zones preferred by OEH, land use zones have been applied to ENV that is proposed to be protected as follows:

- Where ENV to be protected is on land that is currently in Council or State Government ownership, the E2 Environmental Conservation zone has been used. The exception to this is Craik Park, in the centre of the Precincts, which is an existing Council reserve that contains a sports field and remnant ENV. The RE1 Public Recreation zone has been applied to this land to enable continued use of the sports fields.
- Where ENV to be protected is within large land holdings (and the area of ENV comprises only small part of the total area of land in the one ownership) the E2 zone has been applied. This land is not proposed to be acquired by a public authority, but the

land owner may seek to dedicate the land to Council subject to Council agreement, and if this did occur, the ENV would be protected by the combination of zoning and public ownership. Regardless, the application of the E2 zone to land that is to remain in private ownership is consistent with OEH requirements for protection of ENV.

- Within flood affected land along Kemps Creek and Bonds Creek, and adjacent to a number of other unnamed watercourses, existing rural properties that partly contain ENV are proposed to have a "split" zoning, with the land containing ENV zoned E2 Environmental Conservation and the remainder of the property zoned for a purpose that enables some commercial return either through limited subdivision or construction of a dwelling, or continued agricultural production. Generally, where the existing rural lot is partly within and partly outside the 100 year ARI flood extent, the combination of E4 Environmental Living and E2 (for the land that contains ENV) has been used. This approach also applies to a property on the eastern side of the Precincts at Eighth Avenue, which contains patches of ENV that are linked to a large remnant to the north and east in land owned by the Sydney Catchment Authority. This enables limited subdivision and construction of dwellings on relatively large lots consistent with the flooding and vegetation constraints on the land. Where the existing rural lot is entirely affected by flooding (such as along the northern parts of the Kemps Creek floodplain) the RU6 Rural Transition zone and E2 zone (for the land that contains ENV) has been used. The Rural Transition zone will enable agricultural uses that do not cause significant amenity impacts for nearby residential areas. The ability to further subdivide this land is limited, with minimum lot size controls established to limit further subdivision of land that contains ENV. In both these situations, the land that contains ENV is anticipated to remain in private ownership.
- Where land that contains ENV is to be acquired as part of a larger acquisition for a public purpose (usually for public recreation or drainage) the RE1 Public Recreation and SP2 Infrastructure (drainage zones) have been used. These approaches have generally been applied along the larger watercourses (eg. Bonds Creek and Scalabrini Creek) where the creek channel and margins are to be acquired by Council as part of the drainage network or where ENV is located on land that is to be acquired for public parks and sporting fields (these are often located within floodprone land near the major creeks). Land in these zones will be acquired by the relevant Council

These zones, in combination with the existing native vegetation provisions (refer to Figure 3 in **Annex C**) and the proposed certification boundaries (refer to **Annex E**), will protect the ENV.

Annex A

Biodiversity Certification Map for Austral and Leppington North Precincts

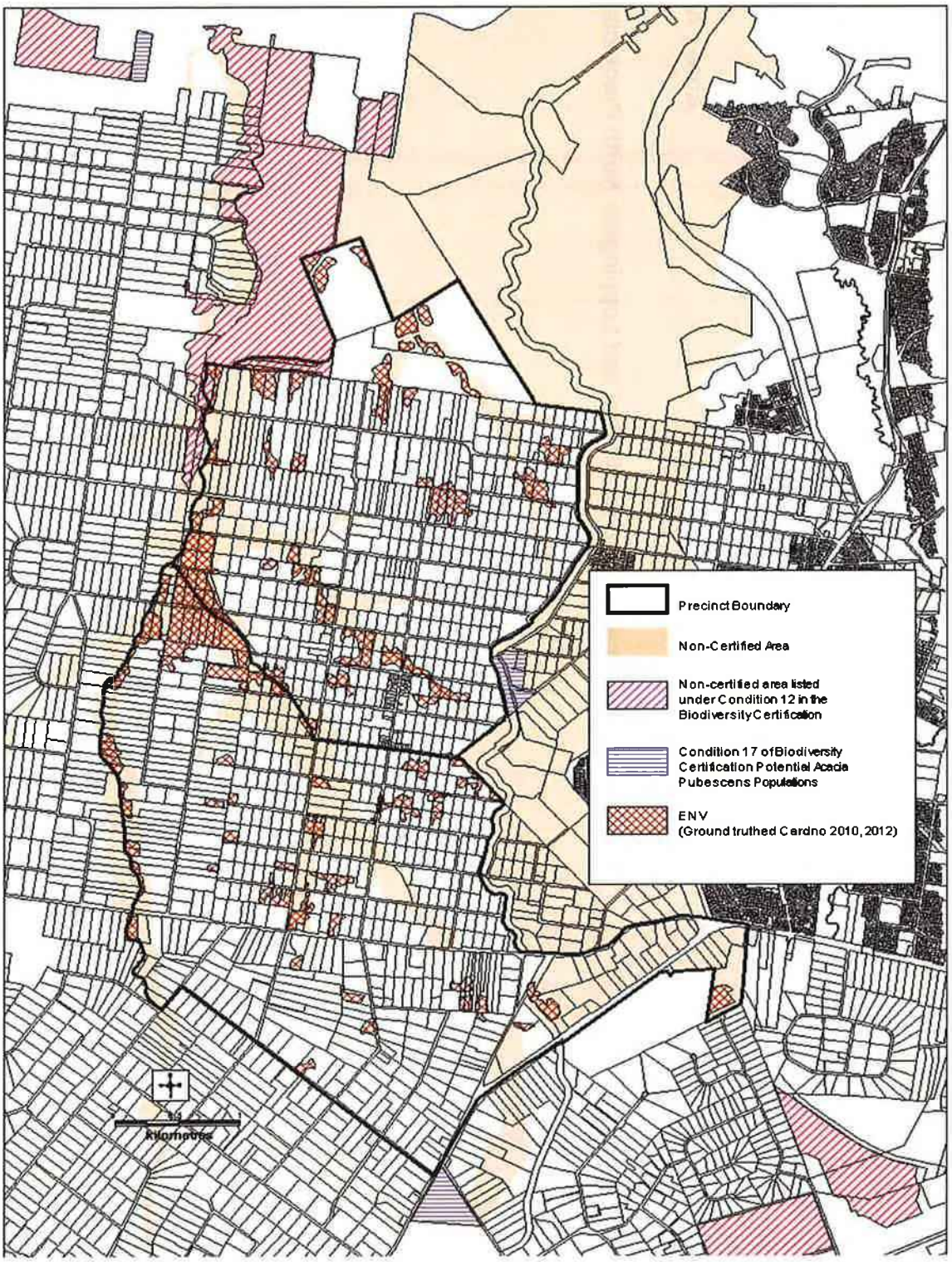

Figure 1: Austral and Leppington North Precincts – Biodiversity Certification Map showing Existing Native Vegetation (as confirmed by 2010 and 2012 ground truthing) and areas listed under Condition 12 and Condition 17 of the Biodiversity Certification.

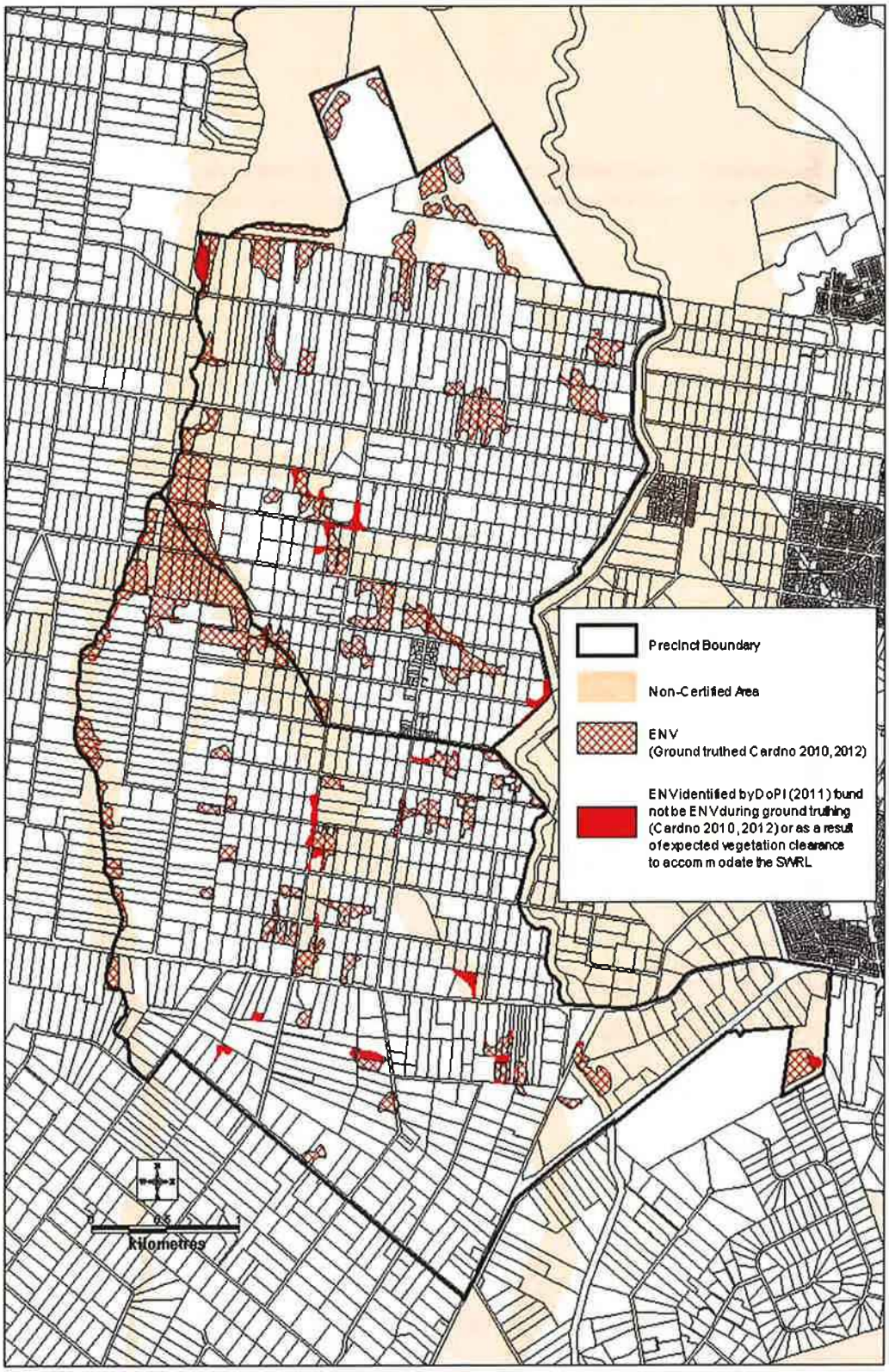

Figure 2 Existing Native Vegetation and vegetation areas found not to meet the criteria of ENV during ground truthing in 2010, 2012.

Annex B

Proposed Indicative Layout Plan for Austral and Leppington North Precincts

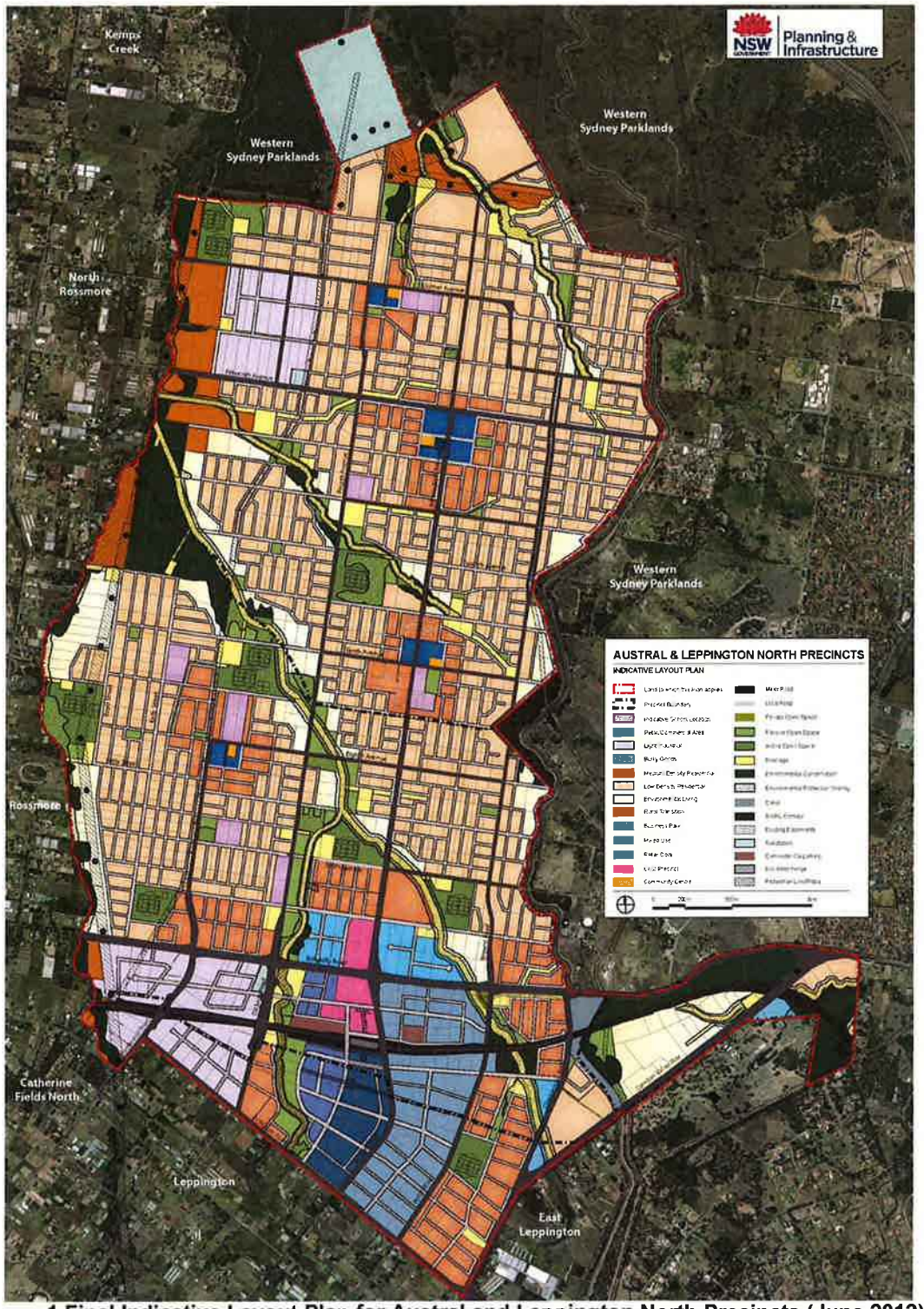

Figure 1 Final Indicative Layout Plan for Austral and Leppington North Precincts (June 2012).

Annex C

Proposed Protection Measures Plan for Austral and Leppington North Precincts

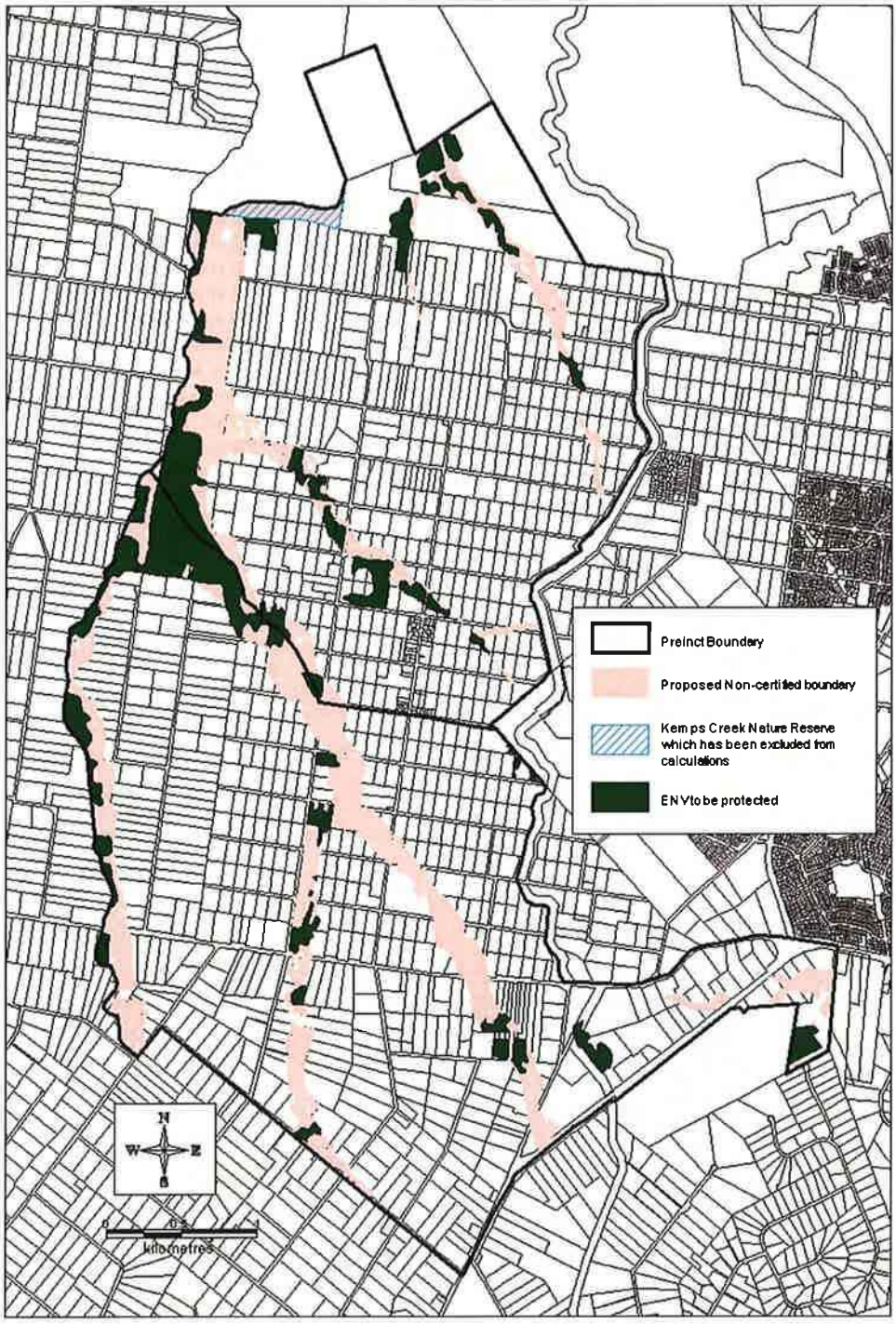

Figure 1 ENV to be protected

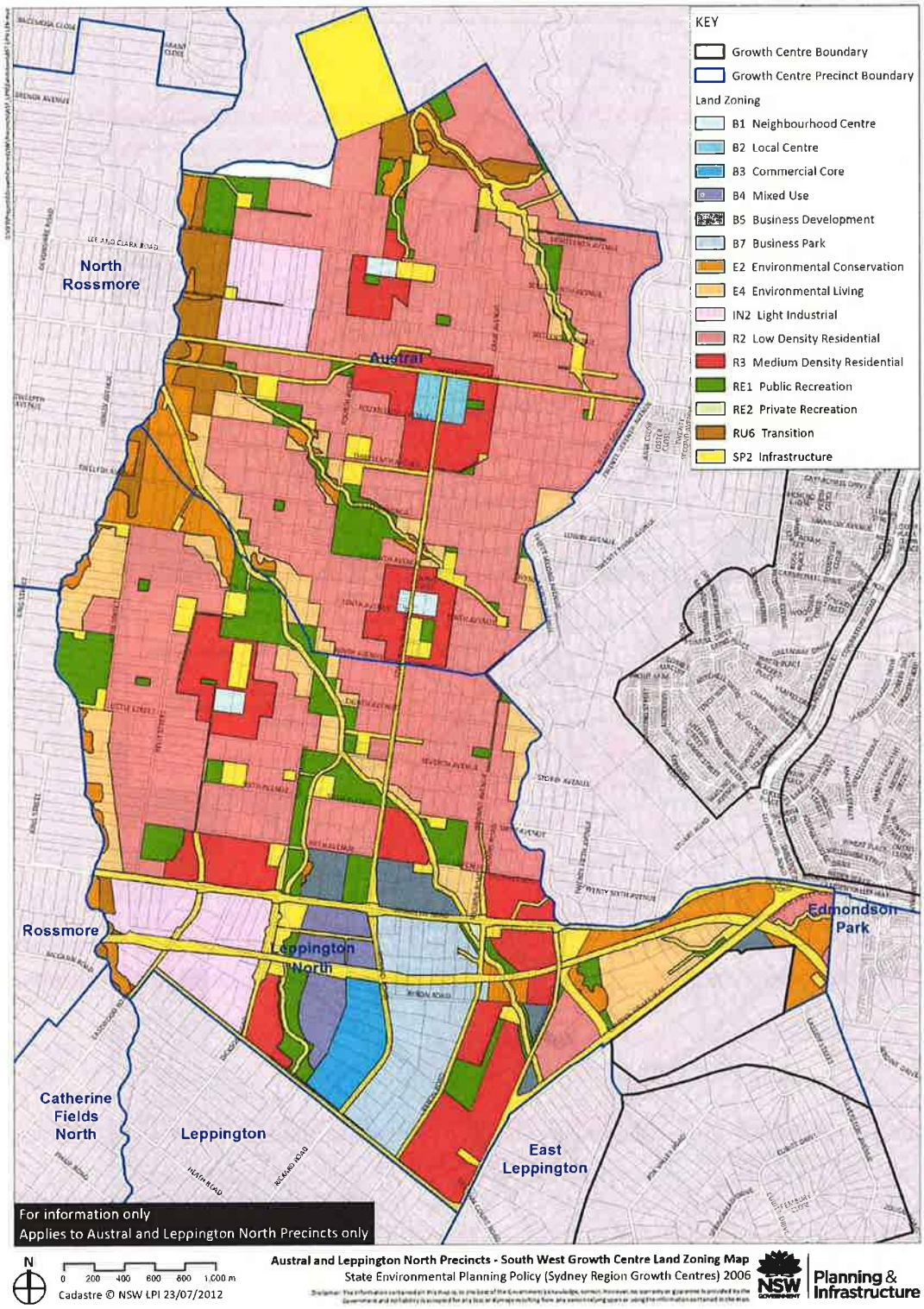

Figure 2 Land Zoning Map

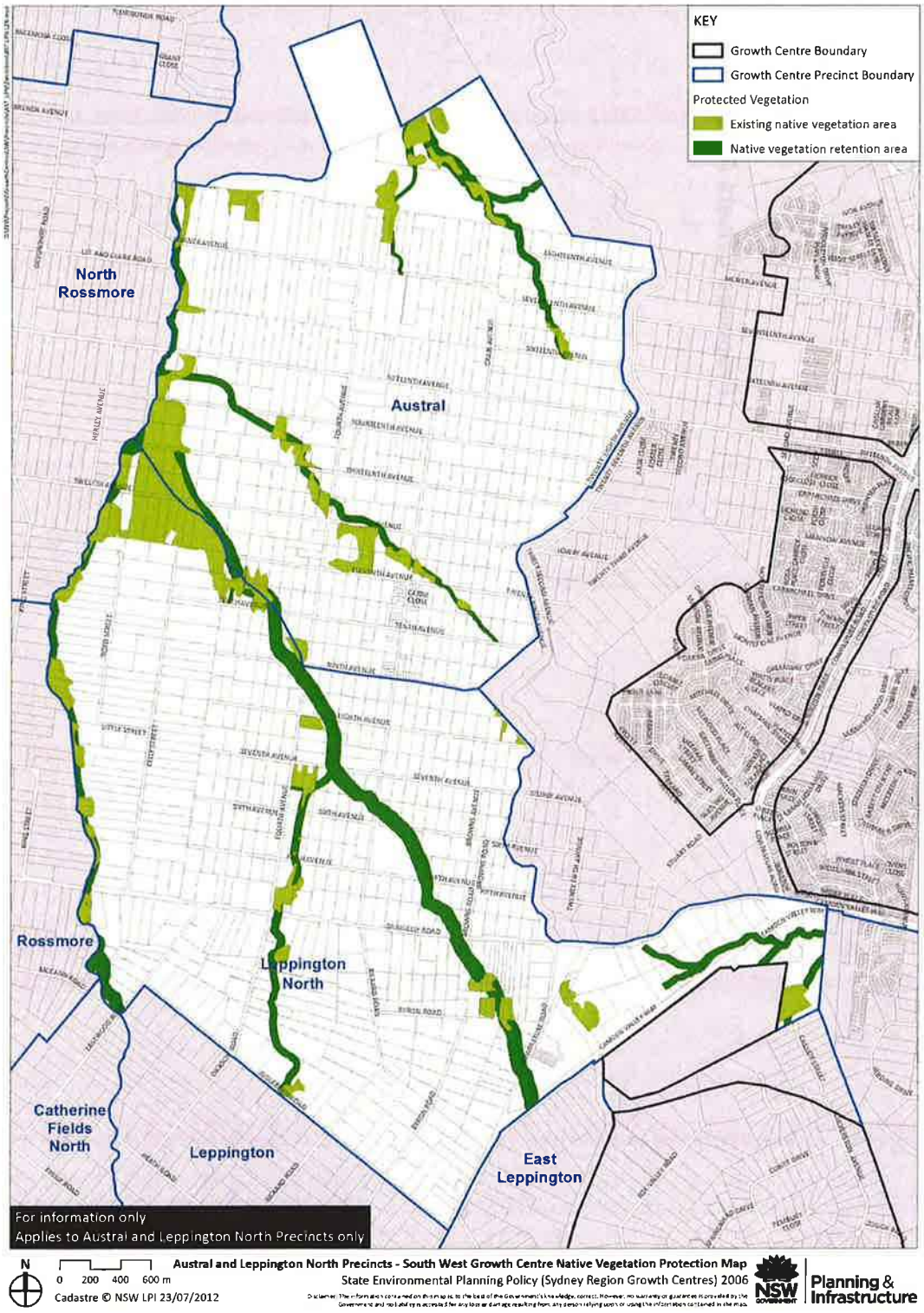

Figure 3 Native Vegetation Protection Areas Map

Annex D

Proposed Offsets Areas Precinct

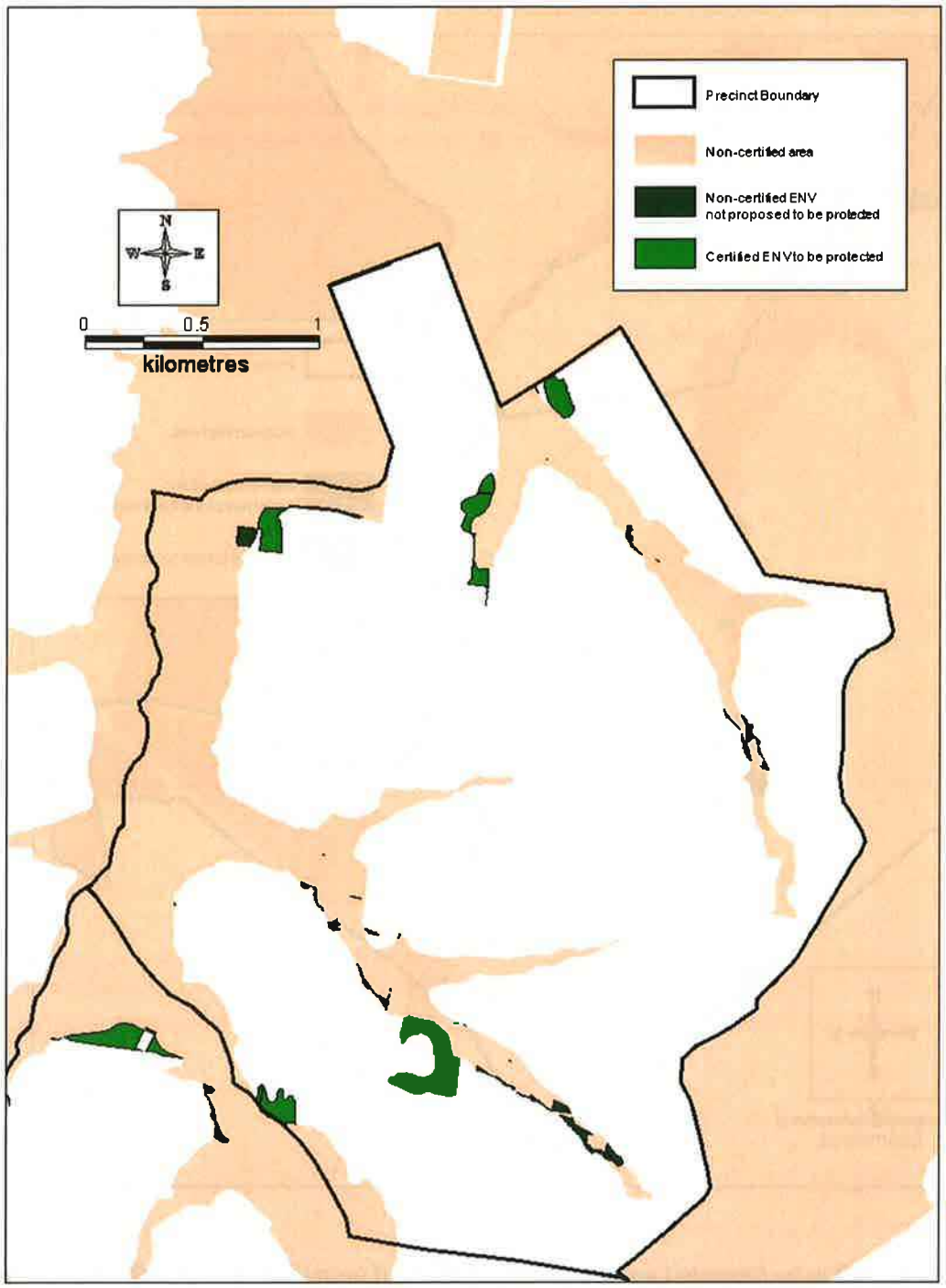

Figure 1: Certified ENV to be protected and Non-certified ENV not proposed to be protected in Austral

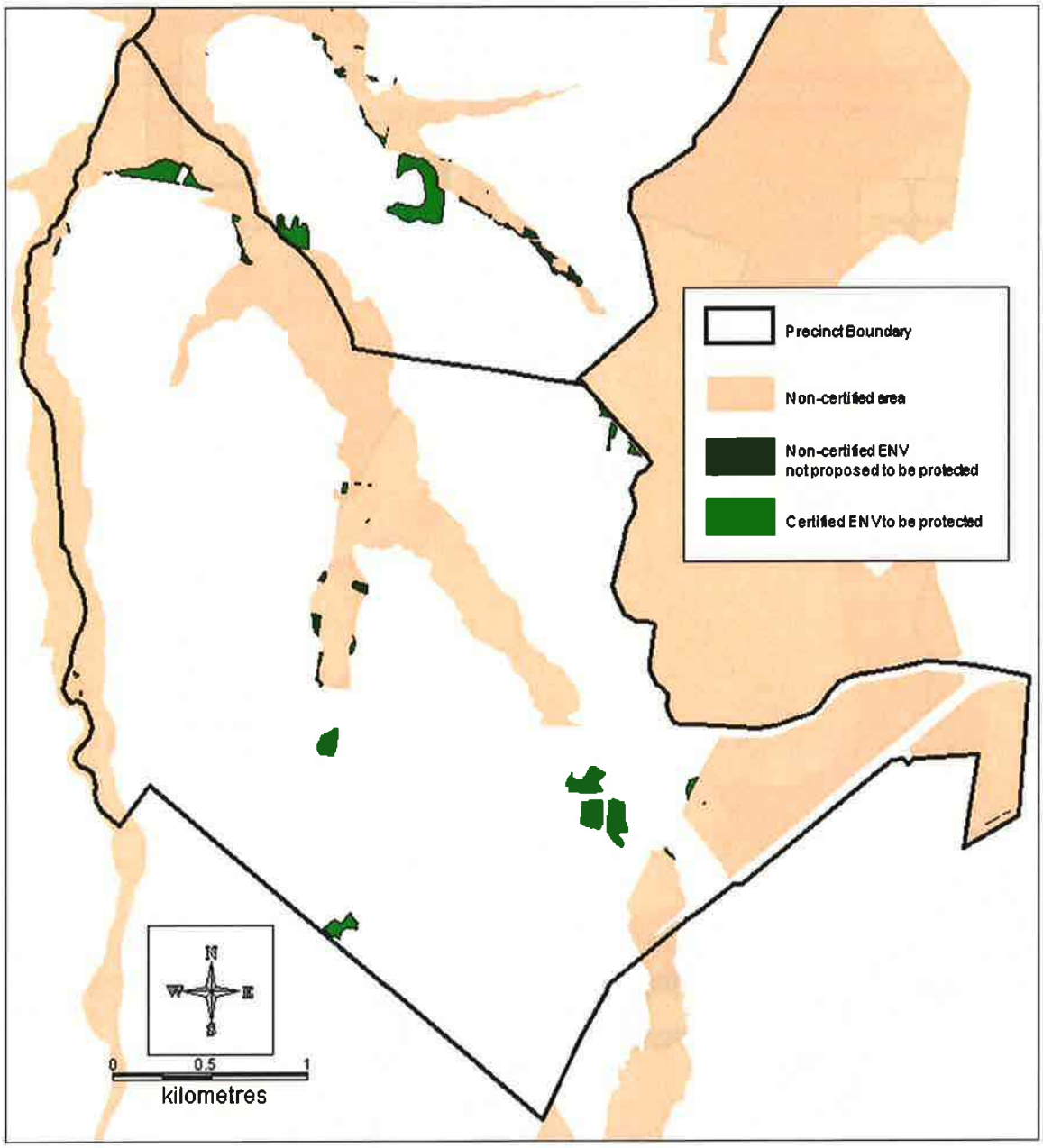

Figure 2: Certified ENV to be protected and Non-certified ENV not proposed to be protected in Leppington

Annex E

Proposed Amendments to Biodiversity Certification Map

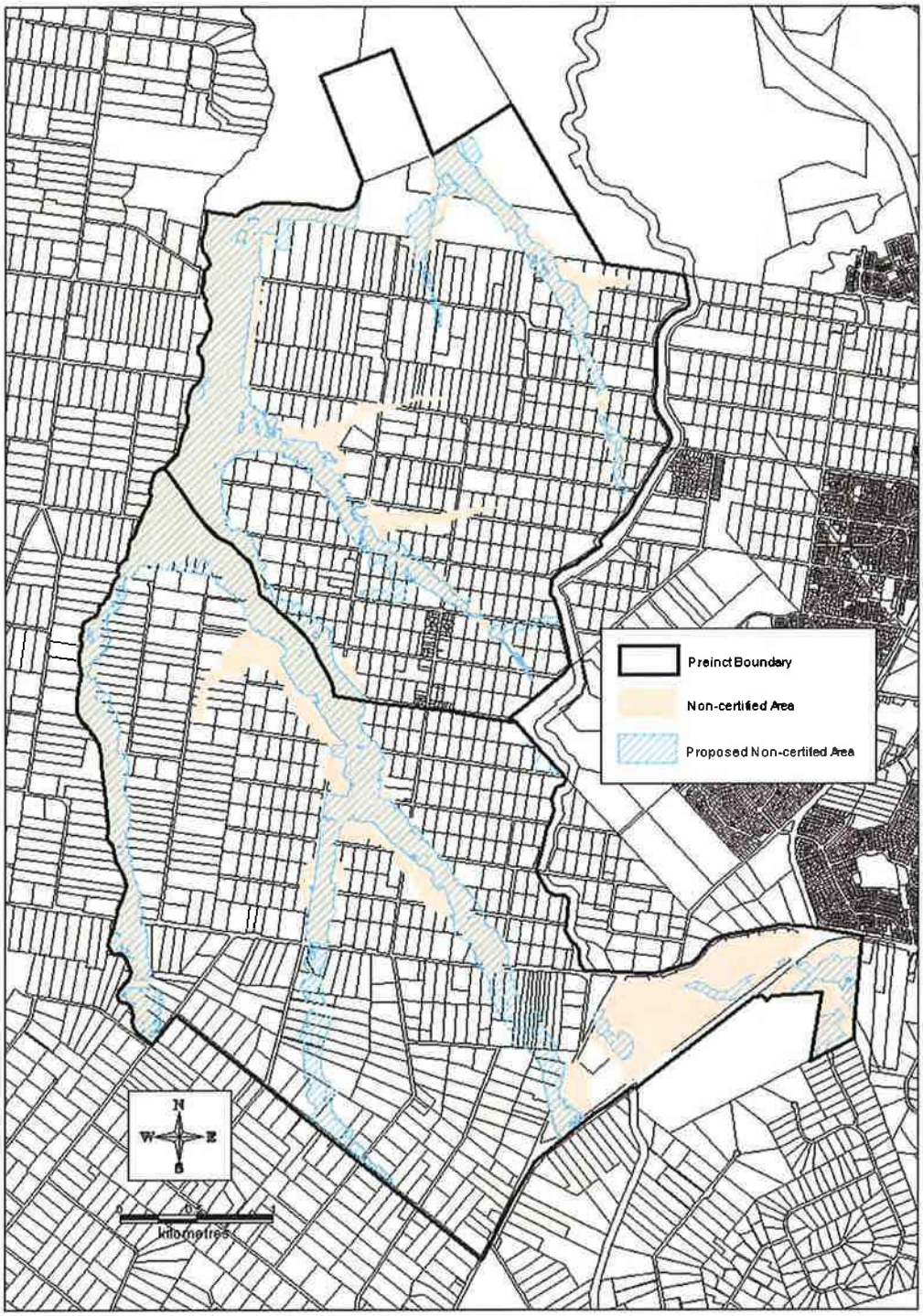

Figure 1: Proposed new boundaries of non-certified area and current non-certified area within the Austral and Leppington North precincts

Appendix N

Ecological Value Results

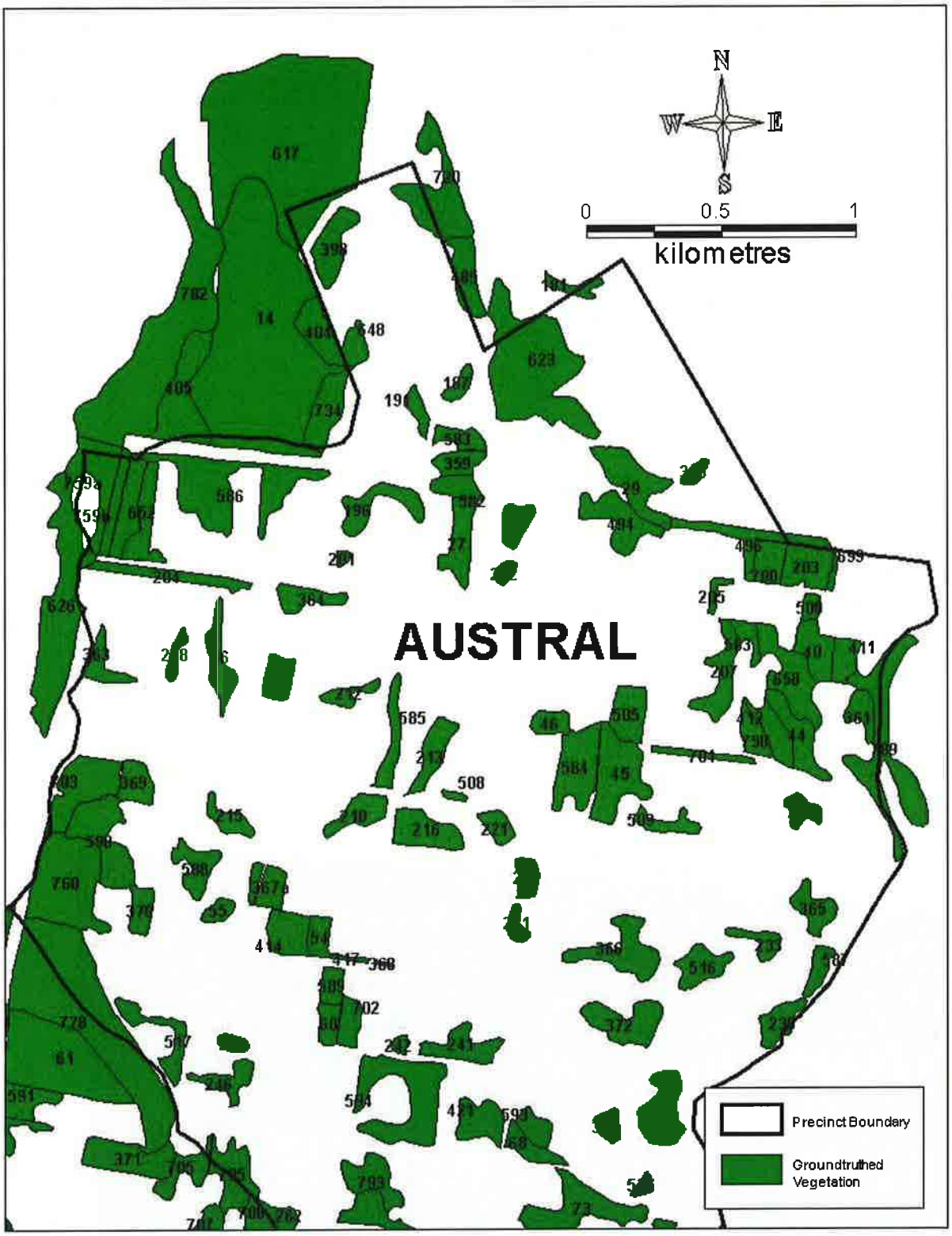

Figure 1 Location of Vegetation areas ground truthed in Austral (Site ID).

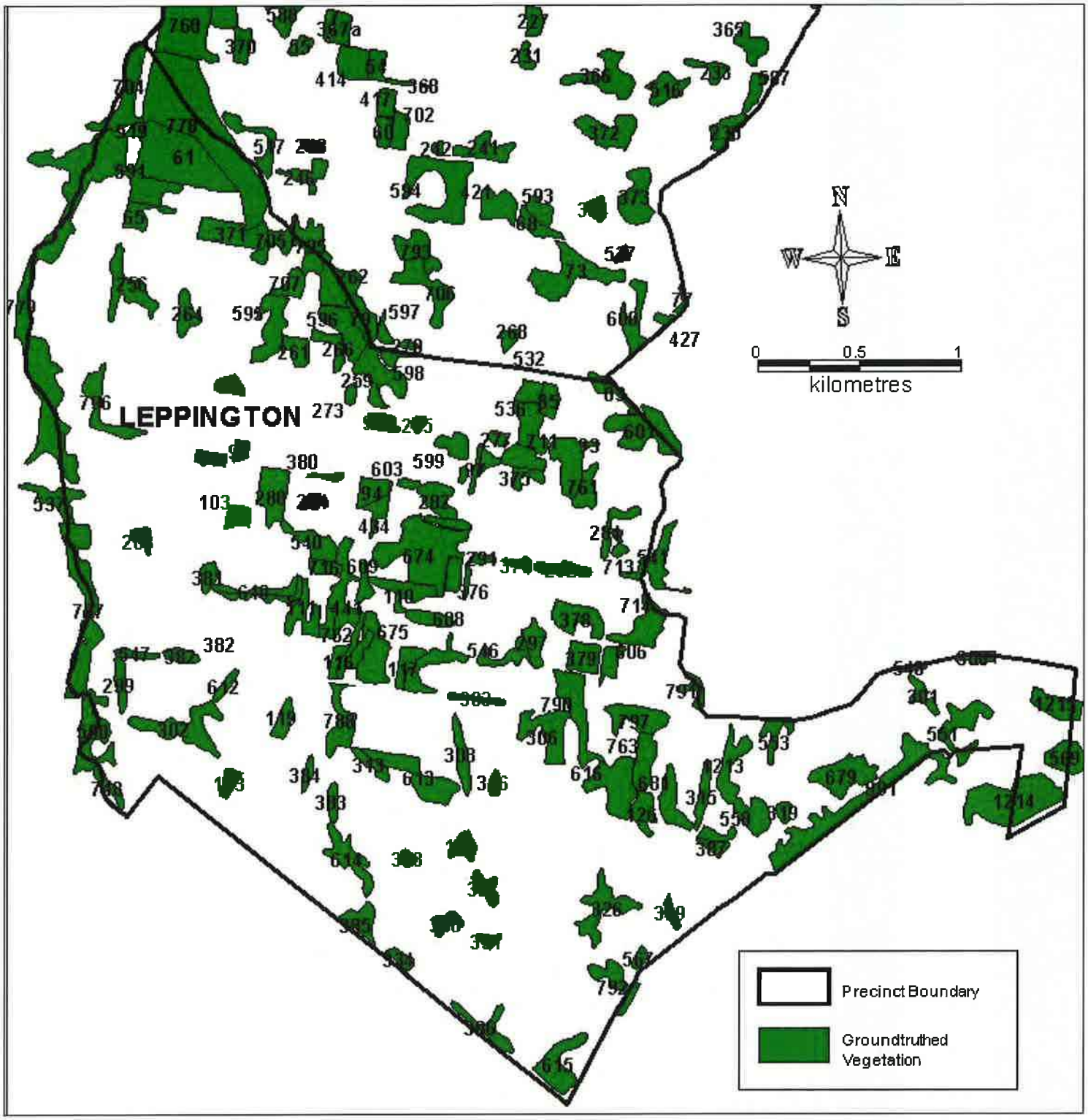

Figure 2 Location of Vegetation areas ground truthed in Leppington North (Site ID).

Site ID (Note 1)	Area	Vegetation Type	Perimeter / Area Ratio	Connectivity Score	Structural Score	GeoSpatial Score	Functional Conservation Value	Threatened Species Value	Recovery Potential Value	Total Ecological Value	Vegetation Community Quality
14	33.2750	Shale/Gravel Transition Forest	0.0089	49.60	50.00	49.71	149.31	115	125	389.308	High
27	2.6195	Shale Plains Woodland	0.0339	15.73	50.00	35.77	101.50	125	100	326.495	High
29	3.7733	Alluvial Woodland	0.0297	43.15	30.00	42.12	115.26	130	75	320.261	High
33	1.4157	Shale Plains Woodland	0.0342	14.11	33.85	29.23	77.19	100	50	227.190	Medium
36	2.1495	Shale Plains Woodland	0.0453	9.07	21.06	26.06	56.19	100	50	206.188	Medium
40	2.3129	Shale Plains Woodland	0.0294	40.73	29.55	37.02	107.30	100	50	257.296	Medium
44	2.6902	Shale Plains Woodland	0.0360	42.14	31.89	34.90	108.93	125	50	283.932	Medium
45	4.7785	Shale Plains Woodland	0.0230	28.23	16.19	46.83	91.24	100	25	216.239	Medium
46	1.1198	Shale Hills	0.0379	12.10	24.81	23.56	60.46	100	50	210.462	Medium

Site ID (Note 1)	Area	Vegetation Type	Perimeter / Area Ratio	Connectivity Score	Structural Score	GeoSpatial Score	Functional Conservation Value	Threatened Species Value	Recovery Potential Value	Total Ecological Value	Vegetation Community Quality
		Woodland									
54	1.1711	Alluvial Woodland	0.0404	11.49	37.88	22.60	71.97	80	75	226.973	Medium
55	0.7735	Shale Plains Woodland	0.0446	12.70	33.08	15.77	61.55	100	100	261.548	Medium
60	1.0693	Shale Plains Woodland	0.0423	8.06	32.18	19.71	59.96	100	50	209.956	Medium
61	9.9139	Shale Plains Woodland	0.0140	47.78	50.00	48.94	146.72	125	125	396.725	High
65	1.7761	Shale Plains Woodland	0.0442	22.18	28.08	24.71	74.97	100	50	224.966	Medium
68	1.4243	Alluvial Woodland	0.0457	30.04	37.69	22.02	89.75	80	25	194.752	Medium
73	5.3792	Shale Plains Woodland	0.0266	18.95	35.10	45.29	99.34	100	75	274.336	Medium
77	0.3973	Shale Hills Woodland	0.0913	10.69	12.92	2.12	25.72	100	25	150.721	Medium
79	1.9873	Alluvial Woodland	0.0307	38.91	35.87	34.52	109.30	100	125	334.296	High

Site ID (Note 1)	Area	Vegetation Type	Perimeter / Area Ratio	Connectivity Score	Structural Score	GeoSpatial Score	Functional Conservation Value	Threatened Species Value	Recovery Potential Value	Total Ecological Value	Vegetation Community Quality
83	1.5869	Shale Plains Woodland	0.0490	17.94	34.74	21.92	74.61	100	50	224.610	Medium
84	1.0293	Shale Plains Woodland	0.0401	10.08	21.12	20.87	52.07	100	50	202.068	Medium
85	1.3295	Shale Hills Woodland	0.0349	25.20	25.29	27.50	77.99	100	25	202.990	Medium
90	0.4323	Shale Plains Woodland	0.0616	5.85	30.10	5.00	40.94	100	25	165.943	Medium
93	0.1674	Shale Plains Woodland	0.1148	34.27	12.92	0.77	47.96	100	25	172.963	Medium
94	1.6385	Shale Plains Woodland	0.0327	6.45	30.74	31.54	68.73	100	100	268.727	Medium
96	0.7065	Shale Plains Woodland	0.0472	14.92	26.76	14.23	55.91	125	50	230.913	Medium
97	0.5571	Shale Hills Woodland	0.0986	24.60	12.92	3.75	41.27	100	25	166.267	Medium
98	0.8789	Shale Plains Woodland	0.0478	2.42	29.49	15.48	47.39	100	25	172.387	Medium
103	1.1544	Shale Plains Woodland	0.0377	11.29	36.22	24.33	71.84	100	25	196.835	Medium

Site ID (Note 1)	Area	Vegetation Type	Perimeter / Area Ratio	Connectivity Score	Structural Score	GeoSpatial Score	Functional Conservation Value	Threatened Species Value	Recovery Potential Value	Total Ecological Value	Vegetation Community Quality
110	2.4713	Shale Plains Woodland	0.0406	43.35	28.21	30.38	101.94	125	75	301.937	High
111	2.2952	Shale Plains Woodland	0.0482	29.84	34.62	25.38	89.84	100	75	264.839	Medium
116	0.8388	Alluvial Woodland	0.0570	40.52	39.49	10.87	90.88	75	100	265.877	Medium
117	1.4531	Shale Plains Woodland	0.0425	21.98	32.24	23.56	77.78	125	75	277.777	Medium
119	1.2329	Shale Plains Woodland	0.0400	0.20	36.35	23.17	59.72	100	100	259.721	Medium
123	0.9171	Shale Plains Woodland	0.0450	14.31	38.37	17.21	69.89	100	100	269.891	Medium
126	1.7956	Alluvial Woodland	0.0354	31.85	40.67	30.58	103.10	115	75	293.105	Medium
129	1.3727	Shale Plains Woodland	0.0352	3.43	38.43	27.69	69.55	100	75	244.549	Medium
181	0.9312	Shale Plains Woodland	0.0662	42.94	30.00	9.42	82.37	125	75	282.367	Medium
187	0.7656	Shale Plains Woodland	0.0520	40.32	12.92	12.50	65.74	100	25	190.743	Medium

Site ID (Note 1)	Area	Vegetation Type	Perimeter / Area Ratio	Connectivity Score	Structural Score	GeoSpatial Score	Functional Conservation Value	Threatened Species Value	Recovery Potential Value	Total Ecological Value	Vegetation Community Quality
191	0.8598	Shale Plains Woodland	0.0547	9.88	30.00	12.12	51.99	100	50	201.994	Medium
196	2.5254	Shale Plains Woodland	0.0397	33.06	38.37	31.35	102.78	125	75	302.776	High
201	0.2524	Shale Plains Woodland	0.0746	13.10	12.92	2.60	28.62	100	25	153.621	Medium
202	0.4958	Shale Plains Woodland	0.0545	12.30	12.92	8.75	33.97	100	25	158.968	Medium
203	2.6673	Shale Plains Woodland	0.0260	18.35	23.27	40.96	82.58	100	75	257.578	Medium
204	2.0214	Shale Plains Woodland	0.0641	45.16	12.92	18.46	76.54	100	25	201.543	Medium
205	0.4790	Alluvial Woodland	0.0872	26.21	12.92	3.46	42.59	62.5	25	130.091	Low
207	2.6148	Shale Plains Woodland	0.0409	28.83	29.55	30.58	88.96	100	25	213.959	Medium
208	0.6908	Shale Plains Woodland	0.0674	6.85	12.92	6.73	26.51	100	25	151.506	Medium
210	1.8780	Shale Hills Woodland	0.0348	23.19	28.01	31.83	83.03	100	50	233.025	Medium

Site ID (Note 1)	Area	Vegetation Type	Perimeter / Area Ratio	Connectivity Score	Structural Score	GeoSpatial Score	Functional Conservation Value	Threatened Species Value	Recovery Potential Value	Total Ecological Value	Vegetation Community Quality
212	1.0004	Shale Hills Woodland	0.0578	5.24	38.30	12.02	55.56	100	75	230.562	Medium
213	2.0335	Shale Hills Woodland	0.0385	23.59	35.74	29.52	88.85	100	100	288.845	Medium
215	1.2669	Shale Plains Woodland	0.0459	12.70	21.47	20.19	54.37	100	50	204.368	Medium
216	2.8153	Shale Plains Woodland	0.0260	24.40	26.76	41.44	92.60	100	75	267.600	Medium
217	1.1406	Shale Plains Woodland	0.0423	15.32	32.82	20.48	68.62	100	50	218.624	Medium
221	1.0673	Shale Plains Woodland	0.0394	13.31	12.92	21.83	48.05	100	25	173.053	Medium
227	1.0793	Shale Plains Woodland	0.0398	4.84	35.10	21.63	61.57	100	100	261.570	Medium
230	1.7142	Shale Plains Woodland	0.0349	4.44	36.35	30.58	71.36	100	75	246.359	Medium
231	0.7250	Shale Hills Woodland	0.0526	2.82	12.92	11.73	27.47	100	25	152.473	Medium
233	1.1275	Shale Plains Woodland	0.0510	6.65	12.92	16.54	36.11	100	25	161.112	Medium

Site ID (Note 1)	Area	Vegetation Type	Perimeter / Area Ratio	Connectivity Score	Structural Score	GeoSpatial Score	Functional Conservation Value	Threatened Species Value	Recovery Potential Value	Total Ecological Value	Vegetation Community Quality
241	2.3533	Shale Plains Woodland	0.0370	23.79	23.49	32.02	79.30	100	75	254.303	Medium
242	0.3509	Shale Plains Woodland	0.0656	29.03	23.49	4.04	56.56	100	75	231.564	Medium
243	0.5949	Shale Plains Woodland	0.0510	3.83	30.74	11.44	46.01	100	50	196.010	Medium
246	1.6359	Shale Plains Woodland	0.0493	44.35	32.24	21.83	98.43	100	125	323.425	High
256	3.4797	Shale Plains Woodland	0.0373	4.64	12.92	36.25	53.81	100	25	178.807	Medium
259	0.6875	Alluvial Woodland	0.0558	19.56	30.10	9.62	59.27	62.5	25	146.768	Low
261	1.4746	Shale Plains Woodland	0.0363	17.14	35.38	28.37	80.89	100	75	255.887	Medium
262	0.1494	Shale Hills Woodland	0.1215	26.81	36.92	0.58	64.31	125	75	264.315	Medium
264	1.5384	Shale Plains Woodland	0.0383	0.20	12.92	27.21	40.33	100	25	165.333	Medium
266	1.4109	Shale Plains Woodland	0.0509	34.88	12.92	19.62	67.41	100	25	192.414	Medium

Site ID (Note 1)	Area	Vegetation Type	Perimeter / Area Ratio	Connectivity Score	Structural Score	GeoSpatial Score	Functional Conservation Value	Threatened Species Value	Recovery Potential Value	Total Ecological Value	Vegetation Community Quality
268	0.0582	Shale Hills Woodland	0.2506	2.22	28.14	0.00	30.36	100	25	155.359	Medium
270	0.3113	Shale Hills Woodland	0.0865	16.33	12.92	2.31	31.56	100	25	156.558	Medium
273	0.5309	Shale Plains Woodland	0.0563	30.85	20.35	7.98	59.18	100	50	209.180	Medium
275	0.4861	Alluvial Woodland	0.0547	7.26	39.55	8.37	55.17	62.5	75	192.675	Medium
277	0.5880	Shale Hills Woodland	0.0489	28.63	12.92	12.50	54.05	100	25	179.049	Medium
280	3.3342	Shale Plains Woodland	0.0245	18.15	36.57	43.46	98.18	125	75	298.177	Medium
281	0.7766	Shale Plains Woodland	0.0506	22.38	35.51	13.37	71.26	100	100	271.257	Medium
282	2.2370	Alluvial Woodland	0.0300	35.48	29.01	35.96	100.45	115	75	290.452	Medium
284	1.3518	Shale Hills Woodland	0.0613	23.39	12.92	14.52	50.83	100	25	175.826	Medium
288	0.8883	Shale Plains Woodland	0.0478	0.20	12.92	15.77	28.89	100	25	153.891	Medium

Site ID (Note 1)	Area	Vegetation Type	Perimeter / Area Ratio	Connectivity Score	Structural Score	GeoSpatial Score	Functional Conservation Value	Threatened Species Value	Recovery Potential Value	Total Ecological Value	Vegetation Community Quality
291	0.5086	Alluvial Woodland	0.0609	35.89	36.92	6.54	79.35	62.5	75	216.849	Medium
292	1.4023	Shale Hills Woodland	0.0453	6.05	12.92	21.63	40.60	100	25	165.603	Medium
297	1.6430	Alluvial Woodland	0.0374	30.24	36.03	28.46	94.73	100	50	244.729	Medium
299	1.1730	Alluvial Woodland	0.0521	32.46	33.91	16.92	83.29	75	75	233.293	Medium
300	0.9730	Shale Plains Woodland	0.0517	0.00	12.92	14.62	27.54	100	50	177.535	Medium
301	1.1455	Shale Hills Woodland	0.0573	11.69	35.03	14.13	60.86	150	75	285.860	Medium
302	4.5328	Shale Plains Woodland	0.0329	25.60	34.20	40.87	100.67	125	75	300.669	High
303	0.7882	Shale Plains Woodland	0.0783	27.02	12.92	7.12	47.05	100	25	172.051	Medium
306	3.6532	Shale Plains Woodland	0.0323	16.13	34.84	40.19	91.16	100	50	241.161	Medium
308	1.8137	Shale Plains Woodland	0.0494	19.35	12.92	22.69	54.97	100	25	179.967	Medium

Site ID (Note 1)	Area	Vegetation Type	Perimeter / Area Ratio	Connectivity Score	Structural Score	GeoSpatial Score	Functional Conservation Value	Threatened Species Value	Recovery Potential Value	Total Ecological Value	Vegetation Community Quality
313	1.0473	Shale Plains Woodland	0.0527	23.99	31.06	14.81	69.86	100	50	219.857	Medium
315	1.4513	Shale Plains Woodland	0.0512	27.62	12.92	19.81	60.35	100	25	185.349	Medium
316	0.5570	Shale Plains Woodland	0.0549	5.04	17.02	9.04	31.10	100	50	181.098	Medium
319	0.5588	Shale Hills Woodland	0.0529	40.20	35.80	10.10	86.10	100	100	286.097	Medium
323	0.5560	Shale Plains Woodland	0.0491	0.20	12.92	11.83	24.95	100	25	149.949	Low
326	3.6029	Shale Plains Woodland	0.0386	7.66	32.12	35.58	75.35	100	75	250.354	Medium
327	1.3610	Shale Plains Woodland	0.0407	3.63	12.92	23.65	40.20	100	25	165.203	Medium
329	0.6970	Alluvial Woodland	0.0581	2.02	36.92	9.13	48.07	87.5	75	210.574	Medium
330	1.1160	Shale Plains Woodland	0.0424	1.81	36.22	20.00	58.03	100	100	258.032	Medium
331	0.6058	Shale Plains Woodland	0.0559	3.02	36.22	9.04	48.28	100	100	248.281	Medium

Site ID (Note 1)	Area	Vegetation Type	Perimeter / Area Ratio	Connectivity Score	Structural Score	GeoSpatial Score	Functional Conservation Value	Threatened Species Value	Recovery Potential Value	Total Ecological Value	Vegetation Community Quality
334	0.7620	Shale Plains Woodland	0.0492	5.44	34.42	13.65	53.52	100	25	178.520	Medium
359	1.4082	Shale Plains Woodland	0.0365	20.97	30.00	27.31	78.28	100	75	253.275	Medium
360	0.5399	Shale Plains Woodland	0.0575	11.69	30.00	7.79	49.48	100	50	199.482	Medium
361	1.3196	Shale Hills Woodland	0.0416	44.15	29.55	22.31	96.01	100	50	246.012	Medium
362	1.5774	Shale Plains Woodland	0.0315	6.85	30.87	32.21	69.93	100	50	219.932	Medium
363	1.5480	Alluvial Woodland	0.0463	37.30	28.08	22.60	87.97	62.5	75	225.471	Medium
364	1.6139	Shale Plains Woodland	0.0409	7.46	12.92	25.58	45.96	100	25	170.957	Medium
365	1.8387	Shale Plains Woodland	0.0350	3.23	42.34	31.25	76.82	100	100	276.816	Medium
366	3.6529	Shale Hills Woodland	0.0319	18.75	35.16	40.58	94.49	100	125	319.487	High

Site ID (Note 1)	Area	Vegetation Type	Perimeter / Area Ratio	Connectivity Score	Structural Score	GeoSpatial Score	Functional Conservation Value	Threatened Species Value	Recovery Potential Value	Total Ecological Value	Vegetation Community Quality
367a[1]	1.3790	Alluvial Woodland	0.0351	13.71	19.55	27.88	61.15	80	50	191.146	Medium
367b[1]	0.4935	Alluvial Woodland	0.0745	13.71	19.55	4.71	37.97	80	50	167.973	Medium
368	0.0676	Shale Hills Woodland	0.2072	1.61	12.92	0.19	14.73	100	25	139.725	Low
369	1.7236	Shale Plains Woodland	0.0306	29.23	26.83	33.46	89.52	100	100	289.522	Medium
370	1.4111	Shale Plains Woodland	0.0367	38.51	35.32	27.21	101.04	125	150	376.040	High
371	3.5819	Shale Plains Woodland	0.0257	43.75	21.06	43.94	108.75	125	25	258.750	Medium
372	3.3043	Shale Plains Woodland	0.0270	19.76	21.41	41.92	83.09	100	25	208.091	Medium
373	3.3293	Shale Hills Woodland	0.0248	4.03	33.14	43.17	80.35	100	75	255.346	Medium
374	0.9020	Shale Hills	0.0411	9.68	27.31	18.65	55.64	100	75	230.639	Medium

[1] The Connectivity Scores were assigned considering these vegetation areas as one. The area separating these two vegetation areas is minimal. If the two areas were considered as discrete communities, the difference between Connectivity Scores would

Site ID (Note 1)	Area	Vegetation Type	Perimeter / Area Ratio	Connectivity Score	Structural Score	GeoSpatial Score	Functional Conservation Value	Threatened Species Value	Recovery Potential Value	Total Ecological Value	Vegetation Community Quality
		Woodland									
375	1.1054	Shale Plains Woodland	0.0558	32.06	19.87	13.94	65.87	100	50	215.871	Medium
376	1.1498	Shale Plains Woodland	0.0395	38.71	32.53	22.98	94.22	100	100	294.223	Medium
377	0.6396	Shale Plains Woodland	0.0596	5.65	36.92	8.08	50.65	100	50	200.645	Medium
378	2.9246	Shale Plains Woodland	0.0295	27.82	25.93	40.10	93.85	100	25	218.848	Medium
379	2.1474	Shale Plains Woodland	0.0271	37.70	35.32	37.40	110.43	125	25	260.426	Medium
380	0.4360	Shale Plains Woodland	0.0937	21.17	12.92	2.31	36.40	100	25	161.397	Medium
381	1.0401	Shale Hills Woodland	0.0395	7.86	30.16	21.35	59.37	100	75	234.369	Medium
382	0.9881	Shale Plains Woodland	0.0430	5.24	25.84	18.37	49.45	100	50	199.447	Medium
383	0.8419	Shale Plains Woodland	0.0536	10.28	12.92	12.31	35.51	100	25	160.510	Medium

Site ID (Note 1)	Area	Vegetation Type	Perimeter / Area Ratio	Connectivity Score	Structural Score	GeoSpatial Score	Functional Conservation Value	Threatened Species Value	Recovery Potential Value	Total Ecological Value	Vegetation Community Quality
384	0.6216	Shale Plains Woodland	0.0656	10.48	12.92	6.83	30.23	100	25	155.231	Medium
385	1.9023	Alluvial Woodland	0.0359	11.09	42.69	31.15	84.93	62.5	100	247.435	Medium
386	1.9901	Shale Plains Woodland	0.0531	0.20	12.92	21.73	34.85	100	25	159.852	Medium
387	0.8363	Shale Hills Woodland	0.0499	15.93	35.80	13.94	65.67	100	75	240.671	Medium
398	2.6301	Shale Plains Woodland	0.0292	48.99	50.00	39.04	138.03	125	125	388.030	High
404	2.3531	Shale Hills Woodland	0.0295	47.18	50.00	37.21	134.39	125	125	384.389	High
405	5.1124	Alluvial Woodland	0.0245	49.19	50.00	46.35	145.54	105	125	375.540	High
411	1.3923	Shale Hills Woodland	0.0362	41.33	29.55	27.31	98.19	100	50	248.190	Medium
412	1.9159	Alluvial Woodland	0.0409	39.31	32.82	27.12	99.25	105	100	304.250	High
414	2.3070	Shale Plains Woodland	0.0262	14.72	30.93	38.37	84.01	100	50	234.013	Medium

Site ID (Note 1)	Area	Vegetation Type	Perimeter / Area Ratio	Connectivity Score	Structural Score	GeoSpatial Score	Functional Conservation Value	Threatened Species Value	Recovery Potential Value	Total Ecological Value	Vegetation Community Quality
417	0.2576	Shale Hills Woodland	0.1294	15.52	12.92	0.87	29.31	100	25	154.310	Medium
421	2.3823	Shale Plains Woodland	0.0286	30.65	37.40	38.27	106.32	125	100	331.318	High
427	0.4667	Shale Plains Woodland	0.0959	18.95	67.56	2.60	89.11	150	75	314.112	High
431	0.6933	Alluvial Woodland	0.0497	16.94	39.55	12.79	69.28	80	75	224.275	Medium
432	0.7026	Shale Plains Woodland	0.0631	20.77	19.87	7.98	48.62	100	50	198.619	Medium
434	1.1653	Alluvial Woodland	0.0660	40.12	21.83	12.21	74.16	80	25	179.159	Medium
437	0.9493	Alluvial Woodland	0.0788	39.52	38.59	8.65	86.76	100	75	261.760	Medium
441	0.9260	Alluvial Woodland	0.0660	25.00	34.78	9.42	69.20	75	25	169.199	Medium
485	2.4708	Shale Plains Woodland	0.0326	44.76	50.00	35.77	130.53	125	125	380.527	High
494	3.3034	Shale Plains Woodland	0.0308	22.78	40.80	39.33	102.91	125	75	302.911	High

Site ID (Note 1)	Area	Vegetation Type	Perimeter / Area Ratio	Connectivity Score	Structural Score	GeoSpatial Score	Functional Conservation Value	Threatened Species Value	Recovery Potential Value	Total Ecological Value	Vegetation Community Quality
496	2.6481	Shale Plains Woodland	0.0572	38.31	40.80	23.37	102.47	125	100	327.473	High
500	0.5692	Shale Plains Woodland	0.0533	35.28	29.55	10.00	74.83	100	50	224.834	Medium
503	0.8848	Alluvial Woodland	0.0658	33.27	32.82	9.04	75.13	100	100	275.125	Medium
505	2.3920	Shale Plains Woodland	0.0260	32.66	24.46	39.42	96.54	100	100	296.539	Medium
508	0.2509	Shale Plains Woodland	0.0924	20.56	12.92	1.25	34.73	100	25	159.735	Medium
509	1.2356	Shale Plains Woodland	0.0554	16.53	30.19	15.67	62.40	100	50	212.398	Medium
516	2.0780	Shale Plains Woodland	0.0319	26.61	24.10	34.52	85.23	100	75	260.235	Medium
517	2.1226	Shale Plains Woodland	0.0522	43.55	12.92	22.69	79.16	100	25	204.161	Medium
519	0.4690	Shale Plains Woodland	0.0641	48.39	43.75	5.38	97.52	100	100	297.522	Medium
527	0.4117	Shale Plains Woodland	0.0677	18.55	15.00	3.75	37.30	100	25	162.298	Medium

Site ID (Note 1)	Area	Vegetation Type	Perimeter / Area Ratio	Connectivity Score	Structural Score	GeoSpatial Score	Functional Conservation Value	Threatened Species Value	Recovery Potential Value	Total Ecological Value	Vegetation Community Quality
532	0.6765	Shale Plains Woodland	0.0501	1.41	28.14	12.31	41.86	100	25	166.860	Medium
536	2.9006	Shale Hills Woodland	0.0281	32.26	24.81	40.67	97.74	100	25	222.739	Medium
537	2.2788	Alluvial Woodland	0.0411	46.37	27.60	28.08	102.04	100	25	227.044	Medium
540	2.2477	Shale Plains Woodland	0.0366	31.65	21.06	31.54	84.25	125	75	284.249	Medium
541	2.9354	Shale Plains Woodland	0.0482	24.19	34.01	28.75	86.95	100	50	236.954	Medium
546	1.6799	Shale Plains Woodland	0.0585	27.22	35.45	18.08	80.74	100	75	255.743	Medium
547	0.8160	Shale Plains Woodland	0.0605	33.67	12.92	9.52	56.11	100	25	181.109	Medium
548	0.4415	Shale Plains Woodland	0.0839	6.75	12.92	3.08	22.75	100	50	172.748	Medium
550	4.2986	Alluvial Woodland	0.0364	46.17	43.53	38.37	128.06	125	100	353.060	High
551	3.3412	Shale Plains Woodland	0.0409	34.91	12.92	32.79	80.62	100	75	255.620	Medium

Site ID (Note 1)	Area	Vegetation Type	Perimeter / Area Ratio	Connectivity Score	Structural Score	GeoSpatial Score	Functional Conservation Value	Threatened Species Value	Recovery Potential Value	Total Ecological Value	Vegetation Community Quality
553	1.5228	Shale Hills Woodland	0.0540	17.42	36.63	18.94	73.00	100	100	272.999	Medium
558	0.8447	Shale Hills Woodland	0.0615	25.81	33.72	9.52	69.04	100	75	244.044	Medium
567	0.5351	Shale Plains Woodland	0.0555	12.50	36.63	8.46	57.60	100	100	257.596	Medium
569	2.5154	Shale Plains Woodland	0.0240	27.16	36.63	41.15	104.94	100	100	304.944	High
582	1.3492	Shale Plains Woodland	0.0367	31.25	30.00	26.15	87.40	125	50	262.404	Medium
583	1.2237	Shale Plains Woodland	0.0462	41.94	30.00	19.62	91.55	125	75	291.551	Medium
584	4.0210	Shale Plains Woodland	0.0249	27.42	31.35	44.81	103.57	125	125	353.573	High
585	1.8590	Shale Hills Woodland	0.0524	25.40	28.01	21.63	75.05	100	50	225.051	Medium
586	8.2150	Shale Plains Woodland	0.0289	49.40	32.60	45.10	127.09	125	100	352.088	High
587	1.1444	Shale Plains Woodland	0.0452	10.89	28.01	19.52	58.42	100	25	183.419	Medium

Site ID (Note 1)	Area	Vegetation Type	Perimeter / Area Ratio	Connectivity Score	Structural Score	GeoSpatial Score	Functional Conservation Value	Threatened Species Value	Recovery Potential Value	Total Ecological Value	Vegetation Community Quality
588	2.0160	Alluvial Woodland	0.0385	6.25	25.22	29.42	60.90	62.5	50	173.397	Medium
589	1.1151	Shale Hills Woodland	0.0382	21.57	36.35	23.08	81.00	100	100	280.996	Medium
590	4.5212	Shale Plains Woodland	0.0263	41.13	27.53	44.71	113.37	125	75	313.373	High
591	2.8013	Shale Plains Woodland	0.0307	46.57	12.92	38.46	97.95	100	25	222.951	Medium
593	1.2588	Shale Hills Woodland	0.0360	31.05	12.92	26.44	70.41	100	25	195.411	Medium
594	6.4552	Shale Plains Woodland	0.0277	29.44	50.00	45.10	124.53	125	100	349.532	High
595	3.4698	Shale Plains Woodland	0.0320	11.90	22.18	39.81	73.88	100	25	198.882	Medium
596	3.3832	Alluvial Woodland	0.0261	37.10	34.13	43.08	114.31	125	100	339.308	High
597	0.6699	Shale Hills Woodland	0.0824	32.86	12.92	5.48	51.26	100	25	176.264	Medium
598	0.8262	Shale Hills Woodland	0.0596	34.07	29.42	9.81	73.30	100	75	248.303	Medium

Site ID (Note 1)	Area	Vegetation Type	Perimeter / Area Ratio	Connectivity Score	Structural Score	GeoSpatial Score	Functional Conservation Value	Threatened Species Value	Recovery Potential Value	Total Ecological Value	Vegetation Community Quality
599	1.5320	Shale Hills Woodland	0.0344	8.87	24.10	30.00	62.97	100	75	237.974	Medium
600	2.3525	Shale Plains Woodland	0.0465	20.16	36.57	26.15	82.89	100	75	257.886	Medium
601	5.2056	Shale Plains Woodland	0.0237	8.67	36.63	46.73	92.03	100	125	317.035	High
602	0.2819	Alluvial Woodland	0.0776	17.54	12.92	2.60	33.06	62.5	25	120.556	Low
603	0.4469	Alluvial Woodland	0.0643	17.74	12.92	4.90	35.57	75	25	135.566	Low
604	0.8907	Alluvial Woodland	0.0586	35.69	38.30	10.87	84.85	100	75	259.852	Medium
605	0.4721	Shale Plains Woodland	0.0878	35.08	12.92	3.27	51.27	100	25	176.270	Medium
606	1.3339	Shale Plains Woodland	0.0438	39.11	25.16	21.54	85.81	100	75	260.812	Medium
607	2.6846	Shale Plains Woodland	0.0455	29.64	23.69	28.75	82.07	125	50	257.073	Medium
608	1.4358	Shale Plains Woodland	0.0391	39.72	12.92	25.96	78.60	100	25	203.599	Medium

Site ID (Note 1)	Area	Vegetation Type	Perimeter / Area Ratio	Connectivity Score	Structural Score	GeoSpatial Score	Functional Conservation Value	Threatened Species Value	Recovery Potential Value	Total Ecological Value	Vegetation Community Quality
609	1.0122	Alluvial Woodland	0.0509	43.95	26.41	15.38	85.75	100	100	285.747	Medium
610	2.3932	Shale Plains Woodland	0.0801	33.47	25.84	18.75	78.06	100	50	228.058	Medium
612	0.7314	Shale Plains Woodland	0.0609	35.89	12.92	8.85	57.65	100	25	182.653	Medium
613	4.2358	Shale Plains Woodland	0.0303	19.15	34.13	42.21	95.50	100	75	270.499	Medium
614	2.8500	Alluvial Woodland	0.0402	9.27	31.06	32.12	72.45	75	50	197.447	Medium
615	3.3695	Shale Plains Woodland	0.0292	13.91	23.97	41.44	79.33	100	50	229.328	Medium
616	4.6449	Alluvial Woodland	0.0228	26.41	40.67	46.83	113.91	115	75	303.911	High
617	31.4768	Shale/Gravel Transition Forest	0.0083	49.80	50.00	49.71	149.51	115	125	389.510	High
623	12.7041	Alluvial Woodland	0.0158	42.74	30.00	48.85	121.59	140	75	336.588	High
626	9.7228	Alluvial Woodland	0.0241	45.77	50.00	47.60	143.36	140	125	408.362	High

Site ID (Note 1)	Area	Vegetation Type	Perimeter / Area Ratio	Connectivity Score	Structural Score	GeoSpatial Score	Functional Conservation Value	Threatened Species Value	Recovery Potential Value	Total Ecological Value	Vegetation Community Quality
648	1.1325	Shale Hills Woodland	0.0391	46.98	50.00	22.88	119.86	125	125	369.860	High
652	2.5288	Shale Plains Woodland	0.0419	47.98	35.32	29.81	113.11	125	100	338.112	High
658	4.0749	Shale Plains Woodland	0.0308	40.93	31.89	41.73	114.55	125	50	289.549	Medium
674	9.0502	Shale Plains Woodland	0.0191	36.29	12.92	48.17	97.38	100	25	222.383	Medium
675	3.5928	Shale Plains Woodland	0.0303	41.53	32.34	41.35	115.22	125	25	265.218	Medium
679	4.0337	Shale Hills Woodland	0.0234	32.17	36.63	45.96	114.77	100	100	314.766	High
681	2.3736	Shale Plains Woodland	0.0355	24.80	35.03	33.37	93.20	100	75	268.196	Medium
699	0.2857	Shale Hills Woodland	0.1303	20.36	29.04	1.06	50.46	100	75	225.459	Medium
700	1.8313	Shale Plains Woodland	0.0320	19.96	39.97	33.17	93.10	100	50	243.101	Medium
701	0.9148	Alluvial Woodland	0.0894	34.68	12.92	7.60	55.19	62.5	25	142.694	Low

Site ID (Note 1)	Area	Vegetation Type	Perimeter / Area Ratio	Connectivity Score	Structural Score	GeoSpatial Score	Functional Conservation Value	Threatened Species Value	Recovery Potential Value	Total Ecological Value	Vegetation Community Quality
702	1.3480	Shale Hills Woodland	0.0381	28.43	26.06	25.38	79.87	100	25	204.870	Medium
703	4.3088	Alluvial Woodland	0.0235	41.73	37.53	46.25	125.52	105	150	380.516	High
704	3.9748	Shale Plains Woodland	0.0334	48.59	43.75	39.81	132.15	125	100	357.146	High
705	1.8119	Shale Plains Woodland	0.0484	45.36	37.82	23.17	106.36	125	100	331.356	High
706	3.4500	Shale Plains Woodland	0.0331	8.27	19.10	38.94	66.31	100	25	191.311	Medium
707	1.3983	Shale Plains Woodland	0.0383	36.49	25.38	25.67	87.55	100	100	287.550	Medium
708	3.0510	Alluvial Woodland	0.0248	33.87	36.92	42.50	113.29	125	100	338.294	High
709	3.2247	Alluvial Woodland	0.0280	34.48	34.42	41.35	110.25	87.5	75	272.745	Medium
710	1.2531	Shale Hills Woodland	0.0408	13.51	25.29	22.69	61.49	100	25	186.489	Medium
711	1.8538	Shale Plains Woodland	0.0316	31.45	35.32	33.65	100.43	125	50	275.426	Medium

Site ID (Note 1)	Area	Vegetation Type	Perimeter / Area Ratio	Connectivity Score	Structural Score	GeoSpatial Score	Functional Conservation Value	Threatened Species Value	Recovery Potential Value	Total Ecological Value	Vegetation Community Quality
712	0.2822	Shale Plains Woodland	0.0745	4.23	12.92	2.98	20.13	75	25	120.135	Low
713	0.4107	Shale Plains Woodland	0.0611	15.12	25.77	5.10	45.99	100	25	170.986	Medium
714	3.3205	Shale Hills Woodland	0.0299	36.09	28.30	40.38	104.77	125	75	304.775	High
716	1.0239	Shale Plains Woodland	0.0422	37.50	39.26	19.23	95.99	100	125	320.994	High
717	0.4530	Shale Plains Woodland	0.0762	26.01	20.77	3.85	50.62	100	50	200.623	Medium
718	1.0416	Alluvial Woodland	0.0545	28.02	35.61	14.13	77.77	87.5	50	215.268	Medium
720	5.5354	Shale Plains Woodland	0.0271	44.96	50.00	45.10	140.06	125	125	390.056	High
734	2.8664	Shale Plains Woodland	0.0296	47.38	50.00	39.62	136.99	125	125	386.994	High
758	1.4205	Shale Plains Woodland	0.0443	37.90	31.89	22.60	92.39	100	50	242.390	Medium
759a	3.5567	Alluvial Woodland	0.0339	48.79	25.99	38.94	113.73	130	100	343.726	High

Site ID (Note 1)	Area	Vegetation Type	Perimeter / Area Ratio	Connectivity Score	Structural Score	GeoSpatial Score	Functional Conservation Value	Threatened Species Value	Recovery Potential Value	Total Ecological Value	Vegetation Community Quality
759b	1.5125	Alluvial Woodland	0.0593	48.79	12.92	16.83	78.54	125	0	203.537	Medium
760	7.9178	Alluvial Woodland	0.0157	46.77	42.28	48.27	137.32	105	125	367.319	High
761	1.7331	Shale Hills Woodland	0.0366	17.34	22.79	29.52	69.65	100	25	194.646	Medium
762	1.0094	Shale Plains Woodland	0.0521	36.69	39.49	14.71	90.89	100	100	290.892	Medium
763	2.3526	Shale Plains Woodland	0.0302	36.90	31.41	36.63	104.94	125	100	329.940	High
777	2.4507	Shale Plains Woodland	0.0368	48.19	25.99	32.69	106.87	125	100	331.871	High
778	18.0367	Alluvial Woodland	0.0134	45.97	50.00	49.33	145.29	115	125	385.295	High
779	21.4404	Alluvial Woodland	0.0237	0.00	47.58	48.37	95.95	150	100	345.946	High
782	17.6023	Alluvial Woodland	0.0168	50.00	50.00	48.75	148.75	115	125	388.750	High
787	7.8242	Alluvial Woodland	0.0291	45.56	43.40	44.81	133.77	140	100	373.770	High

Site ID (Note 1)	Area	Vegetation Type	Perimeter / Area Ratio	Connectivity Score	Structural Score	GeoSpatial Score	Functional Conservation Value	Threatened Species Value	Recovery Potential Value	Total Ecological Value	Vegetation Community Quality
788	2.6525	Shale Plains Woodland	0.0405	38.10	44.36	31.35	113.81	150	100	363.810	High
789	7.6764	Shale Plains Woodland	0.0382	39.92	40.26	38.27	118.45	125	100	343.445	High
790	3.9215	Shale Plains Woodland	0.0344	42.54	39.78	39.13	121.45	150	100	371.451	High
791	1.0820	Shale Plains Woodland	0.0549	0.20	29.07	14.13	43.41	100	50	193.407	Medium
792	2.3255	Shale Hills Woodland	0.0438	21.37	12.92	27.50	61.79	100	25	186.791	Medium
793	2.5031	Shale Plains Woodland	0.0322	33.47	31.83	36.35	101.64	125	125	351.641	High
794	3.3814	Alluvial Woodland	0.0439	42.34	12.92	31.63	86.89	75	25	186.893	Medium
795	3.0677	Shale Plains Woodland	0.0334	22.58	38.24	37.69	98.51	100	75	273.510	Medium
796	2.9191	Shale Plains Woodland	0.0421	44.56	12.92	31.15	88.63	100	25	213.630	Medium
797	2.8565	Shale Plains Woodland	0.0322	21.77	12.92	37.69	72.39	100	25	197.387	Medium

Site ID (Note 1)	Area	Vegetation Type	Perimeter / Area Ratio	Connectivity Score	Structural Score	GeoSpatial Score	Functional Conservation Value	Threatened Species Value	Recovery Potential Value	Total Ecological Value	Vegetation Community Quality
798	3.3794	Shale Plains Woodland	0.0247	30.44	35.32	43.65	109.42	125	50	284.418	Medium
991	9.4840	Shale Plains Woodland	0.0326	46.20	12.92	42.60	101.72	100	75	276.716	Medium
1213	4.9868	Shale Hills Woodland	0.0340	39.62	36.63	40.58	116.83	150	125	391.829	High
1214	8.2336	Shale Plains Woodland	0.0166	37.61	36.63	48.27	122.52	100	125	347.517	High
1215	2.4018	Shale Plains Woodland	0.0291	0.00	36.63	38.27	74.90	100	100	274.904	Medium

Note 1: Site ID refers to sites shown in Figures 1 and 2 of this appendix. Only those sites wholly within the study site and assessed by Cardno during fieldwork are included within this table.

Appendix O

Water Quality Sampling Results

Water quality measurements taken *in situ* at 13 sites within the Study Area (Recorded by Cardno Ecology Lab 19/08/10).

Site	Waterway	Replicate	Temperature (°C)	Conductivity (µs/cm)	Salinity (ppt)	pH	ORP (mV)	Dissolved Oxygen (% sat.)	Dissolved Oxygen (mg/L)	Turbidity (NTU)	Turbidity (NTU)	Turbidity (NTU)
1	Bonds Creek	1	10.82	3235	1.64	7.47	425	50.5	5.5	20.2	20.0	20.0
		2	10.81	3241	1.64	7.46	424	49.7	5.5	20.0	19.7	19.2
2	Bonds Creek	1	10.97	1887	0.89	7.68	423	71.2	7.8	8.4	8.6	8.6
		2	10.94	1889	0.89	7.67	423	67.9	7.4	8.1	8.4	8.6
3	Scalabrini Creek	1	11.78	2085	0.98	7.71	421	61.3	6.5	44.8	45.2	45.0
		2	11.77	2055	0.98	7.70	421	60.2	6.4	44.3	44.5	44.8
4	Kemps Creek	1	12.35	2687	1.31	7.77	427	82.1	8.7	15.8	16.0	15.1
		2	12.32	2678	1.31	7.76	425	75.0	7.9	14.6	13.9	14.2
5	Kemps Creek	1	12.04	3527	1.82	7.60	422	81.0	8.7	3.9	3.9	3.9
		2	12.02	3542	1.82	7.57	422	77.8	8.5	8.8	8.8	9.0
6	Bonds Creek	1	12.71	2459	1.18	7.62	407	59.5	6.1	6.0	6.3	6.4
		2	12.70	2470	1.21	7.61	407	57.9	6.0	6.0	6.0	6.3
7	Bonds Creek	1	14.09	2334	1.11	7.86	406	106.5	10.9	12.1	13.5	13.0
		2	14.08	2332	1.14	7.85	406	103.6	10.8	12.3	12.1	13.0
8	Bonds Creek	1	13.93	3094	1.56	7.87	419	99.4	10.1	8.1	7.4	7.2
		2	13.94	3094	1.56	7.85	419	97.3	10.0	7.4	8.6	7.7
9	Unnamed	1	13.99	944	0.37	7.52	404	50.3	5.1	21.6	22.5	21.2
		2	13.98	640	0.37	7.91	402	48.1	5.0	21.6	21.1	21.3
10	Unnamed	1	14.09	980	0.39	7.66	409	92.2	9.4	39.7	39.2	38.4
		2	14.08	981	0.39	7.65	409	85.0	8.6	38.3	38.7	38.7
11	Bonds Creek	1	15.20	3317	1.68	7.81	418	79.8	7.9	6.7	6.3	6.7
		2	15.19	3318	1.70	7.81	418	76.8	7.5	6.7	6.5	7.0
12	Kemps Creek	1	13.10	3366	1.71	7.62	422	64.8	6.7	12.3	12.8	12.8
		2	13.08	3369	1.71	7.61	422	60.1	6.2	12.8	12.8	11.8
13	Unnamed	1	15.27	2169	1.05	7.73	421	74.2	7.5	2.8	2.6	2.8

Appendix P

Threatened Aquatic Species Likelihood of Occurrence

The table below presents a summary of the ecological characteristics of the threatened aquatic species identified as potentially occurring on site and a subsequent likelihood of occurrence.

Species	Ecology*	Likelihood of Occurrence
Macquarie Perch (***Macquaria australasica***)	Macquarie perch is listed as endangered under the EPBC Act and as vulnerable under the FM Act. There are two distinct populations of Macquarie perch in NSW, a western form found in the Murray-Darling Basin, and an eastern form found in south-eastern coastal NSW, including the Hawkesbury-Nepean catchment (DPI 2005). Macquarie perch have also been translocated into a number of river systems. Macquarie perch usually inhabit the upper reaches of clear, freshwater courses containing deep, rocky pools with upstream riffle and pool sequences for spawning (DPI 2005). They migrate upstream to spawn in October - November and their eggs settle and develop in the gravel and cobble found in riffle habitat. The distribution of the eastern form can also be a function of interactions with other species. For example, if Australian bass are found in a watercourse then typically Macquarie perch will generally only be found upstream of the bass population (McDowall 1996). Macquarie perch is threatened by: ▪ Changes in water quality associated with agriculture and forestry; ▪ Modification of natural river flows and temperatures as a result of the construction of dams and weirs; ▪ Spawning failures resulting from cold water releases from dams; ▪ Competition from introduced fish species;	Given the altitude, presence of instream barriers, modifications to the natural flow regimes and the degraded state of the aquatic habitat the chance of Macquarie perch occurring within the Study Area is considered extremely low.

Species	Ecology*	Likelihood of Occurrence
	▪ Diseases, such as epizootic haematopoietic necrosis, which is carried by redfin perch; and ▪ Over-fishing in the past. Australian bass are relatively common within the lower elevation reaches of the Hawkesbury – Nepean system, the furthest downstream record of Macquarie perch from the Nepean River, however, is from just below Pheasants Nests Weir (60 km south at 160 m AHD).	
Australian Grayling (***Prototroctes maraena***)	Australian grayling is listed as vulnerable under the *EPBC Act* and as a protected species by the *FM Act*. Australian grayling (*P. maraena*) prefer watercourses with low turbidity and gravel substrata, and occupy lowland rivers through to high elevation reaches at 1000 m AHD (McDowall 1996). Grayling occur in streams and rivers on the eastern and southern flanks of the Great Dividing Range from Sydney southwards to the Otway Ranges in Victoria, and in Tasmania (McDowall 1996, DPI 2006). The species has an amphidromous life cycle; newly-hatched larvae are photo tactic and swim to the surface where they are swept downstream to estuarine/marine waters. They only migrate back to adult freshwater habitats at the age of 6 months. Populations are therefore very susceptible to barriers to passage. Adults suffer heavy post-spawning mortality so it is possible after a few years without juvenile recruitment, that local populations will become extinct (Morris *et al.*, 2001). Threats to Australian grayling include:	It is extremely unlikely that Australian grayling inhabit the Study Area. The Hawkesbury – Nepean drainage system represents the northern extent of the grayling's historical distribution. Despite considerable sampling within the region, the species has not been recorded from the catchment since the 1950s (Morris *et al.* 2001). It is likely that river regulation and habitat degradation are responsible for its disappearance.

Species	Ecology*	Likelihood of Occurrence
	▪ Construction of weirs and dams, which prevent downstream and upstream migration; ▪ Land clearing that degrades water quality and causes siltation; ▪ Smothering of gravel beds by fine sediment; ▪ Competition from the introduced brown trout.	
Southern (Giant) Barred Frog **(*Mixophyes iterates*)**	The southern barred frog is listed as endangered by the *EPBC Act*. The southern barred frog is a large, dark coloured frog that grows to 115 mm. Its historical distribution ranged from Belli Creek, south-east Queensland south to Warrimoo, in NSW's Blue Mountains (DSEWPC 2010a). It has suffered severe population declines in the southern portion of its range in the Sydney Basin and there are no recent records from the Blue Mountains. There are no records of southern barred frog from the Study Area. The Southern Barred Frog occurs along shallow rocky streams in rainforest, wet sclerophyll forest and farmland riparian strips, between 100 and 1000m or in deep, slow moving streams with steep banks in lowland areas (DSEWPC 2010). Populations have been found in disturbed areas with vegetated riparian strips on cattle farms and in regenerated logged areas. Threats to the southern barred frog include: ▪ Upstream clearing; ▪ Changes to flow regimes;	The degraded aquatic and riparian habitat within the Study Area is unlikely to support a viable population of southern barred frog.

Species	Ecology*	Likelihood of Occurrence
	▪ Degradation of water quality; ▪ Disturbance to riparian vegetation; ▪ Feral animals and domestic stock; and ▪ Weed invasion. Disturbance to riparian vegetation is particularly important and chytridiomycosis (infection with the chytrid fungus) may also have contributed to the decline of the species (DSEWPC 2010). Regional degradation of water quality, riparian vegetation and aquatic habitat has contributed to the disappearance of southern barred frog from the southern section of its range.	
Green and Golden Bell Frog **(*Litoria aurea*)**	The green and golden bell frog is listed as vulnerable under the *EPBC Act* and as endangered under the *TSC Act*. The green and golden bell frog ranges from 45 to 100 mm in length and has olive to emerald green colouration with brassy brown to gold splotches. The species is found mainly along coastal lowland areas of eastern NSW and Victoria. Its distribution ranges from Yuraygir National Park near Grafton, in northern NSW and south to Lakes Entrance in south-eastern Victoria. Since 1990, green and golden bell frogs have been recorded at approximately 50 locations in NSW, including the metropolitan areas of NSW, including some with disturbed habitats (DECC 2005a). There are no recorded populations from the Study Area but the species is known from the Cumberland sub-catchment of the Hawkesbury – Nepean Catchment Management Region	Potential habitat for this species occurs within the Study Area, however it has been degraded considerably. Mosquitofish were also highly abundant at every site surveyed, and are known to predate on this species. Although the possibility of the green and golden bell frog occurring within the Study Area is considered low, it is recommended that appropriate targeted surveys be carried out as a precautionary measure.

Species	Ecology*	Likelihood of Occurrence
	and the adjacent Sydney Metro Catchment Management Area. The green and golden bell frog inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as mosquitofish (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available. In NSW, the species commonly occupies disturbed habitats, and breeds largely in ephemeral ponds Major threats identified for the Green and Golden Bell Frog include (DEWHA 2009): ▪ habitat loss, fragmentation or degradation (including siltation, changes to aquatic vegetation diversity or structure reducing shelter, increased light and noise, grazing, mowing, fire); ▪ reduction in water quality (e.g. pollution, siltation and erosion); ▪ changes to hydrology (e.g. changes to drainage patterns or timing, duration or frequency of flood events); ▪ predation by exotic animals (e.g. mosquitofish, cats and foxes); ▪ disease (e.g. infection with chytrid fungus resulting in chytridiomycosis); and ▪ introduction or intensification of public access to Green and Golden Bell Frog habitats. Predation by Gambusia holbrooki (plague minnow)' has been listed as a key	

Species	Ecology*	Likelihood of Occurrence
	threatening process on Schedule 3 of the TSC Act as it has been implicated in the decline of a number of threatened Litorid frog species, including the green and golden bell frog. Breeding and persistence of populations has also been observed at locations where mosquitofish are present, suggesting that certain site conditions may reduce the impact of their predation (White and Pyke 2008).	
Growling Grass Frog **(*Litoria raniformis*)**	The growling grass frog, also known as the southern bell frog in NSW, is listed as vulnerable under the *EPBC Act* and as vulnerable under the *TSC Act*. The growling grass frog is one of the largest frog species in Australia, reaching up to 104 mm (DECC 2005b). It was historically distributed across a large area of south-east Australia, including NSW, Victoria, Tasmania and South Australia. In NSW, growling grass frog was once distributed along the Murray and Murrumbidgee Rivers and their tributaries, the southern slopes of the Monaro district and the central southern tablelands as far north as Tarana, near Bathurst. The species has experienced a pronounced decline in NSW and is currently only known to exist in isolated populations in the Coleambally Irrigation Area, the Lowbidgee floodplain and around Lake Victoria. Adults are usually found close to or in water or very wet areas in woodlands, shrublands, and open and disturbed areas. Eggs and tadpoles are found in permanent lakes, swamps, dams, and lagoons with still water.	The growling grass frog has not been recorded from the Study Area, and indeed, the Study Area appears to be outside the historical and existing range of the species. The identification of this species as potentially being present within the Kemps Creek catchment by the DSEWPC Environmental Reporting Tool may reflect an error in the database. The growling grass frog is considered unlikely to occur within the Study Area.
Giant Burrowing Frog	The giant burrowing frog is listed as vulnerable under the EBPC Act and	Giant burrowing frogs have not been observed in

Species	Ecology*	Likelihood of Occurrence
(***Heleioporus australicus***)	vulnerable under the *TSC Act*. The giant burrowing frog is a large, powerfully-built species that grows to approximately 10 cm in length. It is confined to the eastern slopes of the Great Dividing Range and coastal regions, and ranges from Wollemi National Park in NSW, south to Walhalla in the central highlands of eastern Victoria (DSEWPC 2010b). The species appears to exist as two distinct populations: the northern population is confined largely to the sandstone geology of the Sydney Basin and extends as far south as Ulladulla, and the southern population occurring from north of Narooma through to Walhalla, Victoria (DECC 2005c). The current taxonomy of this species is under investigation. The giant burrowing frog has been found from near sea level up to 1000 m, from the coast to almost 100 km inland. They are found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based (DECC 2005c). The frog spends 95 % of its time in burrows below the soil surface or in the leaf litter, but immediately before or after heavy rain move into nearby pools in first or second order streams to breed. Threats to the giant burrowing frog include: ▪ habitat loss through clearing for residential, agricultural and urban infrastructure development; ▪ reduction of water quality generally in the vicinity of urban development; ▪ climate change; ▪ disease (chytrid fungus);	the Study Area and the nearest record is 15 km to the west in the relatively undisturbed Gulguer Nature Reserve and the Bents Basin Conservation Area that borders the Nepean River. The Study Area has been substantially modified for small-scale agriculture and low-density residential purposes, resulting in degraded aquatic and riparian habitat and is potentially dominated by clay-based soils. As such the likelihood of the occurrence of giant burrowing frog within the Study Area is considered low, either due to a lack of suitable habitat or the highly modified nature of their preferred habitat.

Species	Ecology*	Likelihood of Occurrence
	▪ fragmentation of populations and consequent susceptibility to stochastic events; and ▪ forest disturbance associated with forestry operations.	
Tall Knotweed (***Persicaria elatior***)	Tall knotweed is listed as vulnerable under the *EPBC Act* and as vulnerable under the *TSC Act*. Tall knotweed grows on sandy, alluvial soil in swampy areas and riparian herblands along watercourses and lake edges. Associated plant species include *Melaleuca linarifolia*, *M. quinquenervia*, *Pseudognaphalium luteoalbum*, *Persicaria hydropiper* and *Floydia praealta*. Knotweed has been recorded in the North Coast, Central Coast, and South Coast botanical subdivisions of NSW (DEWHA 2008a). There are two records of the species from the Hawkesbury – Nepean drainage system and both are from the upper parts of the catchment at Picton Lakes and the upper Avon River catchment. Major threats to tall knotweed include localised disturbance from clearing, track maintenance and changes to hydrology (DECC 2005d).	Neither tall knotweed, nor its commonly associated plant species, were observed at any of the proposed works sites during targeted surveys. The likelihood of the occurrence of tall knotweed within the Study Area is considered low due to a lack of suitable habitat.
Red-crowned toadlet (***Pseudophryne australis***)	The red-crowned toadlet is listed as vulnerable under the *TSC Act*. The red-crowned toadlet is a small frog, usually measuring less than 30 mm long. The species is confined to the Sydney Basin, ranging from Pokolbin in the north to the Nowra area in the south, and west to Mt Victoria in the Blue Mountains (DECC 2005e). Red-crowned toadlets are found under rocks and in dense vegetation or leaf	It is considered unlikely that red-crowned toadlet inhabit the Study Area as their preferred habitat is either absent or significantly degraded. The Study Area contains relatively few distinct ridges and it has a relatively low-gradient geography and the geology is dominated by Wianamatta Shales (not Sandstone formations). Moreover, the riparian

Species	Ecology*	Likelihood of Occurrence
	litter beside ephemeral creeks and in wet drainage lines located below ridges in open forests (usually on Hawkesbury and Narrabeen Sandstones). The species is quite localised, as populations are restricted largely to the immediate vicinity of suitable breeding habitat. Breeding congregations occur in dense vegetation and debris beside ephemeral creeks (DECC 2005e). The eggs are laid in moist leaf litter, from where they are washed by heavy rain; a large proportion of the development of the tadpoles takes place in the egg. Breeding of red-crowned toadlets has not been observed in mildly polluted waters or those with a pH outside the range 5.5 to 6.5. Outside of the breeding period they are found under rocks and logs on sandstone ridges and forage amongst leaf-litter. Threats to red-crowned toadlet include: ▪ climate change; ▪ clearing of habitat, particularly along ridges; ▪ reduction in water quality flowing from ridges, particularly near urban areas; ▪ high frequency fire, resulting in changing vegetation structure and composition; ▪ collection of bush rock; and ▪ disease (chytrid fungus).	vegetation and bank structure along the waterways within the Study Area is highly degraded. Water quality is low at most sites, with conductivity levels outside the ANZECC and ARMCANZ threshold limits and pH levels at all sites surveyed are outside the preferred breeding range of the red-crowned toadlet.

Species	Ecology*	Likelihood of Occurrence
Sydney Hawk Dragonfly **(*Austrocordulia leonardi*)**	Historically the Sydney hawk dragonfly (*Austrocordulia leonardi*) was known from only a few sites, one of which was the Nepean River at Maldon Bridge near Wilton, which is located approximately 60 km south of the study area. Numbers of the Sydney hawk dragonfly have declined at the Maldon Bridge site, but it has since been recorded in the upper Hawkesbury-Nepean catchment at O'Hares Creek. This dragonfly spends most of its life as an aquatic larva, with adults emerging from the water and living for only a few weeks or months. The larvae appear to have specific habitat requirements and have been found only under rocks in deep, cool, shady pools (DPI 2007b). This species is threatened by: ▪ River regulation and changes in flows that cause the disappearance of natural deep pools; ▪ Habitat degradation associated with removal of riparian vegetation, drainage works and sedimentation; ▪ Water pollution and sedimentation due to land clearing, waste disposal and stormwater runoff from urban, industrial and agricultural development in the catchment; and ▪ Chance events such as natural disasters (drought) that eliminate the remaining local populations.	The Sydney hawk dragonfly was not identified from macroinvertebrate samples taken during the current survey. Given previous dragonfly sampling has failed to find specimens in the area and the considerable local disturbance to waterways, it is considered highly unlikely that the species occurs in the Study Area.
Adam's emerald	Adam's emerald dragonfly has only been collected at four localities in NSW,	Adam's emerald dragonfly was not collected in the

Species	Ecology*	Likelihood of Occurrence
dragonfly (***Archaeophya adamsi***)	one of which was Bedford Creek in the Lower Blue Mountains. Bedford Creek flows into Erskine Creek which eventually discharges into the Nepean River downstream of the Warragamba River and Nepean River confluence. The aquatic larvae of Adam's emerald dragonfly were found in small creeks with gravel or sandy bottoms, in narrow, shaded riffle zones with moss and rich riparian vegetation (DPI 2009). Adam's emerald dragonfly larvae live for 7 years or so and undergo various moults before metamorphosing into adults. Adult dragonflies generally fly away from the water to mature before returning to breed. Males congregate at breeding sites and often guard a territory. Females probably lay their eggs into the water (DPI 2009). Threats to this species include: ▪ Habitat degradation resulting from the loss of riparian vegetation and drainage works; ▪ Water pollution and siltation due to land clearing, waste disposal and stormwater runoff from urban, industrial and agricultural development in the catchment; ▪ Chance events such as natural disasters.	Study Area during the current survey. Given the species' rarity, the absence of suitable habitat within the Study Area and the considerable disturbance within the catchment, it is considered extremely unlikely that Adam's emerald dragonfly inhabits the Study Area or that suitable habitat for them occurs in the Study Area. Protected Species and Habitats
Stuttering Frog (***Mixophyes balbus***)	Stuttering Barred Frogs occur along the east coast of Australia from southern Queensland to north-eastern Victoria. It is thought to have disappeared from Victoria and to have undergone considerable range contraction in NSW, particularly in south-east NSW. It is the only *Mixophyes* species that occurs in south-east NSW and in recent surveys it has only been recorded at three	The degraded aquatic and riparian habitat within the Study Area does not represent core habitat for this species is unlikely to support a viable population of stuttering frog.

Species	Ecology*	Likelihood of Occurrence
	locations south of Sydney. The Dorrigo region, in north-east NSW maintains the largest populations (DECC, 2005f). The species is typically found within rainforest, and wet, tall open forest on the eastern side of the dividing range. As such they prefer thick lead litter and dense understorey vegetation. Breeding occurs within streams with eggs laid on rock shelves or riffles in small, flowing streams. Threats to this species include: ▪ Modification and loss of habitat. ▪ Changes to natural water flows and water quality. ▪ Predation of eggs and tadpoles by introduced fish. ▪ Disease - chytrid fungus.	
Heath Frog **(*Litoria littlejohni*)**	Littlejohn's Tree Frog is confined to eastern New South Wales and north-east Victoria. The Frog occurs in scattered locations between the Watagan Mountains, New South Wales, to Buchan in Victoria. Despite its very large distribution there are very few records of Littlejohn's Tree Frog, and it is one of the least known frogs in New South Wales (DEWHA 2008b). The species is not associated with any specific vegetation types. However it is known to inhabit forest, coast woodland and heath from 100 – 950m above sea level. Breeding is typically done within standing water such as dams or pools.	The degraded aquatic and riparian habitat within the Study Area does not represent core habitat for this species is unlikely to support a viable population of heath frog.

Species	Ecology*	Likelihood of Occurrence
	Land clearance is considered to be a significant threat to this species, with most sightings occurring only in relatively undisturbed forest and un-polluted water supplies. The species is considered to be susceptible to the chytrid fungus.	

*all references are provided in Section 9 of the main document to which this is an appendix.

Appendix Q

Strategic Assessment Consistency Report

NSW GOVERNMENT | Planning & Infrastructure

Growth Centres Strategic Assessment Program

Assessment of Consistency between the Commitments of the Strategic Assessment Program and the Austral and Leppington North Precincts

August 2012

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1. Introduction

In December 2011 the Federal Government endorsed the Sydney Growth Centres Strategic Assessment Program Report and in February 2012 approved the classes of actions in the Growth Centres that if undertaken in accordance with the approved program do not require separate approval under the *Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)*

The Program includes a range of commitments for matters of national environmental significance protected under the EPBC Act. The commitments are drawn from the analysis in the Supplementary Assessment Report and Draft Strategic Assessment Report (Part B), and build upon the Relevant Biodiversity Measures for the Growth Centres Biodiversity Certification.

This report has been prepared to assess of the consistency of proposed precinct plans with the commitments of the Strategic Assessment Program and to satisfy the evaluation and reporting requirements for the Program. Consistency with the Strategic Assessment Program is required to ensure proposals in the Growth Centres benefit from the Commonwealth approval.

This report has been prepared in a table format and addresses all commitments that are relevant to precinct planning. It is noted that some of the commitments are not specific to precinct planning and have therefore not been included in the report.

The Strategic Assessment Program can be viewed in full at http://www.growthcentres.nsw.gov.au/strategicassessment-94.html

Where the report indicates that precinct planning is inconsistent with the Biodiversity Certification or the Strategic Assessment Program, full justification for the inconsistency is provided as part of the ecological assessment for the precinct.

Both the Growth Centres Biodiversity Certification Relevant Biodiversity Measures and Strategic Assessment require a consistency report be prepared and publicly exhibited when the precinct plan is exhibited.

The draft Austral and Leppington North Precinct Plan was publicly exhibited from 26 October to 2 December 2011, prior to the Sydney Growth Centres Strategic Assessment Program coming into effect. Therefore, a consistency report was not part of the public exhibition. This report has been prepared since exhibition and is based on the final Precinct Plan (the final Indicative Layout Plan is at **Annex B**).

Definitions

Terms defined below appear in **bold** in the table. Where the terms are also defined in the Biodiversity Certification Order, the definitions provided are consistent with those in the Order.

- Biodiversity Certification Maps means the maps marked "North West Growth Centre – Biodiversity Certification" and "South West Growth Centre – Biodiversity Certification" dated November 2007 and included in Schedule 2 of the Biodiversity Certification Order.
- *Certified Area* means an area marked as a certified area on a biodiversity certification map.
- *Clearing* of vegetation means any one or more of the following:

  a) cutting down, felling, thinning, logging or removing native vegetation in whole or in part,

  b) killing, destroying, poisoning, ringbarking, uprooting or burning native vegetation in whole or in part.
- *Commitments* means the commitments set out in section 4 of the Sydney Growth Centres Strategic Assessment Program Report.
- *DECCW* means the Department of Environment, Climate Change and Water (which is now the Office of Environment and Heritage).
- *EPBC Act* means Environmental Protection and Biodiversity Conservation Act 1999
- *GCC* means the Growth Centres Commission constituted under the *Growth Centres (Development Corporations) Act 1974* (which is now the Department of Planning and Infrastructure).
- *Minister* means the Minister administering the EPBC Act.
- *Protection or Protected* in relation to land means land that is protected by a land use zoning under an environmental planning instrument or public ownership arrangements that provide for the protection of biodiversity values as a priority, or another arrangement that provides in perpetuity security for biodiversity on the subject land.
- *Relevant Biodiversity Measures* means the conditions in Schedule 1 of the Biodiversity Certification Order.
- *TSC Act* means the *Threatened Species Conservation Act 1995.*

2. Assessment

Table 1: Assessment of consistency between the commitments of the Strategic Assessment Program and the Austral and Leppington North Precincts.

	Commitment	Austral and Leppington North Precincts – Comment	Consistent with Commitment	Justification
Review of Zoning				
3	Review the provisions of the Environment Conservation and Public Recreation - Regional zones in the Growth Centres SEPP to confirm they are adequate for conservation purposes. Note this commitment is being undertaken for the Growth Centres as one exercise as does not need to be addressed separately for each precinct.	Undertake a review of the zone objectives, permitted land uses and development controls to ensure the conservation values of the land are adequately protected.	Yes	
Threatened Ecological Communities				
4	Retention and protection of a minimum 998 ha of CPW within the Growth Centres, including a minimum of 363 ha of HMV CPW. i) Retention and protection of CPW in the following areas of the Growth Centres: a) 138 ha within Flood Prone Land to be protected through the vegetation clearing controls under the Growth Centres SEPP or through zoning and/or development controls following completion of precinct planning. b) 424 ha within Environment Conservation and Public Recreation – Regional zoning to be protected. • RBM 12 which states that clearing of these areas is not	The total area of Commonwealth listed CPW as mapped in the Strategic Assessment in the precincts is 88 ha. Of this 2.65 ha is in the Kemps Creek Nature Reserve and 3.35 ha is within the former Western Sydney Parklands Area. The Kemps Creek Nature Reserve area has been excluded from all further calculations, and the Western Sydney Parklands Area is addressed under condition 4i)c) below. Of the 138 hectares of CPW to be protected across the Growth Centres, 22.13ha is within the Austral and Leppington North Precincts. None of the CPW in the Precincts is HMV CPW. This is the 'target' amount of CPW to be protected to maintain consistency with condition 4(i)(a) of the Strategic Assessment.	Yes	**Annex A** contains a map showing the current boundaries of non-certified land in the Precincts, and ENV that is required to be protected. **Annex D** highlights ENV in non-certified areas that is proposed to be impacted by the Precinct Plan, and ENV in certified areas that is proposed to be protected by the Precinct Plan. **Annex E** shows

	Commitment	Austral and Leppington North Precincts – Comment	Consistent with Commitment	Justification
	permitted unless it is in accordance with a Plan of Management endorsed by DECCW; • the zoning and vegetation clearing controls under the Growth Centres SEPP; and • the Growth Centres Conservation Fund which provides funding to acquire the land.	Cardno's groundtruthing identified 121.84 ha of CPW in the precincts which is mapped as ENV. Of this 3.03 ha is in Kemps Creek Nature Reserve and 6.39 ha is within the former Western Sydney Parklands area. (These areas are based on vegetation community mapping as per the strategic assessment). Using the Ground-truthed mapping of CPW, under the Precinct Plan, 39.62 ha of CPW is to be protected. Of this: • 24.55ha of CPW that is currently non-certified is to be protected. • 15.07ha of CPW is to be protected in currently certified areas. • 3.17ha of CPW that is currently non-certified is proposed to be cleared.		proposed amendments to the certified/non-certified land boundaries to ensure protection of ENV as proposed by the Precinct Plan. The Land Zoning Map and Native Vegetation Protection Map give effect to provisions in the Precinct Plan that will protect the 39.62 hectares of ENV in the Precincts. Protection measures are further described in the **Conclusion** of this report.
	c) 280 ha to be protected within existing reserved areas including the Westlink M7 Motorway Offsets area, the Kemps Creek Nature Reserve, and the Western Sydney Parklands.	A small part of the Kemps Creek Nature Reserve (which is subject to RBM 12 and condition 4(i)(c) of the Strategic Assessment) is within the Austral Precinct (refer to Figure 1 and **Annex A**). There is 3.03ha of ground truthed CPW mapped within this part of the Precinct. The Precinct Plan does not apply to this land (see **Annex B**) and there will be no impacts on it. Therefore, this vegetation is not included in the calculations in this report. In the former Western Sydney Parklands, there is 3.39 ha of Commonwealth listed CPW while ground truthed CPW, classified as ENV, shows 6.39 ha. All of the 6.39 ha of CPW ENV will be		Some ENV within the former Western Sydney Parklands area will be impacted by the South West Rail Line construction. These impacts have been separately assessed and offset in accordance with the Minister's Conditions of Approval for the project. ENV to be protected within this area takes into account the impacts of the rail line. The protection measures

	Commitment	Austral and Leppington North Precincts – Comment	Consistent with Commitment	Justification
		protected by the Precinct Plan.		maps at **Annex C** identify ENV that is proposed to be protected in the former Parklands area. **Annex E** shows proposed amendments to the certified/non-certified land boundaries.
	d) 79 ha to be protected within protected zones within Edmondson Park. e) 77 ha to be retained within non-certified and transitional lands. These areas will be retained subject to the confirmation of the presence of the community through survey at the precinct planning stage. ii) If for any reason the above targets cannot be achieved then the NSW Government will ensure that 998 ha of CPW is protected within the Growth Centres through the measures contained in either RBM 8a or 8b.	Not Applicable	Not Applicable	Not Applicable
5	Assessment of 14 ha HMV CPW within Marsden Park & Marsden Park Industrial Precincts to confirm its presence and if present protect, shown in red hatching on the **Biodiversity Certification maps** a) Assessment of the HMV CPW in accordance with RBM 14 and 15. b) Based on the outcomes of the assessment, DECCW will advise the NSW Minister for the Environment whether the area should be protected in accordance with RBM 16.	Not Applicable	Not Applicable	Not Applicable

	Commitment	Austral and Leppington North Precincts – Comment	Consistent with Commitment	Justification
Shale Sandstone Transition Forest (SSTF)				
8	Retention and protection of a minimum of 58 ha of SSTF within the Growth Centres. i) Retention and protection of SSTF in the following areas of the North West Growth Centre: a) 5.5 ha within Flood Prone Land to be protected through the vegetation clearing controls under the Growth Centres SEPP. b) 5.5 ha within Public Recreation – Regional zoning to be protected. • RBM 12 which states that clearing of these areas is not permitted unless it is in accordance with a Plan of Management endorsed by DECCW; • the zoning and vegetation clearing controls under the Growth Centres SEPP; and • the Growth Centres Conservation Fund which provides funding to acquire the land. c) 0.5 ha within the Westlink M7 Motorway Offsets area to be protected through maintenance of the existing conservation area (purchased by the RTA for transfer to DECCW as part of the Westlink M7 Motorway offsets). d) 46.5 ha within the E3 Environmental	There is no mapped Shale Sandstone Transition Forest in the Austral and Leppington North Precincts.	Not Applicable	Not Applicable

	Commitment		Austral and Leppington North Precincts – Comment	Consistent with Commitment	Justification
	Management zone in North Kellyville to be protected under the existing native vegetation and native vegetation retention controls under the North Kellyville Precinct Plan.				
Additional conservation actions within the Growth Centres – plants					
11. and 12. *15. and 30.*	During or before the preparation of the relevant precinct plan(s) under the Growth Centres Development Code relating to the areas referred to in the table below, the following actions must be undertaken:		While RBM 17- *Acacia pubescens* refers to areas in the Austral Precinct, the area mapped under this condition is adjacent to the Austral Precinct, within the Western Sydney Parklands and Sydney Catchment Authority Upper Canal. As the land covered by this condition is not in the Precincts, this condition is not relevant to this report.	Not Applicable	
	Species	***Required action***			
	Acacia pubescens	Known populations at Kemps Creek and Austral – as shown in red hatching on the **Biodiversity Certification maps**: • survey to confirm the presence of the population in the Kemps Creek and Austral precincts, and • if the species is present and the population is identified as significant relative to the adjacent property by DECCW, provide for the **protection** of the area of suitable habitat for the species to the satisfaction of the **DECCW**.			
	Dillwynia tenuifolia	Retention and protection of habitat supporting the four important			

		Commitment	Austral and Leppington North Precincts – Comment	Consistent with Commitment	Justification
	Pultenaea parviflora	populations of *Dillwynia tenuifolia* and *Pultenaea parviflora* known to occur within the Growth Centres through acquisition of land for environmental conservation. a) Protection of the Marsden Park North population within Environment Conservation zoning in accordance with the measures outlined in commitment 8.b) b) Protection of the population within the Air Services Australia site at Shanes Park (noting that at the time of finalising the Program the site is still under care of the Commonwealth) through: • RBM 12 which states that clearing of these areas is not permitted unless it is in accordance with a Plan of Management endorsed by DECCW; and • the zoning and vegetation clearing controls under the Growth Centres SEPP. c) Protection of the majority of the large population within Kemps Creek in accordance with the measures outlined in commitment 15.b) above. d) Protection of the large population that occurs within the Westlink M7 Motorway			
27.					
17.					

	Commitment		Austral and Leppington North Precincts – Comment	Consistent with Commitment	Justification
18. and 19.		offset adjacent to the Colebee Precinct through maintenance of the existing conservation area (purchased by the RTA for transfer to DECCW as part of the Westlink M7 Motorway offsets).			
23. 24. and 25.	*Pimelea spicata*	Potential populations at Denham Court Road within the East Leppington Precinct - as shown in red hatching on the **Biodiversity Certification maps**: • survey to confirm the presence of population, and • if the population is present and identified as significant relative to adjacent property by DECCW, provide for the **protection** of the area of suitable habitat for the species to the satisfaction of the **DECCW**.			
20.	*Grevillea parviflora subsp. parviflora* *Persoonia nutans*	Retention and protection of habitat supporting the population known to occur within the Growth Centres through acquisition of land in Kemps Creek. a) Protection of the majority of the large population within Kemps Creek through: • RBM 12 which states that clearing of these areas is not permitted unless it is in			

		Commitment	Austral and Leppington North Precincts – Comment	Consistent with Commitment	Justification
		accordance with a Plan of Management endorsed by DECCW; and • the zoning and vegetation clearing controls under the Growth Centres SEPP. Potential populations at Kemps Creek Precinct - as shown in red hatching on the **Biodiversity Certification maps**: • survey to confirm the presence of population, and • if the species is present and population is identified as significant relative to adjacent property by DECCW, provide for the **protection** of the area of suitable habitat for the species to the satisfaction of the **DECCW**.			
22.	*Micromyrtus minutiflora*	Retention and protection of habitat supporting the two important populations known to occur within the Growth Centres. a) Protection of the Marsden Park North population within Environment Conservation zoning through: • RBM 12 which states that clearing of these areas is not permitted unless it is in accordance with a Plan of Management			

		Commitment	Austral and Leppington North Precincts – Comment	Consistent with Commitment	Justification
14.		endorsed by DECCW; • the zoning and vegetation clearing controls under the Growth Centres SEPP; and • the Growth Centres Conservation Fund which provides funding to acquire the land. b) Protection of the population within the Air Services Australia site at Shanes Park (noting that at the time of finalising the Program the site is still under care of the Commonwealth) through: • RBM 12 which states that clearing of these areas is not permitted unless it is in accordance with a Plan of Management endorsed by DECCW; and • the zoning and vegetation clearing controls under the Growth Centres SEPP.			
	Persoonia hirsuta	Potential habitat at North Kellyville – as shown in red hatching on the **Biodiversity Certification maps**: • survey to confirm the presence of the species, and • if the species is present,			

	Commitment		Austral and Leppington North Precincts – Comment	Consistent with Commitment	Justification
		provide for the **protection** of the habitat within the Precinct through zoning as E3 Environmental Management and existing native vegetation or native vegetation retention development controls.			
	Darwinia biflora	Known populations at North Kellyville - as shown in red hatching on the **Biodiversity Certification maps**: • survey to confirm the extent of the populations, and • provide for the protection and ongoing management of key populations within the Precinct through zoning as E3 Environmental Management and existing native vegetation controls.			
	Note: On completion of the above actions the **Minister** may decide that it is appropriate to amend the boundaries of the area subject to biodiversity certification, in accordance with condition 3.				
Additional conservation actions within the Growth Centres – animals					
During or before the preparation of the relevant precinct plan(s) under the Growth Centres Development Code relating to the area referred to in the table below, the following actions must be undertaken:			Commitments in relation to the Swift Parrot and Grey-Headed Flying Fox are relevant and have been satisfied for the Austral and Leppington North Precincts by the protection of 116.62 hectares of ENV across the Precincts, this is 10 hectares more ENV than is required to maintain parity with the 2,000 hectares of ENV across the Growth Centres	Yes	116.62 hectares of ENV will be protected in the Austral and Leppington North Precincts, this is 10 hectares more ENV than is required to maintain parity with the target identified in the draft
	Species	***Required action***			
32.	*Swift Parrot*	Protection of potential habitat for the Swift Parrot within the Growth			

		Commitment	Austral and Leppington North Precincts – Comment	Consistent with Commitment	Justification
34, and 35.		Centres. a) Protection of 2,000 ha native vegetation within the Growth Centres through: • RBM 6 which requires a minimum of 2,000 ha of existing native vegetation to be retained; and • the relevant development controls under the Growth Centres SEPP that relate to the retention of native vegetation.	in accordance with RBM 6. This will include any existing potential habitat for the Swift Parrot and Grey-headed Flying Fox found within this area.		Growth Centres Conservation Plan. Refer to the Maps in Annex B and C which show the Indicative Layout Plan and zoning. The Maps at Annex D shown ENV that is proposed to be protected, including currently non-certified ENV proposed to be cleared and currently certified ENV that is to be protected.
36. *38.*	*Green and Golden Bell Frog*	Potential population at Riverstone – as shown in red hatching on the **Biodiversity Certification maps**: a) Incorporation of habitat protection and enhancement features (as per the agreed concept design) in the Riverstone Precinct Development Control Plan for the trunk drainage land. b) Inclusion of provisions in the Riverstone Precinct Plan and Development Control Plan to require the design and assessment of development on subject lands to be consistent with any recovery plan for the species and the Best Practice Guidelines for Green and Golden Bell Frog			

	Commitment	Austral and Leppington North Precincts – Comment	Consistent with Commitment	Justification
	Habitat (DECC 2008b). Retention of major drainage lines and associated vegetation throughout the Growth Centres through Growth Centres SEPP development controls for major creeks and flood prone areas.			
	Large-eared Pied Bat	Retention of potential roosting habitat and immediately adjacent potential foraging habitat along Cattai Creek in North Kellyville through development controls associated with the E3 Environmental Management and E4 Environmental Living zones.			
	Grey-headed Flying Fox	Protection of potential habitat for the Grey-headed Flying Fox within the Growth Centres. b) Protection of 2,000 ha native vegetation within the Growth Centres through: • RBM 6 which requires a minimum of 2,000 ha of existing native vegetation to be retained; and • the relevant development controls under the Growth Centres SEPP that relate to the retention of native vegetation.		
	Note: On completion of the above actions the **Minister** may decide that it is appropriate to amend the boundaries of the area subject to biodiversity certification, in accordance with condition 3.			

3. Conclusion

This report has undertaken an assessment of the consistency of the Austral and Leppington North Precinct Plan with the Strategic Assessment and the applicable commitments.

It is concluded that the Austral and Leppington North Precinct Plan is consistent with the Strategic Assessment of the Growth Centres SEPP, as follows:

- 116.62 hectares of ENV will be protected by the Precinct Plan, 10 hectares more than is required under the Biodiversity Certification.
- 24.55 hectares of CPW ENV that is currently non-certified will be protected by the Precinct Plan.
- 3.17 hectares of non-certified CPW ENV is proposed to be cleared to enable efficient urban development of the Precincts and to ensure that essential infrastructure can be constructed. To more than offset these impacts, 15.07 hectares of CPW ENV that is currently certified will be protected by the Precinct Plan and by amendments to the boundaries of certified and non-certified land.
- The total area of ENV (that is also Cumberland Plain Woodland as mapped under the Strategic Assessment Program) protected by the Precinct Plan is 39.62 hectares. This is 17.49 hectares more than the amount of CPW ENV (22.13 hectares) that is currently on non-certified land. The 39.62 hectares of CPW ENV will be protected by a combination of zoning, vegetation clearing controls and amendments to the boundaries of non-certified land. The proposed zoning of protected ENV is explained below.
- Amendments to the certification maps are proposed to ensure that all ENV that is protected by the Precinct Plan is also on non-certified land (see **Annex E**).

Land use zones have been selected based on advice from the OEH in relation to appropriate zoning of land containing ENV, and with consideration of other land use planning factors, including the future ownership, acquisition and use of land in accordance with the draft Precinct Plan and the EP&A Act. While the use of Environment Protection zones is preferred by OEH, in many cases it is not possible to apply this zoning to land containing ENV because of restrictions on the ability of Council to acquire the land under section 94 of the EP&A Act. In accordance with the hierarchy of land use zones preferred by OEH, land use zones have been applied to ENV that is proposed to be protected as follows:

- Where ENV to be protected is on land that is currently in Council or State Government ownership, the E2 Environmental Conservation zone has been used. The exception to this is Craik Park, in the centre of the Precincts, which is an existing Council reserve that contains a sports field and remnant ENV. The RE1 Public Recreation zone has been applied to this land to enable continued use of the sports fields.
- Where ENV to be protected is within large land holdings (and the area of ENV comprises only small part of the total area of land in the one ownership) the E2 zone has been applied. This land is not proposed to be acquired by a public authority, but the land owner may seek to dedicate the land to Council subject to Council agreement, and if this did occur, the ENV would be

protected by the combination of zoning and public ownership. Regardless, the application of the E2 zone to land that is to remain in private ownership is consistent with OEH requirements for protection of ENV.

- Within flood affected land along Kemps Creek and Bonds Creek, and adjacent to a number of other unnamed watercourses, existing rural properties that partly contain ENV are proposed to have a "split" zoning, with the land containing ENV zoned E2 Environmental Conservation and the remainder of the property zoned for a purpose that enables some commercial return either through limited subdivision or construction of a dwelling, or continued agricultural production. Generally, where the existing rural lot is partly within and partly outside the 100 year ARI flood extent, the combination of E4 Environmental Living and E2 (for the land that contains ENV) has been used. This approach also applies to a property on the eastern side of the Precincts at Eighth Avenue, which contains patches of ENV that are linked to a large remnant to the north and east in land owned by the Sydney Catchment Authority. This enables limited subdivision and construction of dwellings on relatively large lots consistent with the flooding and vegetation constraints on the land. Where the existing rural lot is entirely affected by flooding (such as along the northern parts of the Kemps Creek floodplain) the RU6 Rural Transition zone and E2 zone (for the land that contains ENV) has been used. The Rural Transition zone will enable agricultural uses that do not cause significant amenity impacts for nearby residential areas. The ability to further subdivide this land is limited, with minimum lot size controls established to limit further subdivision of land that contains ENV. In both these situations, the land that contains ENV is anticipated to remain in private ownership.
- Where land that contains ENV is to be acquired as part of a larger acquisition for a public purpose (usually for public recreation or drainage) the RE1 Public Recreation and SP2 Infrastructure (drainage zones) have been used. These approaches have generally been applied along the larger watercourses (eg. Bonds Creek and Scalabrini Creek) where the creek channel and margins are to be acquired by Council as part of the drainage network or where ENV is located on land that is to be acquired for public parks and sporting fields (these are often located within floodprone land near the major creeks). Land in these zones will be acquired by the relevant Council.

Annex A

Biodiversity Certification Map for the Austral and Leppington North Precincts

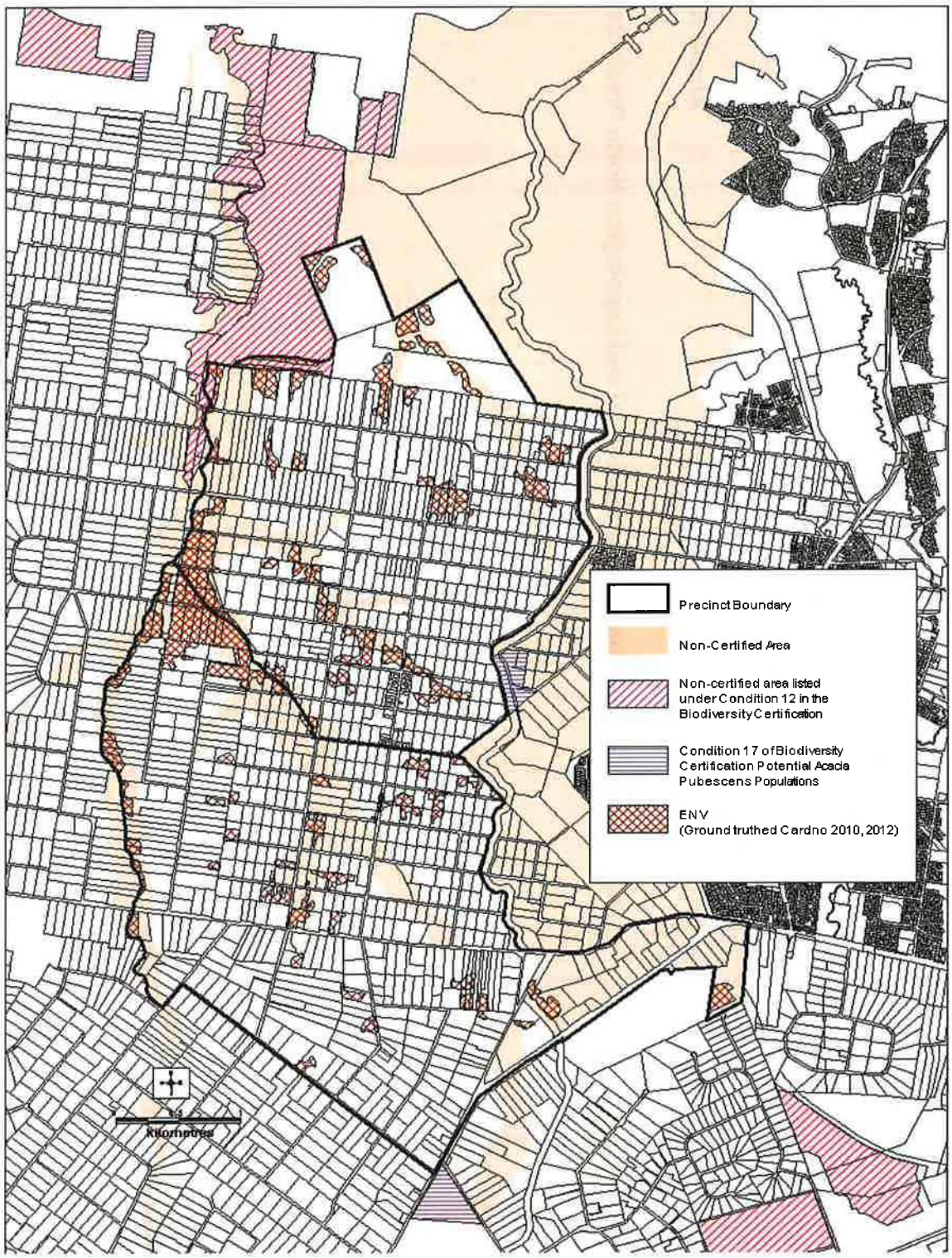

Figure 1: Austral and Leppington North Precincts – Biodiversity Certification Map showing Existing Native Vegetation (as confirmed by 2010 and 2012 ground truthing) and areas listed under Condition 12 and Condition 17 of the Biodiversity Certification.

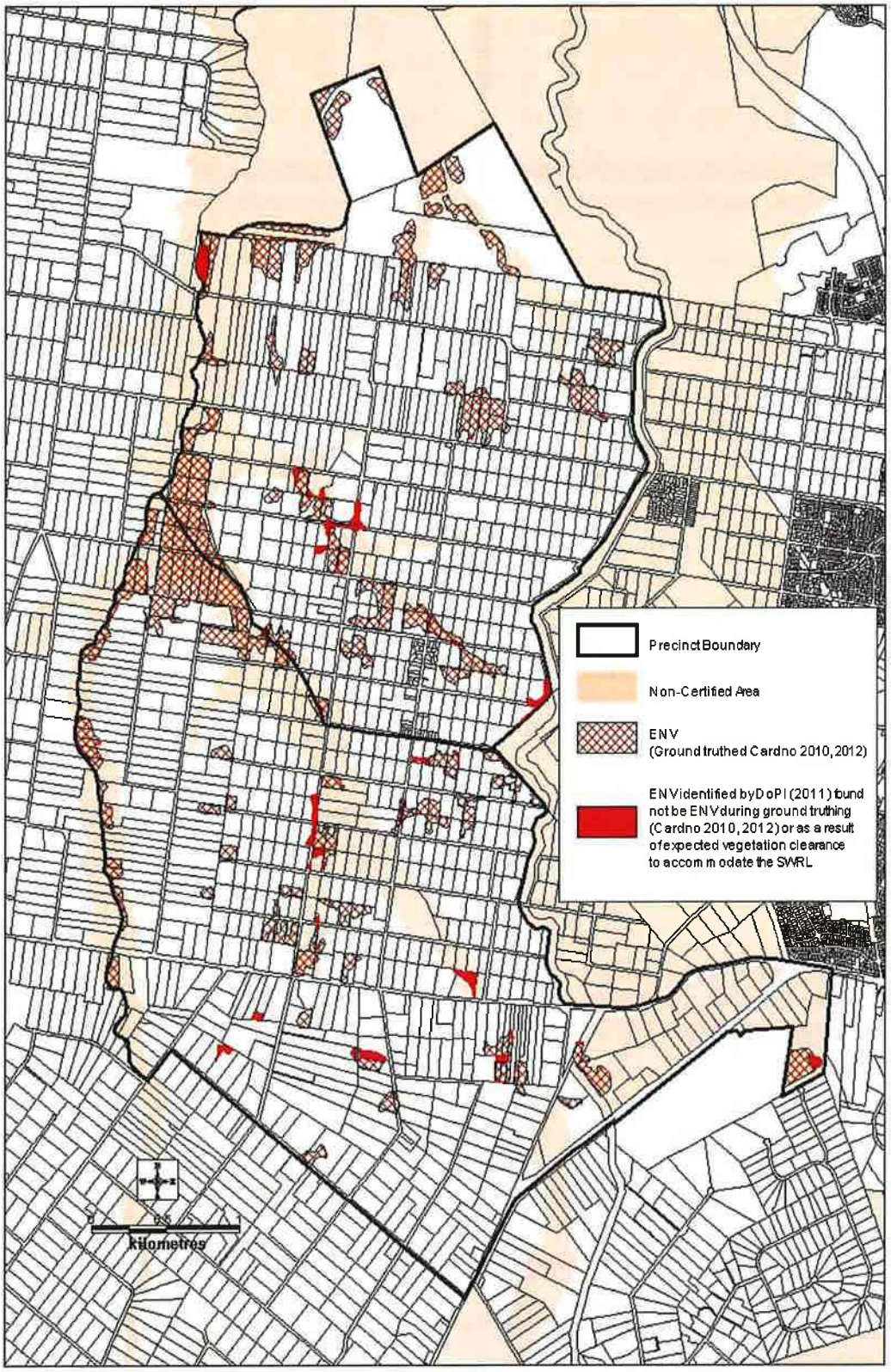

Figure 2 Existing Native Vegetation and vegetation areas found not to meet the criteria of ENV during ground truthing in 2010, 2012.

Annex B

Indicative Layout Plan for the Austral and Leppington North Precincts

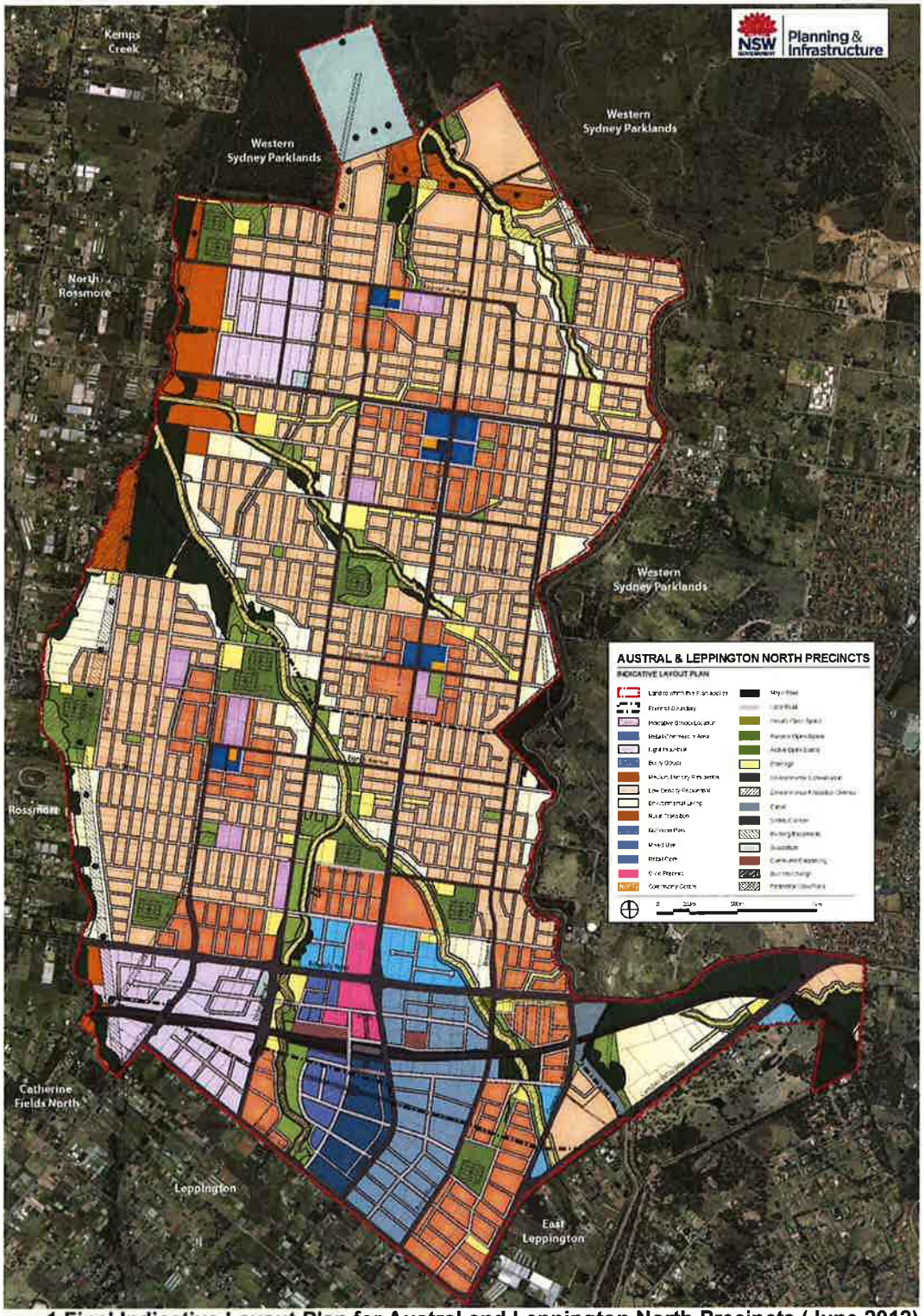

Figure 1 Final Indicative Layout Plan for Austral and Leppington North Precincts (June 2012).

Annex C

Proposed Protection Measures Plan for the Austral and Leppington North Precincts

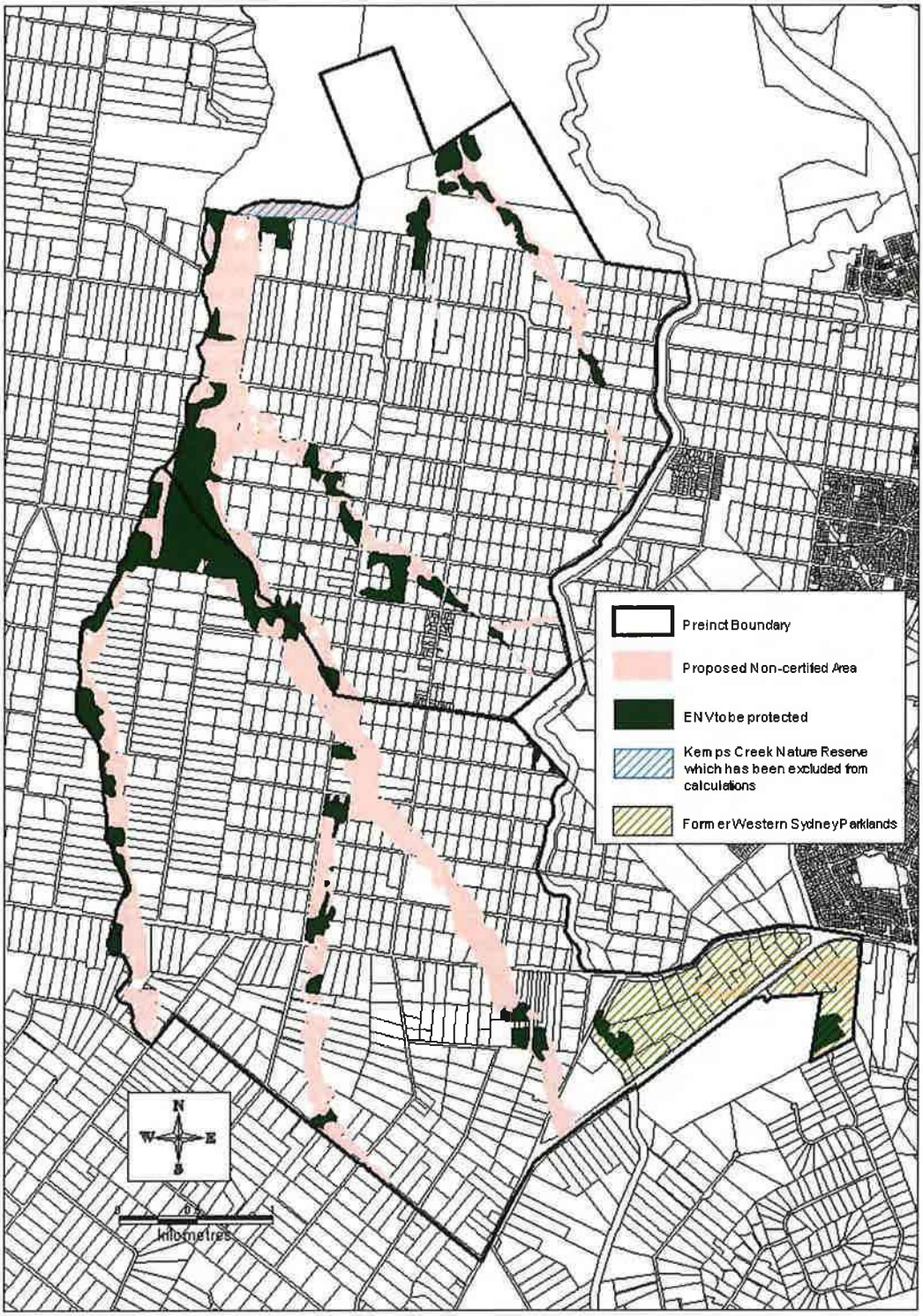

Figure 1 ENV to be protected

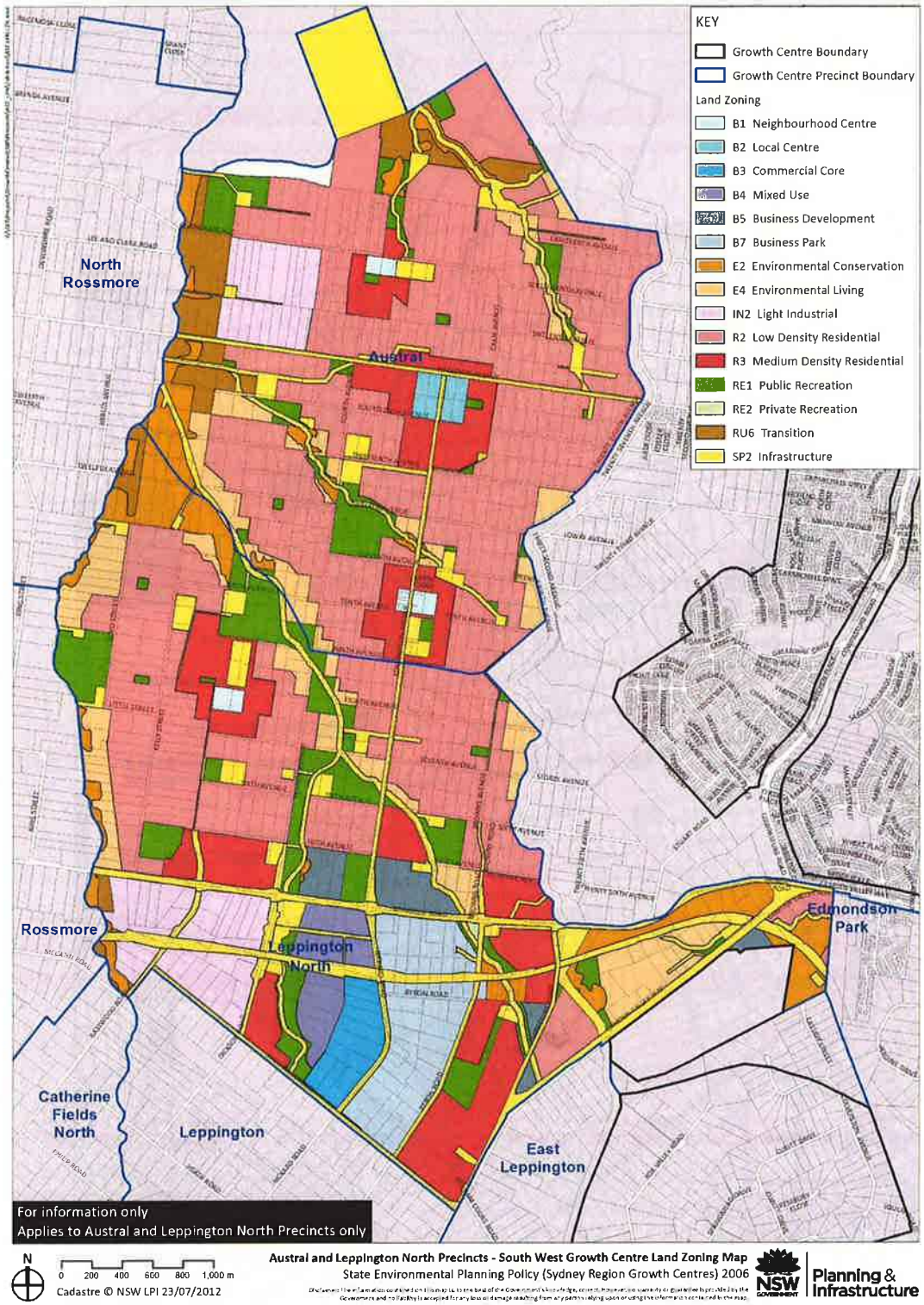

Figure 2 Land Zoning Map

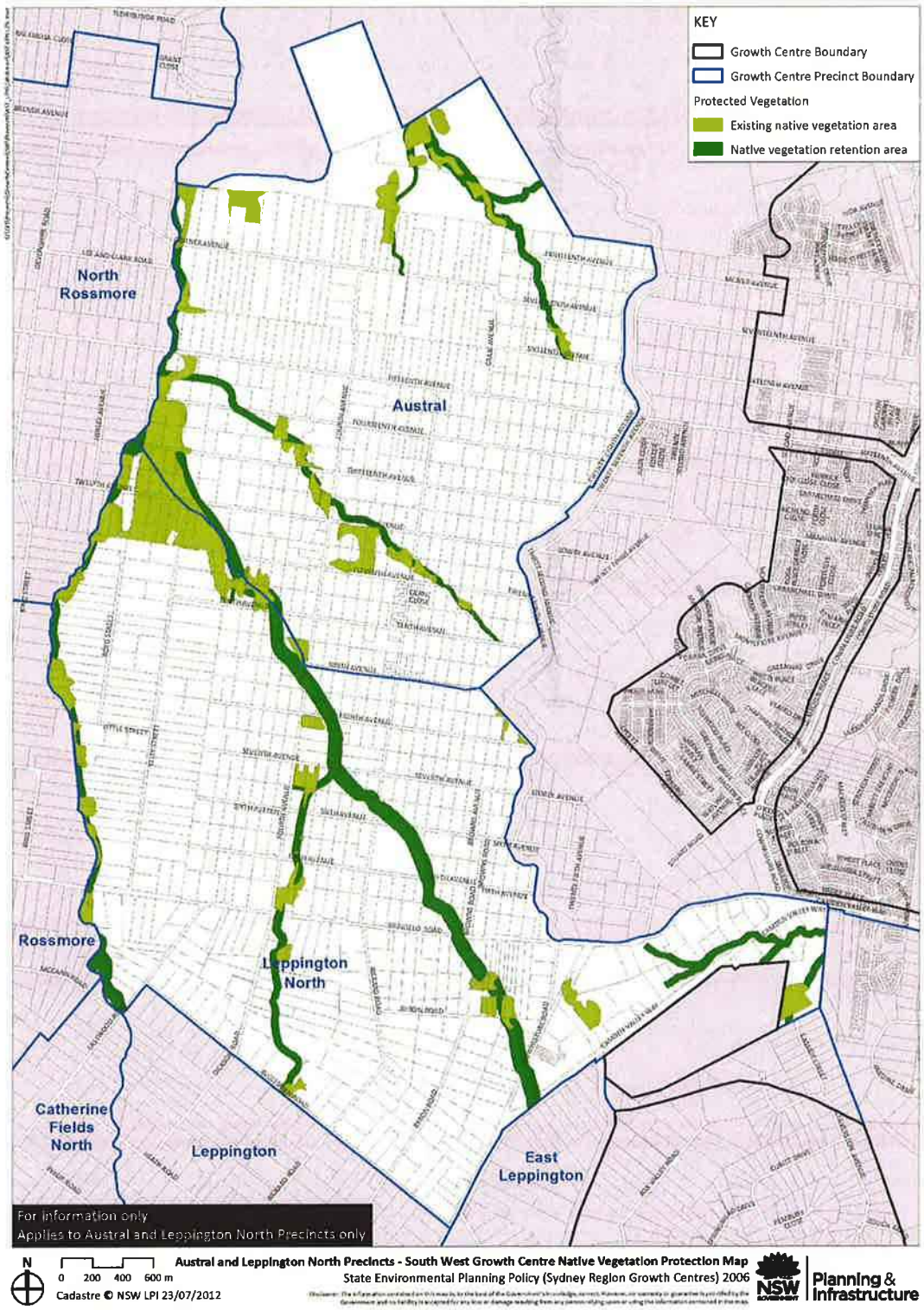

Figure 3 Native Vegetation Protection Areas Map

Annex D

Proposed Offsets Areas the Austral and Leppington North Precincts

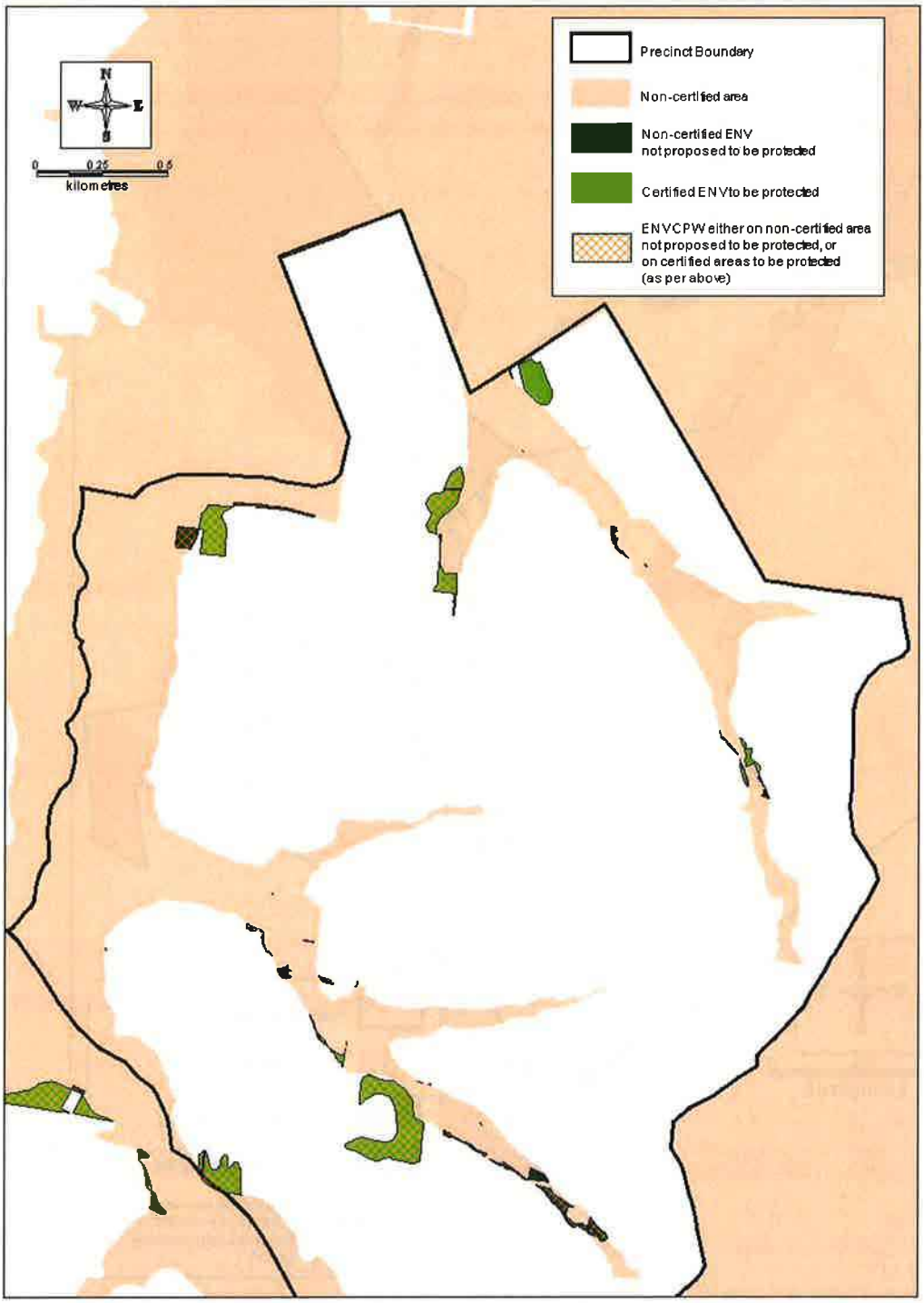

Figure 1: Certified ENV to be protected and Non-certified ENV not proposed to be protected in Austral

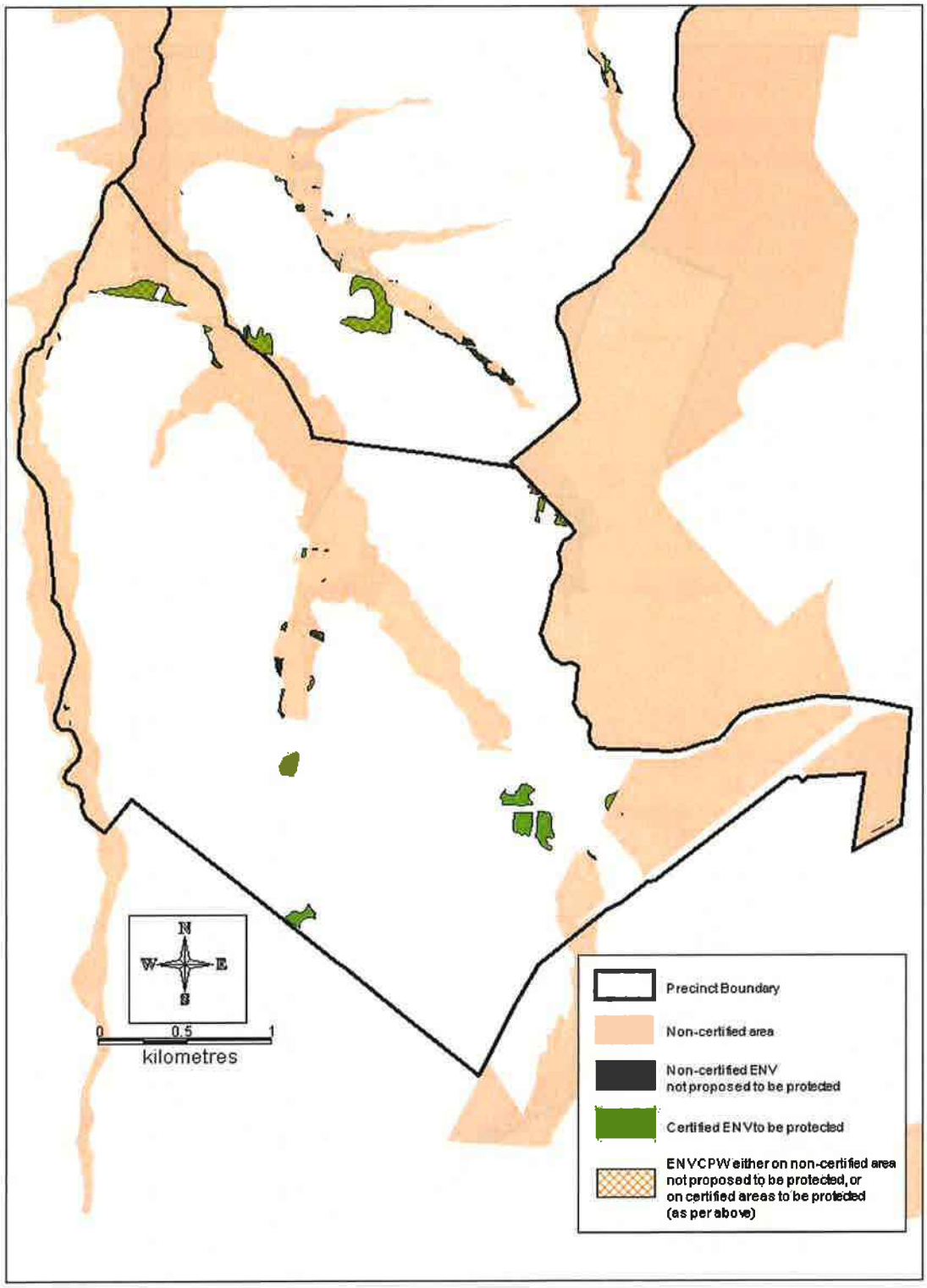

Figure 2: Certified ENV to be protected and Non-certified ENV not proposed to be protected in Leppington

Annex E

Proposed Amendments to Biodiversity Certification Map

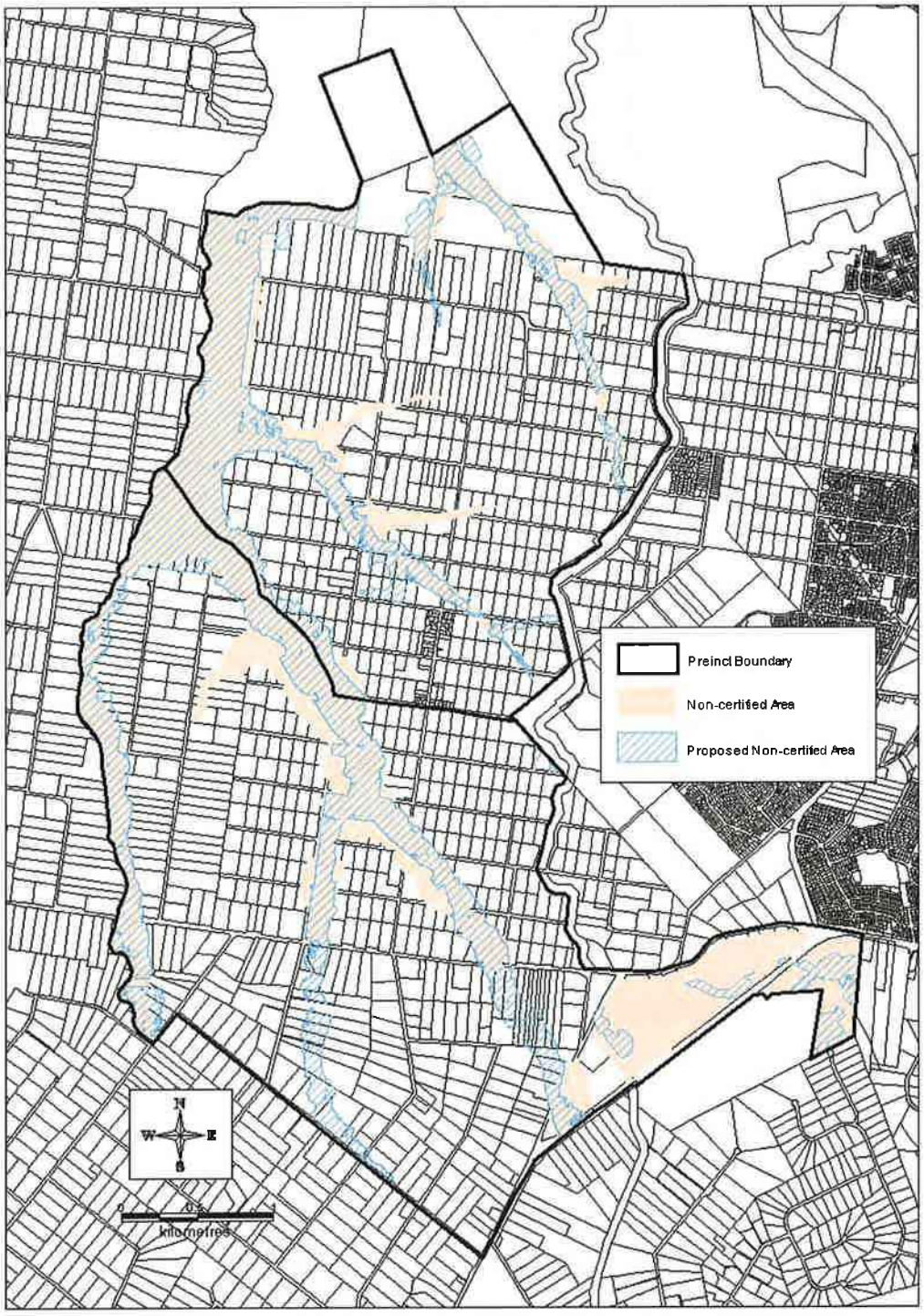

Figure 1: Proposed new boundaries of non-certified area and current non-certified area within the Austral and Leppington North precincts

Australian museum
BUSINESS SERVICES

Austral and Leppington North Precincts – Historic Heritage Project

Prepared by Australian Museum Business Services
for the Department of Planning and Infrastructure

Volume 1: Report

June 2012

100791

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Recipient:	Paul Robilliard, Precinct Project Manager, Strategies and Land Release, Department of Planning and Infrastructure
Approved by:	Jennie Lindbergh, AMBS Senior Project Manager

Executive Summary

Australian Museum Business Services (AMBS) has been commissioned by the NSW Department of Planning and Infrastructure (DP&I) to prepare a Historic Heritage Assessment for the Austral and Leppington North Precincts of the South West Growth Centres (SWGC). This report identifies and describes items and places of historic heritage significance, assesses opportunities and constraints for development in the vicinity of these items and places, and provides recommendations to ensure that heritage values are conserved for future generations. Conservation will make an important contribution to public understanding and appreciation of the local history and significance of the Precincts to enrich the lives of current and future residents.

The study area was first settled by Europeans in the early nineteenth century, on large land grants made to government officials, ex-soldiers, wealthy settlers and emancipist farmers. The construction of Cowpasture and Bringelly Roads, in 1805 and c1815 had a profound influence on the pattern of settlement of the area, forming the boundaries of numerous early land grants in the study area, and facilitating transport, communication and growth throughout the region. The Upper Canal was constructed between 1881 and 1888 as part of the Upper Nepean Scheme to provide Sydney with a reliable supply of clean water. The exceptional historic, technical, and aesthetic significance of the Canal is recognised through its listing on the SHR.

By the 1880s, increasing pressure for housing in Sydney led to the purchase of a number of the larger estates by land speculators, with an eye to subdivision for either housing or for smaller farm lots. Much of the land north of Bringelly Road was purchased by a single land development company, to form the Hoxton Park Estate subdivision. Over 1,000 small, rectangular three-acre residential lots were laid out along a regular grid of streets, which ignored natural boundaries and barriers embodied in the hills and valleys of the natural landscape. The early subdivisions were ostensibly a failure, in large part due to the lack of transport infrastructure, and it was not until the years immediately before and after WWII that the Austral and Leppington districts underwent a major phase of development and agricultural intensification, historically associated with an influx of migrant settlers from Europe.

The historic subdivision patterns of the area have been preserved substantially intact, and much of the land retains a distinct semi-rural character, with houses flanked by open paddocks, market gardens, and the occasional poultry farm. A more recent wave of migrants from Vietnam and Cambodia has contributed to the ongoing success of the market gardening industry in the area. However, the character of the area is changing, likely in association with generational change, and the retirement and death of post-war period migrant farmers.

There are four local heritage items and one State heritage item within the study area. In addition, this study has identified a further 12 potential local heritage items and one conservation area within the study area. The historic, aesthetic, scientific/technical and social or spiritual values identified for each item or place are summarised in Section 5 and in the Appendices to this report.

AMBS' preliminary recommendations regarding the future conservation of historic heritage items and potential heritage items have primarily been addressed during the development of the Indicative Layout Plan (ILP) for the Precincts, and the location of various roads and sporting facilities have been redesigned to avoid direct impacts on key identified heritage items and places within the study area. However, in some cases, the proposed road layout conflicts with the proposed heritage curtilage of potential heritage items. Moreover, the ILP does not explicitly address heritage issues,

constraints or opportunities for individual places arising from the proposed development. The overall development prefigured by the ILP has the potential to have a significant adverse impact on the SHR values of Upper Canal, where it runs along the eastern boundary of the study area. These issues will therefore need to be addressed during subsequent, more detailed planning stages for the Precincts, and during the Development Application process.

Precinct Planning

The following State, local, and potential historic heritage items, places, and archaeological site should be listed in an amendment to the *State Environmental Planning Policy (Sydney Region Growth Centres) 2006* (SEPP Amendment), and in the Development Control Plan (DCP) for the Austral and Leppington North Precincts, to protect their identified heritage values during the development of the Precincts:

- Upper Nepean Scheme – Upper Canal
- Row of Bunya Pines, 145 Bringelly Road, Leppington
- Brown Memorial and water trough, 145 Bringelly Road, Leppington
- Leppington Public School, 142-148 Rickard Road, Leppington
- Austral Town Centre Conservation Area, Austral
- H J Starr Progress Hall, 264 Edmondson Avenue, Austral
- Ian's Hardware and House, 256 Edmondson Avenue, Austral
- Brick House and Garden, 275 Edmondson Avenue, Austral
- House and Garden, 170 Edmondson Avenue (125 Eighth Avenue), Austral
- Cement Rendered House, 40 Browns Road (60 Fifth Avenue), Austral
- W V Scott Memorial and Park, Austral
- Hellenic Monument, Lot 10 DP 771080, Austral
- Forest Home – Archaeological Site, 1720-1726 Camden Valley Way, Leppington
- Blacksmith's Workshop (Former) – Archaeological Site, 240 Fifteenth Avenue, Austral
- Weatherboard House – Archaeological Site, 305 Fifteenth Avenue, Austral
- Cowpasture Road – Cultural Landscape, Leppington
- Bringelly Road – Cultural Landscape, Austral and Leppington

Development controls outlined in this report provide practical guidelines for protecting and maintaining the cultural significance of the heritage items and potential heritage items, including areas of archaeological sensitivity. These guidelines should be incorporated in the DCP for the Precincts.

The potential built heritage items listed above are generally modest in scale, and are historically associated with an open, agricultural landscape setting. Future development in the vicinity of each heritage item and conservation area should have an appropriate scale and mass, which respects the aesthetic significance and landscape setting of the item. Adjacent development should not dominate or overwhelm the item. Development adjacent to the Cement Rendered House at 40 Browns Road, Austral and Leppington Public School, 142-148 Rickard Road, Leppington, in particular, should consider these principles.

Development in the vicinity of war memorials at 145 Bringelly Road and at the W V Scott Memorial Park, and in the vicinity of Forest Home at 1720-1726 Camden Valley Way, should respect the social value of these places to the local community. The original locations of the war memorials were chosen by the community, and the memorials act in lieu of graves for the deceased servicemen. Relocation of commemorative parks and plaques should only be considered as a last resort, and in consultation with family and other stakeholders.

AMBS understands that heritage items listed in the SEPP Amendment will in future be incorporated in the LEPs for Camden and Liverpool LGAs. Heritage curtilages for listed and potential heritage items should be acknowledged in the DCP and local Council heritage inventories as indicative of the minimum area required to protect significant physical fabric and/or an appropriate landscape setting for each item or place during the development of the Austral and Leppington North Precincts.

Further investigation of areas of archaeological sensitivity will be required during the development of the Precincts. Site specific Archaeological Assessments should be completed to address the impact of the development on the following sites:

- Upper Nepean Scheme – Upper Canal
- Forest Home (Dwelling and Rural Lot), 1720-1726 Camden Valley Way, Leppington
- Blacksmith's Workshop (Former), 240 Fifteenth Avenue, Austral
- House, 305 Fifteenth Avenue, Austral

Upper Nepean Scheme – Upper Canal

The SHR listed Upper Nepean Scheme – Upper Canal is the most significant element of European built heritage within the study area. An increase in the density of houses and people living in the vicinity of the Canal is likely to have gradual and cumulative impacts on the physical fabric of the Canal and its associated elements. These include problems associated with incremental changes in surface drainage patterns and related impacts on water quality, which may in turn impact on the historic and technical significance of the Canal as an operational element of Sydney's water supply system. Intensified residential development adjacent to the Canal corridor will also have an adverse impact on its rural landscape setting and other picturesque elements of the Canal corridor. Mitigation of these impacts will require long-term solutions, which should be addressed in consultation with SCA and the NSW Heritage Council, and should be consistent with the recommendations in the CMP for the Canal. A supplementary heritage management document should be prepared following exhibition of the ILP, to guide development in the vicinity of the Canal corridor, and to manage the impacts of intensified housing, roads and road infrastructure in the vicinity of the Canal corridor on the SHR values of the Canal. Objectives and development controls addressing these impacts should be incorporated in the DCP for the Precincts.

The eastern perimeter road should be designed to deter heavy through traffic to prevent the impacts of vibration on the physical fabric of the Upper Canal. The creation of additional open landscape buffering along the route of the Canal, in association with the perimeter road and walking or cycling trails, could be used to reinforce its historic rural setting, whilst maintaining passive surveillance and security for the Canal. The DCP should provide design guidelines for the perimeter road and road infrastructure, to support traffic calming and additional open landscape buffering adjacent to the Canal alignment, whilst maintaining significant view corridors. The roadside verge adjacent to the Canal should be a minimum width of five metres to provide for a broad, grassed area and a pedestrian footpath, and car parking should be restricted to the west side of the road. The DCP should also provide design guidelines for housing adjacent to the Canal corridor. Houses should address the road and Canal corridor to provide passive surveillance for the Canal infrastructure.

Road crossings over the Upper Canal adjacent to the Precincts should be limited to extant reinforced concrete beam bridges. Site specific Statements of Heritage Impact (SoHIs) should be prepared to address the impact of new, augmented or modified Canal crossings on the SHR values of the Upper Canal. Applications for approval to the NSW Heritage Council should be made in

accordance with Section 60 of the Heritage Act, or an exemption gazetted under Section 57(2) of the Act.

Leppington Public School

The ILP presupposes that Department of Education and Communities (DEC) will at some future time decommission and relocate Leppington Public School, as part of the long-term future development of Leppington Town Centre. As such, consideration should be given to an sympathetic function for the school, which retains the key weatherboard buildings, ablutions block and mature plantings in their original location, and adapts them for another use which respects the historic, social and aesthetic significance of the place. Adaptive reuse may include a child care centre, information centre, or other community/educative function.

Recognition and maintenance of the heritage curtilage will ensure that the elements of high heritage value are protected in the short- to medium-term while the staged development of the Town Centre takes place. The identification of a *reduced heritage curtilage* should not prevent the ongoing development and/or expansion of the school by DEC to accommodate new buildings or other facilities appropriate to the normal functioning of the school, including new buildings within the curtilage, provided that the elements identified as having high heritage value are also maintained in their current location within this curtilage. Appropriate maintenance also includes pruning trees where they may prove a safety issue.

The *reduced heritage curtilage* is defined by the original 1923 boundary of the school, comprising two acres at the south side of the site. In the long-term, this curtilage would provide a 30m buffer for the original school building (Building H), retaining its existing garden setting, and reducing the impacts of increased traffic noise and visual overshadowing by neighbouring commercial buildings in a future Town Centre. It would also incorporate Buildings J and Q, and key cultural plantings, listing of which are supported by DEC. Guidelines for future development adjacent to the school grounds should be addressed in the DCP for the Precincts. New buildings in the immediate vicinity of Leppington Public School's reduced heritage curtilage should be sympathetic to the scale, massing, and character of the significant weatherboard buildings and their garden setting. Ongoing augmentation of the school facilities by DEC in the short- to medium- term is compatible with the historic and social significance of the place.

Austral Town Centre Conservation Area

The proposed Austral Town Centre Conservation Area should be conserved as a cohesive group of mid-twentieth century commercial, civic and residential buildings on the west side of Edmondson Avenue, between Tenth and Eleventh Avenues. The ILP indicates that the proposed Heritage Conservation Area will form part of a small Retail/Commercial node surrounded by a discrete area of medium density housing. This zoning is consistent with the historic (and existing) function of the proposed conservation area, namely a small mixed use precinct with a strong community focus.

The proposed Heritage Conservation Area also provides an opportunity to preserve a representative sample of three mid-twentieth century fibro houses within the new Precincts. This report identifies the working-class fibro house as an unassuming, but ubiquitous element of the study area, reflecting the major period of development in the area during the years immediately before and after WWII. This building type will become increasingly rare as the area is developed as part of the SWGC. Listing the houses as contributory elements in the proposed conservation area may entail less onerous regulatory control by permitting some modifications to the houses, while focusing on the protection of the form and character of the street-facing facades and overall character of the streetscape.

Listing as a Conservation Area does not preclude further development of the vacant land between Ian's Hardware and the H J Starr Progress Hall, nor to the rear of the fibro houses. On the contrary, new retail, community or other commercial development would contribute positively to the ongoing use of significant heritage buildings as active elements of a neighbourhood centre. That being said, new development in the vicinity of the conservation area should not detract from the character of the conservation area. Detailed design guidelines for development within and immediately adjacent to the conservation area should be addressed in the DCP for the Precincts.

W V Scott Memorial and Park, Austral

The proposed redevelopment of the W V Scott Memorial Park as a regional Aquatic and Indoor Recreation Centre should be compatible with the historic heritage significance of the place. Continuity in the use of the land for community recreational purposes, retention of the name 'W V Scott Memorial' for any future recreational facilities, and ongoing conservation of a commemorative monument to W V Scott are in keeping with the local community's desire not to forget the sacrifice of local residents in WWII, and will contribute to the conservation of the social and historic significance of the place. The commemorative monument should retain the inscription recorded on the present monument, and should be located at the main entrance to the facility, within an appropriate garden setting.

Historic Subdivision Patterns and Road Alignments

Roads and property boundaries provide an important, tangible link with the history of land use and settlement of the area, but are less likely to warrant individual heritage listing or other special protections. In general, the ILP has retained key historic roads along their original alignments, and the historic grid pattern of roads and streets associated with the late nineteenth century Hoxton Park Estate subdivision will be retained substantially intact. Bringelly, Edmondson and Fifteenth Avenue will be upgraded, retaining their historic and technical significance as important local transport and communications corridors.

In contrast, new local roads within the precincts will generally cut across pre-existing property boundaries. This will gradually reduce the physical evidence of early property boundaries within the landscape. In cases where new local roads coincide with the historic boundaries of early land grants, future naming of these roads could take into consideration the historic names of the land grants and the people associated with them, thereby forming part of the interpretation of early settlement patterns within the landscape. Future naming of local roads could also address historic themes associated with more recent migrant history of the area.

Cowpasture Road – Cultural Landscape

Cowpasture Road was the earliest road in the Liverpool area, southwest of Sydney, and formed the boundary of several early land grants in the study area. The road has an important historic and visual relationship with the route of the Upper Canal: construction of the Canal in 1886-1888 led to a re-alignment of Cowpasture Road at its junction with Bringelly Road. The original junction of Cowpasture and Bringelly Roads is marked by a row of three Bunya Pines, which are prominent landmarks within the local landscape, and a disused section of the original nineteenth century alignment is retained to the south of Bringelly Road, east of the Canal. A short section is also retained further south on the west side of the Canal, with the bend in the present, active road marking the junction with the original alignment.

Incorporating the original, disused section of the Cowpasture Road alignment into Open Space and Environmental Conservation zones within the Leppington North Precinct represents an opportunity to conserve this section of the historic road within a natural landscape setting. A SoHI,

that includes an assessment of the archaeological potential, should be prepared prior to redevelopment of the disused section of the original road corridor for park, recreation, or other purposes.

Views

The ILP for the Austral and Leppington North Precincts includes strategies for addressing impacts of future development on culturally significant views and landscapes, including views which have been identified in this report at Judges Hill and Carnes Hill.

Interpretation

Interpretation of individual items of historic heritage, as well as the broader cultural landscape of the Austral and Leppington North Precincts, is an important tool in the conservation of heritage significance. It presents the story of a place in a way that will engage the community in its continuing care and protection. It can also be a source of enjoyment for local residents and visitors to the area. The interpretation strategy outlined in Section 6.6 of this report should be implemented as part of the Precinct planning process, during the assessment of future development applications, and in other Council-sponsored initiatives.

Consultation

DP&I should give written notice to the owners and occupiers of properties identified by AMBS as potential heritage items, areas of archaeological sensitivity, and of properties within the proposed Austral Town Centre Conservation Area, to advise them of recommendations to list the property on the SEPP Amendment, to explain the implications of heritage listing, and to invite written submissions regarding the proposed listing. DP&I should take submissions into consideration before a final determination is made as to the listing of each property on the SEPP amendment. Objections should be relevant to the assessment of significance and long-term conservation of potential heritage items.

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1 Introduction

1.1 Preamble

In December 2004, the NSW Government announced a new land release plan for the South West and North West Growth Centres as a key component of the Metropolitan Strategy for Sydney. The Growth Centres are anticipated to accommodate up to 30 percent of Sydney's long term housing growth.

Australian Museum Business Services (AMBS) has been commissioned by the NSW Department of Planning and Infrastructure (DP&I) to prepare a Historic Heritage Assessment for the Austral and Leppington North Precincts of the South West Growth Centres (SWGC). This report identifies and describes items and places of historic heritage significance, assesses opportunities and constraints for development in the vicinity of these items and places, and provides recommendations to ensure that significant heritage items and places are conserved for future generations. This report will inform the Urban Form Analysis and preparation of the Precincts' future development footprint.

AMBS has also been commissioned to prepare an Aboriginal (Indigenous) heritage assessment for these Precincts.

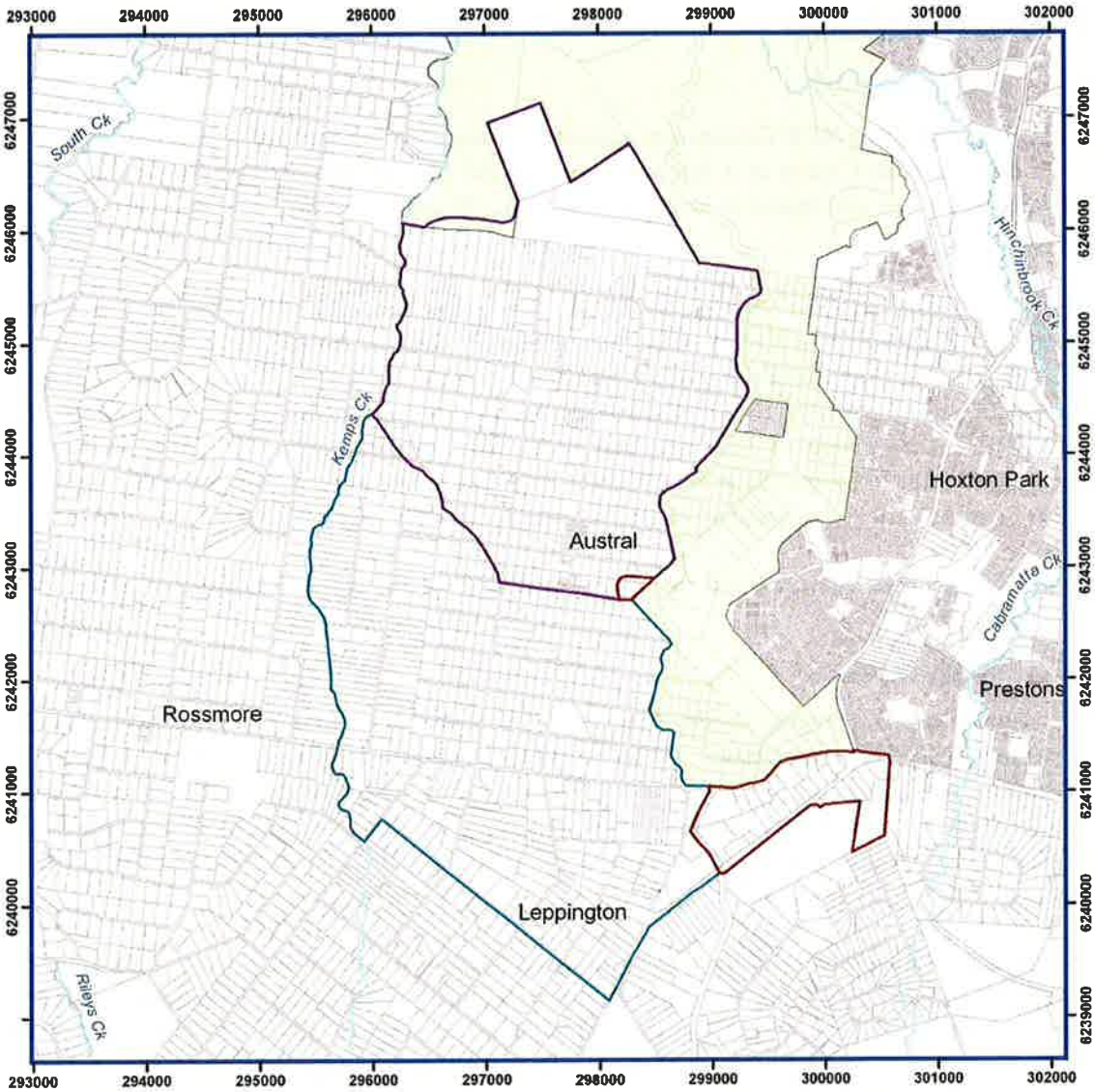
1.2 Study Area

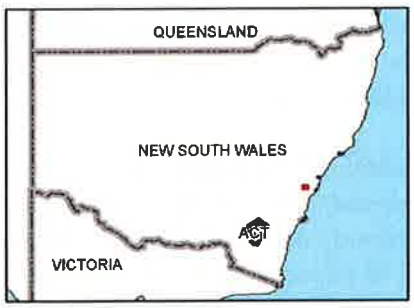
The Austral and Leppington North Precincts (the study area) comprise part of the NSW Government's SWGC land release. DP&I is currently undertaking Precinct Planning for these precincts. The Austral and Leppington North Precincts are second release precincts in the SWGC. The precincts fall within the boundaries of the Camden and Liverpool Local Government Areas (LGAs) and are located in the central eastern portions of the SWGC, approximately 50km west of Sydney.

The precincts comprise a total area of approximately 2,025 hectares, with a target population of 50,000 people and 20,000 new homes. The Austral Precinct covers an area of approximately 930 hectares and is expected to contain around 8,000 dwellings for up to 20,000 people. The Leppington North Precinct covers an area of approximately 1090 hectares (including land recently added as a result of the Boundary Review process) and is expected to contain approximately 12,000 dwellings for up to 30,000 people. The Leppington North Precinct also contains the proposed Leppington Town Centre, identified as a major centre under the Sydney Metropolitan Strategy to provide for commercial, retail, employment, government and high density residential uses.

During the Boundary Review process, two investigation areas (additional lands that may be included in the Precincts) were identified. The first has an area of approximately 100 hectares and is located to the east of the Leppington North Precinct. This land was previously included within the Western Sydney Parklands. However, access to and use of the land will be impacted by the extension of the South West Rail Link to Leppington and major upgrades to Bringelly Road and Camden Valley Way. As such, alternative suitable uses of the land are to be investigated through the Precinct Planning process. The second investigation area is located at the south east corner of the Austral Precinct and is approximately 4.5 hectares.

This Historic Heritage Assessment addresses all lands in the Austral and Leppington North Precincts, and the two investigation areas (see Figure 1.1).





Key Map 1: New South Wales

Key Map 2: Study Area

Legend

- Austral Precinct
- Leppington Precinct
- Investigation Areas
- Western Sydney Parklands
- Cadastre

N

Background topographic data © Department of Lands (2006) 1:25000 TopoView Topographic and Orthophoto Map
Settlement data © Copyright Commonwealth of Australia (Geoscience Australia) 2006
Horizontal datum: GDA94/MGA Zone 56

Figure 1.1 Location of the study area.

1.3 Methodology

This report is informed by the principles and guidelines of the Burra Charter (*The Australia ICOMOS charter for the conservation of places of cultural significance).*

The report has been prepared in accordance with current best-practice heritage guidelines as identified in the *NSW Heritage Manual* (1996), published by the Heritage Office and Department of Urban Affairs and Planning (now the Heritage Branch, Office of Environment and Heritage, Department of Premier and Cabinet), and associated documents including *Heritage Curtilages* (1996), *Assessing Heritage Significance* (2001), and *Assessing Significance for Historical Archaeological Sites and 'Relics'* (2009).

The assessment of constraints and opportunities was based on the following:

- Review of statutory and non-statutory lists and registers, to identify heritage items and places in the vicinity of the precincts:
    - National Heritage List (NHL),
    - Commonwealth Heritage List (CHL),
    - Register of the National Estate (RNE),
    - National Trust Register,
    - State Heritage Register (SHR),
    - State Heritage Inventory (SHI),
    - Sydney Catchment Authority (SCA) draft Heritage and Conservation Register,
    - Roads and Traffic Authority (RTA) Heritage and Conservation Register,
    - Department of Education and Communities (DEC) (formerly the Department of Education and Training) Heritage and Conservation Register,
    - Camden Local Environmental Plan 2010, Schedule 5 'Environmental Heritage,'
    - Camden Development Control Plan 2006, Part D, Chapter 5, Schedule A 'Potential Heritage Items,'
    - Liverpool Local Environmental Plan 2008, Schedule 5 'Environmental Heritage;'
- Historical background research, to provide an historical context to the study area, to identify other potential historic structures and landscape features within the study area, and to identify areas of potential historical archaeological sensitivity. Background research included:
    - Review of relevant historical studies and heritage consultants' reports,
    - Analysis of relevant historical maps, plans, and aerial photographs, and
    - Land title searches;
- Field surveys, to analyse the historic character of the area and to confirm the location and condition of known and potential historic heritage items and places;
- Statements of significance for existing heritage items; and
- Assessments of significance for potential heritage items, places, and areas of historical archaeological sensitivity.

Surveys of the study area were conducted by Libby Percival, Ngaire Richards, and Jennie Lindbergh during November and December 2010, and January and February 2011.

1.4 Limitations

This report was initially prepared and issued in June 2011, and placed on public exhibition from 26 October until 2 December 2011. The current version of the report includes minor amendments that address the Indicative Layout Plan (ILP) for the Precincts issued after the public exhibition period, in June 2012. It does not address new background information or other changes to statutory heritage lists and registers which have taken place between June 2011 and June 2012.

Background research for the field survey included a review of aerial photographs of the study area from 1930, 1955, and 2010. The series of photographs available from 1930 covered the central, northern and eastern parts of the study area only; the southern and western parts of the study area were not photographed at this time. Other sources of data included historic maps and subdivision plans of the study area.

The datasets were digitised and georeferenced in a Geographic Information System (GIS). Ground control points (features within the scans) were matched against co-ordinates derived from a mosaic of colour aerial photographs taken in 2010, and supplied by DP&I in ECW format. In some cases, inaccuracies in the historic maps meant that they could not be aligned precisely with modern topographic features or cadastral boundaries. Where this was the case, the locations of features such as buildings were only considered to be approximate for the purposes of the analysis.

Field survey was limited to public areas and individual properties for which DP&I or AMBS had obtained prior permission to enter and inspect the property. In some instances where AMBS had identified individual properties as having potential heritage value, permission to enter to assess and/or discuss the potential heritage value of the property was not granted. In the event that AMBS has been unable to gain access, the assessment of heritage significance has been based on historical documentation and preliminary visual inspection from the street.

This report does not address natural heritage values, which are the subject of separate studies.

1.5 Authorship and Acknowledgements

This report has been prepared by AMBS Project Officer Libby Percival, with contributions by AMBS Project Officer Ngaire Richards and AMBS Senior Project Manager Jennie Lindbergh. Section 3 *Thematic History* is based on a historic background report by Mark Dunn, Historian, with additional information prepared by Libby Percival, Ngaire Richards and Jennie Lindbergh. AMBS Senior Project Manager, Jennie Lindbergh, provided technical advice. AMBS Project Officer Jenna Weston reviewed the report for quality and consistency.

The authors also acknowledge the assistance of the following people:

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- Bronwyn York, Principal, Leppington Public School

2 Statutory Context

2.1 Preamble

The conservation and management of historic heritage items, places, and archaeological sites takes place in accordance with relevant Commonwealth, State or local government legislation. Non-statutory heritage lists and registers, ethical charters, conservation policies, and community attitudes and expectations can also have an impact on the management, use, and development of heritage items. The relevant statutory and non-statutory heritage listings for the study area are summarised below.

2.2 *Environment Protection and Biodiversity Conservation Act* 1999

In 2004, a new Commonwealth heritage management system was introduced under the *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act). The National Heritage List (NHL) was established to protect places that have outstanding value to the nation. The Commonwealth Heritage List (CHL) was established to protect items and places owned or managed by Commonwealth agencies. The Australian Government Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) is responsible for the implementation of national policy, programs and legislation to protect and conserve Australia's environment and heritage and to promote Australian arts and culture. Approval from the Minister is required for controlled actions which will have a significant impact on items and places included on the NHL or CHL. There are no heritage items listed on the NHL or CHL within the study area or its near vicinity.

2.2.1 Register of the National Estate

The Register of the National Estate (RNE) was originally established under Section 22 of the *Australian Heritage Commission Act* 1975 (AHC Act). Since the establishment of the NHL and CHL, there is now a considerable level of overlap between the RNE and heritage lists at the national, state and territory, and local government levels. In February 2012, all reference to the RNE will be removed from the EPBC Act and the AHC Act. The RNE is now maintained on a non-statutory basis as a publicly available archive. The following place is listed on the RNE:

Ref	Name	Primary Address	Significance
16379	Kemps Creek Natural Area	Exeter Rd, Cecil Park, NSW, Australia	Natural*

*The RNE identifies Kemps Creek Natural Area as a place of natural rather than cultural heritage significance; as such, it is not addressed in this report.

2.3 *Heritage Act* 1977

The NSW *Heritage Act* 1977 (Heritage Act) provides protection for heritage places, buildings, works, relics, moveable objects or precincts that are important to the people of NSW. These include items of Aboriginal and non-Aboriginal heritage significance. Where these items have particular importance to the state of NSW, they are listed on the State Heritage Register (SHR). The following item is listed on the SHR:

Ref	Name	Primary Address	Significance
01373	Upper Canal System (Pheasants Nest Weir to Prospect Reservoir)	Prospect, NSW 2148	State

The Upper Canal corridor forms much of the eastern boundary of the study area. The Canal itself is primarily outside the study area; however, a short section crosses the study area, between Camden Valley Way and Bringelly Road.

In the vicinity of the study area, the Upper Canal System is defined by the following properties:

Lot 1, 596351	Lot 2, DP 596352
Lot 2, 596351	Lot 2, DP 1086645
Lot 1, DP 725231	Lot 1, DP 1086645
Lot 1 DP 596355	Lot 1, DP 613552
Part Lot B, DP 392726	Lot 12, DP 1055232

These properties form part of Sections 8 and 9 of the Upper Canal System, as identified in SCA's Conservation Management Plan (CMP) for the Canal (Higginbotham 2002:79-80).

Sections 57 to 69 of the Heritage Act address the requirements for items and places listed on the SHR. Works which include demolition, damage or alteration of a heritage item or place require the approval of the Heritage Council or its delegates.

Section 62 of the Act, 'Matters for consideration,' requires that, when determining an application for approval in respect of a heritage item, the approval body shall take into consideration:

(a) the extent to which that application, if approved, would affect the significance of any item as an item of the environmental heritage,
(b) the representations, if any, made with respect to that application under section 61 (3),
(c) such matters relating to the conservation of that item or land as to it seem relevant, and
(c1) any applicable conservation management plan (within the meaning of section 38A endorsed by the Heritage Council), and
(d) such other matters as to it seem relevant.

The Heritage Act also provides statutory protection to relics, archaeological artefacts, features or deposits. Sections 139 to 146 of the Act require that excavation or disturbance of land that is likely to contain, or is believed may contain, archaeological relics is undertaken in accordance with an excavation permit issued by the Heritage Council (or in accordance with a gazetted exception under Section 139(4) of the Act).

The Heritage Act defines an archaeological relic as:

any deposit, artefact, object or material evidence that:
(a) relates to the settlement of the area that comprises New South Wales, not being Aboriginal settlement, and
(b) is of State or local heritage significance.

Section 170 of the Heritage Act requires government instrumentalities to maintain a Heritage and Conservation Register (Section 170 Register). This Register provides a list of assets which may have State or local heritage significance, including:

(i) heritage items under environmental planning instruments,
(ii) items subject to interim heritage orders,
(iii) items listed on the State Heritage Register,
(iv) items identified by the government instrumentality as having State heritage significance.

Section 170A of the Act requires that a government instrumentality must give the NSW Heritage Council not less than 14 days written notice before the government instrumentality:

(a) removes any item from its register under section 170, or

(b) transfers ownership of any item entered in its register, or
(c) ceases to occupy or demolishes any place, building or work entered in its register.

The government instrumentality is also responsible for ensuring that the items listed on its Section 170 Register are maintained with due diligence in accordance with State Owned Heritage Management Principles.

2.3.1 Department of Education and Communities Section 170 Register

There are no heritage items within the study area or its vicinity listed on the Department of Education and Communities (DEC) (formerly the Department of Education and Training) Section 170 Register.

2.3.2 Roads and Traffic Authority Section 170 Register

There are no heritage items within the study area or its vicinity listed on the NSW Roads and Traffic Authority (RTA) Section 170 Register.

2.3.3 Sydney Catchment Authority Draft Section 170 Register

The following item is listed on the Sydney Catchment Authority (SCA) Draft Section 170 Register:

Ref	Name	Primary Address	Significance
4580005	Upper Nepean Scheme – Upper Canal	From Pheasants Nest to Prospect Reservoir	State

2.4 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act* 1979 (EP&A Act) is the main law regulating land use planning and development in NSW, and requires consideration to be given to the environment as part of the land use planning process. The EP&A Act controls the making of environmental planning instruments (EPIs). Two types of EPIs can be made: Local Environmental Plans (LEPs), covering local government areas; and State Environment Planning Policies (SEPPs), covering areas of State or regional environmental planning significance. Clause 36(1) of the Act states that, in the event of an inconsistency between EPIs, there is a general presumption that a SEPP will prevail over a LEP. The EP&A Act also provides for the preparation of Development Control Plans (DCPs), which can include more detailed guidelines for certain types of development.

LEPs and DCPs commonly identify and have provisions for the protection of local heritage items and heritage conservation areas. The study area is located in the Liverpool and Camden LGAs. The local heritage items identified in these LGAs are listed below. Heritage items may also be identified in SEPPs.

2.4.1 Camden LEP 2010

Clause 5.10 of the Camden LEP 2010 has been prepared in accordance with the NSW Government's Standard Instrument—Principal Local Environmental Plan, and is consistent with current heritage best practice guidelines, providing for the protection of heritage buildings, places, works and trees, heritage conservation areas, and archaeological relics.

Schedule 5 'Environmental Heritage' of the LEP does not identify any individual heritage items within the study area or its vicinity.

2.4.2 Camden DCP 2006

Part D: Chapter 5 'Heritage Conservation' of Camden DCP 2006 includes provisions for potential heritage items. These are items or places which may have heritage value, but require further investigation to determine if the item or place should be listed on the Camden LEP as a heritage item.

Schedule A 'Potential Heritage Items' identifies the following cultural landscapes in the vicinity of the study area:

Ref	Name	Description	Significance
1280131	Bringelly Road / Greendale Road	Rural cultural landscape	N/A
1280004	Camden Valley Way	The former "Cowpastures Road" road corridor including trees and sequential vistas and view corridors to historical properties and pastoral landscapes	N/A

Camden Valley Way has recently been the subject of a separate heritage report, completed by Cosmos Archaeology Pty Ltd (2010) for the RTA. AMBS understands that Bringelly Road is also the subject of an ongoing heritage assessment being undertaken for the RTA.

2.4.3 Liverpool LEP 2008

Clause 5.10 of Liverpool LEP 2008 has been prepared in accordance with the NSW Government's Standard Instrument—Principal Local Environmental Plan, and is consistent with current heritage best practice guidelines, providing for the protection of heritage buildings, places, works and trees, heritage conservation areas, and archaeological relics.

Schedule 5 'Environmental Heritage' of the LEP identifies the following heritage items within the study area:

Ref	Name	Primary Address	Significance
15	Sydney Water Supply Upper Canal	Denham Court to Cecil Hills	State
38	Kemps Creek forest	Gurners Avenue (off), Kemps Creek	Local*
39	Row of Bunya Pines	Bringelly Road, Leppington	Local#
40	Brown Memorial and water trough	145 Bringelly Road, Leppington	Local
41	Dwelling and rural lot	1720 Camden Valley Way, Leppington	Local

*The Liverpool Heritage Study identifies Kemps Creek Forest as a place of natural rather than cultural heritage significance; as such, it will not be addressed further in this report.

#The Row of Bunya Pines is associated within the SHR Upper Canal System and is included within the heritage curtilage of that item. As such, the pines should be considered to have State heritage significance.

Liverpool Heritage Study Review

In 2005, FORM architect (aust) pty ltd completed a review of the Liverpool Heritage Study. The review incorporated an inventory of places or items local heritage value. Some of these places were identified during the public consultation phase of the study (2004). The following places are within

the study area and as such have been addressed by this report; however, they are not listed as heritage items in Liverpool LEP:

Ref	Name	Primary Address
1970223	Bare Cottage & Landscape	Lot 351 Fifteenth Avenue, West Hoxton
1970484	Private Residence	305 Fifteenth Avenue, West Hoxton
1970487	Nissen hut	97a Bringelly Road, Leppington
1970489	Nissen hut	Cnr Seventh and Edmondson Avenues, Austral
1970532	Former Blacksmith Shop	SW cnr of Fifteenth and Twentyeighth Avenues, West Hoxton
1970539	Hut	15 Seventeenth Avenue, Austral
1970544	Water Board Headquarters, West Hoxton Depot*	Twentyeighth Avenue, West Hoxton

*The Water Board Headquarters, West Hoxton Depot is associated with the SHR Upper Canal System and is within the heritage curtilage of that item. As such, the Depot should be considered to have State heritage significance.

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

State Environmental Planning Policy (Sydney Region Growth Centres) 2006 (SEPP Growth Centres 2006) establishes the development controls and objectives for the North West and South West Growth Centres. As part of the coordinated release of land for residential, employment and other urban development, the policy aims *to protect and enhance land with natural and cultural heritage value* (Clause 2(h)).

Development controls applying to the Austral and Leppington North Precincts, following finalisation of the precinct planning process, will form an amendment to the policy (SEPP Amendment). An Appendix covering these precincts will specify controls for the conservation of heritage items, heritage conservation areas and archaeological sites (if any) within the precincts. A Schedule to the policy will also specify individual heritage items, conservation areas and archaeological sites which have been identified in the precincts, and which are determined to have local or State heritage significance. This report includes an assessment of the significance of potential heritage items within the study area, and associated recommendations for the inclusion of existing and newly identified heritage items in future amendments to the policy.

2.4.5 State Environmental Planning Policy (Infrastructure) 2007

State Environmental Planning Policy (Infrastructure) 2007 (SEPP Infrastructure 2007) provides specific provisions and development controls for essential infrastructure projects, such as roads, railways, sewerage, stormwater, and telecommunications facilities.

Clause 14 of the SEPP requires that a public authority, or a person acting on behalf of a public authority, should consult with the relevant local Council if a development proposal undertaken in accordance with the provisions of SEPP Infrastructure 2007 has the potential to impact on local heritage items listed on Council's LEP.

SEPP Infrastructure 2007 does not affect the approvals processes of the Heritage Act.

2.5 National Trust of Australia (NSW)

The National Trust of Australia is a private, not-for-profit organisation committed to conserving Australia's heritage. Listing with the National Trust of Australia does not have statutory authority; however, it does have a role in raising public awareness of heritage issues.

The following items are classified by the National Trust:

Ref	Name	Primary Address
8644	Kemps Creek Landscape Conservation Area	Approx 1km south of Elizabeth Drive (Part of Cumberland Plain Remnant Communities Landscape Conservation Area)
10080	Sydney Water Supply: Upper Canal	Blacktown, Fairfield, Liverpool and Campbelltown LGAs

3 Thematic History

3.1 European Exploration and Settlement

In 1789 Captain John Hunter surveyed the Georges River from Botany Bay to close to present day Liverpool, to the east of the study area. This marked the first incursion by Europeans into the area, and although Hunter was unimpressed, over the next year a number of other parties explored further up the river. George Bass and Matthew Flinders followed Hunter shortly after their arrival in 1795. Venturing further up river to the junction with Prospect Creek, they went beyond the steep timbered banks of the lower river and saw better country, about which they reported favourably (Keating 1996:9). Following Bass and Flinders' reports, by early 1798 land grants began to be offered along the Georges River in the area around what are now the suburbs of Moorebank and Chipping Norton. These early grants were characterised by their proximity to the river, which provided water for the settlers and their farms as well as a convenient means of transport for their produce back to Sydney markets (Kass 2004:10).

During the same period, rich, fertile grasslands were discovered on the southwest side of the Cumberland Plain. This land became known as the Cowpastures as it was here that a herd of wild cattle were found grazing, descended from cows which had wandered from Sydney soon after their arrival on the First Fleet. Vital to the survival of the European settlement as a source of fresh meat, the Cowpastures was restricted from settlement to allow the cattle room to graze and multiply (Liston 1988:7-8; Morris and Britton 2000:13; Kass 2004:10).

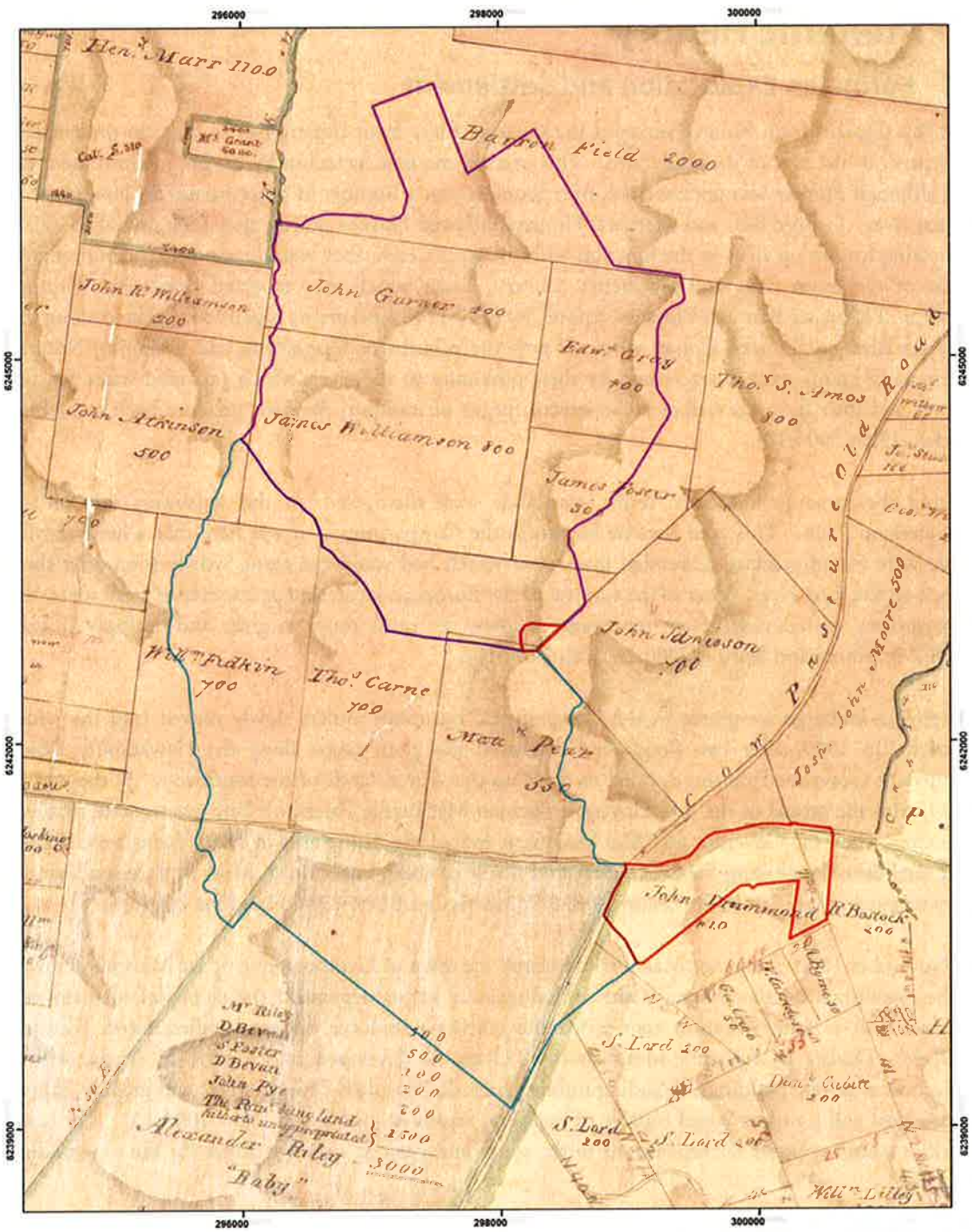
Despite an embargo on grants in the Cowpastures, European settlers slowly moved into the wider district. In 1809, after two floods had destroyed the grain crops along the Hawkesbury River, Lieutenant Governor Paterson decided to open up the 'forest' lands of the southwest. At the end of 1809, with the arrival of the new Governor Lachlan Macquarie, Paterson's land grants were recalled. However, when the Governor and Mrs Macquarie toured the Minto area in 1810, farms were already well established, including fields of wheat and flocks of sheep and cattle. Most of Paterson's grants were reissued in January 1810 (Liston 1988:8-9; Morris and Britton 2000:13; Kass 2004:11).

In November 1810, Governor Macquarie declared the town of Liverpool, one of the Macquarie towns to be established on the fringes of the settled areas to act as depots for the shipment of grain and produce and as administration centres for the convict workforce on surrounding farms (Keating 1996:7). During Macquarie's administration, Liverpool developed into a regional centre, with a collection of public buildings, including military barracks, hospital, church, stores and granary, school house, gaol and a timber wharf capable of handling vessels up to 50 tons (Kass 2004:15). The town acted as a staging point for expeditions to the south and grew as a service centre for the surrounding estates.

3.2 Early Land Grants

The land around the growing town of Liverpool was granted to a mix of government officials, ex-soldiers, wealthy settlers and emancipist farmers. The size of each grant was dependent in large part on the standing in the community and the financial situation of the grantee. Members of the colonial elite received large pastoral grants of 400 acres or more, while ex-soldiers, emancipists and native born people often received smaller grants of 100 acres or less (Kass 2004:11-12).

The earliest grants in the vicinity of the study area, made to John Jamieson and Simeon Lord, were located alongside the Cowpasture Road. Later grants spread out towards the west, with moderately large estates adjacent to Kemps Creek and along the Bringelly Road (Figure 3.1, Table 3.1).



Precinct Boundaries

- Leppington Precinct
- Austral Precinct
- Investigation Areas

0 0.5 1 2 3 4 Kilometres

Background image: Mosaic of Parish Maps, c1850s. (Source: Parish Map Preservation Project, Parish of Cabramatta, Ref: 140705; Parish of Cook, Ref: 140697; Parish of Minto, Ref:140644)
Horizontal datum: GDA94/MGA Zone 56

N

Figure 3.1 Early land grants in the vicinity of the study area.

Table 3.1 Early land grants in the vicinity of the study area.

Grantee	Property Name	Parish	Date	Acres
John Jamieson	Cow-de-Knaves	Cabramatta	1-1-1810	700
Simeon Lord	Pembury	Minto	1-1-1810	200
John Drummond		Minto	20-6-1816	410
Alexander Riley	Raby	Cook	8-10-1816	3000
Urban Fidkin	Stanfield Park	Cabramatta	13-1-1818	700
Barron Field	Hinchinbrook	Cabramatta	13-1-1818	2000
James Foster	Eccleston	Cabramatta	13-1-1818	300
Edward Gray		Cabramatta	13-1-1818	400
John Gurner	Ickleton	Cabramatta	13-1-1818	400
Matthew Pear	Bellevue	Cabramatta	13-1-1818	550
James Williamson	Dungarthell	Cabramatta	13-1-1818	800
Robert Bostock		Minto	17-8-1819	200
Thomas Carne		Cabramatta	31-8-1819	700
Hannibal Macarthur (Matthew Dysert Hunter)	Eastwood	Cook	8-1819 (26-7-1841)	1060

3.2.1 Barron Field

Barron Field was appointed to replace Judge Jeffery Bent on the Supreme Court of NSW in May 1816. He arrived in NSW in February 1817 with his new wife Jane, on the female convict ship *Lord Melville*. As a senior government official, Field soon received a substantial grant of 2000 acres (809.4ha) in the District of Cabramatta, which he named *Hinchinbrook*. This land extended from Cowpasture Road in the west to Kemps Creek in the east, and is partly within the study area (Figure 3.1 and Figure 3.2). Field courted controversy with his court judgements, including his opinions concerning the rights of ex-convicts to hold property. He fell out with Governor Macquarie over his support of the exclusives in the colony, and also with John Macarthur, whom he had not supported in his quest to become a magistrate. Field is also remembered for publishing a book of poems in 1819, called *First Fruits of Australian Poetry* (Curry 1966:373-376).

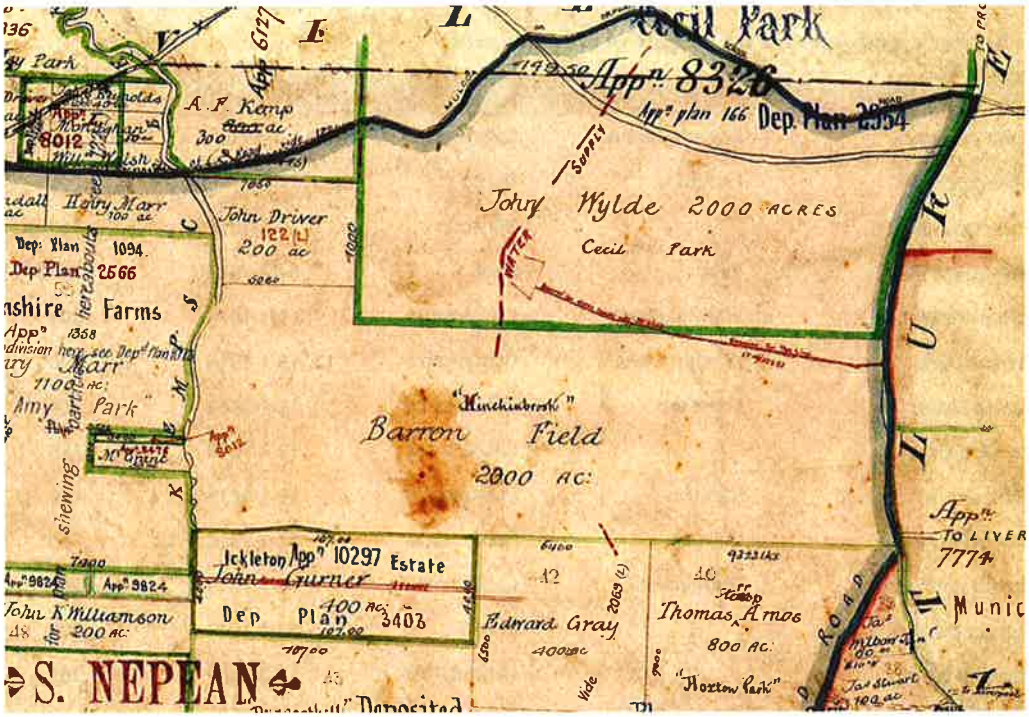


Figure 3.2 Detail of Parish Map of Cabramatta, nd, showing Barron Field's *Hinchinbrook* and John Gurner's *Ickleton* estates (Source: © NSW Land Information Centre, Ref: 14070401).

In 1828, Field left Sydney to take up a position as advocate-fiscal of Ceylon, after which he was appointed as a judge in Gibraltar. His *Hinchinbrook* estate was managed by his clerk and neighbour, John Gurner. In October 1834, the 2000 acre property was advertised for lease. There was no mention of any buildings on the farm, so it is possible that it was never developed by Field (*The Australian* 28 October 1834).

3.2.2 John Gurner

English solicitor John Gurner was appointed clerk to Barron Field, NSW Supreme Court Judge, in 1816. Gurner and his wife Rebecca arrived in the colony with Field in 1817. In January 1818, Gurner received a grant of 400 acres (161.88 ha) in the Parish of Cabramatta, which he named *Ickleton* after the village in which he was born in England. The farm adjoined Barron Field's *Hinchinbrook* to the north, and also had a frontage on the east bank of Kemps Creek. Gurner, with the support of Field, was allocated a number of government convicts and some stock for his farm. Although he resided in Sydney, his land was tenanted, and in 1826 he applied for an additional grant stating that he had cultivated 40 acres, and cleared and fenced a further 80 acres of his *Ickleton* grant (Walsh 1966:494-495; Liston 2009:52).

Following Gurner's death in 1882, *Ickleton* was put up for sale by the executors of his estate. Advertisements for the sale confirmed that about 40 acres had been cleared:

> *… the residue is chiefly ringbarked timber, very suitable for fire wood, for which there is a profitable market. The soil is good, of great depth, and is represented to grow anything. It was formerly known as the late Scotty's Farm. Mr. Wayman is the tenant, at a nominal rental* (*SMH* 8 October 1884).

3.2.3 James Williamson

Adjoining Gurner's *Ickleton* estate to the south was the 800 acre (323.76 ha) estate of James Williamson, known as *Dungarthell Plains* (Figure 3.3). Williamson had arrived in the colony in 1795, and had been appointed as one of the colony's commissaries. In this role, Williamson acted along with his fellow officer John Palmer as a type of banker to the elite. As well as acting as the manager of

internal trade and supply of goods through the commissariat, Williamson was involved in many of the money making schemes and ventures of the NSW Corps officer class, as well as lending public monies to officers and charging interest, which he re-invested in his own transactions. Many small landholders complained of Williamson's role and favouritism. By 1800, Williamson had amassed 359 acres of land around Sydney and was running one of the largest flocks of sheep in the colony with 320 head (Parsons 1988:112). Despite his wealth, Williamson's use of the public office to further his own interests saw him eventually accused of fraud and later dismissed from office. Williamson had returned to England in 1809-10 to testify at the trial of Lieutenant-Colonel George Johnston following the Rum Rebellion and returned to Sydney in 1817. Now a ticket of leave man, Williamson applied to Governor Macquarie for a grant of land and received his *Dungarthell Plains* estate, which he farmed until his death in 1826 (Fletcher 1967:602).

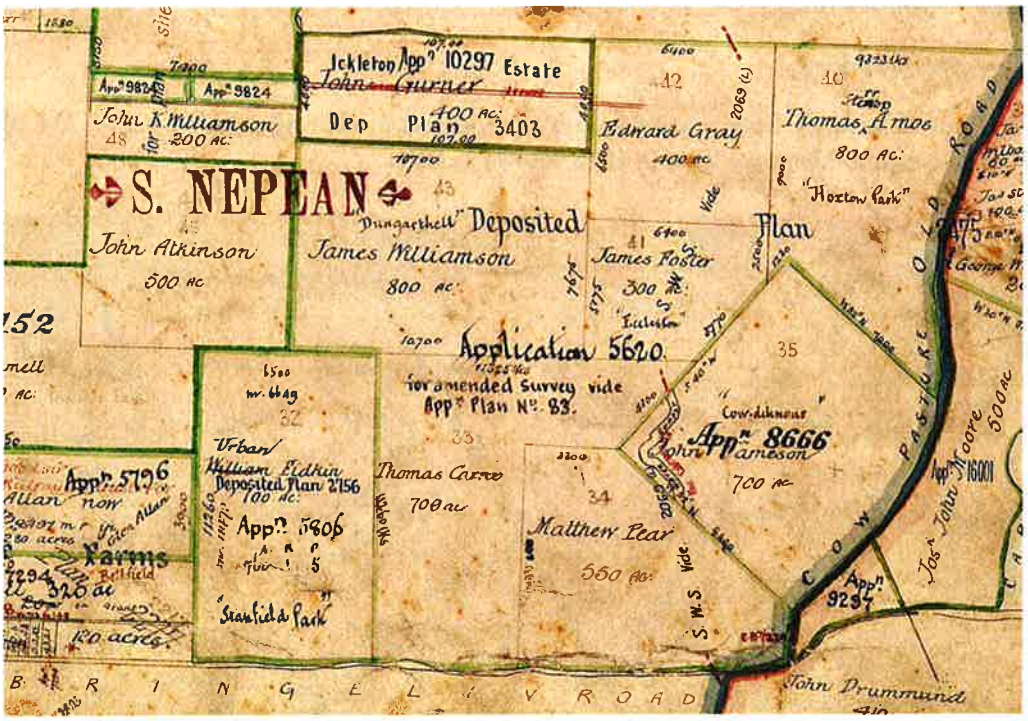


Figure 3.3 Detail of Parish Map of Cabramatta, nd, showing James Williamson's *Dungarthell*, James Foster's *Eccleston*, and Thomas Carne's estates (Source: © NSW Land Information Centre, Ref: 14070401).

3.2.4 Thomas Carne

To the immediate south of Williamson, Thomas Carne received his grant of 700 acres (283.29 ha) fronting the north side of Bringelly Road in 1818 (Figure 3.3). Carne came to Australia in 1814 as a Lieutenant in the 46th Regiment. In 1816, he married Mary Ann Broughton, daughter of First Fleeter William Broughton and convict Elizabeth Heathorn (also known as Ann Glossop) (Vallance 1979: 565-566). Carne was appointed Coroner of the Town of Liverpool and surrounding districts in January 1820, and Deputy Provost Marshall for the same area in April 1820 (*The Sydney Gazette and NSW Advertiser* 1 January1820; 29 April 1820).

Carne soon acquired and occupied the neighbouring property of Matthew Pear, known as *Bellevue Farm* (*The Sydney Gazette and NSW Advertiser* 27 February 1823). A prominent hill at the east end of the property became popularly known as Carnes Hill (Liston 2009:52). However, by 1822 Carne was advertising this property for sale:

> *That most desirable FARM and PREMISES known by the Name of Bellevue Farm, and situated within 7 miles of Liverpool, near the four Cross-roads on the Cow-pasture Road, consisting of 565*

> *Acres of excellent Land, upwards of 200 of which are fallen and 100 cleared; 7 large paddocks are fenced in by upwards of 2000 rods of 3 and 4-railed fences. The House affords every accommodation for a genteel family, with kitchens, granaries, stables, stock-yards, and all necessary out-offices; a verandah upwards of 100 feet in length, most completely finished; and in front is a lawn of 12 acres, totally cleared of stumps, and laid down with clover and the choicest of pasturage. Also, an extensive garden and garden-house in complete order, affording every variety of fruits and vegetables. The limits of an Advertisement are insufficient to explain the beauties and advantages of this most desirable Estate, the value of which can only be appreciated by inspection.* (*The Sydney Gazette and NSW Advertiser* 1 November 1822)

Carne apparently failed to sell the estate, and upon his return to England in 1825 he undertook to let *Bellevue Farm* and the adjoining 700 acres of his original grant (*The Sydney Gazette and NSW Advertiser* 13 January 1825).

3.2.5 Alexander Riley

To the south of Bringelly Road, the study area takes in part of the original 3000 acre (1214.10 ha) crown grant issued to Alexander Riley in 1816, known as *Raby*.

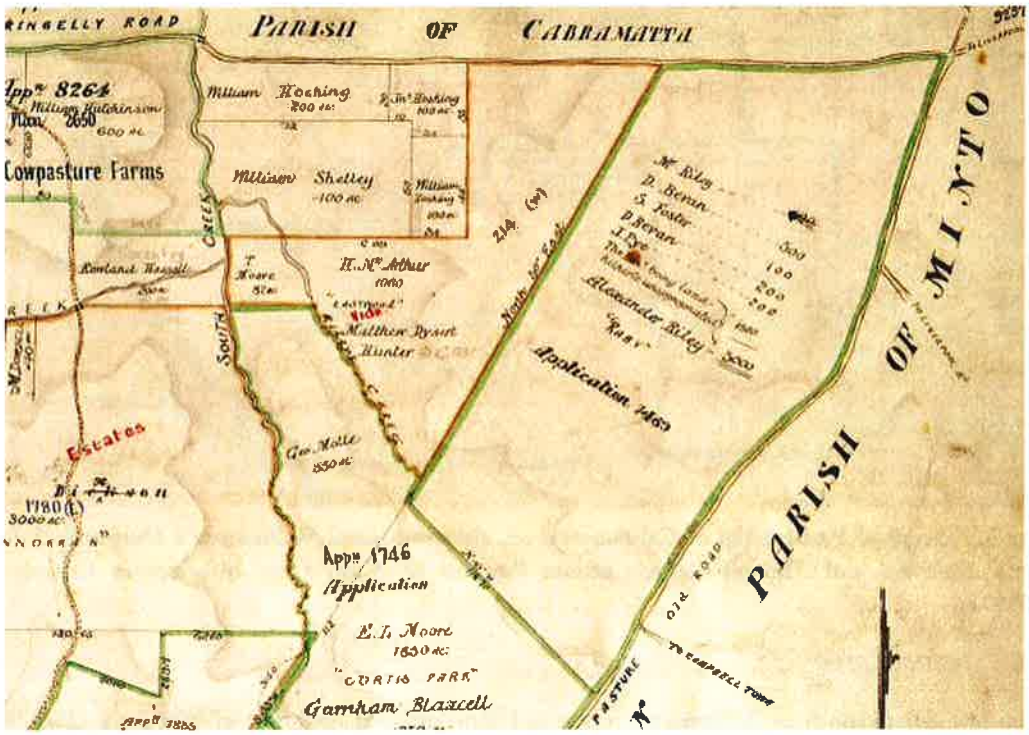


Figure 3.4 Detail of Parish Map of Cook, nd, showing Alexander Riley's *Raby* and Hannibal Macarthur's *Eastwood* estates (Source: © NSW Land Information Centre, Ref: 14069601).

Alexander Riley was the son of George Riley, a London bookseller, and Margaret Raby. He arrived in the Colony as a free settler in 1804, with his wife Sophia Hardwicke, and was appointed store-keeper and magistrate at Port Dalrymple. He returned to Sydney in 1809, taking up the position of Secretary to the Colony (Conway 1967:379-381).

Riley was successful as a merchant, magistrate, government official, and was one of the founders of the Bank of NSW. However, from 1812 onwards he became more and more involved in the development of the pastoral industry and the wool trade. Although he had little farming experience, he began to raise sheep on his *Raby* estate (Conway 1967:379-381).

Riley returned to England in 1817, but retained ownership of *Raby*. His commercial affairs in Sydney were left under the management of his younger brother Edward, and *Raby* was leased out for farming and grazing (LPMA CT Vol 1793 Fol 206; Conway 1967: 379-381). In 1834, the estate was described as *one of the most famous farms in the colony* (quoted in Morris and Britton 2000:15). While a substantial house and associated outbuildings were erected on the estate by the early 1820s, these were located outside the study area (Cosmos Archaeology 2010:35-36).

Raby remained in the hands of the Riley family until 1867, when the property was sold to William Moore, a grazier from Booligal, Lachlan River (LPMA CT Vol 44 Fol 161). Moore also acquired the neighbouring *Eastwood* estate. He ran a mixed farm that was stocked with horses, cattle, sheep and pigs, and undertook improvements including clearing and fencing. The farm remained in operation following Moore's death in 1878, when it was inherited by his widow Caroline, and his children William, Ada Grace, Clara Edith, Edgar Raby, Arthur Barrington, Ellen Elizabeth and Joseph Moore (Perdriau 1966:239; LPMA CT Vol 800 Fol 5).

3.2.6 Hannibal Macarthur

Hannibal Hawkings Macarthur first arrived in Australia in June 1805, as a companion to his uncle John Macarthur. John Macarthur was at this time returning to the colony as a private individual, having been sent back to England in 1801 to face court martial for duelling with his superior, Colonel Paterson. While in England, Macarthur lobbied extensively in support of his interests back in New South Wales. He subsequently resigned his military commission and returned to the colony with official sanction for his project to breed sheep and to develop a wool industry (Nairn 1967:147-149).

From 1808 to 1810, Hannibal Macarthur travelled in China and the Philippines, trading sandalwood for his uncle, before eventually returning to England. He returned to Sydney in 1812, with a cargo for disposal in the colony. Hannibal proved to be unsuccessful as a merchant, and failed to live up to his uncle's expectations. However, he usefully assisted John's wife Elizabeth in looking after the Macarthur merino flocks at Camden Park during John's absences, and later established his own substantial flocks (Nairn 1967:147-149).

In 1812, Hannibal married Anna Maria King, eldest daughter of the former governor, Philip Gidley King. The following year he bought Captain Henry Waterhouse's farm, *The Vineyard*, on the river near Parramatta, as a residence. He sought a land grant from Governor Lachlan Macquarie but was initially refused. However in 1814, he was made a magistrate, and in August 1819 he finally received recognition of his status by a grant of 1060 acres (428.98 ha) on the south side of Bringelly Road, which he named *Eastwood* (Nairn 1967:147-149). Macarthur later ceded his *Eastwood* estate back to the Crown, having received land at Werombi near Camden in lieu. The Cowpastures land was subsequently re-granted to Matthew Dysert Hunter in 1841 (*The Sydney Gazette and NSW Advertiser* 13 April 1841).

By 1826, Hannibal Macarthur had also developed banking interests and became a director of the Bank of Australia. In 1830, he joined the NSW Legislative Council, representing the conservatives of the colony, where he strongly opposed the inclusion of ex-convicts on juries. He continued in the nominated Legislative Council until its end in 1843, when he was returned unopposed to represent Parramatta in the new part-elective Council. However, the depression of the early 1840s brought a dramatic change in Macarthur's fortunes. The Bank of Australia failed and was liquidated in 1843. Hannibal lost a large part of his property and became insolvent. He retired from the Legislative Council in 1848, and in 1852 was appointed to the position of police magistrate in Ipswich, Queensland. He returned to England in 1853, following the death of his wife (Nairn 1967:147-149).

3.2.7 John Drummond

John Drummond arrived in the colony with the First Fleet in 1788 as quartermaster on the *Sirius*. He was stationed on Norfolk Island from 1796 until 1813, serving as pilot and beach master, landing stores for the outlying settlement. In 1813, with his partner the convict Ann Read, he returned to Sydney and purchased 100 acres (40.47 ha) near Liverpool known as Chipp's Farm (Liston 2009:9). In June 1816 he was granted a further 410 acres (165.93 ha) in the Parish of Minto fronting the Cowpastures and Bringelly Roads. As Chipp's Farm had a good dwelling house on it, Drummond probably used his 410 acres for cattle and cropping (Cosmos Archaeology 2010:146).

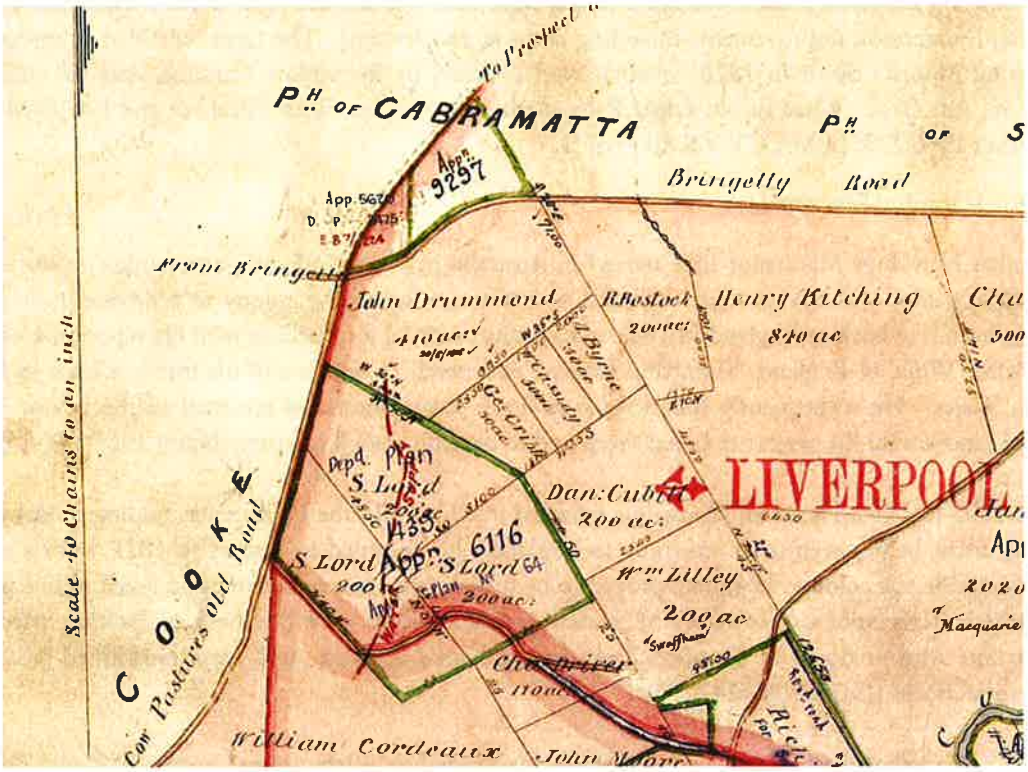


Figure 3.5 Detail of Parish Map of Minto, nd, showing John Drummond's estate (Source: © NSW Land Information Centre, Ref: 14064301).

3.2.8 Other Land Grants

Other landholders in the study area included: emancipist farmer James Foster, who had 300 acres east of James Williamson, known as *Eccleston*; Urban Fidkin, who farmed his 700 acres, possibly known as Stanfield Park, until selling it in 1821 (*The Sydney Gazette and NSW Advertiser* 24 February 1821); Matthew Pear, Edward Gray, and Richard Bostock (see Figure 3.1).

3.3 Developing Local and Regional Economies

3.3.1 Transport – Roads

The development of early roads and other transport infrastructure was one of the key means of taming the unfamiliar Australian landscape, controlling access to resources, and promoting the growth and economic development of the colony. A c.1826 plan of roads in the district of Cook shows two early roads in the region southwest of Liverpool: Cowpasture Road and Bringelly Road (Figure 3.6). These roads had a profound influence on the pattern of settlement of the area, forming the boundary of numerous early land grants in the study area, and facilitating transport and communication

throughout the district. These roads remained important regional transport links until the end of the nineteenth century. Bringelly Road is still an important road corridor today.

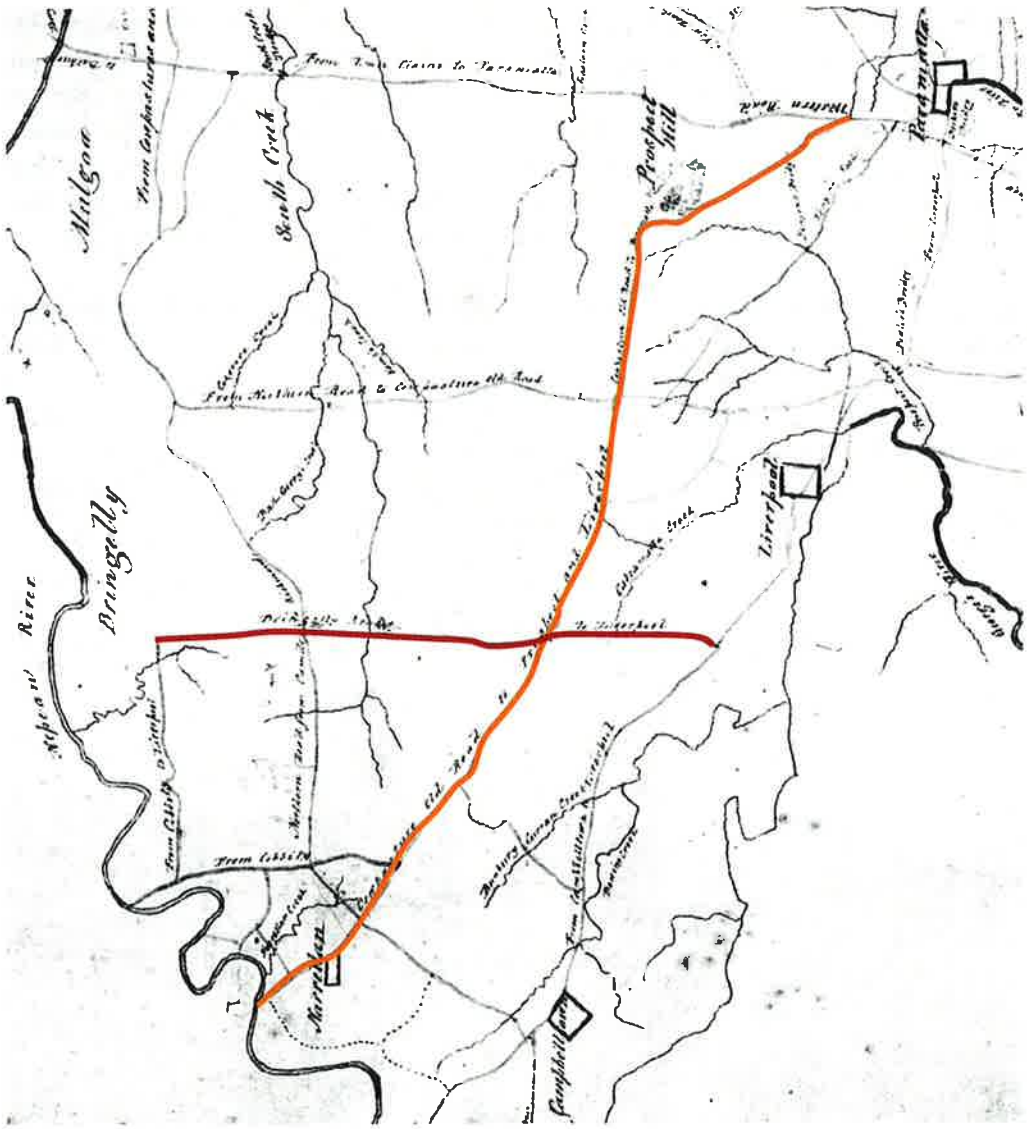


Figure 3.6 Detail of Plan of Roads in the District of Cook, c.1826, showing the route of the 'Cowpasture Old Road to Prospect and Liverpool' (traced in orange) and the Bringelly Road (traced in red) (Source: Mitchell Library, Ref: Z/M2 811.112/1826/1).

Cowpasture Road

In 1795, two bulls and five cows that had escaped from the First Fleet in 1788 were rediscovered near what is now Camden. The seven animals had multiplied into a substantial herd and the area became known as the Cowpastures. In 1805, a track was cut from the settlement of Prospect Hill through the bush to reach the herd and a constable was stationed at the Nepean River to protect the herd from poachers and runaway convicts. This track was surveyed by pardoned convict James Meehan under instruction from Governor King; the surveyed route formed the basis of Cowpasture Road, opening between Prospect and the Cowpastures in 1806 (Keating 1996:15).

This road was the earliest in the Liverpool area, southwest of Sydney. In order to pay for the construction and maintenance of the road, a tollgate was erected near the junction with the Bringelly

Road, at Carne's Hill. This gate was operated by a lessee until at least the 1850s (SMH 2 March 1850; Keating 1996:15).

By 1850, Cowpasture Road was being used as an alternate route for the Great South Road, another early nineteenth century road that originally linked Sydney to Goulbourn via Campbelltown and Picton. The alternate route departed from the Cross Roads at Glenfield, following Bringelly Road to Carnes Hill, and then south to Camden along Cowpasture Road. The alternate route became the main road for traffic between Liverpool and Camden and areas further to south. As a consequence, the section of Cowpasture Road north of Bringelly Road, between Prospect and Carnes Hill was little used and eventually became derelict (SMH 2 March 1850; Hall 1931:87; Wilson 1920:6-7).

In September 1907, the alignment of Cowpasture Road at its junction with Bringelly Road was permanently altered. The point at which Cowpasture Road moved south of Bringelly Road was shifted approximately 200 metres to the west, following the west side of a triangle of land reserved in 1886 for the route of the Upper Nepean Scheme – Upper Canal (Figure 3.7 and Figure 3.8; LPMA CT Vol 796 Fol 99). There is no evidence a bridge was ever built for Cowpasture Road to cross the Canal on its original alignment, and it is therefore possible that the new alignment was informally established in 1888, upon the opening of the Canal (see Section 3.3.6 below).

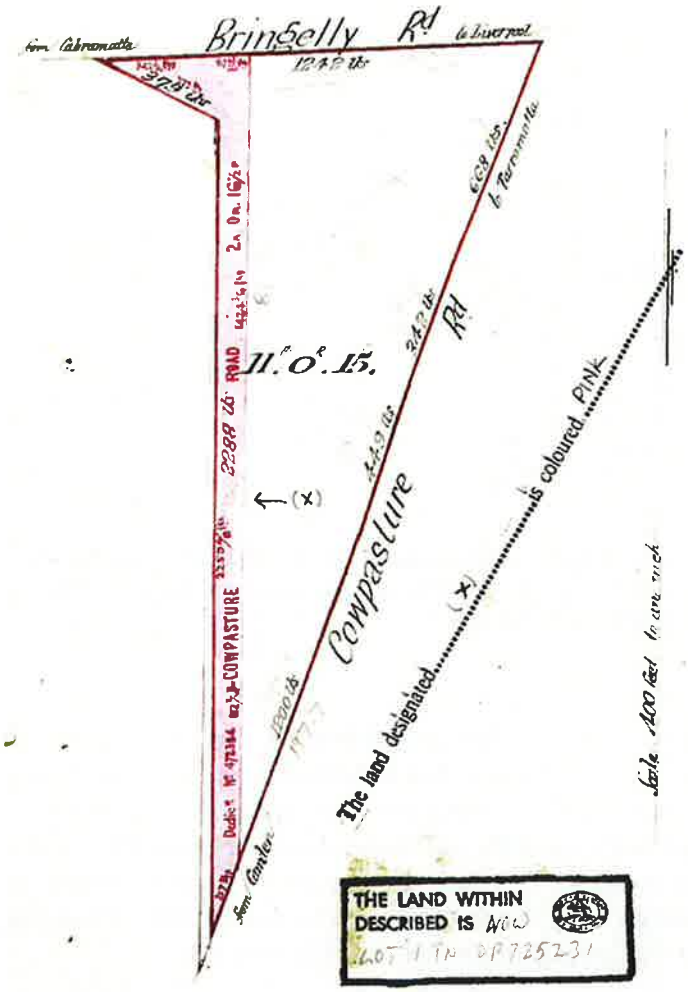


Figure 3.7 Plan of land resumed by the Minister for Public Works for the Upper Nepean Scheme, July 1886, also showing the land resumed for the deviation of the Cowpasture Road in September 1907 (Source: LPMA CT Vol 796 Fol 99).

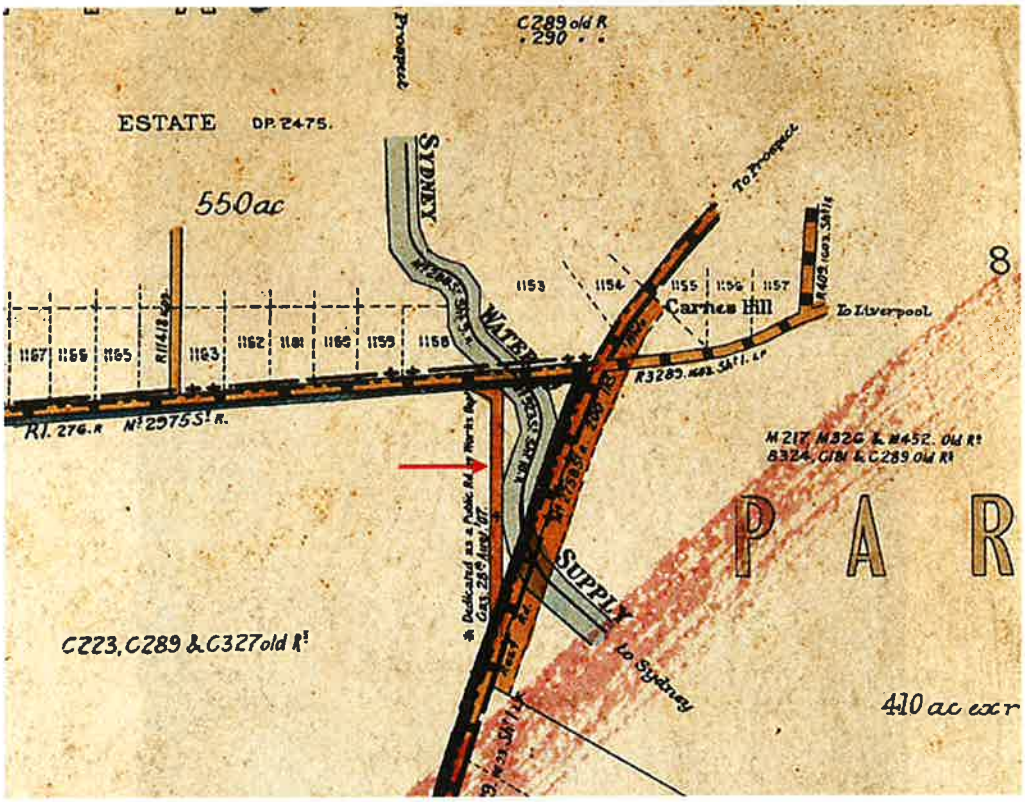


Figure 3.8 Detail of Parish Map of Cook, 1914-1928, showing the old and new alignments of Cowpasture Road, on east and west sides of the Upper Canal respectively. The new alignment is indicated with a red arrow (Source: © NSW Land Information Centre, Ref: 14090502).

In 1920, Australian born architect and artist William Hardy Wilson published *The Cow Pasture Road*, a romanticised travelogue and illustrated description of the old colonial houses and gardens along the road, between Prospect and Camden. Wilson confirmed that traffic picked up on the road south of Carnes Hill, along the route of the Great South Road; that being said, a traveller was unlikely to see more than two dozen timber or farmer's carts per day. Automobiles had also started to appear by this date; however, Wilson notes that the surface was perilous to the wheels of cars when wet, suggesting that it was simply formed of compacted clay. Wilson's whimsical map of the road, which is the frontispiece to the book, has Carnes Hill at its centre, at the junction of Cowpasture and Bringelly Roads, and the Upper Canal (Figure 3.9). This hill has expansive views of the surrounding landscape, and a traveller could

> *overlook the Cross Road, Bringelly Road, both parts of the divided Cow Pasture Road, the counties of Cumberland, Camden and Cook, and, on a clear day, the metropolitan cemetery [Rookwood] where multitudes are buried … (Wilson 1920:33).*

Figure 3.9 Wilson's map of The Cow Pasture Road, with 'Carn Hill' at the junction of Cowpasture and Bringelly Roads, and the Upper Canal. (Source: Wilson 1920:frontispiece)

In 1926, following commencement of the Main Roads Act (1924), the Board of Main Roads decided that the Great South Road via Carnes Hill should be upgraded to a standard width of 20 feet, with a surface suitable to carry main highway traffic, including wet weather motor traffic. In 1928, following approval of the project for Federal Aid, the Board decided to construct a deviation to the route, to the south of Carnes Hill. The deviation reduced the grade of the road from 1 in 21 (on Carne's Hil) to 1 in 13, and shortened the route by 1,200 feet (366m).

The new section of road, which cut a northeast-southwest line through the former Drummond estate, was constructed between 1928 and 1929, with an 8in sandstone Telford foundation and a 3in 'wearing course' of bituminous macadam, and a reinforced concrete bridge over the Upper Canal (Figure 3.10) (LPMA CT Vol 2858 Fol 106; Hall 1931:88, 90). Due to the unstable nature of the local clay substrate, the Board decided to continue the works south of the Canal as 7in concrete pavement, along the original route of Cowpasture Road. The change was warranted by the rapidly increasing rates of motor vehicle traffic, which by 1929 had reached an average of 600 vehicles per day travelling between Sydney and Camden (Hall 1931:89-90).

The upgraded road was opened in December 1930, as part of the Hume Highway, named in 1928 after Australian explorer Hamilton Hume (Figure 3.11) (SMH 31 December 1930). The new road can be seen on aerial photographs of the area (Figure 3.12). A series of photographs published in the

Board's journal, Main Roads, also show before and after pictures of the road (Figure 3.13-Figure 3.14).

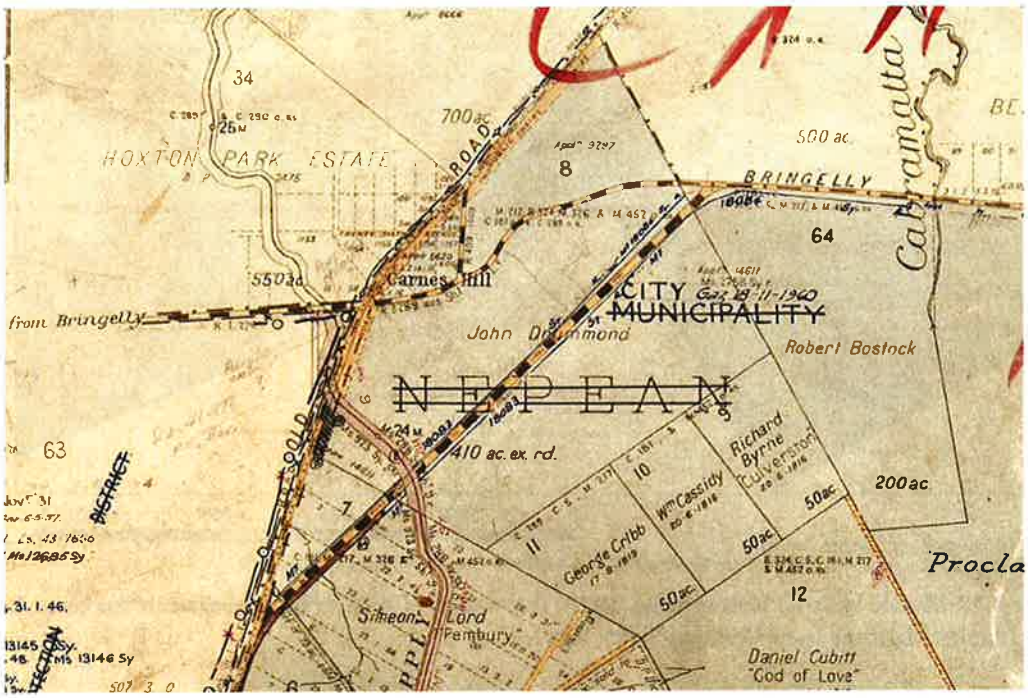


Figure 3.10 Detail of Parish Map of Minto, 1930-1962, showing the route of the Hume Highway through the former Drummond estate (Source: © NSW Land Information Centre, Ref: 14046601).

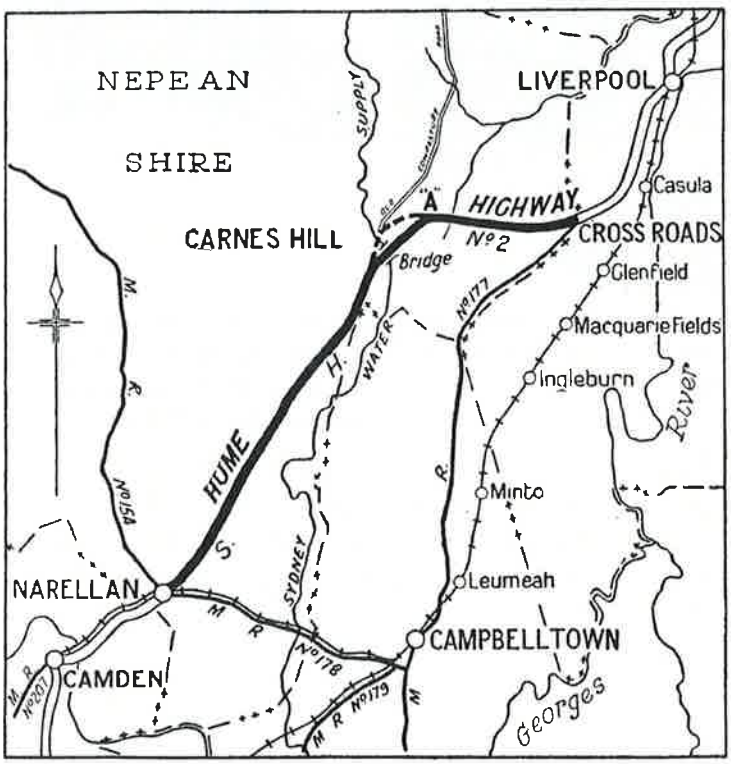
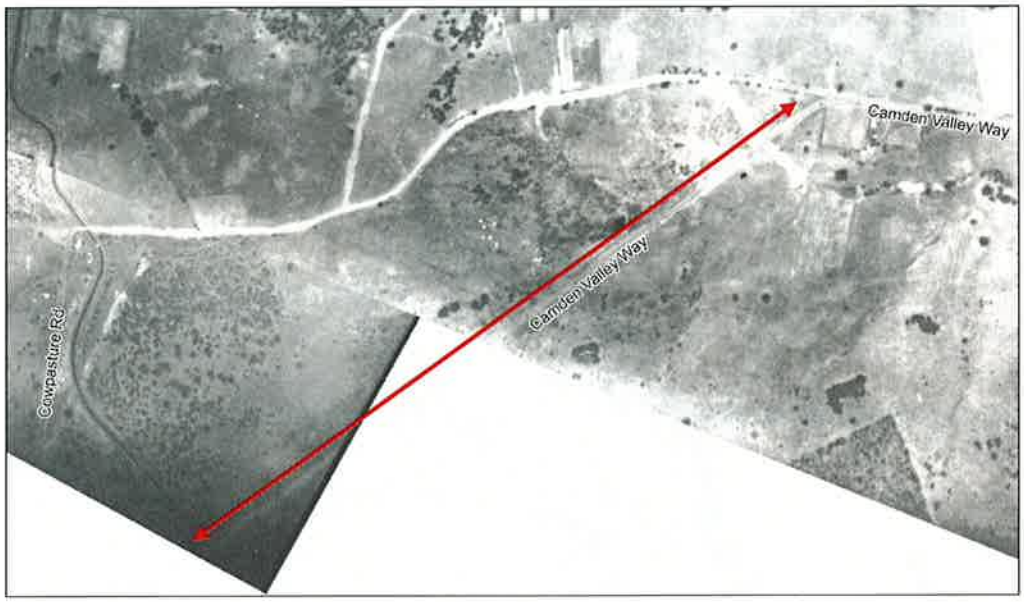


Figure 3.11 ***Locality Sketch of the Hume Highway between Cross Roads and Narellen. The old road at Carne's Hill deviation is shown dotted at "A."*** **(Source: Hall 1931:87).**



Horizontal datum: GDA94/MGA Zone 56
Background image: Detail from Geoscience Australia, Aerial photographs 3429-807 and 3429-807A, Sydney Survey, 1930

Figure 3.12 Mosaic of aerial photographs, 1930, showing the Carne's Hill deviation to the Great South Road / Hume Highway (now Camden Valley Way).

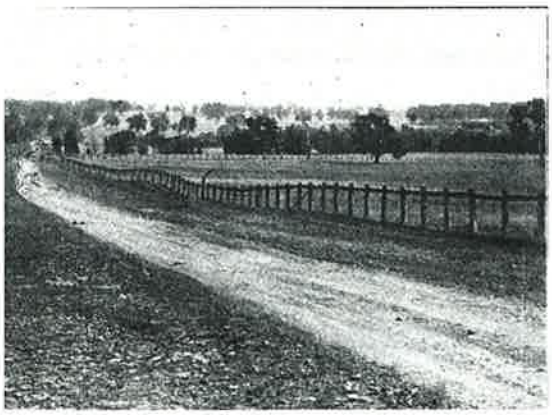


Figure 3.13 Before reconstruction: *Cross Roads-Narellen Road, 4 ½ miles south of the water race.* (Source: Hall 1931:88).

Figure 3.14 After reconstruction: *Completed concrete pavement between Carne's Hill and Narellan, 1 ½ miles south of the water-race.* (Source: Hall 1931:89).

This section of the Hume Highway is now called Camden Valley Way. The bypassed section of Cowpasture Road, north of the new junction became a local road and has retained the name Cowpasture Road (Figure 3.15). Camden Valley Way is currently being upgraded from two to four lanes, as part of the process of improving regional transport infrastructure in conjunction with development of the SWGC.

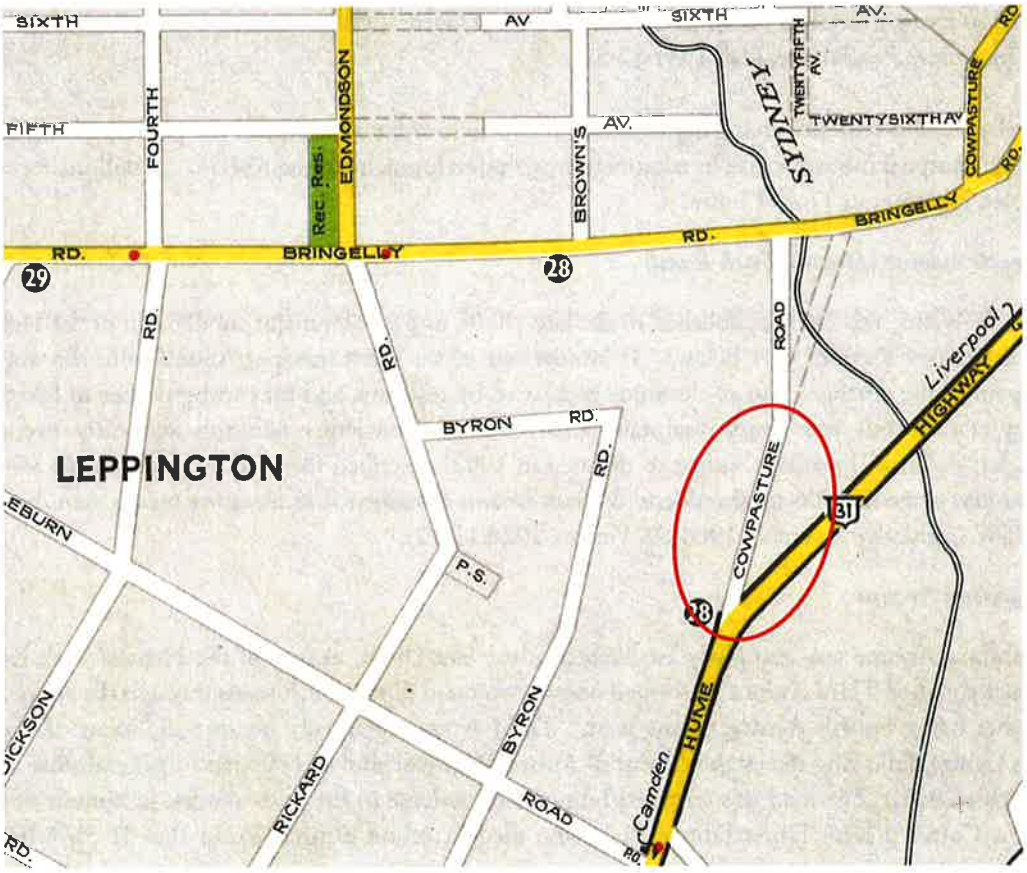


Figure 3.15 Detail of Map 94 from the *UBD Sydney Street Directory*, 1964, showing the junction of the Hume Highway (now Camden Valley Way) and Cowpasture Road. A short section of Cowpasture Road retains its original alignment (circled red).

Bringelly Road

In August 1815, Governor Macquarie ordered the construction of a new public road between Liverpool and the Cooke and Bringelly districts (Sydney Gazette 12 August 1815; Keating 1996:15). The area of Bringelly had been crossed in 1802 by the explorer George Caley, and in 1810 Governor Macquarie described the area as being of *a superior quality but far from being very good land for cultivation* (Keating 1996:22). The route of the Bringelly Road was laid out by James Meehan, who was at that time Deputy Surveyor General to the colony, and included timber bridges built by convict gangs across the local creeks (Keating 1996:15).

By 1822, the bridges were in need of repair, and were an ongoing source of complaint for travellers (*Sydney Monitor* 23 January 1830; Keating 1996:15). In 1906, a local resident William Brown reported that the road from Bringelly to Liverpool used to be impassable, but that it was now splendid: *it is a credit to the Government for the way they fixed it up* (NSW Legislative Assembly 1904:69). Another local resident, Edith Fitzpatrick, recalled that in the 1920s the Bringelly Road at the Upper Canal was *a shocking road … because there [were] so many wood drays* carting loads to sawmills at Liverpool railway station (Keating 1996:131).

In 1925, Nepean Shire Council requested that the newly formed Board of Main Roads reconstruct Bringelly Road, in order to provide an adequate means of transport and communications between Liverpool and the heart of the Nepean Shire. The Board decided to upgrade the road east of the Upper Canal to carry main highway traffic, as part of the Great South Road (later Hume Highway) upgrade between Liverpool and Narellen. However, in 1928, midway through the project, it was

decided to create a deviation around the steep slopes of Carne's Hill bypassing this section of the road (see *Cowpasture Road* above; Hall 1931:87-88).

Bringelly Road is currently being upgraded from two to four lanes, as part of the process of improving regional transport infrastructure in conjunction with development of the SWGC. It will intersect the proposed Leppington Town Centre.

Fifteenth Avenue (Hoxton Park Road)

Fifteenth Avenue was likely established in the late 1880s, as part of a major subdivision of the Hoxton Park Estate (see Section 3.4.1 below). It formed one of the main transport routes from the town of Liverpool to the northern part of the study area, used by residents and for carting timber to Liverpool railway station, but was poorly maintained for much of the late nineteenth and early twentieth centuries. William Freame, a visitor to the area in 1902, described the road as *absolutely the worst in the country*, while in 1906 local resident William Brown described it as *the worst road a man could get on* (NSW Legislative Assembly 1904:69; Freame 1928:11-12).

Edmondson Avenue

Edmondson Avenue was also likely established in the late 1880s, as part of the Hoxton Park Estate. Originally named Third Avenue, it formed one of two main north-south roads through the study area, the other being Fourth Avenue to the west. Third Avenue gradually became the focus of Austral Town Centre, following the establishment of Austral Public School in 1893, and a general store in the late 1930s-1940s. The road was renamed Edmondson Avenue in the post-war era, in honour of local resident Corporal John Hurst Edmondson, who died in action during World War II (WWII) (see Section 3.5.1).

3.3.2 Transport – Railways

In 1904, the Parliamentary Standing Committee on Public Works considered a proposal to construct a new railway from Liverpool to Mulgoa, running through the centre of the Hoxton Park Estate. The proposal originated in a report in 1890 by E B Price of the Department of Public Works, which drew attention to an area of undeveloped land that lay in the angle between the Southern and Western Railways, namely the Cowpastures. This proposal attracted public attention, and in 1897 the Minister for Public Works subsequently initiated surveys of two routes, one of which passed through the middle of the study area. The Committee noted that the area was only sparsely settled, and in view of the cost of the railway, estimated at £92,148 exclusive of land, concluded that the proposal was unviable (NSW Legislative Assembly 1904:5-6).

In the late twentieth century, the question of a railway through the region was revisited, beginning with investigations by the Commonwealth Government into a proposed Second Sydney Airport (also known as Badgerys Creek Airport). By the 1990s, the NSW Government was also beginning to explore development opportunities in the region, which included the provision of new areas of suburban housing supported by new forms of public transport. In December 2004, the NSW Government announced its planning policy to develop 'growth centres' in Sydney's South West and North West. This policy included a new rail line, the South West Rail Link, which would be constructed between Glenfield and Leppington. Construction of the new line began in Glenfield in late 2010.

3.3.3 Forestry

Although some large areas of native forest were cleared for pasture during the first decades of European settlement, much of it by burning, the majority of land was cleared in the late nineteenth and early

twentieth centuries, as an important source of fuel and building timber in Sydney and as a reliable cash crop for local farmers.

In 1904, the Parliamentary Standing Committee on Public Works reported that a large percentage of settlers in the area were engaged in carting firewood to the Southern or Western railway, for conveyance to Sydney, with over 18,000 tons loaded at Liverpool Station each year (NSW Legislative Assembly 1904:7; Keating 1996:125-126). However, in his evidence to the Committee, local butcher William Brown described woodcarting as *a played out game*, a last resort if *a man had nothing else to do* (NSW Legislative Assembly 1904:68-75; Keating 1996: 126).

In 1906, a Reconnaissance Map of the Neighbourhood of Liverpool Camp confirms that a large part of the study area north of the Bringelly Road was still thickly timbered at this date, while the large pastoral estates south of the road had been cleared (Figure 3.16). The *Hinchinbrook* estate beyond the north edge of the study area has also been substantially cleared.

In 1931, the *Sands' Sydney, Suburban and Country Commercial Directory* (Sands' Directory) indicates that there was a sawmill active in the Austral area, operated by Longford & Thomas. The directory also lists three carters in the area at this date.

Aerial photographs from 1930 show a patchwork of cleared and lightly timbered land throughout the study area (Figure 3.17). However, Kemps Creek Nature Reserve, at the west side of the *Hinchinbrook* estate, was maintained as a wooded area throughout the twentieth century, and is now protected as a rare pocket of native Shale-Gravel Transitional Forest, Cumberland Plain Woodland and Alluvial Woodland (Cardno 2011:12-14).

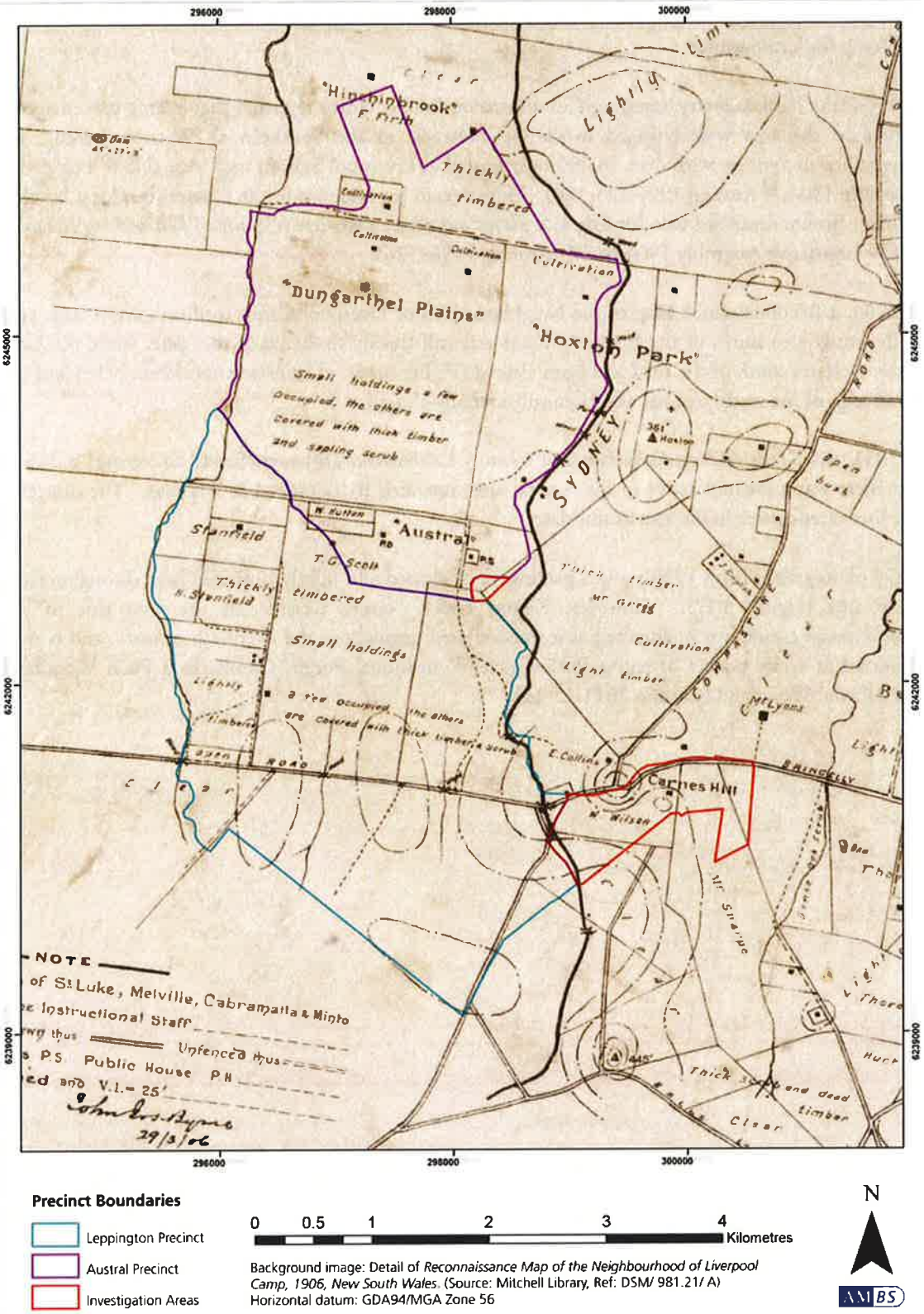


Figure 3.16 Detail of the Reconnaissance Map of the Neighbourhood of Liverpool Camp, 1906. Much of the study area was still thickly timbered at this date. Buildings, indicated by small black squares, are sparsely scattered through the area. The map contains some errors, including the misplacement of Austral Public School.

0 0.25 0.5 1 1.5 2 Kilometres

Horizontal datum: GDA94/MGA Zone 56
Background image: Detail from Geoscience Australia, Aerial photograph 3429-805, Sydney Survey, 1930

Figure 3.17 Aerial photograph of the north part of the study area, 1930, showing a series of lightly timbered three acre lots along Fifteenth Avenue. A thickly timbered area at the northwest corner of the study area (top left) is now part of Kemps Creek Nature Reserve, a rare pocket of native Shale-Gravel Transitional Forest, Cumberland Plain Woodland and Alluvial Woodland.

3.3.4 Agriculture and Pastoralism

Many of the early grants in the Liverpool district were taken up as grazing land. By 1821, when Governor Macquarie left the colony, the broader district boasted the highest stock numbers in the colony. Liverpool was recorded as having 27.5% of the sheep, 27% of the horses and 26.9%t of the cattle in NSW at this time (Kass 2004:14). However, in later decades, sheep were moved across the Blue Mountains to the larger properties being developed in the west, and cattle came to dominate livestock numbers in the region.

As well as livestock, a thriving agricultural economy developed around Liverpool. In 1821 there were 2,372 acres of wheat and 1,835 acres of maize under cultivation in the district. This was in addition to 364 acres of market gardens and orchards, 170 acres of barley, 164 acres of potatoes, 97 acres of

oats, and 55 acres of pease and beans (Kass 2004:14). Wheat remained a major cash crop for the area until the 1850s and 1860s, when a series of floods was followed by an outbreak of stem rust, which destroyed the grain crops. Like the sheep farmers before them, landowners growing wheat soon moved over the mountains to the drier climates to the west.

Although the Liverpool area continued to be an agricultural region, the production of fruit, vegetables and grain crops declined towards the end of the nineteenth century, from 5,100 acres under crops in 1895 to 1,714 acres in 1904 (Keating 1996:125). Drought was a contributor to the falling numbers of farmers, with the drought in 1902 being particularly severe. The subdivision of many of the larger estates in the 1880s, during a land speculation boom, was also problematic. By the 1910s, all of the large estates except *Hinchinbrook* had been carved up into small farms, generally between three and fifteen acres in size. Ironically, it was the combination of these small acreages, which were difficult to farm at a productive scale, and the ability of farmers further west to grow crops cheaper and ship them to market via the railway, that was a major factor in the decline of the Liverpool district as a cropping centre.

The 1904 report of the Parliamentary Standing Committee on Public Works includes detailed descriptions of living conditions and early farming practices in the study area. The committee took evidence from two witnesses who lived on the Hoxton Park Estate subdivision: William Hutton, caretaker of the estate from 1896, and William Brown, butcher and resident from c.1899. Hutton stated that the chief crops grown in the area were stone fruits, citrus, grapes, cabbage, and other vegetables. Brown stated that the soil was fair and would grow anything: maize, sorghum, potatoes, pumpkins, corn and oaten hay. Two local farmers, J Gorst and G Griffin of *Ickleton*, had recently *topped the market for several weeks* in Sydney with their swede turnips. The area was also good for poultry. That being said, few farmers made a living from their land, and many had to work somewhere else to make ends meet, either splitting and fencing or doing casual jobs. The small size of the land holdings also meant that farmers on the Hoxton Park Estate could not engage in dairying (NSW Legislative Assembly 1904:14, 68-69; Keating 1996: 126).

The numbers of small-scale farms in the study area began to grow in the inter-war period. In 1921, the Sands' Directory for NSW listed 11 farmers in Austral Park, including one orchardist and one poultry farmer; and 28 farmers in Hoxton Park, including one orchardist, four poultry farmers and one dairy farmer. By 1926, there were 23 farmers in Austral Park, including seven poultry farmers and one grazier; and 36 farmers in Hoxton Park, including one orchardist, one dairyman and four poultry farmers. In 1931, Austral had 37 farmers listed, including two market gardeners, three dairymen and ten poultry farmers; Hoxton Park had 31 farmers listed, including one grazier, two dairymen and five poultry farmers; and Leppington had ten farmers, including one grazier and six poultry farmers.

The local agricultural industry received a boost in the years immediately before and after WWII, with an influx of new migrant settlers from Europe, particularly from southern Italy and Yugoslavia. These families, many of whom had been farmers or rural workers back home, found a ready local agricultural economy in Austral and Leppington, based on intensive small scale farming (Keating 1996:188).

By the middle of the twentieth century, market gardening and poultry and pig farming were the focus of local agricultural industry. Aerial photographs of the study area in 1955 show numerous clusters of small farming buildings and poultry sheds springing up across the landscape (Figure 3.18).

0 75 150 300 450 600 Meters

Horizontal datum: GDA94/MGA Zone 56
Background image: Detail from Land and Property Management Authority, Aerial photograph 228-5147, Run 26, Liverpool NSW, 1955

Figure 3.18 Aerial photograph showing market gardens and poultry farms along Sixth Avenue, Austral, 1955.

The Leppington Vegetable Growers' Cooperative was set up in 1955, and by 1958 it was selling tomatoes and other local produce direct to markets in Melbourne. The Cooperative ensured fair prices for the growers' produce, and allowed members to organise their own supplies, such as fertiliser and feed. It employed five staff by 1960 and was seen as an important component in the post-war settlement of migrant workers. Membership cost £20 and included Australian-born farmers and migrants from Croatia, Bosnia, Malta, Montenegro and New Caledonia (Keating 1996:188; *Daily Telegraph* 2 June 2010).

Another important employer was Walter Ingham's poultry farms. 'Wally' Ingham had opened his first poultry farm at Casula in the 1940s, and by 1955 he had over 148 acres. Ingham imported the American-style cage farms in the late 1950s and his business began to grow. His chicken factories expanded throughout the Liverpool area and by 1972 Ingham Enterprises owned 1,970 acres including farms at Austral and Leppington (Keating 1996:189).

From the 1980s, a new wave of migrants from Vietnam and Cambodia contributed to the ongoing success of the market gardening industry in the Austral and Leppington area. These gardens continue to supply a significant proportion of the fresh vegetables consumed by the population of Sydney.

3.3.5 Commerce and Industry

From the end of the nineteenth century, a few small shops and industries had sprung into existence to provide supporting services to the predominantly agricultural economy of the district.

In 1889 and 1890, 36 residents signed a petition calling for the establishment of a post office. The petitioners claimed that the population of the area was increasing daily, but that the roads were *so frightful … so bad, in fact, that at times we cannot go to Liverpool for our letters for a whole fortnight.* The petitions were unsuccessful, and in 1890 a local man, John Doyle, was contracted to convey the mail on horseback twice per week from Liverpool (Keating 1996:106). However, in 1894 a mail receiving office was established on Sarah Ayshford's property, to be known as the 'Austral' office (Clarke and Haak 1993:6).

In 1906, the Reconnaissance Map of the area shows a post office on Tenth Avenue, to the west of Austral Public School (Figure 3.16). A photograph of the post office from the early twentieth century shows a simple hut clad in timber slabs, with a metal roof (Figure 3.19). In 1929, the Sands' Directory indicates that the postmaster, Herbert G Starr, was also operating as a newsagent and poultry farmer. H G Starr later moved the post office to Third Avenue (now Edmondson Avenue), between Tenth and Eleventh Avenues.

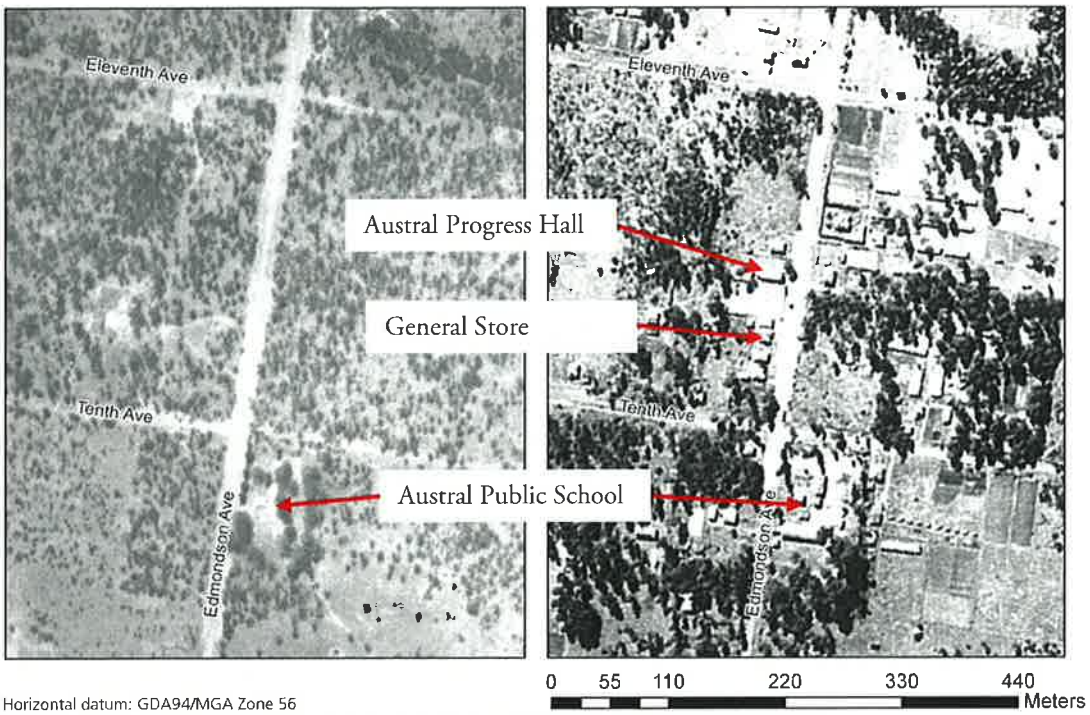
Figure 3.19 Austral post office, Tenth Avenue, c.1942 (Source: Erica Clarke).

The Sands' Directory provides some evidence of other early businesses in the area. In 1901, the directory listed two businesses in Hoxton Park: Scott Brothers Butchers and H Walcott's General Store. By 1911, there were two butchers, run by the Scott Brothers and T Brown respectively, and two general stores, run by H Walcott and J Padmore. By 1926, Sands' Directory lists E Peacock as greengrocer, and two stores run by T G Scott and A Weatherill; Peter Castle and Alexander Grierson were timber merchants, H Porch was a blacksmith, John Cherry and John Kelly were engineers, Alfred

Mildwater was a carpenter, and Alexander Munro was a stonemason. A former resident of the area, Bob Kirkpatrick, remembers that Billy Chamberlin ran a blacksmith workshop at the corner of Fifteenth and Twentyeighth Avenues in the late 1920s and 1930s, shoeing draft horses that carted the timber to Liverpool along Fifteenth Avenue (Hoxton Park Road) (pers. comm. 30 March 2011).

In December 1937, T G Scott and Sons initiated the first bus service, running from Liverpool to the corner of Fifteenth and Edmondson Avenue. During WWII, the services were extended to the corner of Tenth and Edmondson Avenues. This service was transferred to the Liverpool Transport Co. in 1956 (Clarke and Haak 1993:7; Henderson nd).

In 1938, Emma Rosetta Salome Starr, wife of postmaster Herbert G Starr, purchased Lot 837 of the Hoxton Park Estate along Edmondson Avenue, and the Starr family likely established a general store on the land around this date (LPMA CT Vol 4698 Fols 149-150; Vol 5013 Fol 142). This store was the first commercial business in what would later become the Austral Town Centre (Figure 3.20).



Horizontal datum: GDA94/MGA Zone 56
Background images: Detail from Geoscience Australia, Aerial photograph 3428-B07, Sydney Survey, 1930 (left) and Land and Property Management Authority, Aerial photograph 228-5108, Run 25, Liverpool NSW, 1955

Figure 3.20 Aerial photographs of Edmondson Avenue, 1930 (left) and 1955 (right), showing the beginnings of Austral Town Centre.

South of Bringelly Road, on the former *Raby* estate, a post office was opened in 1930, with local blacksmith W Hancock as the first postmaster. The post office was called 'Leppington,' after the nearby Cordeaux family estate, because there was another Raby Post Office in the state. The post office stood on Cowpasture Road (now Camden Valley Way), and became the focus for a small commercial district (LPS 1982:17).

3.3.6 Utilities – Sydney's Water Supply and the Upper Canal

In 1867, Sydney was under pressure to find a new, reliable source of drinking water for its ever increasing population. Governor John Young appointed a Commission to recommend how this might be achieved. The Commission reported in 1869, recommending a scheme whereby water from the head waters of the Upper Nepean River and its tributaries would be carried through a system of canals, tunnels, pipes and aqueducts to a new storage reservoir at Prospect. From there, the water

would be distributed to Sydney via a second system of canals and pipes (Figure 3.21). The scheme was not immediately adopted, and after six years the Government sought an independent assessment. Finally, in 1879, after a favourable endorsement by E Clark, an eminent civil engineer in England, the Government authorised a public works loan for the Upper Nepean Scheme. Construction began in the following year and was completed in 1888, for a total cost of £2,076,313. Within the study area, land was resumed for the construction of the Upper Canal in October 1882 (Figure 3.22; *SMH* 14 October 1882; Aird 1961:15-17; Edward Higginbotham & Associates 2002:6).

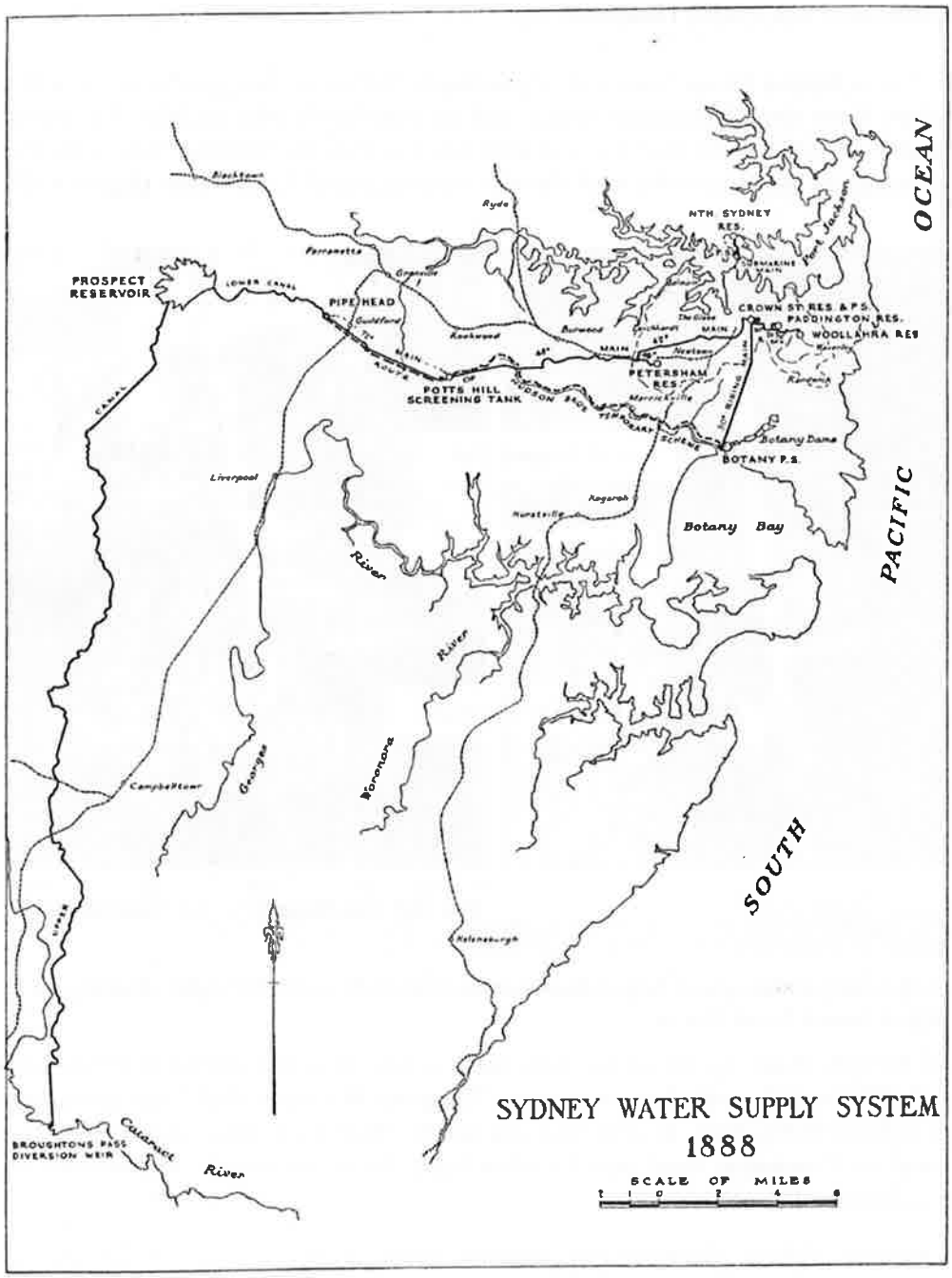


Figure 3.21 Plan of the Sydney Water Supply System, showing the route of the Upper Canal (Aird 1961:between pages 6-7).

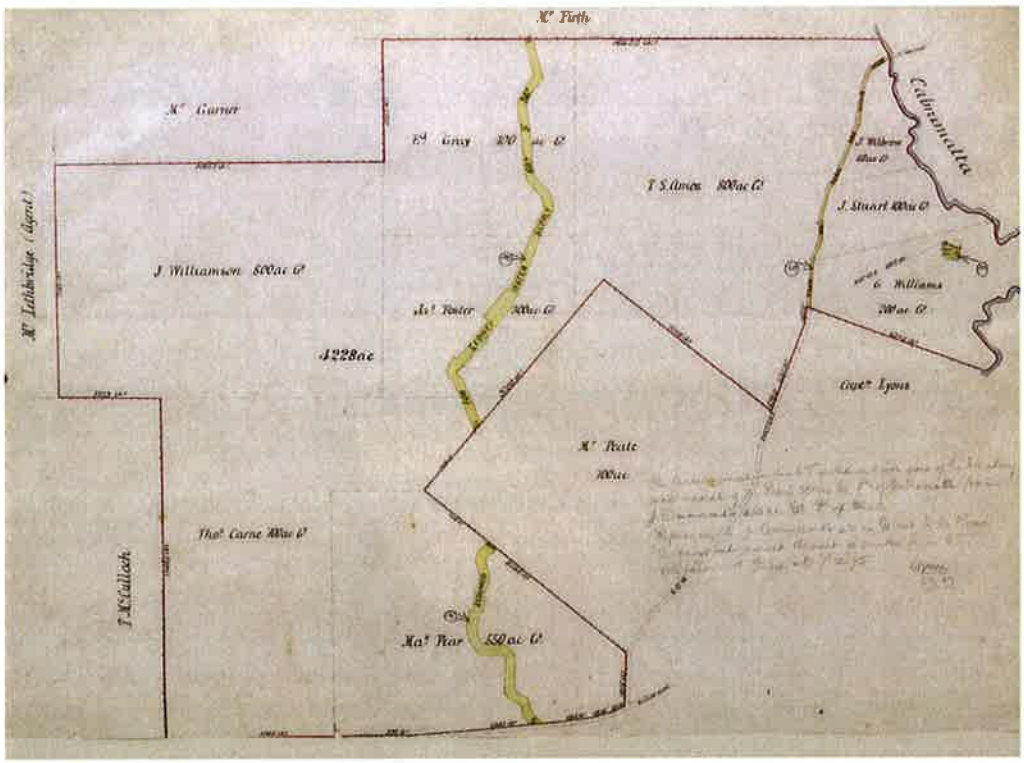


Figure 3.22 Plan of the Hoxton Park Estate, showing land resumed for the route of the Upper Canal, 1890 (Source: LPMA CT Vol 970 Fol 114).

Construction of the Upper Nepean Scheme was carried out by contractors, under the direction of the Harbours and Rivers Branch of the Public Works Department. Edward Orpen Moriarty, Engineer-in-Chief for the Harbours and Rivers Branch, was responsible for the design and execution of the works. The main virtue of the scheme was that it was an entirely gravity fed system. Water harvested in the Southern Highlands flowed all the way down the Upper Canal into Prospect Reservoir, then along the Lower Canal to Pipe Head, then by pipe to Potts Hill Reservoir, and again by pipe to Crown Street Reservoir from where it was reticulated to much of the city and suburbs (Edward Higginbotham & Associates 2002:8).

The Upper Canal itself is part of 39 3/4 miles (64km) of tunnels, open canals and aqueducts, running between the Pheasants Nest Weir and Prospect Reservoir. The method of construction and materials used differed depending on the type of terrain through which it passed. Where the ground was soft, the Canal was V-shaped and the sides were pitched with shale or sandstone slabs (Figure 3.23); in other sections, the Canal was U-shaped and the sides were walled with sandstone masonry, or cut into solid rock. Tunnels took it under hills, and again these were either brick-lined or unlined depending on the surrounding terrain (Edward Higginbotham & Associates 2002:8).

Figure 3.23 A section of V-shaped masonry Canal at 24 1/2 miles, with the original Raby Road bridge in the background (Section 6, Inventory 48). Although this section of the Canal is south of the study area, the image illustrates similar forms of construction to those used in the study area (Source: Edward Higginbotham & Associates 2002:37; from Sydney Water/SCA Historical Research and Archives Facility, Ref: X841025-8).

From the beginning, the Upper Canal was maintained by Inspectors and maintenance men, who were housed in cottages along the way. These cottages were owned by the Water Board. James Kirkpatrick was the first Maintenance Overseer for Section 9 of the canal, raising eleven children in a weatherboard cottage at the corner of Fifteenth and Twentyeighth Avenues (Bob Kirkpatrick, pers. comm. 30 March 2011).

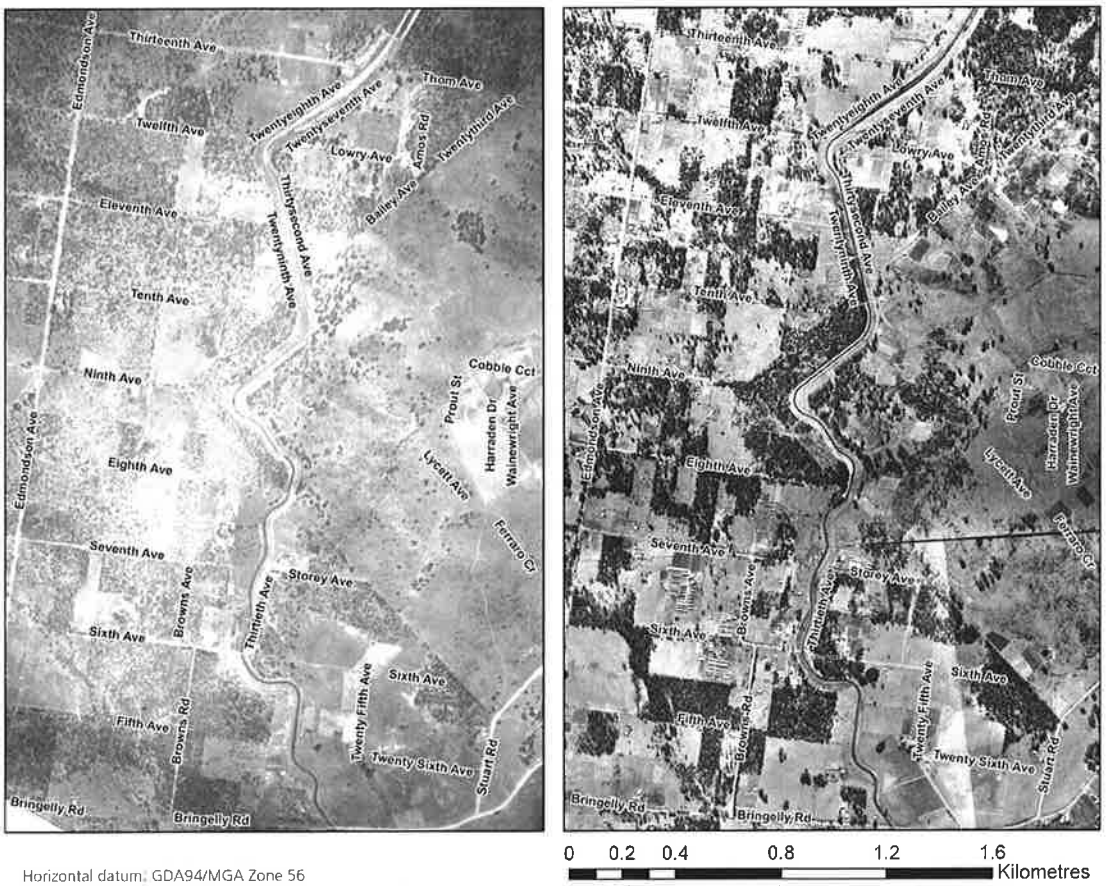
Initially, the maintenance men walked or used horses to patrol the length of Canal, but by the late 1890s the Water Board had begun to add maintenance roads along the Canal. By 1898, a telephone line was also in operation along the whole length of the Canal (Edward Higginbotham & Associates 2002:10).

The sides of the Canal were regularly cleaned, and stopboards or bulk-heads allowed the maintenance men to close short sections of the Canal for cleaning and repairs. Early modifications included concreting rough spots along the bottom and sides, and by the late 1890s some sections of stone pitching were being relined with concrete in order to improve the flow of water along the Canal. Gradual relining of the Canal with concrete continued into the 1910s (Edward Higginbotham & Associates 2002:11-12).

A series of flumes were constructed to carry stormwater over the Canal, to prevent the stormwater entering the Canal and polluting Sydney's drinking water. At first, many of these flumes were made of timber, but gradually they were replaced by wrought iron and, later, by concrete flumes (Edward Higginbotham & Associates 2002:9).

A series of bridges were constructed to carry major roads over the Canal. In addition, 'occupation bridges' were built to allow large property owners, whose land had been cut by the Canal, to access either side. Early bridges in the study area are wrought iron; however, by the 1910s bridges were being constructed of concrete (Edward Higginbotham & Associates 2002:9).

Historic aerial photographs of the study area show that a number of early farms in the Hoxton Park and Raby subdivisions were established in close proximity to the Canal, despite the fact that local residents were unable to source water from the Canal (Figure 3.24). An offtake reservoir was constructed to supply water to the town of Liverpool in the 1890s, but residents of Austral and Leppington were dependent on water from local dams, wells and rain water tanks, until a water pumping station was erected at Ingleburn Dam in 1938-9 to service the area (LPS 1982:14; Aird 1961:269, 271-272).



Horizontal datum: GDA94/MGA Zone 56
Background images: Detail from Geoscience Australia, Aerial photograph 3429-807, Sydney Survey, 1930 (left) and mosiac of Land and Property Management Authority, Aerial photographs 228-5108 Run 25, 228-5147 Run 26 and 228-5149 Run 26, Liverpool NSW, 1955

Figure 3.24 Aerial photographs of the Upper Canal, 1930 (left) and 1955 (right).

As Sydney continued to grow, the Upper Nepean Scheme became inadequate to meet all the city's water needs. A number of other dams were subsequently built to augment the city's water supplies, including Warragamba Dam in 1946. However, the Upper Canal continues to be operational, carrying water from the Nepean River system to the Water Filtration Plant at Prospect Reservoir. This supply supplements water from the Warragamba-Prospect Pipeline.

In more recent decades, the rural setting of the Upper Canal has changed as modern housing developments have encroached. This has influenced surface water drainage in the vicinity of the Canal, in some cases causing the historic drainage system associated with the Canal to fail. The increased population living adjacent to the Canal has also created other more mundane challenges,

including traffic accidents and vandalism, which have indirect impacts on water quality in the Canal (Edward Higginbotham & Associates 2002:72; Angela Langdon, pers. comm., 5 November 2010).

3.4 Building Settlements and Towns

3.4.1 Subdivisions

By the 1880s, increasing pressure for housing in Sydney led to the purchase of a number of the larger estates by land speculators, with an eye to subdivision for either housing or for smaller farm sites. Most of the land north of Bringelly Road was purchased by a single land development company, to form the Hoxton Park Estate subdivision. John Gurner's *Ickleton* was subdivided separately, while the former Urban Fidkin grant became part of the Cowpastures Estate subdivision. Only John Jamieson's *Cow-de-Knaves* land grant was spared, forming a conspicuous diamond shaped area in the early maps of the Hoxton Park Estate. The western corner of this old estate forms part of the eastern boundary of the study area.

South of Bringelly Road, the pattern of development was slightly different. The main subdivisions for smallholders took place in the mid-1910s, when lots on the Eastwood Farms and Raby Acres Estates were offered for sale.

Hoxton Park Estate

In 1887, the former estates of Thomas Amos, Edward Gray, James Foster, James Williamson, Thomas Carne and Matthew Pear were purchased by William Edgar Harold Phillips, who together with his brother John Otis owned a land development company known variously as Phillips & Company or the Austral Banking and Land Proprietary (see Figure 3.22 above). These estates were joined together as part of a large subdivision known as the Hoxton Park Estate. The subdivision offered 1,186 lots, most of three acres (1.2 ha) each, accessed by a regular grid of streets (Figure 3.25-Figure 3.26). The grid, which identified streets by numbers rather than names, appears to have been based on the east-west alignment of Bringelly Road, and is still evident in the landscape today.

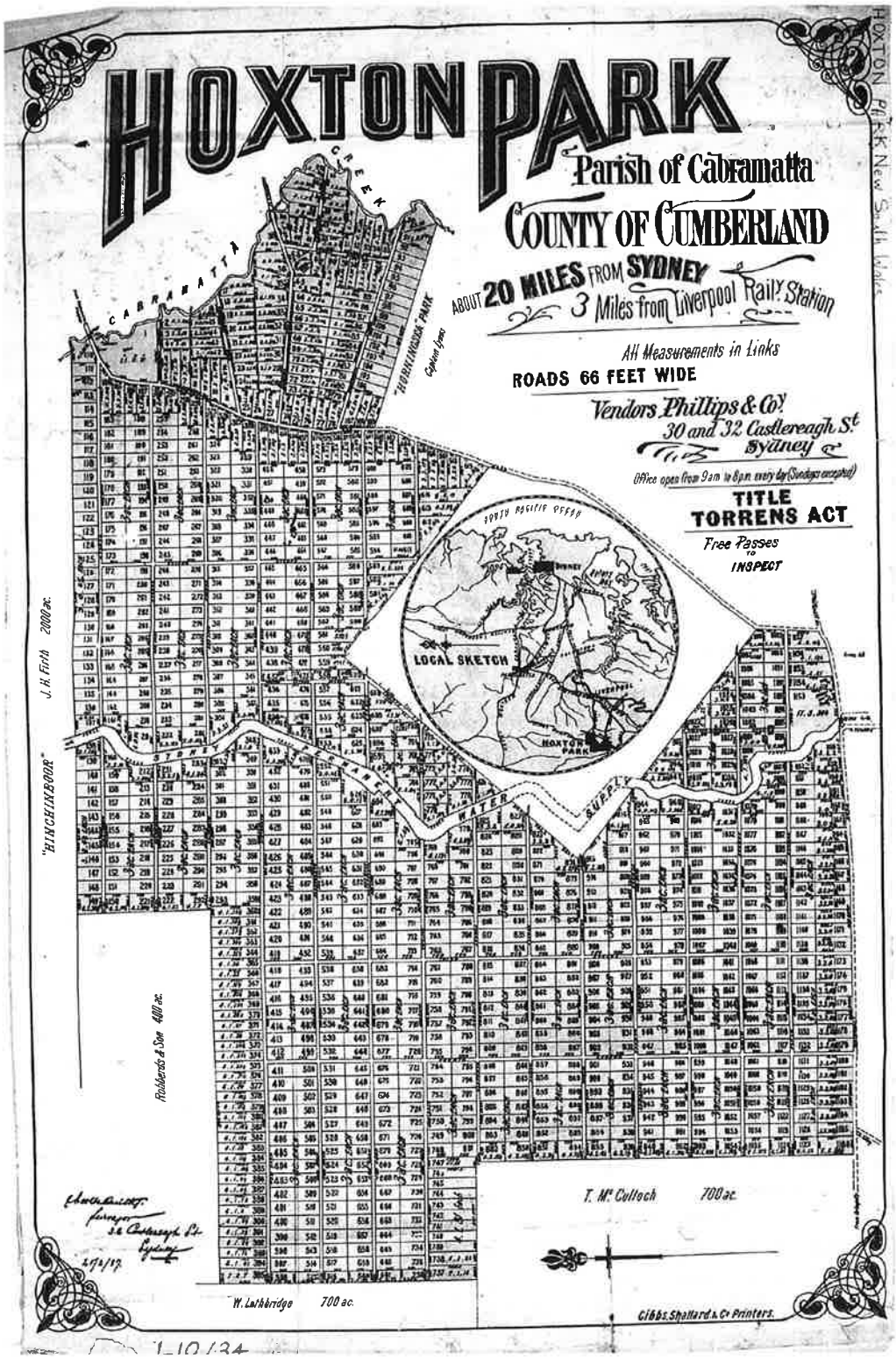


Figure 3.25 Advertisement for sale of the Hoxton Park Estate by Phillips & Company, 1887 (Source: Mitchell Library, Ref: SP/L10/34).

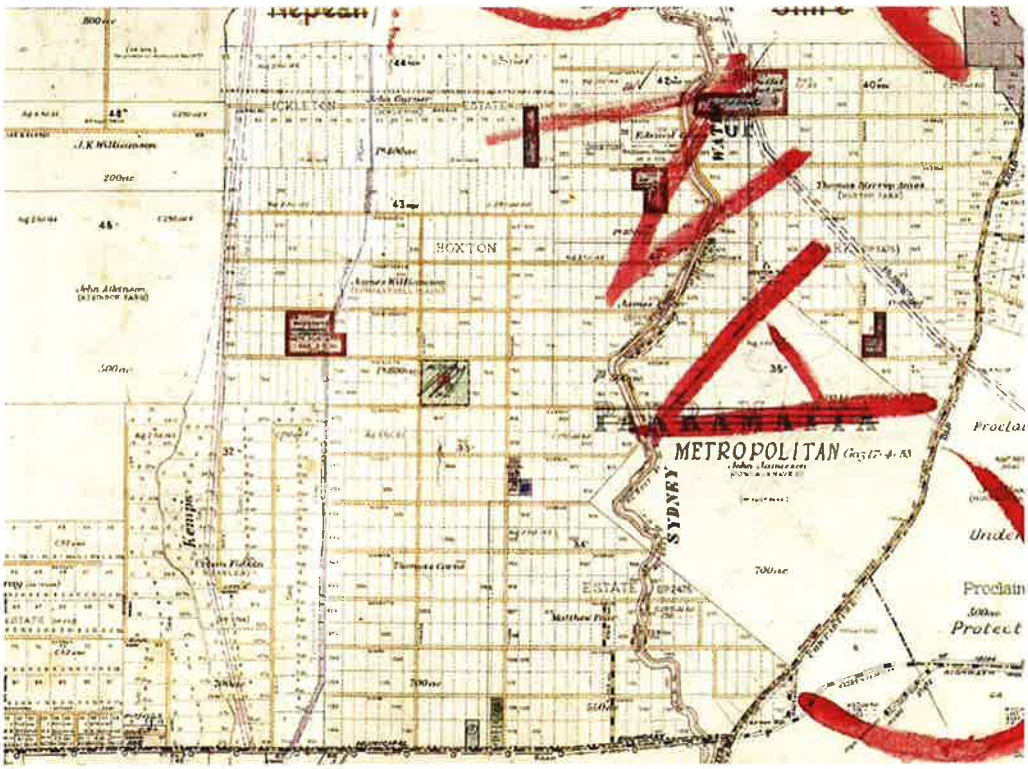


Figure 3.26 Detail of Parish Map of Cabramatta, 1940-1966, showing layout of Hoxton Park Estate subdivision in relation to the earlier land grants (Source: Source: © NSW Land Information Centre, Ref: 14094802).

Phillips & Company initiated a slick advertising program for the subdivision, and produced an eloquent sales brochure entitled *Progress and Wealth*. The brochure appealed to the working man, promoting the ownership of land as the source of all wealth: *the working man who desires to receive the full reward of his labour must become the owner of a small freehold.* It described the land at Hoxton Park as *a magnificent stretch of country which we hope to make a comfortable home for about five hundred families.* The soil was:

> *mostly a rich and friable loam, specially suited from fruit growing; though there are parts where market gardening might be profitably carried on, while other parts are more specially adapted to poultry farming. [...] The estate is permanently watered by a fresh water creek, and about two miles of the main water supply for Sydney passes through it. The uncleared portion [approx 800 acres] carries valuable timber, mostly box, iron bark and spotted gum. [...] A Government School is also on the ground, so purchasers who intend to live on their land will find the education of their children already provided for…*
>
> *The estate is liberally supplied with roads, which are all cleared, and all sixty-six feet wide [...] This grand estate is not situated away out in the wilderness, remember, but is within 23 miles of Sydney, about 3 miles from Liverpool railway station, and is surrounded by a thickly settled and prosperous district.* (Powerhouse Museum 2010)

To make it easy for the working man to buy this land, Phillips & Company also introduced a subscription model, which would enable purchasers to take possession of their land following an initial upfront investment. However, like many other speculative subdivisions of the 1880s, it failed to attract buyers, with only 371 of 1,186 lots sold in the first release. In 1892, William Edgar Harold Phillips was convicted of fraud and sentenced to four years prison, and his company was declared insolvent (*SMH* 14 November 1892; Keating 1996:126).

In 1904, the Parliamentary Standing Committee on Public Works found that a large portion of the Hoxton Park Estate was still unsold and untenanted. There were only 75-80 families on the land, most of whom had occupations somewhere else. Nearly half of the original purchasers had left, primarily due to poor regional transport infrastructure and lack of communication with Sydney. Moreover, the prices of the land had crashed, from £15-£25 per acre in the boom years of the late 1880s down to as low as £7 per acre in the early 1900s. As such, many of the early purchasers would have made a significant loss on their investment. Such was the failure of the entire venture that William Hutton was forced to admit that, of all the purchasers in the last eight years, there was only one that was making a living from the land. Hutton attributed much of the ongoing problems of the estate to the lack of railway communication, which Phillips & Company had apparently promised would be constructed within five years when he bought his own land. Other physical constraints to the progress of development were the poor state of roads connecting with Liverpool, and the small size of the lots. Hutton argued that the subdivision was primarily intended to be residential. However, the people who had purchased a lot for a house had found it too difficult to access places of employment. In contrast, people interested in working the land, in line with Phillips & Company's promotional material, were obliged to take up two or three adjoining lots to create a viable farm (NSW Legislative Assembly 1904:11-16; Keating 1996:106-107, 126-127).

> *In his evidence to the committee, William Hutton stated that he had bought 51 acres, and that he was* making a fair living on it *by growing fruit. This land is marked on the 1906 Reconnaissance Map of the area, on the west side of the development between Tenth and Eleventh Avenues (see Figure 3.16 above). Sixteen buildings are also indicated in the area of the Hoxton Park Estate, of which seven are within the study area. The area is generally described as Small holdings a few occupied, the others are covered with thick timber and sapling scrub.*

Subsequent sales of Hoxton Park Estate were slow, with a gradual uptake of both single and multiple lots throughout the 1910s and 1920s (LPMA CT Vol 1101 Fol 115).

Ickleton Estate

In 1897, the former estate of John Gurner, *Ickleton*, was purchased by a Sydney Conveyancer, Hardinge Gifford King, along with some small areas of the adjoining estates of Barron Field to the north and Henry Marr to the west. King subdivided the land into 43 small farming lots of approximately 10 acres each, which were gradually sold between 1897 and 1906 (LPMA CT Vol 1230 Fol 237). Although the lots were larger than those on the neighbouring Hoxton Park Estate, prospective landowners generally had to buy multiple lots to create a viable farm (Figure 3.27).

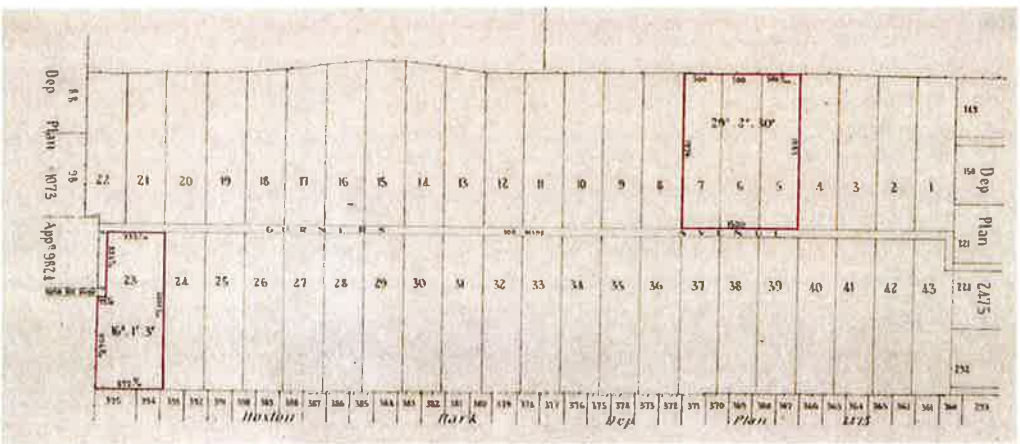


Figure 3.27 Subdivision plan of the Ickleton Estate, showing four lots purchased by Henry Steadman in 1900 (Source: LPMA, CT Vol 1339, Fol 37).

The 1906 Reconnaissance Map shows that there were only two buildings on the Ickleton Estate by this date, both associated with areas of cultivation.

Cowpasture Estate

In September 1891, the former estate of Urban Fidkin was purchased by Thomas Hussey Kelly, a Sydney-based merchant (LPMA CT Vol 1025 Fol 243-244), and incorporated into a large subdivision known as The Cowpasture Estate and Cowpasture Farms (Figure 3.28-Figure 3.29). The Cowpasture subdivision extended west from Fidkin's estate as far as the village of Bringelly, forming four discontinuous blocks on both the north and south sides of Bringelly Road. The former Fidkin land grant was the third release in the development, primarily comprising 10 acre (4 ha) blocks targeted at small-scale farmers and orchardists. However, like many of the other subdivisions in the area, the lot sizes were often insufficient for a family to make a living in either cultivation or orcharding (Keating 1996:104).

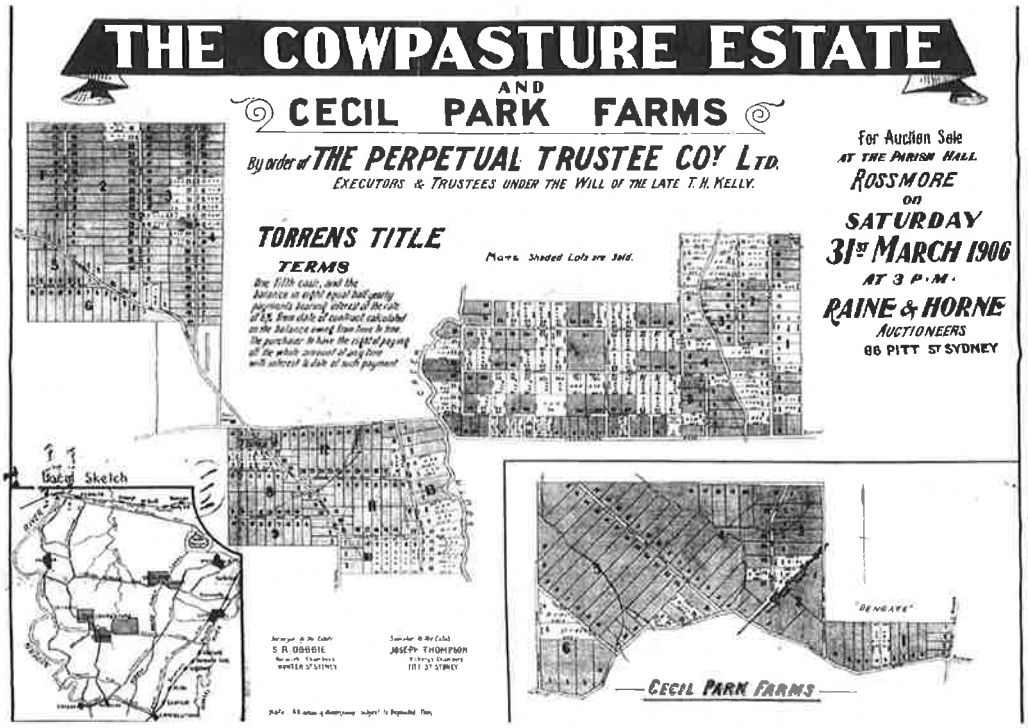


Figure 3.28 Advertisement for the sale of the Cowpasture Estate, 1906 (Source: Mitchell Library, Ref: SP/L10).

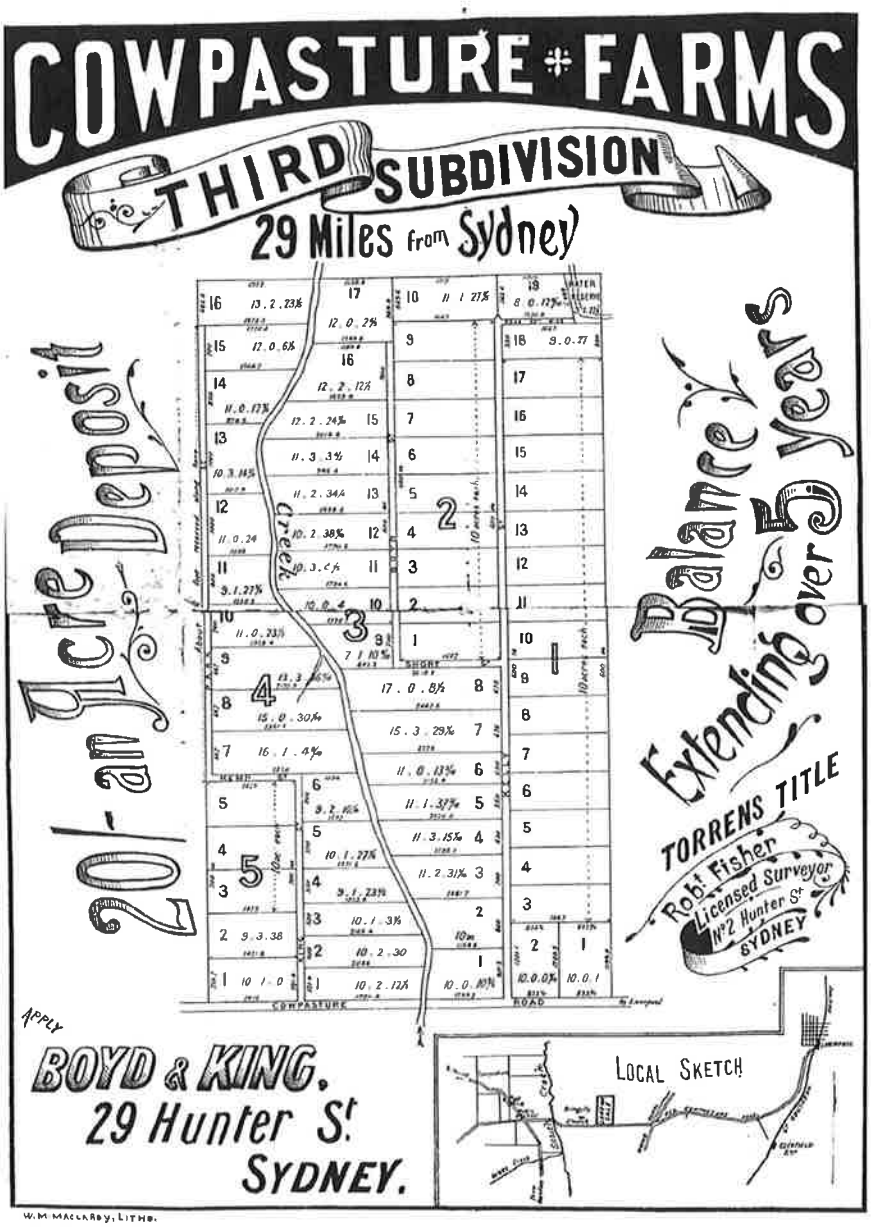


Figure 3.29 Advertisement for the sale of the Cowpasture Estate, c1906 (Source: Mitchell Library, Ref: SP/L10/18).

Following Kelly's death in 1901, the Perpetual Trustee Company Limited continued to sell the land as executors of Kelly's estate. A subdivision plan of the Cowpastures Estate for a sale in March 1906 shows that the blocks on the east side of Kemps Creek were arranged along either side of two main north-south streets: Kelly Street and Boyd Street. Approximately half of the blocks had been sold by this date. However, the 1906 Reconnaissance Map only indicates four buildings in the area: one at the north end of the subdivision, labelled Stanfield, and a cluster of three buildings near the east side of the subdivision (see Figure 3.16 above). The north part of the area is described as 'thickly timbered,' while the south part is 'lightly timbered.' A track is indicated along the eastern boundary of the subdivision, where it joined that of Hoxton Park, connecting to Bringelly Road in the south.

Raby and Eastwood Estates

Following the death of William Moore in 1878, his widow Caroline and brother-in-law Albert Stephen Burcher were made executors of his estate. In 1905, the *Raby* estate was surveyed for subdivision into five lots (Figure 3.30). The two southernmost lots, outside the study area, were

transferred to Arthur Barrington Moore in 1907 (Lots 1 and 2). After the death of Caroline in 1913, the remaining lots passed to Burcher (Lots 3, 4 and 5) (LPMA CT Vol 1793 Fol 206; Cosmos Archaeology 2010:37).

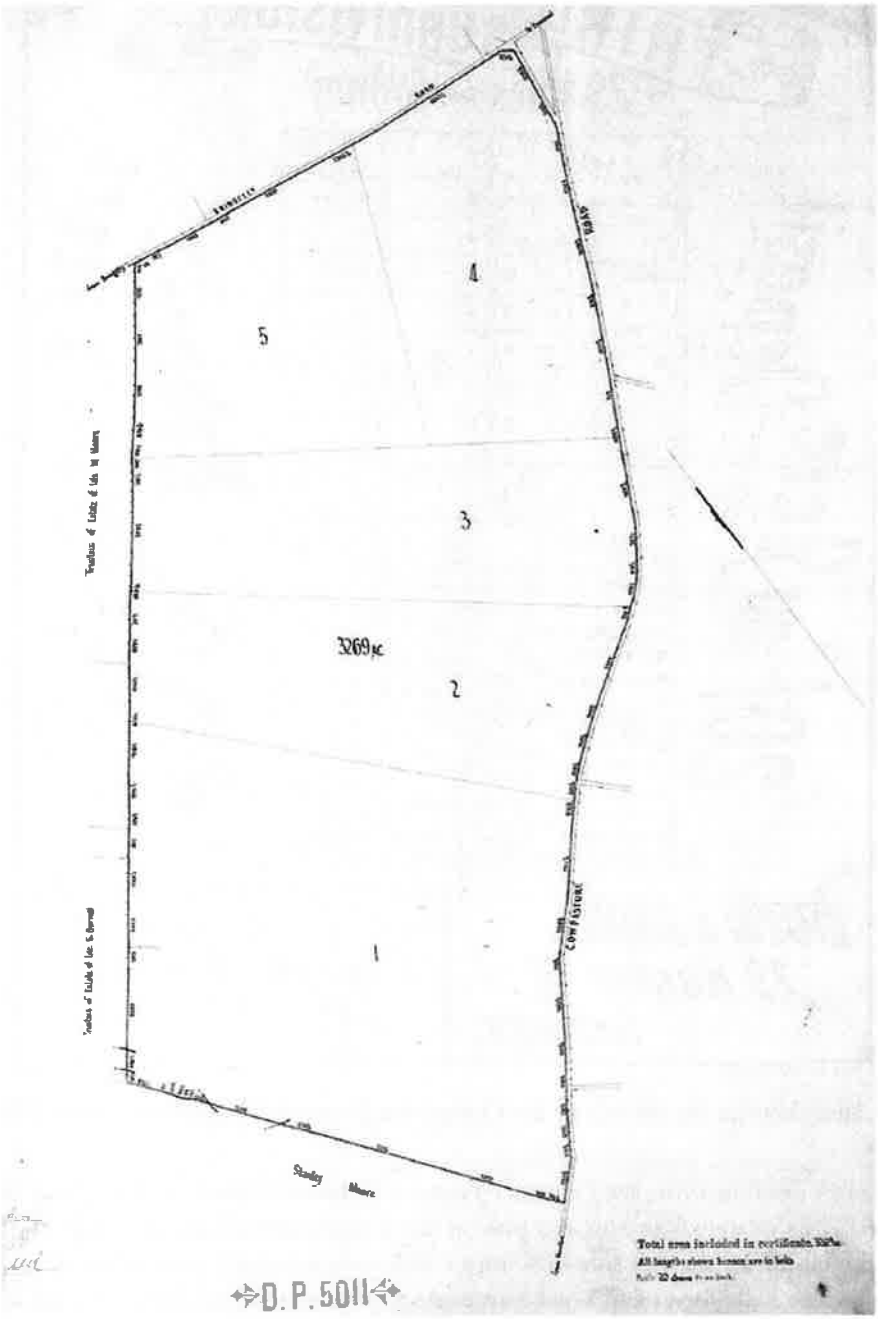


Figure 3.30 Subdivision plan of *Raby*, 1905 (Source: LPMA CT Vol 1793 Fol 206).

In 1913, a plan was drawn up to re-subdivide the northern part of the former *Raby* estate into 71 smaller farms, ranging in size from ten acres to over 33 acres (LPMA CT Vol 800 Fol 5; Cosmos Archaeology 2010:37; SMH 17 October 1914:9). The following year, the auctioneers Arthur Rickard & Co Ltd advertised the Raby Acres Estate for private sale, along with the neighbouring Eastwood Farms Estate (Figure 3.31). These estates were described as being similar in situation and character, with:

> *[...] choice, undulating, well-grassed land, having a decidedly attractive, park-like aspect, with some very valuable timber on most of the blocks.* (SMH 17 October 1914:9)

Figure 3.31 Advertisement for the sale of the Raby Acres and Eastwood Farms Estates, 'Farms of Plenty,' 1914, by Arthur Rickard & Co Ltd (Source: SMH 17 October 1914:9).

A later, undated Rickard advertisement shows a number of buildings adjacent to the Bringelly and Cowpasture Roads (Figure 3.32). However, most of the lots were acquired by the N.S.W. Realty Co. Limited between 1916 and 1920. Subsequent sales of land to the public were slow, with a gradual uptake of both single and adjoining lots throughout the area in the1920 and 1930s (LPMA CT Vol 1793 Fol 206; SMH 17 October 1914:9).

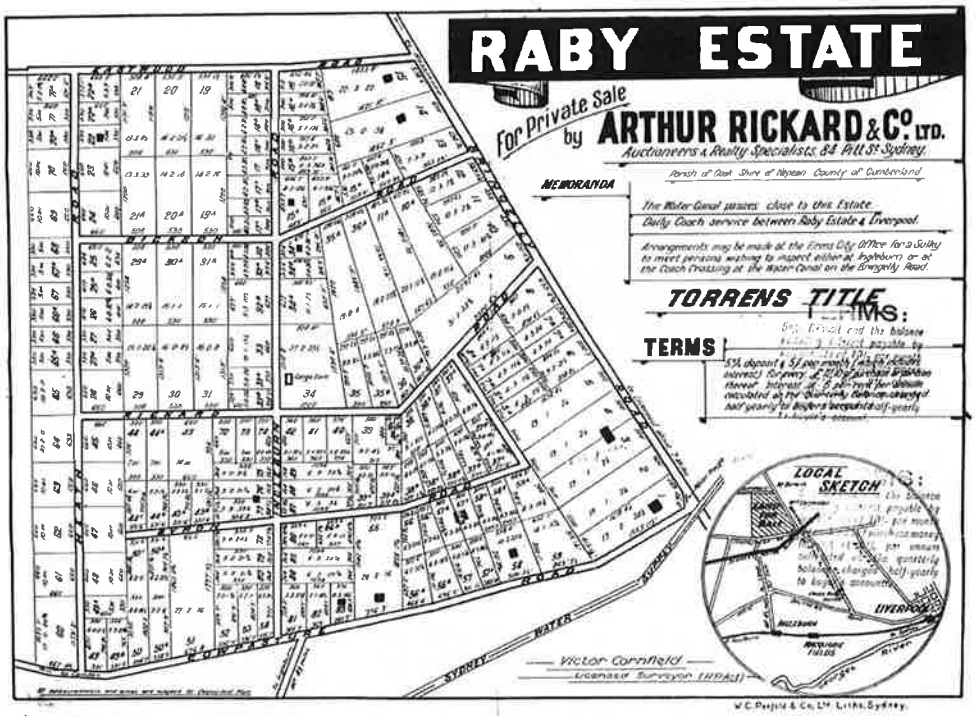


Figure 3.32 Advertisement for sale of the Raby Estate Subdivision, nd (Source: Mitchell Library, Ref: SP L10/74).

Edmondson property

The Edmondson property originally comprised approximately 564 acres to the south of the Great Southern Road, between Cowpasture Road and Cabramatta Creek (Figure 3.33). The land included John Drummond's original crown grant of 410 acres, and part of the adjoining grants issued to Robert Bostock and Henry Kitching. It was purchased in 1906 by Joseph Edmondson, a hotel proprietor from Campbelltown. Edmondson likely built a weatherboard farmhouse on the land, known as Forest Home (LPMA CT Vol 1833 Fol 74; HLA 2003:8).

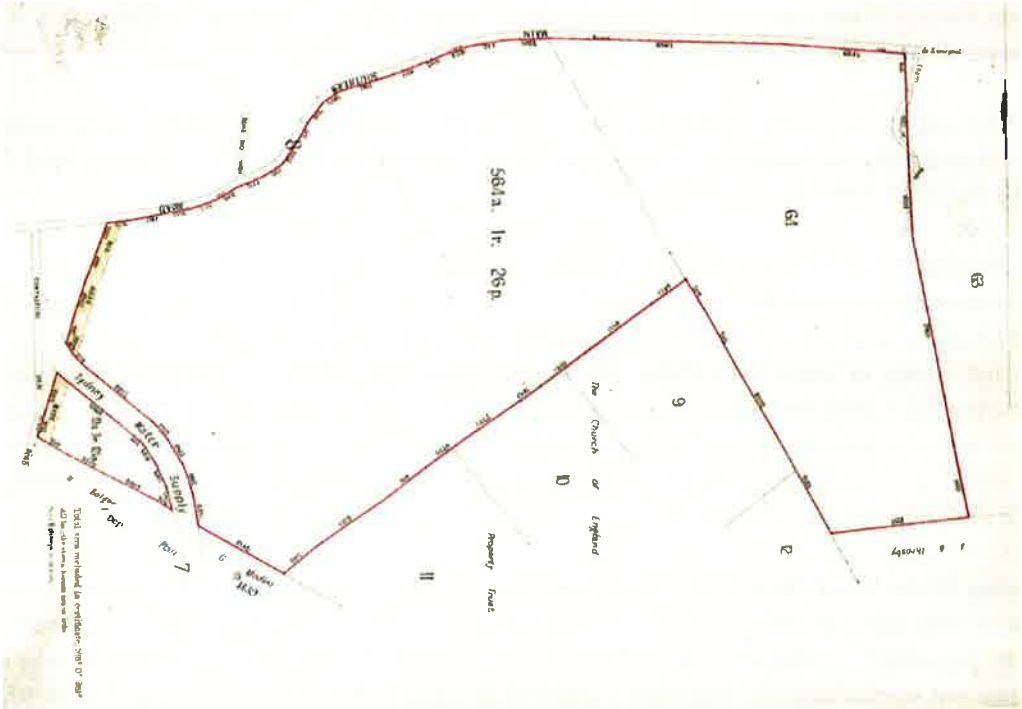


Figure 3.33 Plan of the Edmondson property, 1907 (Source: LPMA CT Vol 7823 Fol 74).

In 1918, the estate was subdivided into three lots, which were transferred to three of Edmondson's sons (Figure 3.33). All three lots were probably used as farmland (Cosmos Archaeology 2010:34). Forest Home was located on the middle lot, which was owned by Edmondson's eldest child, Joseph William Edmondson (LPMA CT Vol 2858 Fol 106).

Joseph William Edmondson was a farmer from Wagga Wagga, who had taken up residence at Forest Home in 1916, with his wife, Maude Elizabeth Hurst, and son, John Hurst Edmondson. John Hurst Edmondson worked on the property with his father, but was sent overseas on active duty after enlisting in the Australian Imperial Forces during WWII. He was killed in action at Tobruk in 1941, leaving his father to manage the property alone (Grant 2006; *Australian Women's Weekly* 1941:3).

In 1930, a strip of land through the centre of the property was resumed as a road reserve, for the Hume Highway deviation around Carne's Hill (later renamed Camden Valley Way) (LPMA Vol 2825 Fol 106; Hill 1931:87-88). The farm to the south of Camden Valley Way remained substantially intact until the 1940s, when it was subdivided and various parts sold off between 1944 and 1957. Within the study area, the house, Forest Home, and approximately 70 acres of attached farm land were retained by the Edmondson family until the death of Maude Edmondson in 1961 (LPMA Vol 2858 Fol106, Vol 7802 Fol 141; SMH 25 April 2007). The property was compulsorily acquired by the Department of Planning in the early 1970s and is now managed by the Land and Property Management Authority (LPMA).

3.4.2 Civic Development

Local Government was first established in Sydney in 1842 and the District of Liverpool incorporated in 1843, but this first attempt at local determination was generally considered a failure. The Council raised no money and did nothing to improve regional services or roads. When Liverpool Municipal Council was declared in 1872, the land west of Cowpasture Road was excluded, such that Austral, Hoxton Park and Leppington were to remain unincorporated (Keating 1996:68, 87-88; Kass 2004:46). This finally changed in 1906, when Nepean Shire Council was established, covering the areas of Hoxton Park, Austral, parts of Luddenham and Narellan. Local grocer and bus operator

Thomas George Scott was elected Alderman to the Council from 1906 until 1948, when it was disbanded (Penrith City Council 2011).

In 1948, Leppington was incorporated in the Municipality of Camden, and Austral was incorporated in the Municipality of Liverpool. Austral was finally declared a suburb of Liverpool in April 1972 (Clarke and Haak 1993:7).

Local Progress Associations were formed in both Austral (1931) and Leppington (c.1930s), as part of a broader movement towards local, participatory involvement in the affairs of the district. These groups lobbied Council and other public bodies regarding works in the area, such as improvements to local roads and access to water. In 1939, the Austral postmaster H G Starr donated land for the construction of a Progress Hall on Edmondson Avenue. This hall burnt down in 1962, and was replaced with the present hall in 1965 (Ian Wilmington, pers. comm., 25 January 2011; Clarke and Haak 1993:7). The Leppington Progress Association also built a hall on Ingleburn Avenue, just outside the study area (LPS 1982:17).

Following World War I (WWI), the Austral area was surveyed for a soldier settlement area, but few of the farms were taken up and as the Great Depression took hold in the late 1920s, Austral remained sparsely populated (Clarke and Haak 1993:6). Progress did come, albeit slowly. A telephone exchange was opened and the electricity connected in 1938, and water was reticulated to Austral in 1939. During WWII a temporary army camp was established near the current Scott Park and between Tenth and Eleventh Avenues (Clarke and Haak 1993:7).

Prior to 1932, Austral residents travelled to surrounding areas to attend church on Sunday: Holy Innocents Anglican Church at Rossmore, The Union Church at West Hoxton, or to Liverpool. In 1932, Miss Lily Argue began to hold Sunday School lessons in the open air, and from 1935, the Church of Christ began to hold regular Sunday Services in Austral village (Clarke and Haak 1993:7).

Catholic Services were held in the Austral Progress Hall from the 1950s until 1962, when the first St Anthony's Catholic Church was constructed. This church was replaced by a new building in 1993 (Clarke and Haak 1993:7).

3.4.3 Education

Austral Public School

The town of Austral developed in the vicinity of Austral Public School, which was established in 1893 on the west side of the Hoxton Park Estate. The subdivision already had one school, at Hoxton Park village, but this school was considered to be too far away for children on the west side of estate. In order to avoid confusion, it was proposed to name the new school 'Austral' after the Austral Banking and Land Proprietary, which in 1891 had promised to donate three acres at the corner of Third (now Edmondson) and Tenth Avenues (Lot 865). This name was gradually applied to the surrounding area. The school was approved by the Department of Public Instruction in July 1891; however, the Austral Banking and Land Proprietary went bankrupt and failed to transfer the land. The lot was subsequently resumed by the Department and the new school opened in 1893, with 21 children enrolled (Clarke and Haak 1993:9).

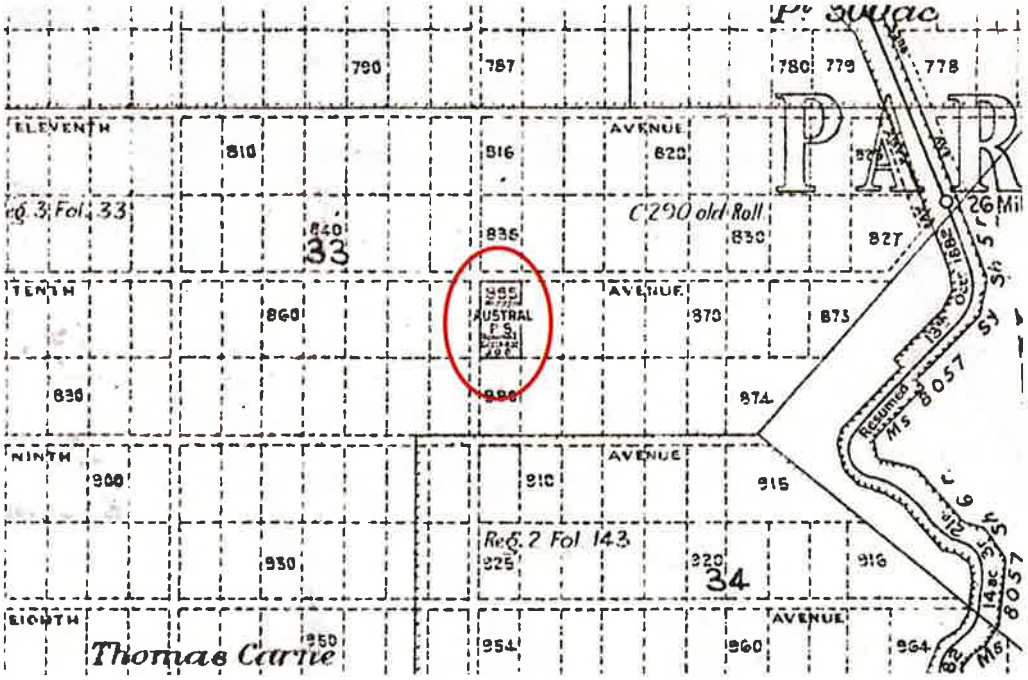


Figure 3.34 Detail of Map of Parish Cabramatta, 1940, showing Lot 865 of the Hoxton Park Estate reserved for Austral Public School (circled red) (Source: © NSW Land Information Centre, Ref: 14031202).

In 1956, a new timber school building was opened, including four classrooms with folding partitions, an office, staffroom and storeroom. The school was further expanded in 1977-1978, and some of the original buildings were relocated, possibly to Rossmore Public School (Clarke and Haak 1993:9).

Leppington (Raby) Public School

Leppington Public School is located on land within the original 3000 acre grant issued to Alexander Riley on 8 October 1816, which was known as *Raby* (Figure 3.35). In approximately 1920, the residents of the Raby Estate subdivision south of Bringelly Road began a campaign to establish their own school. Community meetings were held, with the teacher from Austral Public School in attendance, and letters were written to the Department of Education. The application for a school was eventually approved and the first building was completed in November of 1922, with 28 pupils enrolling from January 1923 (LPS 1982:16). The school consisted of a single, weatherboard building, which was extended in 1942 to accommodate more pupils. Additional buildings were erected at the school in the 1950s, and the school grounds were extended to the north in 1955-56 as the population of the area began to grow after WWII (LPS 1982:19). A series of new brick buildings were constructed on the north side of the school in the 1960s (DET 1968:2-3).

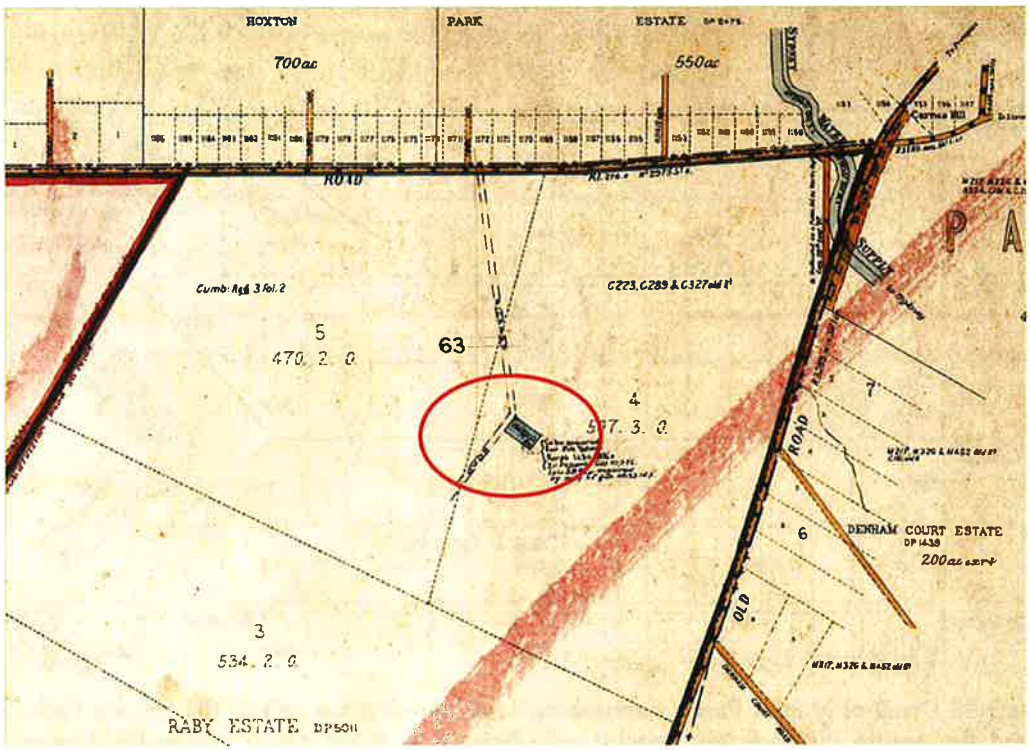


Figure 3.35 Detail of Parish Map of Cook, 1914-1928, showing land reserved for Raby Public School (circled red) (Source: © NSW Land Information Centre, Ref: 14090502).

The school was initially named Raby Public School after Riley's estate; however, the local postal district is called Leppington. To reflect this, the name of the school was officially changed to Leppington Public School in 1955 (LPS 1982: 19).

3.4.4 Migration

The Austral and Leppington areas today are characterised by the market gardens, many no longer operational, which dot the landscape, cultivated primarily by waves of migrants following the two world wars and the Vietnam War. Following WWII the Australian migration program encompassed a wider range of ethnic groups than at any time previously in Australia's history. Formal agreements were made with the United Kingdom, Malta, The Netherlands, Italy, West Germany, Turkey and Yugoslavia, which often included an offer of assisted passage. The invasion of Hungary in 1956 and the later unrest in Czechoslovakia in 1968 saw the arrival of migrants from these countries, some of whom also settled in the Austral-Leppington area (Australian Government Department of Immigration and Citizenship (2009). However, members of these communities had been arriving earlier. Rudolf Prokoph, who had migrated to Australia from Czechoslovakia in 1928, established a poultry farm in Austral.

During WWII, Italian men interned at Liverpool interment and POW camp were transported by military trucks to work in the outlying agricultural areas on a daily basis. Following the war, many of these men returned to work in the region, with many settling within the Austral area, and during the 1950s and 1960s numbers increased in response to the government migration program. The majority established themselves as market gardeners, and many focused on the cultivation of tomatoes. Today their influence can be seen in the bilingual (English/Italian) signage throughout the Leppington Public School. The Scalabrinian Missionaries arrived in Australia in 1952, initially caring for remote Italian communities throughout NSW, Queensland and Tasmania. As populations of Italian migrants increased, their care was focused on urban areas and, today as the population ages, the provision of

community care facilities has been a priority. The Missionaries have established nursing homes and hostels, like the Scalabrini Village in Austral (Scalabrinians Missionaries 2009).

The Holsworthy-Liverpool interment and POW camp also housed approximately 740 Croatian labourers, woodcutters, miners, gumdiggers and sailors from all over Australasia during WWI. Following the war, when Yugoslavia was established, 100 of the 574 former internees were permitted to stay in Australia (Budak and Lalich 2008:91). In 1952, with the influx of new migrants, the first Croatian welfare association in Australia, Croatian Caritas, was founded in Sydney to help the new migrants with language difficulties and to find jobs. A few years later in 1958, a cooperative society of Croatian farmers was founded on 112 hectares of land near Liverpool, attracting about 40 Croatians (Budak and Lalich 2008:95).

Since WWII, immigration has diversified such that today the Austral and Leppington North precincts continue to have strong Italian, Lebanese, Maltese and Chinese communities, reflecting the waves of post war migration to the area (ABS 2006).

3.5 Memorialisation

Memorialisation is a form of public history. The erection of public monuments or the creation and naming of commemorative spaces provides a context for remembering important people and events in the local community, and in the wider world. The process of memorialisation reflects a public desire to experience a process of commemoration and public ritual, particularly in the context of death or other forms of human suffering. The ongoing maintenance of memorials acts as a buttress against forgetting and loss of a common local history.

There are a number of places in the study area which have been named after local people in the community, in recognition of their contribution to the community. For example, the H J Starr Progress Hall was named after H J Starr, local postmaster and an important donor to the Austral Progress Association; Browns Road and Avenue in Austral was named after William Brown Senior, local butcher and an Alderman on Nepean Shire Council (Clarke and Haak 1993:5; Ian Wilmington, pers. comm., 25 January 2011).

The remains of a monument apparently erected by the Federation of Hellenic Associations are on Lot 10 DP 771080, off Gurner Avenue. The Federation had intended the land to be used as a hub for recreational and community activities for the Greek community; however, little else is known concerning the monument (see below Section 5.3.9).

3.5.1 War Memorials

War memorials are some of the most common forms of memorialisation in local communities, outside of cemeteries. In many cases, where the body may still lie on the battlefield or is buried overseas, the memorial replaces a grave, acting as the focus of mourning and commemorative rituals.

A memorial at the corner of Cowpasture and Bringelly Roads commemorates the death of Second Lieutenant William Brown, son of William Brown Senior, during WWI. Brown died in September 1916, aged 22, at Mouquet Farm at the Battle of the Somme, France. The memorial was erected soon after the war, in approximately 1920, by the people of the district; it was relocated to the current site in 1994. Brown is also commemorated at the Villiers-Bretonneux Memorial in France, the Australian War Memorial in Canberra, and by a memorial erected by his parents at Rossmore Church (Clarke and Haak 1993:5; Australian War Memorial, nd). The value of the memorial to the community is recognised by its local heritage listing.

Edmondson Road in Austral is named after another local man, Corporal John Hurst Edmondson. Edmondson died in 1941, at the Battle of Tobruk, Libya. He was awarded the Victoria Cross for Valour for actions in the defence of Tobruk, the first Australian in WWII to receive the medal. He is also commemorated at the Australian War Memorial in Canberra, and in the naming of various local places and buildings. These include the John Edmondson VC Memorial RSL Club in Liverpool, John Edmondson High School in Horningsea Park, the school hall at his former high school, Hurlstone Agricultural High School, and the new suburb of Edmondson Park, amongst others (Clarke and Haak 1993:5). The contribution and prominence of the Edmondson family is acknowledged by the heritage listing of the family home, Forest Home.

Another war hero is Flying Office William Verdun Scott, who was shot down over The Netherlands in December 1943. Scott was the son of a Leppington grocer and long-serving Alderman on Nepean Shire Council, Thomas Scott. He is remembered by a memorial at, and the naming of, W V Scott Memorial Park, at the corner of Bringelly Road and Edmondson Avenue (LPS 1982:16; Clarke and Haak 1993:5; Australian War Memorial, nd).

4 Physical Analysis

4.1 Preamble

The study area is characterised as a semi-rural landscape, with a mixture of market gardens, open grassy paddocks or vacant land, poultry farms, orchards, and large residential properties. The majority of the land is zoned for Rural Small Holdings, but there are two areas zoned for Primary Production: at the north edge of the study area and in the Investigation Area to the southeast. A small Neighbourhood Centre surrounded by Low Density Residential lots is located at the junction of Tenth and Edmondson Avenues.

The topography of the study area is gently undulating, with some moderately hilly land towards the south and east. The topography and underlying soils are well-suited to agriculture. Kemps Creek, which forms the western boundary of the study area, flows in a north-south direction and is fed by several tributaries within the study area. Kemps Creek Nature Reserve, at the northwest corner of the study area, is the only substantial area of native vegetation in the vicinity of the study area. The remainder of the land has been substantially cleared through historic timber-getting and for farming, since the mid-nineteenth century and accelerating through the early to mid-twentieth century.

The Western Sydney Parklands border the study area to the north and east. The Parklands are made up of former farmland, which is being redeveloped into a series of regional recreational facilities with regenerated natural bushlands, walking trails, and habitat for local wildlife. The Parklands are separated from the study area by the Upper Canal, the historic water supply Canal managed by the SCA.

Bringelly Road and Fifteenth Avenue are the main east-west transport corridors through the study area, and provide long views across the landscape, while Edmondson and Fourth Avenues provide north-south linkages between these corridors. Camden Valley Way, which takes in part of the historic alignment of Cowpasture Road along the southeast boundary of the study area, is a major arterial road, linking the Hume Highway, M7 and M5 interchange at Prestons near Liverpool with Camden. These are all two lane roads, and despite increasing traffic retain a strong rural character, with narrow gravel and/or grass verges and ditch drainage. That being said, Camden Valley Way and Bringelly Road will soon be upgraded from two to four lanes, in association with the development of the SWGC (Figure 4.1).

Figure 4.1 Bringelly Road, view to the west.

The urban form of the study area reflects the patterns of subdivision established in the late nineteenth century and associated use of the land for small farms and housing. The following analysis considers general physical evidence of these patterns, in the context of the historic development of the study area.

4.2 Hinchinbrook Estate

The northern part of the study area is associated with the former Barron Field land grant, originally known as *Hichinbrook* (Figure 4.2-Figure 4.3). It is unusual in the study area insofar as the original land grant has not been subdivided into small farming lots, which are prevalent in other parts of the study area. The area includes Kemps Creek Nature Reserve to the west, Kemps Creek Substation to the north, and a large area of open grassed paddocks to the east (Figure 4.2-Figure 4.7. Transmission lines cross the paddocks, with three main lines running towards the north, south and east. An underground gas pipeline runs along the eastern boundary of the study area. A series of unsurfaced tracks provides access to the transmission lines and gas pipeline.

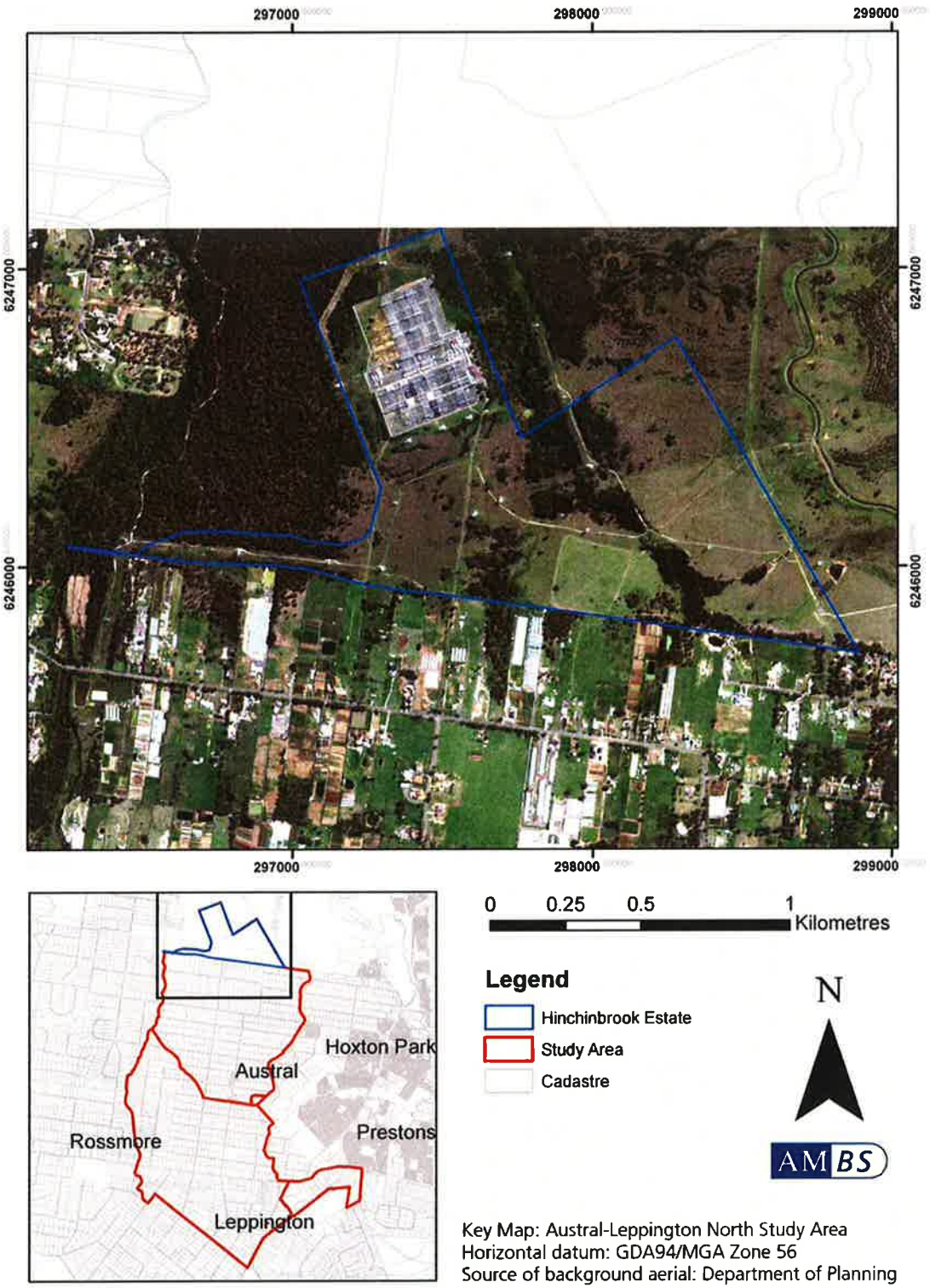
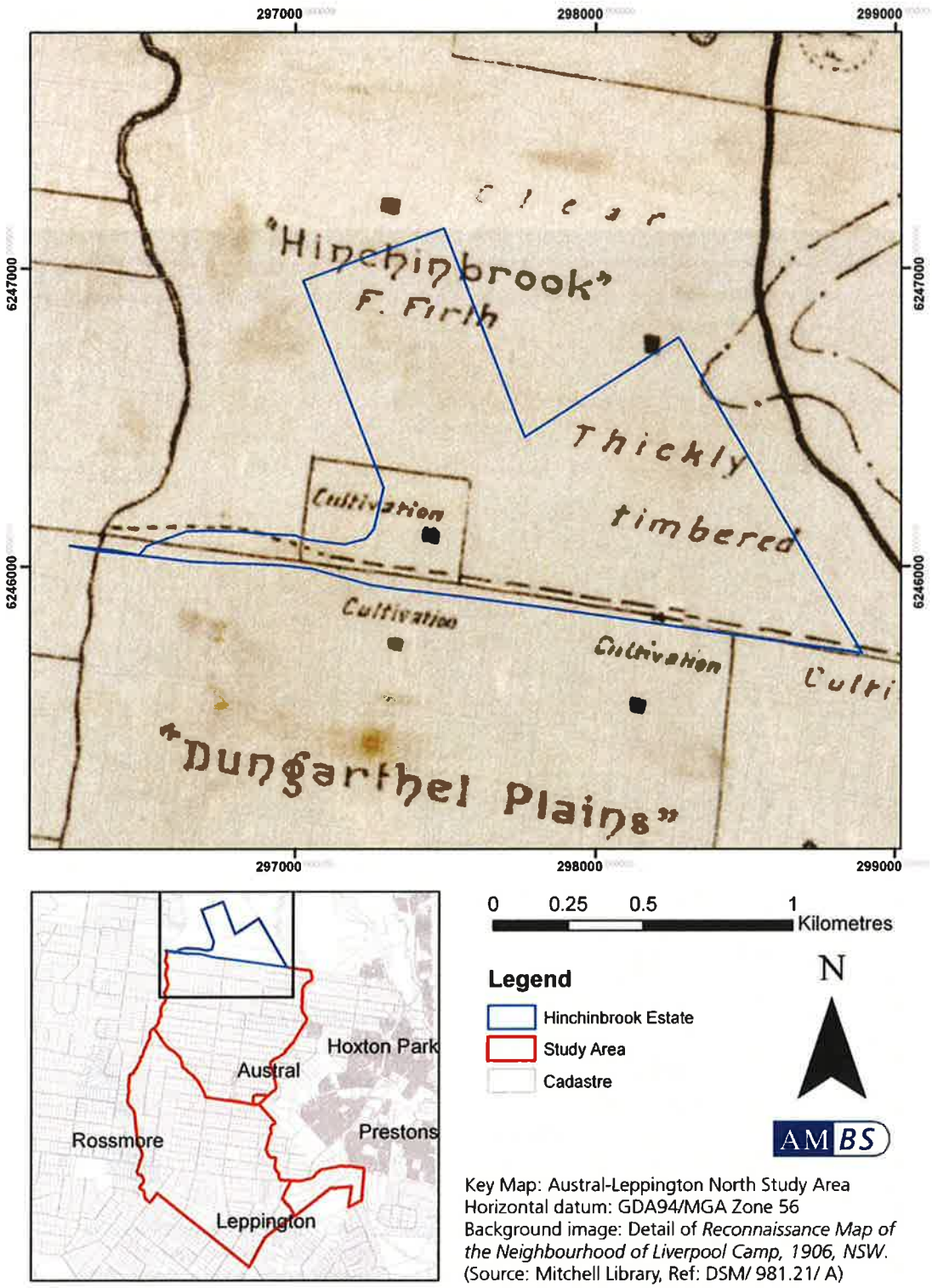


Figure 4.2 Section of study area on former Hinchinbrook Estate, overlain on 2010 aerial photograph.



Key Map: Austral-Leppington North Study Area
Horizontal datum: GDA94/MGA Zone 56
Background image: Detail of *Reconnaissance Map of the Neighbourhood of Liverpool Camp, 1906, NSW.* (Source: Mitchell Library, Ref: DSM/ 981.21/ A)

Figure 4.3 Section of the study area within former Hinchinbrook Estate, overlain on 1906 Reconnaissance Map.

Figure 4.4 Entrance to Kemps Creek Nature Reserve. View to the northeast.

Figure 4.5 Cows grazing on Transgrid land, south of Kemps Creek Substation.

Figure 4.6 Kemps Creek Substation.

Figure 4.7 Transmission lines crossing the paddocks east of Kemps Creek Substation.

Early maps and aerial photographs indicate that the area to the east of Kemps Creek Nature Reserve was almost entirely cleared of timber in the early twentieth century, and prior to 1930. Pockets of native regrowth vegetation line a series of creeks running through the area (Figure 4.8). Unsurfaced tracks cross the creeks over small stone bridges (Figure 4.9), constructed of field stones set in coarse cement and, in one case, incorporating a cast concrete pipe.

Figure 4.8 Pockets of native regrowth vegetation line creeks running through the area.

Figure 4.9 Rubble stone bridge.

An area of cultivation with a building identified on the 1906 Reconnaissance Map at the southern edge of the property appears to have been removed prior to the 1930 aerial photograph of the property, and there is no evidence of this building on the ground today (Figure 4.3).

The eastern edge of the area is dominated by a small knoll, known as Judges Hill, with expansive views to the north, south and southeast, and west. A small concrete monument, in ruinous condition, stands on the west side of the knoll, just within the boundary of the study area (see Section 5.3.9 below). An unsurfaced track connects the monument with a creek crossing to the west (Figure 4.10). The creek crossing creates a break in the trees lining the creek, opening up long views from the monument to the landscape to the west. The careful positioning of the monument in a commanding position near the crest of the knoll suggests that it was intended to be visible from long distances, and in turn that there would be long views from the monument over the surrounding landscape (Figure 4.11).

Figure 4.10 View along dirt track to small knoll and monument at the east side of the study area.

Figure 4.11 Composite panorama, showing expansive view from Judges Hill monument to the west.

4.3 Ickleton Estate

The northeast corner of the study area is associated with the former John Gurner land grant, originally known as *Ickleton* (Figure 4.12). Gurner Avenue, which crosses the area in an approximate east-west direction, marks the centreline of the original grant The boundaries of the lots adjoining Gurner Avenue provide a good indication of the rectangular shape and extent of the land grant, which covered

approximately 400 acres (161.87ha). The anomalous northern boundaries of the lots at 125 to 185 Gurner Avenue are consistent with the alignment of a track marked on a 1906 map of the area, which roughly followed the boundary between John Gurner and Barron Field's grants, but crossed into Barron Field's grant in this area (Figure 4.13).

The subdivision pattern was established in the 1880s-1890s, when *Ickleton* was broken up into two rows of small, narrow farming lots of three acres each, with Gurner Avenue running down the middle. The subdivision pattern paid no attention to the prevailing topography, and as such Gurner Avenue traverses a series of low hills before crossing Kemps Creek at the western edge of the study area (Figure 4.14).

Just over half of the original lots have since been re-subdivided into smaller, narrower lots, of one to two acres each, and houses have been built to address the street. However, most of the land to the rear of the houses continues to be used as paddock or market gardens (Figure 4.15-Figure 4.18). Some of the land appears to have been abandoned, or lies fallow (Figure 4.17).

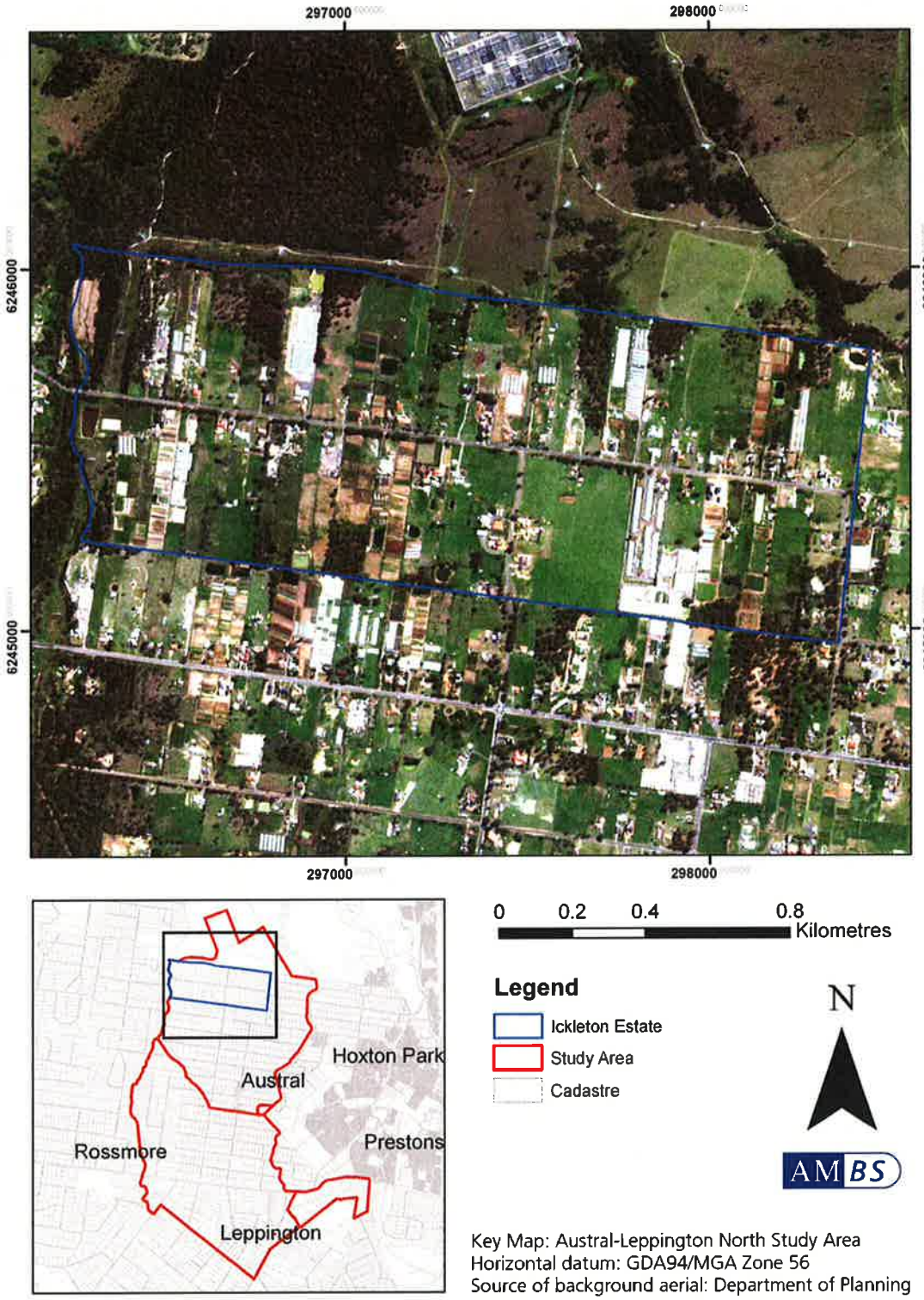
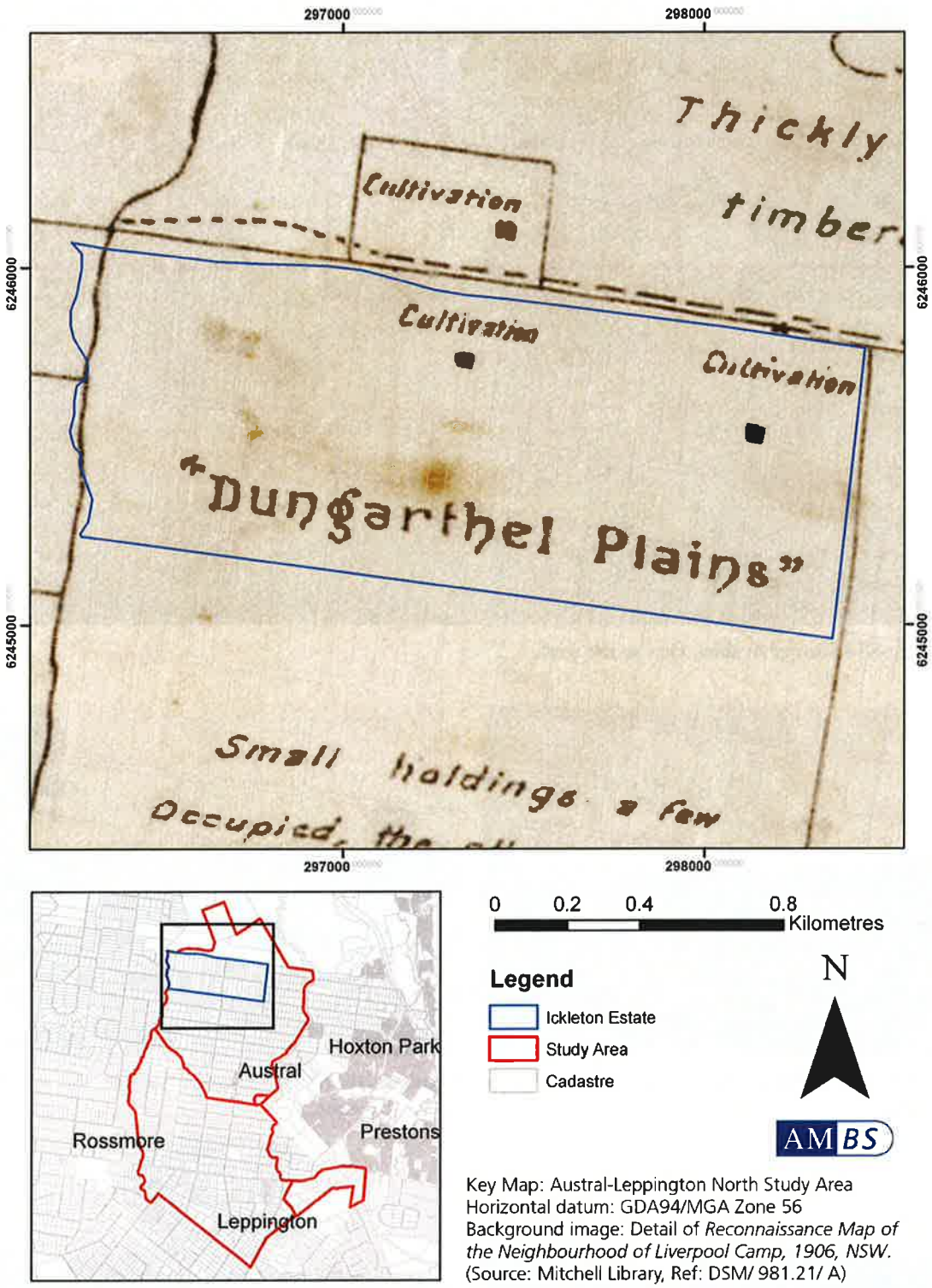


Figure 4.12 Section of study area on former Ickleton Estate, overlain on aerial photograph.



Key Map: Austral-Leppington North Study Area
Horizontal datum: GDA94/MGA Zone 56
Background image: Detail of *Reconnaissance Map of the Neighbourhood of Liverpool Camp, 1906, NSW.* (Source: Mitchell Library, Ref: DSM/ 981.21/ A)

Figure 4.13 Section of the study area within former Ickleton Estate.

Figure 4.14 Gurner Avenue, view to the west.

Figure 4.15 Paddocks to the rear of 5-11 Gurner Avenue.

Figure 4.16 Market Garden to the rear of 30 Gurner Avenue.

Figure 4.17 Abandoned pig sties to the rear of 115 Gurner Avenue.

Figure 4.18 Farm buildings to the rear of 85 Gurner Avenue.

4.3.1 Houses and Gardens

The majority of the houses and gardens along Gurner Avenue date to the second half of the twentieth century, with a few large houses constructed during the past ten years (Figure 4.19-Figure 4.20). However, there are also some earlier houses and gardens, which provide evidence of the history of the area and its development during the early to mid-twentieth century.

Figure 4.19 Small brick house at 5 Gurner Avenue.

Figure 4.20 Large brick house at 67 Gurner Avenue.

The 1906 Reconnaissance Map of the area indicates two buildings and associated areas of cultivation in the vicinity of the *Ickleton* estate (Figure 4.13 above). Due to inconsistencies with the 1906 map, it has not been possible to match these buildings precisely to any one modern property. However, analysis of the 1930 aerial photographs of the area suggests that there were two buildings in the vicinity of the buildings marked on the 1906 map. These were located in the centre of blocks at 49-55 Gurner Avenue and 105-110 Gurner Avenue. A review of current aerial photographs suggests that these buildings are no longer extant.

The 1930 aerial photographs also show evidence of five additional buildings adjacent to Gurner Avenue. Of these, only one building is likely to be extant: a rambling weatherboard house at 11 Gurner Avenue (see Figure 4.21 and Section 5.4.4 below).

The 1955 aerial photograph indicates that the number of buildings along Gurner Avenue had more than doubled by this date, with at least a dozen buildings, likely houses, close to the street. Several mid-twentieth century houses are extant at the eastern end of Gurner Avenue, distinguished by their timber or fibro cladding and corrugated metal roofs.

The single-storey house at 15 Gurner Avenue has a centrally placed front door, fibro siding, and a corrugated metal hipped roof (Figure 4.22). Based on an analysis of aerial photographs, the house was constructed on the west half of a cleared lot between 1930 and 1955.

A single-storey building at 40 Gurner Avenue is set back from the street, and hidden behind a pair of pines (Figure 4.23). The building was likely constructed on the lot between 1930 and 1955, but has since been substantially altered. The 1955 aerial photograph of the property shows several rows of trees planted in front and to the sides of the building. The rows are likely evidence of an orchard; however, it is possible that the extant pines were associated with this planting.

Figure 4.21 Weatherboard house at 11 Gurner Avenue.

Figure 4.22 Fibro house at 15 Gurner Avenue.

Figure 4.23 Pair of pines in front of building at 40 Gurner Avenue.

The single-storey house at 45 Gurner Avenue has timber siding, a metal hipped roof, and a brick chimney on the east side (Figure 4.24). There is an enclosed verandah at the front, with a central door. Based on an analysis of aerial photographs, the house was constructed on the east half of a cleared lot between 1930 and 1955. A short Canary Island Date Palm (*Phoenix canariensis*) stands in front of the house, adjacent to the street.

A row of four tall pines line the fence between 37 and 45 Gurner Avenue (Figure 4.25). These pines are a prominent feature of the streetscape, but there is evidence that a fifth tree has recently been removed from the row. The pines do not appear on the 1955 aerial photograph of the properties and were therefore planted after this date.

Figure 4.24 Weatherboard house at 45 Gurner Avenue.

Figure 4.25 Row of tall pines along fenceline between 37 and 45 Gurner Avenue.

A medium-sized Bunya Pine (*Araucaria bidwillii*) is a notable element of the garden at 115 Gurner Avenue (Figure 4.26). The Bunya Pine does not appear on the 1955 aerial photograph of the property; however, it is understood that the tree was planted by the current owner, Francis Mackay, who has lived on the property for 50 years. The property has a single-storey yellow-brick building constructed in the second half of the twentieth century, and a small outbuilding with a corrugated metal roof (Figure 4.27). Francis Mackay has indicated that her family constructed the brick house to replace an earlier house to the west, on the same lot (pers. comm., 2 December 2010). The 1930 and 1955 aerial photographs confirm that a small building was previously located at the south end of the block, in the vicinity of the outbuilding. Abandoned sheds at the north end of the block are likely former pig sties.

Figure 4.26 Outbuilding and Bunya Pine at 115 Gurner Avenue.

Figure 4.27 Bunya Pine and house at 115 Gurner Avenue.

4.4 Hoxton Park Estate

The central part of the study area is associated with the Hoxton Park Estate, a major subdivision of the 1880s (Figure 4.28-Figure 4.29). This subdivision involved the consolidation of six early land grants comprising over 3500 acres, which were broken up into 1,186 small, rectangular residential lots, most of three acres each. The lots were laid out along a regular grid of streets, which ignored natural boundaries and barriers embodied in the hills and valleys of the natural landscape. The grid is parallel with the historic alignment of Bringelly Road, which also formed the southern boundary of two of the original land grants incorporated into the subdivision. Bringelly Road and Fifteenth Avenue (Figure 4.30) provide the main east-west access through the area, while Edmondson Avenue and Fourth Avenue are important north-south road routes.

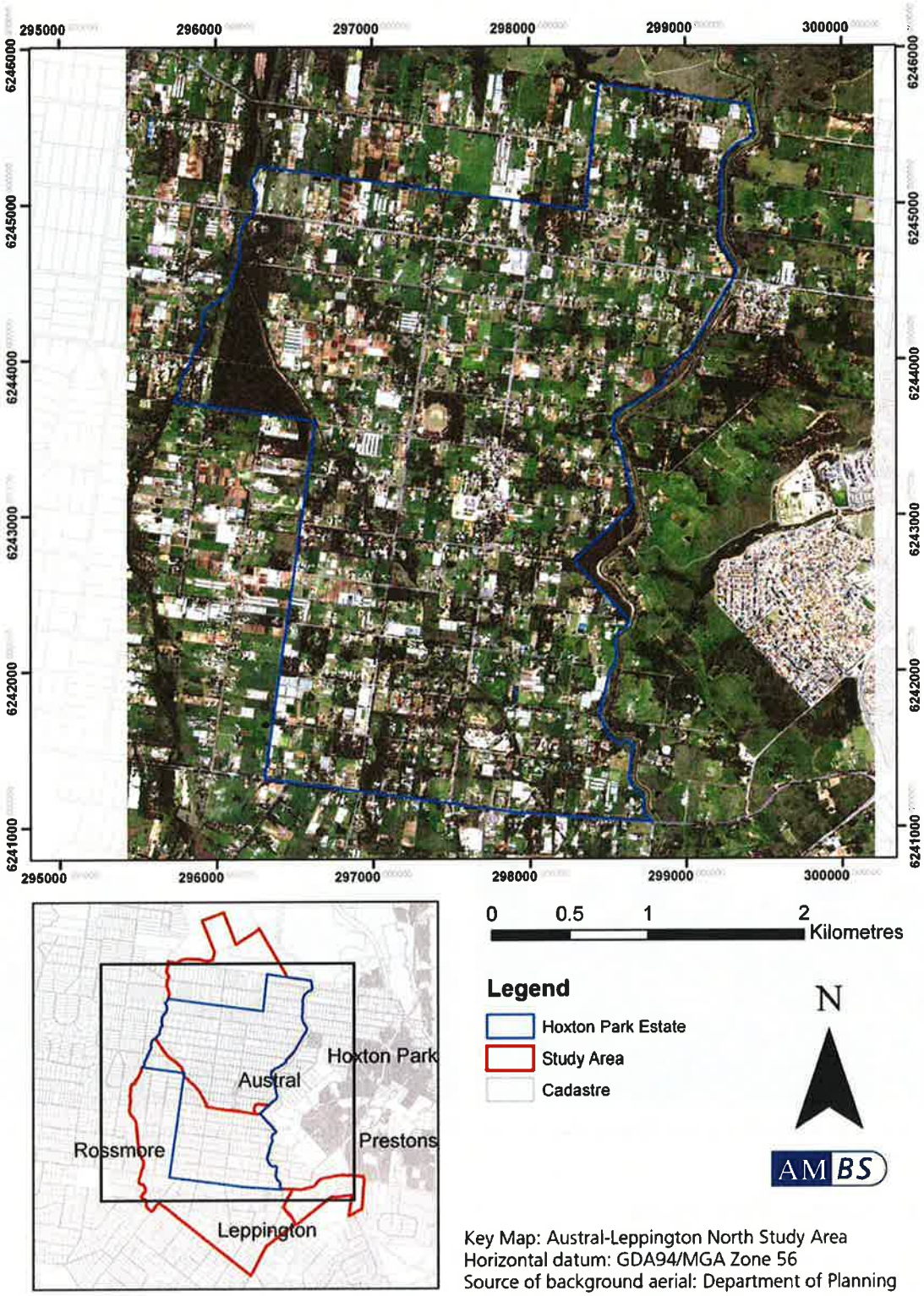


Figure 4.28 Section of study area within former Hoxton Park Estate, overlain on 2010 aerial photograph.

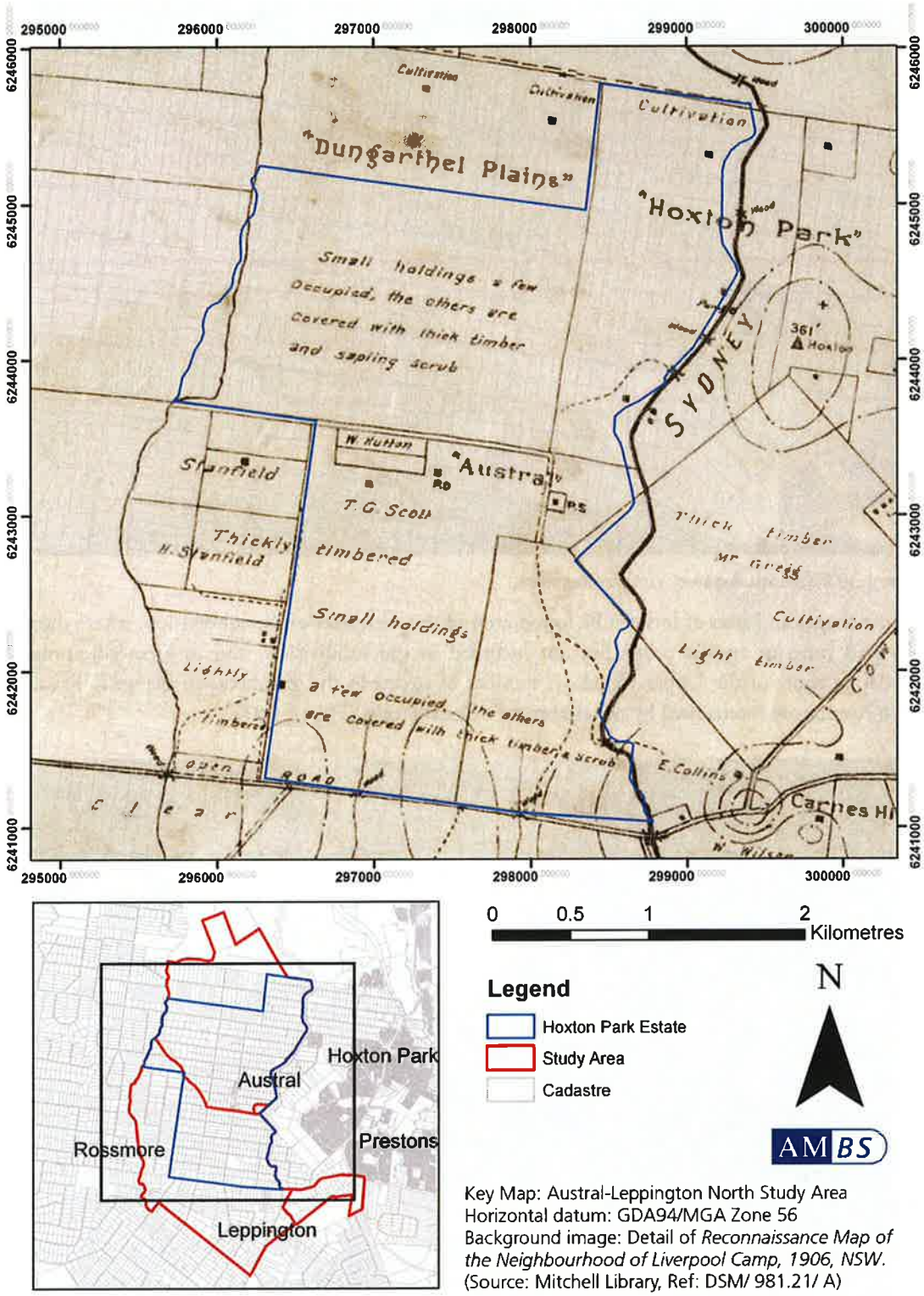


Figure 4.29 Section of the study area within former Hoxton Park Estate, overlain on 1906 Reconnaissance Map.

Figure 4.30 Fifteenth Avenue, view to the west.

Irregular shapes and sizes of lots can be found around the perimeter of the subdivision, where the rigid street grid runs up against properties not included in the subdivision, and in areas adjoining the meandering route of the Upper Canal. A number of streets in the grid between Bringelly Road and Eighth Avenue are interrupted by the alignment of local creeks (Figure 4.31).

Figure 4.31 View along Seventh Avenue, to the west. Seventh Avenue is interrupted between Edmondson and Fourth Avenues by the alignment of a local creek.

The historic subdivision pattern is substantially intact, and much of the original Hoxton Park Estate retains a distinct semi-rural character, with houses flanked by open paddocks, market gardens, and the occasional poultry farm (Figure 4.32-Figure 4.36).

Figure 4.32 House flanked by a market garden on Thirteenth Avenue.

Figure 4.33 Poultry farm on Thirteenth Avenue.

Figure 4.34 View along Eighteenth Avenue, to the west, with a market garden on the south (left) side of the road.

Figure 4.35 Market gardens on Ninth Avenue.

Figure 4.36 View of market gardens beside Twentyeighth Avenue, near junction with Fifteenth Avenue.

However, the character of the area appears to be changing, likely in association with generational change, including the retirement and death of post-war period migrant farmers. A significant number of blocks in the east-central part of the original Hoxton Park Estate are now dual-occupancy, with two large houses facing the street on each block. Much of the land to the rear of the houses is still used as paddock or market gardens, particularly on the western side of the study area, but some properties are now entirely residential, with large gardens, lawns, and/or small orchards adjacent to the houses (Figure 4.37-Figure 4.38). Two medium-density residential complexes have recently been constructed in the area: Kantarra village for 'over-55s' on the western side of the Austral Town Centre (Figure 4.39), and Scalabrini retirement village. Scalabrini is a Christian-run facility, closely associated with the Italian community. A low density housing subdivision comprising two cul-de-sacs has also been established on the northern side of the Austral Town Centre, beginning in the late 1970s, with more than twenty houses filling two former three acres blocks.

Figure 4.37 A large house surrounded by expansive lawn at 95 Twelfth Avenue.

Figure 4.38 House under construction.

Figure 4.39 Kantarra village for 'over-55s'.

The former Hoxton Park Estate has two small commercial precincts: Austral Town Centre at the junction of Edmondson and Tenth Avenues, and the West Hoxton Shopping Centre at the junction of Edmondson and Fifteenth Avenues. The West Hoxton Shopping Centre includes a strip of late-twentieth century glass-fronted shops facing Edmondson Avenue, a warehouse-style Home Timber

and Hardware store facing Fifteenth Avenue, and a Speedway petrol station facing the junction of the two roads (Figure 4.40-Figure 4.41).

Figure 4.40 West Hoxton Shopping Centre, Edmondson Avenue.

Figure 4.41 Speedway petrol station at the junction of Edmondson and Fifteenth Avenues.

The Austral Town Centre also has a series of late-twentieth century shopfronts, including an IGA supermarket on the eastern side of Edmondson Ave (Figure 4.42-Figure 4.44). These are in close proximity to a series of older, inter-war period houses, and commercial and community buildings, giving the area a village-like character (see Section 4.4.2 below).

Figure 4.42 Austral shops, eastern side of Edmondson Avenue.

Figure 4.43 Austral shops, northeast corner of Edmondson and Tenth Avenues.

Figure 4.44 Austral shops, northwest corner of Edmondson and Tenth Avenues.

The study area has several well-established public parks and sports ovals, including Craik Park on Fourth Avenue between Eleventh and Twelfth Avenues, and the W V Scott Memorial Park, at the junction of Bringelly Road and Edmondson Avenue (Figure 4.45). The latter park was named in honour of a local soldier who died in action during WWII. A memorial to W V Scott is located at the southeast corner of the park. The memorial is a black granite plaque, which has been installed on top of a pre-existing concrete plinth. There are indications that a different plaque had previously been installed at the base of the plinth. The association of the park with the memorial, and the evidence of the ongoing maintenance of the memorial suggest that the park has special meaning for the local community (see Section 5.3.8 below).

Figure 4.45 W V Scott Memorial Park, at the junction of Bringelly Road and Edmondson Avenue.

4.4.1 Houses and Gardens

The majority of houses and gardens in the Hoxton Park Estate date to the second half of the twentieth century. However, a few older early- to mid-twentieth century buildings can be found on the eastern side of the estate, particularly on lots close to the Upper Canal and key historic roads: Fifteenth Avenue, Edmondson Avenue and Bringelly Road.

The 1906 Reconnaissance Map of the area indicates seven buildings in the vicinity of the Hoxton Park Estate (see Figure 4.29 above). One building is likely associated with an Upper Canal maintenance worker's cottage, which was on the southeastern corner of the junction of Fifteenth and Twentyeighth Avenues. The maintenance worker's cottage has since been replaced, although there may be archaeological remains associated with this site. Two other buildings are associated with Austral Public School and the first Austral Post Office. Austral Public School is extant, but the 1906 map inaccurately records its location as being approximately 350 metres west-north-west of the land set aside for it; the first post office building has long since been demolished and mail services moved to another location. Due to inconsistencies with the map, it has not been possible to match the remaining four buildings precisely to any one modern property. However, analysis of the 1930 aerial photograph of the area suggests that a building at 10 Thirteenth Avenue, adjacent to the Upper Canal, may have been consistent with one of the locations indicated on the 1906 map. A review of current aerial photographs suggests that this building has now been demolished.

The 1930 aerial photographs do not cover the entire extent of the study area. However, based on the available evidence, there were more than 25 buildings in the area of the Hoxton Park Estate west of the Canal by this date. Of these, there is evidence that four buildings may be extant. The remainder appear to have been removed or replaced with more modern structures. It is also possible that there are additional early buildings in the area, which are obscured by trees on the early photographs.

The single-storey house at 29 Eighteenth Avenue is consistent with the location of building on the 1930 aerial photographs. The house has a medium-pitched corrugated metal roof with a front facing gable, fibro siding, and a lean-to kitchen and brick chimney at the rear. It is a modest, symmetrical building, with two casement windows facing the street (Figure 4.46).

The single-storey weatherboard house at 305 Fifteenth Avenue, consistent with the 1930 aerials, has a steep-pitched corrugated metal roof, and a corrugated metal bull-nosed verandah (Figure 4.47) (see Section 5.4.2 below).

Figure 4.46 House at 29 Eighteenth Avenue.

Figure 4.47 House at 305 Fifteenth Avenue.

The single-storey house at 110 Sixth Avenue is set back from the street, at an oblique angle (Figure 4.48). Consistent with the 1930 aerials, it has a low-pitched corrugated metal roof with a front facing gable, fibro siding, and a lean-to kitchen and brick chimney at the rear. There is an enclosed verandah at the front, with a central door. The position of the house may be associated with the nearby Upper Canal. The current owners of the house have indicated that the interior has been substantially modified (Mrs Doris Camilleri pers. comm., 1 February 2011).

The siting of a single-storey house at 10 Fifth Avenue, consistent with the 1930 aerials, may also be associated with the Canal. It is set back from the street, at an oblique angle. It has a low pitched corrugated metal roof, fibro cladding and a skillion-roof kitchen to the rear (Figure 4.49).

Figure 4.48 House at 110 Sixth Avenue, close to the Upper Canal.

Figure 4.49 House at 10 Fifth Avenue, close to the Upper Canal.

Settlement of the former Hoxton Park Estate finally took off in the period between 1930 and 1955, with aerial photographs showing the numbers of houses increasing five-fold or more. Numerous inter-war and post-war period houses are preserved in the study area. These are modest houses, constructed by and for working people, primarily with a timber frame set on brick piers and fibro cladding. Some examples of the mid-twentieth century houses and gardens noted during the field survey are described below.

A small fibro house at 5A Eighteenth Avenue is a well-preserved example of a workers cottage constructed prior to 1955 (Figure 4.50). Located immediately adjacent to the Upper Canal, the cottage has a corrugated metal gable end roof, an enclosed front verandah, and a skillion-roof addition at the rear.

A small weatherboard house at 15 Seventeenth Avenue is in poor condition, but provides a rare example of a small-scale vernacular weatherboard house in this area (Figure 4.51). The building has a corrugated metal roof with gable-end, a brick chimney in one corner, and skillion-roof additions at the side and rear. The front is asymmetrical, with an off-centre door. The house is set on a lightly wooded lot, which also includes a dilapidated timber barn. The house is not apparent on the 1930 aerial of the area, but it is possible that the building was relocated to the current site. The lot is currently surrounded by cyclone fencing, indicating that the property may be in the process of development. The site may have archaeological potential (see Section 5.4.3 below).

Figure 4.50 Small house at 5A Eighteenth Avenue, adjacent to the Upper Canal.

Figure 4.51 Small house at 15 Seventeenth Avenue.

A single-storey house at 280 Fifteenth Avenue is a representative example of a modest post-war style bungalow in good condition (Figure 4.52). Constructed after 1955, the house has a hipped tile roof and fibro cladding. The front is symmetrical, with a small covered entry. A large storage shed or garage with roller-doors has recently been constructed behind the house.

A single-storey weatherboard house at 80 Thirteenth Avenue was likely constructed between 1930 and 1955 (Figure 4.53). The house has a hipped corrugated metal roof, symmetrical front and a central front door. Although picturesque, the foundations appear to be subsiding, giving the house a lopsided appearance.

Figure 4.52 Fibro clad house at 280 Fifteenth Avenue.

Figure 4.53 Weatherboard house at 80 Thirteenth Avenue.

A single-storey house at 275 Edmondson Avenue is an early example of a brick-built bungalow in the area (Figure 4.54). Constructed in approximately 1948-9, the house has a hipped tile roof and a small front porch with brick columns and a flat awning. The curving line of the awning introduces a modernist note to the building. Two prominent Canary Island Date Palms flank a central path leading to the front door. These palms may be seen on the 1955 aerial photograph of the study area, and combined with the house, warrant further investigation as a point of historical interest in the local area (see Section 5.3.5 below).

A single-storey Californian bungalow at 170 Edmondson Avenue stands within an expansive landscaped garden, which is a prominent feature of the local streetscape and includes distinctive rows of large Canary Island Date Palms (Figure 4.55). These palms can be seen on the 1955 aerial photograph of the study area. The house and garden are well maintained, and also warrant further investigation as a point of historical interest in the local area (see Section 5.3.6).

Figure 4.54 Brick house and garden at 275 Edmondson Avenue.

Figure 4.55 House and garden at 170 Edmondson Avenue.

A small Nissen hut is prominently located beside a worker's cottage at 105-110 Edmondson Avenue. The Nissen hut is currently being used to store insulation materials (Figure 4.56). Nissen huts were prefabricated structures, commonly re-used in rural areas following WWII, in particular to house farm animals or as convenient storage areas. They are becoming increasing rare in Australia (see Section 5.3.10 below).

Figure 4.56 House and Nissen hut at 105-110 Edmondson Avenue, view from the north.

A single-storey house at 255 Eighth Avenue is associated with a row of tall pines (Figure 4.57-Figure 4.58). The house has a low-pitched roof with a front facing gable and fibro siding. The house and pines do not appear on the 1955 aerial photograph of the properties and were therefore constructed/planted after this date.

Figure 4.57 Row of pines associated with house at 255 Eighth Avenue.

Figure 4.58 House at 255 Eighth Avenue.

A small house at 60 Fifth Avenue (corner of 40 Browns Road) appears as a good example of a timber-frame worker's cottage, with an unusual cement rendered finish (Figure 4.59). A row of Cocos Island Palms (*Syagrus romanzoffiana*) are planted along the fence line on Browns Road, on either side of a wire gate and path leading to the front door. Constructed between 1930 and 1955, the remarkable appearance of the house, including decorative architectural features more common to larger, grander residences, warrants further investigation as a point of historical interest in the local area (see Section 5.3.7 below).

Figure 4.59 Cement rendered worker's cottage at 60 Fifth Avenue (40 Browns Road).

A tall Hoop Pine (*Araucaria cunninghamii*) is a notable landscape element at 185 Fifth Avenue (Figure 4.60). The pine and associated house do not appear on the 1955 aerial photographs of the area, and were likely planted/constructed after this date.

A single-storey house at 50 Edmondson Avenue has a combination of hipped and gabled roofs made of corrugated metal, with an enclosed verandah facing Edmondson Avenue and a chimney and skillion

roof addition to the rear (Figure 4.61). The house was likely constructed between 1930 and 1955, but has been modified on several occasions, and also appears to have been reclad. A number of outbuildings and sheds constructed of various materials are behind the house to the west, and a ploughed field is between the house and Fifth Avenue to the south.

Figure 4.60 Hoop pines at 185 Fifth Avenue.

Figure 4.61 House and outbuildings at 50 Edmondson Avenue.

4.4.2 Austral Town Centre

Austral Town Centre is historically associated with Austral Public School (Figure 4.62). The school was established in 1891 on the south side of Tenth Avenue. The 1906 Reconnaissance Map shows the school and a post office in the vicinity of the current shopping centre (see Figure 4.29 above). The school is still in operation in its original location, but all of the early school buildings were replaced in the second half of the twentieth century. The earliest building on the site today dates to the 1950s (Figure 4.63). The centenary history of the school reports that some of the early school buildings were relocated to Rossmore Public School, and some were relocated to the girl guides camp, Camp Austral, at the corner of Fourth and Twelfth Avenues (Figure 4.64-Figure 4.65).

Figure 4.62 Austral Public School, east side of Edmondson Avenue.

Figure 4.63 Austral Public School, 1950s fixed timber building.

Figure 4.64 Camp Austral, view from the south.

Figure 4.65 Camp Austral, view from the east.

The prevailing character of Austral Town Centre today appears to have been established in the inter-war period, with the construction of a general store and a Progress Hall. The 1930 aerial photograph shows the land along Edmondson Avenue, between Tenth and Eleventh Avenues, as lightly timbered, with only a single small building and some larger trees in the school ground south of Tenth Avenue. Two additional buildings can be seen approximately 100-130m west of Edmondson Avenue, but these buildings are no longer extant. By 1955, six buildings had been constructed on the western side of Edmondson Avenue, between Tenth and Eleventh Avenues, including the Progress Hall, general store and telegraph, and four houses; while two houses had been constructed to the east, including the brick house at 275 Edmondson Avenue (see above). The Progress Hall subsequently burnt down, and was replaced in approximately 1965 with the current building (Figure 4.66). The telegraph building adjacent to the general store has also been removed. The former general store now forms the core of Ian's Hardware at 256 Edmondson Avenue (Figure 4.67). The two single-storey fibro houses on the south side of Ian's Hardware have at various times been associated with the Austral Post Office. Together these buildings demonstrate the character of the rural township and its local environment in the mid-twentieth century. In particular, the H J Starr Progress Hall, Ian's Hardware and associated house, as well as the two fibro houses to the south of Ian's Hardware, form a coherent group, historically associated with the Starr family (see Sections 5.3.2-5.3.4 below).

Figure 4.66 H J Starr Progress Hall, 264-266 Edmondson Avenue.

Figure 4.67 Ian's Hardware, 256 Edmondson Avenue.

Figure 4.68 View of streetscape along west side of Edmondson Avenue, with Austral Post Office (left), Ian's Hardware, and the H J Starr Progress Hall (far right).

Austral Church of Christ and hall is located at the southwest corner of Edmondson and Tenth Avenues, opposite Austral Public School (Figure 4.69-Figure 4.70). The church was established in Austral in 1932, but the extant buildings were constructed after 1955.

Figure 4.69 Austral Church of Christ and hall.

Figure 4.70 Austral Church of Christ hall.

4.5 Cowpasture Estate

The western side of the study area is associated with the former Urban Fidkin land grant (Figure 4.71-Figure 4.72). The subdivision pattern was established in the 1890s, when the property was broken up into small farming lots of between 10 and 17 acres each. Two main streets, Kelly Street and Boyd Street, were laid out in a north-south alignment, with Kelly Street connecting to Bringelly Road in the south. The 10 acre lots were laid out on the east side of Kelly Street and in the area between Kelly and Boyd Streets, while the larger lots were primarily located along the east bank of Kemps Creek.

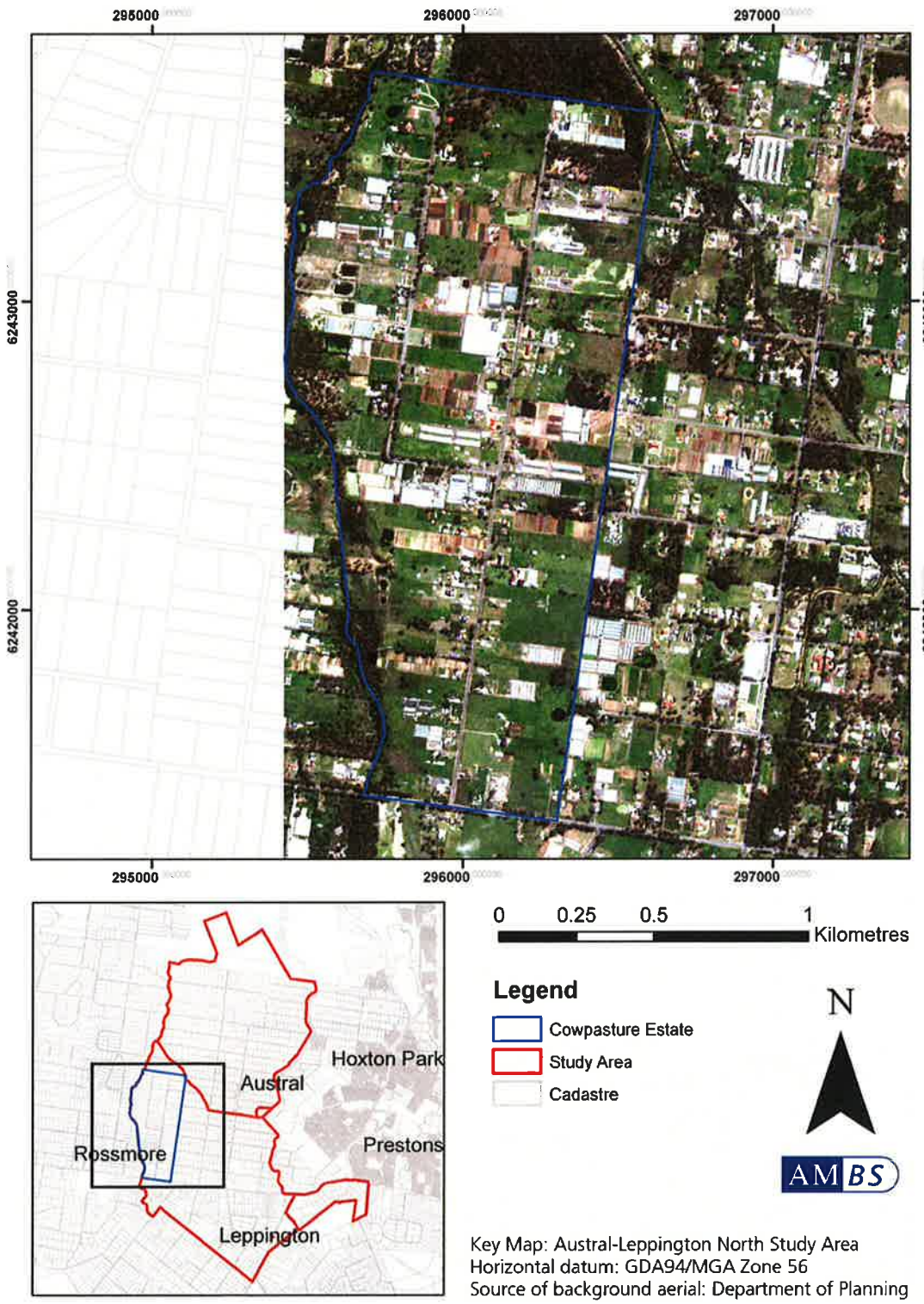
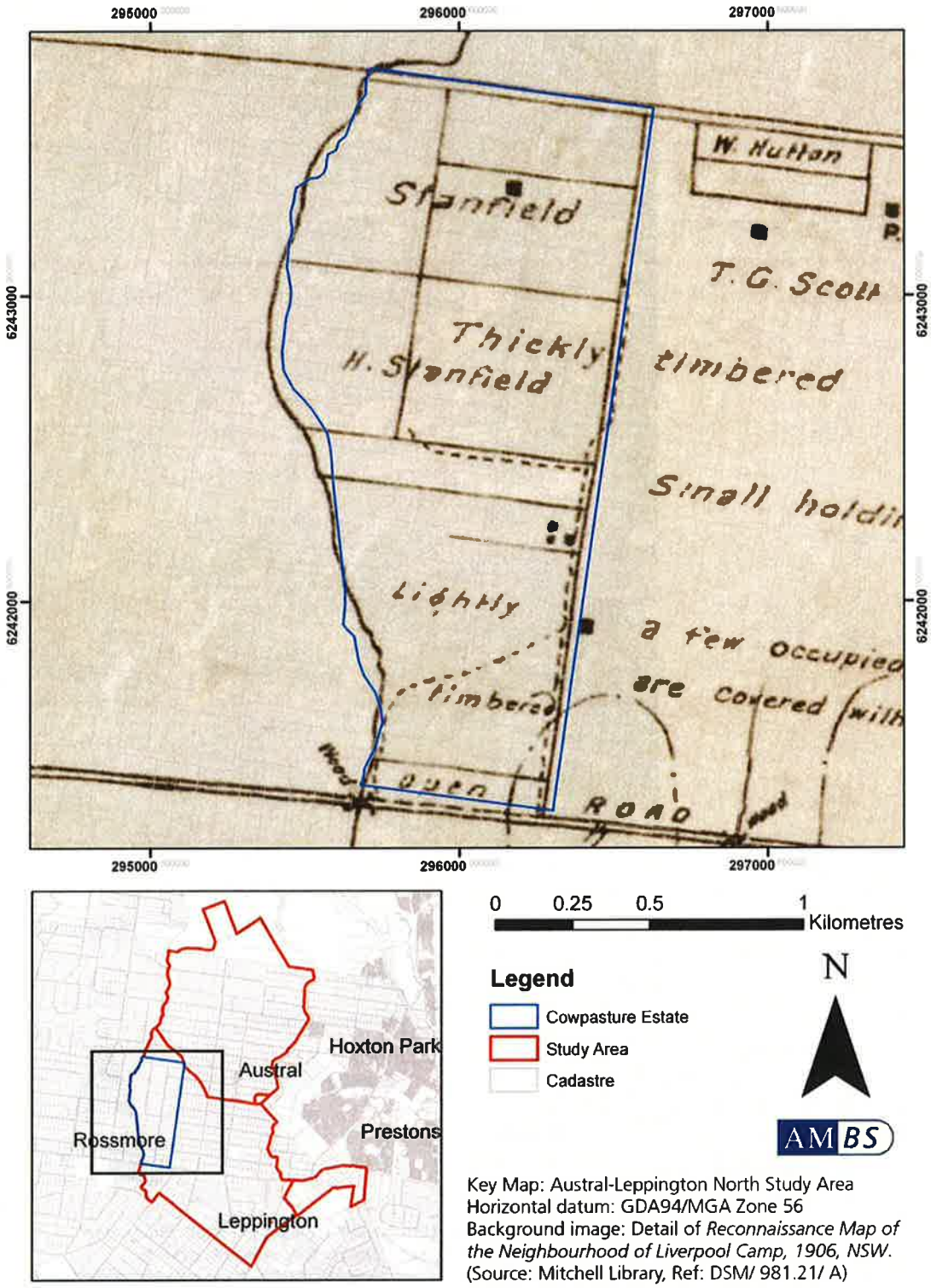


Figure 4.71 Section of study area on former Cowpasture Estate, overlain on 2010 aerial photograph.



Key Map: Austral-Leppington North Study Area
Horizontal datum: GDA94/MGA Zone 56
Background image: Detail of *Reconnaissance Map of the Neighbourhood of Liverpool Camp, 1906, NSW.* (Source: Mitchell Library, Ref: DSM/ 981.21/ A)

Figure 4.72 Section of the study area within former Cowpasture Estate, overlain on 1906 Reconnaissance Map.

The majority the original lots have since been re-subdivided into smaller, narrower lots, of five to six acres each, and houses have been built on many. However, the area retains a strong rural character and land to the rear of the houses continues to be used for agriculture. Abandoned and disused farm equipment in fields at the north end of Kelly and Boyd Streets is evocative of former land uses (Figure 4.73-Figure 4.75).

Figure 4.73 Paddock with small dilapidated hut, 1 Kelly Street.

Figure 4.74 Abandoned plough, 1 Kelly Street.

Figure 4.75 Disused stock loading run and holding pen, north end of Boyd Street.

Transmissions lines leading south from the Kemps Creek Substation pass over the area, between Boyd Street and Kemps Creek (Figure 4.76).

Figure 4.76 Transmission lines leading from the Kemps Creek Substation; view from Boyd Street.

4.5.1 Houses and Gardens

The majority of housing has been built during the second half of the twentieth century, with a few early- or mid-twentieth century buildings at the northern end of Kelly Street.

The 1906 Reconnaissance Map indicates four buildings in the area of the former Cowpasture Estate: one at the northern end of the subdivision, and a cluster of three buildings near the eastern side of the subdivision (Figure 4.72). Due to inconsistencies with the 1906 map, it has not been possible to match these buildings precisely to any one modern property. Moreover, the 1930 aerial photographs do not cover this part of the study area. However, it is possible that the cluster of three buildings on the 1906 map was associated with a series of small farm buildings that can be seen on the 1955 aerial photographs of the area, at the eastern end of 42-44 Kelly Street. These buildings are no longer extant, and the area has been heavily disturbed by market gardening. The house at 46 Kelly Street, to the south, has a low retaining wall at the front of the property, built of large squared sandstone blocks, with a sandstone step leading up to the path to the house (Figure 4.77-Figure 4.78). This wall is likely constructed of reused blocks from the foundations of another building. However, it is not known whether these blocks have been sourced locally.

Figure 4.77 Low retaining wall built of squared sandstone blocks, 46 Kelly Street.

Figure 4.78 Sandstone step and retaining wall, 46 Kelly Street.

By 1955, much of the land on either side of Kelly Street had been cleared for agriculture, particularly market gardens, and there are more than 20 houses extant along the street. The aerial photographs show that houses at the southern end were constructed to address the street, while a few buildings at the northern end were set back further in the block. This pattern is still apparent today, although few buildings can be positively dated to the mid-twentieth century or earlier. That being said, a fibro clad hut with a pitched metal roof at 1 Kelly Street can be clearly matched to a building on the 1955 aerial, as can a Californian bungalow with a green metal roof at 2 Kelly Street (Figure 4.79-Figure 4.80). Both of these buildings appear to be in poor condition.

Figure 4.79 Small, dilapidated hut at 1 Kelly Street.

Figure 4.80 Californian bungalow at 2 Kelly Street.

The 1955 aerial photographs also show that the land on the western side of Boyd Street, adjacent to Kemps Creek, was undeveloped at this date. All of this land was therefore cleared of timber and houses built in the second half of the twentieth century. In contrast with Kelly Street, many of the houses on the western side of Boyd Street have extremely large setbacks, particularly at the northern end of the street (Figure 4.81-Figure 4.82).

Figure 4.81 House at 100-106 Boyd Street, with an extremely large setback from the road.

Figure 4.82 House at 108 Boyd Street.

4.6 Raby-Eastwood Estates

The study area south of Bringelly Road is primarily associated with land granted to Alexander Riley and Hannibal Macarthur in the early nineteenth century (Figure 4.83-Figure 4.84). The area between Cowpasture Road, Bringelly Road, and Eastwood Road formed the northern part of Riley's grant, originally known as *Raby*. The area to the west of Eastwood Road formed the northeast corner of Macarthur's grant, originally known as Eastwood. Eastwood Road therefore marks the boundary of these two estates. The Upper Canal cuts through a triangle of land at the northeast corner of the former Raby estate. As noted above, this land was resumed from the estate for the construction of the Canal in 1886. The alignment of Bringelly Road, and part of Cowpasture Road, predates the granting of land in the study area.

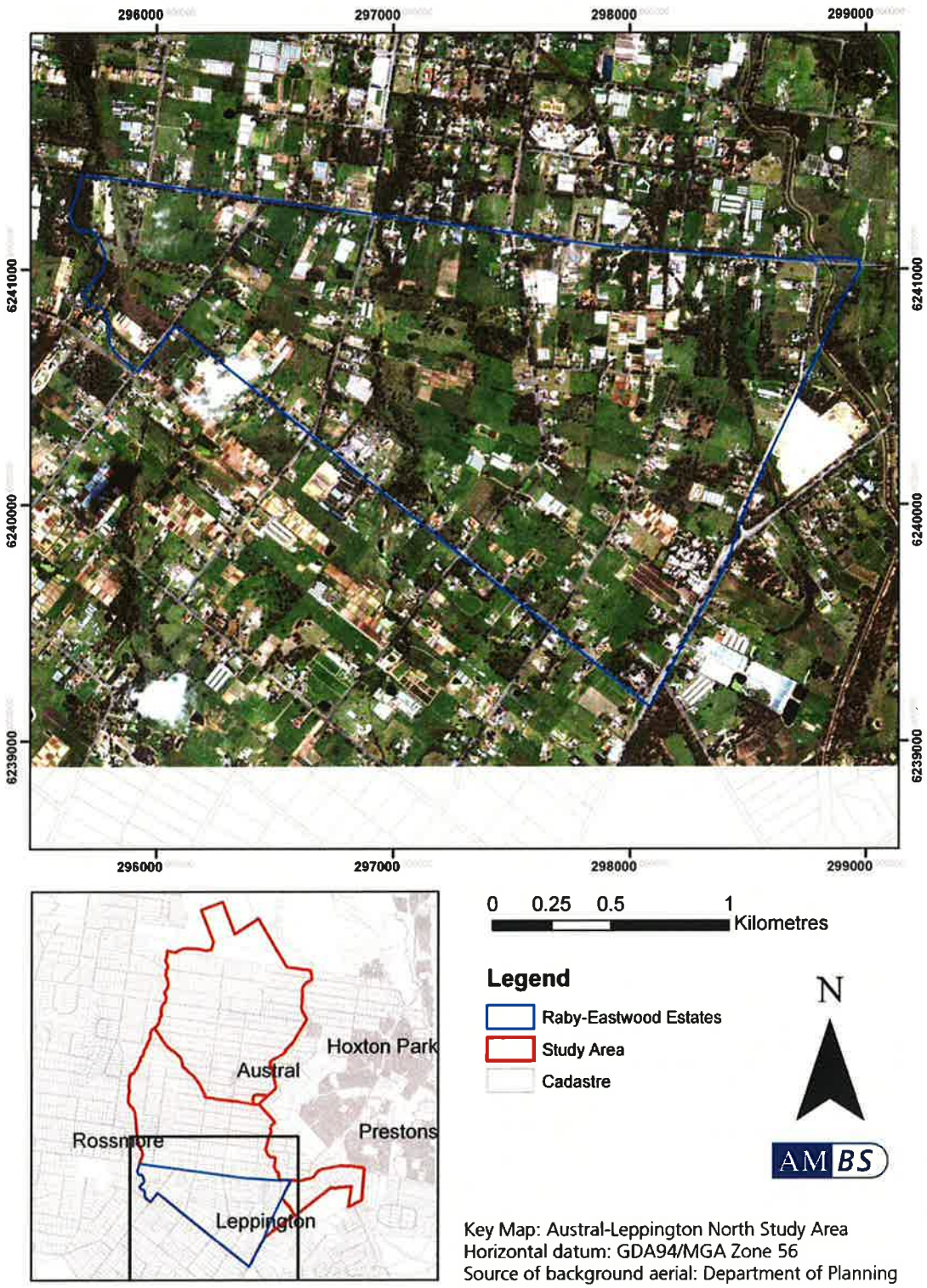
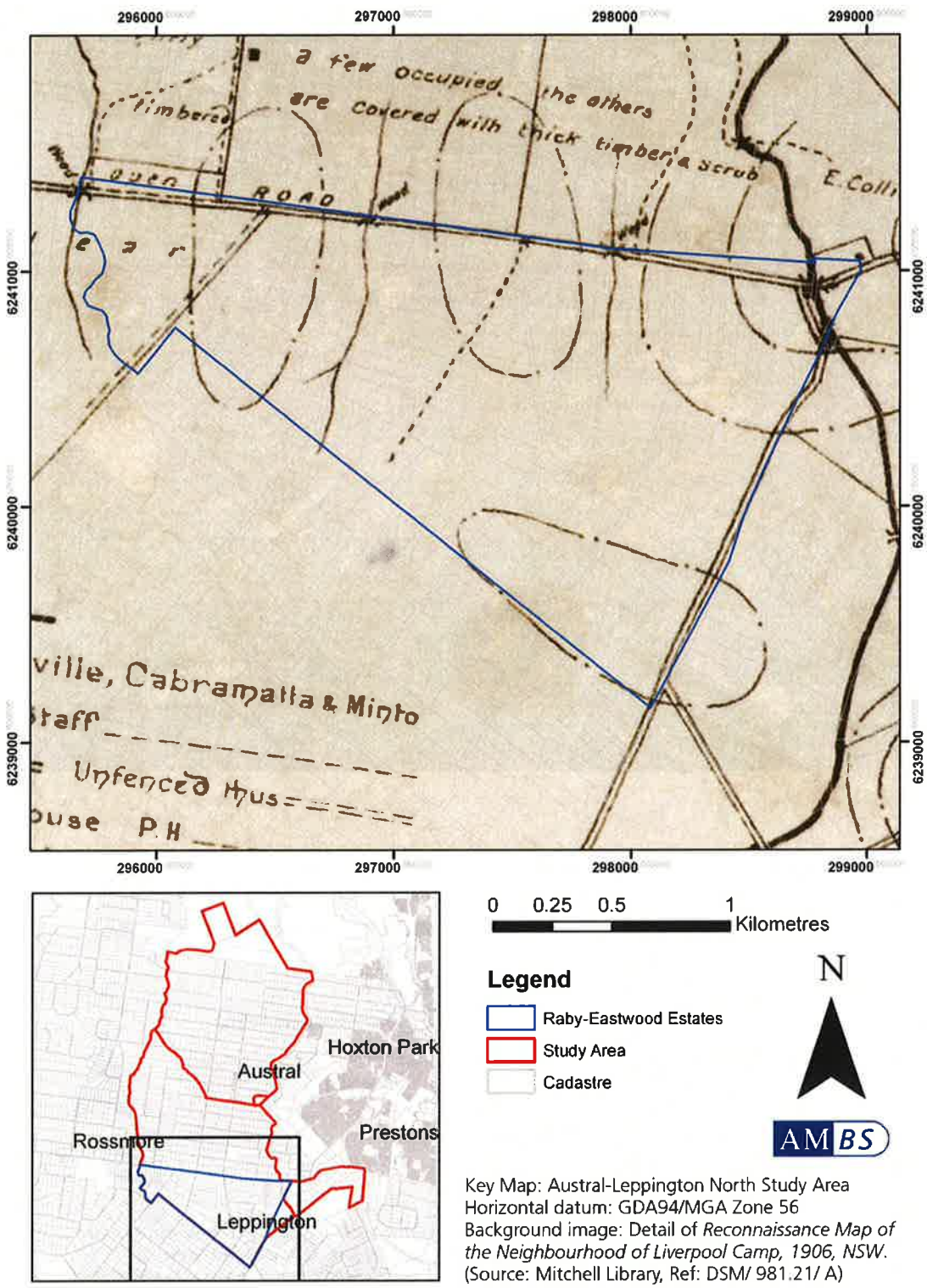


Figure 4.83 Section of study area on former Raby-Eastwood Estates, overlain on 2010 aerial photograph.



Key Map: Austral-Leppington North Study Area
Horizontal datum: GDA94/MGA Zone 56
Background image: Detail of *Reconnaissance Map of the Neighbourhood of Liverpool Camp, 1906, NSW.* (Source: Mitchell Library, Ref: DSM/ 981.21/ A)

Figure 4.84 Section of the study area within former Raby-Eastwood Estates, overlain on 1906 Reconnaissance Map.

The subdivision pattern and street layout for the Raby and Eastwood Estates was established in the 1910s, when the northern part of these estates was broken up into a series of small to medium sized farming lots, ranging from four to 31 acres in size. In contrast to the northern part of the study area, the lots are irregular in shape, partly to accommodate the pre-existing alignments of Bringelly and Cowpasture Roads. The area includes four streets that were laid out as part of the subdivision: Byron,

Dickson, Rickard and Ingleburn Roads. The alignment of Ingleburn Road provided for a more regular, grid-like pattern of subdivision of land to the south of the study area.
Most of these lots have since been re-subdivided into smaller lots, particularly along Bringelly Road; however, there is still a wide variety of lot sizes in this area. Like much of the study area, the Raby and Eastwood Estates retain a distinct semi-rural character, with houses flanked by open paddocks, market gardens, and the occasional poultry farm (Figure 4.85-Figure 4.87).

Figure 4.85 View of paddocks on the western side of Rickard Road.

Figure 4.86 Market garden, at the junction of Bringelly and Eastwood Roads.

Figure 4.87 Farm buildings on the eastern side of Byron Road.

There is a small shopping strip along Camden Valley Way, and Lockies Hotel is a prominent feature at the corner of Camden Valley Way and Ingleburn Road, incorporating an old tramway car as part of the building (Figure 4.88).

Figure 4.88 Tramway car at Lockies Hotel, corner of Camden Valley Way and Ingleburn Road.

4.6.1 Houses and Gardens

The extant housing primarily dates to the second half of the twentieth century, but a few older early- to mid-twentieth century buildings can be found scattered through the area (Figure 4.89-Figure 4.90). A new, compact housing subdivision has been created on a lot of approximately six acres near the junction of Cowpasture Road and Camden Valley Way.

Figure 4.89 Large new house on Byron Road.

Figure 4.90 Mid-twentieth century house on Rickard Road.

The 1906 Reconnaissance Map of the area predates the subdivision of the Raby and Eastwood Estates. It shows that the area has been cleared, but there do not appear to be any houses or tenant farmers on the northern part of the estates (see Figure 4.84 above). A subdivision plan of the 1910s indicates that there were ten buildings in the area, likely constructed soon after the first release sale. Due to the schematic nature of the map, it has not been possible to precisely match these to any one modern property. However, based on stylistic evidence, two buildings are likely to be extant: one on the western side of Cowpasture Road, near the junction with Bringelly Road; and the other at the junction of Eastwood and Bringelly Roads.

The house at 111 Cowpasture Road, which can be seen on the 1930s aerial photographs of the area, has a Dutch gable roof of corrugated metal, fibro cladding, and an internal chimney (Figure 4.91).

There is an enclosed front verandah with a central door, and a skillion roof addition to the rear. The house does not appear to be in good condition.

The house at 5 Eastwood Road has a medium-pitched corrugated metal roof with a front facing gable, brick chimney on the side, and skillion roof additions to the front and rear (Figure 4.92). The roof, windows and siding have all been updated. An associated barn has also been re-clad. This part of the study area is not covered by the 1930s aerial photographs, but the house and barn are consistent with buildings seen on the 1955 aerials.

Figure 4.91 Early twentieth century house at 111 Cowpasture Road.

Figure 4.92 House at 5 Eastwood Road.

By 1955, the area was a patchwork of small farms, with more than 50 houses and other buildings, although there were still some pockets of uncleared land, particularly west of Eastwood Road.

A house at 419 Bringelly Road is a good example of the 'Post War Austerity' style, a style coined by architect Robin Boyd to describe the basic fibro clad bungalows of the late 1940s and early 1950s (Stapleton & Stapleton 2003:86). It has a hipped tile roof, fibro cladding, brick chimney to the side and a skillion roof addition to the rear. The central front door with glass panels is a modest decorative element (Figure 4.93).

Figure 4.93 Post War Austerity cottage at 419 Bringelly Road.

4.6.2 Leppington Public School

Leppington Public School is within the study area, on the eastern side of Rickard Road. The school opened in 1923, and the original weatherboard school building is extant on the site (Figure 4.94). A row of blue-painted weatherboard buildings are adjacent to the original building, along the southwest boundary of the school property, while more recent brick buildings are arranged to the north (Figure 4.95). A mature fig and pine tree are growing adjacent to the front fence of the property, and together with the collection of timber buildings marks a point of historical interest in the area (Figure 4.96) (see Section 5.3.1 below).

Figure 4.94 Original 1923 timber school building, Leppington Public School.

Figure 4.95 Row of timber demountables, Leppington Public School.

Figure 4.96 Mature fig at the front of Leppington Public School.

4.7 Edmondson Estate

The area east of Cowpasture Road is associated with the Edmondson family farm, established in 1906 on part the former Drummond and Bostock land grants (Figure 4.97-Figure 4.98). The area is bordered by two major roads: Bringelly Road to the north and Camden Valley Way to the south. The

northern part of the area along Bringelly Road is dominated by a prominent knoll, known as Carnes Hill, which has expansive views to the southeast, east, northeast, and northwest, including distant views of the Sydney CBD and the Blue Mountains (Figure 4.99-Figure 4.100).

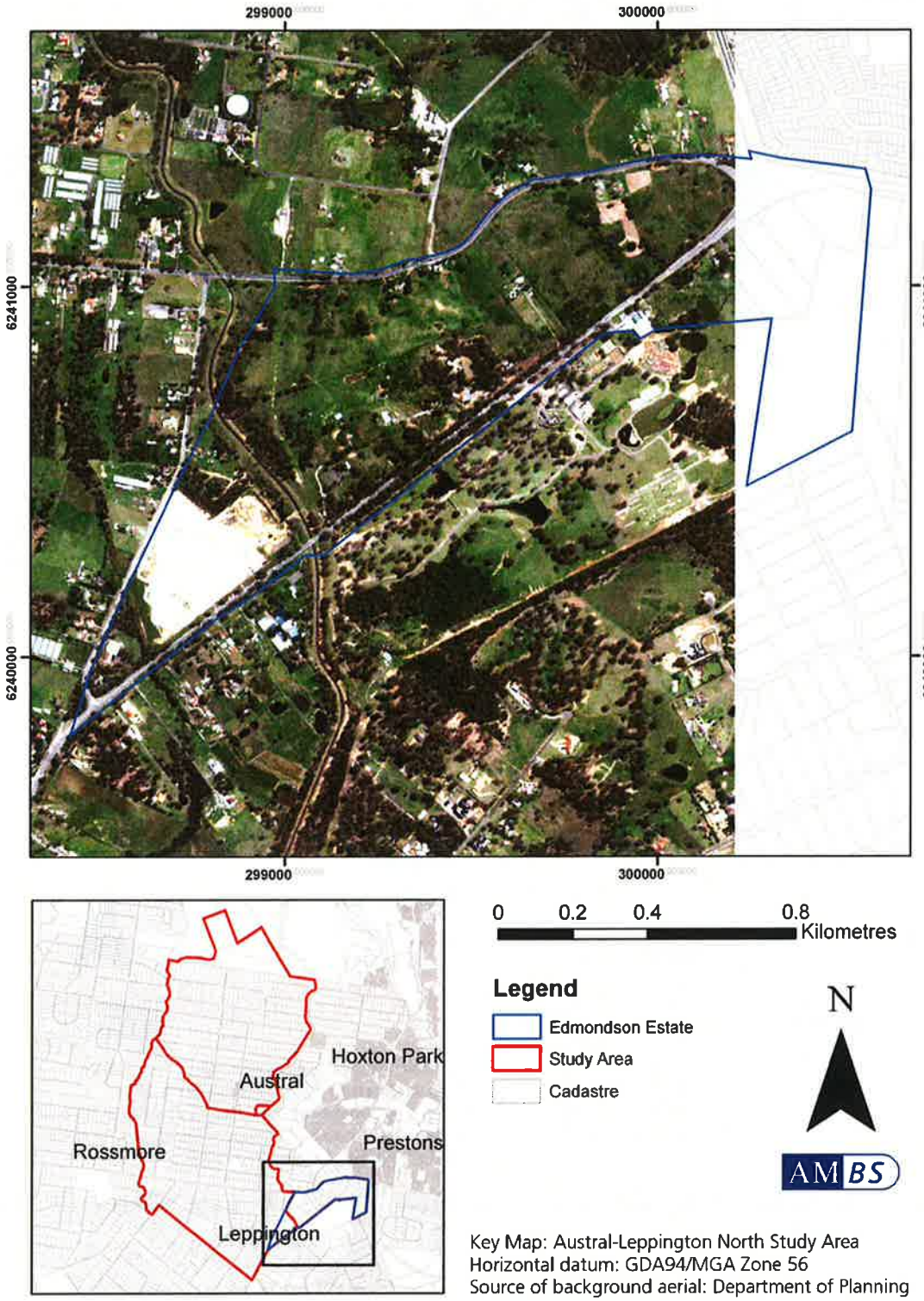
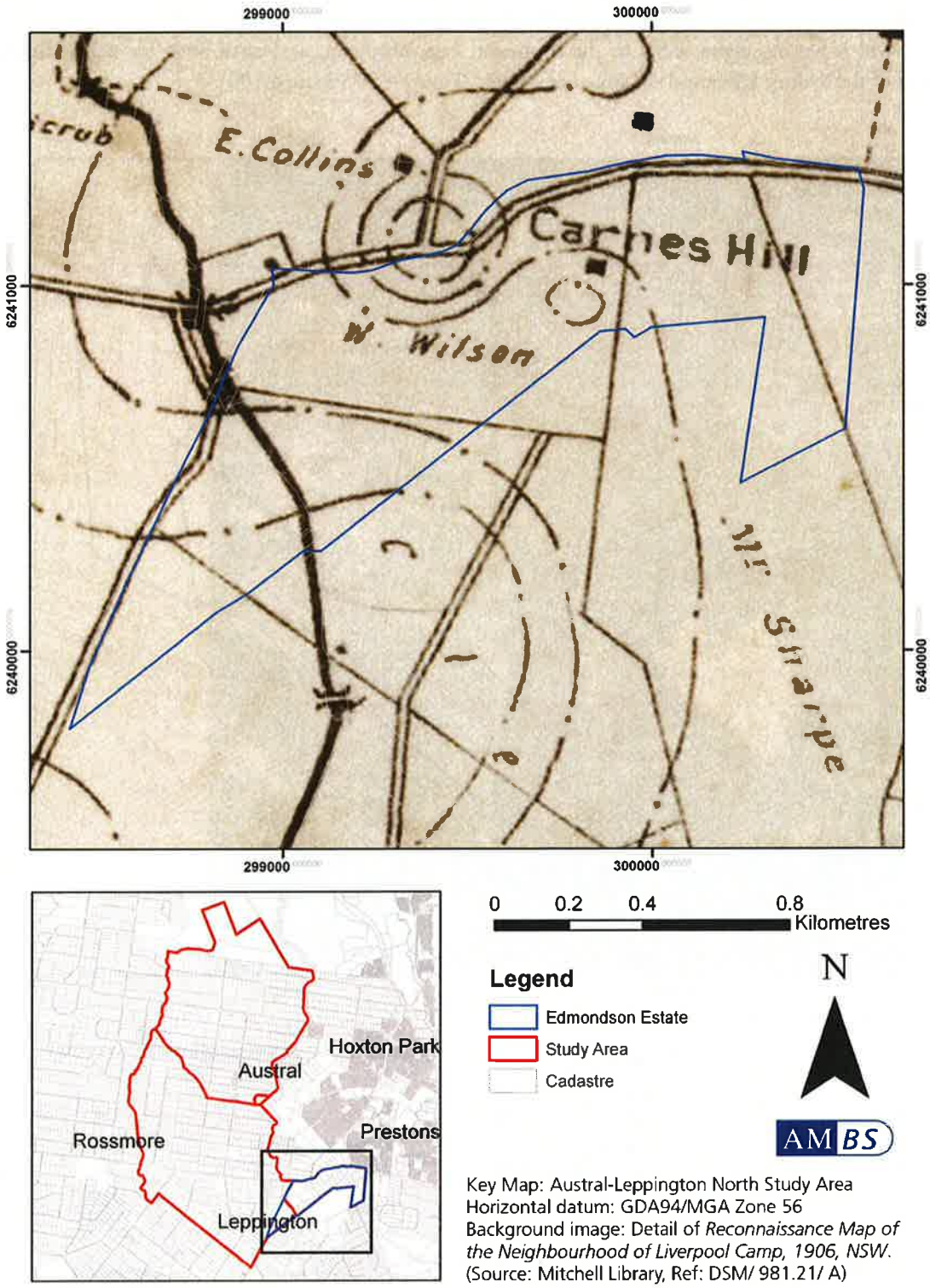


Figure 4.97 Section of study area on former Edmondson Estate, overlain on 2010 aerial photograph.



Key Map: Austral-Leppington North Study Area
Horizontal datum: GDA94/MGA Zone 56
Background image: Detail of *Reconnaissance Map of the Neighbourhood of Liverpool Camp, 1906, NSW.* (Source: Mitchell Library, Ref: DSM/ 981.21/ A)

Figure 4.98 Section of the study area within former Edmondson Estate, overlain on 1906 Reconnaissance Map.

Figure 4.99 Panoramic view from Carnes Hill to the plains to the northeast. Red arrow to Sydney CBD.

Figure 4.100 View from Carnes Hill, Bringelly Road, to the east, including distant view of Sydney CBD.

Figure 4.101 View of farmland south of Bringelly Road.

The subdivision pattern dates to the middle of the twentieth century, when the Edmondson property was broken up into a series of smaller farms. The area has retained its rural character, and much of the land comprises open fields and pasture (Figure 4.101). The exception is an area of approximately 27 acres between Cowpasture Road and the Upper Canal, which was developed as the former Casa Paloma caravan park.

The 1906 Reconnaissance Map of the area indicates that there was one building in the area at this time, to the east of Carnes Hill (see Figure 4.98 above). This building is drawn approximately 600m west of the Edmondson family home, Forest Home, and it is possible that it represents an earlier cottage or hut. However, in view of other inconsistencies in the map, the building may also represent Forest Home. There do not appear to be any buildings extant in this location today.

The area is substantially covered by the 1930s aerial photographs, which shows a small cluster of buildings at the eastern edge of the area, consistent with the location of Forest Home, and a second cluster of small huts or other farm buildings in the centre of the area, between 1701 and 1725 Camden Valley Way. By 1955, there are at least nine houses in the area in addition to Forest Home. A few of these houses are extant, including a derelict Nissen hut at 97A Bringelly Road. The 1955 aerials also show a large area of terracing in the vicinity of 1661 Camden Valley Way. This terracing can also be seen on the 2010 aerial photographs of the area, albeit somewhat overgrown.

Forest Home, on Lot 6 DP205472, has been substantially modified, and now bears little resemblance to the Federation cottage seen in early photographs of the property (see below Section 5.2.4). The house is obscured from view by an overgrown garden, including poinsettia, jacaranda trees, oleander bushes, pepper trees, hibiscus, impatiens and roses (Figure 4.102-Figure 4.103).

Figure 5.53 Canary Island Date Palm at the West Hoxton Depot (Inventory 9.14).

Figure 5.54 A Crepe Myrtle in flower at the West Hoxton Depot (Inventory 9.14).

Figure 5.55 Cactus at the West Hoxton Depot (Inventory 9.14).

More recent structures on the northern part of the Hoxton Park cottage site include the yellow-brick residence/office building, and a brown brick water pumping station (WPS 152; Figure 5.56-Figure 5.57). These buildings add a new layer of history to the site.

Figure 5.56 Brick residence/office building, West Hoxton cottage site; view from the southwest.

Figure 5.57 WPS 152; view from the west.

The site of the cottage for Maintenance Section 8 is located on the west side of the Canal at the corner of Bringelly Road and Old Cowpasture Road. The original weatherboard cottage has been demolished, but the site is marked by a small weatherboard toilet with a corrugated metal gable roof and a circular concrete septic tank (Inventory 8.32; Figure 5.58-Figure 5.59). A row of three mature Bunya Pines, lining Bringelly Road on the east side of the Canal, form a prominent backdrop to the site (Inventory 8.30; see Section 5.2.2 below). A longer row of mature Stone Pines can also be seen running along the east side of the Canal, adjacent to the cottage site; however, a number of these trees are dead or dying (Inventory 8.30; Figure 5.60-Figure 5.61).

Figure 5.58 Weatherboard toilet, Section 8 cottage site, Inventory 8.32.

Figure 5.59 Toilet and septic tank, Section 8 cottage site, Inventory 8.32; and row of Bunya Pines along Bringelly Road, Inventory 8.30.

Figure 5.60 Row of Stone Pines, along the east side of the Canal, Inventory 8.30.

Figure 5.61 View of Section 8 Cottage site across the Canal, framed by two dead Stone Pines.

The Section 8 cottage site retains evidence of an earlier garden. Remnant garden plantings include an Indian Hawthorne (*Raphiolepis indica*), a Willow (*Salix sp.*) on the eastern side of the Canal, and three flowering quinces (*Chaenomeles*, commonly known as Japonica) along the southern fence line (Figure 5.62-Figure 5.63). One of the quinces has grown over and hidden a rectangular concrete tank set in the ground and a rectangular concrete trough (Figure 5.64). A second concrete water trough and a small monument dedicated to Lieutenant William Brown MM have been placed next to the Indian Hawthorne tree (Figure 5.65). An associated plaque indicates that the memorial and water trough were relocated to the grounds of the then Water Board in 1994.

Figure 5.62 Section 8 cottage site, with three flowering quinces along the southern fence line. View from the north.

Figure 5.63 Row of flowering quinces along the fence line.

Figure 5.64 Concrete trough, overgrown by a flowering quince.

Figure 5.65 Brown memorial and concrete water trough, with Indian Hawthorne behind.

Interface between the Upper Canal and the Study Area

The fence line of the Upper Canal forms much of the eastern boundary of the study area. Twentyeighth Avenue is aligned with the Canal's fence line, between Thirteenth and Eighteenth Avenues. Further to the south, the Canal is flanked by individual properties, except for a triangle of land between Eighth and Tenth Avenues, where the Canal is bordered by wooded land. This triangle marks the boundary of John Jamieson's *Cow-de-Knaves* estate, granted in 1810, which was not included in the Hoxton Park subdivision of the 1880s. As such, it provides rare physical evidence of early European land tenure in the study area.

Although the Canal is a distinct, picturesque element of the landscape, it is often obscured from view by tree cover, with long views primarily evident at the Canal crossings between Tenth and Eighteenth Avenues (Figure 5.66-Figure 5.67). SCA has constructed a series of earthen embankments or berms at T-intersections and dead-end streets adjacent to the Canal, to prevent cars inadvertently driving into the Canal and to reduce opportunities for people to dump rubbish into the Canal (Figure 5.68). The berms are an important means of passive maintenance for the Canal, but further reduce sight-lines towards and across the Canal.

Figure 5.66 View towards Upper Canal from the eastern end of Sixteenth Avenue.

Figure 5.67 Picturesque view of Upper Canal from overbridge between Seventeenth and Eighteenth Avenues.

Figure 5.68 An earthen embankment at the eastern end of Fifth Avenue prevents cars driving into the Upper Canal and dumping of stolen vehicles.

Archaeological Sensitivity

Physical evidence associated with the construction of the Upper Canal is known to be present to each side of the Canal and within the SHR curtilage. Archaeological relics associated with the construction would make an important contribution to understanding late nineteenth century construction and maintenance of the Canal. Excavations associated with road and bridge widening have the potential to expose archaeological relics associated with the Upper Canal, which will need to be addressed and managed appropriately. There is some potential that associated works may have an effect on the fabric of the Canal, which would also need to be managed to ensure that the SHR significance of the Upper Canal is not undermined.

Summary Statement of Significance

The Upper Nepean Scheme – Upper Canal is listed on the SHR and SCA's draft Section 170 Register as a place of State heritage significance. The sections of the Canal that pass through Liverpool LGA are also listed on Liverpool LEP. The SHR and SCA inventories are attached in Appendix A. They include the following summary statement of heritage significance:

> *The Upper Canal is significant as a major component of the Upper Nepean Scheme. As an element of this Scheme, the Canal has functioned as part of Sydney's main water supply system for over 120 years. Apart from maintenance and other improvements, the Upper Canal has changed little.*
>
> *As part of this System, the Canal is associated with Edward Moriarty, Head of the Harbours and Rivers Branch of the NSW Public Works Department.*
>
> *The Canal is aesthetically significant, running in a serpentine route through a rural bushland setting as an impressive landscape element with sandstone and concrete-lined edges;*
>
> *The Canal is significant as it demonstrates the techniques of canal building, and evidence of engineering practice. The Canal as a whole is an excellent example of 19th century hydraulic engineering, including the use of gravity to feed water along the canal.*

SCA's assessment against the NSW Heritage Council criteria also includes the following, which are not included in the summary statement but which are relevant to this report:

- *For over half its route the canal follows, and at one point crosses, the Old Cowpasture Road which is one of the earliest European travel routes in Australia.*
- *Surviving long avenues of single and mixed pine species as a late 19th/20th century landscape feature are becoming increasingly rare within the Cumberland Plain. The Upper Canal route has two landmark features – the mixed pine avenue at Kenny Hill and the line of Stone Pines and Bunya Pines near the Old Cowpasture Road at Leppington.*
- *The Upper Nepean Scheme provides detailed and varied evidence of engineering construction techniques prior to the revolution inspired by reinforced concrete construction. Although concrete was used later to improve the durability of the system, much of the earlier technology is still in evidence along the Canal.*

  It also provides extensive evidence of the evolution of engineering practice, such as the replacement of timber flumes by wrought iron flumes to be followed by concrete flumes. The early utilisation of concrete for many engineering purposes in the System, also demonstrates the growing emergence of an engineering technology based upon man-made materials.

The Upper Canal meets the following SHR criteria: a), b), c), e) and f).

5.2.2 Row of Bunya Pines, Bringelly Road

A row of three mature Bunya Pines on the southern side of Bringelly Road, east of the junction between Bringelly and Cowpasture Roads, is associated with the SHR listed Upper Canal (Figure 5.69-Figure 5.70). These pines are included in the heritage curtilage of the Canal, and have been assessed as having exceptional significance, directly contributing to the State heritage significance of the Canal (Edward Higginbotham & Associates 2002:Inventory 8.30). The Bunyas are also listed on the Liverpool LEP as a significant cultural planting of the late nineteenth or early twentieth century and a prominent landmark in the local landscape.

The Bunyas are planted approximately 30-35m apart, and approximately 10m from the verge of the road. They have a distinctive symmetrical form, with a dome-shaped crown. Bunya Pines can grow up to 50m tall, and comparative evidence of other *Araucaria* suggests that they can live for hundreds of years.

Figure 5.69 Row of three Bunya Pines on the southern side of Bringelly Road, east of the Upper Canal; view from the northwest.

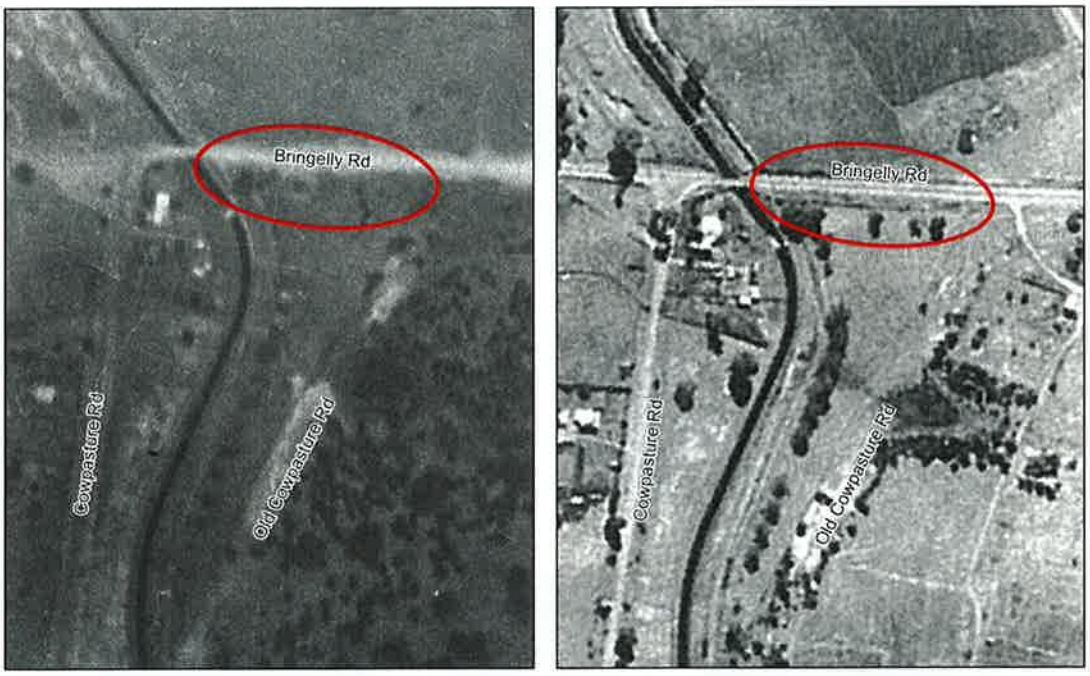
Figure 5.70 Row of three Bunyas; view from the southwest.

Imposing avenues or feature plantings of Bunya and other *Araucaria* are characteristic of nineteenth and early twentieth century landscape design in Australia, particularly in the context of public parks

and large estate gardens (Morris and Britton 2000:26, 28). The exact date of the Bringelly Road planting is not known; however, the trees are evidently associated with the former alignment of Cowpasture Road, on the eastern side of the Canal, at its junction with Bringelly Road. Predating the construction of the Upper Canal, these roads formed important transport and communication routes through the region, and their junction would have been an important spatial landmark in the colonial landscape.

There is no evidence for a Canal crossing associated with the former alignment of the Cowpasture Road, and it is possible that the new alignment on the western side of the Canal, south of Bringelly Road, was established at this time. In this context, the Bunyas may have signalled the change in the alignment of this important road and were likely planted in association with the construction of the Canal in the 1880s. The new (and current) alignment of Cowpasture Road was formalised in 1907 (see Figure 3.7 and Figure 3.8 above; LPMA CT Vol 796 Fol 99).

Aerial photographs of the study area in 1930 and 1955 show three trees in a location consistent with that of the Bunyas today, and as such, provide supporting evidence that the trees were planted before the 1930s (Figure 5.71). Moreover, the photographs show a second major planting along the western bank of the Canal, which is likely associated with a remnant row of Stone Pines today.



Horizontal datum: GDA94/MGA Zone 56
Background images: Detail from Geoscience Australia, Aerial photograph 3429-807, Sydney Survey, 1930 (left) and Land and Property Management Authority, Aerial photograph 228-5147, Run 26, Liverpool NSW, 1955

Figure 5.71 Aerial photographs of the Upper Canal in 1930 (left) and 1955 (right), showing three Bunyas on the south side of Bringelly Road.

Summary Statement of Significance

The summary statement of significance for the Row of Bunyas has been updated, based on the background information collected for this report:

> *A row of three Bunya Pines on the south side of Bringelly Road is a prominent local landmark, associated with the historic junction of the Bringelly and Cowpasture Roads, and the Upper Nepean Scheme – Upper Canal. The trees likely signalled a change in the alignment of Cowpasture Road*

following construction of the Canal in the 1880s. Imposing avenues or feature plantings of Bunya and other Araucaria are characteristic of late nineteenth and early twentieth century landscape design, particularly in the context of public parks and large estate gardens; but examples of these plantings are becoming increasingly rare in the Cumberland Plain.

The Row of Bunya Pines meets the following local heritage criteria: a), c), and f). They also meet the following SHR criteria, as an element of the SHR listed Upper Nepean Scheme – Upper Canal: a) and c).

5.2.3 Brown Memorial and Water Trough

The Brown Memorial commemorates William (Bill) Brown, Second Lieutenant in the 51st Battalion of the Australian Army, who died in action in France during WWI. The memorial was erected soon after the war, in approximately 1920, by the people of the district (Clarke and Haak 1993:5; Eileen Sargent, pers. comm., 18 February 2011).

Brown was the son of William and Ellen Brown of 'Dartmoor,' Austral. William Brown Senior was the local butcher and an Alderman on Nepean Shire Council. Born in 1894, Second Lieutenant Brown attended Austral Public School and was apprenticed as a butcher before joining the army to fight in the war. He was 22 years old when he was killed on 3 September 1916, at Mouquet Farm at the Battle of the Somme, France (Clarke and Haak 1993:5; Australian War Memorial, nd).

The memorial and water trough were originally sited on the opposite side of Cowpasture Road, at its junction with Bringelly Road. The site was an important junction in the regional road network, linking roads between the railway station at Liverpool, and Campbelltown in the south and Bringelly in the west. It was also adjacent to the maintenance worker's cottage for Section 8 of the Upper Canal, and was used as a stock-watering place. A water trough is thought to have been established here in the 1880s (Eileen Sargent, pers. comm., 18 February 2011). The trough can be seen on a subdivision plan of the Raby Estate from the 1910s (Figure 5.72).

The memorial was originally surrounded by a small picket fence, and a tree was planted nearby (Eileen Sargent, pers. comm., 18 February 2011). A white-painted post-and-rail fence made of wrought iron pipes is extant on the original site, demarcating a small rectangular area appropriate to the scale of the memorial (Figure 5.73-Figure 5.75).

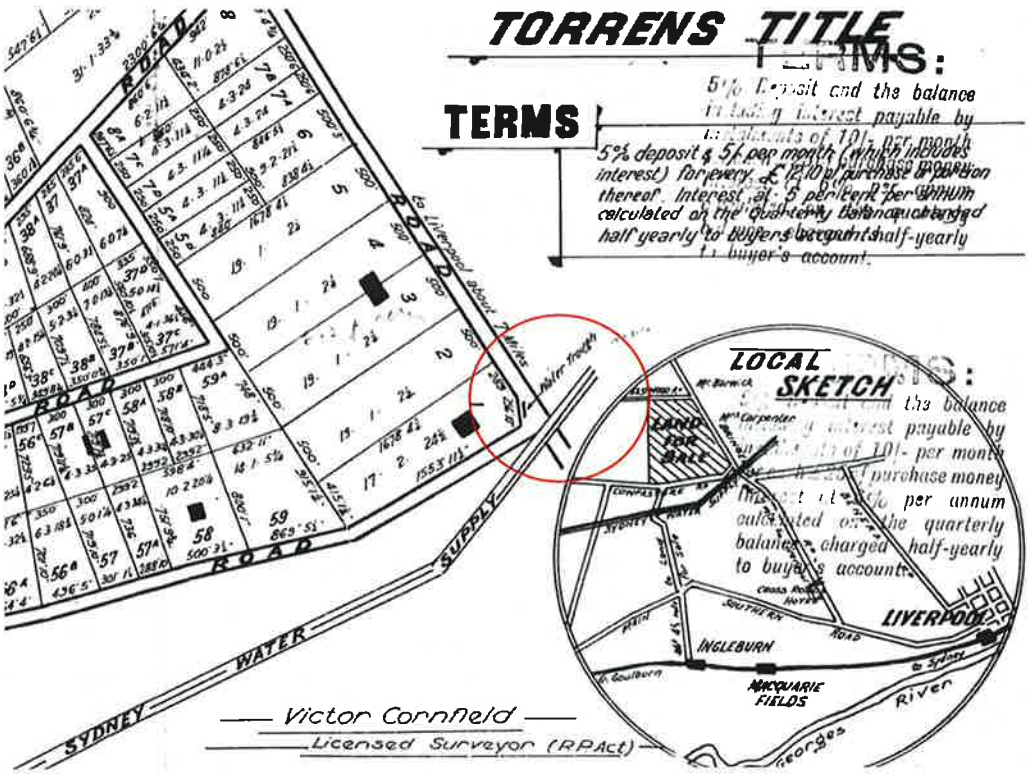


Figure 5.72 Detail of subdivision plan of the Raby Estate, c.1910s, showing the location of a water trough at the junction of Cowpasture and Bringelly Roads (Source: Mitchell Library, Ref: SP L10/74).

Figure 5.73 Post-and-rail fence; view from the north.

Figure 5.74 Post-and-rail fence; view from the west, with the current location of the Brown Memorial behind on the far side of Cowpasture Road.

Figure 5.75 A small, white-painted, metal post-and-rail fence on the west side of Cowpasture Road, at the junction with Bringelly Road, may represent the original location of the Brown Memorial.

With increasing use of motor vehicles in the second half of the twentieth century, the memorial came to be viewed as a traffic hazard, and was damaged by cars cutting across the corner between Bringelly and Cowpasture Roads. In 1994, the memorial was removed from the site to the Liverpool City Council office; this removal was undertaken without the knowledge of the Brown family, and became something of a local scandal (Eileen Sargent, pers. comm., 18 February 2011). The memorial and water trough were subsequently reinstalled on the current site, a wedge-shaped portion of land between the Sydney Water Upper Canal, Cowpasture and Bringelly Roads, and the site of the former maintenance worker's cottage for the Upper Canal. This land is included in the historic heritage curtilage of the SHR Upper Nepean Scheme – Upper Canal. A plaque associated with site indicates that the relocation was undertaken with the 'encouragement and co-operation' of the Hon R J Webster MLC, Minister for Housing and Minister for Planning.

The memorial and water trough stand on a concrete slab, at the base of an Indian Hawthorne (Figure 5.76-Figure 5.78). The water trough is a rectangular concrete basin, with four feet and a semi-circular sheet metal cover at one end. The cover may be adapted from a metal drum.

Figure 5.76 Brown Memorial, water trough, and an associated plaque.

Figure 5.77 Water trough; end view.

Figure 5.78 Water trough; side view.

The Brown Memorial consists of an inscribed, black granite plaque set on a sandstone desk-style monument on a small sandstone plinth. The inscription reads:

In Memory Of
W. BROWN.
KILLED IN ACTION
3RD SEPTEMBER 1916

The plaque has been broken into four pieces, one of which is missing (Figure 5.79). The remaining pieces appear to have been repaired. The sandstone base is in poor condition, and would benefit from remedial care (Figure 5.80).

Figure 5.79 The Brown Memorial plaque has been broken into four pieces, one of which is missing.

Figure 5.80 The sandstone base of the memorial is suffering significant deterioration, including contour scaling.

A sign associated with the memorial has been placed at the perimeter of the property, adjacent to Cowpasture Road (Figure 5.81-Figure 5.82). The sign provides information about the memorial, including a faded photograph of Second Lieutenant Brown, and documents related to his commemoration at the Villers-Bretonneux Memorial in France, and the Australian War Memorial in Canberra.

Figure 5.81 Information sign associated with the Brown Memorial, adjacent to Cowpasture Road.

Figure 5.82 Detail of the information sign associated with the Brown Memorial.

Summary Statement of Significance

The following summary statement of significance for the Brown Memorial and Water Trough has been prepared by AMBS, based on the background information collected for this report:

> *The Brown Memorial embodies the collective grief felt by the people of Austral and Leppington at the death of a local serviceman in France during World War I. The Brown Memorial is associated with Second Lieutenant William (Bill) Brown, son of William and Ellen Brown, early settlers in the Hoxton Park subdivision at the end of the nineteenth century. The memorial stands in lieu of a grave for Second Lieutenant Brown. Erected in approximately 1920 by the people of the district, the memorial provides evidence of an era of widespread Australian patriotism and nationalism, particularly during and following the First World War.*
>
> *The memorial and water trough were originally sited on the opposite side of Cowpasture Road, at its junction with Bringelly Road. The water trough is illustrative of the history and importance of this*

junction in the regional road network, which was used as a stock-watering place in the late nineteenth and early twentieth centuries. The memorial and trough were relocated to the current site in 1994.

The Brown Memorial and Water Trough meets the following criteria for local heritage significance: a), b), d) and g). .

5.2.4 Dwelling and Rural Lot, 1720 Camden Valley Way, Leppington

The dwelling and rural lot is associated with the WWII hero, Corporal John Hurst Edmondson. The family home, Forest Home, was likely built by John Hurst Edmondson's grandfather, Joseph Edmondson Snr, following his purchase of the land in 1906 (LPMA CT Vol 1833 Fol 74).

Joseph William Edmondson, a farmer, his wife Maude Elizabeth Hurst, and their only child John Hurst Edmondson, moved from Wagga Wagga to the family home in Leppington in 1916 (Grant 2006). John Hurst Edmondson was born on 8 October 1914 in Wagga Wagga, but grew up on the property in Leppington (Beckingsale 1941:3; HLA 2003:8).

A photograph of the house from 1941 shows a timber-framed weatherboard cottage with a corrugated iron hip roof and a front facing gable. It was built in the Federation style, consistent with the first decades of the twentieth century. It was set in a formal front garden, with scarlet poinsettias planted around the bull nose verandah (Beckingsale 1941:3; Figure 5.83).

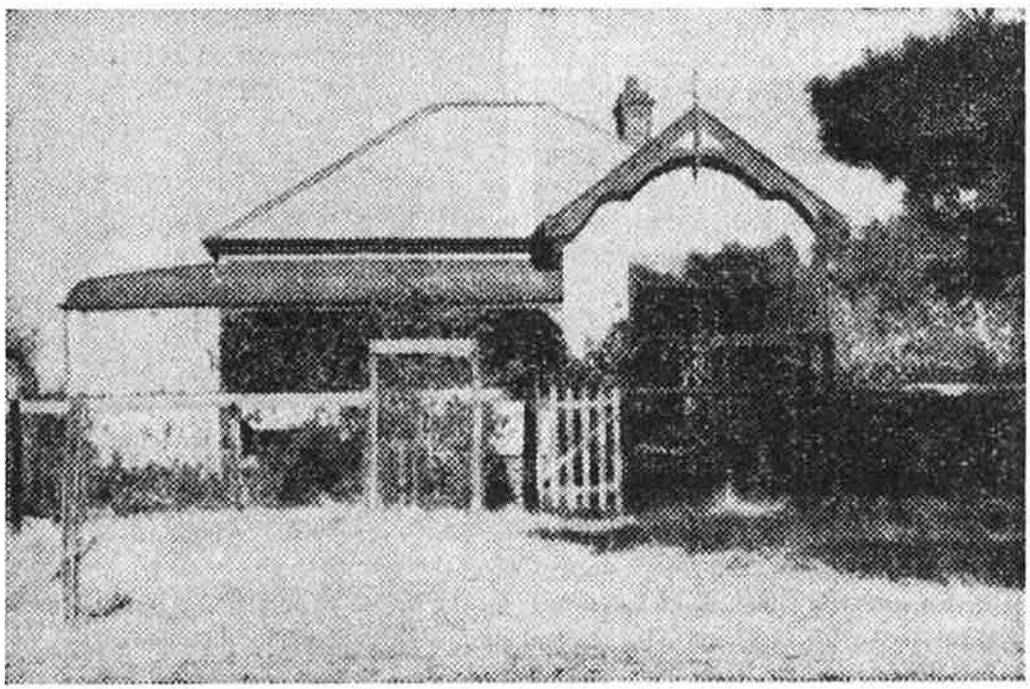


Figure 5.83 Forest Home and garden (Beckingsale 1941:3).

John Edmondson attended Austral Public School and Hurlstone Agricultural High School, after which he worked with his father on the family farm and became an expert cattle judge, and council-member of the Liverpool Agricultural Society (Grant 2006; Beckingsale 1941:3). Edmondson trained at Ingleburn Army Camp and served as a reserve in the 4th Battalion (The Australian Rifles) Citizen Military Forces, enlisting in the Australian Imperial Forces on 20 May 1940. He was promoted to Corporal in the 2/17th Battalion (Infantry), and was sent to the Middle East in 1940 (HLA 2003:8). Edmondson was killed in action at the Battle of Tobruk on 14 April 1941, aged 26, after saving the

life of a superior officer during a German machine-gun attack. He was posthumously awarded the first Australian Victoria Cross of WWII (Grant 2006).

Edmondson's father died in 1958 and his mother in 1961. In 1960, a mortgage was taken out on the property by Jean Maude Cummings (LPMA Vol 7802 Fol 141). The Cummings' renovated the house, removing the original roof and verandah and replacing them with a flat, corrugated iron roof. Other additions to the grounds included the construction of new silos and stables to the rear of the house. Forest Home was sold to the Bray family in the 1960s, who added fibro cladding, painted the exterior pale green, and introduced a circular stock yard (LHI: 1970123).

The property was compulsorily acquired by the Department of Planning in the early 1970s and is now managed by the LPMA. In 2004, the dwelling and rural lot at 1720 Camden Valley Way was identified as having heritage value to the local community during public consultation for the Liverpool Heritage Study Review (LHI: 1970123).

Today the dwelling is a single storey house with low pitched roof clad in profile steel. The external walls are clad in weatherboards along the west wall and former gable end. The remainder of the house is clad in fibro and weatherboard sheets, and the partially enclosed verandah, to the east of the entry, features a textured brick wall (Figure 5.84-Figure 5.86). The front entry is recessed between the brick feature section and the former gable end, but is no longer accessible (Figure 5.85). Although the interior has been extensively modified, some indications of the original house form can be discerned; however, it no longer retains the original fixtures or fittings and the original hearth is now an open fireplace.

Figure 5.84 Front of dwelling, 1720 Camden Valley Way.

Figure 5.85 Front of house with brick extension and fibro cladding.

Figure 5.86 Rear of dwelling.

The original garden has run wild and is now very overgrown. The front garden retains the remnants of the formal garden beds, with sandstone block edging now obscured by overgrown grasses and foliage (Figure 5.87). A mature poinsettia survives on the eastern side of the house and other plantings include mature jacaranda trees, oleander bushes, pepper trees, hibiscus, impatiens and roses (Figure 5.88).

The property now appears to operate as a farrier, as indicated by the sign on the gate, with a second sign identifying the property as Pinewood (Figure 5.91). This name is referenced in the initial 'P' worked into a 1950s-style metal gate to the rear of the house (Figure 5.92). The stables, circular stock yard and silos are extant, although the stables are in poor condition (Figure 5.89-Figure 5.93). The rural lot continues to be used as a horse paddock (Figure 5.94).

Figure 5.87 Sandstone blocks edging a circular garden bed.

Figure 5.88 Poinsettia to the east of the dwelling.

Figure 5.89 Stables.

Figure 5.90 Round stock yard.

Figure 5.91 'Pinewood' sign on main gate.

Figure 5.92 Metal gate leading to the stables and stock yard.

Figure 5.93 Silos.

Figure 5.94 Rural lot with horses.

The extent of alterations and the poor condition are such that the heritage significance of the property, as the former home of a WWII hero, has been substantially compromised. The house today bears no resemblance to the original Federation cottage and as such cannot be considered to have aesthetic or architectural significance. However, the property does have an historic association with John Hurst Edmondson VC which should not be lost.

Although the former dwelling has lost its architectural and historic integrity, the property has undergone little substantial change and as such is likely to have archaeological integrity associated with its occupation by the Edmondson family and as an example of a rural property within the wider Austral and Leppington area. There is potential for intact archaeological relics and deposits with good

integrity to be present in the site, and as such the listing of the *Dwelling and rural lot, 1720 Camden Valley Way, Leppington*, should reflect the heritage value of the site as the home of the WWII hero and as an archaeological site.

Summary Statement of Significance

The following summary statement of significance for Forest Home (Dwelling and rural lot), 1720-1726 Camden Valley Way, Leppington has been prepared by AMBS, based on the background information collected for this report:

> *Forest Home is associated with the WWII hero, Corporal John Hurst Edmondson, who was posthumously awarded the first Australian Victoria Cross of the war. The property has importance to the local community arising from its association with Edmondson, remembered as a local digger and war hero. The property is likely to contain intact archaeological relics associated with the Edmondson family and as an example of a rural property within the wider Austral and Leppington area. The property has the potential to yield information that will contribute to an understanding of the daily life of the Edmondson family and as a representative example of rural settlement and land use in south west Sydney during the first half of the twentieth century.*

Forest Home meets the following criteria for local heritage significance: b), d) and e). .

5.3 Potential Historic Heritage Items

5.3.1 Leppington (Raby) Public School, Rickard Road, Leppington

In the early 1920s, parents of children on the Raby Estate subdivision sent a series of letters to the Department of Education requesting the establishment of a new public school (LPS 1982:16). The application was eventually approved, and two roods of land fronting onto Rickard Road were resumed on 10 March 1922 for public education purposes (LPMA CT Vol 4484 Fol 166). The adjoining lot to the south was gifted to the crown a few months later by the NSW Realty Co. Ltd, who had bought up much of the surrounding land in the subdivision between 1916 and 1920 (LPMA CT Vol 3135 Fol 165, Vol 3339 Fol 147; DET 1968:1). This brought the total area of land to just under two acres.

Construction of the original school building was completed by the end of 1922 (Figure 5.95). The public school, originally known as Raby Public School, opened the following year as a one-teacher school with an initial enrolment of 28 pupils. The building was a single weatherboard classroom with a verandah around three sides, and an open fireplace with brick chimney. Two water tanks stood at the rear of the building, supplying water from drinking and watering the garden. In 1942, the east side of the classroom was extended by eight feet to accommodate the growing number of children enrolled, partially enclosing the verandah (LPS 1982:16-18).

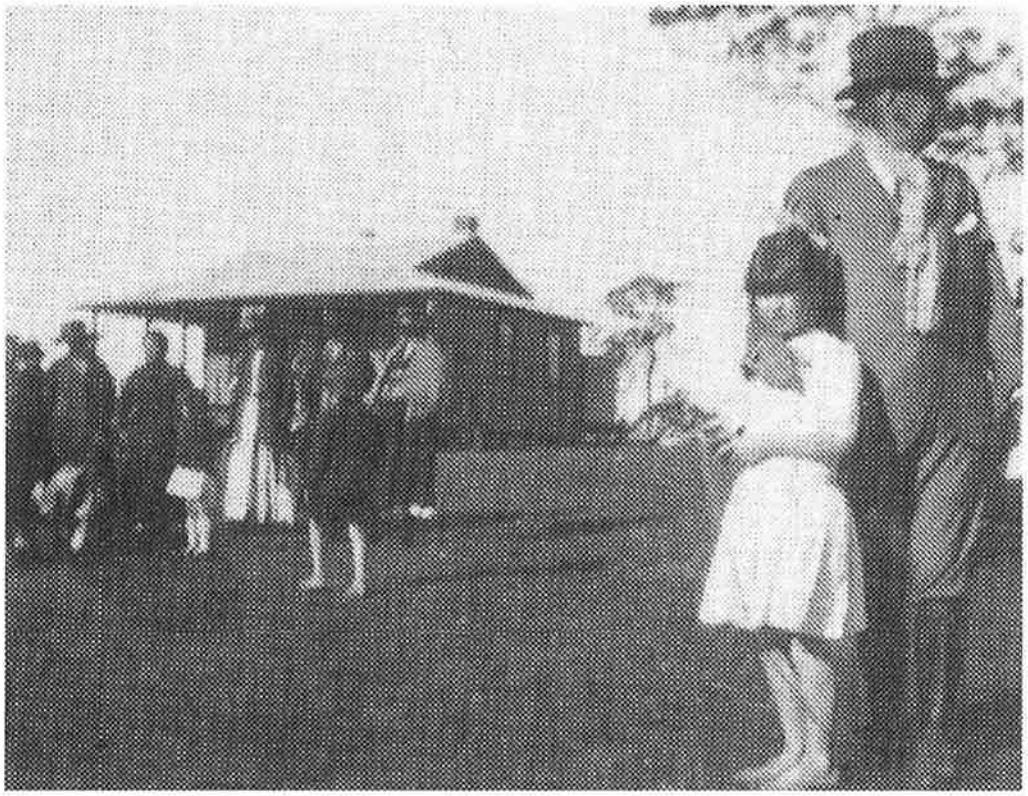
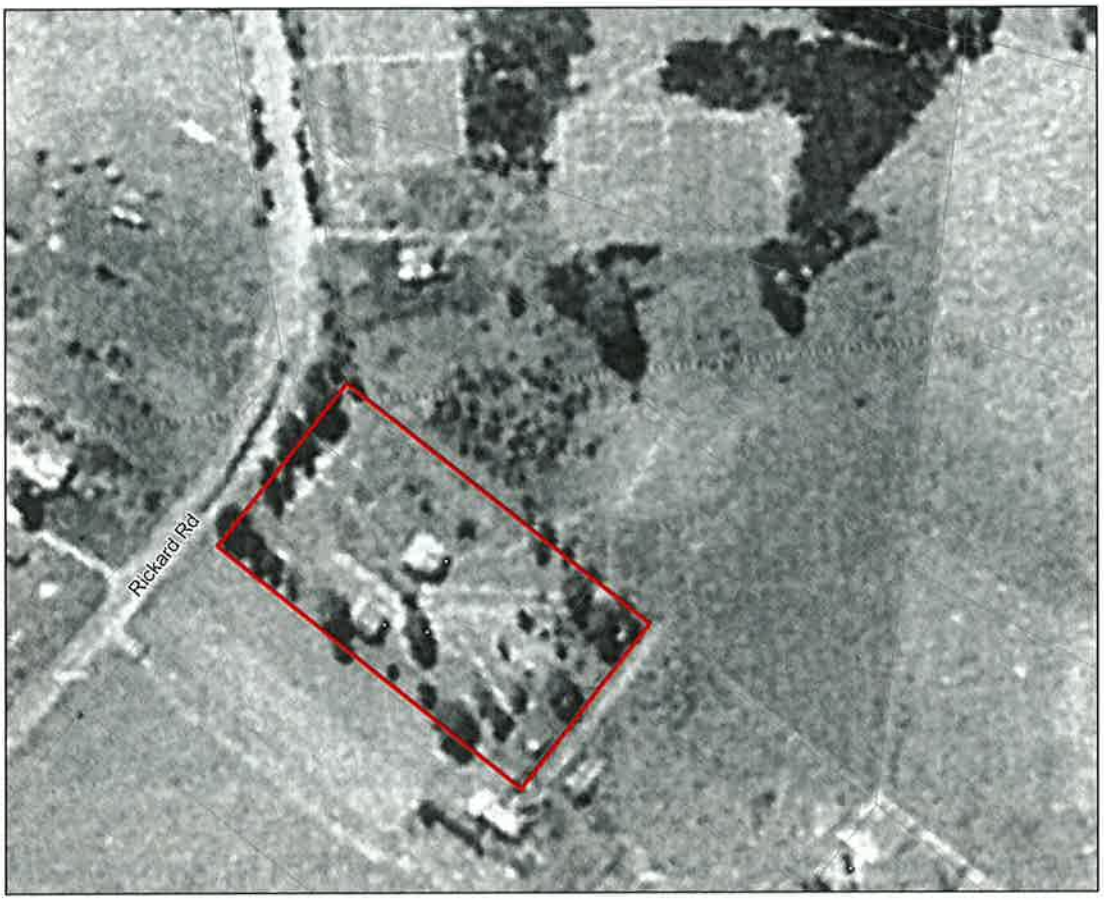


Figure 5.95 Original Raby Public School building, 1923; view from the west (Sourece: LPS 1982:16).

The district population increased steadily after WWII with the arrival of migrants from various countries including Italy, Yugoslavia, Czechoslovakia and England. There was a corresponding rise in enrolments at the school, and additional classrooms were gradually built between 1951 and 1961 to accommodate the growing number of students (Figure 5.96) (DET 1968:2; LPS 1982:19). Five weatherboard buildings were erected in a row along the south-western school boundary in the vicinity of the original school building, with an adjacent weathershed and ablution shed added during the same period (Figure 5.97-Figure 5.98). The name of the school was officially changed to Leppington Public School in 1955, after the local postal district (LPS 1982: 19).



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Horizontal datum: GDA94/MGA Zone 56
Background images: Detail from Land and Property Management Authority, Aerial photograph 228-5147, Run 26, Liverpool NSW, 1955

Figure 5.96 Aerial photograph of Leppington Public School, 1955, showing two buildings in the southwest part of the school grounds: Buildings H and K. The approximate area of the school prior to 1955 is outlined in red.

Figure 5.97 From left: group of weatherboard school buildings, ablution shed (Building Q), and original Raby Public School building (Building H); view from the southeast.

Figure 5.98 Group of weatherboard buildings (Buildings I to M); view from Rickard Road.

The school reached its current extent in 1955-56, when approximately five acres of additional land was resumed to the north (Figure 5.99). Between 1966 and 1968, four new brick classrooms, an administration building, toilet block, and canteen were constructed in this area (DET 1968:2-3). A

row of pines was also planted along the back fence around this time; however, most had died by the end of the 1980s. A new brick library building was added in 1981 (LPS nd). (Figure 5.100-Figure 5.101).

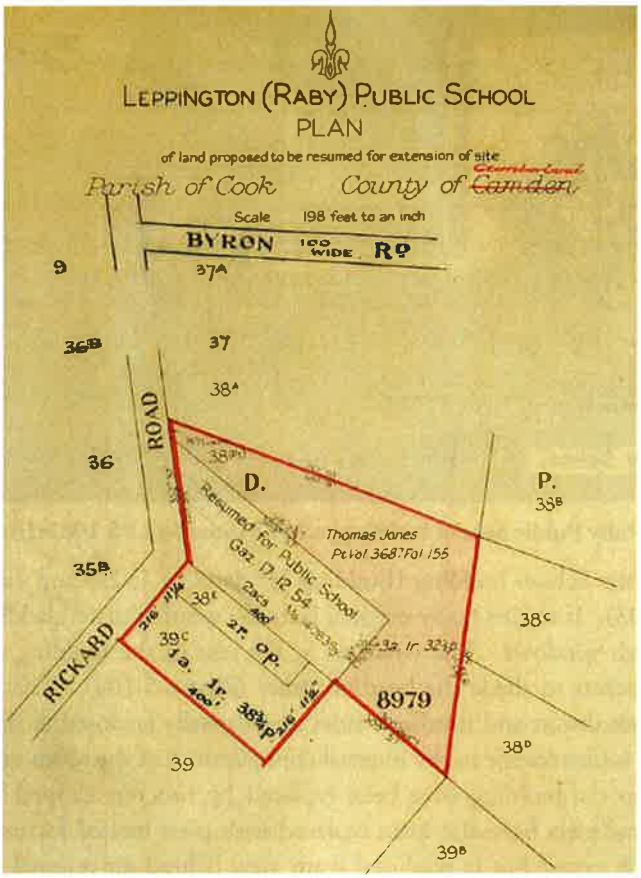


Figure 5.99 Plan of Leppington (Raby) Public School, 1956 (Source: DET Sites Register).

Figure 5.100 Northern group of school buildings; view from Rickard Road.

Figure 5.101 J Peck Oval, with row of pines along the back fence.

A Parents & Citizens Association (P&C) was formed in 1940, which soon raised money for a piano, a radio, and other school needs. In the 1950s, the P&C purchased a large number of rose bushes and shrubs which were planted in the school grounds. A photograph published in 1972 shows the old Raby Public School building with a grass lawn, two immature trees, a bird bath and a bed of agapanthus (LPS 1982:18-19) (Figure 5.102).

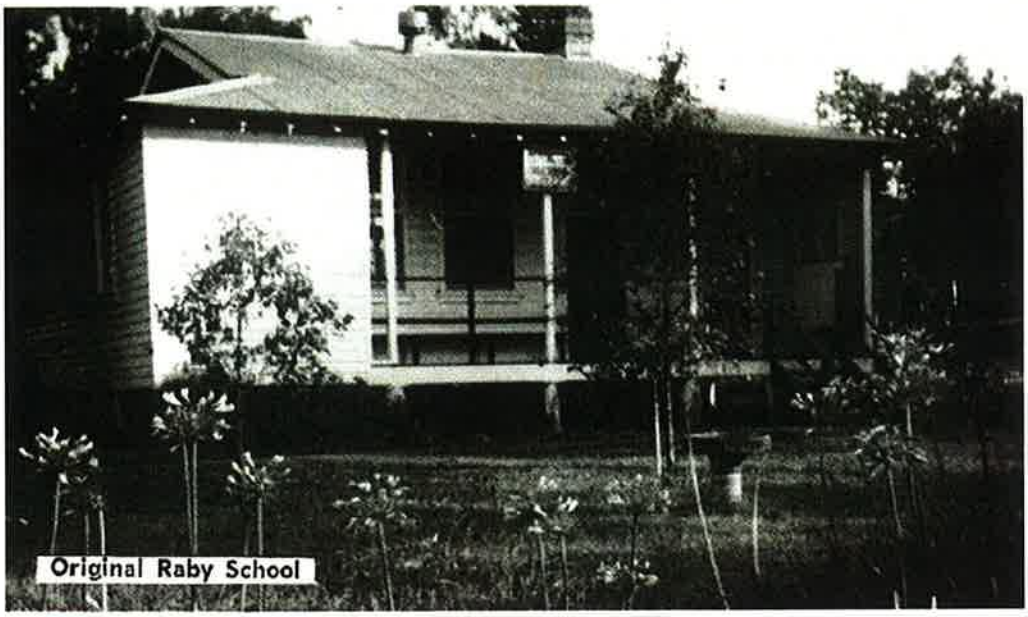


Figure 5.102 Original Raby Public School building, c.1972 (Source: LPS 1982:18).

The original Raby Public School building (Building H) dates to 1922, and currently functions as a staff room (Figure 5.103). It retains many original features: weatherboard cladding, Dutch gable roof, brick chimney, and sash windows. The windows at the rear of the building are fitted with timber awnings on timber brackets to shade the bottom sashes (Figure 5.104). The original verandah has been enclosed on the southwest and northeast sides and partially enclosed at the front. The original extent of the verandah is identifiable in the internal configuration of the room and ceiling panels. The original timber steps to the building have been replaced by concrete capped brick steps and metal safety rails. The original piers have also been replaced with piers treated for termites (Figure 5.105). The original fireplace is extant but is obscured from view behind an internal partition wall (Figure 5.106).

Figure 5.103 Original Raby Public School building, 2011; view from the west

Figure 5.104 Rear of original Raby Public School building; view from the southeast.

Figure 5.105 Brick stairs with concrete capping, metal safety rails and timber piers.

Figure 5.106 Interior partition and rear of brick chimney.

Five weatherboard classrooms aligned along the southwestern school boundary (Buildings I to M) were erected between 1951 and 1961 (Figure 5.107).

- Building I is a portable timber classroom, with sash windows that retain original glass panes (Figure 5.108). This style of building was first built in NSW in 1912, and was designed to be easily disassembled and transported. It is currently used as a community room.
- Building J is a fixed timber Van der Steen building erected in 1959 (Robert Demkiw, pers. comm., 14 December 2010). It contains adjoining rooms divided by a folding partition, with two separate entrances at the front of the building (Figure 5.109). It is currently used as the school hall.
- Building K is a fixed timber classroom of a type provided to rural areas, erected prior to 1955 (Figure 5.110). This style of classroom dates from c.1915 onwards. It is currently used as the community languages room.
- Building L is a fixed timber classroom that is currently used by the school counsellor (Figure 5.111).
- Building M is a fixed timber building erected in 1961, in a style similar to Building L. It consists of a single and double classroom joined together, and has a distinct breakfront with projecting verandah (Robert Demkiw, pers. comm., 14 December 2010) (Figure 5.112). Buildings L and M have been retrofitted with concrete access ramps.

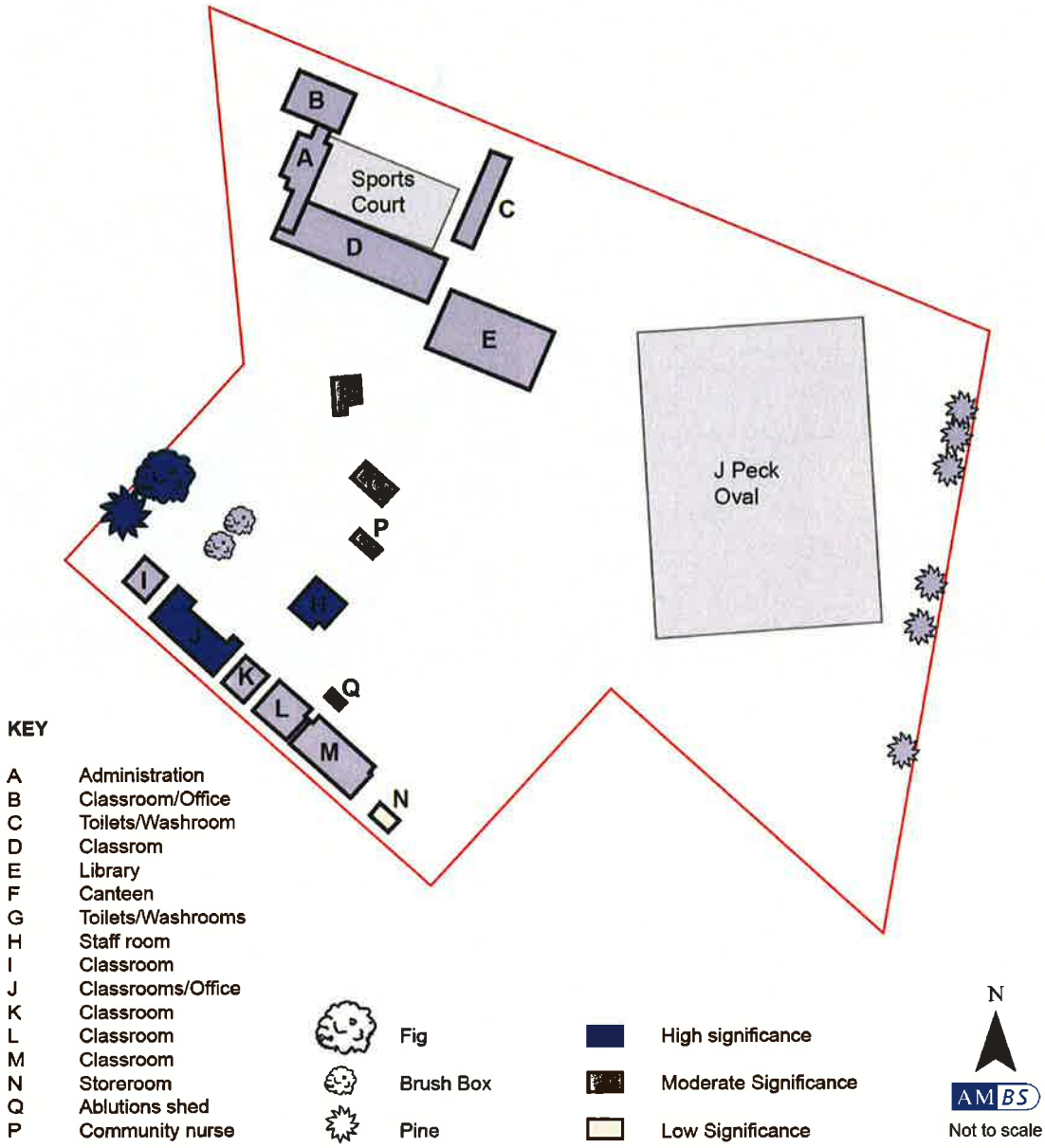


Figure 5.107 Schematic plan of Leppington Public School

Figure 5.108 Building I.

Figure 5.109 Building J.

Figure 5.110 Building K.

Figure 5.111 Building L.

Figure 5.112 Building M.

Buildings I to M form a coherent group by virtue of their predominantly timber fabric and the colour scheme of pale blue walls, dark blue detailing of window- and door-frames, and red verandah posts and rails. The colour scheme is shared with the original Raby Public School building (Building H). The classrooms retain much of their original fabric, are in good physical condition and modifications reflect ongoing maintenance and functionality. They are currently being upgraded under the Commonwealth Government's Building the Education Revolution (BER) program.

A fibro and weatherboard weather shed (Building N) and brick ablution shed (Building Q) are also within this area (Figure 5.113-Figure 5.114). The weather shed has been infested by white ants and is in poor condition. The brick ablution shed is of a standard type introduced to public schools from c.1955 to meet new standards of hygiene. Ablution sheds are now becoming increasingly rare in NSW as schools are gradually upgraded (Robert Demkiw, pers. comm. 28 March 2011).

Figure 5.113 Weather shed (Building N).

Figure 5.114 Ablution shed (Building Q).

The northern group of school buildings (Buildings A to E) were erected between 1966 and 1981. They form a complex of brick buildings, which has been physically integrated by the construction of a central sports court and COLA (Covered Outdoor Learning Area).

- Building D is a brick Van der Steen building of the same design as Building J (Figure 5.115). It was constructed in 1966, parallel to the northern school boundary. The southern external wall is decorated with a series of murals painted by students from Leppington Public School to celebrate Australia's bicentenary in 1988 (LPS nd). The murals depict scenes from Leppington's history (Figure 5.116).
- Building A, facing Rickard Road, contains the Administration block and Principal's office (Figure 5.117). It was constructed in 1967, and joins the eastern end of Building D.
- Building B is a classroom/office connected to Building A by a covered walkway (Figure 5.117). It was constructed in 1968.
- Building C contains the toilet block, washrooms, kiln and store. It was constructed in 1966 (Figure 5.118).
- Building E is the library. Constructed in 1981, it is set back from the other buildings in this complex, but maintains a similar alignment with the northern school boundary (Figure 5.119).

Buildings D and J were both designed by J Van der Steen, Design Architect with the Government Architect's Branch, 1955-1964 (Bob Demkiew, pers. comm. 14 December 2010; Jack 1980:227). Van der Steen designed several mid-twentieth century schools, including the Beverly Hills Girls' High School (documented in 1957) and Manly Girls' High School (documented in 1958) (Jack 1980:86). Building J is a rare example of a timber-framed weatherboard Van der Steen building (Robert Demkiw, pers. comm. 14 December 2010). It marks a deviation from Van der Steen's standard use of

brick and may reflect the shortage of available materials during the post-war period, and an enthusiasm for prefabrication (Jack 1980:87). It is possible that the weatherboard classrooms along the southwest boundary may all be prefabricated at the NSW Public Works Department.

Figure 5.115 Building D, Classrooms, north side.

Figure 5.116 Building D, south side.

Figure 5.117 Building A, Administration.

Figure 5.118 Building C and sports court.

Figure 5.119 Building E, Library.

Buildings F, G and P are located in the centre of the school grounds, to the east of the school car park..

- Building F is the brick school canteen and was constructed in 1968.
- Building G is a brick building containing toilets/washrooms, and was constructed in 1968.
- Building P is used by the community nurse and dates to 1991 (Figure 5.120).

Figure 5.120 Building P (left) and Building G; view from the north.

Bi-lingual signs in English and Italian, representative of the strong Italian heritage of the area, are present throughout the school.

A number of mature trees, including a fig and a pine near the front fence, stand on Rickard Road. The location of these trees is consistent with the 1955 aerial photo of the site, and it is likely that they are early plantings marking the original school site. A garden bed adjacent to Building D contains a number of rose bushes (Figure 5.121). Two brush box trees in front of Building H, and a row of pines along the eastern boundary, behind J Peck Oval, post-date 1955, and were likely planted in the 1960s. A collection of former farming equipment, including three ploughs and a chaff cutter, painted red and bolted to a brick and concrete base located between Building D and Building F, provide a reference to the farming heritage of the area (Figure 5.122).

Figure 5.121 Rose bushes next to Building D.

Figure 5.122 Farming equipment.

Summary Statement of Significance

The original Raby Public School building and the associated weatherboard classrooms form a coherent aesthetic group reflecting the early development of Leppington Public School and the surrounding district in the early- to mid-twentieth century. The expansion of the semi-rural school in the 1950s and 1960s, and the shift from weatherboard to brick classroom buildings, is demonstrative of a local population increase and demand for education during the post-war era in the Austral and Leppington areas. A link between the early and later periods, and between the southern and northern parts of the school, is provided in the weatherboard and brick Van der Steen designed classroom buildings. A mature fig and pine along the Rickard Road boundary likely mark the original school site and are visual landmarks in the local area. The school continues to play an important role in the local community and to provide a link with the migrant and agricultural history of the area.

The Leppington Public School, Rickard Road, Leppington, meets the following criteria for local heritage significance: a), b), c), d), f)and g). .

	Grading of Significance				
School Element	**Exceptional**	**High**	**Moderate**	**Little**	**Intrusive**
Old Raby Public School building (Building H)		✓			
Weatherboard Van der Steen building (Building J)		✓			
Group of weatherboard buildings (Buildings I-M)			✓		
Weather shed (Building N)				✓	
Ablution shed (Building Q)		✓			
Brick Van der Steen building (Building D)			✓		
Group of brick buildings (Buildings A-E)			✓		
Buildings F, G and P			✓		
Farming implements			✓		
Mature plantings along Rickard Road (fig and pine)		✓			
Other cultural plantings (rose bushes, brush box trees in front of Building H,row of pines behind J Peck Oval)			✓		

5.3.2 Austral Town Centre Conservation Area

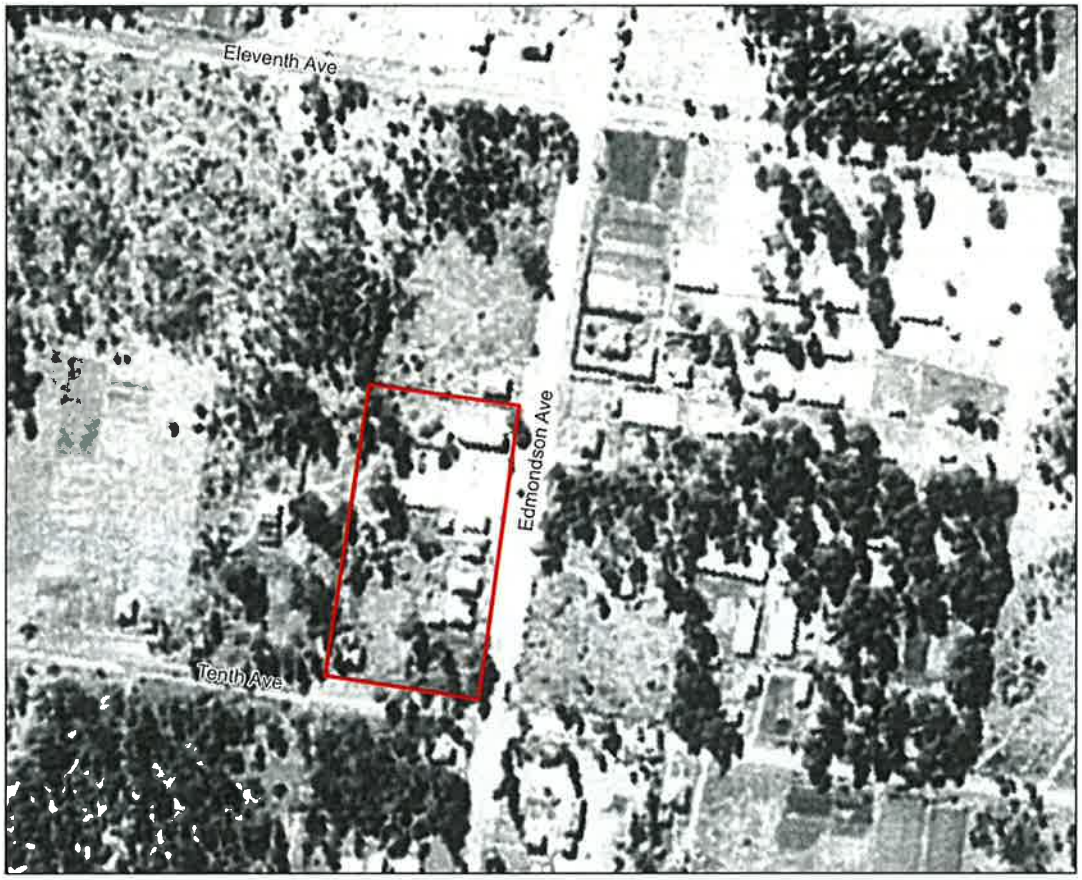
The proposed Austral Town Centre Conservation Area is focused on a small mixed residential, shopping and community precinct on the west side of Edmondson Avenue, between Tenth and Eleventh Avenues. The name 'Austral' comes from the nearby Austral Public School, which was established on land originally owned by Phillips & Company, also known as the Austral Banking and Land Proprietary. The precinct incorporates a representative sample of vernacular architecture, characteristic of the local region, constructed between 1938-39 and 1965. The building styles are complementary in their character and scale, and illustrate a range of functions important to the town as it developed in the mid-twentieth century, including the general store, Progress Hall, and post office.

The commercial development of Austral Town Centre began in 1938, when lot 837 of the Hoxton Park Estate was sold to Emma Rosetta Salome Starr, wife of Herbert George Starr, Austral postmaster (LPMA CT Vol 4698, Fol 149). The Starrs constructed a general store, telegraph office and house on the land, along Third Avenue (now Edmondson Avenue). Prior to this, the Starrs were running a post office on Tenth Avenue. The Starrs subdivided the lot, and in November 1939, H G Starr donated the north part (Part Lot A) to the Austral Progress Association to build a hall (LPMA CT Vol 5096 Fol 227; Ian Wilmington, pers. comm., 25 January 2011).

In 1947, the Starrs re-subdivided the remainder of lot 837, retaining ownership of the southern part in the hands of Emma Starr, and transferring the title to the general store to their son, Herbert James Starr (LPMA CT Vol 5096 Fol 228; Vol 5721 Fol 58)

In 1953, H J Starr again re-subdivided the land with the general store, and sold the store (Part Lot E) to new owners (LPMA CT Vol 5721 Fol 58; Vol 6804 Fol 32). H J Starr later established a new store on the southwest part of the original lot (Part Lot H), at the corner of Edmondson and Tenth Avenues (LPMA CT Vol 7160 Fol 22; Ian Wilmington, pers. comm., 25 January 2011).

By 1955, there were six buildings on the western side of Edmondson Avenue, including five buildings on the original area of lot 837: the Progress Hall, General Store, and three houses (Figure 5.123). These buildings are extant, and together demonstrate the character of the rural township and its local environment in the mid-twentieth century. In particular, the H J Starr Progress Hall, Ian's Hardware and associated house, as well as two single-storey fibro houses to the south of Ian's Hardware, form a coherent group, historically associated with the Starr family, and representative of the development of the town as a commercial and civic centre in the mid-twentieth century



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Horizontal datum: GDA94/MGA Zone 56
Background images: Detail from Land and Property Management Authority, Aerial photograph 228-5108, Run 25, Liverpool NSW, 1955

Figure 5.123 Aerial photograph of Austral Town Centre, 1955, showing a series of small buildings on the western side of Edmondson Avenue. The approximate area of Lot 837 of the Hoxton Park Estate is outlined in red.

The H J Starr Progress Hall at 264 Edmondson Avenue is a red-brick building, constructed in 1965 to replace the original Progress Association Hall, which had been destroyed by fire (see Section 5.3.3 below for further details). The H J Starr Progress Hall is regularly used by community groups for meetings and classes, and anecdotal evidence suggests that the building has strong social value to the local community. A demountable building occupied by the Outer Liverpool Community Services is located to the rear.

The former general store forms the core of Ian's Hardware at 256 Edmondson Avenue, a single-storey timber-frame and fibro clad building with a pitched corrugated metal roof, and painted brick parapet. An associated fibro clad bungalow with a low pitched roof and street-facing gables has been relocated from the north side of the shopfront to the rear of the block (see Section 5.3.4 below for further details). A vacant block between the hardware store and the H J Starr Progress Hall provides overflow parking for the store and the hall.

The two houses on the south side of Ian's Hardware were likely to have been constructed for members of the Starr family in the Post-War period and have at various times been associated with the Austral Post Office. AMBS has not received permission to inspect the two fibro houses, and as such a thorough assessment has not been possible; however, a preliminary visual inspection has been undertaken from the street.

The house at 250-252 Edmondson Avenue is a plain, single-storey bungalow with a low-pitched corrugated metal roof, hipped to the front and gable to the rear, fibro cladding, and a skillion roof addition to the rear (Figure 5.124). The front is symmetrical, with a central front door. The house has been the residence of Ms Rose Ellen Starr for some years and as such it is possible that the house retains much of its original fabric, fixtures and fittings. The house has previously been used as the Austral Post Office (Graeme McIntosh, pers. comm. 3 February 2011). Concrete footings on the north side of the house are thought to be associated with the former telegraph office, and as such the site may have some archaeological potential.

The current Austral Post Office at 246-248 Edmondson Avenue is also a single-storey bungalow, with a hipped tile roof, and fibro cladding (Figure 5.125). The building is asymmetrical, with a single bay projecting forward on the south side. A red-brick addition with a flat roof also projects out from the front of the building on the north side. The brick addition served as the post office prior to the refitting of the house for the present post office (Graeme McIntosh, pers. comm. 3 February 2011).

Figure 5.124 House at 250-252 Edmondson Avenue.

Figure 5.125 Austral Post Office at 246-248 Edmondson Avenue.

The two fibro houses at 246-252 Edmondson Avenue are representative of a particular housing type that is currently well represented within the study area and is likely to become increasingly rare with future development. The two houses therefore make a contribution to an understanding of the development of Austral and the local area and as such warrant further investigation as built heritage items and for potential archaeological resources associated with the development of Austral town. Regardless of whether the two fibro houses meet the criteria for listing as individual heritage items, they should be identified as contributory elements in the Austral Conservation Area.

It should be noted that AMBS was not able to contact the owner(s) of Ian's Hardware or the houses at 246-252 Edmondson Avenue to undertake a formal inspection of these properties. However, AMBS understands that one of the owners may not support heritage listing of some of the properties, and has taken this into consideration during this assessment.

Summary Statement of Significance

Austral Town Centre Conservation Area is an intact grouping of residential, commercial and community buildings, historically associated with the family of Emma and H G Starr, Austral Postmaster in the early- to mid-twentieth century. The grouping has aesthetic value, insofar as it incorporates a representative sample of vernacular architecture of the southwest Sydney region, including three fibro houses of various styles, all constructed between 1938-39 and 1965. These building forms will become increasingly rare as the area is developed as part of the SWGC. The building styles are complementary in their character and scale, and illustrate a range of functions

important to the town as it developed in the mid-twentieth century, including the general store, Progress Hall, and post office.

The Austral Town Centre Conservation Area meets the following criteria for local heritage significance: a), b), c), e) and g).

5.3.3 H J Starr Progress Hall, 264 Edmondson Avenue, Austral

The Austral Progress Association was formed in 1931, out of the local school's P&C. It originally had a dual role, catering to the requirements of the school, and the broader needs of the local community. Following the formation of a separate P&C in 1936, the Progress Association focused on representing and promoting the interests of local residents and the Austral community (Clarke and Haak 1993:7). This was in keeping with a broader social movement towards local, participatory involvement in the affairs of the district (Keating 1996:135-138). The Austral Progress Association was formally incorporated in 1989 (LPMA CT Vol 5096 Fol 228).

The original Progress Hall was constructed in approximately 1939 on a small parcel of land on Edmondson Avenue, donated to the Progress Association by Austral Postmaster H G Starr (LPMA CT Vol 5096 Fol 228; Ian Wilmington, pers. comm., 25 January 2011).

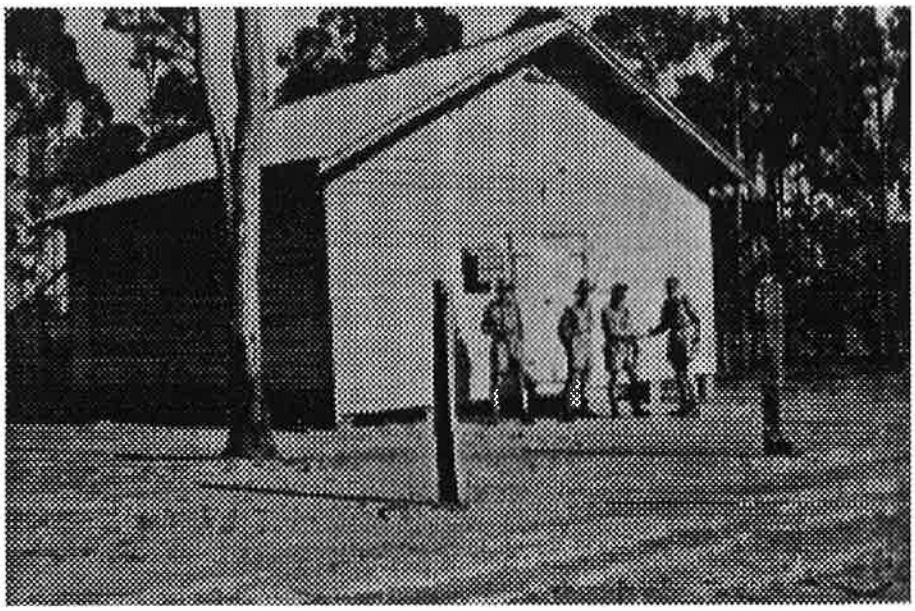


Figure 5.126 Original Austral Progress Hall (Source: Clarke and Haak 1993:6).

The original Progress Hall burnt down on 16 April 1962, and an 'Austral Queen Quest' was organised to raise money to fund a new hall. The existing hall was constructed in 1965, and upgraded with a new roof and kitchen in 1991 (Clarke and Haak 1993:7; Ian Wilmington, pers. comm., 25 January 2011).

The current hall is a simple single storey red textured brick building, with contrasting panels of pale yellow brick along the front, timber-frame windows, and a low pitched profile steel roof (Figure 5.127-Figure 5.133). The wide entry is flanked by projecting wings, with commemorative plaques mounted on the walls. Double glass doors provide access into the hall which has a stage at the far end, and the ladies and gents toilets to each side. The front wings house the kitchen to the right and a storage area to the left. The hall is lit by large, six-pane windows set high along the long walls. The roof is supported by steel trusses, which relieve the simplicity of the interior design. A demountable building to the rear houses the Outer Liverpool Community Services.

Figure 5.127 H J Starr Progress Hall, view from the southeast.

Figure 5.128 View from the street.

Figure 5.129 View from the northeast.

Figure 5.130 Commemorative plaque, in honour of H G Starr.

Figure 5.131 Commemorative plaque, for the renaming of the hall in honour of H J Starr.

Figure 5.132 Interior of the hall, with stage at the far end.

Figure 5.133 View of kitchen, installed in 1991.

The hall was renamed the H J Starr Progress Hall in December 2001, honouring the long-term patronage of H J Starr, son of H G and Emma Starr. The hall continues to be used on a regular basis by a variety of community-based groups and for private social gatherings (Ian Wilmington, pers. comm., 25 January 2011; Clarke and Haak 1993:7).

Summary Statement of Significance

> *The H J Starr Progress Hall is historically associated with the Austral Progress Association, originally formed in 1931 to represent and promote the interests of local residents, and with a broader social movement towards local, participatory involvement in the affairs of the district. It also has a special association with prominent members of the local community H G and H J Starr. Although the current hall does not have high aesthetic or architectural values, it is representative of its era, and it continues to play a vital role in the social and cultural life of the Austral community.*

The H J Starr Progress Hall meets the following criteria for local heritage significance: a), b), d) and g). The H J Starr Progress Association Hall makes an important contribution to the proposed Austral Town Centre Conservation Area.

5.3.4 Ian's Hardware and House, 256 Edmondson Avenue, Austral

In 1938, the land at 256 Edmondson Avenue was purchased by Emma Rosetta Salome Starr, wife of Herbert George Starr, Austral postmaster (LPMA CT Vol 4698, Fol 149-150). The Starrs likely constructed a general store, telegraph office and house on the land around this time. The store was the

first commercial business in what would later become the Austral Town Centre (see Section 5.3.2 above).

In 1947, the Starrs subdivided their land and transferred the title to the lot on which the store stands to their son, Herbert James Starr. H J Starr is described in the certificate of title as a storeman.

In 1953, H J Starr again re-subdivided the land with the general store, and sold the store (Part Lot E) to new owners: William Isaac Ratcliffe of Manly, salesman, and his wife Lyn (LPMA CT Vol 5721 Fol 58). It was subsequently purchased by Raymond Wesley Saints of Austral, merchant, and his wife June (1958); Robert Sydney Cryer of Austral, storekeeper (1960); and Gino Casella of Yagoona, box manufacturer, and his wife Nota (1963) (LPMA CT Vol 6804 Fol 32).

In 1966, H J Starr re-purchased the land, and leased the store to his nephew, Ian Wilmington. A photograph of the land from about this time shows the building being used as a hardware store, with two petrol pumps out the front, and the adjacent house flush with the front of the store (Figure 5.134). This house has since been relocated to the rear of the block (LPMA CT Vol 6804 Fol 32; Ian Wilmington pers. comm., 25 January 2011).

Figure 5.134 Photograph of Ian's Hardware and adjacent fibro house, c1966 (Source: Ian Wilmington).

The former general store continues to form the core of Ian's Hardware at 256 Edmondson Avenue. It is a single-storey timber-framed fibro-clad building with a pitched roof clad in corrugated roofing sheets and a painted brick parapet over the entry (Figure 5.135-Figure 5.136). A large, flat metal awning extending out at the front has been added to provide protection for two petrol pumps. The present awning is larger than that appearing in the photograph shown in Figure 5.134. The parapet provides the building with a more imposing façade than the other early buildings in the township and, as an Art Deco architectural detail, is consistent with a 1938-39 date of construction.

The original store building has been extended at the rear such that it now forms a long narrow space broken up into sections by surviving early wall sections and added counters. There is also a narrow addition along the north side of the original building. The stock includes a wide variety of items including general hardware, personal and household items, and refreshments.

Figure 5.135 View along Edmondson Avenue to Ian's Hardware.

Figure 5.136 Ian's hardware.

The fibro house, which now stands to the rear of the store, is a modest example of the Califronian bungalow style, with a low pitched roof, street-facing gables, and timber frame windows (Figure 5.137-Figure 5.138). Strapwork on the gables adds some simple decorative detail. The bungalow style of the house is also consistent with a 1939 construction date. The building currently serves as the office to Ian's Hardware. Although no longer a residence, the house has a strong historic connection with the store, as the store owner's family home. It appears to retain much of its original layout and fabric, and is in good condition.

Figure 5.137 View along the north side of Ian's Hardware to the fibro house.

Figure 5.138 The relocated fibro house to the rear of Ian's Hardware.

There is some potential for archaeological relics associated with the construction and operation of Ian's Hardware and the lives of the people who occupied the associated fibro house to be present in the site and the adjacent vacant lot.

Summary Statement of Significance

Ian's Hardware has historic significance arising from its association with the Starr family, who established the first general store in Austral Town Centre in approximately 1938-39. This store formed the basis of the Austral shopping district. The hardware store is demonstrative of the aspirations of the developing town in the early- to mid-twentieth century, reflecting the

contemporary Art Deco style of architecture, and is now a rare example of a commercial building of this period in the area.

The associated fibro house is no longer used as a residence, but it has a strong historic connection with the store, as the store owner's family home. The continuity of use of the store, and the continuing association of the store with the fibro house, contributes to the historic significance of the store and house as a coherent group.

The fibro house is a good, albeit modest example of the Californian bungalow style, and is characteristic of the mid-twentieth century housing stock that is currently well represented within the study area, but which is likely to become increasingly rare with future development.

Ian's Hardware and House meet the following criteria for local heritage significance: a), b), c), e) , f) and g). . Ian's Hardware store and the associated fibro house also make an important contribution to the proposed Austral Conservation Area.

5.3.5 Brick House and Garden at 275 Edmondson Avenue, Austral

In June 1925, John Frederick Valentine Landers purchased lots 816 and 817 in the Hoxton Park Estate from the Asset Realization Company Limited (LPMA CT Vol 1101 Fol 115). Landers also accumulated numerous other blocks in the district. Following Landers' death, his son Ferdinand Landers sold lots 816 and 817 to William White, a labourer from Hoxton Park (1932; LPMA CT Vol 4391 Fol 116). White likely built a small house and established a poultry farm on the land. In 1938, ownership of the land was transferred to Anna Prokoph, wife of Rudolf Prokoph, a poultry farmer who had emigrated to Australia from Czechoslovakia in 1928. Together with their son, Rudolf Prokoph Jnr, who joined his parents in Australia in 1938, the Prokophs continued farming poultry on the land (Erica Clarke, pers. comm., 1 February 2011).

In approximately 1948-9, Rudolf Prokoph Jnr constructed a new brick house for himself and his parents on lot 816, on Edmondson Avenue (Figure 5.139). The house is thought to be one of the earliest brick houses extant in the area. (A possible late nineteenth century brick cottage at 265 Fifteenth Avenue has now been demolished.) The decision to construct in brick was made despite advice from the local Council that the subsoil was primarily clay and unsuited to brick construction (Erica Clarke, pers. comm., 1 February 2011). Following construction, Anna Prokoph planted a pair of Canary Island Date Palms in the front yard, and a privet hedge along the fence line (Figure 5.140-Figure 5.141). These plantings are extant.

Figure 5.139 House and garden at 275 Edmondson Avenue, soon after construction in 1948-9. A newly planted Canary Island Date Palm is in front of the house (left) and privet hedges are in the foreground and background (Source: Erica Clarke).

Figure 5.140 Gate posts and privet hedge in front of house at 275 Edmondson Avenue, nd (Source: Erica Clarke).

Figure 5.141 Aerial photograph of Austral, 1955, showing the Prokoph poultry farm. The brick house, two palms and privet hedge can be seen adjacent to Edmondson Avenue (Source: LPMA, 228-1508, Run 25, Liverpool).

The Prokophs maintained a model poultry farm and participated in the Colombo Plan, providing experience and training for visiting farmers from less developed countries (Erica Clarke, pers. comm., 1 February 2011). The Colombo Plan was a cooperative venture conceived at the Commonwealth Conference on Foreign Affairs held in Colombo, Ceylon (now Sri Lanka) in January 1950 and launched in 1951, aimed at the economic and social advancement of the peoples of South and Southeast Asia. The farm and farming practices of the Prokoph family were described in a 1957 issue of Poultry, a weekly newspaper for poultry farmers: *"Greenfeed Keeps Birds Healthy", Says Austral Farmer* (Figure 5.142). Following the retirement of Rudolf Prokoph Jnr, the land was subdivided for a housing estate.

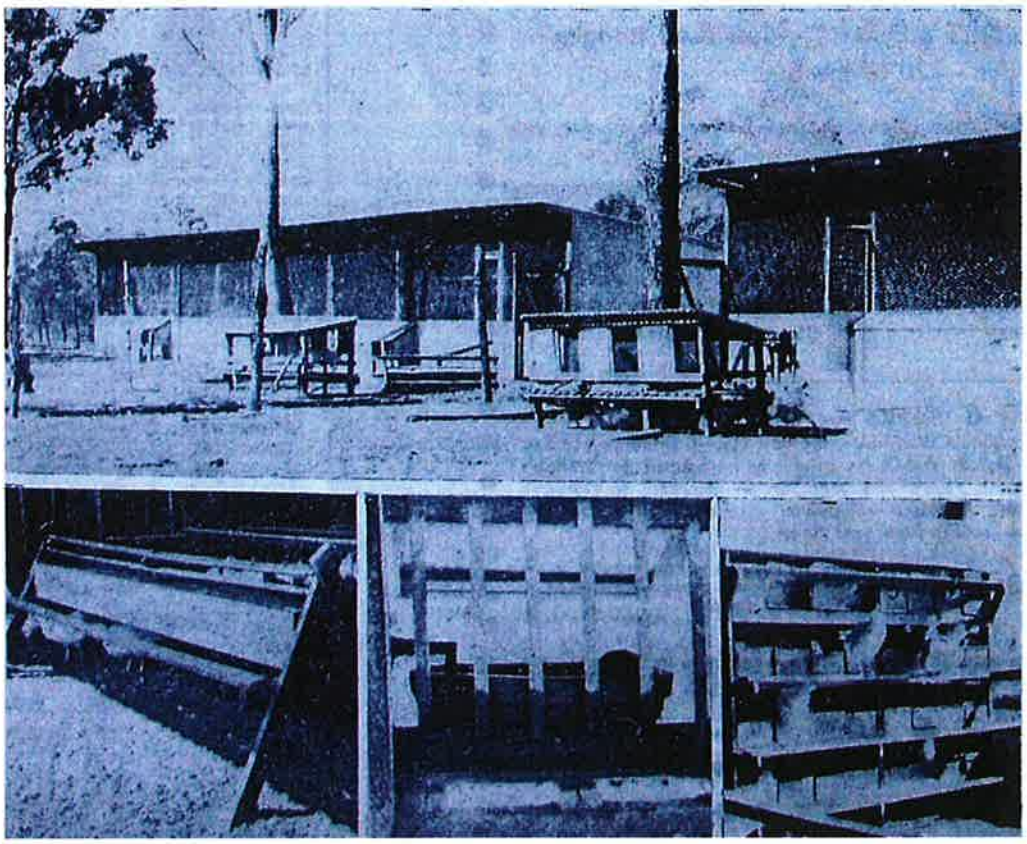


Figure 5.142 ***Three camera glimpses of Messrs. R. Prokoph & Sons farm at Austral, NS.W.,*** **showing the type of laying house standardised at the farm (top) and the equipment in these houses: home made wheat hopper (bottom left), earthenware drinking troughs (bottom centre) and a battery of 24 nests in three tiers (bottom right) (Source:** ***Poultry*** **5 October 1957, p.781; copy provided by Erica Clarke).**

The Prokoph house is architecturally consistent with its date of construction with a hipped tile roof and dark red face-brick walls (Figure 5.143). The symmetrical front has centrally placed glass-panelled French doors approached by a semi-circular entrance porch (Figure 5.144). The entry is flanked by three-bay casement windows. The concrete porch has brick-faced steps and brick columns. The house retains most of the original fixtures and fittings; however, the kitchen has been updated. A brick chimney on the south side of the house is intact, but the hearth has been concealed behind a panel (Figure 5.146). The house is well-maintained, although there is minor cracking in the walls, likely the result of shifting foundations.

A large fibro-clad shed and outdoor toilet are to the rear of the house. The shed was originally the feed shed for the poultry farm (Figure 5.147). The toilet is not original.

Figure 5.143 House at 275 Edmondson Ave, view from the street.

Figure 5.144 Detail of glass-panelled French doors.

Figure 5.145 Detail of brick chimney, south side of house.

Figure 5.146 Former feed shed, to the rear of the house.

The garden along the front and sides has a consistent mid-twentieth century character, and was established at the same time as the house. A concrete path leads directly from the street to the house via a metal gate, flanked by a pair of square, concrete gate posts (Figure 5.147). The gate replaces an earlier timber gate. The two Canary Island Date Palms, growing on either side of the path, are now a prominent feature of the corner block, and may well act as a local landmark Figure 5.148-Figure 5.149). The privet hedge along the front of the property is somewhat overgrown, and screens the house from street.

Figure 5.147 Detail of front gate.

Figure 5.148 Pair of Canary Island Date Palms, view from the southeast.

Figure 5.149 House and garden at 275 Edmondson Avenue, view from the northwest.

Summary Statement of Significance

The house and garden at 275 Edmondson Avenue have a strong mid-twentieth century character, and are representative of semi-rural styles of this era in western Sydney. Constructed in approximately 1948-9, the house is one of the earliest brick houses extant in Austral. It has been well maintained, retaining most of its original fixtures and fittings. Two Canary Island Date Palms in the front yard are roughly contemporary with the house, and are now a prominent feature of the streetscape.

The house and garden are associated with the mid-twentieth century migrant population of Austral. The house was constructed by Rudolf Prokoph Jnr for himself and his parents, Anna and Rudolf Prokoph Snr, who ran a poultry farm on the land. The Prokoph family emigrated to Australia from Czechoslovakia in the 1920s-1930s. The Prokophs maintained a model poultry farm and participated in the Colombo Plan, launched by Commonwealth countries in 1951, providing experience and training for visiting farmers from less developed countries.

The house and garden at 275 Edmondson Avenue meets the following criteria: a), b), c) and g) for an item of local heritage significance. .

5.3.6 House and Garden at 170 Edmondson Avenue, Austral

In February 1901, Ernest Stanley Simmonds, clerk of Woolwich, purchased Lots 925 and 926 in the Hoxton Park Estate from the New Oriental Bank Co Ltd (LPMA CT Vol 1101 Fol 115; Vol 1402 Fol 165). Two months later, the property was transferred to Henry George Simmonds, a Sydney conveyancer; and in December 1903, a warrant of execution was issued against the property for the recovery of debts owed by Simmonds. The warrant was resolved in 1912, when the property was sold by the Commercial Bank of Australia to Frank Kime, a licenced victualler of Sydney. Kime held onto the property until June 1933, when it was purchased by Violet Primrose Dudley, wife of John Dudley of Lakemba, Shoe Manufacturer (LPMA CT Vol 1402 Fol 165). The house was likely built by the Dudley family (Erica Clarke, pers. comm., 1 February 2011).

Violet Dudley was a local girl, the daughter of William Ayshford Jnr and Mary Dunn, and granddaughter of William Ayshford Snr and Sarah Morrish, nineteenth century settlers in the Hoxton Park district. Violet married John Dudley in 1927 (Kirkpatrick Family Archives 2008). The property remained in Dudley's ownership until 1956, when Lot 926 was sold to local grazier Alfred Mervyn Phillis. The land was subsequently purchased by: John Henry Tobin and his wife Elfreda (1960); Edwin George Wilce of Moorebank, retired grazier (1964); Janos Gerstner of Bankstown, factory manager, and his wife Anna (1970); Barry Patrick Geraghty (1970); and Kenneth John Montgomery of Austral, trainer, and his wife Elaine Helen (1974) (LPMA CT Vol 1402 Fol 165, Vol 7199 Fol 76, Vol 11232 Fol 158). The property remains in the hands of the Montgomery family at the present time.

A single-storey Californian style bungalow stands on the property at 170 Edmondson Avenue. A collection of farm outbuildings to the rear, and a series of overgrown animal pens and post-and-rail fenced paddocks to the south along Eighth Avenue, are associated with the house and are an important part of the property (Figure 5.150-Figure 5.151). The bungalow has white painted rendered and textured walls with a diamond pattern picked out in blue paint on the front. The hipped roof is clad in Marseilles-type roofing tiles with a prominent white painted central chimney. The front fence comprises square concrete posts with timber rails, which reflect the style of the verandah posts along the front of the house.

Figure 5.150 House at 170 Edmondson Avenue, view from the street.

Figure 5.151 Disused paddocks and animal pens to the south of the house.

The bungalow stands within an expansive landscaped garden, which is a prominent feature of the local streetscape, and may well act as a local landmark. Two rows of large Canary Island Date Palms flank a path that winds from Edmondson Avenue around to the front of the house. A third row of palms is aligned along the front fence, and flowering shrubs line a driveway on the north side of the property (Figure 5.152-Figure 5.154).

Figure 5.152 Row of Canary Island Date Palms along Edmondson Avenue.

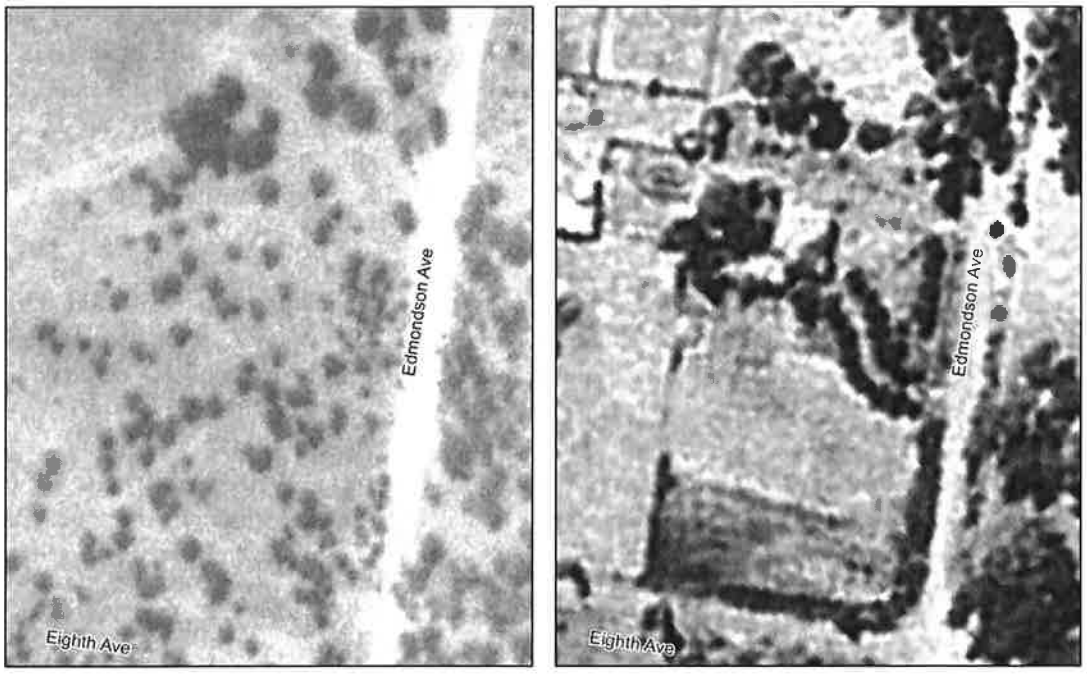
Figure 5.153 Remnants of timber gate post.

Figure 5.154 Flowering shrubs line a driveway on the north side of the property.

The exact date of the construction of the house is unknown. However, it is clear from the 1930 aerial photographs of the property that the lot was undeveloped at this date, while the 1955 aerials clearly show the house and the three rows of palms that form a prominent feature of the garden today. The house and garden were therefore established during the intervening period, likely around 1933-1934, following the sale of the land to Violet Primrose Dudley (Figure 5.155). The Californian bungalow architectural style appears in Australia in the decade before WWI, becoming common by the 1920s, after which time variations to the style began to appear. The bungalow style of the house is consistent with a 1933-1934 construction date, which would fall into the post-Depression period, but prior to

WWII. The garden also has an early- to mid-twentieth century character, and was likely established at the same time as the house. The serpentine path and feature plantings of palms were popular in suburban front gardens during the Federation and Inter-War periods, representing a scaled-down version of grand, gardenesque style planting schemes seen in nineteenth century public parks and large estate gardens. Palms generally went out of fashion after the war, not coming back in until the 1970s (Cuffley 1991:144; 2007:150).

The house and garden stand on their original 3 acre block, and as such provide good evidence of late nineteenth to early twentieth century patterns of land tenure in the Austral and Hoxton Park area.



Horizontal datum: GDA94/MGA Zone 56
Background images: Detail from Geoscience Australia, Aerial photograph 3429-807, Sydney Survey, 1930 (left) and Land and Property Management Authority, Aerial photograph 228-5108, Run 25, Liverpool NSW, 1955

Figure 5.155 Aerial photographs of the property at 170 Edmondson Avenue, 1930 (left) and 1955 (right). The house and garden are established between these two dates.

AMBS was refused permission to enter the property at 170 Edmondson Ave (also known as 125 Eighth Avenue); however, the house and garden appear to be well maintained, and an inspection from the street indicates that the house is currently being renovated.

Summary Statement of Significance

> *The garden at 170 Edmondson Avenue is an excellent representative example of suburban gardening styles in the southwest Sydney region in the Inter-War period, and the three rows of Canary Island Date Palms in the front yard are now a prominent feature of the local streetscape. Mature gardens of this date are rare in the region.*
>
> *Too little is known of the history and associations of the bungalow at 170 Edmondson Avenue to assess its historic significance with any credibility. However, the bungalow was likely established at the same time as the garden, possibly 1933-1934, and the pairing of bungalow and garden is unique within the study area.*

> *The house and garden stand on their original 3 acres block, and as such provide good evidence of late nineteenth to early twentieth century patterns of land tenure in the Austral and Hoxton Park area.*

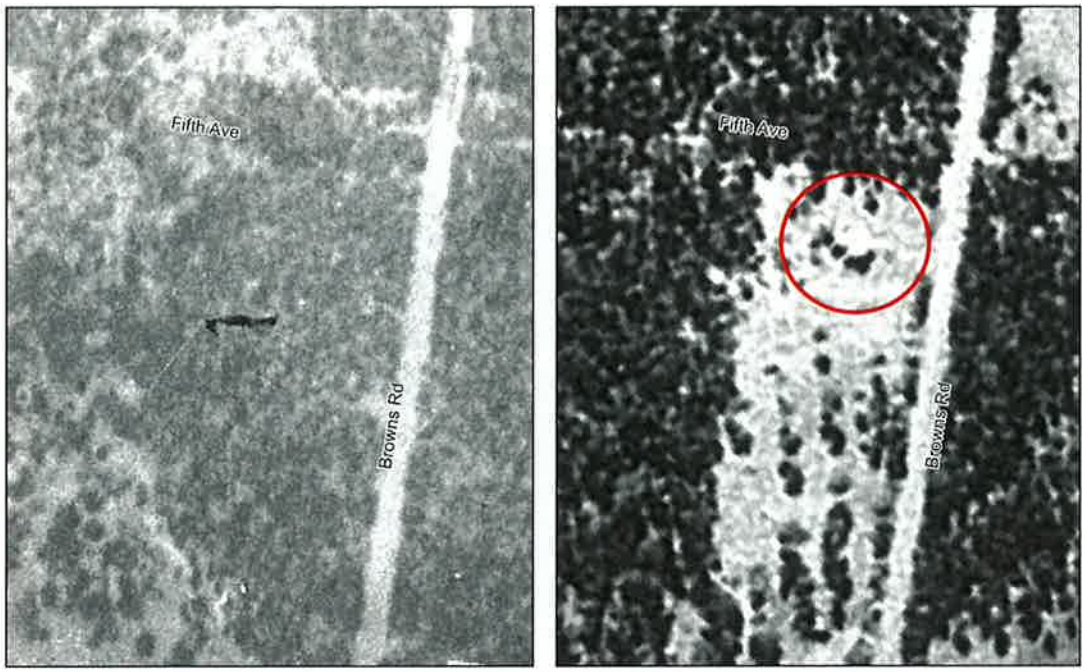
The house and garden at 170 Edmondson Avenue meets the following criteria: c) f) and g) for an item of local heritage significance.

5.3.7 Cement Rendered House at 40 Browns Road, Austral

In March 1894, Charles Bowles, chairmaker of South Brisbane, purchased Lot 1147 in the Hoxton Park Estate from Marie Sophie Nicholson Bellasis, mortgagee executing power of sale over the estate. In November 1913, a 100ft strip of land on eastern side of the lot was resumed for a public road, now known as Browns Road, reducing the size of the lot from 3 acres to 2 1/4 acres. The lot was sold in August 1935 to Charles Albert Brown of Auburn, Printer, and transferred to his widow Teresa Julia Brown in May 1946 (LPMA CT Vol 1101 Fol 115; Vol 1120 Fol 182). The death notice for Charles Brown in 1944 indicates that his primary residence was Hargrave Street, Auburn, and there is currently no evidence that the Brown family ever lived on the property in Austral (SMH 11 April 1944).

In December 1949, the property was purchased by James Arthur Langmead, plasterer of Paddington, and his wife Melva. It is likely that the building was constructed by Langmead soon after this date, and the unusual decorative treatment of the building may be a testament to his skill as a plasterer and renderer.

Aerial photographs of the area confirm that the building was constructed before 1955 (Figure 5.156). The property was later transferred to his daughter, May Puckridge of Penolo, South Australia (July 1980) and Margaret Raumer of Austral (October 1980), and was subsequently leased to tenants (LPMA CT Vol 1120 Fol 182; Vol 14222 Fol 241).



0 20 40 80 120 160 Meters

Horizontal datum: GDA94/MGA Zone 56
Background images: Detail from Geoscience Australia, Aerial photograph 3429-807, Sydney Survey, 1930 (left) and Land and Property Management Authority, Aerial photograph 228-5147, Run 26, Liverpool NSW, 1955

Figure 5.156 Aerial photographs of 40 Browns Road (corner 60 Fifth Avenue), 1930 (left) and 1955 (right). The house is circled in red.

The house stands on the corner of Fifth Avenue and Browns Road, facing Browns Road: the current tenant uses a mailing address of 40 Browns Road (Figure 5.157-Figure 5.158). The house stands on its original 2 1/4 acre block: reduced from 3 acres by the resumption of land for Browns Road. The property to the south of the house and yard has native regrowth forest.

The house is very small, comprising four rooms including kitchen and bathroom. It is cement rendered with a pitched roof clad in corrugated steel sheets with gable ends. An open skillion roofed addition to the rear is overgrown with vines and flowers. A concrete path leads directly from Browns Road to the house via a wire gate set in a short section of white picket fence; the remainder of the yard surrounding the house is defined by a chain wire fence. A row of Cocos Island Palms are planted along the fence line on Browns Road. The yard is grassed, with an occasional flower bed, and to the north-east is a healthy vegetable patch. A double gate on Fifth Avenue provides car access and the collection of caravans sitting to the rear of the house.

The house is an excellent example of twentieth century vernacular architecture, with many elements constructed of reclaimed materials. Internal walls are plastered and painted, the floors are polished timber boards, and the internal doors are Victorian panel doors. The hearth is a synthetic replica of a Victorian iron fireplace. (Apparently the builder capped the chimney because of a concern that 'invading Nazis would come down the chimney' [John Lenton, pers. comm., 11 February 2011]). The house has been well cared for and maintained.

The house has a projecting enclosed porch at the front, which appears to frame the entry, but which is currently used as a storage area; access is from the rear kitchen door. The porch has a central triangular pediment, a classical motif more common to larger, grander residences. Multi-pane windows are arranged symmetrically to either side of the porch; however the entryway is offset from the centre of the wall. A cement rendered dado across the front has been textured and painted to

resemble rusticated sandstone blocks. The path leading from the gate continues to each side of the entry, and has been scored to resemble 'crazy paving' and painted red and yellow; this was a common decorative motif of the Inter-War and early post-War period (Figure 5.159) (Cuffley 2007:155).

Figure 5.157 The cement rendered house at 40 Browns Road.

Figure 5.158 Cement rendered house at 40 Browns Road within its landscaped garden.

Figure 5.159 Detail of the painted crazy paving path at the front of the house.

Summary Statement of Significance

The cement rendered house is a rare example of a small, mid-twentieth century vernacular house in good condition. The house was likely constructed around 1950-52 by its owner, plasterer James

Langmead, during a major phase of development and agricultural intensification in the Austral and Leppington districts after World War II. It has a remarkable appearance, including evidence of craftsmanship and decorative architectural features more common to larger, grander residences.

The Cement Rendered House at 40 Browns Road, Austral meets the following criteria: a), c), e) and f) for an item of local heritage significance.

5.3.8 W V Scott War Memorial and Park, Bringelly Road, Austral

The W V Scott Memorial and the W V Scott Memorial Park commemorate William (Bill) Verdun Scott, Flying Officer in 7 Squadron of the Royal Australian Airforce, who died in action in Europe during WWII, aged 27.

Scott was the son of local grocer, bus operator, and long serving Nepean Shire Alderman Thomas George Scott. William Scott was born in Austral in 1917 and attended Austral Public School and Parramatta High School. Scott joined the army the morning after war was declared. He later joined the airforce, working as a bomb aimer and navigator, and was a member of the elite pathfinders stationed at Bournemouth in England. During WWII, the pathfinders were a group of volunteers who were specially trained to guide the main airborne force to designated drop zones. Their tasks were to mark the drop zones or landing zones, set up radio beacons as a guide for the aircraft carrying the main force, and to clear and protect the area as the main force arrived. Scott's plane was shot down over Alkmaar, Netherlands on 16 December 1943. Six crew members from the plane were buried in Stompetoren, Netherlands (Clarke and Haak 1993:5; Australian War Memorial, nd).

A monument in honour of Flying Officer Scott was erected at the corner of Bringelly Road and Edmondson Avenue in Austral (Figure 5.160). This originally consisted of a water bubbler on a raised foundation, with an associated plaque. One local resident also remembers that the bubbler was covered with a pergola in the 1960s (Erica Clarke, pers. comm. 1 February 2011). The bubbler was eventually vandalised and, following complaints, removed by Liverpool Council. A new black granite commemorative plaque and memorial rose garden was installed in the same location in approximately 1998 by the Liverpool RSL Sub Branch in cooperation with Council and Austral Public School (Figure 5.161) (District Reporter, nd; Vic Watts, pers. comm., 28 February 2011). The inscription replicates that of the original plaque:

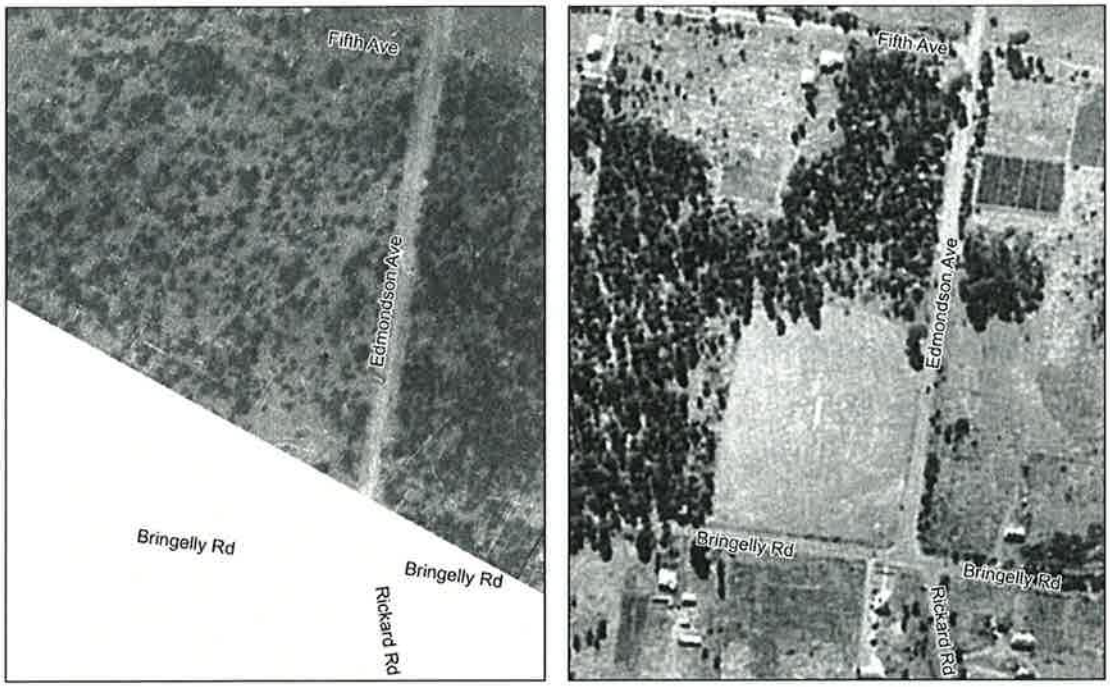
IN APPRECIATIVE
MEMORY OF
FLYING OFFICER
W.V. SCOTT R.A.A.F.
KILLED IN ACTION
DEC 16TH 1943
THERE WAS, THERE IS
NO NOBLER, STRONGER,
GENTLER, MANLIER MAN.

The last three lines make reference to American orator Robert G Ingersoll's famous eulogy at his brother's grave.

Figure 5.160 W V Scott Memorial and Park, at the junction of Bringelly Road and Edmondson Avenue.

Figure 5.161 Commemorative plaque at the W V Scott Memorial Park.

The monument is adjacent to a sports ground, also named in honour of W V Scott. The land for the memorial park was partially owned by Nepean Shire Council, and the remainder was purchased by Council after the War, in April 1948 (LPMA CT Vol 2880 Fol 146; Vol 1086 Fol 43). It is likely that the main oval and memorial were established around this time. The main oval can be seen on a 1955 aerial photograph of the area, with a central cricket pitch. Although the photograph is not entirely clear, the first memorial appears to have been constructed by this time (Figure 5.162).



Horizontal datum: GDA94/MGA Zone 56
Background images: Detail from Geoscience Australia, Aerial photograph 3429-807, Sydney Survey, 1930 (left) and Land and Property Management Authority, Aerial photograph 228-5146, Run 26, Liverpool NSW, 1955

Figure 5.162 Aerial photographs of land at the corner of Bringelly Road and Edmondson Avenue, 1930 (left) and 1955 (right). By 1955, an oval had been established on the land, named in honour of Flying Officer W V Scott.

The park now comprises a large grassy oval at the junction of Bringelly Road and Edmondson Avenue, and a smaller playing field at the corner of Edmondson and Fifth Avenues (Figure 5.163). A grandstand and other facilities present are at the north end of the oval. The park is surrounded by a

number of mature gum trees and a wire and pipe rail fence. The park appears to be well-patronised, and is the home training field for a number of local sporting clubs.

Figure 5.163 Small playing field at the corner of Edmondson and Fifth Avenues.

Summary Statement of Significance

The W V Scott War Memorial and Park commemorates the death of a local serviceman in Europe in World War II. The Memorial is associated with Flying Officer William (Bill) Verdun Scott, son of Thomas George Scott, early settler in the Hoxton Park Estate and long serving Nepean Shire Alderman. The memorial stands in lieu of a grave for Flying Officer Scott, and expresses the community's grief at his death. The naming of the associated W V Scott Memorial Park reinforces the community's desire to not forget the sacrifice of local residents in the war.

The W V Scott War Memorial and Park meets the following criteria for local heritage significance: a), b), d) and g).

5.3.9 Hellenic Monument, Lot 10 DP 771080

There is little available information concerning Greek migrants to the area or the Greek community; however, Lot 10 DP 771080, north of Gurner Avenue was purchased by the Federation of Hellenic Associations in 1995. Previously the Associations had had a 99 year lease on the land, but after lobbying the government, the 21 shareholders successfully purchased the land. The aim for the land was to create a cultural hub for the Greek community: sporting facilities, recreation, community care and housing for elderly members of the community. The plans have been on hold, mainly because of the proposed electrical substation and additional 330kV transmission line, which will remove part of the land (John Petropoulos, pers. comm., 2 February 2011).

The land is marked out by an Hellenic or Greek style monument, which stands overlooking the valley from an elevated position on Judges Hill (Figure 5.164). The monument is in a ruinous condition, but continues to form a prominent feature of the landscape. Constructed of reinforced concrete, it has

four Doric columns set on a stepped rectangular podium; the column on the northwest side has fallen over. There are remnants of a marble plaque attached to the front, west side of the podium. The marble plaque is inscribed with Greek lettering; however, too little survives from which to decipher a meaning (Figure 5.165-Figure 5.166). The monument is painted white, and a u-shaped shadow in the paint at the centre of the podium marks the site of an additional element, now missing.

Figure 5.164 The Hellenic Monument on Judges Hill.

Figure 5.165 Remnant of the inscribed marble plaque.

Figure 5.166 Detail of inscribed marble plaque.

Summary Statement of Significance

Too little is known about the Hellenic Monument to assess its historic significance. However, construction of the monument would have involved a substantial investment of materials and labour, and its placement in the landscape suggests a desire to commemorate events associated with the acquisition of the land and/or the activities of the Greek community in southwest Sydney. There is potential to gain new information about the historic significance of the monument and its association

with the Greek community from further historical research. The monument is centred on Judges Hill such that it has landmark qualities within an important view corridor within the local environment.

The Federation of Hellenic Associations monument on Judges Hill is likely to meet the following criteria for local heritage significance: a), c), and e).

5.3.10 Nissen Huts at 97A Bringelly Road and 105-111 Edmondson Avenue, Austral

In early 1916, Major Peter Nissen, 29th Company Royal Engineers, developed prefabricated portable utilitarian huts, which were being produced by August the same year (Stuart 2005:51; Figure 5.167). The standard sizes for Nissen huts are described in the Prefabricated Building Catalogue issued by the Department of Works & Housing as:

> *Standard lengths are 36ft and 60ft for 16ft and 24ft span buildings respectively, of approximately semi-circular section, constructed of semi-circular steel T ribs with timber purlins covered with corrugated aluminium sheeting placed vertically. Ends of 3ft and 2ft frame and dressed weatherboards. Single or double doors and windows. Dormer windows can be added if required. At present (Jan 1951) aluminium sheeting is unavailable and corrugated black iron must be supplied in lieu. For full details of Bldgs see handbook* (1951:Sheet No.1).

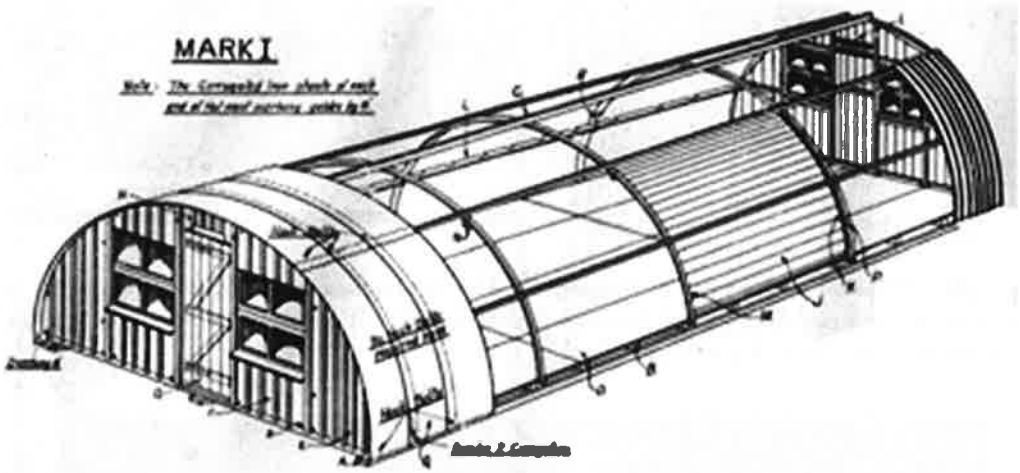


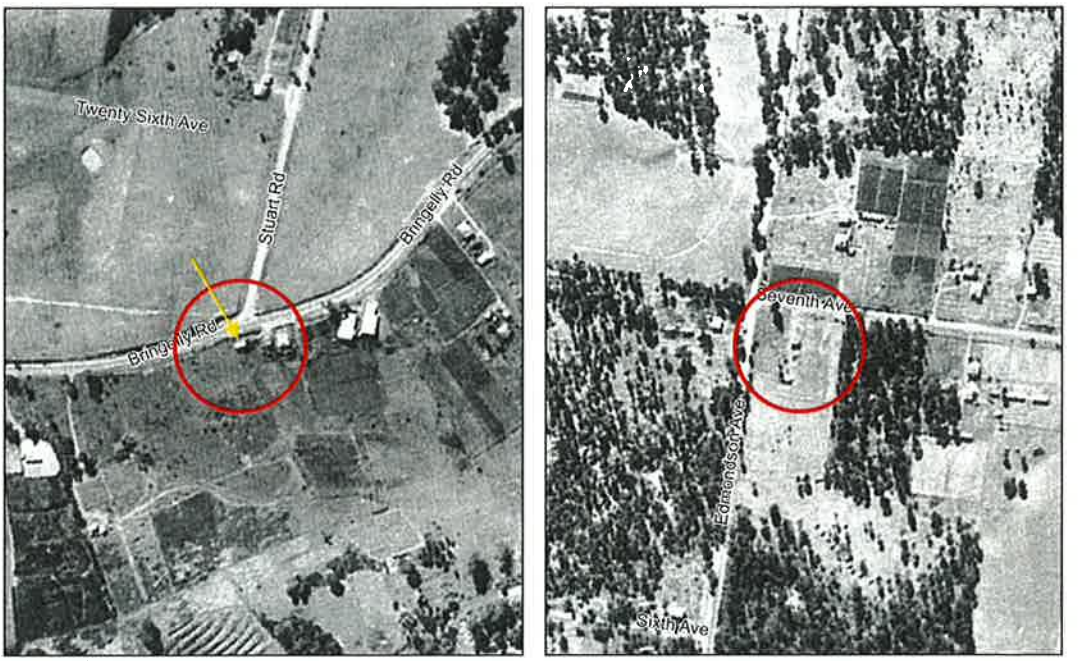
Figure 5.167 The components of a Nissen Hut (Source: http://www.eriding.net/worldinconflict/images/glossary/nissen_hut_plan.jpg).

The uses of Nissen huts identified in the Prefabricated Buildings Catalogue are as garages, stores, workshops and temporary housing, and have been used as accommodation barracks during and following WWII. After the War, Nissen huts served the Displaced Persons Migrant Accommodation program in NSW as housing for the massive influx of migrants. Following the closure of many of the migrant hostels, and particularly by 1952-1953, there was a surplus and huts, including Nissen huts, were sold off (Stuart 2005:54). Some surplus huts were acquired by rural landholders as convenient utilitarian multi-purpose structures to be adapted to farm use.

Within the study area are two Nissen huts, located at the corner of Seventh and Edmondson Avenues, and at 97A Bringelly Road. The two Nissen huts comply with the smaller hut size of 36ft x 16ft and appear to have been acquired for farming purposes, as indicated in the 1955 aerial photographs of the study area. The hut at 97A Bringelly Rd is clearly present, whereas it is less certain whether the hut is on the lot at the corner of Seventh and Edmondson Avenues (Figure 5.168).

The two Nissen huts are in poor condition (Figure 5.169-Figure 5.173). They appear to retain the original steel T ribbing and are clad in corrugated iron/steel sheets, but neither is lined. The west end

section, and part of the east end, of the Bringelly Road Nissen hut appears to be original, but the east end has been modified for use as a garage (Figure 5.173). The end sections of the Edmondson Avenue hut are fitted with a mix of profile steel and corrugated sheets, and the hut is used for storage (Figure 5.170-Figure 5.171).



Horizontal datum: GDA94/MGA Zone 56
Background image: Land and Property Management Authority, Aerial photographs 228-5149 Run 26 (left), and 228-5417 Run 26, Liverpool NSW, 1955

Figure 5.168 1955 aerial photos of 97A Bringelly Rd with the hut arrowed (left, circled), and the lot at the corner of Seventh and Edmondson Avenues (right, circled). It is unclear whether the hut on the corner of Edmondson Avenue is present at this time.

Figure 5.169 The west elevation of the Nissen hut on the corner of Seventh and Edmondson Avenues.

Figure 5.170 North elevation of the Nissen hut on the corner of Seventh and Edmondson Avenues.

Figure 5.171 South elevation of the Nissen hut on the corner of Seventh and Edmondson Avenues.

Figure 5.172 Nissen hut on Bringelly Road; view of the west elevation with original cladding and windows.

Figure 5.173 Nissen hut on Bringelly Road; the east end has been modified to provide parking access.

Assessment of Significance

Each of the Nissen huts has been identified in the heritage study prepared by FORM Architects (Aust) Pty Ltd in 2004 as having local significance.

The two Nissen huts are demonstrative of the characteristic utilitarian structures developed for military use during WWI, and which have continued to be used for military and domestic purposes. Although Nissen huts are becoming increasingly rare, the two examples within the study area are incomplete and poor examples of their type and do not retain all the characteristic elements that define this class of building, and as such, would not make a significant contribution to an understanding of the building type.

The Nissen hut at corner of Seventh and Edmondson Avenues, and the Nissen Hut at 97A Bringelly Road do not fulfil the requirements for heritage listing.

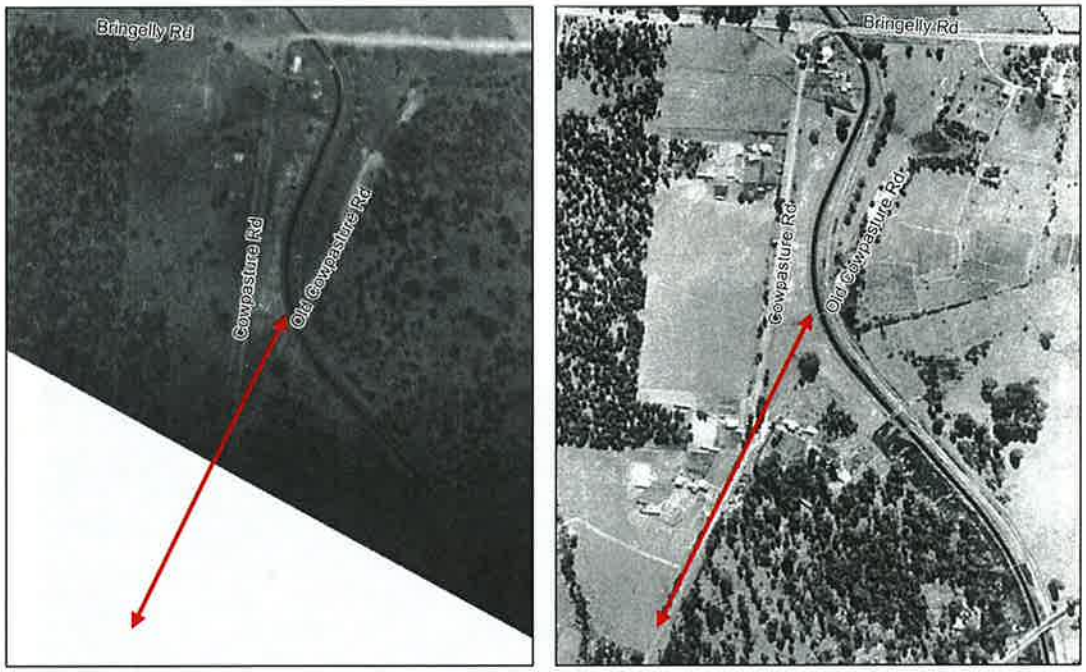
5.3.11 Cowpasture Road – Cultural Landscape

Opened in 1806, Cowpasture Road is one of the earliest roads in the south western Sydney region and the oldest road in the Liverpool area (see Section 3.3.1 above). It formed the boundary of several early land grants in the study area, including those of Matthew Pear, Alexander Riley, John Drummond, and Simeon Lord.

The original alignment of Cowpasture Road extended in a northeasterly direction through the Leppington area, joining Bringelly Road on the east side of a row of three Bunya Pines (see Figure 3.8 above). The Upper Canal was constructed approximately 80 years after the road, and intersects the original alignment near a prominent bend in the present alignment of the road. The bend represents the point at which the road was realigned along the west side of the Canal in the late nineteenth or early twentieth century, with a Canal crossing at Bringelly Road (Figure 5.174; also see Section 5.2.2 above).

Figure 5.174 A prominent bend in the present Cowpasture Road represents the point at which the road was realigned along the west side of the Upper Canal, following its construction in 1886-1888. A shallow depression along the disused road reserve indicates the original alignment (red arrow.)

Historic aerial photographs provide evidence of the original alignment of the road, with the route marked by changes in vegetation, particularly along the property boundaries east of the road (Figure 5.175). The original alignment can still be interpreted within the present landscape by a shallow depression in the local topography, and a localised area of native regrowth forest along the unused section of road reserve (Figure 5.176). In some sections, both east and west of the Canal, the depression is more clearly indicated by discrete embankments (Figure 5.177). The row of Bunya Pines marks the original junction with Bringelly Road (Figure 5.178).



0 65 130 260 390 520 Meters

Horizontal datum: GDA94/MGA Zone 56
Background images: Detail from Geoscience Australia, Aerial photograph 3429-807, Sydney Survey, 1930 (left) and
Land and Property Management Authority, Aerial photographs 235-5019 Run 27 and 235-5147 Run 26, Liverpool NSW, 1955

Figure 5.175 Aerial photographs of the study area, 1930 (left) and 1955 (right), showing the lack of development within the vicinity of the Old Cowpasture Road alignment (red) and the Upper Canal.

Figure 5.176 Shallow depression in the local topography, east of the Upper Canal. View to the south.

Figure 5.177 Section of embankment along east side of historic road reserve, west of the Upper Canal.

Figure 5.178 View along the original road alignment, towards the north, where the junction with Bringelly Road is marked by a row of Bunya Pines.

The present road surface on the west side of the Canal has been asphalted and widened since its original construction; however, the disused alignment on the east side of the Canal has remained relatively untouched since the construction of the Canal and diversion of Cowpasture Road, and as such it may retain physical evidence of early road use, including wheel ruts, and attempts to modify the landscape to control surface drainage. Areas of exposed ground surface along the disused road reserve consist of compacted clay and lateritic gravel, consistent with the local geology (Figure 5.179).

There is some potential for physical evidence associated with the early construction of the road to be present within the original road easement. However, evidence of erosion along the embankments along the disused section of road reserve suggests that it is likely to be limited, and somewhat ephemeral. Historical background suggests that a Telford-type road surface was never constructed on this section of the road, and that the road south of the Camden Valley Way crossing of the Upper Canal was first surfaced with concrete in 1930-1931. Any physical evidence may be also impacted by the construction of the SWRL over the original road alignment.

Figure 5.179 Compacted clay and gravel surface, exposed in unused area of road reserve, on the east side the Canal.

Figure 5.180 View to the south, with new development to the southeast of the road (left).

Sparse housing along the west side of the road, juxtaposed with the Upper Canal to the east, adds to the rural character of the landscape. This character has begun to change, beginning with development of the former Casa Paloma caravan park on the southeast side of the road (Figure 5.180). It will undergo further substantial change following the development of the Leppington Town Centre to the west and the construction of the SWRL over the route of the Canal and the road. However, there is potential to maintain a physical evidence of a short section of the original road route along the east side of the Canal, within a natural landscape setting, which would assist in the interpretation of this important early road to the general public.

Summary Statement of Significance

Cowpasture Road was constructed in 1805-1806, as one of the earliest roads in the south western Sydney region and the oldest road in the Liverpool area. It was surveyed by pardoned convict James Meehan, and formed the boundary of several early land grants, including Alexander Riley's Raby Estate. By 1850, the section of road south of Bringelly Road was being used as an alternate route for the Great South Road, the main road for traffic between Liverpool and Camden and areas further south.

Cowpasture road is historically associated with the alignment and landscape setting of the Upper Nepean Scheme -- Upper Canal: construction of the Canal in 1886-1888 led to a re-alignment of Cowpasture Road at its junction with Bringelly Road. In 1920, the road achieved iconic status, as the subject of Hardy Wilson's illustrated book: The Cow Pasture Road.

The disused section of Cowpasture Road provides rare evidence of the early road corridor, and may also retain early physical fabric undisturbed by twentieth century road works. The natural landscape setting is evocative of the original rural setting of the road, and has an important visual relationship with the route of the Upper Nepean Scheme – Upper Canal. The original junction of Cowpasture and Bringelly Roads is marked by a row of three Bunya Pines, which are prominent landmarks within the local landscape.

Cowpasture Road meets the following criteria for local heritage significance: a), b), c), e), f), and g).

5.3.12 Bringelly Road – Cultural Landscape

Bringelly Road is a major two lane highway and a key route of access to and from the study area. It is one the earliest roads in the Liverpool area, southwest of Sydney (see Section 3.3.1 above). It winds up and over the crest of Carnes Hill at the eastern edge of the study area, before crossing the study area in a straight, roughly east-west line (Figure 5.181). Carnes Hill marks the junction with the original

alignment of Cowpasture Road, and provides important views to Sydney and Parramatta to the east, and the Blue Mountains to the west (Figure 5.182-Figure 5.183).

Figure 5.181 Bringelly Road traverses much of the study area in a straight, roughly east-west line. View from the base of Carnes Hill to the west.

Figure 5.182 View from Carnes Hill to Sydney CBD to the east.

Figure 5.183 View from Carnes Hill to the Blue Mountains.

Bringelly Road formed the boundary of several early land grants in the study area, including those of Alexander Riley (Raby), Matthew Pear, Thomas Carne, Urban Fidkin, and Hannibal Macarthur (Eastwood). From 1887 the road formed the southern boundary of the Hoxton Park Estate subdivision, and its east-west alignment through the landscape likely formed the basis for the rigid grid of streets which characterised the subdivision, and which continues to dominate subdivision patterns in the Hoxton Park and Austral areas.

Historic maps and aerial photographs indicate that the original alignment of Bringelly Road is roughly consistent with the alignment of this road today (Figure 5.184). The continuity of use of this transport corridor from the early years of the colony, and the profound influence it has had on European patterns of land tenure and settlement, contribute to its technical significance.

Horizontal datum: GDA94/MGA Zone 56
Background images: TOP Mosaic of Parish Maps, c1850s, Parish Map Preservation Project,
Parish of Cabramatta, Ref: 140705; Parish of Cook, Ref: 140697; Parish of Minto, Ref:140644.
BOTTOM Mosaic of Aerial photographs, 1955, Land and Property Management Authority, 228-5156 Run 26, 228-5147 Run 26, 228-5149 Run 26, Liverpool NSW.

Figure 5.184 Historic maps and photographs indicate that the original alignment of Bringelly Road is roughly consistent with the alignment of this road today.

As with Cowpasture Road, there is some potential for physical evidence associated with the early construction of this road to be present within the road easement. However, since the road was unlikely to have had more than a compacted clay surface prior to the twentieth century, this evidence is likely to be limited, and somewhat ephemeral. Other evidence may include early culverts and drains, preserved beneath the existing road surface.

Despite the regional importance of the road, it continues to have a distinct semi-rural character, flanked by small farms and large residential properties, and lined in sections with native tree (Figure 5.185 and see Figure 4.1 above). This character is likely to change as the road is upgraded from two to four lanes, in conjunction with development of the SWGC

Figure 5.185 View along Bringelly Road to the west, from the corner of Edmondson Avenue.

Summary Statement of Significance

Bringelly Road was constructed in c.1815. It is historically associated with pardoned convict and Deputy Surveyor General James Meehan, who surveyed the route, and with the convict labourers who constructed it.

The road has landmark value as a major early regional road. It continues to be used as a major regional transport corridor, and the original alignment is consistent with the alignment of the road today.

Bringelly Road acts as a physical marker of early land grant boundaries, including the northern boundary of Alexander Riley's Raby Estate. From 1887, it formed the southern boundary of the Hoxton Park Estate subdivision, and its east-west alignment through the landscape likely formed the basis for the rigid grid of streets which characterised the subdivision. This grid continues to dominate subdivision patterns in the Hoxton Park and Austral areas today.

The original junction of Cowpasture and Bringelly Roads is marked by a row of three Bunya Pines, which are prominent landmarks within the local landscape. There are also important views to Sydney CBD from the road at the crest of Carnes Hill.

Bringelly Road meets the following criteria for local heritage significance: a), b), c), and e).

5.4 Items with Historical Archaeological Potential

5.4.1 Former Blacksmith's Workshop, 240 Fifteenth Avenue, Austral

In 2004, the site of a former blacksmith's workshop was identified during the public consultation phase of the Liverpool Heritage Study Review as having historic heritage interest. FORM architects pty ltd agreed that there was potential to gain more information from architectural, archaeological, and documentary research of the site, and recommended that the property be listed on Liverpool LEP.

The site of the former blacksmith's workshop is located at 240 Fifteenth Avenue, on the corner of Twentyeighth Avenue. The current owner of the property has indicated that he removed a structure from the corner approximately 35 years ago, at the request of Council. At the time, the building was extremely dilapidated and was considered to be a traffic hazard as it blocked the line of sight for cars turning out of Twentyeighth Avenue (pers. comm., 2 December 2010). The field in which the smithy was located is currently used as pasture for cattle.

Bob Kirkpatrick, son of Joseph and grandson of James Kirkpatrick, recalls that a shed was erected on the corner of Fifteenth and Twentyeighth Avenues by Charles Kirkpatrick in the 1910s (pers. comm. 30 March 2010). The lot was purchased in 1915 by Charles Kirkpatrick, an employee with the Metropolitan Board of Water Supply and Sewerage (LPMA CT Vol1176 Fol 199). The Kirkpatrick family lived in the Hoxton Park area from 1882, when Charles' father James worked as a stonemason on the construction of the Upper Nepean Scheme – Upper Canal (Kirkpatrick Family Archives 2010). Following completion of the canal, James became the first Maintenance Overseer, and lived with his family in the weatherboard cottage at the West Hoxton Maintenance Depot, on Twentyeighth Avenue opposite lot 433. Charles and his brother Joseph Kirkpatrick were also maintenance workers on the Upper Canal, and lived at the cottage site. Lot 433 remained in the hands of the Kirkpatrick family until 1964, when it was sold to Roy Gimellaro, market gardener (LPMA CT Vol1176 Fol 199).

The shed was in use as a smithy by at least 1926: Bob Kirckpatrick liked to visit the workshop as a boy, and remembers learning some 'bad language' there. The Sands' Directory lists H Porch as blacksmith in Hoxton Park between 1922 and 1927, and W Silk as a Blacksmith in 1922 and 1923. Hornby Porch owned a farm on Gurner Avenue in Austral from 1920 until the 1940s (LPMA CT Vol 1131 Fol 130). However, Bob Kirkpatrick remembers Billy (William) Chamberlin as the blacksmith in the late 1920s and 1930s (pers. comm. 30 March 2011). Chamberlin 'cut and shut' wheels on drays and sulkies, and shod the draft horses carting timber to Liverpool along Fifteenth Avenue (Hoxton Park Road), charging 6 shillings for four shoes. Billy Chamberlin left Austral to fight in WWII, but never returned. The smithy was later run by Harry Porch. Following the war, Joseph Kirkpatrick used the shed to store grass, collected during maintenance works on the Upper Canal, until the roof blew off in a large storm (pers. comm. 30 March 2011).

A 1930 aerial photograph of the Austral area confirms that a small structure had been erected on the site by this date (Figure 5.186). The site was close to an important local road crossing of the Upper Canal, linking the north and west parts of the Hoxton Park Estate with Liverpool, and to the West Hoxton Cottage Site, the maintenance depot for Section 9 of the Upper Canal. The photograph shows that the land was cleared for pasture by this time, but that the majority of the lot was separated from the smithy by a small watercourse.

0 25 50 100 150 200 Meters

Horizontal datum: GDA94/MGA Zone 56
Background images: Detail from Geoscience Australia, Aerial photograph 3429-803, Sydney Survey, 1930 (left) and Land and Property Management Authority, Aerial photograph 228-5031, Run 24, Liverpool NSW, 1955

Figure 5.186 Blacksmith's workshop in 1930 (left) and 1955 (right), circled in red.

A 1955 aerial photograph shows that the structure was still present at this date. The current owner of the property at 240 Fifteenth Avenue has indicated that he removed the structure from the corner of the lot in the 1970s, at the request of Council. At the time, the building was extremely dilapidated and was considered to be a traffic hazard as it blocked the line of sight for cars turning out of Twentyeighth Avenue (pers. comm., 2 December 2010).

The location of the smithy is indicated by a series of timber posts and rails, standing to an approximate height of 2m, which includes part of a door frame addressing Fifteenth Avenue (Figure 5.187). Attached to the posts is a pair of original wrought iron hinges, brackets and spikes (Figure 5.188-Figure 5.189). Immediately south of the posts are two large stone blocks, one of which had been the foundation for a water trough.

Figure 5.187 Remains of former blacksmith's workshop.

Figure 5.188 Iron gate hinge.

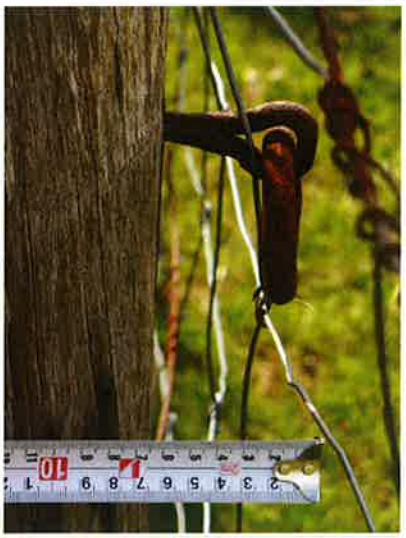


Figure 5.189 Iron spike and ring.

There is some potential that archaeological relics and deposits associated with the blacksmith's workshop are present in the site. The majority of the lot appears to have been maintained as pasture since the 1930s, and the workshop site has not been developed since the building was demolished in the 1970s. As such, any archaeological remains should be relatively intact.

Summary Statement of Significance

The former blacksmith's workshop is associated with the development of local industry in the Austral and Hoxton Park area in the early twentieth century, supporting timber carters and other forms of horse-drawn transportation between the local area and Liverpool. It is also associated with the Upper Canal maintenance workers' depot at the corner of Fifteenth and Twentyeighth Avenues. The potential

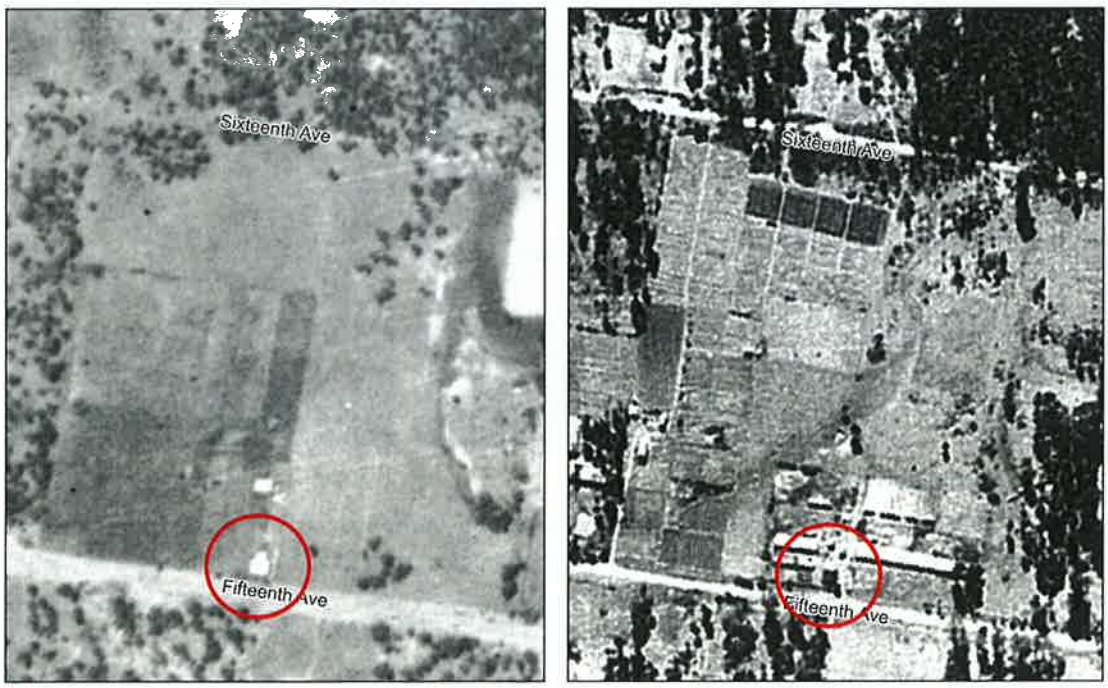
archaeological resources associated with the site have the potential to provide information not available from other sources concerning the daily life and working practices of a rural blacksmith in the early- to mid-twentieth century.

The former blacksmith's workshop on Fifteenth Avenue meets the following criteria for local heritage significance: a) and e).

5.4.2 Weatherboard House at 305 Fifteenth Avenue, Austral

Lot 355 of the Hoxton Park Estate was purchased by William Nickels, farmer of Hoxton Park, in August 1892, along with lots 296 to 298 and 356. The land was subsequently transferred to Frederick Nickels, labourer of Hoxton Park (1913), William Frederick Killinger, tanner of Liverpool (1920), and Harold Lionel Bare, farmer of Hoxton Park (1920). In 1945, the Killinger family, as mortagees exercising the power of sale, sold the land to Kurt Bratel, poultry farmer of West Hoxton. In 1947, Lot 355 was transferred to Marmaduke Randall Bateson Mount, poultry farmer of West Hoxton, along with the neighbouring lots 353 and 354. The land was later transferred to John Livermore, poultry farmer of Padstow (1951), Annabel Livermore, widow of West Hoxton (1968), and Alice Webster and James Edward Livermore (1974) (LPMA CT Vol 970 Fol 114; 1070, Fol 192; Vol 3073, Fol 62; and Vol 5780, Fol 54).

The single-storey weatherboard house, now located at 305 Fifteenth Avenue, is one of the few buildings apparent on the 1930 aerial photograph of the area. This photograph also shows that the surrounding landscape was cleared for farming by this date (Figure 5.190). By 1955, a series of long, linear farm buildings had been constructed behind the house, crossing lots 354 and 355, likely associated with the poultry farm of John Livermore. A possible hedge or fence has also been established along the street in front of Lot 355.



Horizontal datum: GDA94/MGA Zone 56
Background images: Detail from Geoscience Australia, Aerial photograph 3429-803, Sydney Survey, 1930 (left) and Land and Property Management Authority, Aerial photograph 228-5108, Run 25, Liverpool NSW, 1955

Figure 5.190 Aerial photographs of the land at 305 Fifteenth Avenue in 1930 (left) and 1955 (right). The house is circled in red.

The house stands on the north side of the street and is obscured from view behind a high, unkempt hedge, with mature trees to each side (Figure 5.191-Figure 5.192). A much larger house has recently been constructed to the northeast, on lot 354, and an orchard has been planted to the north and west.

The house is small, likely four rooms, with a steep-pitched corrugated iron roof, a bull-nosed verandah along the front, an internal brick chimney, and a skillion roofed addition to the rear. There is a central front door flanked by timber framed windows. The verandah has plain timber posts with chamfered corners. The large size of the roofing sheets indicates that they may be original. AMBS did not receive permission to enter the property. Inspection from the street indicates that the weatherboard cladding may also be original; however, termite or similar damage is evident at the south-east corner (Figure 5.193).

Figure 5.191 The weatherboard house at 305 Fifteenth Avenue.

Figure 5.192 View to the house along Fifteenth Avenue to the east.

Figure 5.193 Detail of the east elevation showing termite damage.

Although the house cannot be aligned with the buildings indicated on the 1906 Reconnaissance Map, the Victorian vernacular architectural style indicates that it may have been built during the late nineteenth or early twentieth century. As such, it is likely to be among the earliest houses within the study area. The original curtilage of the cottage has been reduced to a small area that is now defined by plantings, with a high chain wire security fence along the front. According to a neighbour, brick paving at the front of the house is not original, but was, laid in recent years. This paving is obscured by building materials stacked on the verandah.

In 2004, the site was identified during the public consultation phase of the Liverpool Heritage Study Review as having historic heritage interest. FORM architects pty ltd agreed that there was potential to gain more information from architectural, archaeological, and documentary research of the site, and recommended that the property be listed on Liverpool LEP. The relatively early date and apparent integrity of the house and remnant garden, albeit within a constrained curtilage, indicate the potential for archaeological relics and deposits that could provide new information concerning early settlement and land use practices associated with the development of the Hoxton Park Estate.

Summary Statement of Significance

> *The weatherboard house at 305 Fifteenth Avenue is one of the earliest extant houses in the Austral area, and as such provides evidence of the history of settlement of the Hoxton Park Estate, a historic subdivision west of Liverpool. The associated potential archaeological resources may provide information not available from other sources concerning the daily lives of the inhabitants of the house during the late nineteenth and early twentieth centuries.*

The weatherboard house at 305 Fifteenth Avenue meets the following criteria for local heritage significance: a), e) and g).

5.4.3 Weatherboard House at 15 Seventeenth Avenue, Austral

In August 1920, Rachel Lee purchased lot 213 in the Hoxton Park Estate from the Asset Realization Company Limited (LPMA CT Vol 1101 Fol 115). Lee was the wife of Joseph James Lee, a tailor's cutter from Marrickville. Ownership of the land was subsequently transferred to Richard James Lee, who worked as an electrical engineer in the West Hoxton area (September 1934); Aleksander Valgma, a factory worker from Hoxton (1949); and his widow, Arda Valgma (June 1967).

The 1930 aerial of the property shows that it was covered in trees at this date; however, by 1955, some of the trees had been cleared and several buildings had been constructed on the property, including the present weatherboard house (Figure 5.194).

Horizontal datum: GDA94/MGA Zone 56
Background images: Detail from Geoscience Australia, Aerial photograph 3429-803, Sydney Survey, 1930 (left) and Land and Property Management Authority, Aerial photograph 228-5031, Run 24, Liverpool NSW, 1955

Figure 5.194 Comparison of the 15 Seventeenth Avenue site in 1930 (left) and 1955 (right).

The house at 15 Seventeenth Avenue is a simple, timber-framed, weatherboard clad structure, with a corrugated iron gable roof (Figure 5.195). It has skillion-roofed additions to the side and rear. A brick chimney at the west end of the rear addition indicates that this section was likely used as the kitchen. The house provides a rare example of a small-scale vernacular weatherboard house in the Austral area.

Figure 5.195 The house at 15 Seventeenth Avenue.

AMBS did not receive permission to enter this property; however, based on an inspection from the street, the building is in poor condition and is likely abandoned. A brick house standing on the

neighbouring property is likely the present residence. In Nov 2008, a building area was cleared at the front of the property and Liverpool Council issued a construction certificate for a dual occupancy and swimming pool.

Assessment of Significance

In the 2004 Liverpool Heritage Study Review, FORM architects pty ltd identified the house at 15 Seventeenth Avenue as having local heritage significance, and recommended listing of the property on Liverpool LEP.

The summary statement of significance for the house was:

> *There is potential to gain more information on the site from further architectural archaeological documentary research.*

The recommended management was:

> *Prior to any redevelopment of the site of this building or any redevelopment, alteration or addition to the building a Statement of Heritage Impact (SHI) should be prepared. The SHI should include a detailed history which will aid in the provision of a detailed significance assessment. The SHI should also provide advice as to the level of change that can occur without compromising the significance of the building.*

Although a detailed study of the house at 15 Seventeenth Avenue has not been undertaken, and the house itself was not accessed, AMBS' review of land title information and early aerial photographs indicates that the house is unlikely to date earlier than the mid-1930s. The description of the house by FORM mentions that *attached to the western elevation is an exterior chimney stack constructed from iron sheets*. The chimney is in fact of brick and appears to be consistent with a post-1940s style. Although there has been little subsequent development of the property, and the rustic setting of the building has some aesthetic interest, the potential archaeological resources of the site are unlikely to provide new information which cannot be obtained from other sources. On current evidence, property does not satisfy the criteria for local heritage listing.

5.4.4 Weatherboard House at 11 Gurner Avenue, Austral

In March 1900, lots 2 and 3 of Plan 3403 (Ickleton Estate) were purchased by George Robert Mansell, a Lieutenant in Her Majesty's Navy (LPMA CT Vol 1230 Fol 237). The land was subsequently sold to William Carter of Sydney, farmer (January 1903); William Wrightson of Randwick, journalist (February 1904); and Henry William Ernest Steadman of Drummoyne, contractor (July 1908) (LPMA CT Vol 1311 Fol 130). Henry Steadman also owned lots 5, 6 and 7, which he had purchased in 1900, and he may have been looking to expand upon his original property (LPMA CT Vol 1339 Fol 37).

In September 1914, Steadman sold lots 2 and 3 to John James Palmer of Willoughby, box maker. The property was subsequently sold to William Martindale of Liverpool, poultry farmer (February 1916); and Hornby Porch of Liverpool, also a poultry farmer (December 1920). The property remained in the hands of the Porch family for the following three decades, and it is likely that the house at 11 Gurner Avenue was built during this time (LPMA CT Vol 1311 Fol 130). This suggestion is supported by the 1930 aerial photograph of the property, which shows a small building in this location (Figure 5.196).

In August 1945, lots 1, 2 and 3 were transferred to Porch's three sons, who each held a one third share in the property: Hornby (Harry), John Hornby, and William Charles Frederick Porch (LPMA CT Vol 1311 Fol 130, Vol 5517 Fols 154-156). In October 1948, the Porch sons sold the property to the Stellins family, who subsequently broke up the land, selling lot 2 to farmers John and Mary

Therbridge (August 1949; LPMA CT Vol 5517 Fols 154-156, Vol 6028 Fol 181). The 1955 aerial photograph of the property shows that a second house had been constructed on lot 2 by this date (15 Gurner Avenue).

The extant property comprises two separate dwellings on the north side of the street; a modern brick dwelling, with an adjacent weatherboard house, to its west. The weatherboard house is now surrounded by a large yard, but was previously surrounded by market gardens (Sam Mollusco, pers. comm., 7 February 2011).

Horizontal datum: GDA94/MGA Zone 56
Background images: Detail from Geoscience Australia, Aerial photograph 3429-805, Sydney Survey, 1930 (left) and Land and Property Management Authority, Aerial photograph 228-5031, Run 24, Liverpool NSW, 1955

Figure 5.196 Aerial photographs of the house at 11 Gurner Avenue, 1930 and 1955.

The weatherboard house has a medium pitched corrugated metal roof with gable ends, an architectural style consistent with a 1920s date. The front is asymmetrical, with a half verandah and front facing gable; however, there is evidence of several phases of construction and it is not currently clear which section is the earlier part of the building. A brick chimney forms part of the rear section of the house.

The weatherboard house is a composite of two cottages: a not unusual form of extending the available living area as families grew (Figure 5.197-Figure 5.198). Often, additional rooms would be added to the original cottage as required, a process which could see kitchens being shifted further to the rear with a series of chimneys identifying original positions (Moore et al 1993:91, 102). The connection between the two cottages is clearly defined by the join in the weatherboards. That there is one chimney only, indicates that the extension may have been roughly contemporary with the original cottage. Alternatively, the kitchen was external and was subsequently enclosed in the extension. Although not in good condition, the exterior of each cottage retains original features, including corrugated steel roof, verandah posts and framed casement windows. The interior of the four room layout of the front section retains many original fixtures and fittings, and a more modern bathroom. The rear of the house has been modified for use as a storage area for a variety of vehicles and stands on a concrete slab; however, some original architectural features are extant (Figure 5.199).

The weatherboard house has been disconnected from all utilities, as a condition of the construction of the brick house on the same lot (Sam Mollusco, pers. comm. 3 February 2011).

Figure 5.197 Weatherboard house at 11 Gurner Avenue, view from the southwest.

Figure 5.198 View from the southeast.

Figure 5.199 Interior of the rear building, now used for storing vehicles. Note original architraves around doors and windows.

Assessment of Significance

Whether the two sections of the house were constructed at the same time, or the second section was brought to the site at a later date is unknown; however, the architectural style of both is consistent with the Federation period of the first decades of the twentieth century. It is therefore possible that there are archaeological resources associated with the house at 11 Gurner Avenue, including underfloor deposits and rubbish pits adjacent to the house. Any archaeological resources that may be present in the site could have the potential to make a contribution to an understanding of the people who lived and worked on this site, and as such would have local significance. However, the evidence indicates that the site has been disturbed by landscaping and the potential for information that could

make a substantive addition to an understanding of the settlement patterns of the local area may be limited. As such, the property does not satisfy the criteria for local heritage listing.

In addition, it should be noted that the current owner has indicated that he would not support heritage listing of the property as an archaeological site. AMBS took this into consideration as part of the assessment of the site.

5.4.5 Former Bare Cottage, 265 Fifteenth Avenue,, Austral

Bare Cottage was formerly listed on Liverpool LEP as a place of local heritage significance. In 1992, the house was described as a mid-nineteenth century Victorian worker's style single storey cottage in dilapidated condition. Located on the north side of Fifteenth Avenue, on Lot 351 of the Hoxton Park Estate, it was a rare example of an early brick building in the local area. In April 2003, application was made to Liverpool Council to demolish the cottage. In September 2003, the house was partially destroyed by fire, and in December of the same year the Council granted the application to demolish the structure, with conditions specifying a photographic recording of the cottage and archaeological investigations of the site. The house was still standing in 2004, when FORM architects pty ltd completed a review of the Liverpool Heritage Study (Figure 5.200). FORM architects recommended de-listing Bare Cottage from the LEP, following demolition; however, the site should remain on the LEP until a detail assessment of the landscape had been undertaken. In addition, if Lot 351 were to be redeveloped or subdivided, a detailed archaeological survey and assessment of all land contained within the lot should be undertaken (FORM architects pty ltd 2004: Inventory 1970223). The cottage has since been demolished and de-listed from Liverpool LEP. However, AMBS has been unable to verify whether the recommended archaeological assessment of the lot has been prepared. A childcare centre is currently being constructed on the site (Figure 5.201-Figure 5.202).

Figure 5.200 Bare Cottage, 2004. (Source: Liverpool Heritage Inventory, Ref: 1970223)

Figure 5.201 Sign advertising new child care centre at 265 Fifteenth Avenue.

Figure 5.202 Child care centre under construction.

6 Constraints and Opportunities

6.1 General

Heritage places contribute to the character of a community by providing tangible evidence of its local history and identity. They can tell us stories about how the landscape and environment came to be the way it is today. At times of change, they help to preserve a connection to the past for current residents, and can provide a point of reference for interpreting the past to future generations. The proposed development of the NSW Government's SWGC land release area of the Austral and Leppington North Precincts represents a significant time of change.

The Australia ICOMOS Burra Charter has established conservation principles and processes for the management of heritage places. Conservation means all the processes of looking after a place so as to retain its cultural significance (Article 1.4). Conservation may, according to circumstance, include the processes of: retaining or reintroducing a significant use; retaining historical associations and meanings; maintaining, preserving, restoring, reconstructing, adapting and/or interpreting physical fabric; and will commonly include a combination of more than one of these (Article 14). It generally requires a cautious approach to change (Article 15).

The Burra Charter Process also recognises that the development of heritage conservation policies should include consideration of other factors affecting the future of heritage places, such as:

- the broader strategic planning framework for the SWGC,
- owners' requirements,
- available resources, and
- the physical condition of the places and their associated elements.

Constraints and opportunities that relate to the conservation and management of heritage places within the study area are outlined here and summarised in Figure 6.1-Figure 6.4 Key issues are discussed in more detail below.

Constraints

- The general planning framework for the SWGC recognises an obligation to protect and enhance land with cultural heritage value, as part of the broader environment. This includes an obligation to conserve the heritage significance of heritage items and places in accordance with best practice guidelines, including associated fabric, settings and views. It also includes an obligation to appropriately manage archaeological relics.

Opportunities

- Heritage listing of the 12 potential local heritage items and one heritage conservation area within the study area, would create an opportunity to conserve and interpret key aspects of the history of the area for present and future generations (Figure 6.1).
- The maintenance of key elements of the historic subdivision patterns, road alignments, street names and other toponyms, would respect the historic development of the area. The naming of new streets, parks, and other community places would also provide an opportunity to interpret various aspects of the history of the area for present and future generations.
- Interpretation of the cultural significance of listed and potential heritage items and places, by means of signage, walking paths, and other forms of media, may enhance public understanding and appreciation of local heritage.

- Maintaining and strengthening the rural character of historic road alignments of Bringelly, Cowpasture and Eastwood Roads, and Fifteenth and Edmondson Avenues by, for example, creating wide vegetation corridors adjacent to these roads and preserving extant plantings of large trees, would respect the regional historic significance of the roads, and provide points of aesthetic interest in the newly developed Precincts.
- Maintaining and strengthening key historic vistas at Jugdes Hill, Carnes Hill, and along the Upper Canal, would respect the historic and aesthetic significance of these places, and provide aesthetic points of interest in the newly developed Precincts (Figure 6.4).

6.2 Upper Nepean Scheme – Upper Canal

The SHR listed Upper Nepean Scheme – Upper Canal is the most significant element of European built heritage within the study area. As such, the Canal and its associated elements should be conserved and managed in accordance with heritage best-practice guidelines as outlined in the Burra Charter and the NSW Heritage Manual within the proposed development of the Austral and Leppington North Precincts.

Constraints

The Upper Canal forms the eastern boundary of a large part of the study area and a short section of the Canal passes through the study area, between Bringelly Road and Camden Valley Way. The ongoing operation of the Upper Canal in its nineteenth century form, using gravity to transport water long distances through an open channel, is a major element of its technical significance. This is supplemented by historic drainage systems, incorporating back or coping drains, flumes and culverts. The rural setting of the Canal also contributes to its aesthetic significance, as a picturesque element of the broader landscape.

Some housing has already been established in the vicinity of the Canal corridor, as part of the mid-to late-twentieth century development of land in Austral. The construction of new roads, cycleways, and pedestrian footpaths, and the intensification of suburban housing and community facilities in close proximity to the heritage curtilage of the Canal, including the construction and management of stormwater and sewerage systems, will inevitably place pressure on SCA's ability to manage and control water purity, such that SCA may need to construct additional flumes, culverts or other drainage structures, to supplement heritage elements currently used to control drainage. SCA has recommended that there should be no stormwater runoff above the current volume and below the current quality entering the Canal corridor during the construction phase or post development in the Austral and Leppington Precincts. Adequate stormwater controls should prevent some potential impacts on the technical significance of the Canal. An increase in the local population will also lead to an increase in public activity adjacent to the Canal, which may in turn have direct and indirect impacts on the physical fabric of the Canal and its associated elements. There is potential for an increase in damage to significant elements such as maintenance road gates, for example as a result of traffic accidents, pranks, theft and vandalism. It should be anticipated that these impacts will be gradual and cumulative, and will thus require long-term solutions. Potential long-term impacts and viable solutions should be addressed in consultation with SCA and NSW Heritage Council, and should be consistent with the recommendations of the CMP for the Canal.

The Canal overbridges present a more immediate constraint, insofar as augmented traffic and pedestrian corridors will be required between the Precincts and recreational centres in the Western Sydney Parklands. There is currently one riveted iron trough overbridge within the study area, and two immediately adjacent to the study area. Dated c.1904-1909, these overbridges have been assessed as having exceptional significance (Figure 6.2). In addition, there are six reinforced concrete beam bridges immediately adjacent to the study area, dated c.1917-1918, assessed as having considerable

significance, and two mid-twentieth century concrete and steel beam bridges at Bringelly Road and Camden Valley Way, which are assessed as having little or no significance. Heritage constraints associated with these crossings are:

- Required augmentation of Canal crossings should be limited to extant reinforced concrete beam bridges, and in particular to existing east-west through roads: Camden Valley Way, Bringelly Road, and Fifteenth Avenue;
- All bridges of exceptional significance should be conserved in their current condition, in accordance with the recommendations of the CMP;
- Designs and materials of the new bridge additions should be sympathetic to the original bridges. Augmentation of bridges having considerable significance should be restricted to one side only, particularly where there is evidence of other recent modification, while preserving evidence of the historic form and construction techniques on the other side;
- Augmentation of existing bridges and feeder roads should aim to limit or avoid changes to existing patterns of surface drainage; and
- Modifications proposed for bridges of exceptional or considerable significance should only be undertaken in consultation with the SCA and the Heritage Branch.

The broader landscape setting of the Upper Canal is an important consideration in the precinct planning process. The immediate setting of the Canal, and associated elements, is protected by its heritage curtilage, which is roughly defined by the security fencing. However, the historic and aesthetic significance of the Canal cannot be separated from the broader rural landscape, which will be substantially altered by the proposed development. The creation of the Western Sydney Parklands on the eastern side of the Canal goes some way towards addressing this issue. However, managing key views along the Canal, particularly from public crossing points, and maintenance areas of public open space adjacent to the Canal would contribute to the integration of the historic setting of the Canal into its new urban setting. Similarly, the historic relationship between the alignment of the Canal and that of Cowpasture Road, should be interpreted through the retention of key landscape elements such as cultural plantings at the former Section 8 cottage site, at the junction of the Canal, Bringelly, and Cowpasture Roads, and the row of three mature Bunya Pines on the south side of Bringelly Road.

The key constraints arising from the heritage significance of the Upper Canal are:

- An obligation to maintain the form, fabric, and operational utility of the Canal and associated built heritage elements in their original location;
- An obligation to preserve technological evidence of nineteenth century hydraulic engineering and Canal building techniques, as illustrated by the Upper Canal, and progressive improvements in the construction of culverts, flumes and overbridges etc;
- An obligation to conserve some picturesque elements of the Canal, including its serpentine route, evidence of its original rural setting, and associated cultural plantings;
- An obligation to conserve evidence of the historic relationship between the alignment of the Upper Canal and Cowpasture Road;
- Costs related to the ongoing maintenance and conservation of the Canal, as an historic operational element of Sydney's water supply infrastructure, in a more developed urban environment. This includes costs associated with
    - routine and preventative maintenance of the Canal and associated built heritage elements, and
    - construction and maintenance of appropriate surface drainage of land adjacent to the Canal; and
- An obligation to provide arrangements for appropriate access to and security for the Canal and its historic heritage curtilage, including strategies to preserve the quality of the water

and to prevent inadvertent damage and intentional vandalism to the physical fabric of the Canal.

Other constraints include:

- Statutory requirements for the conservation and maintenance of the Upper Canal as a State heritage item, as outlined in Section 2.3 above, including the protection of archaeological relics associated with the Canal;
- Potential for archaeological relics associated with the construction and maintenance of the Upper Canal to be exposed during modifications to roads or bridges within its SHR curtilage; and
- SCA requirements for the ongoing operation of the Canal. This may include future decommissioning of the Canal as an operational element of the water supply system.

Opportunities

The picturesque qualities of the Upper Canal provide opportunities to integrate this historic item of water infrastructure into the social and cultural life of the community. The provision of parks, walking and/or cycling trails, and other areas of public open space adjacent to the Canal could contribute to the open landscape setting. They could also be designed to improve security for the Canal, through increased passive surveillance by members of the general public.

The row of three Bunya Pines along Bringelly Road are aesthetically associated with the Canal, and are prominent visual landmarks within the broader landscape. The preservation of these and other cultural plantings associated with the Canal provides an opportunity to maintain established plantings within the study area, and signal the historic significance of both the Canal and Bringelly Road.

Interpretation of the Canal though explanatory signage, in conjunction with the preservation of historic fabric, could inform the local community about the heritage significance of the Canal, and foster an appreciation of its history and ongoing value to the community. Interpretation could explore a range of themes associated with the Canal, including the history of Sydney's water supply and related engineering achievements.

A summary of key opportunities arising from the heritage significance of the Upper Canal are:

- Conservation of the Upper Canal as an operational element of Sydney's water supply infrastructure;
- Preservation of significant historic fabric of the Upper Canal and associated built heritage elements in close proximity to the Austral and Leppington North Precincts;
- Conservation of picturesque elements of the Canal, including its serpentine route, evidence of its original rural setting, and associated cultural plantings, through the provision of parks, walking and/or cycling trails, and other areas of public open space adjacent to the Canal;
- Interpretation of the heritage significance of the Upper Canal and its heritage curtilage to the general public, to foster an appreciation of its history and ongoing value to the community;
- Improved security for the Upper Canal, through increased passive surveillance by members of the general public.

6.3 Local Heritage Items and Potential Heritage Items

Constraints

Future development of the Austral and Leppington North Precincts should be undertaken in such a way as to minimise impacts on local heritage items and potential heritage items (Figure 6.1). This includes the ongoing maintenance and protection of the physical fabric of the item, an appropriate landscape setting, an appropriate use, and key views associated with the item.

There are four local heritage items within the study area. These places are currently subject to statutory protection that will constrain development of the Precincts:

- Kemps Creek forest, Gurner Avenue (off), Kemps Creek
- Row of Bunya Pines, 145 Bringelly Road, Leppington
- Brown Memorial and water trough, 145 Bringelly Road, Leppington
- Dwelling and rural lot, 1720 Camden Valley Way, Leppington

AMBS has identified an additional 12 potential local heritage items and one heritage conservation area, which, if listed in an amendment to either the SEPP Growth Centres 2006, Liverpool LEP or Camden LEP, would also constrain development of the Precincts. These include a range of built and landscape heritage items, and areas of archaeological sensitivity, although all are associated with the development of Austral and Leppington as distinct, semi-rural communities in the early to mid-twentieth century period:

- Leppington Public School, 142-148 Rickard Road, Leppington
- Austral Town Centre Conservation Area
- H J Starr Progress Hall, 264 Edmondson Avenue, Austral
- Ian's Hardware and House, 256 Edmondson Avenue, Austral
- Brick House and Garden, 275 Edmondson Avenue, Austral
- House and Garden, 170 Edmondson Avenue (125 Eighth Avenue), Austral
- Cement Rendered House 40 Browns Road (60 Fifth Avenue), Austral
- W V Scott Memorial and Park, Austral
- Hellenic Monument, Lot 10 DP 771080, Austral
- Blacksmith's Workshop (Former) – Archaeological Site, 240 Fifteenth Avenue, Austral
- Weatherboard House – Archaeological Site, 305 Fifteenth Avenue, Austral
- Cowpasture Road – Cultural Landscape, Leppington
- Bringelly Road – Cultural Landscape, Austral and Leppington

The potential built heritage items listed above are generally modest in scale, and are historically associated with an open, agricultural landscape setting. Future development in the vicinity of each heritage item and conservation area should have an appropriate scale and mass, which respects the aesthetic significance (if any) and landscape setting of the item. Adjacent development should not dominate or overwhelm the item. Development adjacent to the Cement Rendered House at 40 Browns Road, Austral and Leppington Public School, 142-148 Rickard Road, Leppington, in particular, should consider these principles.

Development in the vicinity of war memorials at 145 Bringelly Road and at the W V Scott Memorial Park, and in the vicinity of Forest Home at 1720-1726 Camden Valley Way, should respect the social value of these places to the local community. The original locations of the war memorials were chosen by the community, and the memorials act in lieu of graves for the deceased servicemen. Relocation of commemorative parks and plaques should only be considered as a last resort, and in consultation with family and other stakeholders.

Opportunities

The conservation of a range of built and landscape heritage items of the mid-twentieth century demonstrates respect for this period of development in the local area, and could be used to foster an appreciation of local history to the community. Built and landscape heritage items may provide an aesthetic point of interest in the newly developed Precincts, contributing in a tangible way to a local sense of place and community identity.

The appreciation of individual places can be enhanced through an interpretation strategy, exploring a range of themes associated with the area, including the history of agriculture and market gardening in the area, education, memorialisation, early commercial activity, the role of migrant farmers, and community organisations such as the Austral and Leppington Progress Associations.

The proposed Austral Town Centre Conservation Area presents an opportunity to maintain and strengthen the historic character of the Town Centre, by conserving a cohesive grouping of modest, mid-twentieth century buildings, including three fibro houses, all associated with development of a strip of land in the c.1940s on the west side of Edmondson Avenue by Emma and H G Starr, Austral Postmaster. Listing as a Conservation Area would entail less onerous regulatory control of these properties, focusing on the protection of the street-facing facades and overall character of the streetscape. The Austral Town Centre Conservation Area would be an appropriate location for interpretation of the historical development of the local area.

6.3.1 Archaeological Sensitivity

The archaeological resources of any site are finite and have the potential to provide insights into everyday life that are not available from any other resource. As such, potential archaeological sites may have high scientific or research value. Statutory protection for archaeological relics is provided by the Heritage Act, as described in Section 2.3 above.

Three main sites have been identified through background research as having potential archaeological sensitivity:

- Forest Home, 1720-1726 Camden Valley Way, Leppington
- Blacksmith's Workshop (Former) – Archaeological Site, 240 Fifteenth Avenue, Austral
- Weatherboard House – Archaeological Site, 305 Fifteenth Avenue, Austral

These sites are associated with the early- to mid-twentieth century history of the study area, and may provide evidence of an industrial or domestic nature.

In addition, the SHR curtilage of the Upper Canal has identified archaeological sensitivity which must be managed in accordance with the requirements of Section 60 of the Heritage Act. Should excavation adjacent to the Upper Canal be required for widening or modifications to road or pedestrian bridges, the archaeological sensitivities should be managed appropriately.

AMBS has not been able to identify with any certainty archaeological sites associated with early nineteenth century land grants, or associated tenant farmers. However, there is some potential for early road surfaces, culverts and drains associated with early nineteenth century roads to survive beneath hard road surfaces, where these follow historic road alignments. This is particularly relevant to the historic alignments of Cowpasture and Bringelly Roads.

6.4 Historic Subdivision Patterns and Road Alignments

As noted in Section 3.4.1 above, the majority of the study area was subdivided for smaller farm sites in the 1880s-1890s by speculative investors. These subdivisions overlaid an earlier pattern of colonial

land grants, bordering the Cowpasture and Bringelly Roads. The boundaries of some of these land grants are still evident in the landscape today, primarily in the form of road alignments, but also in the collective form of property boundaries, and in vegetation areas historically reserved from development.

Although many of the late nineteenth century subdivisions were initially unsuccessful, the pattern of the original subdivision plans is evident in the landscape today, including the rigid street grid and the three acre blocks established by Phillips & Company for the Hoxton Park Estate, north of Bringelly Road. These small blocks eventually formed the basis of a thriving culture of market gardening and poultry farming, commonly associated with European migrants of the mid twentieth century.

Opportunities

Precinct planning within the study area presents an opportunity to interpret the historic subdivision patterns and road alignments associated with the early European history of the area (Figure 6.3).

Maintaining and strengthening the rural character of historic road alignments by creating wide vegetation corridors adjacent to the roads and preserving extant plantings of large trees, would be a means of respecting the regional historic significance of the roads, and provide aesthetic points of interest in the newly developed Precincts. Historic road alignments and names should be preserved wherever possible.

New roads or vegetation corridors proposed as part of the Indicative Layout Plan (ILP) are generally aligned with key historic land grant boundaries, which would reflect this element of the history of the area. The naming of new roads may be used to interpret these elements of the landscape. Discrete variations in urban density and built form could also be used to interpret the pattern of land grants in the area.

The following roads have been identified as key features of the historic landscape:

- Cowpasture Road,
- Bringelly Road,
- Eastwood Road,
- Edmondson Avenue, and
- Fifteenth Avenue.

The following colonial estate boundaries have been identified as key features of the landscape:

- John Gurner's *Ickleton* land grant,
- Urban Fidkin's land grant, and an historic track associated with the eastern boundary of the estate,
- Southern boundary of Barron Field's *Hinchinbrook* land grant, and an historic track associated with this alignment,
- Western boundaries of John Jamieson's *Cow-de-Knaves* land grant,
- Northern, eastern, and western boundaries of Alexander Riley's *Raby* land grant, and
- Northern and eastern boundaries of Hannibal Macarthur's *Eastwood* land grant.

6.5 Historic Views

Opportunities

The physical analysis has identified a number of key high-points in the study area, where long natural views have been maintained and/or enhanced through cultural modification of landscape (Figure 6.4). These include:

- View from Judges Hill toward the west, and

- View from Carnes Hill, along Bringelly Road toward Sydney CBD in the east and the Blue Mountains in the west.

The view from Judges Hill is primarily associated with the positioning and orientation of the Hellenic Monument on Lot 10 DP 771080 by the Federation of Hellenic Associations. However, the toponym *Judges Hill* also preserves an earlier association with the original land grant to Barron Field, an early Supreme Court Judge in the Colony.

The view from Carnes Hill is primarily associated with the junction of the historic Cowpasture and Bringelly Roads, early key transport and communication routes in the Colony. The toponym *Carnes Hill* also preserves an association with Thomas Carne, an early resident of the land and Coroner of the Town of Liverpool.

Precinct planning within the study area presents an opportunity to preserve these views as historic and aesthetic points of interest in the area. Historic toponyms should be preserved, as evidence of past occupants and land use.

6.6 Interpretation Strategy

Interpretation is a means of presenting the story of a place in a way that will engage the community in its continuing care and protection, and by doing so conserve the significance of the place. It conveys an understanding of the history and cultural significance of the place though a range of actions, including the retention and maintenance of historic fabric, documentation of changes to the site, explanatory signage, and other forms of multi-media or heritage-themed activities. It can also be a source of enjoyment for local residents and visitors to the area.

Opportunities

Meaningful interpretation can be incorporated into the Planning Process for the Precincts. Opportunities to interpret the built and landscape heritage of the area include:

- Photographic recording of historic heritage items, places, and the broader rural landscape, to conserve evidence of the present environment for future generations. Photographic recording would contribute valuable information about environmental changes during development of the Austral and Leppington Precincts, and images could be considered for inclusion in the future interpretation displays.
- Placing interpretive signage containing appropriate text, historic images, and plans (where available) at various locations throughout the study area, to help residents and visitors understand the history and significance of key heritage items, places, and archaeological sites. Interpretive signage can also be used to reinforce historic linkages between widely dispersed heritage items, by addressing common historical themes and using a common design approach. Locations could include:
    - Pedestrian overbridges associated with the Upper Canal, so that people crossing from the Precincts to the Western Sydney Parklands can understand and appreciate the form and function of the Canal, and its historical setting in a rural landscape;
    - Sites of former Upper Canal maintenance workers' cottages, to provide an understanding of the role of maintenance workers in maintaining a clean and safe water supply, and to foster appreciation of the remnant plantings in these areas;
    - Austral Town Centre, to describe the historical development of the town and the role of the Austral Progress Association in the community;
    - High points at Judges Hill, Carnes Hill, and Leppington Public School, to explain the history of the development of the land in the context of the historic themes

outlined in this report, including historic patterns of subdivision and agricultural development;
  - Junction of Cowpasture and Bringelly Roads, to explain the importance of the early road network to the history and development of the area; and
  - Junction of the original alignment of Cowpasture Road and the later re-alignment of the road near to the Upper Canal, to explain the historical relationship between the road and the Canal, and to describe long term changes in the local landscape.
- Commissioning quality public art for key public spaces in the Precincts, which interpret various themes or periods of history of the area. Public art is a less traditional means of interpreting history, which can express alternative points of view and attract new audiences to an appreciation of local heritage. It can also provoke different emotional or spiritual responses to heritage places or associations in the community.
- Establishing heritage walking or bicycling trails, to encourage local people and visitors to the Precincts to make a connection with the history of the local area. Walking trails can be used in conjunction with signage, printed brochures, and other media such as podcasts to communicate the history of the area and create linkages between disparate elements and places. Key opportunities for heritage walking trails are:
  - Route along the Upper Canal; and
  - Route along Edmondson Avenue, through Austral Town Centre.
- Creating and maintaining an open landscape buffer along the route of the Upper Canal, to reinforce its historical setting in a rural landscape, whilst maintaining passive surveillance and security for the Canal.
- Creating or maintaining landscaped buffers along key historical roads, to reinforce the historic character of these roads within the landscape.
- Creating and/or maintaining roads or landscaped areas along the boundaries of early colonial land grants, to maintain physical evidence of the history of these grants within the landscape of the study area.
- Maintaining historic names of streets, public parks, and natural features within the landscape, including:
  - Cowpasture Road,
  - Bringelly Road,
  - Eastwood Road,
  - Browns Road and Avenue,
  - Edmondson Avenue,
  - Gurner Avenue,
  - Kelly Street,
  - Rickard Road,
  - Judges Hill,
  - Carnes Hill,
  - Craik Park,
  - W V Scott Memorial Park, and
  - Starr Park.
- Naming new streets, public parks, and other community places in accordance with the historic themes identified in this report, including themes associated with more recent migrant history of the area. Various stakeholders, including local residents and regional historical societies, could be given an opportunity to suggest themes or individual names for incorporation into the ILP. Figure 7.4 suggests appropriate names for new local roads which will follow historic land grant boundaries.

Constraints

The interpretation strategy for the Precincts should have a cohesive character, which reinforces historic linkages between the widely dispersed heritage items and places within the Precincts. Since heritage items are owned and maintained by various public and private authorities, consideration should be given to ways of designing and implementing a standardised aesthetic for interpretive signage, including funding for the creation and maintenance of signs and other forms of interpretive media.

Interpretation strategies should incorporate site-specific elements, and should not in any way reduce or detract from the cultural significance of existing or potential heritage items, places and archaeological sites.

6.6.1 Historic Themes

The Commonwealth and State government authorities have developed a series of historic themes that enable the comparative assessment of heritage values, and provide a structure for the future interpretation of the Precincts. The following historic themes have been identified in this report as illustrating significant aspects of the study area:

Australian Themes	NSW Themes	Local Themes
Peopling Australia	Ethnic influences and Migration	Development of rural economies, including market gardens and poultry farms
Developing local, regional and national economies	Agriculture	Rural landscape, market gardens, pig farms, poultry farms
	Commerce	General store, hardware store
	Communication	Post office, telegraph, historic tracks and roads
	Environment – cultural landscape	Kemps Creek Nature Reserve, agriculture, tree clearing, row of Bunya pines, serpentine route of the Upper Canal, route of the Old Cowpasture Road and Bringelly Road, mid-twentieth century gardens
	Industry	Blacksmith
	Pastoralism	Early land grants, water trough
	Technology	Upper Canal – elements associated with safe water supply and drainage
	Transport	Cowpasture Road, Bringelly Road, Fifteenth Avenue, Canal overbridges
Building settlements, towns and cities	Towns, suburbs and villages	Subdivision patterns, Austral Town Centre, areas of archaeological sensitivity
	Land tenure	Bringelly Road, Cowpasture Road, evidence of early land grants, subdivision patterns, areas of archaeological sensitivity
	Utilities	Upper Nepean Scheme – Upper Canal
	Accommodation	Twentieth century vernacular architecture, fibro house, house as archaeological site
	Education	Austral Public School, Leppington Public School
Developing Australia's cultural life	Domestic life	Working-class housing, mid-twentieth century houses and gardens, areas of archaeological sensitivity
	Social institutions	Austral Progress Association, H J Starr Progress Hall, Federation of Hellenic Societies monument
	Sport and Leisure	W V Scott Memorial Park
Marking the phases of life	Birth and death	War memorials

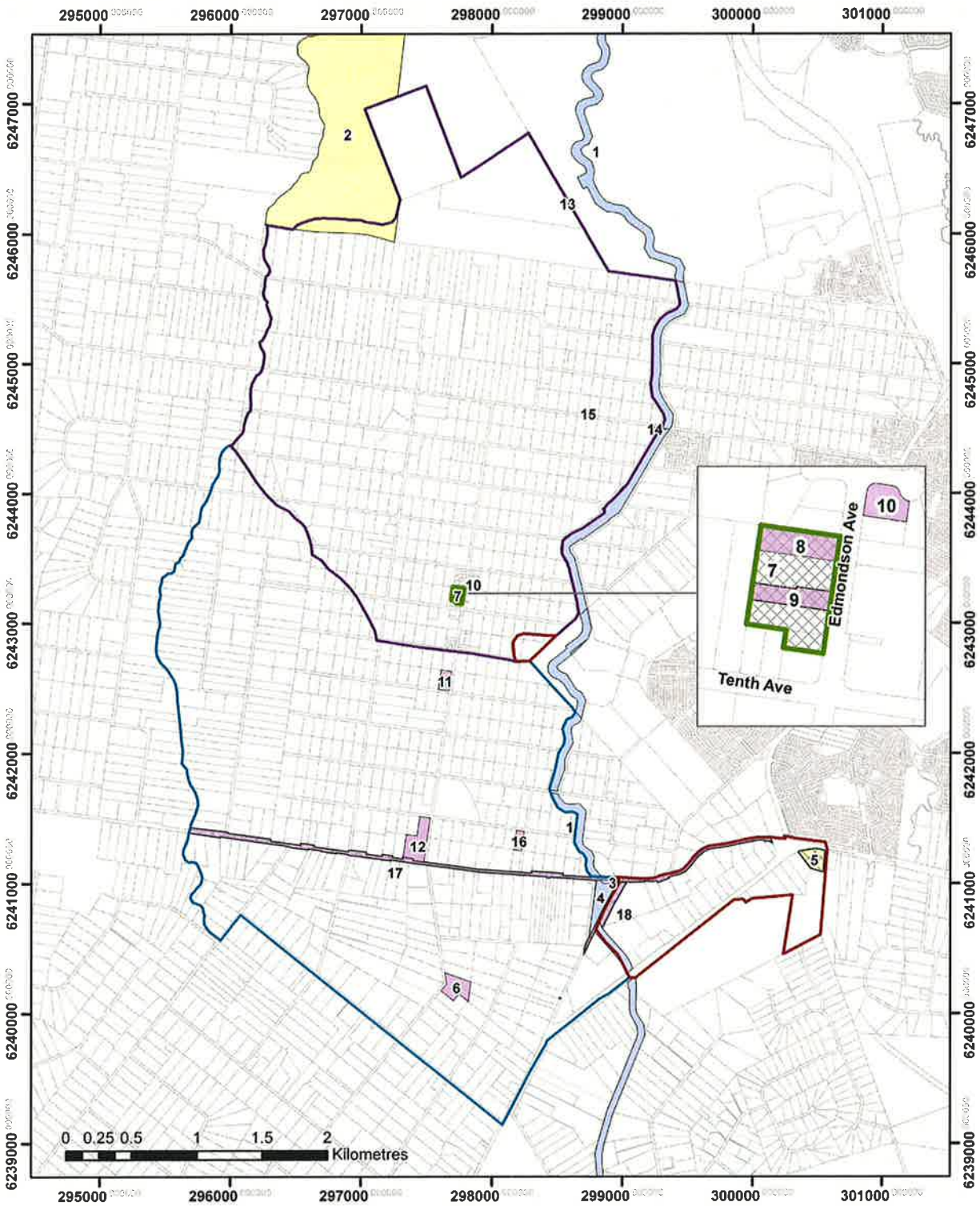
Australian Themes	NSW Themes	Local Themes
	Persons	Commemorative place names, war memorials

6.6.2 Storylines

People's stories and memories provide information about lived experience of the land, and how it has changed over time. Oral histories, videos and soundscapes could supplement historical documents and photographs as an expression of lived experience.

An oral history campaign initiated by Therese Sweeney, Managing Director of Memory Bank Cultural Media Inc, provides an example of ways in which the more recent history of the Austral and Leppington North Precincts can be preserved and interpreted for future generations. The Memory Bank project has focused on migrant farming history of the area, recording the stories of people who are often ignored or marginalised in more traditional forms of history. The project is using a variety of contemporary methods of disseminating this information, including an online repository of film and photographs, and publications through radio, television, and print media (Therese Sweeney, pers. comm., 22 February 2011; http://www.memorybank.org.au).

Some local stories may be preserved in the archives of Liverpool Council, Liverpool Library, and Liverpool Regional Museum, as well as private collections held by local residents.



Legend

- Austral Precinct
- Leppington North Precinct
- Investigation Areas
- Cadastre

Heritage Items

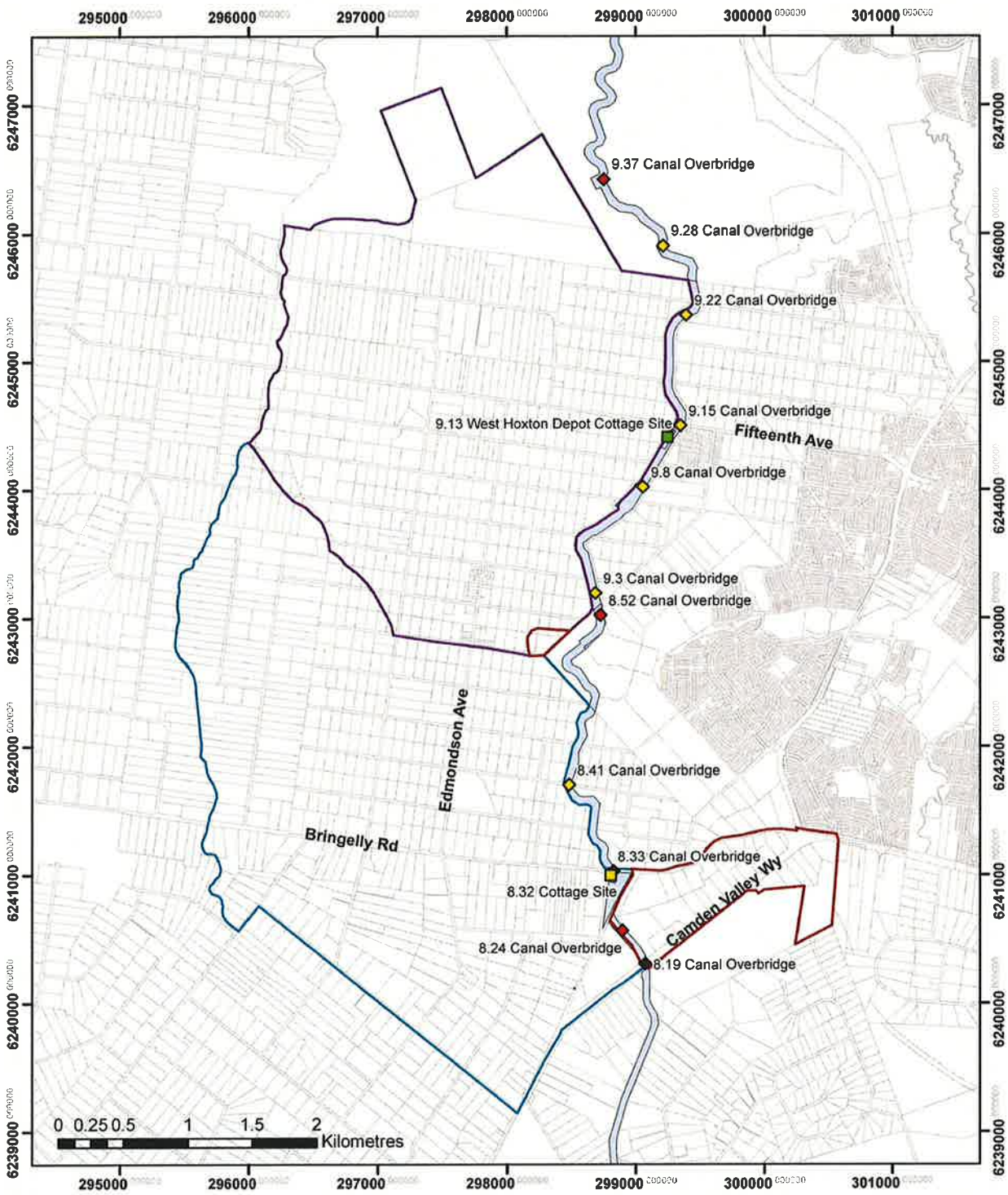
- State heritage item
- Local heritage item
- Potential heritage item
- Potential heritage conservation area
- Archaeological sensitivity

1 Upper Nepean Scheme - Upper Canal
2 Kemps Creek Forest
3 Row of Bunya Pines, Bringelly Road
4 Brown Memorial and Water Trough
5 Forest Home - Archaeological Site (Dwelling and rural lot)
6 Leppington Public School
7 Austral Town Centre Conservation Area
8 H J Starr Progress Hall, 264 Edmondson Ave
9 Ian's Hardware and House, 256 Edmondson Ave
10 Brick House and Garden, 275 Edmondson Ave
11 House and Garden, 170 Edmondson Ave
12 WV Scott Memorial and Park
13 Hellenic Monument, Lot 10 DP771080
14 Blacksmith's Workshop (Former) - Archaeological Site, 240 Fifteenth Ave
15 Weatherboard House - Archaeological Site, 305 Fifteenth Ave
16 Cement Rendered House, 40 Browns Road
17 Bringelly Road - Cultural Landscape
18 Cowpasture Road - Cultural Landscape

N

Background cadastral data © Department of Planning
Horizontal datum: GDA94/MGA Zone 56

Figure 6.1 Heritage items, potential heritage items, and areas of archaeological sensitivity.



Legend

- Austral Precinct
- Leppington North Precinct
- Investigation Areas
- Cadastre
- Sydney Water Supply Upper Canal

Upper Canal elements

Element, Grading of Significance

- Canal Overbridge, Exceptional
- Canal Overbridge, Considerable
- Canal Overbridge, Little or no significance
- Cottage Site, Considerable
- Cottage Site, Considerable with some intrusive

N

Background cadastral data © Department of Planning
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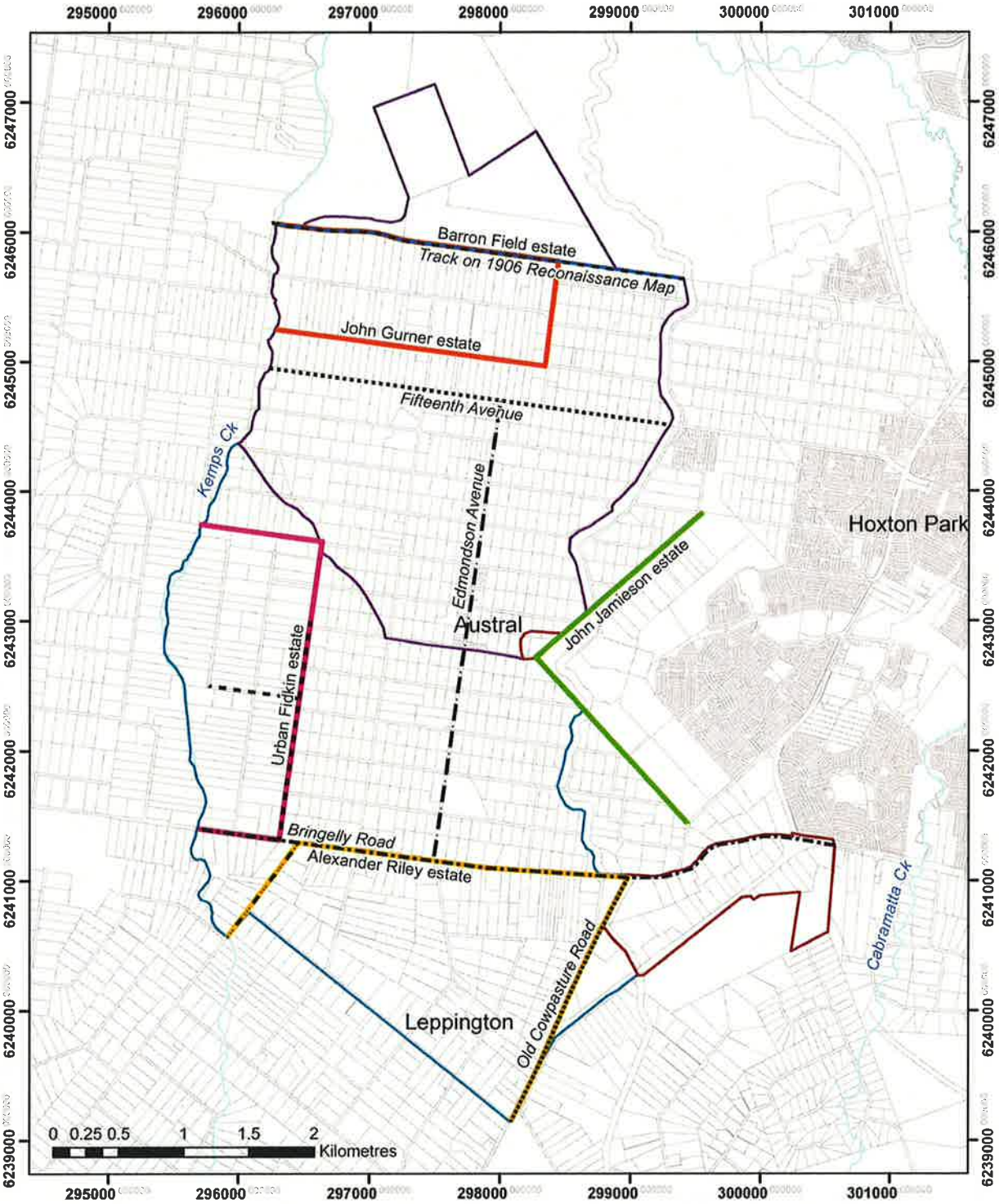
Figure 6.2 SHR Upper Nepean Scheme – Upper Canal. Lot boundary curtilage in blue. Overbridges and cottage sites indicated.



Legend

- Austral Precinct
- Leppington North Precinct
- Investigation Areas
- Cadastre
- Drainage

Historic estate boundaries

- John Gurner estate
- John Jamieson estate
- North boundary of Alexander Riley estate
- South boundary of Barron Field estate
- East boundary of Urban Fidkin estate

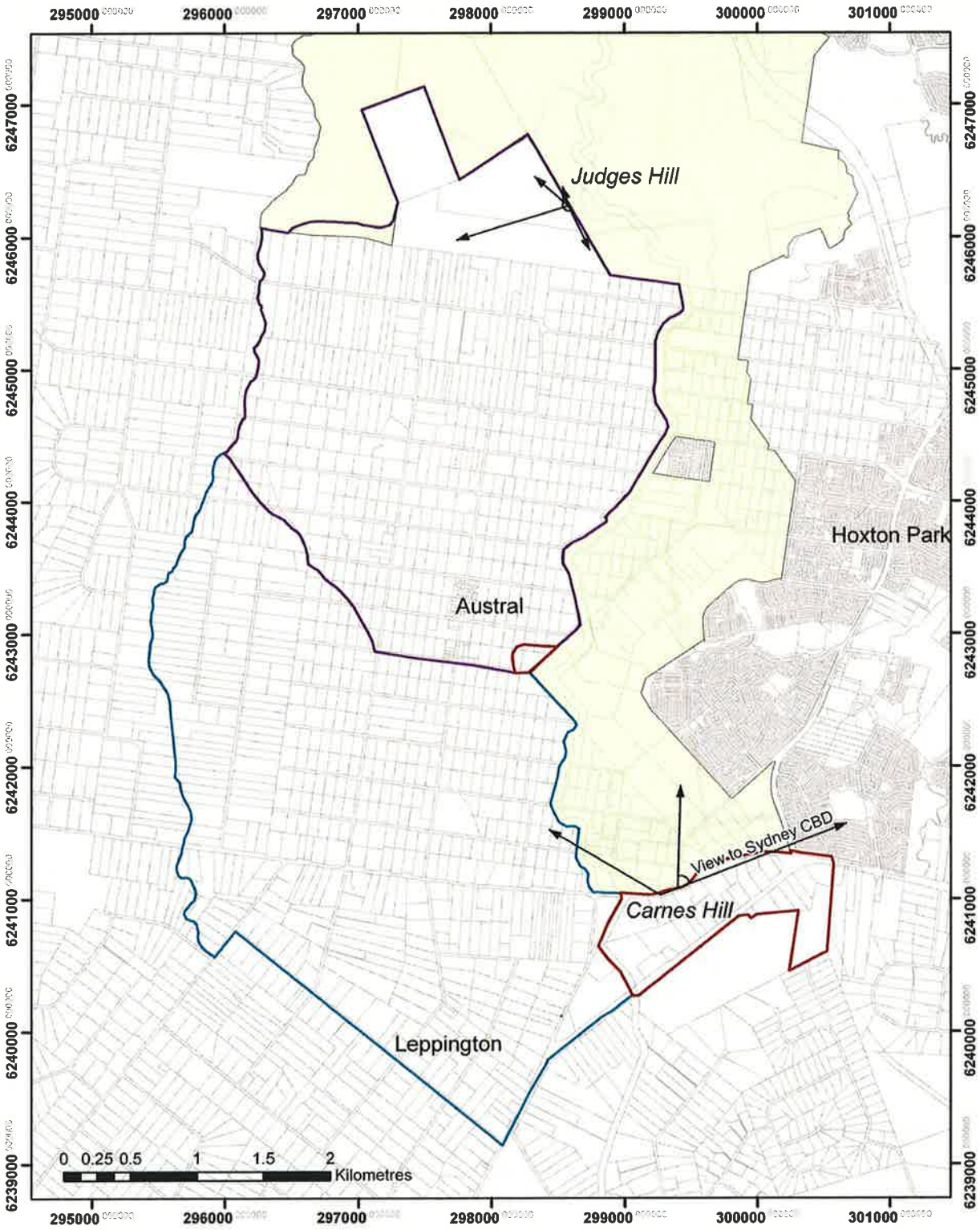
Historic Roads and Tracks

- Old Cowpasture Road
- Bringelly Road
- Eastwood Road
- Edmondson Avenue
- Fifteenth Avenue
- Tracks on 1906 Reconaissance Map

N

Background cadastral and drainage data © Department of Planning
Horizontal datum: GDA94/MGA Zone 56

Figure 6.3 Historic estate boundaries and road alignments.



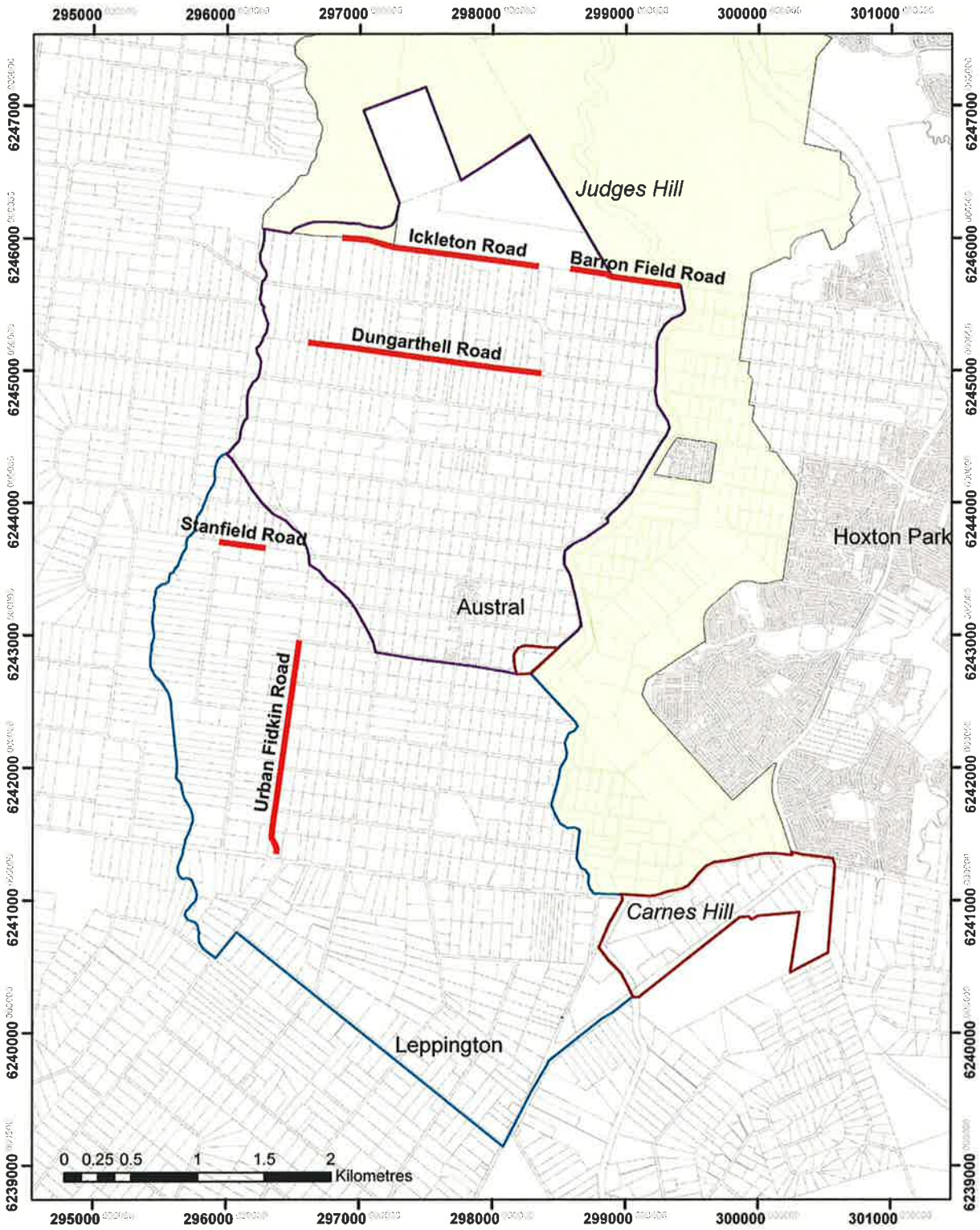
Legend

- Austral Precinct
- Leppington North Precinct
- Investigation Areas
- View
- Cadastre
- Western Sydney Parklands

N

Cadastral data: Department of Planning
Horizontal datum: GDA94/MGA Zone 56

Figure 6.4 Historic views.



Legend

- Austral Precinct
- Leppington North Precinct
- Investigation Areas
- Cadastre
- Western Sydney Parklands
- Proposed Road Names

N

Cadastral data: Department of Planning
Horizontal datum: GDA94/MGA Zone 56

AMBS

Figure 6.5 Proposed future naming of new local roads along early land grant boundaries. These names reflect the historic names of early land grants and the people associated with them.

7 Discussion of ILP and Recommendations

7.1 Preamble

This section includes a brief discussion of the Indicative Layout Plan (ILP) for the Austral and Leppington North Precincts in the context of the preceding analysis of heritage constraints and opportunities. Recommendations are provided to guide the management of historic heritage issues during the development of the Precincts. The ILP is attached in Figure 7.1.

There are four local heritage items and one State heritage item within the study area. In addition, this study has identified a further 12 potential local heritage items and one heritage conservation area within the study area. These items and places should be conserved for present and future generations. Conservation should recognise the historic, aesthetic, scientific/technical and social or spiritual values of these items or places. The values identified for each item are summarised in Section 5 above and in the Appendices to this report.

AMBS' preliminary recommendations regarding the future conservation of historic heritage items and potential heritage items have largely been addressed during the development of the ILP. The locations of various roads and sporting facilities have been redesigned to avoid direct impacts on identified heritage items and places within the study area. However, in some cases, the proposed road layout conflicts with the proposed heritage curtilage of potential heritage items. Moreover, the ILP does not explicitly address heritage issues, constraints or opportunities for individual places arising from the proposed development. The overall development prefigured by the ILP is highly likely to have an adverse impact on the SHR values of Upper Canal, which is aligned immediately adjacent to the eastern boundary of the study area. These issues will therefore need to be addressed during subsequent, more detailed planning stages for the Precincts, and during the Development Application process.

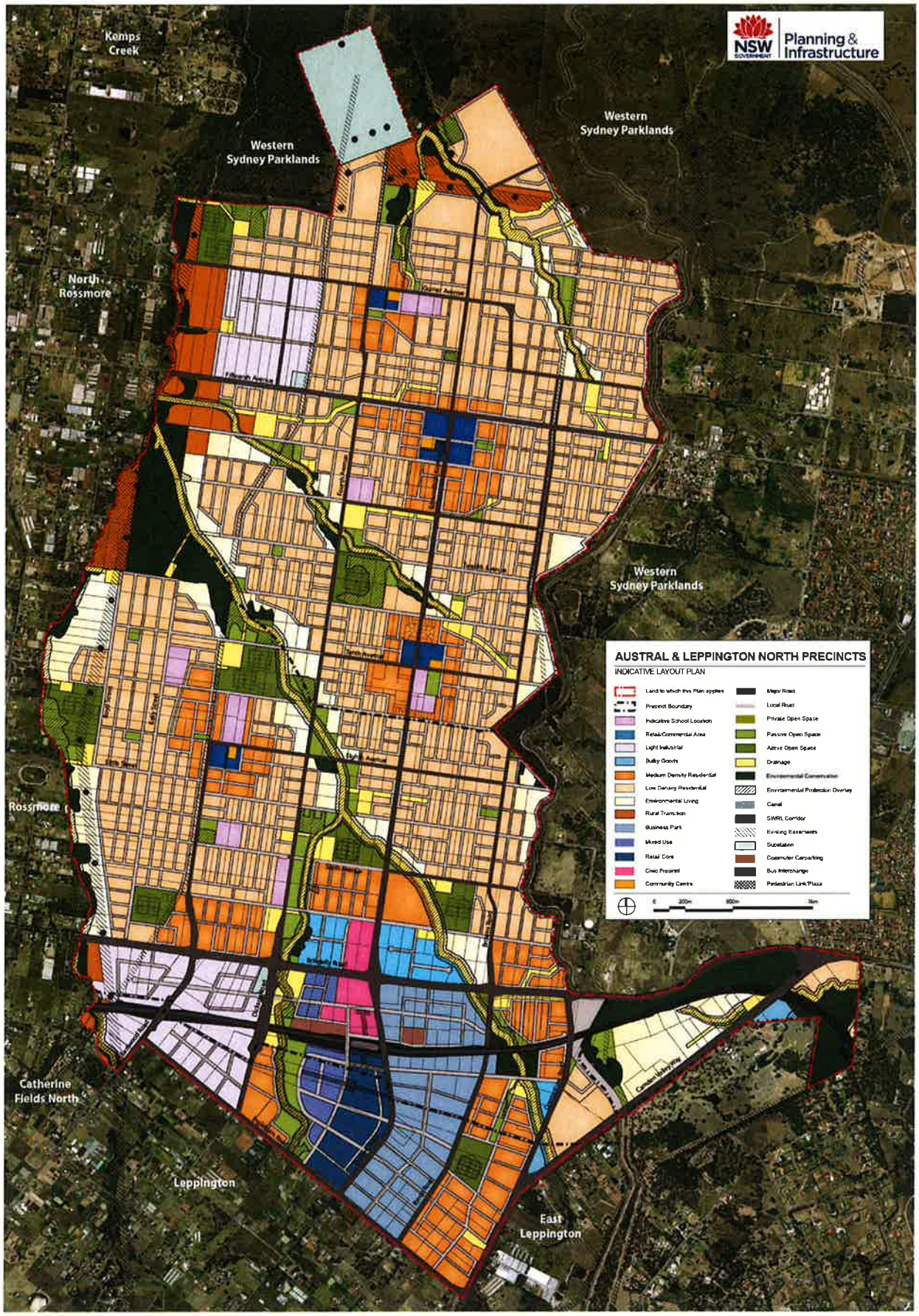


Figure 7.1 Indicative Layout Plan for the Austral and Leppington North Precincts, June 2012.

7.2 Precinct Planning

Appropriate heritage conservation policy and guidelines should be incorporated into the DCP and SEPP Amendment for the Austral and Leppington North Precincts. The conservation of the area's identified heritage values will make an important contribution to public understanding and appreciation of the local history of the Precincts, and potentially enrich the lives of current and future residents. General heritage recommendations regarding the precinct planning process are outlined below. Discussions of site specific heritage issues and recommendations follow.

Recommendation 1

The following State, local, and potential historic heritage items, places, and archaeological site should be listed in the DCP and SEPP Amendment, to protect their identified heritage values during the development of the Austral and Leppington North Precincts:

- ***Upper Nepean Scheme – Upper Canal***
- ***Row of Bunya Pines, 145 Bringelly Road, Leppington***
- ***Brown Memorial and water trough, 145 Bringelly Road, Leppington***
- ***Leppington Public School, 142-148 Rickard Road, Leppington***
- ***Austral Town Centre Conservation Area, Austral***
- ***H J Starr Progress Hall, 264 Edmondson Avenue, Austral***
- ***Ian's Hardware and House, 256 Edmondson Avenue, Austral***
- ***Brick House and Garden, 275 Edmondson Avenue, Austral***
- ***House and Garden, 170 Edmondson Avenue (125 Eighth Avenue), Austral***
- ***Cement Rendered House, 40 Browns Road (60 Fifth Avenue), Austral***
- ***W V Scott Memorial and Park, Austral***
- ***Hellenic Monument, Lot 10 DP 771080, Austral***
- ***Forest Home – Archaeological Site, 1720-1726 Camden Valley Way, Leppington***
- ***Blacksmith's Workshop (Former) – Archaeological Site, 240 Fifteenth Avenue, Austral***
- ***Weatherboard House – Archaeological Site, 305 Fifteenth Avenue, Austral***
- ***Cowpasture Road – Cultural Landscape, Leppington***
- ***Bringelly Road – Cultural Landscape, Austral and Leppington***

The listing process should be undertaken in consultation with Camden and Liverpool Councils and other relevant stakeholders.

Recommendation 2

Heritage curtilages for listed and potential heritage items should be acknowledged in the DCP and local Council heritage inventories as indicative of the minimum area required to protect significant physical fabric and/or an appropriate landscape setting for each item or place during the development of the Austral and Leppington North Precincts.

Recommendation 3

Further investigation of areas of archaeological sensitivity will be required during the development of the Austral and Leppington North Precincts. Site specific Archaeological Assessments should be completed to address the impact of the development on the following sites:

- ***Upper Nepean Scheme – Upper Canal***
- ***Forest Home (Dwelling and Rural Lot), 1720-1726 Camden Valley Way, Leppington***
- ***Blacksmith's Workshop (Former), 240 Fifteenth Avenue, Austral***
- ***House, 305 Fifteenth Avenue, Austral***

7.2.1 Development Control Plan

Development controls should provide practical guidelines for protecting and maintaining the cultural significance of the heritage items and potential heritage items identified in this report, including areas of archaeological sensitivity. Section 5.10 in the Standard Instrument provides the key objectives and conditions for consent for the development of heritage items. Additional detailed guidelines should be included in the DCP for the Precincts.

Development controls regarding the density, height, mass and scale of new buildings, or the character of vegetation and landscaping, could also be used to interpret historic land grant and subdivision patterns in the area, and to minimise impacts on individual heritage items and the proposed Austral Town Centre Conservation Area.

Recommendation 4

General objectives and controls for development in the vicinity of heritage items and heritage conservation areas that could be incorporated in the DCP for the Austral and Leppington North Precincts are:

Objectives

- ***To conserve and enhance the heritage significance of the item or conservation area;***
- ***To ensure that changes to an item or conservation area are based on an understanding of the heritage significance of the place;***
- ***To retain an appropriate landscape setting for the item or conservation area, and views associated with the place;***
- ***To understand the research potential of archaeological resources;***
- ***To facilitate opportunities to improve public understanding and/or appreciation of the environmental heritage of the item or conservation area;***

- *To encourage ongoing use of heritage items, including adaptive reuse where this will contribute to the conservation of the item or conservation area;*

- *To encourage a cautious approach to change. If changes are likely to detract from the heritage significance of the item or place, encourage changes that are reversible;*

- *To acknowledge that past changes to heritage items may contribute to the history of the place;*

- *To encourage the conservation of significant interior elements of built heritage items, including fixtures and fittings; and*

- *To encourage routine maintenance of heritage items and heritage conservation areas to retain their heritage significance.*

Recommended Controls

- *Retain features which contribute to the heritage significance of the item or conservation area.*

- *Retain features which contribute to an understanding of the history of the item, or key periods of its development.*

- *Retain significant landscape elements and/or views associated with the item.*

- *Retain significant historical property boundaries, if identified as part of the significance of the item.*

- *Retain significant uses, if identified as part of the significance of the item, or a similar/compatible use.*

- *Remove unsympathetic elements from the item or conservation area, where this will contribute to the heritage significance the item or conservation area.*

- *For identified archaeological sites, undertake an Archaeological Assessment in accordance with Heritage Branch guidelines to address the archaeological potential of the site prior to its development.*

- *New work in the vicinity of built heritage items should be sympathetic to the form, scale, massing, setback and overall character of the item, and should not detract from its appreciation.*

- *New work should be readily identifiable as such.*

- *Alterations and additions should be located away from significant and/or primary elevations, and behind and below the main ridge line of built heritage items.*

- *Existing fabric, use, associations and meanings should be adequately recorded before any changes are made.*

7.3 Upper Nepean Scheme – Upper Canal

The Upper Nepean Scheme – Upper Canal, which is listed on the SHR, is the most significant element of European built heritage within the study area. An increase in the density of houses and people living in the vicinity of the Canal is likely to incur gradual and cumulative impacts on the physical fabric of the Canal and its associated elements. These include problems associated with incremental changes in surface drainage patterns and related impacts on water quality, which may in turn impact on the historic and technical significance of the Canal as an operational element of Sydney's water supply system. Intensified residential development adjacent to the Canal corridor will also have an adverse impact on its rural landscape setting and associated picturesque elements of the Canal corridor. Mitigation of these impacts will require long-term solutions, which should be addressed in consultation with SCA and the NSW Heritage Council, and should be consistent with the recommendations of the CMP for the Canal. Standard provisions for the development assessment of housing, roads and road infrastructure in the immediate vicinity of the Canal should be strengthened in the SEPP or DCP to address potential impacts on the SHR values of the Canal.

Recommendation 5

Cumulative and long-term impacts of intensified development along the Upper Canal should be addressed in consultation with SCA and the NSW Heritage Council. A supplementary heritage management document should be prepared to guide development in the vicinity of the Canal corridor, and to manage the impacts of intensified housing, roads and road infrastructure in the vicinity of the Canal corridor on the SHR values of the Canal. Objectives and development controls addressing these impacts should be incorporated in the DCP for the Precincts.

Objectives

Development in the vicinity of the Upper Canal should aim to:

- ***maintain the form, fabric, and operational utility of the Canal;***
- ***preserve technological evidence of nineteenth century hydraulic engineering and Canal building techniques, as illustrated by the Upper Canal, and progressive improvements in the construction of associated elements, including culverts, flumes and overbridges;***
- ***conserve picturesque elements of the Canal, including its serpentine route, evidence of its original rural setting, and associated cultural plantings;***
- ***conserve evidence of the historic relationship between the alignment of the Upper Canal and Cowpasture Road;***
- ***maintain appropriate access to and security for the Canal and its historic heritage curtilage, to preserve the quality of the water and prevent inadvertent damage and/or intentional vandalism to the physical fabric of the Canal; and***
- ***interpret the heritage significance of the Upper Canal to the general public, to foster an appreciation of its history and ongoing value to the community.***

7.3.1 Perimeter Road and Open Landscape Buffer

SCA supports the notion of local perimeter road running parallel to the route of the Canal, to maintain access to the Canal for management and maintenance purposes, provided that the road acts as a local internal road only. In sections where a perimeter road is not already in place, the ILP makes

provision for a perimeter road, to be provided by developers. SCA also suggests that local housing should be designed to address the road, so that they overlook the Canal corridor, providing passive surveillance and security for the Canal.

The proposed development will bring about irreversible change to the rural landscape setting associated with the Canal. The impacts of change could be mitigated by the provision of additional open landscape buffering adjacent to the Canal along the east side of proposed perimeter road reserve. Stormwater and flood controls required by SCA to prevent runoff, sediment, and other pollutants entering the Canal corridor could be engineered in association with the road verge, without blocking direct views into the Canal corridor.

Recommendation 6

The perimeter road should be designed to deter heavy through traffic to prevent impacts of vibration on the physical fabric of the Upper Canal. The creation of additional open landscape buffering along the alignment of the Canal in association with the perimeter road and walking or cycling trails would reinforce its historic rural setting, whilst maintaining passive surveillance and security for the Canal.

The DCP should provide design guidelines for the perimeter road and road infrastructure, to support traffic calming and additional open landscape buffering adjacent to the Canal corridor, without interrupting significant view corridors. The roadside verge adjacent to the Canal corridor should be a minimum width of five metres to provide for a broad, grassed area and a pedestrian/cycling path, and car parking should be restricted to the west side of the road.

Recommendation 7

The DCP should provide design guidelines for housing adjacent to the Canal corridor. Houses should address the road and Canal corridor to provide passive surveillance for the Canal infrastructure. In areas where there are clear sightlines to the Canal corridor, landscaping could be limited to low shrubs and intermittent trees.

7.3.2 Overbridges

The ILP indicates that there will be three major road crossings over the Upper Canal to connect the Austral and Leppington North Precincts with areas to the east. These crossings are located on existing traffic corridors at Camden Valley Way, Bringelly Road, and Fifteenth Avenue. A fourth major crossing at the Sixth Avenue overbridge may in future provide a link to a proposed regional sporting facility within the Western Sydney Parklands. All these crossing are likely to require augmentation of the existing overbridges to accommodate increased vehicle traffic.

Impacts of augmentation of the Bringelly Road and Camden Valley Way overbridges, which have been assessed in the CMP as having little or no heritage significance, will be addressed by the RTA as part of the Review of Environmental Factors being undertaken for the upgrade works for those roads. The Sixth and Fifteenth Avenue overbridges have been assessed as having considerable (high) heritage significance; as such site specific statements of heritage impact should be prepared prior to works to address the impacts of augmentation on the heritage values of the Canal. Augmentation should be restricted to one side only, particularly where there is evidence of other recent modification, while preserving evidence of the historic form and construction techniques on the other side. The physical assessment has indicated that one side of the Fifteenth Avenue bridge has already been substantially modified, as part of previous upgrades to the road.

Recommendation 8

Road crossings over the Upper Canal adjacent to the Precincts should be limited to extant reinforced concrete beam bridges. Site specific SoHIs should be prepared to address the impact of new, augmented or modified Canal crossings on the SHR values of the Upper Canal. Applications for approval to the NSW Heritage Council should be made in accordance with Section 60 of the Heritage Act, or an exemption gazetted under Section 57(2) of the Act.

There are five additional overbridges immediately adjacent to the Precincts, which will be maintained for SCA access to the Canal corridor. Some of these overbridges may also be used by pedestrians and cyclists to access the Western Sydney Parklands. These crossings provide an opportunity to open up significant views of the Canal to the general public, but should not allow public access to the Canal corridor or otherwise compromise the security of the Canal. These crossings could also be used as the focus of interpretive signage, designed to explain the history and significance of the Canal, and to engage the general public in the ongoing maintenance of its heritage values.

Recommendation 9

Pedestrian/cyclist crossings over the Upper Canal adjacent to the Precincts should be limited to extant overbridges. These crossings represent an opportunity to interpret the heritage significance of the Canal to the general public. Interpretative signage should be placed at key points along the proposed Perimeter Road, near the pedestrian crossings, addressing open views of the Canal corridor wherever possible: for example near Bringelly Road, Sixth, Tenth, Thirteenth, Fifteenth and Eighteenth Avenues.

7.4 Leppington Public School

Leppington Public School currently occupies four lots, which define the *lot boundary heritage curtilage* of the school (Figure 7.2). This curtilage forms an appropriate setting for the buildings and associated plantings that have been identified as key elements of the heritage significance of the school, or which contribute to the overall significance of the place as an education precinct. However, the ILP presupposes that the school will at some time in the future be decommissioned and relocated by DEC, as part of the long-term future development of Leppington Town Centre. As such, consideration should be given to a sympathetic function for the school, which retains the key weatherboard buildings, ablutions block and mature plantings in their original location, and adapts them for another use which respects the historic, social and aesthetic significance of the place. Adaptive reuse may include a child care centre, information centre, or other community/educative function. It may be noted that TAFE has considered and rejected the area as a potential future campus, and that Camden Council will not acquire the land. It is therefore likely that the land will be managed by a private owner/developer in the long-term.

A *reduced heritage curtilage* would focus on the original 1923 boundary of the school, comprising two acres at the south side of the site, and may form part of a broader civic centre or public open space. In the long-term, it would provide a 30m buffer for the original Raby school building (Building H), retaining its existing garden setting, and reducing the impacts of increased traffic noise and visual overshadowing by neighbouring commercial buildings. It would also incorporate Buildings J and Q, and key cultural plantings, listing of which are supported by DEC.

A reduced curtilage may eventually result in the loss of integrity of the overall school grounds, including the loss of Building D, which has been identified as complementary to the weatherboard Building J, being a later brick example by the same architect. However, in general, the brick Van der Steen buildings are well represented in NSW public schools. It may also result in the loss of

recognition of individuals currently remembered at the school through the commemorative naming of elements outside the proposed curtilage, such as the J Peck Oval. It would therefore be appropriate to develop a memorialisation and naming policy for buildings within the reduced heritage curtilage, to ensure continued recognition of people significant to public education in Leppington.

The definition of heritage curtilage will ensure that the elements of high heritage value are protected in the short- to medium-term while the staged development of the Town Centre takes place. The definition of a *reduced heritage curtilage* should not prevent the ongoing development and/or expansion of the school by DEC to accommodate new buildings or other facilities appropriate to the normal functioning of the school, including new buildings within the curtilage, provided that the elements identified as having high heritage value are also maintained in their current location within this curtilage (Figure 7.2). Appropriate maintenance also includes pruning trees where they may prove a safety issue.

Guidelines for development adjacent to the school grounds should be addressed in the DCP for the Precincts. The Leppington Town Centre ILP indicates that the school will eventually be situated opposite the Retail Core area on Rickard Road, and surrounded by Business Park to the north, south and east. New buildings in the immediate vicinity of the weatherboard group of buildings should not overwhelm the scale or massing of the individual buildings, which are modest in character, and it may be appropriate to define development controls which support a maximum of one or two storeys in areas immediately adjacent to the school boundary, stepping back to larger heights.

Recommendation 10

New buildings in the immediate vicinity of Leppington Public School's reduced heritage curtilage should be sympathetic to the scale, massing, and character of the significant weatherboard buildings and their garden setting. Ongoing augmentation of the school facilities by DEC in the short- to medium- term is compatible with the historic and social significance of the place.

Recommendation 11

New commercial and/or retail buildings should not exceed one (1) or two storeys immediately adjacent to Leppington Public School's reduced heritage curtilage, stepping back to greater heights 10-20m beyond the reduced heritage curtilage.

Figure 7.2 Leppington Public School lot boundary curtilage (red) and reduced curtilage (blue)

7.5 Austral Town Centre Conservation Area

The ILP indicates that the proposed Austral Town Centre Conservation Area will form part of a small Retail/Commercial node surrounded by a discrete area of medium density housing. This zoning is consistent with the historic (and existing) function of the proposed conservation area, namely a small mixed use precinct with a strong community focus.

Listing as a conservation area presents an opportunity to maintain and strengthen the historic character of this neighbourhood centre by preserving a cohesive grouping of modest, mid-twentieth century buildings, historically associated with the development of a discrete area during the 1930s-1940s on the west side of Edmondson Avenue by Emma and H G Starr, Austral Postmaster. The building styles are complementary in their character and scale, and illustrate a range of functions important to the town as it developed in the mid-twentieth century, including the general store, Progress Hall, and post office. The ongoing development of the town centre is closely linked to that of the broader Austral Area, which underwent a major period of change and agricultural intensification in the years immediately before and following after WWII.

Listing as a conservation area would also provide an opportunity to preserve a representative sample of three mid-twentieth century fibro houses within the new Precincts. This report has identified the working class fibro house as an unassuming, but ubiquitous element of the study area, reflecting the same major period of development in the area during the years immediately before and after WWII. This building type will become increasingly rare as the area is developed as part of the SWGC. Listing the houses as contributory elements in the proposed conservation area may entail less onerous regulatory control by permitting some modifications to the houses, while focusing on the protection of the form and character of the street-facing facades and overall character of the streetscape.

Recommendation 12

The proposed Austral Town Centre Conservation Area should be conserved as a cohesive group of mid-twentieth century commercial, civic and residential buildings on the west side of Edmondson Avenue, between Tenth and Eleventh Avenues.

Listing as a conservation area does not preclude further development of the vacant land between Ian's Hardware and the H J Starr Progress Hall, nor to the rear of the fibro houses. On the contrary, new retail, community or other commercial development would contribute positively to the ongoing use of significant heritage buildings as active elements of a neighbourhood centre. That being said, new development in the vicinity of the conservation area should not detract from the character of the conservation area. Detailed design guidelines for development within and immediately adjacent to the conservation area should be addressed in the DCP for the Precincts.

Recommendation 13

Objectives and controls for development in the vicinity of Austral Town Centre Conservation Area that could be incorporated in the DCP for the Precincts are:

Objectives

- ***To retain the conservation area as a small-scale community centre and mixed-use precinct, with a strong mid-twentieth century character; and***
- ***To ensure that changes to the conservation area, including infill development, are based on an understanding of the heritage significance of the place.***

Recommended Controls

- ***Retain elements of built heritage which contribute to the overall heritage significance of the Austral Town Centre Conservation Area (contributory items).***
- ***Retain the principal built form of contributory items, including roof lines, street-facing and side elevations, door and window-openings. Minor alterations that do not have a significant impact on the architectural form and character of the original building may be permitted.***
- ***When required, replace asbestos cement sheeting on contributory items with fibre cement sheet, in accordance with appropriate OH&S standards.***
- ***Infill development should be of a modern design, which responds sympathetically to the historic character and setting of the conservation area, and to the form, scale, massing, orientation and setback of its contributory items. Where possible, new infill buildings should address the street.***

- ***Infill development should not overwhelm the contributory items within the conservation area, in height or massing. A maximum of one (1) storey on the street-facing elevation is appropriate.***

- ***Infill development or additions may be permitted at the rear of contributory items, where the design will achieve an aesthetically cohesive relationship between new and old, and the proposal is consistent with the character of the site and the broader conservation area.***

Figure 7.3 Boundary of the proposed Austral Town Centre Conservation Area and contributory items.

7.6 W V Scott Memorial and Park, Austral

The Leppington Town Centre ILP identifies the area of the W V Scott Memorial Park, at the junction of Bringelly Road and Edmondson Avenue, as the site of a future regional Aquatic and Indoor Recreation Centre. Development as a built recreation centre will have a substantial impact on the original landscape setting of the present war memorial and sports field. The widening of Bringelly

Road may also have an adverse impact on the original site of the war memorial. However, the proposed redevelopment will ensure that the land continues to be used for public, recreational purposes, compatible with the original intent of a memorial sports field, and relevant to the changing needs of this growing suburban community. Retaining the name W V Scott Memorial for the proposed centre will ensure that the original commemorative purpose of the sports field is not lost to future generations.

Future redevelopment of the land for a regional Aquatic and Indoor Recreation Centre should also incorporate a commemorative monument to W V Scott at the main entrance, in keeping with the local community's desire not to forget the sacrifice of local residents in WWII. The monument should retain the inscription recorded on the present monument, which replicates that of the original bubbler monument, and a garden setting, which respects the recent history of the monument and its association with Liverpool RSL and Austral Public School. Future redevelopment should be undertaken in consultation with relevant stakeholders, including descendants of WV Scott, Austral Public School, Liverpool RSL, Liverpool Council, and the local community.

Recommendation 14

The proposed redevelopment of the W V Scott Memorial Park as a regional Aquatic and Indoor Recreation Centre should be compatible with the historic heritage significance of the place. Continuity in the use of the land for community recreational purposes, retention of the name 'W V Scott Memorial' for any future recreational facilities, and ongoing conservation of a commemorative monument to W V Scott are in keeping with the local community's desire not to forget the sacrifice of local residents in WWII and will contribute to the conservation of the social and historic significance of the place. The commemorative monument should retain the inscription recorded on the present monument, and should be located at the main entrance to the facility, within an appropriate garden setting.

7.7 Historic Subdivision Patterns and Road Alignments

Roads and property boundaries provide an important, tangible link with the history of land use and settlement of the area, but are generally unlikely to warrant individual heritage listing or other special protections. Redevelopment of the Austral and Leppington North Precincts represents an opportunity to interpret the historic road alignments and subdivision patterns associated with the early European history of the area to future generations.

In general, the ILP for the Austral and Leppington North Precincts has retained key historic roads along their original alignments, and the historic grid pattern of roads and streets associated with the late nineteenth century Hoxton Park Estate subdivision will be retained substantially intact. Bringelly, Edmondson and Fifteenth Avenue will be upgraded, retaining their historic and technical significance as important local transport and communications corridors. In contrast, new local roads within the precincts will generally cut across pre-existing property boundaries. This will gradually reduce the physical evidence of historic roads and early property boundaries within the landscape.

Eastwood Road provides physical evidence of the boundary between two early land grants: to Alexander Riley, *Raby* (1816), and Hannibal Macarthur, *Eastwood* (1819). The Leppington Town Centre ILP indicates that the alignment of Eastwood Road will be altered to accommodate new traffic conditions at the intersection of Eastwood and Bringelly Roads. The northern end of Eastwood Road will be moved to the west, to meet with a proposed new road corridor north of Bringelly Road, and the disused section of the Eastwood Road corridor will be rezoned for Light Industrial uses. Considering that the footprint of any new industrial buildings will likely obscure physical evidence of the historic road alignment, it is appropriate to require that this historic road alignment is interpreted for future generations in some form of visual media or signage. An embossed bronze medallion set

into the pavement or wall of any future building at the historic junction of Bringelly and Eastwood Roads could, for example, explain the original location and function of the property boundary for future residents of the area. The road alignment could also be incorporated within the building, as an internal passageway or lane.

The house and garden at 170 Edmondson Avenue (corner of 125 Eighth Avenue) in Austral, which has been identified in this report as a potential heritage item, stands on its original 3 acre block. The property provides good evidence of late nineteenth to early twentieth century patterns of land tenure in the Austral and Hoxton Park area, and is representative of the historic patterns of land tenure on the Hoxton Park Estate. The ILP for the Austral and Leppington North Precincts indicates a local road passing through the middle of the block, intersecting the original acreage and significant features of the historic garden. This road alignment should be revised during detailed planning stages for the Precincts, to avoid impacts on heritage significance of the property, including impacts on the garden.

In cases where new local roads coincide with the historic boundaries of early land grants, future naming of these roads could take into consideration the historic names of the land grants and the people associated with them, thereby forming part of the interpretation of early settlement patterns within the landscape. In particular, the ILP indicates new local roads along the north and south boundaries of the former John Gurner land grant, *Ickleton* (1818). These boundaries are also associated with the grants of Barron Field's *Hinchinbrook* and James Williamson's *Dungarthell* respectively. A new local road will also be provided along a section of the northwest and southwest boundaries of the former John Jamieson land grant, *Cow-de-Knaves*.

The ILP has further indicated a new north-south road parallel to the east boundary of the former Urban Fidkin land grant, *Stanfield Park* (1818). Discussions with DP&I have determined that it will not be possible to directly align this road over the historical boundary, because the land is partially included in the Integral Energy easement. That being said, the easement itself will preclude development along the historic property boundary, and may therefore act as an interpretive feature within the landscape.

Recommendation 15

Objectives for development along historic roads and property boundaries that could be incorporated in the DCP for the Precincts are:

Objectives

- ***To maintain key historic roads in use along their original alignment, and to conserve their historic and technical significance as important local transport and communications corridors within the landscape;***
- ***To retain key historic road names, to conserve evidence of their historic associations and meanings;***
- ***To create or maintain broad landscaped buffers along key historical roads, to reinforce the historic rural character of the roads within the landscape;***
- ***Where key historic roads have (or will) go out of use, to conserve evidence of original road alignments within the landscape, either by means of a natural landscape corridor or other forms of interpretation, such as explanatory signage; and***

- ***To create and/or maintain local roads or landscaped areas along the boundaries of early colonial land grants, and to maintain physical evidence of the history of the early grants within the landscape.***

7.7.1 Cowpasture Road – Cultural Landscape

Cowpasture Road was the earliest road in the Liverpool area, southwest of Sydney, and formed the boundary of several early land grants in the study area. The road has an important historic and visual relationship with the route of the Upper Canal: construction of the Canal in 1886-1888 led to a re-alignment of Cowpasture Road at its junction with Bringelly Road. The original junction of Cowpasture and Bringelly Roads is marked by a row of three Bunya Pines, which are prominent landmarks within the local landscape, and a disused section of the original nineteenth century alignment is retained to the south of Bringelly Road, east of the Canal. A short section is also retained further south on the west side of the Canal, near a bend in the present, active road alignment.

The historic, aesthetic and technical significance of the Cowpasture Road corridor is such that it warrants local heritage listing as an important cultural landscape. The ILP indicates that the active section of Cowpasture Road will be upgraded to service residential areas surrounding Leppington Town Centre. However, the original, disused section of the road corridor east of the Upper Canal will likely be incorporated into adjoining Open Space and Environmental Conservation zones. Lack of previous development in the vicinity of the disused road surface represents an opportunity to conserve this section of the road corridor within a natural landscape setting within the Precincts. The disused section west of the Upper Canal also presents an opportunity to create a small pocket park for local residences within the triangular piece of land at the junction with the realigned road, and to install interpretative media to convey information concerning the historic development of Cowpasture Road and its association with the Upper Canal to local residents and members of the broader community.

Recommendation 16

Incorporating the original, disused section of the Cowpasture Road alignment into Open Space and Environmental Conservation zones within the Leppington North Precinct represents an opportunity to conserve this section of the historic road within a natural landscape setting. A SoHI, that includes an assessment of archaeological potential, should be prepared prior to redevelopment of the disused section of the original road corridor for park, recreation, or other purposes. Interpretive signage should be installed along the disused section of the road corridor as part of the future development of parks and other open space to explain its historical significance and associations to local residents and members of the broader community.

7.7.2 Bringelly Road – Cultural Landscape

Bringelly Road is one of the earliest roads in the Liverpool area, and its east-west alignment through the landscape likely formed the basis for the rigid grid of streets which characterises subdivision patterns in the Hoxton Park and Austral areas today. The historic and technical significance of Bringelly Road is such that it warrants local heritage listing as an important cultural landscape.

Bringelly Road is currently being upgraded from two to four lanes, as part of the process of improving regional transport infrastructure in conjunction with development of the SWGC. This is likely to involve the loss of existing vegetation along the road corridor. The road will intersect the proposed Leppington Town Centre, and the present rural character of the road will be significantly altered.

AMBS understands that Bringelly Road is the subject of an ongoing heritage assessment being undertaken for the RTA, and that the archaeological potential associated with the road will be

addressed in that report. AMBS anticipates that any potential archaeological resources associated with the road are likely to be adversely impacted by the proposed road upgrade. However, based on the information collected for this report, the main technical significance of the road as an important regional transport corridor, which had an early influence on the patterns of subdivision and settlement in the area, will be maintained through ongoing improvements to the existing road along its original alignment.

7.8 Views

The ILP for the Austral and Leppington North Precincts includes strategies for addressing impacts of future development on culturally significant views and landscapes, including views which have been identified in this report as historical and aesthetic points of interest in the area.

Expansive views from Judges Hill may by somewhat obscured by surrounding low density residential development. However, a key view corridor toward the southwest will be preserved through the provision of a pocket park at the crest of the hill, associated with the Hellenic Monument, and a new local road running between the park and the base of the hill.

Long open views from Carnes Hill will be retained unaltered, by the provision of an Environmental Management zone between Bringelly Road and the SWRL corridor, and the Western Sydney Parklands north of Bringelly Road.

Recommendation 17

Objectives for development in the vicinity of key history views and landscapes to be incorporated in the DCP for the Precincts are:

Objectives

- ***To conserve and interpret culturally significant views and landscapes at Judges Hill and Carnes Hill as historical and aesthetic points of interest in the area; and***
- ***To preserve historic toponyms as evidence of past occupants and land use.***

7.9 Interpretation

Interpretation of individual items of historic heritage, as well as the broader cultural landscape of the Austral and Leppington North Precincts, is an important tool in the conservation of heritage significance. It presents the story of a place in a way that will engage the community in its continuing care and protection. It can also be a source of enjoyment for local residents and visitors to the area. Section 6.6 of this report outlines an interpretation strategy for the Austral and Leppington North Precincts.

Recommendation 18

The interpretation strategy outlined in Section 6.6 of this report should be implemented as part of the Precinct planning process, during the assessment of future development applications, and in other Council-sponsored initiatives.

7.10 Consultation

Throughout the course of this project, AMBS has made every attempt to contact property owners in an effort to gain access to properties with potential local heritage value to discuss and assess the condition and significance of the place, with a view to recommending heritage listing of significant items in future amendments to the SEPP Growth Centres 2006. This has not always been successful: in one case AMBS was refused access to a property; in several others, AMBS was unable to make

contact with the owner of the land. In these situations, AMBS has undertaken an assessment of the significance of the place based on historical documentation and visual analysis from the street. It should therefore be noted that further research, including discussion with the owners of these properties about the history and condition of each place, may necessitate reassessment of their heritage significance.

Owners and occupiers of potential heritage items should be given written notice of the recommendations for heritage listing contained in this report, and be invited to make written submissions regarding the proposed listing. They should also be invited to forward to DP&I any historical or other information about their properties, including information about the physical condition of the property, which may contribute to a more complete understanding of the place and further inform the assessment of heritage significance contained in this report. These submissions should be taken into consideration before a final determination is made as to whether the property should be listed on the SEPP amendment. It is possible that further research and assessment will determine that one or more of the potential heritage items recommended in this report does not have sufficient heritage value to warrant long-term statutory protection. However, it should be noted that an owner's objection to heritage listing is only one part of the heritage assessment to be considered and is not in itself a reason for not listing a heritage item. Ongoing consultation with property owners is a worthwhile process, and provides an opportunity to explain the long-term benefits of heritage listing, including the social and financial benefits. The Heritage Office Publication *Heritage Listing: Benefits for Owners* (2004) may be useful in this context.

AMBS acknowledges that the desire to capitalise on commercial opportunities presented by Precinct development may conflict with opportunities to preserve significant heritage items for the appreciation of future generations. AMBS has not taken into account commercial considerations as part of the assessment of significance of any sites. However, AMBS also acknowledges that heritage listing is unlikely to be an effective mechanism for the long-term future conservation of more modest elements of the landscape without the understanding and support of the local community and property owners. If a property owner objects to the proposed heritage listing on the grounds that the listing may have potential implications for the economic use of the land, the owner will need to provide justifications for his/her concerns. All options for ongoing conservation and use of significant places should be carefully considered prior to resolving not to list the item.

Recommendation 19

DP&I should give written notice to the owners and occupiers of properties identified by AMBS as potential heritage items, areas of archaeological sensitivity, and properties within the proposed Austral Town Centre Conservation Area, to advise them of recommendations to list the property on the SEPP Amendment, to explain the implications of heritage listing, and to invite written submissions regarding the proposed listing. DP&I should take submissions into consideration before a final determination is made as to the listing of each property in the SEPP Amendment. Objections should be relevant to the assessment of significance and long-term conservation of potential heritage items.

AMBS understands that heritage items listed in the SEPP Amendment will in future be incorporated in the LEPs for Camden and Liverpool LGAs. Ongoing consultation with Councils, their respective heritage advisory committees, and other relevant stakeholders regarding the merits of the potential heritage items recommended in this report will facilitate the long-term conservation of these places for the community.

7.11 Summary of Strategies for Conserving Heritage Values

Table 7.1 lists the individual heritage items and potential heritage items in relation to the ILP for the Austral and Leppington North Precincts, and summarises the recommended strategies to conserve the heritage significance of these items as part of the Precinct Planning process. These recommendations are also listed on the inventory sheets for each item.

Table 7.2 lists the key historic property boundaries and roads within the study area, and recommended strategies to conserve the heritage significance of these landscape features as part of the Precinct Planning process.

Table 7.1 Summary of individual heritage items and potential heritage items in relation to the ILP for the Austral and Leppington North Precincts, and recommended strategies to conserve the heritage significance of these items as part of the Precinct Planning process.

Name	Address	Significance	ILP for Austral and Leppington North Precincts	Recommendations

Upper Nepean Scheme – Upper Canal	SCA land, Leppington	State	• No change to SCA land.
			• Intensified residential development in vicinity of Canal.
			• Local perimeter road adjacent to Canal corridor.
			• Augmented overbridges at Camden Valley Way, Bringelly Road, Sixth Avenue, Fifteenth Avenue.
			• Five additional overbridges immediately adjacent to the Precincts will be maintained for SCA access to the Canal Corridor, and some may be used by pedestrians and cyclists to access the Western Sydney Parklands.
				• List on SEPP.
				• Cumulative and long-term impacts of intensified development adjacent to route of the Upper Canal to be addressed in consultation with SCA and the NSW Heritage Council. Supplementary heritage management document to be prepared following exhibition of the ILP, to guide development in the vicinity of the Canal corridor, and to manage the impacts of intensified housing, roads and road infrastructure in the vicinity of the Canal corridor on the SHR values of the Canal.
				• Objectives and development controls addressing impacts should be incorporated in the DCP for the Precincts. Design guidelines to require:
				  • Perimeter road designed to deter heavy through traffic, to prevent impacts of vibration on the physical fabric of the Canal.
				  • Open landscape buffering in association with the perimeter road to reinforce its historic rural setting, whilst maintaining passive surveillance and security for the Canal. Roadside verge adjacent to the Canal corridor to be a minimum width of five metres to provide for a broad, grassed area and a pedestrian/cycling path.
				  • Houses to address the road and Canal corridor to provide passive surveillance for the Canal infrastructure. In areas where there are clear sightlines to the Canal corridor, landscaping limited to low shrubs and intermittent trees.
				• Road crossings over the Upper Canal adjacent to the Precincts to be limited to extant reinforced concrete beam bridges.
				• Site specific SoHIs to be prepared to address impacts of new, augmented or modified Canal crossings on the SHR values of the Upper Canal, in association with an application to the Heritage Council for approval under Section 60 of the Heritage Act, or an exemption under Section 57(2).
				• Pedestrian/cyclist crossings over the Upper Canal adjacent to the Precincts to be limited to extant overbridges.
				• Interpretation of the heritage significance of the Canal to be placed at key points at pedestrian/cyclist crossings to provide an understanding and appreciation of the form and function of the Canal, and its historical setting in a rural landscape. Interpretative signage along the proposed Perimeter Road, near pedestrian crossings, addressing open views of the Canal corridor wherever possible: for example near Bringelly Road, Sixth, Tenth, Thirteenth, Fifteenth and Eighteenth Avenues.

Name	Address	Significance	ILP for Austral and Leppington North Precincts	Recommendations
Row of Bunya Pines	145 Bringelly Road, Leppington	State	• No change to SCA land. • RTA preparing to upgrade Bringelly Road from 2 to four lanes.	• List on SEPP. • Update Statement of Significance on Liverpool Heritage Inventory, to include association with SHR listed Upper Canal System. • Carry out interpretation: Retention and maintenance of trees in current location, within SHR heritage curtilage. • Impacts of road widening to be addressed by RTA as part of REF.

Brown Memorial and water trough	145 Bringelly Road, Leppington	Local	• Expansion of SCA land at junction of Cowpasture and Bringelly Roads.	• List on SEPP.
				• Update Statement of Significance on Liverpool Heritage Inventory.
				• Consult with property owner and local community regarding ongoing management. Community stakeholders may include descendants of William Brown and Liverpool RSL.
				• Carry out interpretation:
				  • Retention and maintenance of fabric on site;
				  • Permanent signage.

Leppington Public School	142-148 Rickard Road, Leppington	Local	• Located within Leppington Town Centre.
			• Short-to-medium-term use as school; long term use likely private development.
			• Opposite Retail Core and surrounded by Business Park zones.
				• List on SEPP and Camden LEP.
				• Carry out interpretation:
				  • Retention and maintenance of significant fabric on site within the reduced heritage curtilage. Routine maintenance and development of the school, in accordance with DET requirements, is permissible within the heritage curtilage, and is consistent with the historic significance of the place as an educational facility.
				  • Develop a memorialisation and naming policy, especially for buildings within the reduced heritage curtilage, to recognise people significant to public education in Leppington.
				• New buildings in the immediate vicinity of reduced heritage curtilage to be sympathetic to the scale, massing, and character of the significant buildings and garden setting.
				• New commercial and/or retail buildings not to exceed one (1) or two storeys immediately adjacent to the reduced heritage curtilage, stepping back to larger heights 10-20m beyond the reduced heritage curtilage.
				• Prepare SoHI prior to site redevelopment for alternative uses or adaptive reuse.

Austral Town Centre Conservation Area, Austral		Local	• Retail/Commercial zone.	• List on SEPP and Liverpool LEP as heritage conservation area. • Carry out interpretation: Retention and maintenance of contributory items within proposed heritage curtilage. • Consult with property owners and local community regarding ongoing management. • Retain conservation area as small-scale community centre and mixed-use precinct, with a strong mid-twentieth century character.

Name	Address	Significance	ILP for Austral and Leppington North Precincts	Recommendations
				• Retain name 'Austral.' • Changes to the conservation area, including infill development, to be based on an understanding of the heritage significance of the place. • Prepare SoHI and Archaeological Assessment prior to redevelopment or site modifications within the conservation area boundary. • Asbestos cement sheeting to be replaced with fibre cement sheet, as required and in accordance with appropriate OH&S standards. • Detailed guidelines for development within and adjacent to the conservation area to be addressed in the DCP for the Precincts.
H J Starr Progress Hall	264 Edmondson Avenue, Austral	Local	• Retail/Commercial zone. • Within proposed Austral Town Centre Conservation Area.	• List on SEPP and Liverpool LEP. • Consult with property owner and local community regarding ongoing management. • Retention and maintenance of hall and/or similar community function within proposed heritage curtilage. • Retain name 'H J Starr Progress Hall.' • Prepare SoHI prior to redevelopment or modification of the site.
Ian's Hardware and House	256 Edmondson Avenue, Austral	Local	• Retail/Commercial zone. • Within proposed Austral Town Centre Conservation Area.	• List on SEPP and Liverpool LEP. • Prior to change, prepare photographic record of existing fabric of store and house. • Consult with property owner, tenant, and local community regarding ongoing management. • Retention of commercial function and maintenance of associated house on site, within proposed heritage curtilage. • Prepare an Archaeological Assessment and SoHI prior to redevelopment or modification of the site.
Brick House and Garden	275 Edmondson Avenue, Austral	Local	• Medium density residential zone.	• List on SEPP and Liverpool LEP. • Prior to change, prepare a photographic record of existing fabric of house and garden. • Retention and maintenance of house and garden on site, within proposed heritage curtilage. • Consult with property owner and local community regarding ongoing management. • Prepare SoHI prior to redevelopment or modification of the site.
House and Garden	170 Edmondson Avenue (125 Eighth Avenue), Austral	Local	• Low density residential zone. • Potential new local road intersecting property.	• List on SEPP and Liverpool LEP. • Retention and maintenance of house and garden on original lot, within proposed heritage curtilage. • Revise proposed road alignment to avoid impacts on heritage significance of property.

Name	Address	Significance	ILP for Austral and Leppington North Precincts	Recommendations
				• Prior to change, prepare a photographic record of existing fabric of house and garden. • Consult with property owner and local community regarding ongoing management. • Prepare SoHI prior to subdivision, redevelopment or modification of the site.
Cement Rendered House	40 Browns Road (60 Fifth Avenue), Austral	Local	• Environmental living zone – minimum lot size approximately 1,000-2,500 square metres.	• List on SEPP and Liverpool LEP. • Prior to change, prepare a photographic record of existing fabric of house and garden. • Consult with property owner and local community regarding ongoing management. • Retention and maintenance of house and garden on site, within proposed heritage curtilage. • Prepare SoHI prior to subdivision, redevelopment or modification of the site or neighbouring lots. • Surrounding development should not overwhelm the modest scale of the Cement Rendered House.
W V Scott Memorial and Park	380 Bringelly Road, Austral	Local	• Civic Precinct zone. • Site to be redeveloped as regional Aquatic and Indoor Recreation Centre. • Widening of Bringelly Road may encroach on original site of the war memorial.	• List on SEPP and Liverpool LEP. • Consult with property owner and local community regarding ongoing management. Community stakeholders may include descendants of WV Scott, Austral Public School, and Liverpool RSL. • Retention and maintenance of memorial playing fields (or redevelopment of land as proposed aquatic centre and indoor recreation facility, compatible with the original intent of the memorial sports field). • Respectful conservation of WV Scott war memorial in a garden setting at the main entrance to the playing fields (or at the main entrance to a similar sports/recreational facility). • Retention of name of WV Scott Memorial for recreation facility on site. • Interpretative signage. • Prepare SoHI prior to redevelopment of the site.
Hellenic Monument	Lot 10 DP 771080, Austral	Local	• Small Open Space zone surrounded by low density residential zone. • Road alignment from park roughly associated with significant view corridor.	• List on SEPP and Liverpool LEP. • Preservation and/or restoration of memorial within pocket park, in association with significant view corridor. • Name of pocket park to incorporate historic toponym: Judges Hill. • Consult with property owner land and local community regarding ongoing management. • Prepare a SoHI prior to redevelopment of the site.
Forest Home –	1720-1726 Camden	Local	• Low density residential zone.	• List on SEPP.

Name	Address	Significance	ILP for Austral and Leppington North Precincts	Recommendations
Archaeological Site	Valley Way, Leppington		• Possible road connection through heritage curtilage to Landcom development.	• Update summary statement of significance for Liverpool Heritage Inventory. • Consult with property owner and local community regarding ongoing management. • Prepare an Archaeological Assessment prior to redevelopment of the site, and construction of through road.
Blacksmith's Workshop (Former) – Archaeological Site	240 Fifteenth Avenue, Austral	Local	• Residential zone. • Future upgrade/widening of Fifteenth Avenue.	• List on SEPP and Liverpool LEP. • Consult with property owner and local community regarding ongoing management. • Prepare an Archaeological Assessment prior to redevelopment of site and/or upgrade of Fifteenth Avenue.
Weatherboard House – Archaeological Site	305 Fifteenth Avenue, Austral	Local	• Residential zone, with new local road parallel to Fifteenth Avenue. • Future upgrade/widening of Fifteenth Avenue. • Potential new local road intersecting site.	• List on SEPP and Liverpool LEP. • Consult with property owner and local community regarding ongoing management. • Prepare an Archaeological Assessment prior to subdivision, redevelopment of site and/or upgrade of Fifteenth Avenue.

Cowpasture Road – Cultural Landscape	Leppington	Local	• Road reserve maintained by RTA.
			• Possible upgrade of active section of original Cowpasture Road alignment.
			• Disused section of Old Cowpasture Road (east of the Upper Canal) intersected by SWRL Corridor.
			• Remaining disused section of Old Cowpasture Road (east of the Upper Canal) likely incorporated into adjoining Open Space and Environmental Conservation zones.
			• Disused section of Old Cowpasture Road (west of Upper Canal) likely incorporated into small Open Space zone, surrounded by Low Density Residential.
				• List on SEPP and Liverpool LEP.
				• Preserve disused section of original road (east and west of the Upper Canal) within natural landscape setting.
				• Maintain active section of original road alignment.
				• Consult with RTA and local community regarding ongoing management.
				• Prepare a SoHI that includes assessment of archaeological potential prior to redevelopment of disused section of original road and/or upgrade of active section of Cowpasture Road.
				• Retain name 'Cowpasture Road.'
				• Incorporate interpretive signage into future development of parks and other open space associated with Cowpasture Road to:
				  • explain the importance of the early road network to the history and development of the area,
				  • explain the historical relationship between the road and the Upper Canal, and
				  • describe long term changes in the local landscape.

Name	Address	Significance	ILP for Austral and Leppington North Precincts	Recommendations
Bringelly Road – Cultural Landscape	Austral	Local	• RTA preparing to upgrade Bringelly Road from two to four lanes, generally following existing alignment. This will likely involve the removal of existing vegetation along the road corridor.	• List on SEPP, Liverpool LEP, and Camden LEP. • Retain technical significance of the road as important regional transport corridor by maintaining the original road alignment as active part of the ongoing development of the SWGC. • Create a broad landscaped buffer along the Bringelly Road corridor, to reinforce the historic rural character and regional importance of this road within the landscape. • Retain name 'Bringelly Road.' • Impacts of road widening to be addressed by RTA as part of REF.

Table 7.2 Summary of key historic property boundaries and roads in relation to the ILP for the Austral and Leppington North Precincts, and recommended strategies to conserve the heritage significance of these places as part of the Precinct Planning process.

Historic property boundary or road	ILP for Austral and Leppington North Precincts	Recommendations
Cowpasture Road – Eastern Boundary of Alexander Riley's Raby land grant	• See Table 7.1 above.	• See Table 7.1 above.
Bringelly Road – Northern Boundary of Alexander Riley's Raby land grant / Southern boundary of Hoxton Park Estate	• See Table 7.1 above.	• See Table 7.1 above.
Eastwood Road – Eastern boundary Hannibal Macarthur's Eastwood land grant / Western boundary of Alexander Riley's Raby land grant	• Road to be upgraded as major north-south transit corridor through the Precincts. • New alignment to accommodate altered traffic conditions at the intersection of Eastwood and Bringelly Roads. Northern end of Eastwood Road will be moved to the west to meet with proposed new road corridor north of Bringelly Road. • Disused section of Eastwood Road corridor will be rezoned for Light Industrial uses and footprint of any new industrial buildings will likely obscure physical evidence of the historic road alignment.	• Historic alignment of Eastwood Road and associated land grant boundaries to be interpreted by means of visual media or signage: embossed bronze medallions set into the pavement or wall of any future building at the historic junction of Bringelly and Eastwood Roads and at point of departure from original alignment along Eastwood Road. Medallion or other signage to mark the original location and function of property boundaries for future residents of the area. Requirement for interpretation to be addressed in the DCP and at DA stage. • Create a broad landscaped buffer along the sections where the original alignment has been maintained to reinforce the historic rural character of this road within the landscape. • Retain name 'Eastwood Road.'
Edmondson Avenue	• Road to be upgraded, as major north-south transit corridor through the Precincts.	• Maintain historic road alignment. • Create a broad landscaped buffer along the Edmondson Road corridor, to reinforce the historic rural character and regional importance of this road within the landscape. • Retain name 'Edmondson Avenue.'
Fifteenth Avenue	• Road to be upgraded, as major east-west transit corridor through the Precincts.	• Maintain historic road alignment. • Create a broad landscaped buffer along the Fifteenth Avenue corridor, to reinforce the historic rural character and regional importance of this road within the landscape.
Northern boundary John Gurner's *Ickleton* land grant / Southern boundary of Barron Field's *Hinchinbrook* land grant	• New local road.	• New local road to follow historic land grant boundary. • Consider naming road in association with John Gurner's *Ickleton* or Barron Field's *Hinchinbrook* land grants.
Southern boundary John Gurner's *Ickleton* land grant / Northern boundary of James Williamson's *Dungarthell* land grant	• New local road.	• New local road should follow historic land grant boundary. • Consider naming road in association with *Ickleton* or *Dungarthell* land grants.
Eastern boundary John Gurner's *Ickleton* land grant / Western boundary of Edward Gray's land grant	• Extension of Craik Avenue.	• New local road should follow historic land grant boundary. • Retain name 'Craik Avenue.'
Eastern boundary of Urban Fidkin's land grant / Western boundary of Thomas Carne's land grant	• New north-south main road near to, but not following historic property boundary. • Integral Energy easement	• Maintain historic land grant boundary as landscaped/open space corridor in association with Integral Energy easement. • Consider naming road in association with

Historic property boundary or road	ILP for Austral and Leppington North Precincts	Recommendations
	partially follows historic property boundary.	Urban Fidkin or Thomas Carne's land grants.
Western boundaries of John Jamieson's *Cow-de-Knaves* land grant	• New local road. • Open Space and Environmental Conservation areas may obscure part of original alignment of historic property boundary.	• New local road should follow historic land grant boundary. • Consider naming road or pocket park in association with *Cow-de-Knaves* land grant.

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into the pavement or wall of any future building at the historic junction of Bringelly and Eastwood Roads could, for example, explain the original location and function of the property boundary for future residents of the area. The road alignment could also be incorporated within the building, as an internal passageway or lane.

The house and garden at 170 Edmondson Avenue (corner of 125 Eighth Avenue) in Austral, which has been identified in this report as a potential heritage item, stands on its original 3 acre block. The property provides good evidence of late nineteenth to early twentieth century patterns of land tenure in the Austral and Hoxton Park area, and is representative of the historic patterns of land tenure on the Hoxton Park Estate. The ILP for the Austral and Leppington North Precincts indicates a local road passing through the middle of the block, intersecting the original acreage and significant features of the historic garden. This road alignment should be revised during detailed planning stages for the Precincts, to avoid impacts on heritage significance of the property, including impacts on the garden.

In cases where new local roads coincide with the historic boundaries of early land grants, future naming of these roads could take into consideration the historic names of the land grants and the people associated with them, thereby forming part of the interpretation of early settlement patterns within the landscape. In particular, the ILP indicates new local roads along the north and south boundaries of the former John Gurner land grant, *Ickleton* (1818). These boundaries are also associated with the grants of Barron Field's *Hinchinbrook* and James Williamson's *Dungarthell* respectively. A new local road will also be provided along a section of the northwest and southwest boundaries of the former John Jamieson land grant, *Cow-de-Knaves*.

The ILP has further indicated a new north-south road parallel to the east boundary of the former Urban Fidkin land grant, *Stanfield Park* (1818). Discussions with DP&I have determined that it will not be possible to directly align this road over the historical boundary, because the land is partially included in the Integral Energy easement. That being said, the easement itself will preclude development along the historic property boundary, and may therefore act as an interpretive feature within the landscape.

Recommendation 15

Objectives for development along historic roads and property boundaries that could be incorporated in the DCP for the Precincts are:

Objectives

- ***To maintain key historic roads in use along their original alignment, and to conserve their historic and technical significance as important local transport and communications corridors within the landscape;***
- ***To retain key historic road names, to conserve evidence of their historic associations and meanings;***
- ***To create or maintain broad landscaped buffers along key historical roads, to reinforce the historic rural character of the roads within the landscape;***
- ***Where key historic roads have (or will) go out of use, to conserve evidence of original road alignments within the landscape, either by means of a natural landscape corridor or other forms of interpretation, such as explanatory signage; and***

- ***To create and/or maintain local roads or landscaped areas along the boundaries of early colonial land grants, and to maintain physical evidence of the history of the early grants within the landscape.***

7.7.1 Cowpasture Road – Cultural Landscape

Cowpasture Road was the earliest road in the Liverpool area, southwest of Sydney, and formed the boundary of several early land grants in the study area. The road has an important historic and visual relationship with the route of the Upper Canal: construction of the Canal in 1886-1888 led to a re-alignment of Cowpasture Road at its junction with Bringelly Road. The original junction of Cowpasture and Bringelly Roads is marked by a row of three Bunya Pines, which are prominent landmarks within the local landscape, and a disused section of the original nineteenth century alignment is retained to the south of Bringelly Road, east of the Canal. A short section is also retained further south on the west side of the Canal, near a bend in the present, active road alignment.

The historic, aesthetic and technical significance of the Cowpasture Road corridor is such that it warrants local heritage listing as an important cultural landscape. The ILP indicates that the active section of Cowpasture Road will be upgraded to service residential areas surrounding Leppington Town Centre. However, the original, disused section of the road corridor east of the Upper Canal will likely be incorporated into adjoining Open Space and Environmental Conservation zones. Lack of previous development in the vicinity of the disused road surface represents an opportunity to conserve this section of the road corridor within a natural landscape setting within the Precincts. The disused section west of the Upper Canal also presents an opportunity to create a small pocket park for local residences within the triangular piece of land at the junction with the realigned road, and to install interpretative media to convey information concerning the historic development of Cowpasture Road and its association with the Upper Canal to local residents and members of the broader community.

Recommendation 16

Incorporating the original, disused section of the Cowpasture Road alignment into Open Space and Environmental Conservation zones within the Leppington North Precinct represents an opportunity to conserve this section of the historic road within a natural landscape setting. A SoHI, that includes an assessment of archaeological potential, should be prepared prior to redevelopment of the disused section of the original road corridor for park, recreation, or other purposes. Interpretive signage should be installed along the disused section of the road corridor as part of the future development of parks and other open space to explain its historical significance and associations to local residents and members of the broader community.

7.7.2 Bringelly Road – Cultural Landscape

Bringelly Road is one of the earliest roads in the Liverpool area, and its east-west alignment through the landscape likely formed the basis for the rigid grid of streets which characterises subdivision patterns in the Hoxton Park and Austral areas today. The historic and technical significance of Bringelly Road is such that it warrants local heritage listing as an important cultural landscape.

Bringelly Road is currently being upgraded from two to four lanes, as part of the process of improving regional transport infrastructure in conjunction with development of the SWGC. This is likely to involve the loss of existing vegetation along the road corridor. The road will intersect the proposed Leppington Town Centre, and the present rural character of the road will be significantly altered.

AMBS understands that Bringelly Road is the subject of an ongoing heritage assessment being undertaken for the RTA, and that the archaeological potential associated with the road will be

addressed in that report. AMBS anticipates that any potential archaeological resources associated with the road are likely to be adversely impacted by the proposed road upgrade. However, based on the information collected for this report, the main technical significance of the road as an important regional transport corridor, which had an early influence on the patterns of subdivision and settlement in the area, will be maintained through ongoing improvements to the existing road along its original alignment.

7.8 Views

The ILP for the Austral and Leppington North Precincts includes strategies for addressing impacts of future development on culturally significant views and landscapes, including views which have been identified in this report as historical and aesthetic points of interest in the area.

Expansive views from Judges Hill may by somewhat obscured by surrounding low density residential development. However, a key view corridor toward the southwest will be preserved through the provision of a pocket park at the crest of the hill, associated with the Hellenic Monument, and a new local road running between the park and the base of the hill.

Long open views from Carnes Hill will be retained unaltered, by the provision of an Environmental Management zone between Bringelly Road and the SWRL corridor, and the Western Sydney Parklands north of Bringelly Road.

Recommendation 17

Objectives for development in the vicinity of key history views and landscapes to be incorporated in the DCP for the Precincts are:

Objectives

- ***To conserve and interpret culturally significant views and landscapes at Judges Hill and Carnes Hill as historical and aesthetic points of interest in the area; and***
- ***To preserve historic toponyms as evidence of past occupants and land use.***

7.9 Interpretation

Interpretation of individual items of historic heritage, as well as the broader cultural landscape of the Austral and Leppington North Precincts, is an important tool in the conservation of heritage significance. It presents the story of a place in a way that will engage the community in its continuing care and protection. It can also be a source of enjoyment for local residents and visitors to the area. Section 6.6 of this report outlines an interpretation strategy for the Austral and Leppington North Precincts.

Recommendation 18

The interpretation strategy outlined in Section 6.6 of this report should be implemented as part of the Precinct planning process, during the assessment of future development applications, and in other Council-sponsored initiatives.

7.10 Consultation

Throughout the course of this project, AMBS has made every attempt to contact property owners in an effort to gain access to properties with potential local heritage value to discuss and assess the condition and significance of the place, with a view to recommending heritage listing of significant items in future amendments to the SEPP Growth Centres 2006. This has not always been successful: in one case AMBS was refused access to a property; in several others, AMBS was unable to make

contact with the owner of the land. In these situations, AMBS has undertaken an assessment of the significance of the place based on historical documentation and visual analysis from the street. It should therefore be noted that further research, including discussion with the owners of these properties about the history and condition of each place, may necessitate reassessment of their heritage significance.

Owners and occupiers of potential heritage items should be given written notice of the recommendations for heritage listing contained in this report, and be invited to make written submissions regarding the proposed listing. They should also be invited to forward to DP&I any historical or other information about their properties, including information about the physical condition of the property, which may contribute to a more complete understanding of the place and further inform the assessment of heritage significance contained in this report. These submissions should be taken into consideration before a final determination is made as to whether the property should be listed on the SEPP amendment. It is possible that further research and assessment will determine that one or more of the potential heritage items recommended in this report does not have sufficient heritage value to warrant long-term statutory protection. However, it should be noted that an owner's objection to heritage listing is only one part of the heritage assessment to be considered and is not in itself a reason for not listing a heritage item. Ongoing consultation with property owners is a worthwhile process, and provides an opportunity to explain the long-term benefits of heritage listing, including the social and financial benefits. The Heritage Office Publication *Heritage Listing: Benefits for Owners* (2004) may be useful in this context.

AMBS acknowledges that the desire to capitalise on commercial opportunities presented by Precinct development may conflict with opportunities to preserve significant heritage items for the appreciation of future generations. AMBS has not taken into account commercial considerations as part of the assessment of significance of any sites. However, AMBS also acknowledges that heritage listing is unlikely to be an effective mechanism for the long-term future conservation of more modest elements of the landscape without the understanding and support of the local community and property owners. If a property owner objects to the proposed heritage listing on the grounds that the listing may have potential implications for the economic use of the land, the owner will need to provide justifications for his/her concerns. All options for ongoing conservation and use of significant places should be carefully considered prior to resolving not to list the item.

Recommendation 19

DP&I should give written notice to the owners and occupiers of properties identified by AMBS as potential heritage items, areas of archaeological sensitivity, and properties within the proposed Austral Town Centre Conservation Area, to advise them of recommendations to list the property on the SEPP Amendment, to explain the implications of heritage listing, and to invite written submissions regarding the proposed listing. DP&I should take submissions into consideration before a final determination is made as to the listing of each property in the SEPP Amendment. Objections should be relevant to the assessment of significance and long-term conservation of potential heritage items.

AMBS understands that heritage items listed in the SEPP Amendment will in future be incorporated in the LEPs for Camden and Liverpool LGAs. Ongoing consultation with Councils, their respective heritage advisory committees, and other relevant stakeholders regarding the merits of the potential heritage items recommended in this report will facilitate the long-term conservation of these places for the community.

7.11 Summary of Strategies for Conserving Heritage Values

Table 7.1 lists the individual heritage items and potential heritage items in relation to the ILP for the Austral and Leppington North Precincts, and summarises the recommended strategies to conserve the heritage significance of these items as part of the Precinct Planning process. These recommendations are also listed on the inventory sheets for each item.

Table 7.2 lists the key historic property boundaries and roads within the study area, and recommended strategies to conserve the heritage significance of these landscape features as part of the Precinct Planning process.

Table 7.1 Summary of individual heritage items and potential heritage items in relation to the ILP for the Austral and Leppington North Precincts, and recommended strategies to conserve the heritage significance of these items as part of the Precinct Planning process.

Name	Address	Significance	ILP for Austral and Leppington North Precincts	Recommendations

Upper Nepean Scheme – Upper Canal	SCA land, Leppington	State	• No change to SCA land.
			• Intensified residential development in vicinity of Canal.
			• Local perimeter road adjacent to Canal corridor.
			• Augmented overbridges at Camden Valley Way, Bringelly Road, Sixth Avenue, Fifteenth Avenue.
			• Five additional overbridges immediately adjacent to the Precincts will be maintained for SCA access to the Canal Corridor, and some may be used by pedestrians and cyclists to access the Western Sydney Parklands.
				• List on SEPP.
				• Cumulative and long-term impacts of intensified development adjacent to route of the Upper Canal to be addressed in consultation with SCA and the NSW Heritage Council. Supplementary heritage management document to be prepared following exhibition of the ILP, to guide development in the vicinity of the Canal corridor, and to manage the impacts of intensified housing, roads and road infrastructure in the vicinity of the Canal corridor on the SHR values of the Canal.
				• Objectives and development controls addressing impacts should be incorporated in the DCP for the Precincts. Design guidelines to require:
				  • Perimeter road designed to deter heavy through traffic, to prevent impacts of vibration on the physical fabric of the Canal.
				  • Open landscape buffering in association with the perimeter road to reinforce its historic rural setting, whilst maintaining passive surveillance and security for the Canal. Roadside verge adjacent to the Canal corridor to be a minimum width of five metres to provide for a broad, grassed area and a pedestrian/cycling path.
				  • Houses to address the road and Canal corridor to provide passive surveillance for the Canal infrastructure. In areas where there are clear sightlines to the Canal corridor, landscaping limited to low shrubs and intermittent trees.
				• Road crossings over the Upper Canal adjacent to the Precincts to be limited to extant reinforced concrete beam bridges.
				• Site specific SoHIs to be prepared to address impacts of new, augmented or modified Canal crossings on the SHR values of the Upper Canal, in association with an application to the Heritage Council for approval under Section 60 of the Heritage Act, or an exemption under Section 57(2).
				• Pedestrian/cyclist crossings over the Upper Canal adjacent to the Precincts to be limited to extant overbridges.
				• Interpretation of the heritage significance of the Canal to be placed at key points at pedestrian/cyclist crossings to provide an understanding and appreciation of the form and function of the Canal, and its historical setting in a rural landscape. Interpretative signage along the proposed Perimeter Road, near pedestrian crossings, addressing open views of the Canal corridor wherever possible: for example near Bringelly Road, Sixth, Tenth, Thirteenth, Fifteenth and Eighteenth Avenues.

Name	Address	Significance	ILP for Austral and Leppington North Precincts	Recommendations
Row of Bunya Pines	145 Bringelly Road, Leppington	State	• No change to SCA land. • RTA preparing to upgrade Bringelly Road from 2 to four lanes.	• List on SEPP. • Update Statement of Significance on Liverpool Heritage Inventory, to include association with SHR listed Upper Canal System. • Carry out interpretation: Retention and maintenance of trees in current location, within SHR heritage curtilage. • Impacts of road widening to be addressed by RTA as part of REF.

Brown Memorial and water trough	145 Bringelly Road, Leppington	Local	• Expansion of SCA land at junction of Cowpasture and Bringelly Roads.	• List on SEPP.
				• Update Statement of Significance on Liverpool Heritage Inventory.
				• Consult with property owner and local community regarding ongoing management. Community stakeholders may include descendants of William Brown and Liverpool RSL.
				• Carry out interpretation:
				  • Retention and maintenance of fabric on site;
				  • Permanent signage.

Leppington Public School	142-148 Rickard Road, Leppington	Local	• Located within Leppington Town Centre.
			• Short-to-medium-term use as school; long term use likely private development.
			• Opposite Retail Core and surrounded by Business Park zones.
				• List on SEPP and Camden LEP.
				• Carry out interpretation:
				  • Retention and maintenance of significant fabric on site within the reduced heritage curtilage. Routine maintenance and development of the school, in accordance with DET requirements, is permissible within the heritage curtilage, and is consistent with the historic significance of the place as an educational facility.
				  • Develop a memorialisation and naming policy, especially for buildings within the reduced heritage curtilage, to recognise people significant to public education in Leppington.
				• New buildings in the immediate vicinity of reduced heritage curtilage to be sympathetic to the scale, massing, and character of the significant buildings and garden setting.
				• New commercial and/or retail buildings not to exceed one (1) or two storeys immediately adjacent to the reduced heritage curtilage, stepping back to larger heights 10-20m beyond the reduced heritage curtilage.
				• Prepare SoHI prior to site redevelopment for alternative uses or adaptive reuse.

Austral Town Centre Conservation Area, Austral		Local	• Retail/Commercial zone.	• List on SEPP and Liverpool LEP as heritage conservation area. • Carry out interpretation: Retention and maintenance of contributory items within proposed heritage curtilage. • Consult with property owners and local community regarding ongoing management. • Retain conservation area as small-scale community centre and mixed-use precinct, with a strong mid-twentieth century character.

Name	Address	Significance	ILP for Austral and Leppington North Precincts	Recommendations
				• Retain name 'Austral.' • Changes to the conservation area, including infill development, to be based on an understanding of the heritage significance of the place. • Prepare SoHI and Archaeological Assessment prior to redevelopment or site modifications within the conservation area boundary. • Asbestos cement sheeting to be replaced with fibre cement sheet, as required and in accordance with appropriate OH&S standards. • Detailed guidelines for development within and adjacent to the conservation area to be addressed in the DCP for the Precincts.
H J Starr Progress Hall	264 Edmondson Avenue, Austral	Local	• Retail/Commercial zone. • Within proposed Austral Town Centre Conservation Area.	• List on SEPP and Liverpool LEP. • Consult with property owner and local community regarding ongoing management. • Retention and maintenance of hall and/or similar community function within proposed heritage curtilage. • Retain name 'H J Starr Progress Hall.' • Prepare SoHI prior to redevelopment or modification of the site.
Ian's Hardware and House	256 Edmondson Avenue, Austral	Local	• Retail/Commercial zone. • Within proposed Austral Town Centre Conservation Area.	• List on SEPP and Liverpool LEP. • Prior to change, prepare photographic record of existing fabric of store and house. • Consult with property owner, tenant, and local community regarding ongoing management. • Retention of commercial function and maintenance of associated house on site, within proposed heritage curtilage. • Prepare an Archaeological Assessment and SoHI prior to redevelopment or modification of the site.
Brick House and Garden	275 Edmondson Avenue, Austral	Local	• Medium density residential zone.	• List on SEPP and Liverpool LEP. • Prior to change, prepare a photographic record of existing fabric of house and garden. • Retention and maintenance of house and garden on site, within proposed heritage curtilage. • Consult with property owner and local community regarding ongoing management. • Prepare SoHI prior to redevelopment or modification of the site.
House and Garden	170 Edmondson Avenue (125 Eighth Avenue), Austral	Local	• Low density residential zone. • Potential new local road intersecting property.	• List on SEPP and Liverpool LEP. • Retention and maintenance of house and garden on original lot, within proposed heritage curtilage. • Revise proposed road alignment to avoid impacts on heritage significance of property.

Name	Address	Significance	ILP for Austral and Leppington North Precincts	Recommendations
				• Prior to change, prepare a photographic record of existing fabric of house and garden. • Consult with property owner and local community regarding ongoing management. • Prepare SoHI prior to subdivision, redevelopment or modification of the site.
Cement Rendered House	40 Browns Road (60 Fifth Avenue), Austral	Local	• Environmental living zone – minimum lot size approximately 1,000-2,500 square metres.	• List on SEPP and Liverpool LEP. • Prior to change, prepare a photographic record of existing fabric of house and garden. • Consult with property owner and local community regarding ongoing management. • Retention and maintenance of house and garden on site, within proposed heritage curtilage. • Prepare SoHI prior to subdivision, redevelopment or modification of the site or neighbouring lots. • Surrounding development should not overwhelm the modest scale of the Cement Rendered House.
W V Scott Memorial and Park	380 Bringelly Road, Austral	Local	• Civic Precinct zone. • Site to be redeveloped as regional Aquatic and Indoor Recreation Centre. • Widening of Bringelly Road may encroach on original site of the war memorial.	• List on SEPP and Liverpool LEP. • Consult with property owner and local community regarding ongoing management. Community stakeholders may include descendants of WV Scott, Austral Public School, and Liverpool RSL. • Retention and maintenance of memorial playing fields (or redevelopment of land as proposed aquatic centre and indoor recreation facility, compatible with the original intent of the memorial sports field). • Respectful conservation of WV Scott war memorial in a garden setting at the main entrance to the playing fields (or at the main entrance to a similar sports/recreational facility). • Retention of name of WV Scott Memorial for recreation facility on site. • Interpretative signage. • Prepare SoHI prior to redevelopment of the site.
Hellenic Monument	Lot 10 DP 771080, Austral	Local	• Small Open Space zone surrounded by low density residential zone. • Road alignment from park roughly associated with significant view corridor.	• List on SEPP and Liverpool LEP. • Preservation and/or restoration of memorial within pocket park, in association with significant view corridor. • Name of pocket park to incorporate historic toponym: Judges Hill. • Consult with property owner land and local community regarding ongoing management. • Prepare a SoHI prior to redevelopment of the site.
Forest Home –	1720-1726 Camden	Local	• Low density residential zone.	• List on SEPP.

Name	Address	Significance	ILP for Austral and Leppington North Precincts	Recommendations
Archaeological Site	Valley Way, Leppington		• Possible road connection through heritage curtilage to Landcom development.	• Update summary statement of significance for Liverpool Heritage Inventory. • Consult with property owner and local community regarding ongoing management. • Prepare an Archaeological Assessment prior to redevelopment of the site, and construction of through road.
Blacksmith's Workshop (Former) – Archaeological Site	240 Fifteenth Avenue, Austral	Local	• Residential zone. • Future upgrade/widening of Fifteenth Avenue.	• List on SEPP and Liverpool LEP. • Consult with property owner and local community regarding ongoing management. • Prepare an Archaeological Assessment prior to redevelopment of site and/or upgrade of Fifteenth Avenue.
Weatherboard House – Archaeological Site	305 Fifteenth Avenue, Austral	Local	• Residential zone, with new local road parallel to Fifteenth Avenue. • Future upgrade/widening of Fifteenth Avenue. • Potential new local road intersecting site.	• List on SEPP and Liverpool LEP. • Consult with property owner and local community regarding ongoing management. • Prepare an Archaeological Assessment prior to subdivision, redevelopment of site and/or upgrade of Fifteenth Avenue.

Cowpasture Road – Cultural Landscape	Leppington	Local	• Road reserve maintained by RTA.
			• Possible upgrade of active section of original Cowpasture Road alignment.
			• Disused section of Old Cowpasture Road (east of the Upper Canal) intersected by SWRL Corridor.
			• Remaining disused section of Old Cowpasture Road (east of the Upper Canal) likely incorporated into adjoining Open Space and Environmental Conservation zones.
			• Disused section of Old Cowpasture Road (west of Upper Canal) likely incorporated into small Open Space zone, surrounded by Low Density Residential.
				• List on SEPP and Liverpool LEP.
				• Preserve disused section of original road (east and west of the Upper Canal) within natural landscape setting.
				• Maintain active section of original road alignment.
				• Consult with RTA and local community regarding ongoing management.
				• Prepare a SoHI that includes assessment of archaeological potential prior to redevelopment of disused section of original road and/or upgrade of active section of Cowpasture Road.
				• Retain name 'Cowpasture Road.'
				• Incorporate interpretive signage into future development of parks and other open space associated with Cowpasture Road to:
				  • explain the importance of the early road network to the history and development of the area,
				  • explain the historical relationship between the road and the Upper Canal, and
				  • describe long term changes in the local landscape.

Name	Address	Significance	ILP for Austral and Leppington North Precincts	Recommendations
Bringelly Road – Cultural Landscape	Austral	Local	• RTA preparing to upgrade Bringelly Road from two to four lanes, generally following existing alignment. This will likely involve the removal of existing vegetation along the road corridor.	• List on SEPP, Liverpool LEP, and Camden LEP. • Retain technical significance of the road as important regional transport corridor by maintaining the original road alignment as active part of the ongoing development of the SWGC. • Create a broad landscaped buffer along the Bringelly Road corridor, to reinforce the historic rural character and regional importance of this road within the landscape. • Retain name 'Bringelly Road.' • Impacts of road widening to be addressed by RTA as part of REF.

Table 7.2 Summary of key historic property boundaries and roads in relation to the ILP for the Austral and Leppington North Precincts, and recommended strategies to conserve the heritage significance of these places as part of the Precinct Planning process.

Historic property boundary or road	ILP for Austral and Leppington North Precincts	Recommendations
Cowpasture Road – Eastern Boundary of Alexander Riley's Raby land grant	• See Table 7.1 above.	• See Table 7.1 above.
Bringelly Road – Northern Boundary of Alexander Riley's Raby land grant / Southern boundary of Hoxton Park Estate	• See Table 7.1 above.	• See Table 7.1 above.
Eastwood Road – Eastern boundary Hannibal Macarthur's Eastwood land grant / Western boundary of Alexander Riley's Raby land grant	• Road to be upgraded as major north-south transit corridor through the Precincts. • New alignment to accommodate altered traffic conditions at the intersection of Eastwood and Bringelly Roads. Northern end of Eastwood Road will be moved to the west to meet with proposed new road corridor north of Bringelly Road. • Disused section of Eastwood Road corridor will be rezoned for Light Industrial uses and footprint of any new industrial buildings will likely obscure physical evidence of the historic road alignment.	• Historic alignment of Eastwood Road and associated land grant boundaries to be interpreted by means of visual media or signage: embossed bronze medallions set into the pavement or wall of any future building at the historic junction of Bringelly and Eastwood Roads and at point of departure from original alignment along Eastwood Road. Medallion or other signage to mark the original location and function of property boundaries for future residents of the area. Requirement for interpretation to be addressed in the DCP and at DA stage. • Create a broad landscaped buffer along the sections where the original alignment has been maintained to reinforce the historic rural character of this road within the landscape. • Retain name 'Eastwood Road.'
Edmondson Avenue	• Road to be upgraded, as major north-south transit corridor through the Precincts.	• Maintain historic road alignment. • Create a broad landscaped buffer along the Edmondson Road corridor, to reinforce the historic rural character and regional importance of this road within the landscape. • Retain name 'Edmondson Avenue.'
Fifteenth Avenue	• Road to be upgraded, as major east-west transit corridor through the Precincts.	• Maintain historic road alignment. • Create a broad landscaped buffer along the Fifteenth Avenue corridor, to reinforce the historic rural character and regional importance of this road within the landscape.
Northern boundary John Gurner's *Ickleton* land grant / Southern boundary of Barron Field's *Hinchinbrook* land grant	• New local road.	• New local road to follow historic land grant boundary. • Consider naming road in association with John Gurner's *Ickleton* or Barron Field's *Hinchinbrook* land grants.
Southern boundary John Gurner's *Ickleton* land grant / Northern boundary of James Williamson's *Dungarthell* land grant	• New local road.	• New local road should follow historic land grant boundary. • Consider naming road in association with *Ickleton* or *Dungarthell* land grants.
Eastern boundary John Gurner's *Ickleton* land grant / Western boundary of Edward Gray's land grant	• Extension of Craik Avenue.	• New local road should follow historic land grant boundary. • Retain name 'Craik Avenue.'
Eastern boundary of Urban Fidkin's land grant / Western boundary of Thomas Carne's land grant	• New north-south main road near to, but not following historic property boundary. • Integral Energy easement	• Maintain historic land grant boundary as landscaped/open space corridor in association with Integral Energy easement. • Consider naming road in association with

Historic property boundary or road	ILP for Austral and Leppington North Precincts	Recommendations
	partially follows historic property boundary.	Urban Fidkin or Thomas Carne's land grants.
Western boundaries of John Jamieson's *Cow-de-Knaves* land grant	• New local road. • Open Space and Environmental Conservation areas may obscure part of original alignment of historic property boundary.	• New local road should follow historic land grant boundary. • Consider naming road or pocket park in association with *Cow-de-Knaves* land grant.

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Figure 5.53 Canary Island Date Palm at the West Hoxton Depot (Inventory 9.14).

Figure 5.54 A Crepe Myrtle in flower at the West Hoxton Depot (Inventory 9.14).

Figure 5.55 Cactus at the West Hoxton Depot (Inventory 9.14).

More recent structures on the northern part of the Hoxton Park cottage site include the yellow-brick residence/office building, and a brown brick water pumping station (WPS 152; Figure 5.56-Figure 5.57). These buildings add a new layer of history to the site.

Figure 5.56 Brick residence/office building, West Hoxton cottage site; view from the southwest.

Figure 5.57 WPS 152; view from the west.

The site of the cottage for Maintenance Section 8 is located on the west side of the Canal at the corner of Bringelly Road and Old Cowpasture Road. The original weatherboard cottage has been demolished, but the site is marked by a small weatherboard toilet with a corrugated metal gable roof and a circular concrete septic tank (Inventory 8.32; Figure 5.58-Figure 5.59). A row of three mature Bunya Pines, lining Bringelly Road on the east side of the Canal, form a prominent backdrop to the site (Inventory 8.30; see Section 5.2.2 below). A longer row of mature Stone Pines can also be seen running along the east side of the Canal, adjacent to the cottage site; however, a number of these trees are dead or dying (Inventory 8.30; Figure 5.60-Figure 5.61).

Figure 5.58 Weatherboard toilet, Section 8 cottage site, Inventory 8.32.

Figure 5.59 Toilet and septic tank, Section 8 cottage site, Inventory 8.32; and row of Bunya Pines along Bringelly Road, Inventory 8.30.

Figure 5.60 Row of Stone Pines, along the east side of the Canal, Inventory 8.30.

Figure 5.61 View of Section 8 Cottage site across the Canal, framed by two dead Stone Pines.

The Section 8 cottage site retains evidence of an earlier garden. Remnant garden plantings include an Indian Hawthorne (*Raphiolepis indica*), a Willow (*Salix sp.*) on the eastern side of the Canal, and three flowering quinces (*Chaenomeles*, commonly known as Japonica) along the southern fence line (Figure 5.62-Figure 5.63). One of the quinces has grown over and hidden a rectangular concrete tank set in the ground and a rectangular concrete trough (Figure 5.64). A second concrete water trough and a small monument dedicated to Lieutenant William Brown MM have been placed next to the Indian Hawthorne tree (Figure 5.65). An associated plaque indicates that the memorial and water trough were relocated to the grounds of the then Water Board in 1994.

Figure 5.62 Section 8 cottage site, with three flowering quinces along the southern fence line. View from the north.

Figure 5.63 Row of flowering quinces along the fence line.

Figure 5.64 Concrete trough, overgrown by a flowering quince.

Figure 5.65 Brown memorial and concrete water trough, with Indian Hawthorne behind.

Interface between the Upper Canal and the Study Area

The fence line of the Upper Canal forms much of the eastern boundary of the study area. Twentyeighth Avenue is aligned with the Canal's fence line, between Thirteenth and Eighteenth Avenues. Further to the south, the Canal is flanked by individual properties, except for a triangle of land between Eighth and Tenth Avenues, where the Canal is bordered by wooded land. This triangle marks the boundary of John Jamieson's *Cow-de-Knaves* estate, granted in 1810, which was not included in the Hoxton Park subdivision of the 1880s. As such, it provides rare physical evidence of early European land tenure in the study area.

Although the Canal is a distinct, picturesque element of the landscape, it is often obscured from view by tree cover, with long views primarily evident at the Canal crossings between Tenth and Eighteenth Avenues (Figure 5.66-Figure 5.67). SCA has constructed a series of earthen embankments or berms at T-intersections and dead-end streets adjacent to the Canal, to prevent cars inadvertently driving into the Canal and to reduce opportunities for people to dump rubbish into the Canal (Figure 5.68). The berms are an important means of passive maintenance for the Canal, but further reduce sight-lines towards and across the Canal.

Figure 5.66 View towards Upper Canal from the eastern end of Sixteenth Avenue.

Figure 5.67 Picturesque view of Upper Canal from overbridge between Seventeenth and Eighteenth Avenues.

Figure 5.68 An earthen embankment at the eastern end of Fifth Avenue prevents cars driving into the Upper Canal and dumping of stolen vehicles.

Archaeological Sensitivity

Physical evidence associated with the construction of the Upper Canal is known to be present to each side of the Canal and within the SHR curtilage. Archaeological relics associated with the construction would make an important contribution to understanding late nineteenth century construction and maintenance of the Canal. Excavations associated with road and bridge widening have the potential to expose archaeological relics associated with the Upper Canal, which will need to be addressed and managed appropriately. There is some potential that associated works may have an effect on the fabric of the Canal, which would also need to be managed to ensure that the SHR significance of the Upper Canal is not undermined.

Summary Statement of Significance

The Upper Nepean Scheme – Upper Canal is listed on the SHR and SCA's draft Section 170 Register as a place of State heritage significance. The sections of the Canal that pass through Liverpool LGA are also listed on Liverpool LEP. The SHR and SCA inventories are attached in Appendix A. They include the following summary statement of heritage significance:

> *The Upper Canal is significant as a major component of the Upper Nepean Scheme. As an element of this Scheme, the Canal has functioned as part of Sydney's main water supply system for over 120 years. Apart from maintenance and other improvements, the Upper Canal has changed little.*
>
> *As part of this System, the Canal is associated with Edward Moriarty, Head of the Harbours and Rivers Branch of the NSW Public Works Department.*
>
> *The Canal is aesthetically significant, running in a serpentine route through a rural bushland setting as an impressive landscape element with sandstone and concrete-lined edges;*
>
> *The Canal is significant as it demonstrates the techniques of canal building, and evidence of engineering practice. The Canal as a whole is an excellent example of 19th century hydraulic engineering, including the use of gravity to feed water along the canal.*

SCA's assessment against the NSW Heritage Council criteria also includes the following, which are not included in the summary statement but which are relevant to this report:

- *For over half its route the canal follows, and at one point crosses, the Old Cowpasture Road which is one of the earliest European travel routes in Australia.*
- *Surviving long avenues of single and mixed pine species as a late 19th/20th century landscape feature are becoming increasingly rare within the Cumberland Plain. The Upper Canal route has two landmark features – the mixed pine avenue at Kenny Hill and the line of Stone Pines and Bunya Pines near the Old Cowpasture Road at Leppington.*
- *The Upper Nepean Scheme provides detailed and varied evidence of engineering construction techniques prior to the revolution inspired by reinforced concrete construction. Although concrete was used later to improve the durability of the system, much of the earlier technology is still in evidence along the Canal.*

  It also provides extensive evidence of the evolution of engineering practice, such as the replacement of timber flumes by wrought iron flumes to be followed by concrete flumes. The early utilisation of concrete for many engineering purposes in the System, also demonstrates the growing emergence of an engineering technology based upon man-made materials.

The Upper Canal meets the following SHR criteria: a), b), c), e) and f).

5.2.2 Row of Bunya Pines, Bringelly Road

A row of three mature Bunya Pines on the southern side of Bringelly Road, east of the junction between Bringelly and Cowpasture Roads, is associated with the SHR listed Upper Canal (Figure 5.69-Figure 5.70). These pines are included in the heritage curtilage of the Canal, and have been assessed as having exceptional significance, directly contributing to the State heritage significance of the Canal (Edward Higginbotham & Associates 2002:Inventory 8.30). The Bunyas are also listed on the Liverpool LEP as a significant cultural planting of the late nineteenth or early twentieth century and a prominent landmark in the local landscape.

The Bunyas are planted approximately 30-35m apart, and approximately 10m from the verge of the road. They have a distinctive symmetrical form, with a dome-shaped crown. Bunya Pines can grow up to 50m tall, and comparative evidence of other *Araucaria* suggests that they can live for hundreds of years.

Figure 5.69 Row of three Bunya Pines on the southern side of Bringelly Road, east of the Upper Canal; view from the northwest.

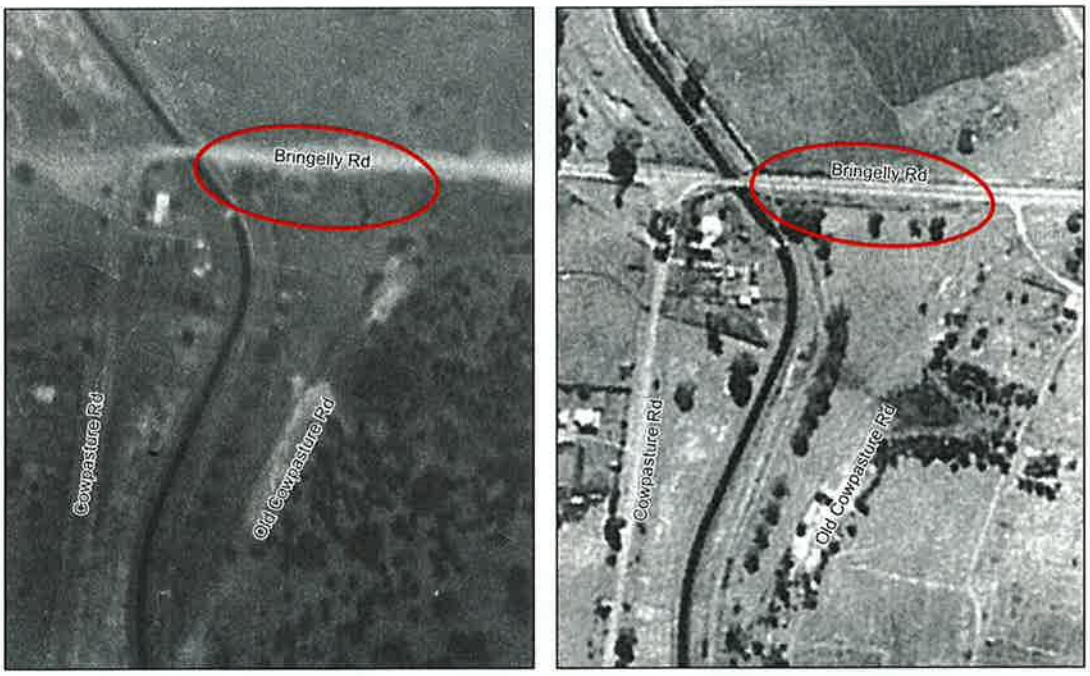
Figure 5.70 Row of three Bunyas; view from the southwest.

Imposing avenues or feature plantings of Bunya and other *Araucaria* are characteristic of nineteenth and early twentieth century landscape design in Australia, particularly in the context of public parks

and large estate gardens (Morris and Britton 2000:26, 28). The exact date of the Bringelly Road planting is not known; however, the trees are evidently associated with the former alignment of Cowpasture Road, on the eastern side of the Canal, at its junction with Bringelly Road. Predating the construction of the Upper Canal, these roads formed important transport and communication routes through the region, and their junction would have been an important spatial landmark in the colonial landscape.

There is no evidence for a Canal crossing associated with the former alignment of the Cowpasture Road, and it is possible that the new alignment on the western side of the Canal, south of Bringelly Road, was established at this time. In this context, the Bunyas may have signalled the change in the alignment of this important road and were likely planted in association with the construction of the Canal in the 1880s. The new (and current) alignment of Cowpasture Road was formalised in 1907 (see Figure 3.7 and Figure 3.8 above; LPMA CT Vol 796 Fol 99).

Aerial photographs of the study area in 1930 and 1955 show three trees in a location consistent with that of the Bunyas today, and as such, provide supporting evidence that the trees were planted before the 1930s (Figure 5.71). Moreover, the photographs show a second major planting along the western bank of the Canal, which is likely associated with a remnant row of Stone Pines today.



Horizontal datum: GDA94/MGA Zone 56
Background images: Detail from Geoscience Australia, Aerial photograph 3429-807, Sydney Survey, 1930 (left) and Land and Property Management Authority, Aerial photograph 228-5147, Run 26, Liverpool NSW, 1955

Figure 5.71 Aerial photographs of the Upper Canal in 1930 (left) and 1955 (right), showing three Bunyas on the south side of Bringelly Road.

Summary Statement of Significance

The summary statement of significance for the Row of Bunyas has been updated, based on the background information collected for this report:

> *A row of three Bunya Pines on the south side of Bringelly Road is a prominent local landmark, associated with the historic junction of the Bringelly and Cowpasture Roads, and the Upper Nepean Scheme – Upper Canal. The trees likely signalled a change in the alignment of Cowpasture Road*

following construction of the Canal in the 1880s. Imposing avenues or feature plantings of Bunya and other Araucaria are characteristic of late nineteenth and early twentieth century landscape design, particularly in the context of public parks and large estate gardens; but examples of these plantings are becoming increasingly rare in the Cumberland Plain.

The Row of Bunya Pines meets the following local heritage criteria: a), c), and f). They also meet the following SHR criteria, as an element of the SHR listed Upper Nepean Scheme – Upper Canal: a) and c).

5.2.3 Brown Memorial and Water Trough

The Brown Memorial commemorates William (Bill) Brown, Second Lieutenant in the 51st Battalion of the Australian Army, who died in action in France during WWI. The memorial was erected soon after the war, in approximately 1920, by the people of the district (Clarke and Haak 1993:5; Eileen Sargent, pers. comm., 18 February 2011).

Brown was the son of William and Ellen Brown of 'Dartmoor,' Austral. William Brown Senior was the local butcher and an Alderman on Nepean Shire Council. Born in 1894, Second Lieutenant Brown attended Austral Public School and was apprenticed as a butcher before joining the army to fight in the war. He was 22 years old when he was killed on 3 September 1916, at Mouquet Farm at the Battle of the Somme, France (Clarke and Haak 1993:5; Australian War Memorial, nd).

The memorial and water trough were originally sited on the opposite side of Cowpasture Road, at its junction with Bringelly Road. The site was an important junction in the regional road network, linking roads between the railway station at Liverpool, and Campbelltown in the south and Bringelly in the west. It was also adjacent to the maintenance worker's cottage for Section 8 of the Upper Canal, and was used as a stock-watering place. A water trough is thought to have been established here in the 1880s (Eileen Sargent, pers. comm., 18 February 2011). The trough can be seen on a subdivision plan of the Raby Estate from the 1910s (Figure 5.72).

The memorial was originally surrounded by a small picket fence, and a tree was planted nearby (Eileen Sargent, pers. comm., 18 February 2011). A white-painted post-and-rail fence made of wrought iron pipes is extant on the original site, demarcating a small rectangular area appropriate to the scale of the memorial (Figure 5.73-Figure 5.75).

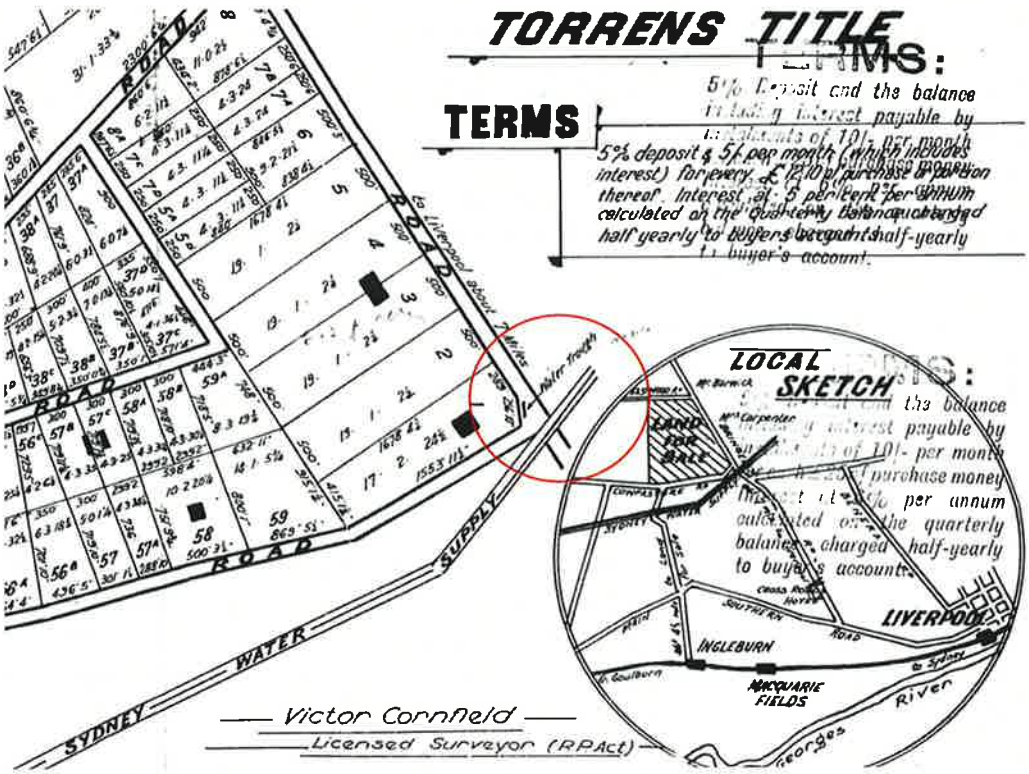


Figure 5.72 Detail of subdivision plan of the Raby Estate, c.1910s, showing the location of a water trough at the junction of Cowpasture and Bringelly Roads (Source: Mitchell Library, Ref: SP L10/74).

Figure 5.73 Post-and-rail fence; view from the north.

Figure 5.74 Post-and-rail fence; view from the west, with the current location of the Brown Memorial behind on the far side of Cowpasture Road.

Figure 5.75 A small, white-painted, metal post-and-rail fence on the west side of Cowpasture Road, at the junction with Bringelly Road, may represent the original location of the Brown Memorial.

With increasing use of motor vehicles in the second half of the twentieth century, the memorial came to be viewed as a traffic hazard, and was damaged by cars cutting across the corner between Bringelly and Cowpasture Roads. In 1994, the memorial was removed from the site to the Liverpool City Council office; this removal was undertaken without the knowledge of the Brown family, and became something of a local scandal (Eileen Sargent, pers. comm., 18 February 2011). The memorial and water trough were subsequently reinstalled on the current site, a wedge-shaped portion of land between the Sydney Water Upper Canal, Cowpasture and Bringelly Roads, and the site of the former maintenance worker's cottage for the Upper Canal. This land is included in the historic heritage curtilage of the SHR Upper Nepean Scheme – Upper Canal. A plaque associated with site indicates that the relocation was undertaken with the 'encouragement and co-operation' of the Hon R J Webster MLC, Minister for Housing and Minister for Planning.

The memorial and water trough stand on a concrete slab, at the base of an Indian Hawthorne (Figure 5.76-Figure 5.78). The water trough is a rectangular concrete basin, with four feet and a semi-circular sheet metal cover at one end. The cover may be adapted from a metal drum.

Figure 5.76 Brown Memorial, water trough, and an associated plaque.

Figure 5.77 Water trough; end view.

Figure 5.78 Water trough; side view.

The Brown Memorial consists of an inscribed, black granite plaque set on a sandstone desk-style monument on a small sandstone plinth. The inscription reads:

In Memory Of
W. BROWN.
KILLED IN ACTION
3RD SEPTEMBER 1916

The plaque has been broken into four pieces, one of which is missing (Figure 5.79). The remaining pieces appear to have been repaired. The sandstone base is in poor condition, and would benefit from remedial care (Figure 5.80).

Figure 5.79 The Brown Memorial plaque has been broken into four pieces, one of which is missing.

Figure 5.80 The sandstone base of the memorial is suffering significant deterioration, including contour scaling.

A sign associated with the memorial has been placed at the perimeter of the property, adjacent to Cowpasture Road (Figure 5.81-Figure 5.82). The sign provides information about the memorial, including a faded photograph of Second Lieutenant Brown, and documents related to his commemoration at the Villers-Bretonneux Memorial in France, and the Australian War Memorial in Canberra.

Figure 5.81 Information sign associated with the Brown Memorial, adjacent to Cowpasture Road.

Figure 5.82 Detail of the information sign associated with the Brown Memorial.

Summary Statement of Significance

The following summary statement of significance for the Brown Memorial and Water Trough has been prepared by AMBS, based on the background information collected for this report:

> *The Brown Memorial embodies the collective grief felt by the people of Austral and Leppington at the death of a local serviceman in France during World War I. The Brown Memorial is associated with Second Lieutenant William (Bill) Brown, son of William and Ellen Brown, early settlers in the Hoxton Park subdivision at the end of the nineteenth century. The memorial stands in lieu of a grave for Second Lieutenant Brown. Erected in approximately 1920 by the people of the district, the memorial provides evidence of an era of widespread Australian patriotism and nationalism, particularly during and following the First World War.*
>
> *The memorial and water trough were originally sited on the opposite side of Cowpasture Road, at its junction with Bringelly Road. The water trough is illustrative of the history and importance of this*

junction in the regional road network, which was used as a stock-watering place in the late nineteenth and early twentieth centuries. The memorial and trough were relocated to the current site in 1994.

The Brown Memorial and Water Trough meets the following criteria for local heritage significance: a), b), d) and g). .

5.2.4 Dwelling and Rural Lot, 1720 Camden Valley Way, Leppington

The dwelling and rural lot is associated with the WWII hero, Corporal John Hurst Edmondson. The family home, Forest Home, was likely built by John Hurst Edmondson's grandfather, Joseph Edmondson Snr, following his purchase of the land in 1906 (LPMA CT Vol 1833 Fol 74).

Joseph William Edmondson, a farmer, his wife Maude Elizabeth Hurst, and their only child John Hurst Edmondson, moved from Wagga Wagga to the family home in Leppington in 1916 (Grant 2006). John Hurst Edmondson was born on 8 October 1914 in Wagga Wagga, but grew up on the property in Leppington (Beckingsale 1941:3; HLA 2003:8).

A photograph of the house from 1941 shows a timber-framed weatherboard cottage with a corrugated iron hip roof and a front facing gable. It was built in the Federation style, consistent with the first decades of the twentieth century. It was set in a formal front garden, with scarlet poinsettias planted around the bull nose verandah (Beckingsale 1941:3; Figure 5.83).

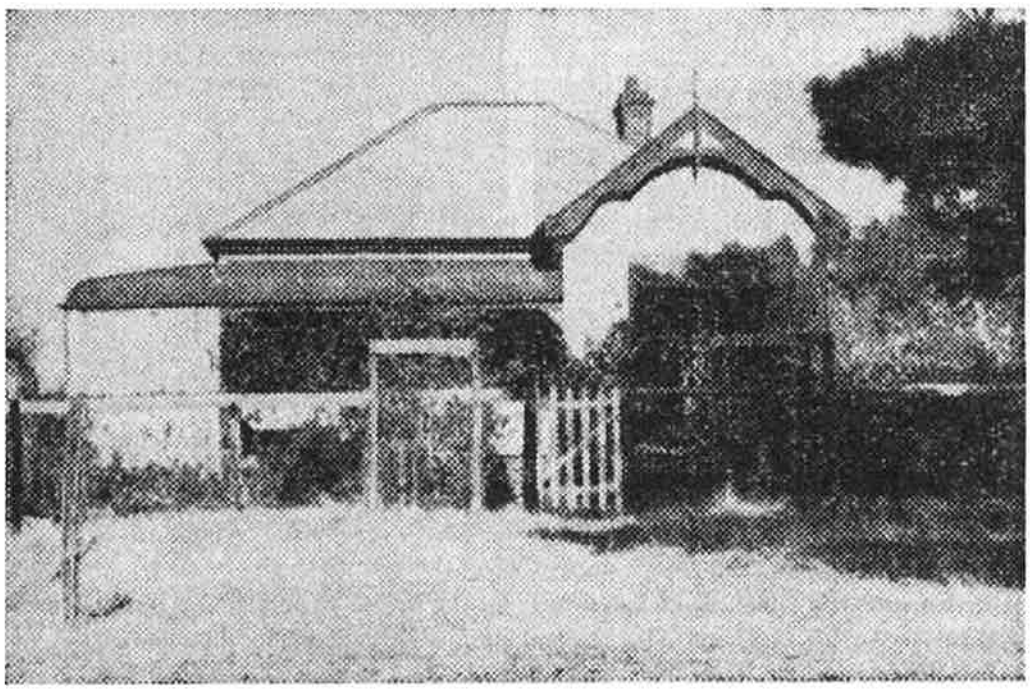


Figure 5.83 Forest Home and garden (Beckingsale 1941:3).

John Edmondson attended Austral Public School and Hurlstone Agricultural High School, after which he worked with his father on the family farm and became an expert cattle judge, and council-member of the Liverpool Agricultural Society (Grant 2006; Beckingsale 1941:3). Edmondson trained at Ingleburn Army Camp and served as a reserve in the 4th Battalion (The Australian Rifles) Citizen Military Forces, enlisting in the Australian Imperial Forces on 20 May 1940. He was promoted to Corporal in the 2/17th Battalion (Infantry), and was sent to the Middle East in 1940 (HLA 2003:8). Edmondson was killed in action at the Battle of Tobruk on 14 April 1941, aged 26, after saving the

life of a superior officer during a German machine-gun attack. He was posthumously awarded the first Australian Victoria Cross of WWII (Grant 2006).

Edmondson's father died in 1958 and his mother in 1961. In 1960, a mortgage was taken out on the property by Jean Maude Cummings (LPMA Vol 7802 Fol 141). The Cummings' renovated the house, removing the original roof and verandah and replacing them with a flat, corrugated iron roof. Other additions to the grounds included the construction of new silos and stables to the rear of the house. Forest Home was sold to the Bray family in the 1960s, who added fibro cladding, painted the exterior pale green, and introduced a circular stock yard (LHI: 1970123).

The property was compulsorily acquired by the Department of Planning in the early 1970s and is now managed by the LPMA. In 2004, the dwelling and rural lot at 1720 Camden Valley Way was identified as having heritage value to the local community during public consultation for the Liverpool Heritage Study Review (LHI: 1970123).

Today the dwelling is a single storey house with low pitched roof clad in profile steel. The external walls are clad in weatherboards along the west wall and former gable end. The remainder of the house is clad in fibro and weatherboard sheets, and the partially enclosed verandah, to the east of the entry, features a textured brick wall (Figure 5.84-Figure 5.86). The front entry is recessed between the brick feature section and the former gable end, but is no longer accessible (Figure 5.85). Although the interior has been extensively modified, some indications of the original house form can be discerned; however, it no longer retains the original fixtures or fittings and the original hearth is now an open fireplace.

Figure 5.84 Front of dwelling, 1720 Camden Valley Way.

Figure 5.85 Front of house with brick extension and fibro cladding.

Figure 5.86 Rear of dwelling.

The original garden has run wild and is now very overgrown. The front garden retains the remnants of the formal garden beds, with sandstone block edging now obscured by overgrown grasses and foliage (Figure 5.87). A mature poinsettia survives on the eastern side of the house and other plantings include mature jacaranda trees, oleander bushes, pepper trees, hibiscus, impatiens and roses (Figure 5.88).

The property now appears to operate as a farrier, as indicated by the sign on the gate, with a second sign identifying the property as Pinewood (Figure 5.91). This name is referenced in the initial 'P' worked into a 1950s-style metal gate to the rear of the house (Figure 5.92). The stables, circular stock yard and silos are extant, although the stables are in poor condition (Figure 5.89-Figure 5.93). The rural lot continues to be used as a horse paddock (Figure 5.94).

Figure 5.87 Sandstone blocks edging a circular garden bed.

Figure 5.88 Poinsettia to the east of the dwelling.

Figure 5.89 Stables.

Figure 5.90 Round stock yard.

Figure 5.91 'Pinewood' sign on main gate.

Figure 5.92 Metal gate leading to the stables and stock yard.

Figure 5.93 Silos.

Figure 5.94 Rural lot with horses.

The extent of alterations and the poor condition are such that the heritage significance of the property, as the former home of a WWII hero, has been substantially compromised. The house today bears no resemblance to the original Federation cottage and as such cannot be considered to have aesthetic or architectural significance. However, the property does have an historic association with John Hurst Edmondson VC which should not be lost.

Although the former dwelling has lost its architectural and historic integrity, the property has undergone little substantial change and as such is likely to have archaeological integrity associated with its occupation by the Edmondson family and as an example of a rural property within the wider Austral and Leppington area. There is potential for intact archaeological relics and deposits with good

integrity to be present in the site, and as such the listing of the *Dwelling and rural lot, 1720 Camden Valley Way, Leppington*, should reflect the heritage value of the site as the home of the WWII hero and as an archaeological site.

Summary Statement of Significance

The following summary statement of significance for Forest Home (Dwelling and rural lot), 1720-1726 Camden Valley Way, Leppington has been prepared by AMBS, based on the background information collected for this report:

> *Forest Home is associated with the WWII hero, Corporal John Hurst Edmondson, who was posthumously awarded the first Australian Victoria Cross of the war. The property has importance to the local community arising from its association with Edmondson, remembered as a local digger and war hero. The property is likely to contain intact archaeological relics associated with the Edmondson family and as an example of a rural property within the wider Austral and Leppington area. The property has the potential to yield information that will contribute to an understanding of the daily life of the Edmondson family and as a representative example of rural settlement and land use in south west Sydney during the first half of the twentieth century.*

Forest Home meets the following criteria for local heritage significance: b), d) and e). .

5.3 Potential Historic Heritage Items

5.3.1 Leppington (Raby) Public School, Rickard Road, Leppington

In the early 1920s, parents of children on the Raby Estate subdivision sent a series of letters to the Department of Education requesting the establishment of a new public school (LPS 1982:16). The application was eventually approved, and two roods of land fronting onto Rickard Road were resumed on 10 March 1922 for public education purposes (LPMA CT Vol 4484 Fol 166). The adjoining lot to the south was gifted to the crown a few months later by the NSW Realty Co. Ltd, who had bought up much of the surrounding land in the subdivision between 1916 and 1920 (LPMA CT Vol 3135 Fol 165, Vol 3339 Fol 147; DET 1968:1). This brought the total area of land to just under two acres.

Construction of the original school building was completed by the end of 1922 (Figure 5.95). The public school, originally known as Raby Public School, opened the following year as a one-teacher school with an initial enrolment of 28 pupils. The building was a single weatherboard classroom with a verandah around three sides, and an open fireplace with brick chimney. Two water tanks stood at the rear of the building, supplying water from drinking and watering the garden. In 1942, the east side of the classroom was extended by eight feet to accommodate the growing number of children enrolled, partially enclosing the verandah (LPS 1982:16-18).

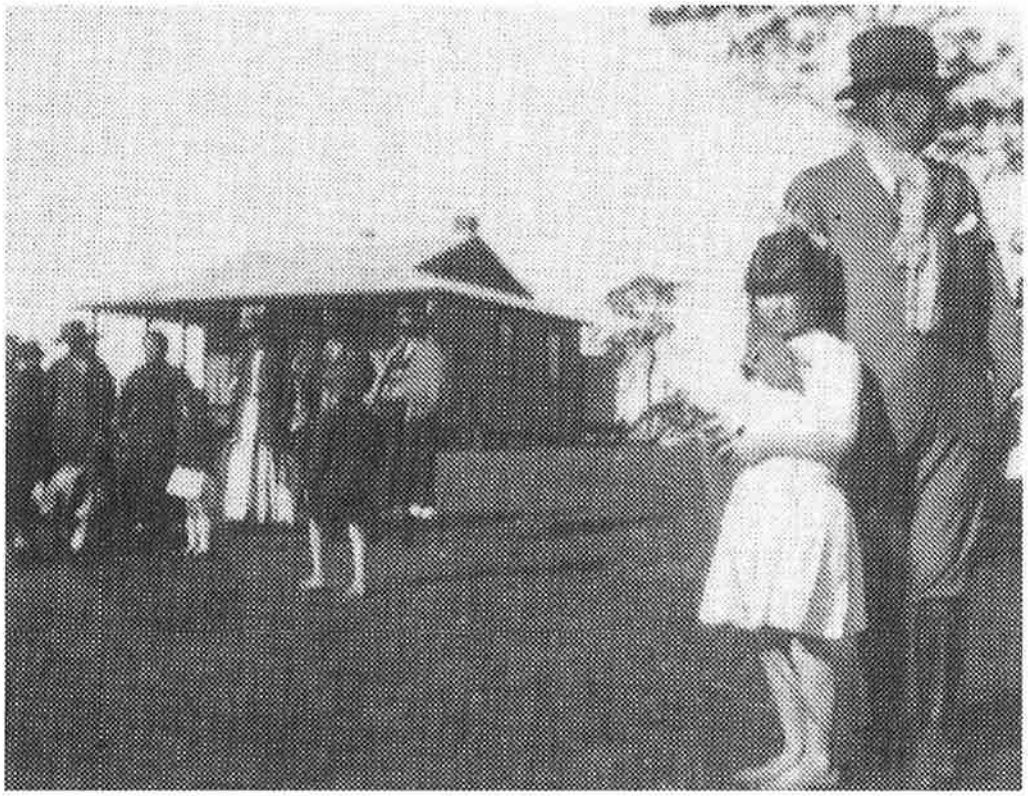
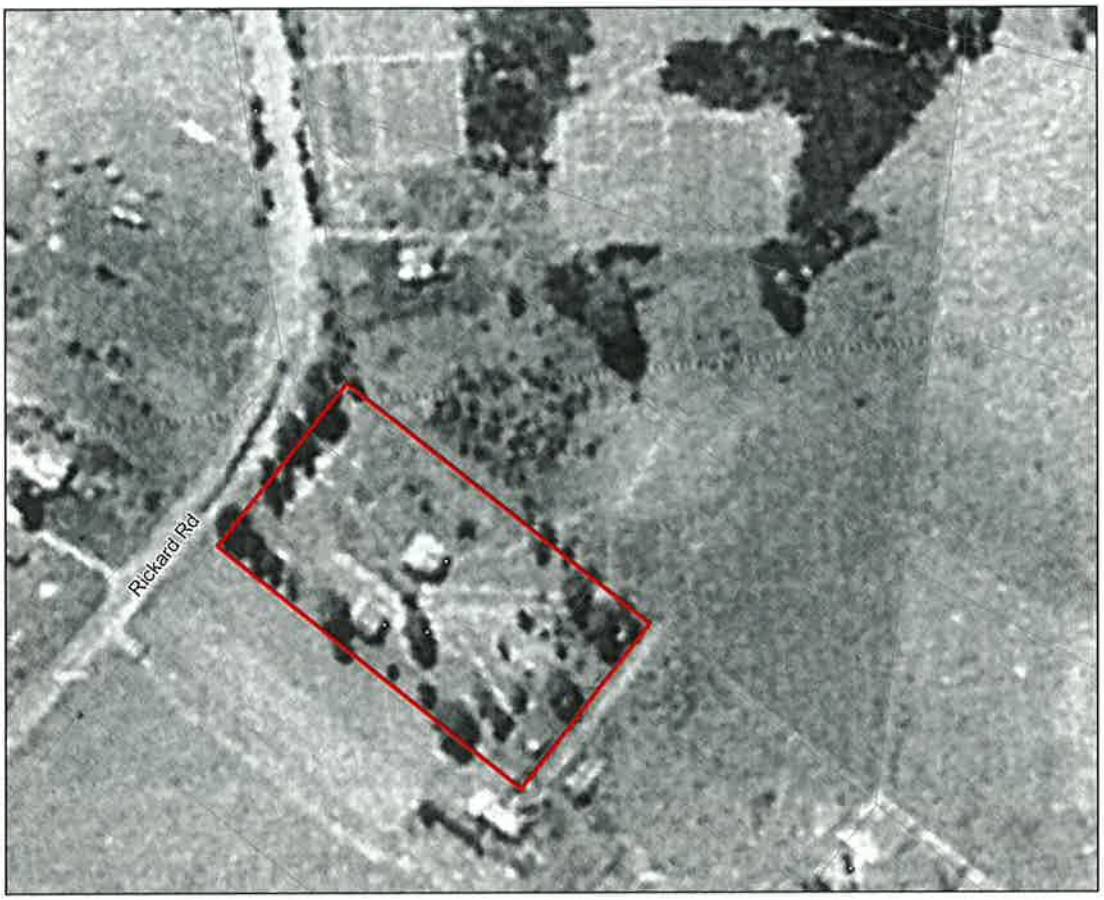


Figure 5.95 Original Raby Public School building, 1923; view from the west (Sourece: LPS 1982:16).

The district population increased steadily after WWII with the arrival of migrants from various countries including Italy, Yugoslavia, Czechoslovakia and England. There was a corresponding rise in enrolments at the school, and additional classrooms were gradually built between 1951 and 1961 to accommodate the growing number of students (Figure 5.96) (DET 1968:2; LPS 1982:19). Five weatherboard buildings were erected in a row along the south-western school boundary in the vicinity of the original school building, with an adjacent weathershed and ablution shed added during the same period (Figure 5.97-Figure 5.98). The name of the school was officially changed to Leppington Public School in 1955, after the local postal district (LPS 1982: 19).



0 20 40 80 120 160 Meters

Horizontal datum: GDA94/MGA Zone 56
Background images: Detail from Land and Property Management Authority, Aerial photograph 228-5147, Run 26, Liverpool NSW, 1955

Figure 5.96 Aerial photograph of Leppington Public School, 1955, showing two buildings in the southwest part of the school grounds: Buildings H and K. The approximate area of the school prior to 1955 is outlined in red.

Figure 5.97 From left: group of weatherboard school buildings, ablution shed (Building Q), and original Raby Public School building (Building H); view from the southeast.

Figure 5.98 Group of weatherboard buildings (Buildings I to M); view from Rickard Road.

The school reached its current extent in 1955-56, when approximately five acres of additional land was resumed to the north (Figure 5.99). Between 1966 and 1968, four new brick classrooms, an administration building, toilet block, and canteen were constructed in this area (DET 1968:2-3). A

row of pines was also planted along the back fence around this time; however, most had died by the end of the 1980s. A new brick library building was added in 1981 (LPS nd). (Figure 5.100-Figure 5.101).

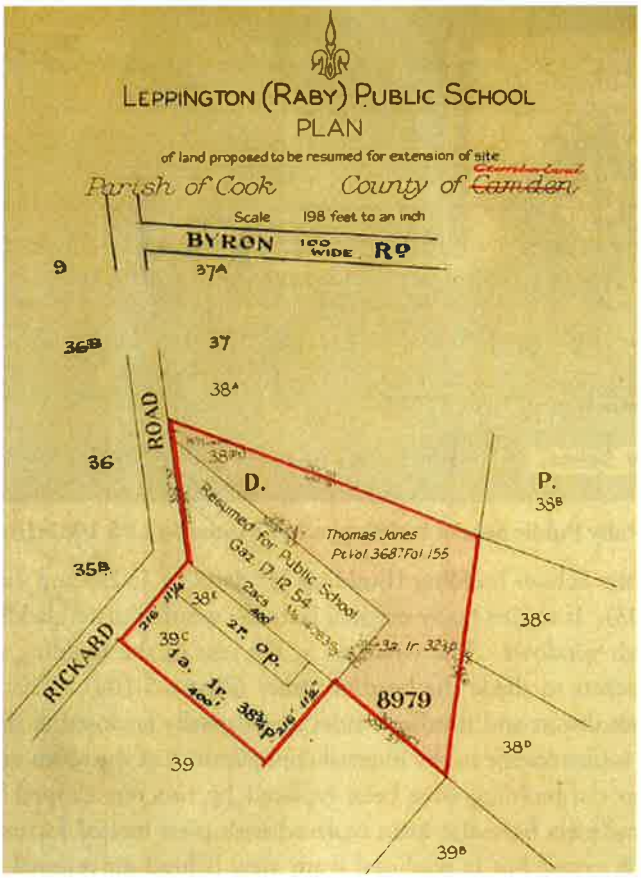


Figure 5.99 Plan of Leppington (Raby) Public School, 1956 (Source: DET Sites Register).

Figure 5.100 Northern group of school buildings; view from Rickard Road.

Figure 5.101 J Peck Oval, with row of pines along the back fence.

A Parents & Citizens Association (P&C) was formed in 1940, which soon raised money for a piano, a radio, and other school needs. In the 1950s, the P&C purchased a large number of rose bushes and shrubs which were planted in the school grounds. A photograph published in 1972 shows the old Raby Public School building with a grass lawn, two immature trees, a bird bath and a bed of agapanthus (LPS 1982:18-19) (Figure 5.102).

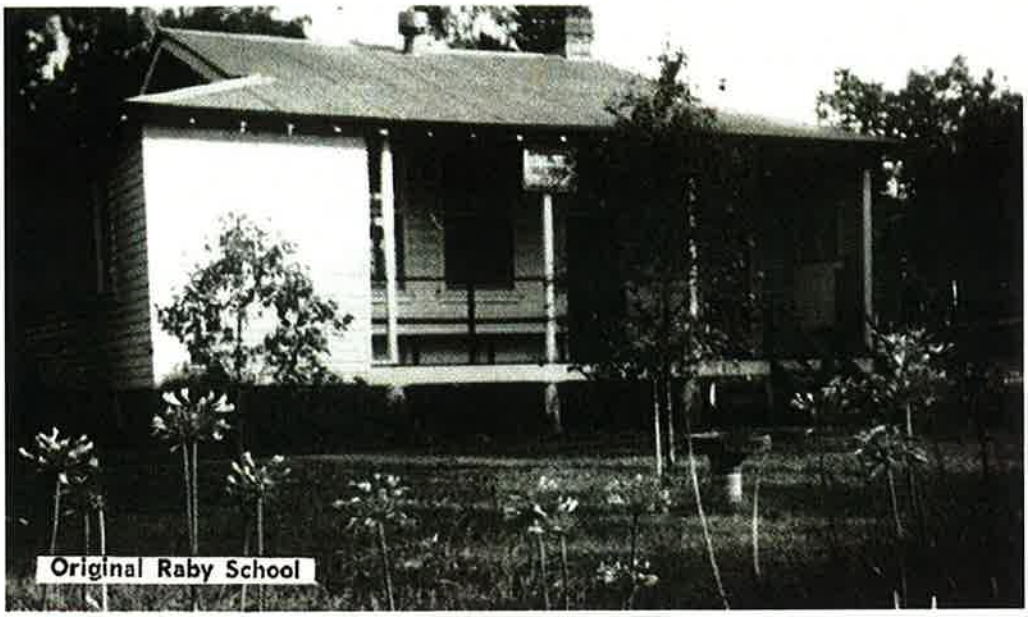


Figure 5.102 Original Raby Public School building, c.1972 (Source: LPS 1982:18).

The original Raby Public School building (Building H) dates to 1922, and currently functions as a staff room (Figure 5.103). It retains many original features: weatherboard cladding, Dutch gable roof, brick chimney, and sash windows. The windows at the rear of the building are fitted with timber awnings on timber brackets to shade the bottom sashes (Figure 5.104). The original verandah has been enclosed on the southwest and northeast sides and partially enclosed at the front. The original extent of the verandah is identifiable in the internal configuration of the room and ceiling panels. The original timber steps to the building have been replaced by concrete capped brick steps and metal safety rails. The original piers have also been replaced with piers treated for termites (Figure 5.105). The original fireplace is extant but is obscured from view behind an internal partition wall (Figure 5.106).

Figure 5.103 Original Raby Public School building, 2011; view from the west

Figure 5.104 Rear of original Raby Public School building; view from the southeast.

Figure 5.105 Brick stairs with concrete capping, metal safety rails and timber piers.

Figure 5.106 Interior partition and rear of brick chimney.

Five weatherboard classrooms aligned along the southwestern school boundary (Buildings I to M) were erected between 1951 and 1961 (Figure 5.107).

- Building I is a portable timber classroom, with sash windows that retain original glass panes (Figure 5.108). This style of building was first built in NSW in 1912, and was designed to be easily disassembled and transported. It is currently used as a community room.
- Building J is a fixed timber Van der Steen building erected in 1959 (Robert Demkiw, pers. comm., 14 December 2010). It contains adjoining rooms divided by a folding partition, with two separate entrances at the front of the building (Figure 5.109). It is currently used as the school hall.
- Building K is a fixed timber classroom of a type provided to rural areas, erected prior to 1955 (Figure 5.110). This style of classroom dates from c.1915 onwards. It is currently used as the community languages room.
- Building L is a fixed timber classroom that is currently used by the school counsellor (Figure 5.111).
- Building M is a fixed timber building erected in 1961, in a style similar to Building L. It consists of a single and double classroom joined together, and has a distinct breakfront with projecting verandah (Robert Demkiw, pers. comm., 14 December 2010) (Figure 5.112). Buildings L and M have been retrofitted with concrete access ramps.

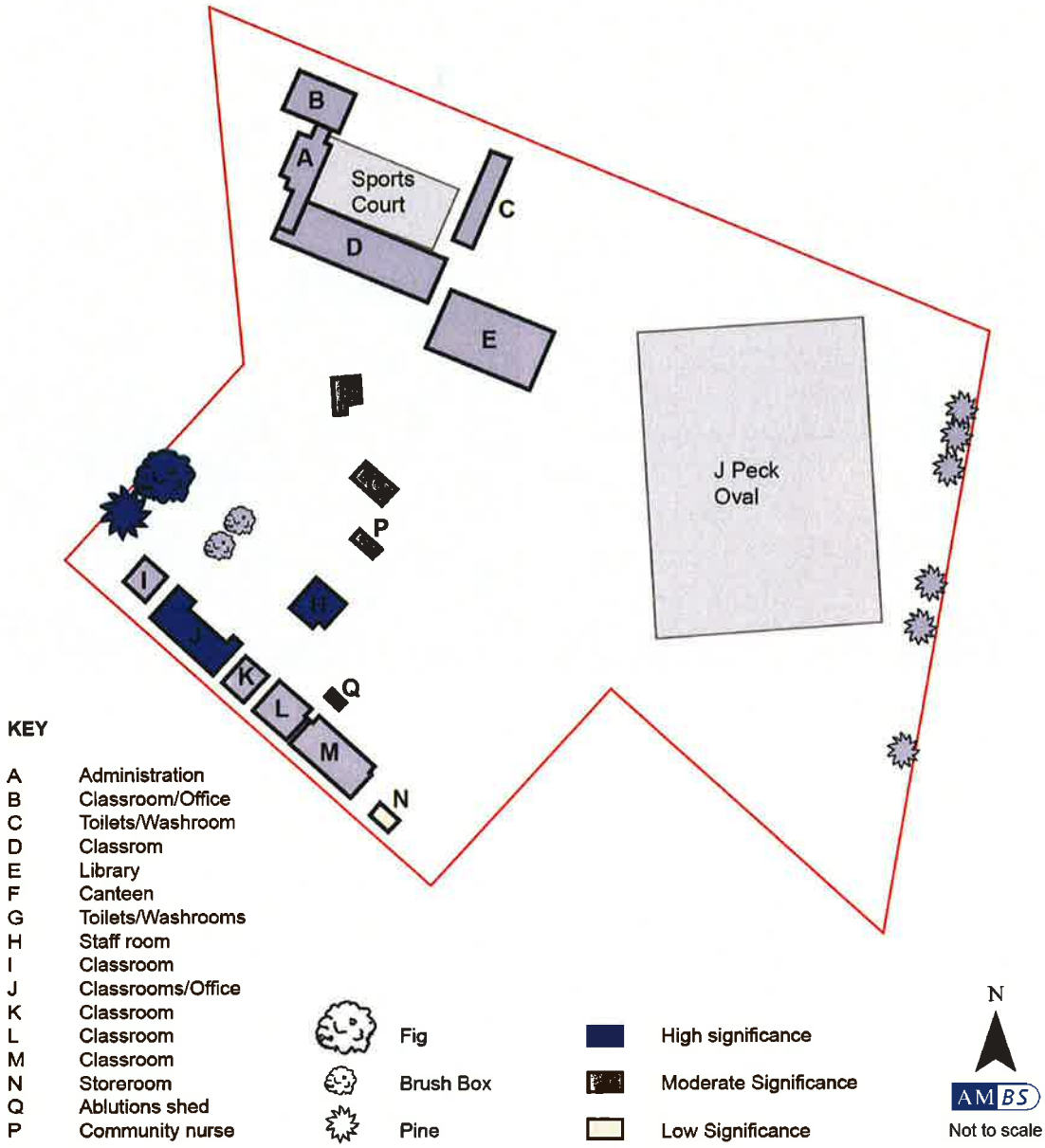


Figure 5.107 Schematic plan of Leppington Public School

Figure 5.108 Building I.

Figure 5.109 Building J.

Figure 5.110 Building K.

Figure 5.111 Building L.

Figure 5.112 Building M.

Buildings I to M form a coherent group by virtue of their predominantly timber fabric and the colour scheme of pale blue walls, dark blue detailing of window- and door-frames, and red verandah posts and rails. The colour scheme is shared with the original Raby Public School building (Building H). The classrooms retain much of their original fabric, are in good physical condition and modifications reflect ongoing maintenance and functionality. They are currently being upgraded under the Commonwealth Government's Building the Education Revolution (BER) program.

A fibro and weatherboard weather shed (Building N) and brick ablution shed (Building Q) are also within this area (Figure 5.113-Figure 5.114). The weather shed has been infested by white ants and is in poor condition. The brick ablution shed is of a standard type introduced to public schools from c.1955 to meet new standards of hygiene. Ablution sheds are now becoming increasingly rare in NSW as schools are gradually upgraded (Robert Demkiw, pers. comm. 28 March 2011).

Figure 5.113 Weather shed (Building N).

Figure 5.114 Ablution shed (Building Q).

The northern group of school buildings (Buildings A to E) were erected between 1966 and 1981. They form a complex of brick buildings, which has been physically integrated by the construction of a central sports court and COLA (Covered Outdoor Learning Area).

- Building D is a brick Van der Steen building of the same design as Building J (Figure 5.115). It was constructed in 1966, parallel to the northern school boundary. The southern external wall is decorated with a series of murals painted by students from Leppington Public School to celebrate Australia's bicentenary in 1988 (LPS nd). The murals depict scenes from Leppington's history (Figure 5.116).
- Building A, facing Rickard Road, contains the Administration block and Principal's office (Figure 5.117). It was constructed in 1967, and joins the eastern end of Building D.
- Building B is a classroom/office connected to Building A by a covered walkway (Figure 5.117). It was constructed in 1968.
- Building C contains the toilet block, washrooms, kiln and store. It was constructed in 1966 (Figure 5.118).
- Building E is the library. Constructed in 1981, it is set back from the other buildings in this complex, but maintains a similar alignment with the northern school boundary (Figure 5.119).

Buildings D and J were both designed by J Van der Steen, Design Architect with the Government Architect's Branch, 1955-1964 (Bob Demkiew, pers. comm. 14 December 2010; Jack 1980:227). Van der Steen designed several mid-twentieth century schools, including the Beverly Hills Girls' High School (documented in 1957) and Manly Girls' High School (documented in 1958) (Jack 1980:86). Building J is a rare example of a timber-framed weatherboard Van der Steen building (Robert Demkiw, pers. comm. 14 December 2010). It marks a deviation from Van der Steen's standard use of

brick and may reflect the shortage of available materials during the post-war period, and an enthusiasm for prefabrication (Jack 1980:87). It is possible that the weatherboard classrooms along the southwest boundary may all be prefabricated at the NSW Public Works Department.

Figure 5.115 Building D, Classrooms, north side.

Figure 5.116 Building D, south side.

Figure 5.117 Building A, Administration.

Figure 5.118 Building C and sports court.

Figure 5.119 Building E, Library.

Buildings F, G and P are located in the centre of the school grounds, to the east of the school car park..

- Building F is the brick school canteen and was constructed in 1968.
- Building G is a brick building containing toilets/washrooms, and was constructed in 1968.
- Building P is used by the community nurse and dates to 1991 (Figure 5.120).

Figure 5.120 Building P (left) and Building G; view from the north.

Bi-lingual signs in English and Italian, representative of the strong Italian heritage of the area, are present throughout the school.

A number of mature trees, including a fig and a pine near the front fence, stand on Rickard Road. The location of these trees is consistent with the 1955 aerial photo of the site, and it is likely that they are early plantings marking the original school site. A garden bed adjacent to Building D contains a number of rose bushes (Figure 5.121). Two brush box trees in front of Building H, and a row of pines along the eastern boundary, behind J Peck Oval, post-date 1955, and were likely planted in the 1960s. A collection of former farming equipment, including three ploughs and a chaff cutter, painted red and bolted to a brick and concrete base located between Building D and Building F, provide a reference to the farming heritage of the area (Figure 5.122).

Figure 5.121 Rose bushes next to Building D.

Figure 5.122 Farming equipment.

Summary Statement of Significance

The original Raby Public School building and the associated weatherboard classrooms form a coherent aesthetic group reflecting the early development of Leppington Public School and the surrounding district in the early- to mid-twentieth century. The expansion of the semi-rural school in the 1950s and 1960s, and the shift from weatherboard to brick classroom buildings, is demonstrative of a local population increase and demand for education during the post-war era in the Austral and Leppington areas. A link between the early and later periods, and between the southern and northern parts of the school, is provided in the weatherboard and brick Van der Steen designed classroom buildings. A mature fig and pine along the Rickard Road boundary likely mark the original school site and are visual landmarks in the local area. The school continues to play an important role in the local community and to provide a link with the migrant and agricultural history of the area.

The Leppington Public School, Rickard Road, Leppington, meets the following criteria for local heritage significance: a), b), c), d), f)and g). .

	Grading of Significance				
School Element	**Exceptional**	**High**	**Moderate**	**Little**	**Intrusive**
Old Raby Public School building (Building H)		✓			
Weatherboard Van der Steen building (Building J)		✓			
Group of weatherboard buildings (Buildings I-M)			✓		
Weather shed (Building N)				✓	
Ablution shed (Building Q)		✓			
Brick Van der Steen building (Building D)			✓		
Group of brick buildings (Buildings A-E)			✓		
Buildings F, G and P			✓		
Farming implements			✓		
Mature plantings along Rickard Road (fig and pine)		✓			
Other cultural plantings (rose bushes, brush box trees in front of Building H,row of pines behind J Peck Oval)			✓		

5.3.2 Austral Town Centre Conservation Area

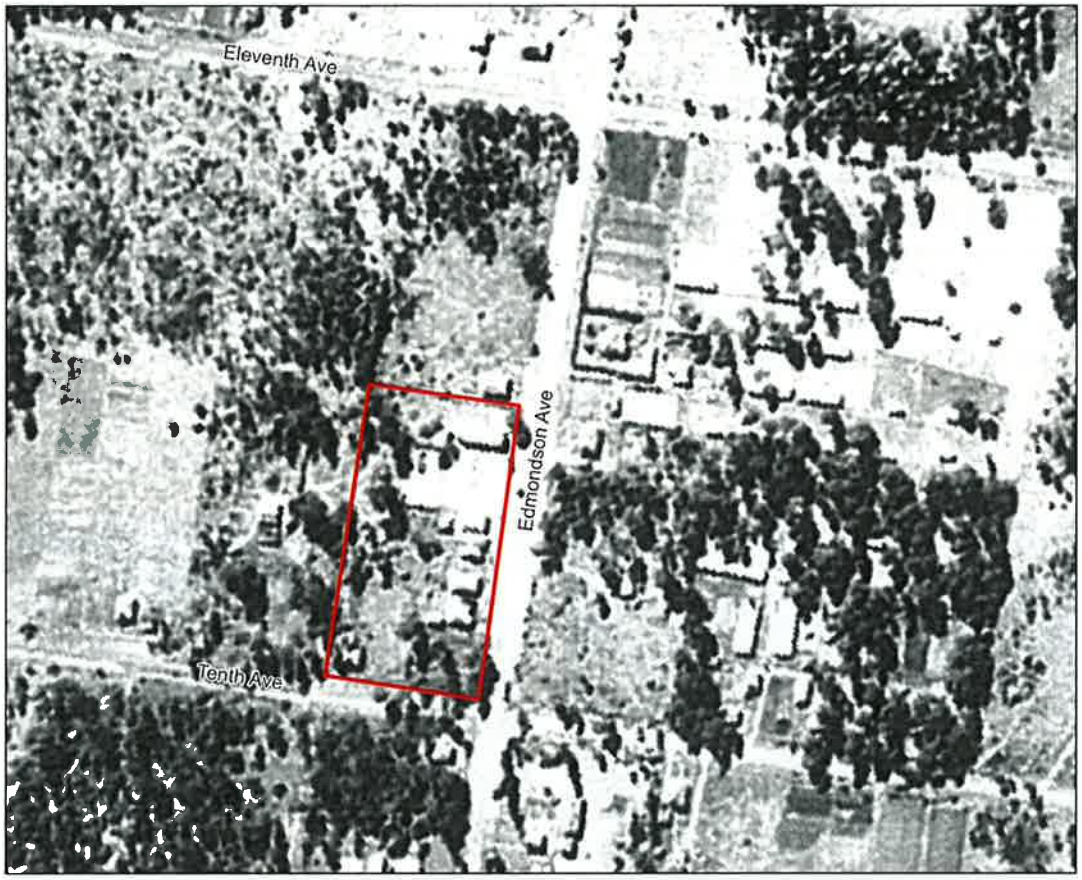
The proposed Austral Town Centre Conservation Area is focused on a small mixed residential, shopping and community precinct on the west side of Edmondson Avenue, between Tenth and Eleventh Avenues. The name 'Austral' comes from the nearby Austral Public School, which was established on land originally owned by Phillips & Company, also known as the Austral Banking and Land Proprietary. The precinct incorporates a representative sample of vernacular architecture, characteristic of the local region, constructed between 1938-39 and 1965. The building styles are complementary in their character and scale, and illustrate a range of functions important to the town as it developed in the mid-twentieth century, including the general store, Progress Hall, and post office.

The commercial development of Austral Town Centre began in 1938, when lot 837 of the Hoxton Park Estate was sold to Emma Rosetta Salome Starr, wife of Herbert George Starr, Austral postmaster (LPMA CT Vol 4698, Fol 149). The Starrs constructed a general store, telegraph office and house on the land, along Third Avenue (now Edmondson Avenue). Prior to this, the Starrs were running a post office on Tenth Avenue. The Starrs subdivided the lot, and in November 1939, H G Starr donated the north part (Part Lot A) to the Austral Progress Association to build a hall (LPMA CT Vol 5096 Fol 227; Ian Wilmington, pers. comm., 25 January 2011).

In 1947, the Starrs re-subdivided the remainder of lot 837, retaining ownership of the southern part in the hands of Emma Starr, and transferring the title to the general store to their son, Herbert James Starr (LPMA CT Vol 5096 Fol 228; Vol 5721 Fol 58)

In 1953, H J Starr again re-subdivided the land with the general store, and sold the store (Part Lot E) to new owners (LPMA CT Vol 5721 Fol 58; Vol 6804 Fol 32). H J Starr later established a new store on the southwest part of the original lot (Part Lot H), at the corner of Edmondson and Tenth Avenues (LPMA CT Vol 7160 Fol 22; Ian Wilmington, pers. comm., 25 January 2011).

By 1955, there were six buildings on the western side of Edmondson Avenue, including five buildings on the original area of lot 837: the Progress Hall, General Store, and three houses (Figure 5.123). These buildings are extant, and together demonstrate the character of the rural township and its local environment in the mid-twentieth century. In particular, the H J Starr Progress Hall, Ian's Hardware and associated house, as well as two single-storey fibro houses to the south of Ian's Hardware, form a coherent group, historically associated with the Starr family, and representative of the development of the town as a commercial and civic centre in the mid-twentieth century



0 25 50 100 150 200 Meters

Horizontal datum: GDA94/MGA Zone 56
Background images: Detail from Land and Property Management Authority, Aerial photograph 228-5108, Run 25, Liverpool NSW, 1955

Figure 5.123 Aerial photograph of Austral Town Centre, 1955, showing a series of small buildings on the western side of Edmondson Avenue. The approximate area of Lot 837 of the Hoxton Park Estate is outlined in red.

The H J Starr Progress Hall at 264 Edmondson Avenue is a red-brick building, constructed in 1965 to replace the original Progress Association Hall, which had been destroyed by fire (see Section 5.3.3 below for further details). The H J Starr Progress Hall is regularly used by community groups for meetings and classes, and anecdotal evidence suggests that the building has strong social value to the local community. A demountable building occupied by the Outer Liverpool Community Services is located to the rear.

The former general store forms the core of Ian's Hardware at 256 Edmondson Avenue, a single-storey timber-frame and fibro clad building with a pitched corrugated metal roof, and painted brick parapet. An associated fibro clad bungalow with a low pitched roof and street-facing gables has been relocated from the north side of the shopfront to the rear of the block (see Section 5.3.4 below for further details). A vacant block between the hardware store and the H J Starr Progress Hall provides overflow parking for the store and the hall.

The two houses on the south side of Ian's Hardware were likely to have been constructed for members of the Starr family in the Post-War period and have at various times been associated with the Austral Post Office. AMBS has not received permission to inspect the two fibro houses, and as such a thorough assessment has not been possible; however, a preliminary visual inspection has been undertaken from the street.

The house at 250-252 Edmondson Avenue is a plain, single-storey bungalow with a low-pitched corrugated metal roof, hipped to the front and gable to the rear, fibro cladding, and a skillion roof addition to the rear (Figure 5.124). The front is symmetrical, with a central front door. The house has been the residence of Ms Rose Ellen Starr for some years and as such it is possible that the house retains much of its original fabric, fixtures and fittings. The house has previously been used as the Austral Post Office (Graeme McIntosh, pers. comm. 3 February 2011). Concrete footings on the north side of the house are thought to be associated with the former telegraph office, and as such the site may have some archaeological potential.

The current Austral Post Office at 246-248 Edmondson Avenue is also a single-storey bungalow, with a hipped tile roof, and fibro cladding (Figure 5.125). The building is asymmetrical, with a single bay projecting forward on the south side. A red-brick addition with a flat roof also projects out from the front of the building on the north side. The brick addition served as the post office prior to the refitting of the house for the present post office (Graeme McIntosh, pers. comm. 3 February 2011).

Figure 5.124 House at 250-252 Edmondson Avenue.

Figure 5.125 Austral Post Office at 246-248 Edmondson Avenue.

The two fibro houses at 246-252 Edmondson Avenue are representative of a particular housing type that is currently well represented within the study area and is likely to become increasingly rare with future development. The two houses therefore make a contribution to an understanding of the development of Austral and the local area and as such warrant further investigation as built heritage items and for potential archaeological resources associated with the development of Austral town. Regardless of whether the two fibro houses meet the criteria for listing as individual heritage items, they should be identified as contributory elements in the Austral Conservation Area.

It should be noted that AMBS was not able to contact the owner(s) of Ian's Hardware or the houses at 246-252 Edmondson Avenue to undertake a formal inspection of these properties. However, AMBS understands that one of the owners may not support heritage listing of some of the properties, and has taken this into consideration during this assessment.

Summary Statement of Significance

Austral Town Centre Conservation Area is an intact grouping of residential, commercial and community buildings, historically associated with the family of Emma and H G Starr, Austral Postmaster in the early- to mid-twentieth century. The grouping has aesthetic value, insofar as it incorporates a representative sample of vernacular architecture of the southwest Sydney region, including three fibro houses of various styles, all constructed between 1938-39 and 1965. These building forms will become increasingly rare as the area is developed as part of the SWGC. The building styles are complementary in their character and scale, and illustrate a range of functions

important to the town as it developed in the mid-twentieth century, including the general store, Progress Hall, and post office.

The Austral Town Centre Conservation Area meets the following criteria for local heritage significance: a), b), c), e) and g).

5.3.3 H J Starr Progress Hall, 264 Edmondson Avenue, Austral

The Austral Progress Association was formed in 1931, out of the local school's P&C. It originally had a dual role, catering to the requirements of the school, and the broader needs of the local community. Following the formation of a separate P&C in 1936, the Progress Association focused on representing and promoting the interests of local residents and the Austral community (Clarke and Haak 1993:7). This was in keeping with a broader social movement towards local, participatory involvement in the affairs of the district (Keating 1996:135-138). The Austral Progress Association was formally incorporated in 1989 (LPMA CT Vol 5096 Fol 228).

The original Progress Hall was constructed in approximately 1939 on a small parcel of land on Edmondson Avenue, donated to the Progress Association by Austral Postmaster H G Starr (LPMA CT Vol 5096 Fol 228; Ian Wilmington, pers. comm., 25 January 2011).

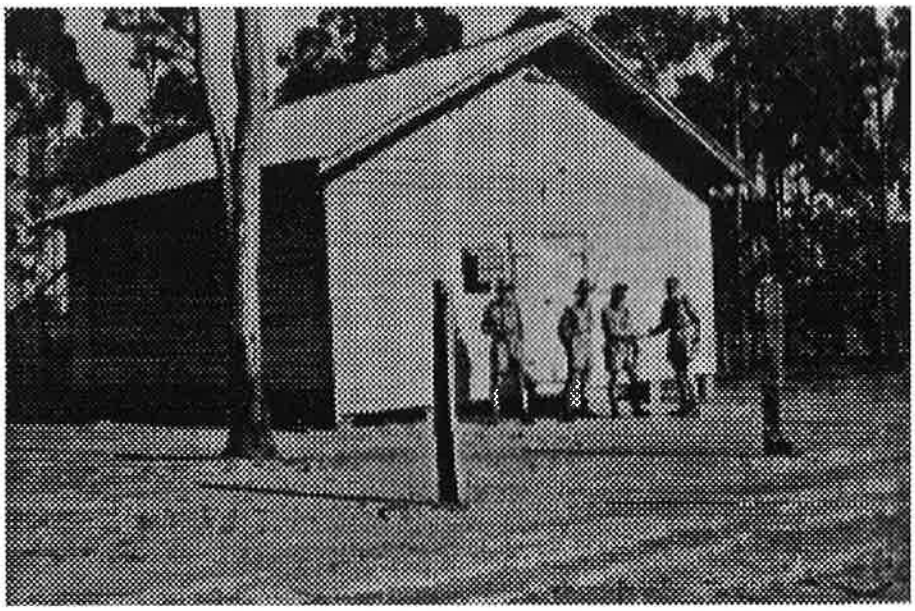


Figure 5.126 Original Austral Progress Hall (Source: Clarke and Haak 1993:6).

The original Progress Hall burnt down on 16 April 1962, and an 'Austral Queen Quest' was organised to raise money to fund a new hall. The existing hall was constructed in 1965, and upgraded with a new roof and kitchen in 1991 (Clarke and Haak 1993:7; Ian Wilmington, pers. comm., 25 January 2011).

The current hall is a simple single storey red textured brick building, with contrasting panels of pale yellow brick along the front, timber-frame windows, and a low pitched profile steel roof (Figure 5.127-Figure 5.133). The wide entry is flanked by projecting wings, with commemorative plaques mounted on the walls. Double glass doors provide access into the hall which has a stage at the far end, and the ladies and gents toilets to each side. The front wings house the kitchen to the right and a storage area to the left. The hall is lit by large, six-pane windows set high along the long walls. The roof is supported by steel trusses, which relieve the simplicity of the interior design. A demountable building to the rear houses the Outer Liverpool Community Services.

Figure 5.127 H J Starr Progress Hall, view from the southeast.

Figure 5.128 View from the street.

Figure 5.129 View from the northeast.

Figure 5.130 Commemorative plaque, in honour of H G Starr.

Figure 5.131 Commemorative plaque, for the renaming of the hall in honour of H J Starr.

Figure 5.132 Interior of the hall, with stage at the far end.

Figure 5.133 View of kitchen, installed in 1991.

The hall was renamed the H J Starr Progress Hall in December 2001, honouring the long-term patronage of H J Starr, son of H G and Emma Starr. The hall continues to be used on a regular basis by a variety of community-based groups and for private social gatherings (Ian Wilmington, pers. comm., 25 January 2011; Clarke and Haak 1993:7).

Summary Statement of Significance

> *The H J Starr Progress Hall is historically associated with the Austral Progress Association, originally formed in 1931 to represent and promote the interests of local residents, and with a broader social movement towards local, participatory involvement in the affairs of the district. It also has a special association with prominent members of the local community H G and H J Starr. Although the current hall does not have high aesthetic or architectural values, it is representative of its era, and it continues to play a vital role in the social and cultural life of the Austral community.*

The H J Starr Progress Hall meets the following criteria for local heritage significance: a), b), d) and g). The H J Starr Progress Association Hall makes an important contribution to the proposed Austral Town Centre Conservation Area.

5.3.4 Ian's Hardware and House, 256 Edmondson Avenue, Austral

In 1938, the land at 256 Edmondson Avenue was purchased by Emma Rosetta Salome Starr, wife of Herbert George Starr, Austral postmaster (LPMA CT Vol 4698, Fol 149-150). The Starrs likely constructed a general store, telegraph office and house on the land around this time. The store was the

first commercial business in what would later become the Austral Town Centre (see Section 5.3.2 above).

In 1947, the Starrs subdivided their land and transferred the title to the lot on which the store stands to their son, Herbert James Starr. H J Starr is described in the certificate of title as a storeman.

In 1953, H J Starr again re-subdivided the land with the general store, and sold the store (Part Lot E) to new owners: William Isaac Ratcliffe of Manly, salesman, and his wife Lyn (LPMA CT Vol 5721 Fol 58). It was subsequently purchased by Raymond Wesley Saints of Austral, merchant, and his wife June (1958); Robert Sydney Cryer of Austral, storekeeper (1960); and Gino Casella of Yagoona, box manufacturer, and his wife Nota (1963) (LPMA CT Vol 6804 Fol 32).

In 1966, H J Starr re-purchased the land, and leased the store to his nephew, Ian Wilmington. A photograph of the land from about this time shows the building being used as a hardware store, with two petrol pumps out the front, and the adjacent house flush with the front of the store (Figure 5.134). This house has since been relocated to the rear of the block (LPMA CT Vol 6804 Fol 32; Ian Wilmington pers. comm., 25 January 2011).

Figure 5.134 Photograph of Ian's Hardware and adjacent fibro house, c1966 (Source: Ian Wilmington).

The former general store continues to form the core of Ian's Hardware at 256 Edmondson Avenue. It is a single-storey timber-framed fibro-clad building with a pitched roof clad in corrugated roofing sheets and a painted brick parapet over the entry (Figure 5.135-Figure 5.136). A large, flat metal awning extending out at the front has been added to provide protection for two petrol pumps. The present awning is larger than that appearing in the photograph shown in Figure 5.134. The parapet provides the building with a more imposing façade than the other early buildings in the township and, as an Art Deco architectural detail, is consistent with a 1938-39 date of construction.

The original store building has been extended at the rear such that it now forms a long narrow space broken up into sections by surviving early wall sections and added counters. There is also a narrow addition along the north side of the original building. The stock includes a wide variety of items including general hardware, personal and household items, and refreshments.

Figure 5.135 View along Edmondson Avenue to Ian's Hardware.

Figure 5.136 Ian's hardware.

The fibro house, which now stands to the rear of the store, is a modest example of the Califronian bungalow style, with a low pitched roof, street-facing gables, and timber frame windows (Figure 5.137-Figure 5.138). Strapwork on the gables adds some simple decorative detail. The bungalow style of the house is also consistent with a 1939 construction date. The building currently serves as the office to Ian's Hardware. Although no longer a residence, the house has a strong historic connection with the store, as the store owner's family home. It appears to retain much of its original layout and fabric, and is in good condition.

Figure 5.137 View along the north side of Ian's Hardware to the fibro house.

Figure 5.138 The relocated fibro house to the rear of Ian's Hardware.

There is some potential for archaeological relics associated with the construction and operation of Ian's Hardware and the lives of the people who occupied the associated fibro house to be present in the site and the adjacent vacant lot.

Summary Statement of Significance

Ian's Hardware has historic significance arising from its association with the Starr family, who established the first general store in Austral Town Centre in approximately 1938-39. This store formed the basis of the Austral shopping district. The hardware store is demonstrative of the aspirations of the developing town in the early- to mid-twentieth century, reflecting the

contemporary Art Deco style of architecture, and is now a rare example of a commercial building of this period in the area.

The associated fibro house is no longer used as a residence, but it has a strong historic connection with the store, as the store owner's family home. The continuity of use of the store, and the continuing association of the store with the fibro house, contributes to the historic significance of the store and house as a coherent group.

The fibro house is a good, albeit modest example of the Californian bungalow style, and is characteristic of the mid-twentieth century housing stock that is currently well represented within the study area, but which is likely to become increasingly rare with future development.

Ian's Hardware and House meet the following criteria for local heritage significance: a), b), c), e) , f) and g). . Ian's Hardware store and the associated fibro house also make an important contribution to the proposed Austral Conservation Area.

5.3.5 Brick House and Garden at 275 Edmondson Avenue, Austral

In June 1925, John Frederick Valentine Landers purchased lots 816 and 817 in the Hoxton Park Estate from the Asset Realization Company Limited (LPMA CT Vol 1101 Fol 115). Landers also accumulated numerous other blocks in the district. Following Landers' death, his son Ferdinand Landers sold lots 816 and 817 to William White, a labourer from Hoxton Park (1932; LPMA CT Vol 4391 Fol 116). White likely built a small house and established a poultry farm on the land. In 1938, ownership of the land was transferred to Anna Prokoph, wife of Rudolf Prokoph, a poultry farmer who had emigrated to Australia from Czechoslovakia in 1928. Together with their son, Rudolf Prokoph Jnr, who joined his parents in Australia in 1938, the Prokophs continued farming poultry on the land (Erica Clarke, pers. comm., 1 February 2011).

In approximately 1948-9, Rudolf Prokoph Jnr constructed a new brick house for himself and his parents on lot 816, on Edmondson Avenue (Figure 5.139). The house is thought to be one of the earliest brick houses extant in the area. (A possible late nineteenth century brick cottage at 265 Fifteenth Avenue has now been demolished.) The decision to construct in brick was made despite advice from the local Council that the subsoil was primarily clay and unsuited to brick construction (Erica Clarke, pers. comm., 1 February 2011). Following construction, Anna Prokoph planted a pair of Canary Island Date Palms in the front yard, and a privet hedge along the fence line (Figure 5.140-Figure 5.141). These plantings are extant.

Figure 5.139 House and garden at 275 Edmondson Avenue, soon after construction in 1948-9. A newly planted Canary Island Date Palm is in front of the house (left) and privet hedges are in the foreground and background (Source: Erica Clarke).

Figure 5.140 Gate posts and privet hedge in front of house at 275 Edmondson Avenue, nd (Source: Erica Clarke).

Figure 5.141 Aerial photograph of Austral, 1955, showing the Prokoph poultry farm. The brick house, two palms and privet hedge can be seen adjacent to Edmondson Avenue (Source: LPMA, 228-1508, Run 25, Liverpool).

The Prokophs maintained a model poultry farm and participated in the Colombo Plan, providing experience and training for visiting farmers from less developed countries (Erica Clarke, pers. comm., 1 February 2011). The Colombo Plan was a cooperative venture conceived at the Commonwealth Conference on Foreign Affairs held in Colombo, Ceylon (now Sri Lanka) in January 1950 and launched in 1951, aimed at the economic and social advancement of the peoples of South and Southeast Asia. The farm and farming practices of the Prokoph family were described in a 1957 issue of Poultry, a weekly newspaper for poultry farmers: *"Greenfeed Keeps Birds Healthy", Says Austral Farmer* (Figure 5.142). Following the retirement of Rudolf Prokoph Jnr, the land was subdivided for a housing estate.

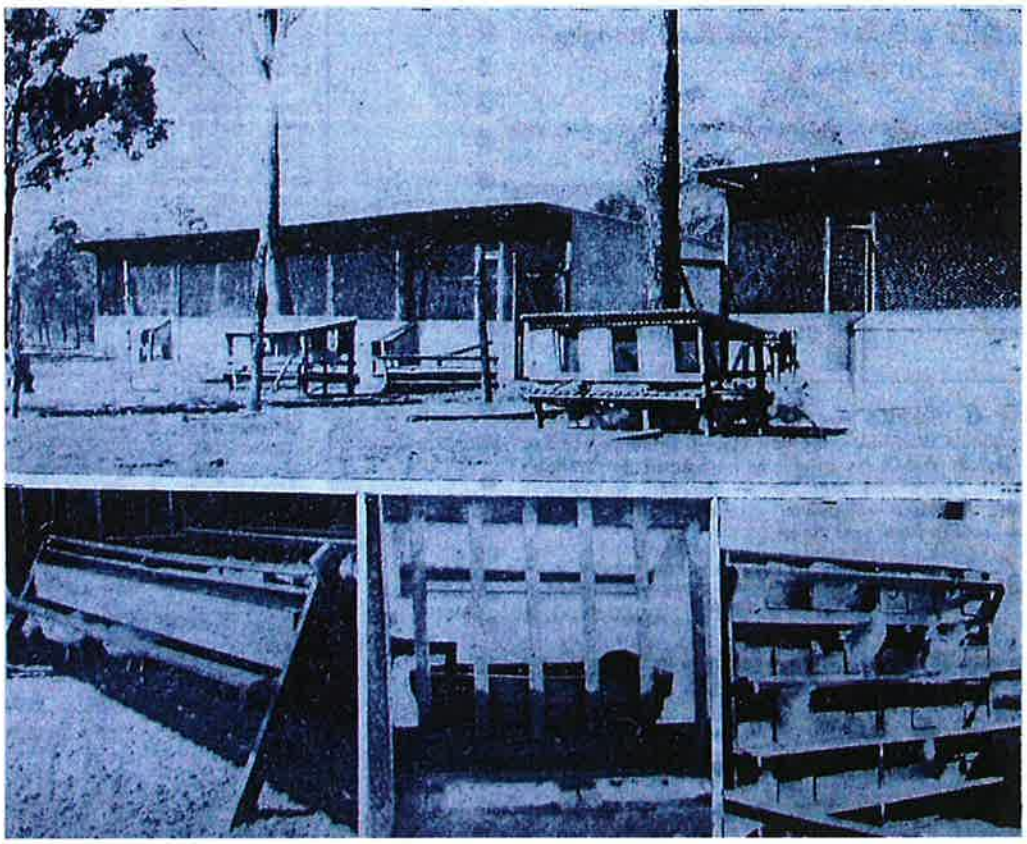


Figure 5.142 ***Three camera glimpses of Messrs. R. Prokoph & Sons farm at Austral, NS.W.,*** **showing the type of laying house standardised at the farm (top) and the equipment in these houses: home made wheat hopper (bottom left), earthenware drinking troughs (bottom centre) and a battery of 24 nests in three tiers (bottom right) (Source:** ***Poultry*** **5 October 1957, p.781; copy provided by Erica Clarke).**

The Prokoph house is architecturally consistent with its date of construction with a hipped tile roof and dark red face-brick walls (Figure 5.143). The symmetrical front has centrally placed glass-panelled French doors approached by a semi-circular entrance porch (Figure 5.144). The entry is flanked by three-bay casement windows. The concrete porch has brick-faced steps and brick columns. The house retains most of the original fixtures and fittings; however, the kitchen has been updated. A brick chimney on the south side of the house is intact, but the hearth has been concealed behind a panel (Figure 5.146). The house is well-maintained, although there is minor cracking in the walls, likely the result of shifting foundations.

A large fibro-clad shed and outdoor toilet are to the rear of the house. The shed was originally the feed shed for the poultry farm (Figure 5.147). The toilet is not original.

Figure 5.143 House at 275 Edmondson Ave, view from the street.

Figure 5.144 Detail of glass-panelled French doors.

Figure 5.145 Detail of brick chimney, south side of house.

Figure 5.146 Former feed shed, to the rear of the house.

The garden along the front and sides has a consistent mid-twentieth century character, and was established at the same time as the house. A concrete path leads directly from the street to the house via a metal gate, flanked by a pair of square, concrete gate posts (Figure 5.147). The gate replaces an earlier timber gate. The two Canary Island Date Palms, growing on either side of the path, are now a prominent feature of the corner block, and may well act as a local landmark Figure 5.148-Figure 5.149). The privet hedge along the front of the property is somewhat overgrown, and screens the house from street.

Figure 5.147 Detail of front gate.

Figure 5.148 Pair of Canary Island Date Palms, view from the southeast.

Figure 5.149 House and garden at 275 Edmondson Avenue, view from the northwest.

Summary Statement of Significance

The house and garden at 275 Edmondson Avenue have a strong mid-twentieth century character, and are representative of semi-rural styles of this era in western Sydney. Constructed in approximately 1948-9, the house is one of the earliest brick houses extant in Austral. It has been well maintained, retaining most of its original fixtures and fittings. Two Canary Island Date Palms in the front yard are roughly contemporary with the house, and are now a prominent feature of the streetscape.

The house and garden are associated with the mid-twentieth century migrant population of Austral. The house was constructed by Rudolf Prokoph Jnr for himself and his parents, Anna and Rudolf Prokoph Snr, who ran a poultry farm on the land. The Prokoph family emigrated to Australia from Czechoslovakia in the 1920s-1930s. The Prokophs maintained a model poultry farm and participated in the Colombo Plan, launched by Commonwealth countries in 1951, providing experience and training for visiting farmers from less developed countries.

The house and garden at 275 Edmondson Avenue meets the following criteria: a), b), c) and g) for an item of local heritage significance. .

5.3.6 House and Garden at 170 Edmondson Avenue, Austral

In February 1901, Ernest Stanley Simmonds, clerk of Woolwich, purchased Lots 925 and 926 in the Hoxton Park Estate from the New Oriental Bank Co Ltd (LPMA CT Vol 1101 Fol 115; Vol 1402 Fol 165). Two months later, the property was transferred to Henry George Simmonds, a Sydney conveyancer; and in December 1903, a warrant of execution was issued against the property for the recovery of debts owed by Simmonds. The warrant was resolved in 1912, when the property was sold by the Commercial Bank of Australia to Frank Kime, a licenced victualler of Sydney. Kime held onto the property until June 1933, when it was purchased by Violet Primrose Dudley, wife of John Dudley of Lakemba, Shoe Manufacturer (LPMA CT Vol 1402 Fol 165). The house was likely built by the Dudley family (Erica Clarke, pers. comm., 1 February 2011).

Violet Dudley was a local girl, the daughter of William Ayshford Jnr and Mary Dunn, and granddaughter of William Ayshford Snr and Sarah Morrish, nineteenth century settlers in the Hoxton Park district. Violet married John Dudley in 1927 (Kirkpatrick Family Archives 2008). The property remained in Dudley's ownership until 1956, when Lot 926 was sold to local grazier Alfred Mervyn Phillis. The land was subsequently purchased by: John Henry Tobin and his wife Elfreda (1960); Edwin George Wilce of Moorebank, retired grazier (1964); Janos Gerstner of Bankstown, factory manager, and his wife Anna (1970); Barry Patrick Geraghty (1970); and Kenneth John Montgomery of Austral, trainer, and his wife Elaine Helen (1974) (LPMA CT Vol 1402 Fol 165, Vol 7199 Fol 76, Vol 11232 Fol 158). The property remains in the hands of the Montgomery family at the present time.

A single-storey Californian style bungalow stands on the property at 170 Edmondson Avenue. A collection of farm outbuildings to the rear, and a series of overgrown animal pens and post-and-rail fenced paddocks to the south along Eighth Avenue, are associated with the house and are an important part of the property (Figure 5.150-Figure 5.151). The bungalow has white painted rendered and textured walls with a diamond pattern picked out in blue paint on the front. The hipped roof is clad in Marseilles-type roofing tiles with a prominent white painted central chimney. The front fence comprises square concrete posts with timber rails, which reflect the style of the verandah posts along the front of the house.

Figure 5.150 House at 170 Edmondson Avenue, view from the street.

Figure 5.151 Disused paddocks and animal pens to the south of the house.

The bungalow stands within an expansive landscaped garden, which is a prominent feature of the local streetscape, and may well act as a local landmark. Two rows of large Canary Island Date Palms flank a path that winds from Edmondson Avenue around to the front of the house. A third row of palms is aligned along the front fence, and flowering shrubs line a driveway on the north side of the property (Figure 5.152-Figure 5.154).

Figure 5.152 Row of Canary Island Date Palms along Edmondson Avenue.

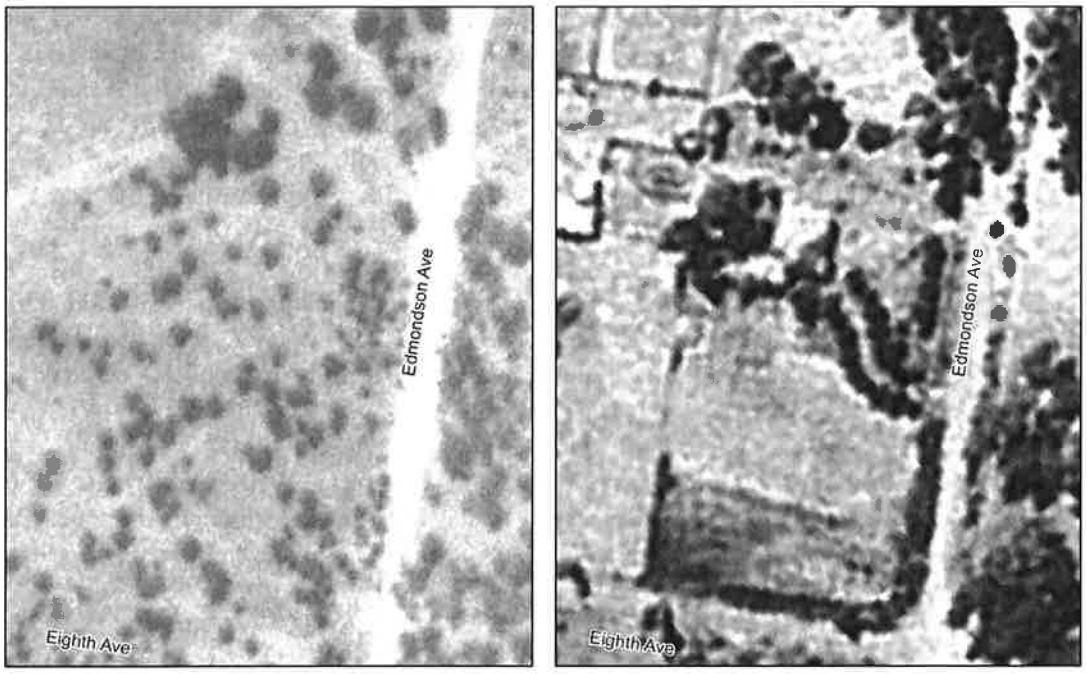
Figure 5.153 Remnants of timber gate post.

Figure 5.154 Flowering shrubs line a driveway on the north side of the property.

The exact date of the construction of the house is unknown. However, it is clear from the 1930 aerial photographs of the property that the lot was undeveloped at this date, while the 1955 aerials clearly show the house and the three rows of palms that form a prominent feature of the garden today. The house and garden were therefore established during the intervening period, likely around 1933-1934, following the sale of the land to Violet Primrose Dudley (Figure 5.155). The Californian bungalow architectural style appears in Australia in the decade before WWI, becoming common by the 1920s, after which time variations to the style began to appear. The bungalow style of the house is consistent with a 1933-1934 construction date, which would fall into the post-Depression period, but prior to

WWII. The garden also has an early- to mid-twentieth century character, and was likely established at the same time as the house. The serpentine path and feature plantings of palms were popular in suburban front gardens during the Federation and Inter-War periods, representing a scaled-down version of grand, gardenesque style planting schemes seen in nineteenth century public parks and large estate gardens. Palms generally went out of fashion after the war, not coming back in until the 1970s (Cuffley 1991:144; 2007:150).

The house and garden stand on their original 3 acre block, and as such provide good evidence of late nineteenth to early twentieth century patterns of land tenure in the Austral and Hoxton Park area.



Horizontal datum: GDA94/MGA Zone 56
Background images: Detail from Geoscience Australia, Aerial photograph 3429-807, Sydney Survey, 1930 (left) and Land and Property Management Authority, Aerial photograph 228-5108, Run 25, Liverpool NSW, 1955

Figure 5.155 Aerial photographs of the property at 170 Edmondson Avenue, 1930 (left) and 1955 (right). The house and garden are established between these two dates.

AMBS was refused permission to enter the property at 170 Edmondson Ave (also known as 125 Eighth Avenue); however, the house and garden appear to be well maintained, and an inspection from the street indicates that the house is currently being renovated.

Summary Statement of Significance

> *The garden at 170 Edmondson Avenue is an excellent representative example of suburban gardening styles in the southwest Sydney region in the Inter-War period, and the three rows of Canary Island Date Palms in the front yard are now a prominent feature of the local streetscape. Mature gardens of this date are rare in the region.*
>
> *Too little is known of the history and associations of the bungalow at 170 Edmondson Avenue to assess its historic significance with any credibility. However, the bungalow was likely established at the same time as the garden, possibly 1933-1934, and the pairing of bungalow and garden is unique within the study area.*

> *The house and garden stand on their original 3 acres block, and as such provide good evidence of late nineteenth to early twentieth century patterns of land tenure in the Austral and Hoxton Park area.*

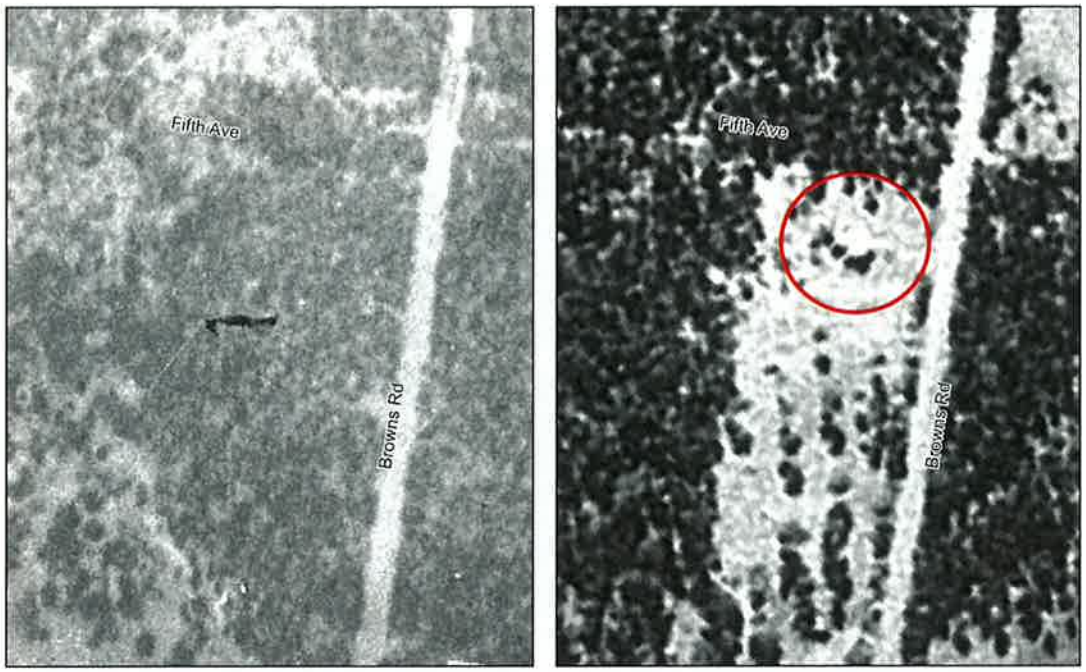
The house and garden at 170 Edmondson Avenue meets the following criteria: c) f) and g) for an item of local heritage significance.

5.3.7 Cement Rendered House at 40 Browns Road, Austral

In March 1894, Charles Bowles, chairmaker of South Brisbane, purchased Lot 1147 in the Hoxton Park Estate from Marie Sophie Nicholson Bellasis, mortgagee executing power of sale over the estate. In November 1913, a 100ft strip of land on eastern side of the lot was resumed for a public road, now known as Browns Road, reducing the size of the lot from 3 acres to 2 1/4 acres. The lot was sold in August 1935 to Charles Albert Brown of Auburn, Printer, and transferred to his widow Teresa Julia Brown in May 1946 (LPMA CT Vol 1101 Fol 115; Vol 1120 Fol 182). The death notice for Charles Brown in 1944 indicates that his primary residence was Hargrave Street, Auburn, and there is currently no evidence that the Brown family ever lived on the property in Austral (SMH 11 April 1944).

In December 1949, the property was purchased by James Arthur Langmead, plasterer of Paddington, and his wife Melva. It is likely that the building was constructed by Langmead soon after this date, and the unusual decorative treatment of the building may be a testament to his skill as a plasterer and renderer.

Aerial photographs of the area confirm that the building was constructed before 1955 (Figure 5.156). The property was later transferred to his daughter, May Puckridge of Penolo, South Australia (July 1980) and Margaret Raumer of Austral (October 1980), and was subsequently leased to tenants (LPMA CT Vol 1120 Fol 182; Vol 14222 Fol 241).



0 20 40 80 120 160 Meters

Horizontal datum: GDA94/MGA Zone 56
Background images: Detail from Geoscience Australia, Aerial photograph 3429-807, Sydney Survey, 1930 (left) and Land and Property Management Authority, Aerial photograph 228-5147, Run 26, Liverpool NSW, 1955

Figure 5.156 Aerial photographs of 40 Browns Road (corner 60 Fifth Avenue), 1930 (left) and 1955 (right). The house is circled in red.

The house stands on the corner of Fifth Avenue and Browns Road, facing Browns Road: the current tenant uses a mailing address of 40 Browns Road (Figure 5.157-Figure 5.158). The house stands on its original 2 1/4 acre block: reduced from 3 acres by the resumption of land for Browns Road. The property to the south of the house and yard has native regrowth forest.

The house is very small, comprising four rooms including kitchen and bathroom. It is cement rendered with a pitched roof clad in corrugated steel sheets with gable ends. An open skillion roofed addition to the rear is overgrown with vines and flowers. A concrete path leads directly from Browns Road to the house via a wire gate set in a short section of white picket fence; the remainder of the yard surrounding the house is defined by a chain wire fence. A row of Cocos Island Palms are planted along the fence line on Browns Road. The yard is grassed, with an occasional flower bed, and to the north-east is a healthy vegetable patch. A double gate on Fifth Avenue provides car access and the collection of caravans sitting to the rear of the house.

The house is an excellent example of twentieth century vernacular architecture, with many elements constructed of reclaimed materials. Internal walls are plastered and painted, the floors are polished timber boards, and the internal doors are Victorian panel doors. The hearth is a synthetic replica of a Victorian iron fireplace. (Apparently the builder capped the chimney because of a concern that 'invading Nazis would come down the chimney' [John Lenton, pers. comm., 11 February 2011]). The house has been well cared for and maintained.

The house has a projecting enclosed porch at the front, which appears to frame the entry, but which is currently used as a storage area; access is from the rear kitchen door. The porch has a central triangular pediment, a classical motif more common to larger, grander residences. Multi-pane windows are arranged symmetrically to either side of the porch; however the entryway is offset from the centre of the wall. A cement rendered dado across the front has been textured and painted to

resemble rusticated sandstone blocks. The path leading from the gate continues to each side of the entry, and has been scored to resemble 'crazy paving' and painted red and yellow; this was a common decorative motif of the Inter-War and early post-War period (Figure 5.159) (Cuffley 2007:155).

Figure 5.157 The cement rendered house at 40 Browns Road.

Figure 5.158 Cement rendered house at 40 Browns Road within its landscaped garden.

Figure 5.159 Detail of the painted crazy paving path at the front of the house.

Summary Statement of Significance

The cement rendered house is a rare example of a small, mid-twentieth century vernacular house in good condition. The house was likely constructed around 1950-52 by its owner, plasterer James

Langmead, during a major phase of development and agricultural intensification in the Austral and Leppington districts after World War II. It has a remarkable appearance, including evidence of craftsmanship and decorative architectural features more common to larger, grander residences.

The Cement Rendered House at 40 Browns Road, Austral meets the following criteria: a), c), e) and f) for an item of local heritage significance.

5.3.8 W V Scott War Memorial and Park, Bringelly Road, Austral

The W V Scott Memorial and the W V Scott Memorial Park commemorate William (Bill) Verdun Scott, Flying Officer in 7 Squadron of the Royal Australian Airforce, who died in action in Europe during WWII, aged 27.

Scott was the son of local grocer, bus operator, and long serving Nepean Shire Alderman Thomas George Scott. William Scott was born in Austral in 1917 and attended Austral Public School and Parramatta High School. Scott joined the army the morning after war was declared. He later joined the airforce, working as a bomb aimer and navigator, and was a member of the elite pathfinders stationed at Bournemouth in England. During WWII, the pathfinders were a group of volunteers who were specially trained to guide the main airborne force to designated drop zones. Their tasks were to mark the drop zones or landing zones, set up radio beacons as a guide for the aircraft carrying the main force, and to clear and protect the area as the main force arrived. Scott's plane was shot down over Alkmaar, Netherlands on 16 December 1943. Six crew members from the plane were buried in Stompetoren, Netherlands (Clarke and Haak 1993:5; Australian War Memorial, nd).

A monument in honour of Flying Officer Scott was erected at the corner of Bringelly Road and Edmondson Avenue in Austral (Figure 5.160). This originally consisted of a water bubbler on a raised foundation, with an associated plaque. One local resident also remembers that the bubbler was covered with a pergola in the 1960s (Erica Clarke, pers. comm. 1 February 2011). The bubbler was eventually vandalised and, following complaints, removed by Liverpool Council. A new black granite commemorative plaque and memorial rose garden was installed in the same location in approximately 1998 by the Liverpool RSL Sub Branch in cooperation with Council and Austral Public School (Figure 5.161) (District Reporter, nd; Vic Watts, pers. comm., 28 February 2011). The inscription replicates that of the original plaque:

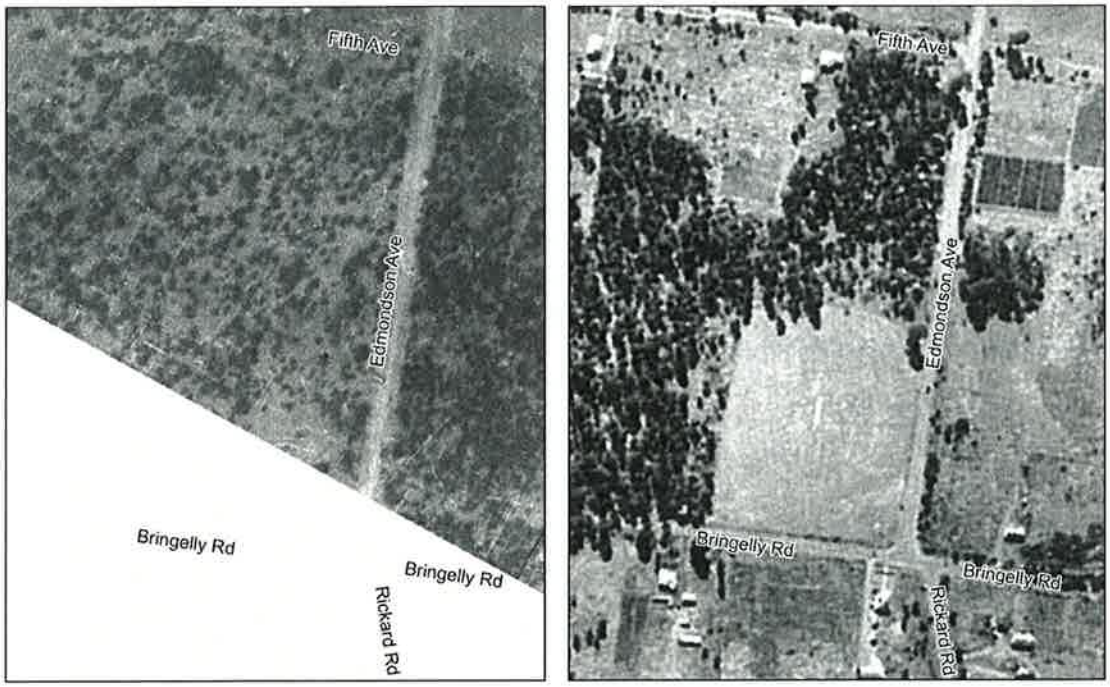
IN APPRECIATIVE
MEMORY OF
FLYING OFFICER
W.V. SCOTT R.A.A.F.
KILLED IN ACTION
DEC 16TH 1943
THERE WAS, THERE IS
NO NOBLER, STRONGER,
GENTLER, MANLIER MAN.

The last three lines make reference to American orator Robert G Ingersoll's famous eulogy at his brother's grave.

Figure 5.160 W V Scott Memorial and Park, at the junction of Bringelly Road and Edmondson Avenue.

Figure 5.161 Commemorative plaque at the W V Scott Memorial Park.

The monument is adjacent to a sports ground, also named in honour of W V Scott. The land for the memorial park was partially owned by Nepean Shire Council, and the remainder was purchased by Council after the War, in April 1948 (LPMA CT Vol 2880 Fol 146; Vol 1086 Fol 43). It is likely that the main oval and memorial were established around this time. The main oval can be seen on a 1955 aerial photograph of the area, with a central cricket pitch. Although the photograph is not entirely clear, the first memorial appears to have been constructed by this time (Figure 5.162).



Horizontal datum: GDA94/MGA Zone 56
Background images: Detail from Geoscience Australia, Aerial photograph 3429-807, Sydney Survey, 1930 (left) and Land and Property Management Authority, Aerial photograph 228-5146, Run 26, Liverpool NSW, 1955

Figure 5.162 Aerial photographs of land at the corner of Bringelly Road and Edmondson Avenue, 1930 (left) and 1955 (right). By 1955, an oval had been established on the land, named in honour of Flying Officer W V Scott.

The park now comprises a large grassy oval at the junction of Bringelly Road and Edmondson Avenue, and a smaller playing field at the corner of Edmondson and Fifth Avenues (Figure 5.163). A grandstand and other facilities present are at the north end of the oval. The park is surrounded by a

number of mature gum trees and a wire and pipe rail fence. The park appears to be well-patronised, and is the home training field for a number of local sporting clubs.

Figure 5.163 Small playing field at the corner of Edmondson and Fifth Avenues.

Summary Statement of Significance

The W V Scott War Memorial and Park commemorates the death of a local serviceman in Europe in World War II. The Memorial is associated with Flying Officer William (Bill) Verdun Scott, son of Thomas George Scott, early settler in the Hoxton Park Estate and long serving Nepean Shire Alderman. The memorial stands in lieu of a grave for Flying Officer Scott, and expresses the community's grief at his death. The naming of the associated W V Scott Memorial Park reinforces the community's desire to not forget the sacrifice of local residents in the war.

The W V Scott War Memorial and Park meets the following criteria for local heritage significance: a), b), d) and g).

5.3.9 Hellenic Monument, Lot 10 DP 771080

There is little available information concerning Greek migrants to the area or the Greek community; however, Lot 10 DP 771080, north of Gurner Avenue was purchased by the Federation of Hellenic Associations in 1995. Previously the Associations had had a 99 year lease on the land, but after lobbying the government, the 21 shareholders successfully purchased the land. The aim for the land was to create a cultural hub for the Greek community: sporting facilities, recreation, community care and housing for elderly members of the community. The plans have been on hold, mainly because of the proposed electrical substation and additional 330kV transmission line, which will remove part of the land (John Petropoulos, pers. comm., 2 February 2011).

The land is marked out by an Hellenic or Greek style monument, which stands overlooking the valley from an elevated position on Judges Hill (Figure 5.164). The monument is in a ruinous condition, but continues to form a prominent feature of the landscape. Constructed of reinforced concrete, it has

four Doric columns set on a stepped rectangular podium; the column on the northwest side has fallen over. There are remnants of a marble plaque attached to the front, west side of the podium. The marble plaque is inscribed with Greek lettering; however, too little survives from which to decipher a meaning (Figure 5.165-Figure 5.166). The monument is painted white, and a u-shaped shadow in the paint at the centre of the podium marks the site of an additional element, now missing.

Figure 5.164 The Hellenic Monument on Judges Hill.

Figure 5.165 Remnant of the inscribed marble plaque.

Figure 5.166 Detail of inscribed marble plaque.

Summary Statement of Significance

Too little is known about the Hellenic Monument to assess its historic significance. However, construction of the monument would have involved a substantial investment of materials and labour, and its placement in the landscape suggests a desire to commemorate events associated with the acquisition of the land and/or the activities of the Greek community in southwest Sydney. There is potential to gain new information about the historic significance of the monument and its association

with the Greek community from further historical research. The monument is centred on Judges Hill such that it has landmark qualities within an important view corridor within the local environment.

The Federation of Hellenic Associations monument on Judges Hill is likely to meet the following criteria for local heritage significance: a), c), and e).

5.3.10 Nissen Huts at 97A Bringelly Road and 105-111 Edmondson Avenue, Austral

In early 1916, Major Peter Nissen, 29th Company Royal Engineers, developed prefabricated portable utilitarian huts, which were being produced by August the same year (Stuart 2005:51; Figure 5.167). The standard sizes for Nissen huts are described in the Prefabricated Building Catalogue issued by the Department of Works & Housing as:

> *Standard lengths are 36ft and 60ft for 16ft and 24ft span buildings respectively, of approximately semi-circular section, constructed of semi-circular steel T ribs with timber purlins covered with corrugated aluminium sheeting placed vertically. Ends of 3ft and 2ft frame and dressed weatherboards. Single or double doors and windows. Dormer windows can be added if required. At present (Jan 1951) aluminium sheeting is unavailable and corrugated black iron must be supplied in lieu. For full details of Bldgs see handbook* (1951:Sheet No.1).

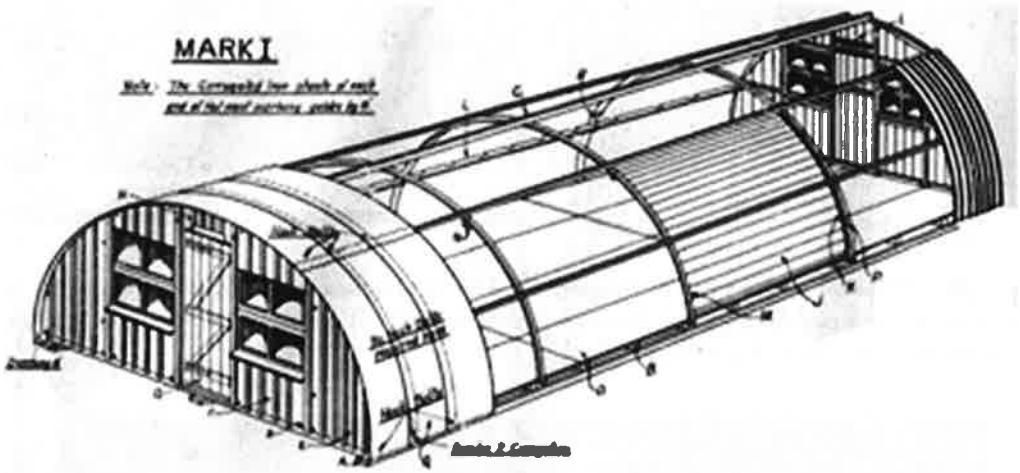


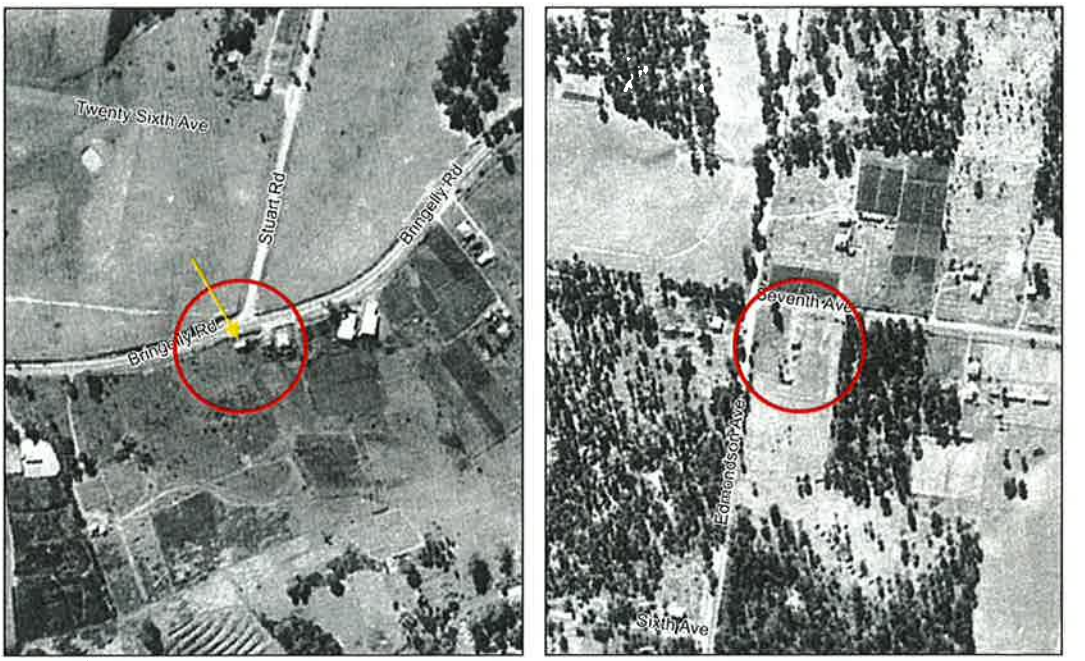
Figure 5.167 The components of a Nissen Hut (Source: http://www.eriding.net/worldinconflict/images/glossary/nissen_hut_plan.jpg).

The uses of Nissen huts identified in the Prefabricated Buildings Catalogue are as garages, stores, workshops and temporary housing, and have been used as accommodation barracks during and following WWII. After the War, Nissen huts served the Displaced Persons Migrant Accommodation program in NSW as housing for the massive influx of migrants. Following the closure of many of the migrant hostels, and particularly by 1952-1953, there was a surplus and huts, including Nissen huts, were sold off (Stuart 2005:54). Some surplus huts were acquired by rural landholders as convenient utilitarian multi-purpose structures to be adapted to farm use.

Within the study area are two Nissen huts, located at the corner of Seventh and Edmondson Avenues, and at 97A Bringelly Road. The two Nissen huts comply with the smaller hut size of 36ft x 16ft and appear to have been acquired for farming purposes, as indicated in the 1955 aerial photographs of the study area. The hut at 97A Bringelly Rd is clearly present, whereas it is less certain whether the hut is on the lot at the corner of Seventh and Edmondson Avenues (Figure 5.168).

The two Nissen huts are in poor condition (Figure 5.169-Figure 5.173). They appear to retain the original steel T ribbing and are clad in corrugated iron/steel sheets, but neither is lined. The west end

section, and part of the east end, of the Bringelly Road Nissen hut appears to be original, but the east end has been modified for use as a garage (Figure 5.173). The end sections of the Edmondson Avenue hut are fitted with a mix of profile steel and corrugated sheets, and the hut is used for storage (Figure 5.170-Figure 5.171).



Horizontal datum: GDA94/MGA Zone 56
Background image: Land and Property Management Authority, Aerial photographs 228-5149 Run 26 (left), and 228-5417 Run 26, Liverpool NSW, 1955

Figure 5.168 1955 aerial photos of 97A Bringelly Rd with the hut arrowed (left, circled), and the lot at the corner of Seventh and Edmondson Avenues (right, circled). It is unclear whether the hut on the corner of Edmondson Avenue is present at this time.

Figure 5.169 The west elevation of the Nissen hut on the corner of Seventh and Edmondson Avenues.

Figure 5.170 North elevation of the Nissen hut on the corner of Seventh and Edmondson Avenues.

Figure 5.171 South elevation of the Nissen hut on the corner of Seventh and Edmondson Avenues.

Figure 5.172 Nissen hut on Bringelly Road; view of the west elevation with original cladding and windows.

Figure 5.173 Nissen hut on Bringelly Road; the east end has been modified to provide parking access.

Assessment of Significance

Each of the Nissen huts has been identified in the heritage study prepared by FORM Architects (Aust) Pty Ltd in 2004 as having local significance.

The two Nissen huts are demonstrative of the characteristic utilitarian structures developed for military use during WWI, and which have continued to be used for military and domestic purposes. Although Nissen huts are becoming increasingly rare, the two examples within the study area are incomplete and poor examples of their type and do not retain all the characteristic elements that define this class of building, and as such, would not make a significant contribution to an understanding of the building type.

The Nissen hut at corner of Seventh and Edmondson Avenues, and the Nissen Hut at 97A Bringelly Road do not fulfil the requirements for heritage listing.

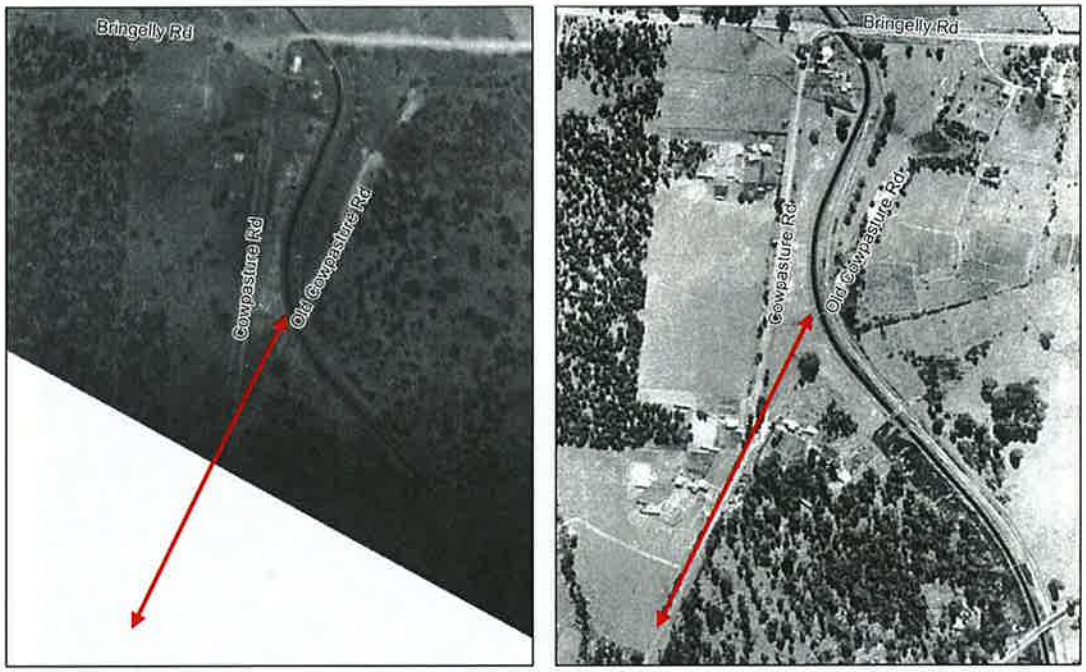
5.3.11 Cowpasture Road – Cultural Landscape

Opened in 1806, Cowpasture Road is one of the earliest roads in the south western Sydney region and the oldest road in the Liverpool area (see Section 3.3.1 above). It formed the boundary of several early land grants in the study area, including those of Matthew Pear, Alexander Riley, John Drummond, and Simeon Lord.

The original alignment of Cowpasture Road extended in a northeasterly direction through the Leppington area, joining Bringelly Road on the east side of a row of three Bunya Pines (see Figure 3.8 above). The Upper Canal was constructed approximately 80 years after the road, and intersects the original alignment near a prominent bend in the present alignment of the road. The bend represents the point at which the road was realigned along the west side of the Canal in the late nineteenth or early twentieth century, with a Canal crossing at Bringelly Road (Figure 5.174; also see Section 5.2.2 above).

Figure 5.174 A prominent bend in the present Cowpasture Road represents the point at which the road was realigned along the west side of the Upper Canal, following its construction in 1886-1888. A shallow depression along the disused road reserve indicates the original alignment (red arrow.)

Historic aerial photographs provide evidence of the original alignment of the road, with the route marked by changes in vegetation, particularly along the property boundaries east of the road (Figure 5.175). The original alignment can still be interpreted within the present landscape by a shallow depression in the local topography, and a localised area of native regrowth forest along the unused section of road reserve (Figure 5.176). In some sections, both east and west of the Canal, the depression is more clearly indicated by discrete embankments (Figure 5.177). The row of Bunya Pines marks the original junction with Bringelly Road (Figure 5.178).



0 65 130 260 390 520 Meters

Horizontal datum: GDA94/MGA Zone 56
Background images: Detail from Geoscience Australia, Aerial photograph 3429-807, Sydney Survey, 1930 (left) and
Land and Property Management Authority, Aerial photographs 235-5019 Run 27 and 235-5147 Run 26, Liverpool NSW, 1955

Figure 5.175 Aerial photographs of the study area, 1930 (left) and 1955 (right), showing the lack of development within the vicinity of the Old Cowpasture Road alignment (red) and the Upper Canal.

Figure 5.176 Shallow depression in the local topography, east of the Upper Canal. View to the south.

Figure 5.177 Section of embankment along east side of historic road reserve, west of the Upper Canal.

Figure 5.178 View along the original road alignment, towards the north, where the junction with Bringelly Road is marked by a row of Bunya Pines.

The present road surface on the west side of the Canal has been asphalted and widened since its original construction; however, the disused alignment on the east side of the Canal has remained relatively untouched since the construction of the Canal and diversion of Cowpasture Road, and as such it may retain physical evidence of early road use, including wheel ruts, and attempts to modify the landscape to control surface drainage. Areas of exposed ground surface along the disused road reserve consist of compacted clay and lateritic gravel, consistent with the local geology (Figure 5.179).

There is some potential for physical evidence associated with the early construction of the road to be present within the original road easement. However, evidence of erosion along the embankments along the disused section of road reserve suggests that it is likely to be limited, and somewhat ephemeral. Historical background suggests that a Telford-type road surface was never constructed on this section of the road, and that the road south of the Camden Valley Way crossing of the Upper Canal was first surfaced with concrete in 1930-1931. Any physical evidence may be also impacted by the construction of the SWRL over the original road alignment.

Figure 5.179 Compacted clay and gravel surface, exposed in unused area of road reserve, on the east side the Canal.

Figure 5.180 View to the south, with new development to the southeast of the road (left).

Sparse housing along the west side of the road, juxtaposed with the Upper Canal to the east, adds to the rural character of the landscape. This character has begun to change, beginning with development of the former Casa Paloma caravan park on the southeast side of the road (Figure 5.180). It will undergo further substantial change following the development of the Leppington Town Centre to the west and the construction of the SWRL over the route of the Canal and the road. However, there is potential to maintain a physical evidence of a short section of the original road route along the east side of the Canal, within a natural landscape setting, which would assist in the interpretation of this important early road to the general public.

Summary Statement of Significance

Cowpasture Road was constructed in 1805-1806, as one of the earliest roads in the south western Sydney region and the oldest road in the Liverpool area. It was surveyed by pardoned convict James Meehan, and formed the boundary of several early land grants, including Alexander Riley's Raby Estate. By 1850, the section of road south of Bringelly Road was being used as an alternate route for the Great South Road, the main road for traffic between Liverpool and Camden and areas further south.

Cowpasture road is historically associated with the alignment and landscape setting of the Upper Nepean Scheme -- Upper Canal: construction of the Canal in 1886-1888 led to a re-alignment of Cowpasture Road at its junction with Bringelly Road. In 1920, the road achieved iconic status, as the subject of Hardy Wilson's illustrated book: The Cow Pasture Road.

The disused section of Cowpasture Road provides rare evidence of the early road corridor, and may also retain early physical fabric undisturbed by twentieth century road works. The natural landscape setting is evocative of the original rural setting of the road, and has an important visual relationship with the route of the Upper Nepean Scheme – Upper Canal. The original junction of Cowpasture and Bringelly Roads is marked by a row of three Bunya Pines, which are prominent landmarks within the local landscape.

Cowpasture Road meets the following criteria for local heritage significance: a), b), c), e), f), and g).

5.3.12 Bringelly Road – Cultural Landscape

Bringelly Road is a major two lane highway and a key route of access to and from the study area. It is one the earliest roads in the Liverpool area, southwest of Sydney (see Section 3.3.1 above). It winds up and over the crest of Carnes Hill at the eastern edge of the study area, before crossing the study area in a straight, roughly east-west line (Figure 5.181). Carnes Hill marks the junction with the original

alignment of Cowpasture Road, and provides important views to Sydney and Parramatta to the east, and the Blue Mountains to the west (Figure 5.182-Figure 5.183).

Figure 5.181 Bringelly Road traverses much of the study area in a straight, roughly east-west line. View from the base of Carnes Hill to the west.

Figure 5.182 View from Carnes Hill to Sydney CBD to the east.

Figure 5.183 View from Carnes Hill to the Blue Mountains.

Bringelly Road formed the boundary of several early land grants in the study area, including those of Alexander Riley (Raby), Matthew Pear, Thomas Carne, Urban Fidkin, and Hannibal Macarthur (Eastwood). From 1887 the road formed the southern boundary of the Hoxton Park Estate subdivision, and its east-west alignment through the landscape likely formed the basis for the rigid grid of streets which characterised the subdivision, and which continues to dominate subdivision patterns in the Hoxton Park and Austral areas.

Historic maps and aerial photographs indicate that the original alignment of Bringelly Road is roughly consistent with the alignment of this road today (Figure 5.184). The continuity of use of this transport corridor from the early years of the colony, and the profound influence it has had on European patterns of land tenure and settlement, contribute to its technical significance.

Horizontal datum: GDA94/MGA Zone 56
Background images: TOP Mosaic of Parish Maps, c1850s, Parish Map Preservation Project,
Parish of Cabramatta, Ref: 140705; Parish of Cook, Ref: 140697; Parish of Minto, Ref:140644.
BOTTOM Mosaic of Aerial photographs, 1955, Land and Property Management Authority, 228-5156 Run 26, 228-5147 Run 26, 228-5149 Run 26, Liverpool NSW.

Figure 5.184 Historic maps and photographs indicate that the original alignment of Bringelly Road is roughly consistent with the alignment of this road today.

As with Cowpasture Road, there is some potential for physical evidence associated with the early construction of this road to be present within the road easement. However, since the road was unlikely to have had more than a compacted clay surface prior to the twentieth century, this evidence is likely to be limited, and somewhat ephemeral. Other evidence may include early culverts and drains, preserved beneath the existing road surface.

Despite the regional importance of the road, it continues to have a distinct semi-rural character, flanked by small farms and large residential properties, and lined in sections with native tree (Figure 5.185 and see Figure 4.1 above). This character is likely to change as the road is upgraded from two to four lanes, in conjunction with development of the SWGC

Figure 5.185 View along Bringelly Road to the west, from the corner of Edmondson Avenue.

Summary Statement of Significance

Bringelly Road was constructed in c.1815. It is historically associated with pardoned convict and Deputy Surveyor General James Meehan, who surveyed the route, and with the convict labourers who constructed it.

The road has landmark value as a major early regional road. It continues to be used as a major regional transport corridor, and the original alignment is consistent with the alignment of the road today.

Bringelly Road acts as a physical marker of early land grant boundaries, including the northern boundary of Alexander Riley's Raby Estate. From 1887, it formed the southern boundary of the Hoxton Park Estate subdivision, and its east-west alignment through the landscape likely formed the basis for the rigid grid of streets which characterised the subdivision. This grid continues to dominate subdivision patterns in the Hoxton Park and Austral areas today.

The original junction of Cowpasture and Bringelly Roads is marked by a row of three Bunya Pines, which are prominent landmarks within the local landscape. There are also important views to Sydney CBD from the road at the crest of Carnes Hill.

Bringelly Road meets the following criteria for local heritage significance: a), b), c), and e).

5.4 Items with Historical Archaeological Potential

5.4.1 Former Blacksmith's Workshop, 240 Fifteenth Avenue, Austral

In 2004, the site of a former blacksmith's workshop was identified during the public consultation phase of the Liverpool Heritage Study Review as having historic heritage interest. FORM architects pty ltd agreed that there was potential to gain more information from architectural, archaeological, and documentary research of the site, and recommended that the property be listed on Liverpool LEP.

The site of the former blacksmith's workshop is located at 240 Fifteenth Avenue, on the corner of Twentyeighth Avenue. The current owner of the property has indicated that he removed a structure from the corner approximately 35 years ago, at the request of Council. At the time, the building was extremely dilapidated and was considered to be a traffic hazard as it blocked the line of sight for cars turning out of Twentyeighth Avenue (pers. comm., 2 December 2010). The field in which the smithy was located is currently used as pasture for cattle.

Bob Kirkpatrick, son of Joseph and grandson of James Kirkpatrick, recalls that a shed was erected on the corner of Fifteenth and Twentyeighth Avenues by Charles Kirkpatrick in the 1910s (pers. comm. 30 March 2010). The lot was purchased in 1915 by Charles Kirkpatrick, an employee with the Metropolitan Board of Water Supply and Sewerage (LPMA CT Vol1176 Fol 199). The Kirkpatrick family lived in the Hoxton Park area from 1882, when Charles' father James worked as a stonemason on the construction of the Upper Nepean Scheme – Upper Canal (Kirkpatrick Family Archives 2010). Following completion of the canal, James became the first Maintenance Overseer, and lived with his family in the weatherboard cottage at the West Hoxton Maintenance Depot, on Twentyeighth Avenue opposite lot 433. Charles and his brother Joseph Kirkpatrick were also maintenance workers on the Upper Canal, and lived at the cottage site. Lot 433 remained in the hands of the Kirkpatrick family until 1964, when it was sold to Roy Gimellaro, market gardener (LPMA CT Vol1176 Fol 199).

The shed was in use as a smithy by at least 1926: Bob Kirckpatrick liked to visit the workshop as a boy, and remembers learning some 'bad language' there. The Sands' Directory lists H Porch as blacksmith in Hoxton Park between 1922 and 1927, and W Silk as a Blacksmith in 1922 and 1923. Hornby Porch owned a farm on Gurner Avenue in Austral from 1920 until the 1940s (LPMA CT Vol 1131 Fol 130). However, Bob Kirkpatrick remembers Billy (William) Chamberlin as the blacksmith in the late 1920s and 1930s (pers. comm. 30 March 2011). Chamberlin 'cut and shut' wheels on drays and sulkies, and shod the draft horses carting timber to Liverpool along Fifteenth Avenue (Hoxton Park Road), charging 6 shillings for four shoes. Billy Chamberlin left Austral to fight in WWII, but never returned. The smithy was later run by Harry Porch. Following the war, Joseph Kirkpatrick used the shed to store grass, collected during maintenance works on the Upper Canal, until the roof blew off in a large storm (pers. comm. 30 March 2011).

A 1930 aerial photograph of the Austral area confirms that a small structure had been erected on the site by this date (Figure 5.186). The site was close to an important local road crossing of the Upper Canal, linking the north and west parts of the Hoxton Park Estate with Liverpool, and to the West Hoxton Cottage Site, the maintenance depot for Section 9 of the Upper Canal. The photograph shows that the land was cleared for pasture by this time, but that the majority of the lot was separated from the smithy by a small watercourse.

0 25 50 100 150 200 Meters

Horizontal datum: GDA94/MGA Zone 56
Background images: Detail from Geoscience Australia, Aerial photograph 3429-803, Sydney Survey, 1930 (left) and Land and Property Management Authority, Aerial photograph 228-5031, Run 24, Liverpool NSW, 1955

Figure 5.186 Blacksmith's workshop in 1930 (left) and 1955 (right), circled in red.

A 1955 aerial photograph shows that the structure was still present at this date. The current owner of the property at 240 Fifteenth Avenue has indicated that he removed the structure from the corner of the lot in the 1970s, at the request of Council. At the time, the building was extremely dilapidated and was considered to be a traffic hazard as it blocked the line of sight for cars turning out of Twentyeighth Avenue (pers. comm., 2 December 2010).

The location of the smithy is indicated by a series of timber posts and rails, standing to an approximate height of 2m, which includes part of a door frame addressing Fifteenth Avenue (Figure 5.187). Attached to the posts is a pair of original wrought iron hinges, brackets and spikes (Figure 5.188-Figure 5.189). Immediately south of the posts are two large stone blocks, one of which had been the foundation for a water trough.

Figure 5.187 Remains of former blacksmith's workshop.

Figure 5.188 Iron gate hinge.

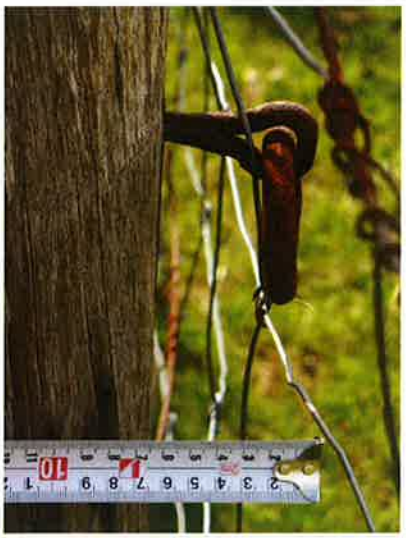


Figure 5.189 Iron spike and ring.

There is some potential that archaeological relics and deposits associated with the blacksmith's workshop are present in the site. The majority of the lot appears to have been maintained as pasture since the 1930s, and the workshop site has not been developed since the building was demolished in the 1970s. As such, any archaeological remains should be relatively intact.

Summary Statement of Significance

The former blacksmith's workshop is associated with the development of local industry in the Austral and Hoxton Park area in the early twentieth century, supporting timber carters and other forms of horse-drawn transportation between the local area and Liverpool. It is also associated with the Upper Canal maintenance workers' depot at the corner of Fifteenth and Twentyeighth Avenues. The potential

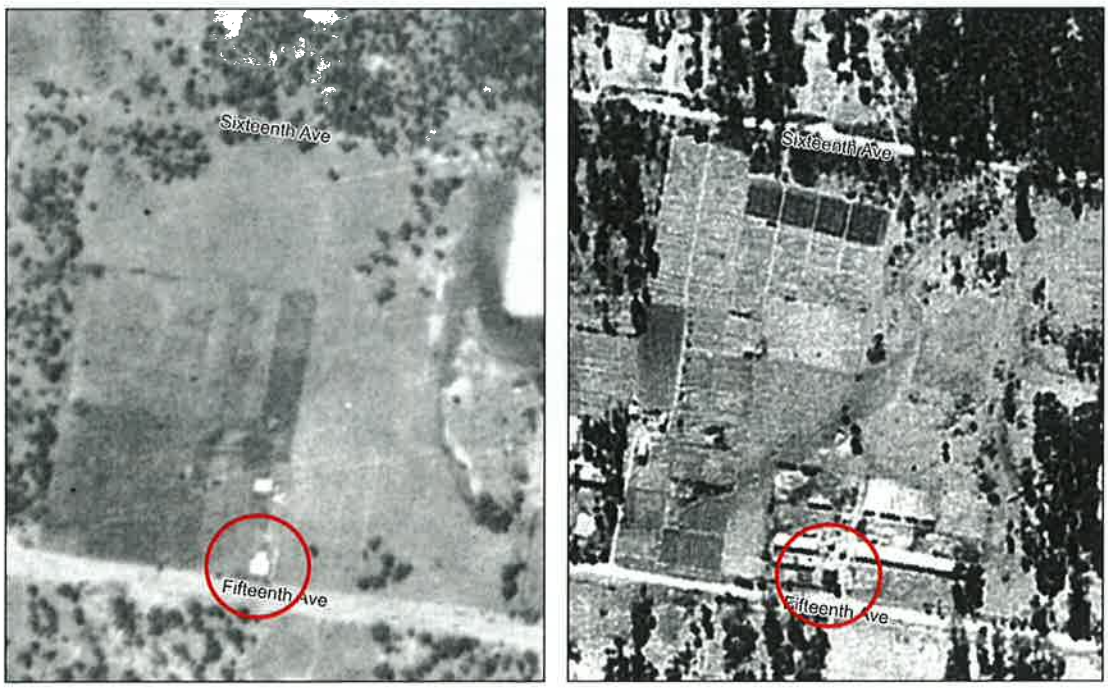
archaeological resources associated with the site have the potential to provide information not available from other sources concerning the daily life and working practices of a rural blacksmith in the early- to mid-twentieth century.

The former blacksmith's workshop on Fifteenth Avenue meets the following criteria for local heritage significance: a) and e).

5.4.2 Weatherboard House at 305 Fifteenth Avenue, Austral

Lot 355 of the Hoxton Park Estate was purchased by William Nickels, farmer of Hoxton Park, in August 1892, along with lots 296 to 298 and 356. The land was subsequently transferred to Frederick Nickels, labourer of Hoxton Park (1913), William Frederick Killinger, tanner of Liverpool (1920), and Harold Lionel Bare, farmer of Hoxton Park (1920). In 1945, the Killinger family, as mortagees exercising the power of sale, sold the land to Kurt Bratel, poultry farmer of West Hoxton. In 1947, Lot 355 was transferred to Marmaduke Randall Bateson Mount, poultry farmer of West Hoxton, along with the neighbouring lots 353 and 354. The land was later transferred to John Livermore, poultry farmer of Padstow (1951), Annabel Livermore, widow of West Hoxton (1968), and Alice Webster and James Edward Livermore (1974) (LPMA CT Vol 970 Fol 114; 1070, Fol 192; Vol 3073, Fol 62; and Vol 5780, Fol 54).

The single-storey weatherboard house, now located at 305 Fifteenth Avenue, is one of the few buildings apparent on the 1930 aerial photograph of the area. This photograph also shows that the surrounding landscape was cleared for farming by this date (Figure 5.190). By 1955, a series of long, linear farm buildings had been constructed behind the house, crossing lots 354 and 355, likely associated with the poultry farm of John Livermore. A possible hedge or fence has also been established along the street in front of Lot 355.



Horizontal datum: GDA94/MGA Zone 56
Background images: Detail from Geoscience Australia, Aerial photograph 3429-803, Sydney Survey, 1930 (left) and Land and Property Management Authority, Aerial photograph 228-5108, Run 25, Liverpool NSW, 1955

Figure 5.190 Aerial photographs of the land at 305 Fifteenth Avenue in 1930 (left) and 1955 (right). The house is circled in red.

The house stands on the north side of the street and is obscured from view behind a high, unkempt hedge, with mature trees to each side (Figure 5.191-Figure 5.192). A much larger house has recently been constructed to the northeast, on lot 354, and an orchard has been planted to the north and west.

The house is small, likely four rooms, with a steep-pitched corrugated iron roof, a bull-nosed verandah along the front, an internal brick chimney, and a skillion roofed addition to the rear. There is a central front door flanked by timber framed windows. The verandah has plain timber posts with chamfered corners. The large size of the roofing sheets indicates that they may be original. AMBS did not receive permission to enter the property. Inspection from the street indicates that the weatherboard cladding may also be original; however, termite or similar damage is evident at the south-east corner (Figure 5.193).

Figure 5.191 The weatherboard house at 305 Fifteenth Avenue.

Figure 5.192 View to the house along Fifteenth Avenue to the east.

Figure 5.193 Detail of the east elevation showing termite damage.

Although the house cannot be aligned with the buildings indicated on the 1906 Reconnaissance Map, the Victorian vernacular architectural style indicates that it may have been built during the late nineteenth or early twentieth century. As such, it is likely to be among the earliest houses within the study area. The original curtilage of the cottage has been reduced to a small area that is now defined by plantings, with a high chain wire security fence along the front. According to a neighbour, brick paving at the front of the house is not original, but was, laid in recent years. This paving is obscured by building materials stacked on the verandah.

In 2004, the site was identified during the public consultation phase of the Liverpool Heritage Study Review as having historic heritage interest. FORM architects pty ltd agreed that there was potential to gain more information from architectural, archaeological, and documentary research of the site, and recommended that the property be listed on Liverpool LEP. The relatively early date and apparent integrity of the house and remnant garden, albeit within a constrained curtilage, indicate the potential for archaeological relics and deposits that could provide new information concerning early settlement and land use practices associated with the development of the Hoxton Park Estate.

Summary Statement of Significance

> *The weatherboard house at 305 Fifteenth Avenue is one of the earliest extant houses in the Austral area, and as such provides evidence of the history of settlement of the Hoxton Park Estate, a historic subdivision west of Liverpool. The associated potential archaeological resources may provide information not available from other sources concerning the daily lives of the inhabitants of the house during the late nineteenth and early twentieth centuries.*

The weatherboard house at 305 Fifteenth Avenue meets the following criteria for local heritage significance: a), e) and g).

5.4.3 Weatherboard House at 15 Seventeenth Avenue, Austral

In August 1920, Rachel Lee purchased lot 213 in the Hoxton Park Estate from the Asset Realization Company Limited (LPMA CT Vol 1101 Fol 115). Lee was the wife of Joseph James Lee, a tailor's cutter from Marrickville. Ownership of the land was subsequently transferred to Richard James Lee, who worked as an electrical engineer in the West Hoxton area (September 1934); Aleksander Valgma, a factory worker from Hoxton (1949); and his widow, Arda Valgma (June 1967).

The 1930 aerial of the property shows that it was covered in trees at this date; however, by 1955, some of the trees had been cleared and several buildings had been constructed on the property, including the present weatherboard house (Figure 5.194).

Horizontal datum: GDA94/MGA Zone 56
Background images: Detail from Geoscience Australia, Aerial photograph 3429-803, Sydney Survey, 1930 (left) and Land and Property Management Authority, Aerial photograph 228-5031, Run 24, Liverpool NSW, 1955

Figure 5.194 Comparison of the 15 Seventeenth Avenue site in 1930 (left) and 1955 (right).

The house at 15 Seventeenth Avenue is a simple, timber-framed, weatherboard clad structure, with a corrugated iron gable roof (Figure 5.195). It has skillion-roofed additions to the side and rear. A brick chimney at the west end of the rear addition indicates that this section was likely used as the kitchen. The house provides a rare example of a small-scale vernacular weatherboard house in the Austral area.

Figure 5.195 The house at 15 Seventeenth Avenue.

AMBS did not receive permission to enter this property; however, based on an inspection from the street, the building is in poor condition and is likely abandoned. A brick house standing on the

neighbouring property is likely the present residence. In Nov 2008, a building area was cleared at the front of the property and Liverpool Council issued a construction certificate for a dual occupancy and swimming pool.

Assessment of Significance

In the 2004 Liverpool Heritage Study Review, FORM architects pty ltd identified the house at 15 Seventeenth Avenue as having local heritage significance, and recommended listing of the property on Liverpool LEP.

The summary statement of significance for the house was:

> *There is potential to gain more information on the site from further architectural archaeological documentary research.*

The recommended management was:

> *Prior to any redevelopment of the site of this building or any redevelopment, alteration or addition to the building a Statement of Heritage Impact (SHI) should be prepared. The SHI should include a detailed history which will aid in the provision of a detailed significance assessment. The SHI should also provide advice as to the level of change that can occur without compromising the significance of the building.*

Although a detailed study of the house at 15 Seventeenth Avenue has not been undertaken, and the house itself was not accessed, AMBS' review of land title information and early aerial photographs indicates that the house is unlikely to date earlier than the mid-1930s. The description of the house by FORM mentions that *attached to the western elevation is an exterior chimney stack constructed from iron sheets*. The chimney is in fact of brick and appears to be consistent with a post-1940s style. Although there has been little subsequent development of the property, and the rustic setting of the building has some aesthetic interest, the potential archaeological resources of the site are unlikely to provide new information which cannot be obtained from other sources. On current evidence, property does not satisfy the criteria for local heritage listing.

5.4.4 Weatherboard House at 11 Gurner Avenue, Austral

In March 1900, lots 2 and 3 of Plan 3403 (Ickleton Estate) were purchased by George Robert Mansell, a Lieutenant in Her Majesty's Navy (LPMA CT Vol 1230 Fol 237). The land was subsequently sold to William Carter of Sydney, farmer (January 1903); William Wrightson of Randwick, journalist (February 1904); and Henry William Ernest Steadman of Drummoyne, contractor (July 1908) (LPMA CT Vol 1311 Fol 130). Henry Steadman also owned lots 5, 6 and 7, which he had purchased in 1900, and he may have been looking to expand upon his original property (LPMA CT Vol 1339 Fol 37).

In September 1914, Steadman sold lots 2 and 3 to John James Palmer of Willoughby, box maker. The property was subsequently sold to William Martindale of Liverpool, poultry farmer (February 1916); and Hornby Porch of Liverpool, also a poultry farmer (December 1920). The property remained in the hands of the Porch family for the following three decades, and it is likely that the house at 11 Gurner Avenue was built during this time (LPMA CT Vol 1311 Fol 130). This suggestion is supported by the 1930 aerial photograph of the property, which shows a small building in this location (Figure 5.196).

In August 1945, lots 1, 2 and 3 were transferred to Porch's three sons, who each held a one third share in the property: Hornby (Harry), John Hornby, and William Charles Frederick Porch (LPMA CT Vol 1311 Fol 130, Vol 5517 Fols 154-156). In October 1948, the Porch sons sold the property to the Stellins family, who subsequently broke up the land, selling lot 2 to farmers John and Mary

Therbridge (August 1949; LPMA CT Vol 5517 Fols 154-156, Vol 6028 Fol 181). The 1955 aerial photograph of the property shows that a second house had been constructed on lot 2 by this date (15 Gurner Avenue).

The extant property comprises two separate dwellings on the north side of the street; a modern brick dwelling, with an adjacent weatherboard house, to its west. The weatherboard house is now surrounded by a large yard, but was previously surrounded by market gardens (Sam Mollusco, pers. comm., 7 February 2011).

Horizontal datum: GDA94/MGA Zone 56
Background images: Detail from Geoscience Australia, Aerial photograph 3429-805, Sydney Survey, 1930 (left) and Land and Property Management Authority, Aerial photograph 228-5031, Run 24, Liverpool NSW, 1955

Figure 5.196 Aerial photographs of the house at 11 Gurner Avenue, 1930 and 1955.

The weatherboard house has a medium pitched corrugated metal roof with gable ends, an architectural style consistent with a 1920s date. The front is asymmetrical, with a half verandah and front facing gable; however, there is evidence of several phases of construction and it is not currently clear which section is the earlier part of the building. A brick chimney forms part of the rear section of the house.

The weatherboard house is a composite of two cottages: a not unusual form of extending the available living area as families grew (Figure 5.197-Figure 5.198). Often, additional rooms would be added to the original cottage as required, a process which could see kitchens being shifted further to the rear with a series of chimneys identifying original positions (Moore et al 1993:91, 102). The connection between the two cottages is clearly defined by the join in the weatherboards. That there is one chimney only, indicates that the extension may have been roughly contemporary with the original cottage. Alternatively, the kitchen was external and was subsequently enclosed in the extension. Although not in good condition, the exterior of each cottage retains original features, including corrugated steel roof, verandah posts and framed casement windows. The interior of the four room layout of the front section retains many original fixtures and fittings, and a more modern bathroom. The rear of the house has been modified for use as a storage area for a variety of vehicles and stands on a concrete slab; however, some original architectural features are extant (Figure 5.199).

The weatherboard house has been disconnected from all utilities, as a condition of the construction of the brick house on the same lot (Sam Mollusco, pers. comm. 3 February 2011).

Figure 5.197 Weatherboard house at 11 Gurner Avenue, view from the southwest.

Figure 5.198 View from the southeast.

Figure 5.199 Interior of the rear building, now used for storing vehicles. Note original architraves around doors and windows.

Assessment of Significance

Whether the two sections of the house were constructed at the same time, or the second section was brought to the site at a later date is unknown; however, the architectural style of both is consistent with the Federation period of the first decades of the twentieth century. It is therefore possible that there are archaeological resources associated with the house at 11 Gurner Avenue, including underfloor deposits and rubbish pits adjacent to the house. Any archaeological resources that may be present in the site could have the potential to make a contribution to an understanding of the people who lived and worked on this site, and as such would have local significance. However, the evidence indicates that the site has been disturbed by landscaping and the potential for information that could

make a substantive addition to an understanding of the settlement patterns of the local area may be limited. As such, the property does not satisfy the criteria for local heritage listing.

In addition, it should be noted that the current owner has indicated that he would not support heritage listing of the property as an archaeological site. AMBS took this into consideration as part of the assessment of the site.

5.4.5 Former Bare Cottage, 265 Fifteenth Avenue,, Austral

Bare Cottage was formerly listed on Liverpool LEP as a place of local heritage significance. In 1992, the house was described as a mid-nineteenth century Victorian worker's style single storey cottage in dilapidated condition. Located on the north side of Fifteenth Avenue, on Lot 351 of the Hoxton Park Estate, it was a rare example of an early brick building in the local area. In April 2003, application was made to Liverpool Council to demolish the cottage. In September 2003, the house was partially destroyed by fire, and in December of the same year the Council granted the application to demolish the structure, with conditions specifying a photographic recording of the cottage and archaeological investigations of the site. The house was still standing in 2004, when FORM architects pty ltd completed a review of the Liverpool Heritage Study (Figure 5.200). FORM architects recommended de-listing Bare Cottage from the LEP, following demolition; however, the site should remain on the LEP until a detail assessment of the landscape had been undertaken. In addition, if Lot 351 were to be redeveloped or subdivided, a detailed archaeological survey and assessment of all land contained within the lot should be undertaken (FORM architects pty ltd 2004: Inventory 1970223). The cottage has since been demolished and de-listed from Liverpool LEP. However, AMBS has been unable to verify whether the recommended archaeological assessment of the lot has been prepared. A childcare centre is currently being constructed on the site (Figure 5.201-Figure 5.202).

Figure 5.200 Bare Cottage, 2004. (Source: Liverpool Heritage Inventory, Ref: 1970223)

Figure 5.201 Sign advertising new child care centre at 265 Fifteenth Avenue.

Figure 5.202 Child care centre under construction.

6 Constraints and Opportunities

6.1 General

Heritage places contribute to the character of a community by providing tangible evidence of its local history and identity. They can tell us stories about how the landscape and environment came to be the way it is today. At times of change, they help to preserve a connection to the past for current residents, and can provide a point of reference for interpreting the past to future generations. The proposed development of the NSW Government's SWGC land release area of the Austral and Leppington North Precincts represents a significant time of change.

The Australia ICOMOS Burra Charter has established conservation principles and processes for the management of heritage places. Conservation means all the processes of looking after a place so as to retain its cultural significance (Article 1.4). Conservation may, according to circumstance, include the processes of: retaining or reintroducing a significant use; retaining historical associations and meanings; maintaining, preserving, restoring, reconstructing, adapting and/or interpreting physical fabric; and will commonly include a combination of more than one of these (Article 14). It generally requires a cautious approach to change (Article 15).

The Burra Charter Process also recognises that the development of heritage conservation policies should include consideration of other factors affecting the future of heritage places, such as:

- the broader strategic planning framework for the SWGC,
- owners' requirements,
- available resources, and
- the physical condition of the places and their associated elements.

Constraints and opportunities that relate to the conservation and management of heritage places within the study area are outlined here and summarised in Figure 6.1-Figure 6.4 Key issues are discussed in more detail below.

Constraints

- The general planning framework for the SWGC recognises an obligation to protect and enhance land with cultural heritage value, as part of the broader environment. This includes an obligation to conserve the heritage significance of heritage items and places in accordance with best practice guidelines, including associated fabric, settings and views. It also includes an obligation to appropriately manage archaeological relics.

Opportunities

- Heritage listing of the 12 potential local heritage items and one heritage conservation area within the study area, would create an opportunity to conserve and interpret key aspects of the history of the area for present and future generations (Figure 6.1).
- The maintenance of key elements of the historic subdivision patterns, road alignments, street names and other toponyms, would respect the historic development of the area. The naming of new streets, parks, and other community places would also provide an opportunity to interpret various aspects of the history of the area for present and future generations.
- Interpretation of the cultural significance of listed and potential heritage items and places, by means of signage, walking paths, and other forms of media, may enhance public understanding and appreciation of local heritage.

- Maintaining and strengthening the rural character of historic road alignments of Bringelly, Cowpasture and Eastwood Roads, and Fifteenth and Edmondson Avenues by, for example, creating wide vegetation corridors adjacent to these roads and preserving extant plantings of large trees, would respect the regional historic significance of the roads, and provide points of aesthetic interest in the newly developed Precincts.
- Maintaining and strengthening key historic vistas at Jugdes Hill, Carnes Hill, and along the Upper Canal, would respect the historic and aesthetic significance of these places, and provide aesthetic points of interest in the newly developed Precincts (Figure 6.4).

6.2 Upper Nepean Scheme – Upper Canal

The SHR listed Upper Nepean Scheme – Upper Canal is the most significant element of European built heritage within the study area. As such, the Canal and its associated elements should be conserved and managed in accordance with heritage best-practice guidelines as outlined in the Burra Charter and the NSW Heritage Manual within the proposed development of the Austral and Leppington North Precincts.

Constraints

The Upper Canal forms the eastern boundary of a large part of the study area and a short section of the Canal passes through the study area, between Bringelly Road and Camden Valley Way. The ongoing operation of the Upper Canal in its nineteenth century form, using gravity to transport water long distances through an open channel, is a major element of its technical significance. This is supplemented by historic drainage systems, incorporating back or coping drains, flumes and culverts. The rural setting of the Canal also contributes to its aesthetic significance, as a picturesque element of the broader landscape.

Some housing has already been established in the vicinity of the Canal corridor, as part of the mid-to late-twentieth century development of land in Austral. The construction of new roads, cycleways, and pedestrian footpaths, and the intensification of suburban housing and community facilities in close proximity to the heritage curtilage of the Canal, including the construction and management of stormwater and sewerage systems, will inevitably place pressure on SCA's ability to manage and control water purity, such that SCA may need to construct additional flumes, culverts or other drainage structures, to supplement heritage elements currently used to control drainage. SCA has recommended that there should be no stormwater runoff above the current volume and below the current quality entering the Canal corridor during the construction phase or post development in the Austral and Leppington Precincts. Adequate stormwater controls should prevent some potential impacts on the technical significance of the Canal. An increase in the local population will also lead to an increase in public activity adjacent to the Canal, which may in turn have direct and indirect impacts on the physical fabric of the Canal and its associated elements. There is potential for an increase in damage to significant elements such as maintenance road gates, for example as a result of traffic accidents, pranks, theft and vandalism. It should be anticipated that these impacts will be gradual and cumulative, and will thus require long-term solutions. Potential long-term impacts and viable solutions should be addressed in consultation with SCA and NSW Heritage Council, and should be consistent with the recommendations of the CMP for the Canal.

The Canal overbridges present a more immediate constraint, insofar as augmented traffic and pedestrian corridors will be required between the Precincts and recreational centres in the Western Sydney Parklands. There is currently one riveted iron trough overbridge within the study area, and two immediately adjacent to the study area. Dated c.1904-1909, these overbridges have been assessed as having exceptional significance (Figure 6.2). In addition, there are six reinforced concrete beam bridges immediately adjacent to the study area, dated c.1917-1918, assessed as having considerable

significance, and two mid-twentieth century concrete and steel beam bridges at Bringelly Road and Camden Valley Way, which are assessed as having little or no significance. Heritage constraints associated with these crossings are:

- Required augmentation of Canal crossings should be limited to extant reinforced concrete beam bridges, and in particular to existing east-west through roads: Camden Valley Way, Bringelly Road, and Fifteenth Avenue;
- All bridges of exceptional significance should be conserved in their current condition, in accordance with the recommendations of the CMP;
- Designs and materials of the new bridge additions should be sympathetic to the original bridges. Augmentation of bridges having considerable significance should be restricted to one side only, particularly where there is evidence of other recent modification, while preserving evidence of the historic form and construction techniques on the other side;
- Augmentation of existing bridges and feeder roads should aim to limit or avoid changes to existing patterns of surface drainage; and
- Modifications proposed for bridges of exceptional or considerable significance should only be undertaken in consultation with the SCA and the Heritage Branch.

The broader landscape setting of the Upper Canal is an important consideration in the precinct planning process. The immediate setting of the Canal, and associated elements, is protected by its heritage curtilage, which is roughly defined by the security fencing. However, the historic and aesthetic significance of the Canal cannot be separated from the broader rural landscape, which will be substantially altered by the proposed development. The creation of the Western Sydney Parklands on the eastern side of the Canal goes some way towards addressing this issue. However, managing key views along the Canal, particularly from public crossing points, and maintenance areas of public open space adjacent to the Canal would contribute to the integration of the historic setting of the Canal into its new urban setting. Similarly, the historic relationship between the alignment of the Canal and that of Cowpasture Road, should be interpreted through the retention of key landscape elements such as cultural plantings at the former Section 8 cottage site, at the junction of the Canal, Bringelly, and Cowpasture Roads, and the row of three mature Bunya Pines on the south side of Bringelly Road.

The key constraints arising from the heritage significance of the Upper Canal are:

- An obligation to maintain the form, fabric, and operational utility of the Canal and associated built heritage elements in their original location;
- An obligation to preserve technological evidence of nineteenth century hydraulic engineering and Canal building techniques, as illustrated by the Upper Canal, and progressive improvements in the construction of culverts, flumes and overbridges etc;
- An obligation to conserve some picturesque elements of the Canal, including its serpentine route, evidence of its original rural setting, and associated cultural plantings;
- An obligation to conserve evidence of the historic relationship between the alignment of the Upper Canal and Cowpasture Road;
- Costs related to the ongoing maintenance and conservation of the Canal, as an historic operational element of Sydney's water supply infrastructure, in a more developed urban environment. This includes costs associated with
    - routine and preventative maintenance of the Canal and associated built heritage elements, and
    - construction and maintenance of appropriate surface drainage of land adjacent to the Canal; and
- An obligation to provide arrangements for appropriate access to and security for the Canal and its historic heritage curtilage, including strategies to preserve the quality of the water

and to prevent inadvertent damage and intentional vandalism to the physical fabric of the Canal.

Other constraints include:

- Statutory requirements for the conservation and maintenance of the Upper Canal as a State heritage item, as outlined in Section 2.3 above, including the protection of archaeological relics associated with the Canal;
- Potential for archaeological relics associated with the construction and maintenance of the Upper Canal to be exposed during modifications to roads or bridges within its SHR curtilage; and
- SCA requirements for the ongoing operation of the Canal. This may include future decommissioning of the Canal as an operational element of the water supply system.

Opportunities

The picturesque qualities of the Upper Canal provide opportunities to integrate this historic item of water infrastructure into the social and cultural life of the community. The provision of parks, walking and/or cycling trails, and other areas of public open space adjacent to the Canal could contribute to the open landscape setting. They could also be designed to improve security for the Canal, through increased passive surveillance by members of the general public.

The row of three Bunya Pines along Bringelly Road are aesthetically associated with the Canal, and are prominent visual landmarks within the broader landscape. The preservation of these and other cultural plantings associated with the Canal provides an opportunity to maintain established plantings within the study area, and signal the historic significance of both the Canal and Bringelly Road.

Interpretation of the Canal though explanatory signage, in conjunction with the preservation of historic fabric, could inform the local community about the heritage significance of the Canal, and foster an appreciation of its history and ongoing value to the community. Interpretation could explore a range of themes associated with the Canal, including the history of Sydney's water supply and related engineering achievements.

A summary of key opportunities arising from the heritage significance of the Upper Canal are:

- Conservation of the Upper Canal as an operational element of Sydney's water supply infrastructure;
- Preservation of significant historic fabric of the Upper Canal and associated built heritage elements in close proximity to the Austral and Leppington North Precincts;
- Conservation of picturesque elements of the Canal, including its serpentine route, evidence of its original rural setting, and associated cultural plantings, through the provision of parks, walking and/or cycling trails, and other areas of public open space adjacent to the Canal;
- Interpretation of the heritage significance of the Upper Canal and its heritage curtilage to the general public, to foster an appreciation of its history and ongoing value to the community;
- Improved security for the Upper Canal, through increased passive surveillance by members of the general public.

6.3 Local Heritage Items and Potential Heritage Items

Constraints

Future development of the Austral and Leppington North Precincts should be undertaken in such a way as to minimise impacts on local heritage items and potential heritage items (Figure 6.1). This includes the ongoing maintenance and protection of the physical fabric of the item, an appropriate landscape setting, an appropriate use, and key views associated with the item.

There are four local heritage items within the study area. These places are currently subject to statutory protection that will constrain development of the Precincts:

- Kemps Creek forest, Gurner Avenue (off), Kemps Creek
- Row of Bunya Pines, 145 Bringelly Road, Leppington
- Brown Memorial and water trough, 145 Bringelly Road, Leppington
- Dwelling and rural lot, 1720 Camden Valley Way, Leppington

AMBS has identified an additional 12 potential local heritage items and one heritage conservation area, which, if listed in an amendment to either the SEPP Growth Centres 2006, Liverpool LEP or Camden LEP, would also constrain development of the Precincts. These include a range of built and landscape heritage items, and areas of archaeological sensitivity, although all are associated with the development of Austral and Leppington as distinct, semi-rural communities in the early to mid-twentieth century period:

- Leppington Public School, 142-148 Rickard Road, Leppington
- Austral Town Centre Conservation Area
- H J Starr Progress Hall, 264 Edmondson Avenue, Austral
- Ian's Hardware and House, 256 Edmondson Avenue, Austral
- Brick House and Garden, 275 Edmondson Avenue, Austral
- House and Garden, 170 Edmondson Avenue (125 Eighth Avenue), Austral
- Cement Rendered House 40 Browns Road (60 Fifth Avenue), Austral
- W V Scott Memorial and Park, Austral
- Hellenic Monument, Lot 10 DP 771080, Austral
- Blacksmith's Workshop (Former) – Archaeological Site, 240 Fifteenth Avenue, Austral
- Weatherboard House – Archaeological Site, 305 Fifteenth Avenue, Austral
- Cowpasture Road – Cultural Landscape, Leppington
- Bringelly Road – Cultural Landscape, Austral and Leppington

The potential built heritage items listed above are generally modest in scale, and are historically associated with an open, agricultural landscape setting. Future development in the vicinity of each heritage item and conservation area should have an appropriate scale and mass, which respects the aesthetic significance (if any) and landscape setting of the item. Adjacent development should not dominate or overwhelm the item. Development adjacent to the Cement Rendered House at 40 Browns Road, Austral and Leppington Public School, 142-148 Rickard Road, Leppington, in particular, should consider these principles.

Development in the vicinity of war memorials at 145 Bringelly Road and at the W V Scott Memorial Park, and in the vicinity of Forest Home at 1720-1726 Camden Valley Way, should respect the social value of these places to the local community. The original locations of the war memorials were chosen by the community, and the memorials act in lieu of graves for the deceased servicemen. Relocation of commemorative parks and plaques should only be considered as a last resort, and in consultation with family and other stakeholders.

Opportunities

The conservation of a range of built and landscape heritage items of the mid-twentieth century demonstrates respect for this period of development in the local area, and could be used to foster an appreciation of local history to the community. Built and landscape heritage items may provide an aesthetic point of interest in the newly developed Precincts, contributing in a tangible way to a local sense of place and community identity.

The appreciation of individual places can be enhanced through an interpretation strategy, exploring a range of themes associated with the area, including the history of agriculture and market gardening in the area, education, memorialisation, early commercial activity, the role of migrant farmers, and community organisations such as the Austral and Leppington Progress Associations.

The proposed Austral Town Centre Conservation Area presents an opportunity to maintain and strengthen the historic character of the Town Centre, by conserving a cohesive grouping of modest, mid-twentieth century buildings, including three fibro houses, all associated with development of a strip of land in the c.1940s on the west side of Edmondson Avenue by Emma and H G Starr, Austral Postmaster. Listing as a Conservation Area would entail less onerous regulatory control of these properties, focusing on the protection of the street-facing facades and overall character of the streetscape. The Austral Town Centre Conservation Area would be an appropriate location for interpretation of the historical development of the local area.

6.3.1 Archaeological Sensitivity

The archaeological resources of any site are finite and have the potential to provide insights into everyday life that are not available from any other resource. As such, potential archaeological sites may have high scientific or research value. Statutory protection for archaeological relics is provided by the Heritage Act, as described in Section 2.3 above.

Three main sites have been identified through background research as having potential archaeological sensitivity:

- Forest Home, 1720-1726 Camden Valley Way, Leppington
- Blacksmith's Workshop (Former) – Archaeological Site, 240 Fifteenth Avenue, Austral
- Weatherboard House – Archaeological Site, 305 Fifteenth Avenue, Austral

These sites are associated with the early- to mid-twentieth century history of the study area, and may provide evidence of an industrial or domestic nature.

In addition, the SHR curtilage of the Upper Canal has identified archaeological sensitivity which must be managed in accordance with the requirements of Section 60 of the Heritage Act. Should excavation adjacent to the Upper Canal be required for widening or modifications to road or pedestrian bridges, the archaeological sensitivities should be managed appropriately.

AMBS has not been able to identify with any certainty archaeological sites associated with early nineteenth century land grants, or associated tenant farmers. However, there is some potential for early road surfaces, culverts and drains associated with early nineteenth century roads to survive beneath hard road surfaces, where these follow historic road alignments. This is particularly relevant to the historic alignments of Cowpasture and Bringelly Roads.

6.4 Historic Subdivision Patterns and Road Alignments

As noted in Section 3.4.1 above, the majority of the study area was subdivided for smaller farm sites in the 1880s-1890s by speculative investors. These subdivisions overlaid an earlier pattern of colonial

land grants, bordering the Cowpasture and Bringelly Roads. The boundaries of some of these land grants are still evident in the landscape today, primarily in the form of road alignments, but also in the collective form of property boundaries, and in vegetation areas historically reserved from development.

Although many of the late nineteenth century subdivisions were initially unsuccessful, the pattern of the original subdivision plans is evident in the landscape today, including the rigid street grid and the three acre blocks established by Phillips & Company for the Hoxton Park Estate, north of Bringelly Road. These small blocks eventually formed the basis of a thriving culture of market gardening and poultry farming, commonly associated with European migrants of the mid twentieth century.

Opportunities

Precinct planning within the study area presents an opportunity to interpret the historic subdivision patterns and road alignments associated with the early European history of the area (Figure 6.3).

Maintaining and strengthening the rural character of historic road alignments by creating wide vegetation corridors adjacent to the roads and preserving extant plantings of large trees, would be a means of respecting the regional historic significance of the roads, and provide aesthetic points of interest in the newly developed Precincts. Historic road alignments and names should be preserved wherever possible.

New roads or vegetation corridors proposed as part of the Indicative Layout Plan (ILP) are generally aligned with key historic land grant boundaries, which would reflect this element of the history of the area. The naming of new roads may be used to interpret these elements of the landscape. Discrete variations in urban density and built form could also be used to interpret the pattern of land grants in the area.

The following roads have been identified as key features of the historic landscape:

- Cowpasture Road,
- Bringelly Road,
- Eastwood Road,
- Edmondson Avenue, and
- Fifteenth Avenue.

The following colonial estate boundaries have been identified as key features of the landscape:

- John Gurner's *Ickleton* land grant,
- Urban Fidkin's land grant, and an historic track associated with the eastern boundary of the estate,
- Southern boundary of Barron Field's *Hinchinbrook* land grant, and an historic track associated with this alignment,
- Western boundaries of John Jamieson's *Cow-de-Knaves* land grant,
- Northern, eastern, and western boundaries of Alexander Riley's *Raby* land grant, and
- Northern and eastern boundaries of Hannibal Macarthur's *Eastwood* land grant.

6.5 Historic Views

Opportunities

The physical analysis has identified a number of key high-points in the study area, where long natural views have been maintained and/or enhanced through cultural modification of landscape (Figure 6.4). These include:

- View from Judges Hill toward the west, and

- View from Carnes Hill, along Bringelly Road toward Sydney CBD in the east and the Blue Mountains in the west.

The view from Judges Hill is primarily associated with the positioning and orientation of the Hellenic Monument on Lot 10 DP 771080 by the Federation of Hellenic Associations. However, the toponym *Judges Hill* also preserves an earlier association with the original land grant to Barron Field, an early Supreme Court Judge in the Colony.

The view from Carnes Hill is primarily associated with the junction of the historic Cowpasture and Bringelly Roads, early key transport and communication routes in the Colony. The toponym *Carnes Hill* also preserves an association with Thomas Carne, an early resident of the land and Coroner of the Town of Liverpool.

Precinct planning within the study area presents an opportunity to preserve these views as historic and aesthetic points of interest in the area. Historic toponyms should be preserved, as evidence of past occupants and land use.

6.6 Interpretation Strategy

Interpretation is a means of presenting the story of a place in a way that will engage the community in its continuing care and protection, and by doing so conserve the significance of the place. It conveys an understanding of the history and cultural significance of the place though a range of actions, including the retention and maintenance of historic fabric, documentation of changes to the site, explanatory signage, and other forms of multi-media or heritage-themed activities. It can also be a source of enjoyment for local residents and visitors to the area.

Opportunities

Meaningful interpretation can be incorporated into the Planning Process for the Precincts. Opportunities to interpret the built and landscape heritage of the area include:

- Photographic recording of historic heritage items, places, and the broader rural landscape, to conserve evidence of the present environment for future generations. Photographic recording would contribute valuable information about environmental changes during development of the Austral and Leppington Precincts, and images could be considered for inclusion in the future interpretation displays.
- Placing interpretive signage containing appropriate text, historic images, and plans (where available) at various locations throughout the study area, to help residents and visitors understand the history and significance of key heritage items, places, and archaeological sites. Interpretive signage can also be used to reinforce historic linkages between widely dispersed heritage items, by addressing common historical themes and using a common design approach. Locations could include:
    - Pedestrian overbridges associated with the Upper Canal, so that people crossing from the Precincts to the Western Sydney Parklands can understand and appreciate the form and function of the Canal, and its historical setting in a rural landscape;
    - Sites of former Upper Canal maintenance workers' cottages, to provide an understanding of the role of maintenance workers in maintaining a clean and safe water supply, and to foster appreciation of the remnant plantings in these areas;
    - Austral Town Centre, to describe the historical development of the town and the role of the Austral Progress Association in the community;
    - High points at Judges Hill, Carnes Hill, and Leppington Public School, to explain the history of the development of the land in the context of the historic themes

outlined in this report, including historic patterns of subdivision and agricultural development;
  - Junction of Cowpasture and Bringelly Roads, to explain the importance of the early road network to the history and development of the area; and
  - Junction of the original alignment of Cowpasture Road and the later re-alignment of the road near to the Upper Canal, to explain the historical relationship between the road and the Canal, and to describe long term changes in the local landscape.
- Commissioning quality public art for key public spaces in the Precincts, which interpret various themes or periods of history of the area. Public art is a less traditional means of interpreting history, which can express alternative points of view and attract new audiences to an appreciation of local heritage. It can also provoke different emotional or spiritual responses to heritage places or associations in the community.
- Establishing heritage walking or bicycling trails, to encourage local people and visitors to the Precincts to make a connection with the history of the local area. Walking trails can be used in conjunction with signage, printed brochures, and other media such as podcasts to communicate the history of the area and create linkages between disparate elements and places. Key opportunities for heritage walking trails are:
  - Route along the Upper Canal; and
  - Route along Edmondson Avenue, through Austral Town Centre.
- Creating and maintaining an open landscape buffer along the route of the Upper Canal, to reinforce its historical setting in a rural landscape, whilst maintaining passive surveillance and security for the Canal.
- Creating or maintaining landscaped buffers along key historical roads, to reinforce the historic character of these roads within the landscape.
- Creating and/or maintaining roads or landscaped areas along the boundaries of early colonial land grants, to maintain physical evidence of the history of these grants within the landscape of the study area.
- Maintaining historic names of streets, public parks, and natural features within the landscape, including:
  - Cowpasture Road,
  - Bringelly Road,
  - Eastwood Road,
  - Browns Road and Avenue,
  - Edmondson Avenue,
  - Gurner Avenue,
  - Kelly Street,
  - Rickard Road,
  - Judges Hill,
  - Carnes Hill,
  - Craik Park,
  - W V Scott Memorial Park, and
  - Starr Park.
- Naming new streets, public parks, and other community places in accordance with the historic themes identified in this report, including themes associated with more recent migrant history of the area. Various stakeholders, including local residents and regional historical societies, could be given an opportunity to suggest themes or individual names for incorporation into the ILP. Figure 7.4 suggests appropriate names for new local roads which will follow historic land grant boundaries.

Constraints

The interpretation strategy for the Precincts should have a cohesive character, which reinforces historic linkages between the widely dispersed heritage items and places within the Precincts. Since heritage items are owned and maintained by various public and private authorities, consideration should be given to ways of designing and implementing a standardised aesthetic for interpretive signage, including funding for the creation and maintenance of signs and other forms of interpretive media.

Interpretation strategies should incorporate site-specific elements, and should not in any way reduce or detract from the cultural significance of existing or potential heritage items, places and archaeological sites.

6.6.1 Historic Themes

The Commonwealth and State government authorities have developed a series of historic themes that enable the comparative assessment of heritage values, and provide a structure for the future interpretation of the Precincts. The following historic themes have been identified in this report as illustrating significant aspects of the study area:

Australian Themes	NSW Themes	Local Themes
Peopling Australia	Ethnic influences and Migration	Development of rural economies, including market gardens and poultry farms
Developing local, regional and national economies	Agriculture	Rural landscape, market gardens, pig farms, poultry farms
	Commerce	General store, hardware store
	Communication	Post office, telegraph, historic tracks and roads
	Environment – cultural landscape	Kemps Creek Nature Reserve, agriculture, tree clearing, row of Bunya pines, serpentine route of the Upper Canal, route of the Old Cowpasture Road and Bringelly Road, mid-twentieth century gardens
	Industry	Blacksmith
	Pastoralism	Early land grants, water trough
	Technology	Upper Canal – elements associated with safe water supply and drainage
	Transport	Cowpasture Road, Bringelly Road, Fifteenth Avenue, Canal overbridges
Building settlements, towns and cities	Towns, suburbs and villages	Subdivision patterns, Austral Town Centre, areas of archaeological sensitivity
	Land tenure	Bringelly Road, Cowpasture Road, evidence of early land grants, subdivision patterns, areas of archaeological sensitivity
	Utilities	Upper Nepean Scheme – Upper Canal
	Accommodation	Twentieth century vernacular architecture, fibro house, house as archaeological site
	Education	Austral Public School, Leppington Public School
Developing Australia's cultural life	Domestic life	Working-class housing, mid-twentieth century houses and gardens, areas of archaeological sensitivity
	Social institutions	Austral Progress Association, H J Starr Progress Hall, Federation of Hellenic Societies monument
	Sport and Leisure	W V Scott Memorial Park
Marking the phases of life	Birth and death	War memorials

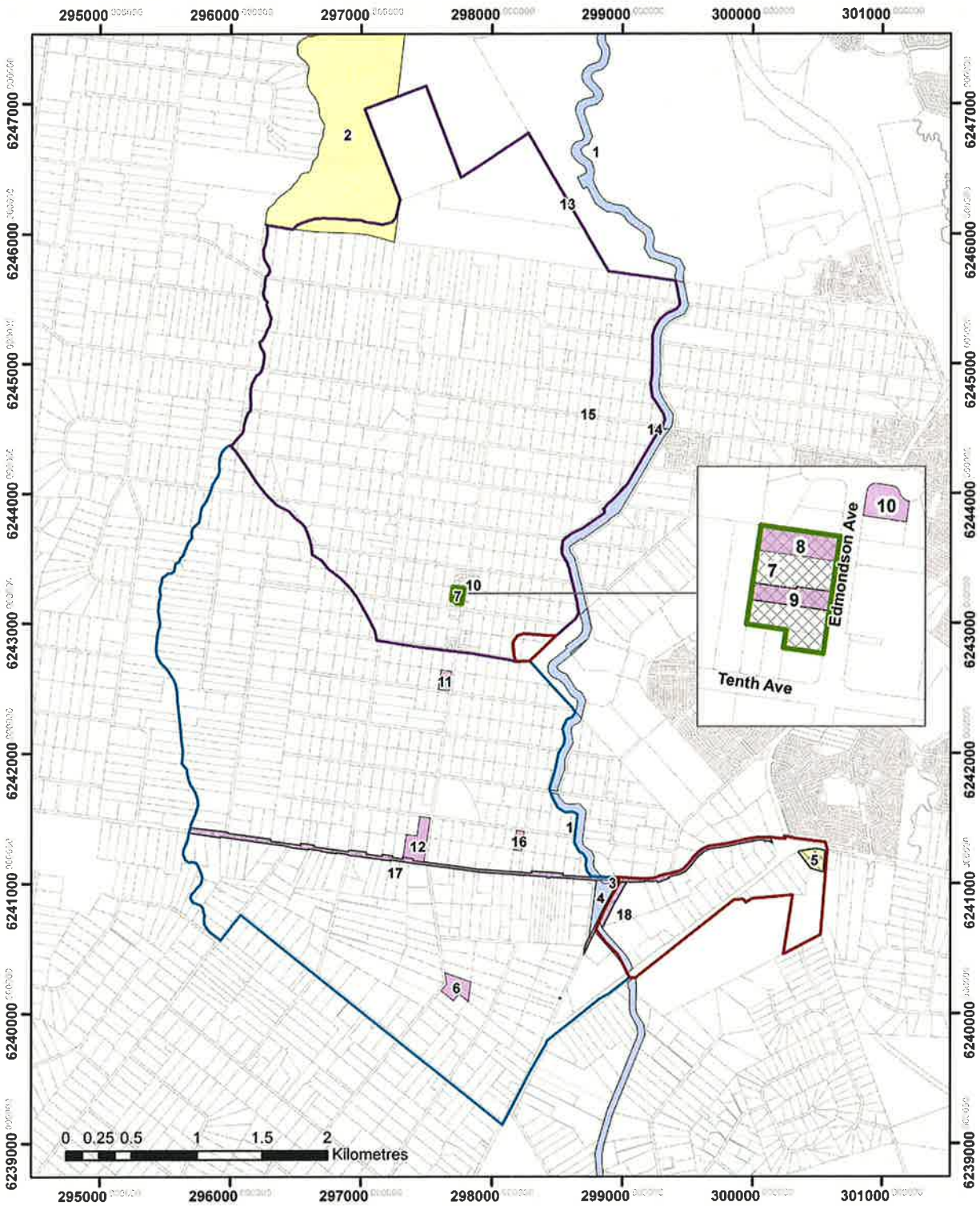
Australian Themes	NSW Themes	Local Themes
	Persons	Commemorative place names, war memorials

6.6.2 Storylines

People's stories and memories provide information about lived experience of the land, and how it has changed over time. Oral histories, videos and soundscapes could supplement historical documents and photographs as an expression of lived experience.

An oral history campaign initiated by Therese Sweeney, Managing Director of Memory Bank Cultural Media Inc, provides an example of ways in which the more recent history of the Austral and Leppington North Precincts can be preserved and interpreted for future generations. The Memory Bank project has focused on migrant farming history of the area, recording the stories of people who are often ignored or marginalised in more traditional forms of history. The project is using a variety of contemporary methods of disseminating this information, including an online repository of film and photographs, and publications through radio, television, and print media (Therese Sweeney, pers. comm., 22 February 2011; http://www.memorybank.org.au).

Some local stories may be preserved in the archives of Liverpool Council, Liverpool Library, and Liverpool Regional Museum, as well as private collections held by local residents.



Legend

- Austral Precinct
- Leppington North Precinct
- Investigation Areas
- Cadastre

Heritage Items

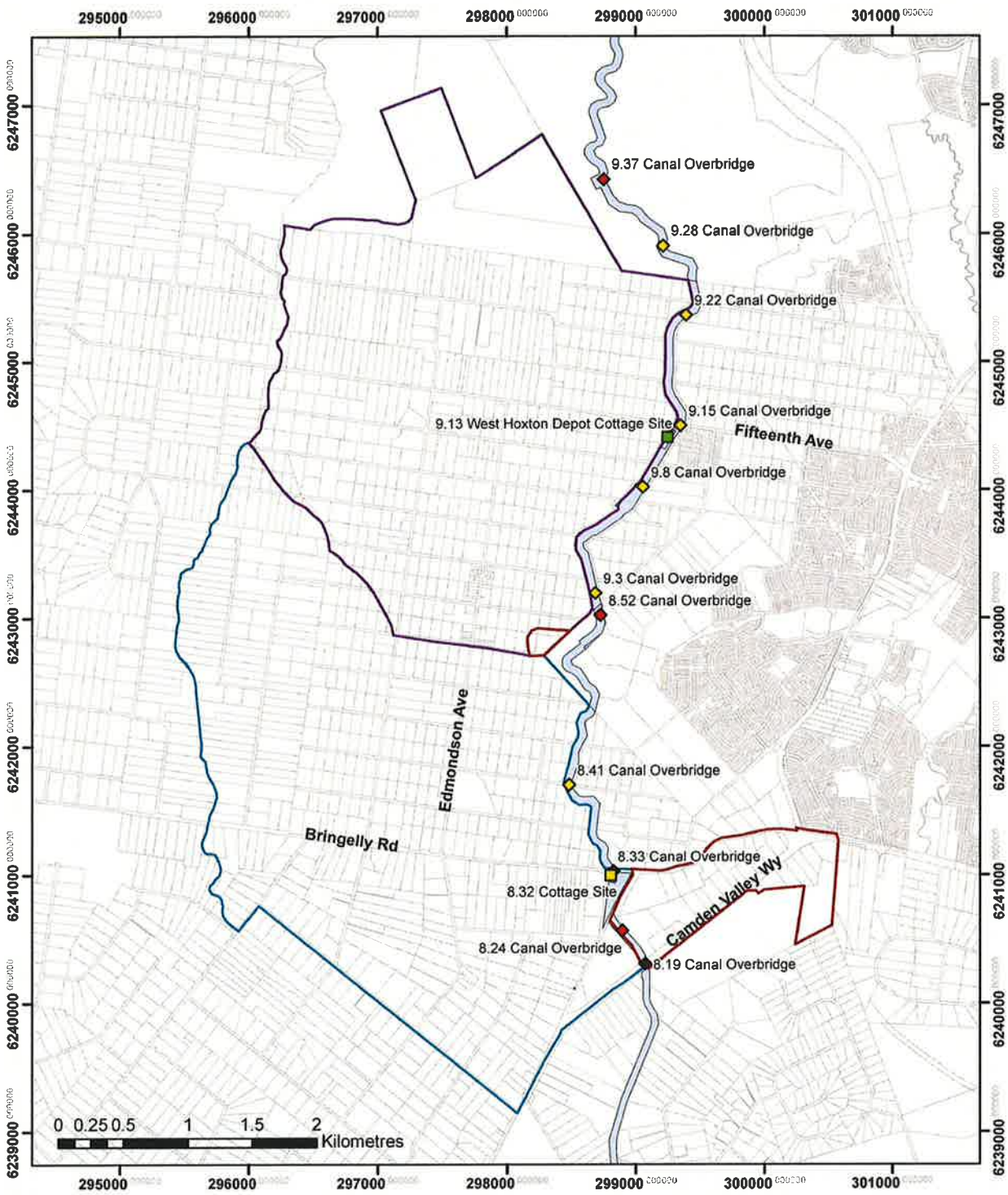
- State heritage item
- Local heritage item
- Potential heritage item
- Potential heritage conservation area
- Archaeological sensitivity

1 Upper Nepean Scheme - Upper Canal
2 Kemps Creek Forest
3 Row of Bunya Pines, Bringelly Road
4 Brown Memorial and Water Trough
5 Forest Home - Archaeological Site (Dwelling and rural lot)
6 Leppington Public School
7 Austral Town Centre Conservation Area
8 H J Starr Progress Hall, 264 Edmondson Ave
9 Ian's Hardware and House, 256 Edmondson Ave
10 Brick House and Garden, 275 Edmondson Ave
11 House and Garden, 170 Edmondson Ave
12 WV Scott Memorial and Park
13 Hellenic Monument, Lot 10 DP771080
14 Blacksmith's Workshop (Former) - Archaeological Site, 240 Fifteenth Ave
15 Weatherboard House - Archaeological Site, 305 Fifteenth Ave
16 Cement Rendered House, 40 Browns Road
17 Bringelly Road - Cultural Landscape
18 Cowpasture Road - Cultural Landscape

N

Background cadastral data © Department of Planning
Horizontal datum: GDA94/MGA Zone 56

Figure 6.1 Heritage items, potential heritage items, and areas of archaeological sensitivity.



Legend

- Austral Precinct
- Leppington North Precinct
- Investigation Areas
- Cadastre
- Sydney Water Supply Upper Canal

Upper Canal elements

Element, Grading of Significance

- Canal Overbridge, Exceptional
- Canal Overbridge, Considerable
- Canal Overbridge, Little or no significance
- Cottage Site, Considerable
- Cottage Site, Considerable with some intrusive

N

Background cadastral data © Department of Planning
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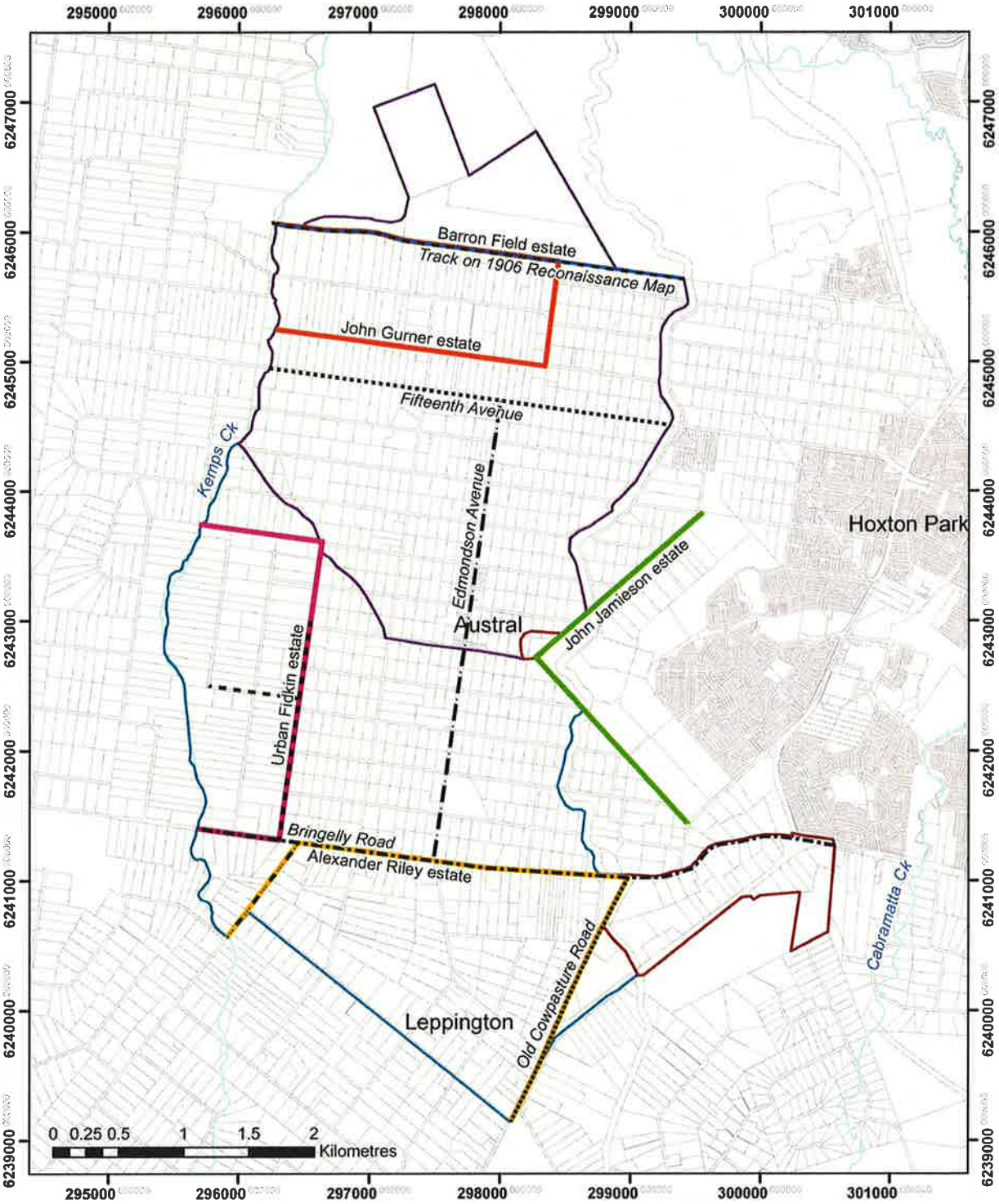
Figure 6.2 SHR Upper Nepean Scheme – Upper Canal. Lot boundary curtilage in blue. Overbridges and cottage sites indicated.



Legend

- Austral Precinct
- Leppington North Precinct
- Investigation Areas
- Cadastre
- Drainage

Historic estate boundaries

- John Gurner estate
- John Jamieson estate
- North boundary of Alexander Riley estate
- South boundary of Barron Field estate
- East boundary of Urban Fidkin estate

Historic Roads and Tracks

- Old Cowpasture Road
- Bringelly Road
- Eastwood Road
- Edmondson Avenue
- Fifteenth Avenue
- Tracks on 1906 Reconaissance Map

N

Background cadastral and drainage data © Department of Planning
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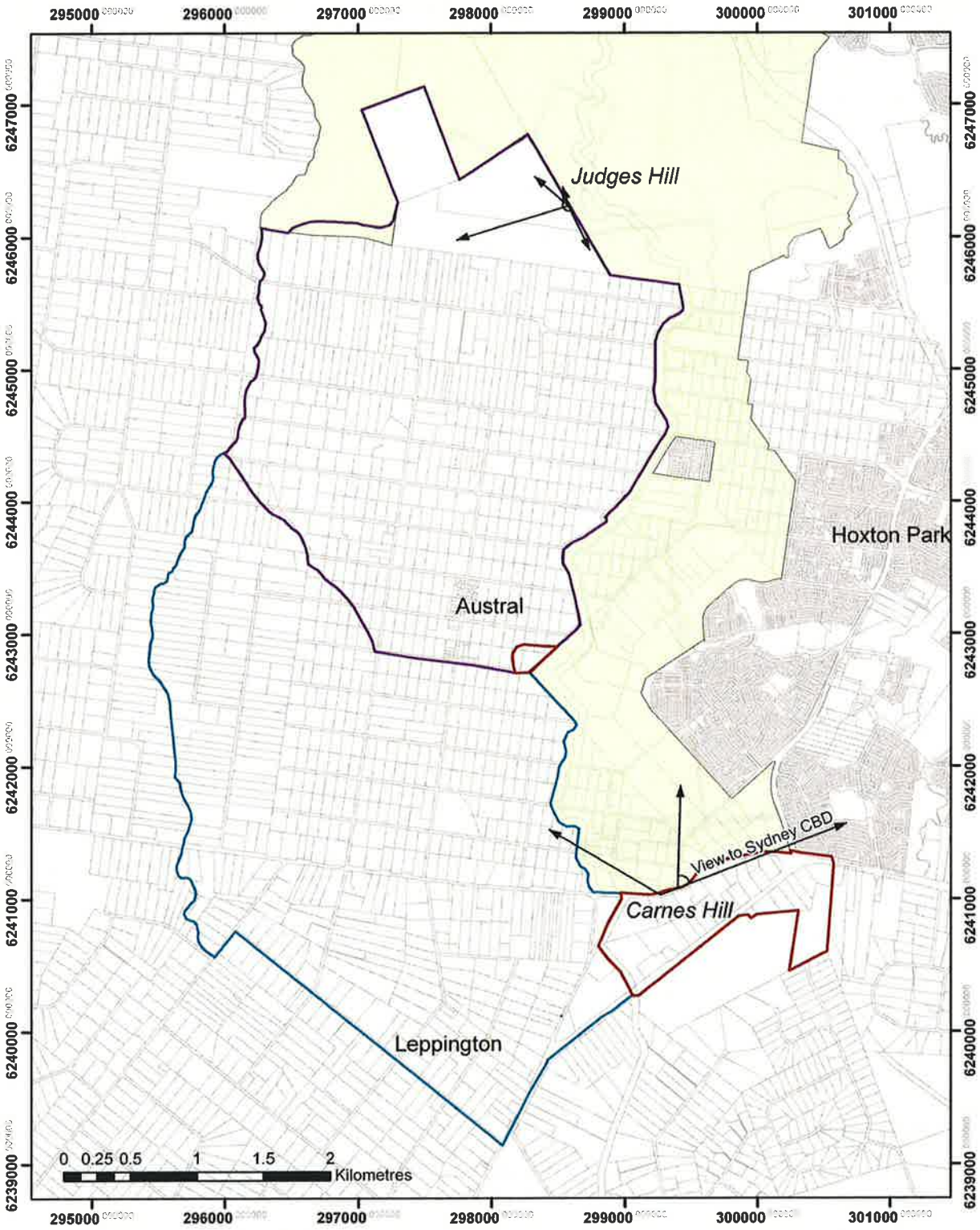
Figure 6.3 Historic estate boundaries and road alignments.



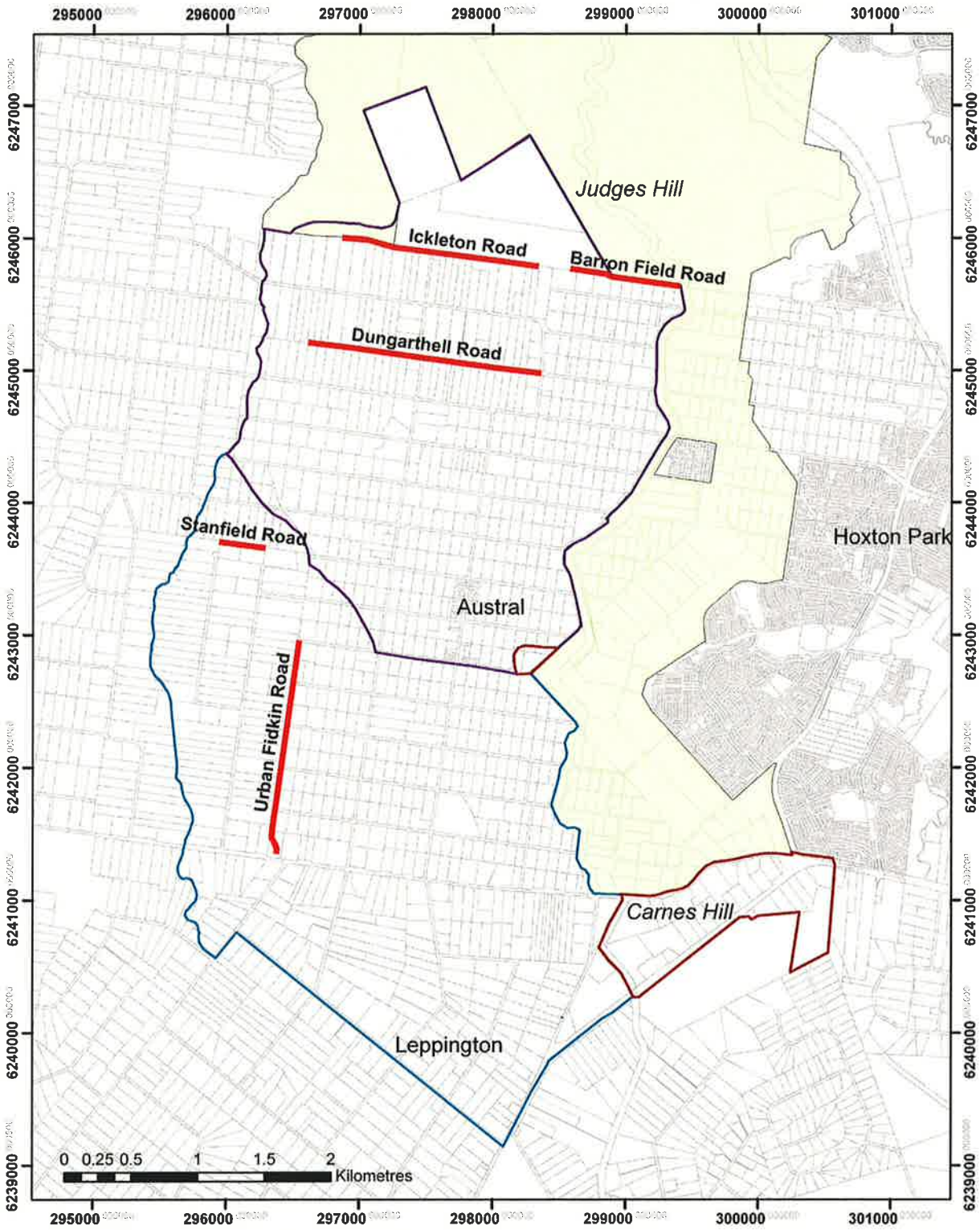
Legend

- Austral Precinct
- Leppington North Precinct
- Investigation Areas
- View
- Cadastre
- Western Sydney Parklands

N

Cadastral data: Department of Planning
Horizontal datum: GDA94/MGA Zone 56

Figure 6.4 Historic views.



Legend

- Austral Precinct
- Leppington North Precinct
- Investigation Areas
- Cadastre
- Western Sydney Parklands
- Proposed Road Names

N

Cadastral data: Department of Planning
Horizontal datum: GDA94/MGA Zone 56

AMBS

Figure 6.5 Proposed future naming of new local roads along early land grant boundaries. These names reflect the historic names of early land grants and the people associated with them.

7 Discussion of ILP and Recommendations

7.1 Preamble

This section includes a brief discussion of the Indicative Layout Plan (ILP) for the Austral and Leppington North Precincts in the context of the preceding analysis of heritage constraints and opportunities. Recommendations are provided to guide the management of historic heritage issues during the development of the Precincts. The ILP is attached in Figure 7.1.

There are four local heritage items and one State heritage item within the study area. In addition, this study has identified a further 12 potential local heritage items and one heritage conservation area within the study area. These items and places should be conserved for present and future generations. Conservation should recognise the historic, aesthetic, scientific/technical and social or spiritual values of these items or places. The values identified for each item are summarised in Section 5 above and in the Appendices to this report.

AMBS' preliminary recommendations regarding the future conservation of historic heritage items and potential heritage items have largely been addressed during the development of the ILP. The locations of various roads and sporting facilities have been redesigned to avoid direct impacts on identified heritage items and places within the study area. However, in some cases, the proposed road layout conflicts with the proposed heritage curtilage of potential heritage items. Moreover, the ILP does not explicitly address heritage issues, constraints or opportunities for individual places arising from the proposed development. The overall development prefigured by the ILP is highly likely to have an adverse impact on the SHR values of Upper Canal, which is aligned immediately adjacent to the eastern boundary of the study area. These issues will therefore need to be addressed during subsequent, more detailed planning stages for the Precincts, and during the Development Application process.

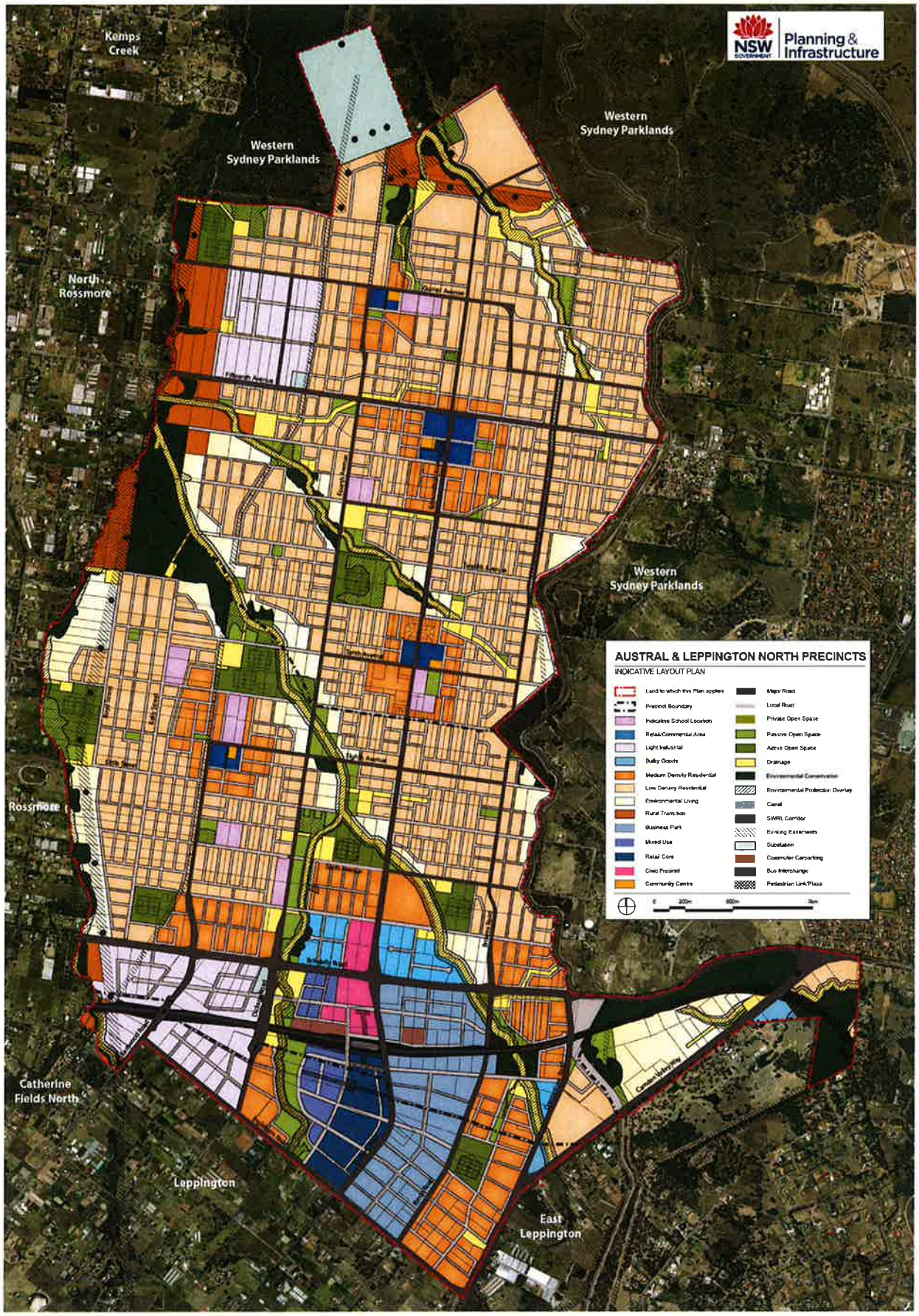


Figure 7.1 Indicative Layout Plan for the Austral and Leppington North Precincts, June 2012.

7.2 Precinct Planning

Appropriate heritage conservation policy and guidelines should be incorporated into the DCP and SEPP Amendment for the Austral and Leppington North Precincts. The conservation of the area's identified heritage values will make an important contribution to public understanding and appreciation of the local history of the Precincts, and potentially enrich the lives of current and future residents. General heritage recommendations regarding the precinct planning process are outlined below. Discussions of site specific heritage issues and recommendations follow.

Recommendation 1

The following State, local, and potential historic heritage items, places, and archaeological site should be listed in the DCP and SEPP Amendment, to protect their identified heritage values during the development of the Austral and Leppington North Precincts:

- ***Upper Nepean Scheme – Upper Canal***
- ***Row of Bunya Pines, 145 Bringelly Road, Leppington***
- ***Brown Memorial and water trough, 145 Bringelly Road, Leppington***
- ***Leppington Public School, 142-148 Rickard Road, Leppington***
- ***Austral Town Centre Conservation Area, Austral***
- ***H J Starr Progress Hall, 264 Edmondson Avenue, Austral***
- ***Ian's Hardware and House, 256 Edmondson Avenue, Austral***
- ***Brick House and Garden, 275 Edmondson Avenue, Austral***
- ***House and Garden, 170 Edmondson Avenue (125 Eighth Avenue), Austral***
- ***Cement Rendered House, 40 Browns Road (60 Fifth Avenue), Austral***
- ***W V Scott Memorial and Park, Austral***
- ***Hellenic Monument, Lot 10 DP 771080, Austral***
- ***Forest Home – Archaeological Site, 1720-1726 Camden Valley Way, Leppington***
- ***Blacksmith's Workshop (Former) – Archaeological Site, 240 Fifteenth Avenue, Austral***
- ***Weatherboard House – Archaeological Site, 305 Fifteenth Avenue, Austral***
- ***Cowpasture Road – Cultural Landscape, Leppington***
- ***Bringelly Road – Cultural Landscape, Austral and Leppington***

The listing process should be undertaken in consultation with Camden and Liverpool Councils and other relevant stakeholders.

Recommendation 2

Heritage curtilages for listed and potential heritage items should be acknowledged in the DCP and local Council heritage inventories as indicative of the minimum area required to protect significant physical fabric and/or an appropriate landscape setting for each item or place during the development of the Austral and Leppington North Precincts.

Recommendation 3

Further investigation of areas of archaeological sensitivity will be required during the development of the Austral and Leppington North Precincts. Site specific Archaeological Assessments should be completed to address the impact of the development on the following sites:

- ***Upper Nepean Scheme – Upper Canal***
- ***Forest Home (Dwelling and Rural Lot), 1720-1726 Camden Valley Way, Leppington***
- ***Blacksmith's Workshop (Former), 240 Fifteenth Avenue, Austral***
- ***House, 305 Fifteenth Avenue, Austral***

7.2.1 Development Control Plan

Development controls should provide practical guidelines for protecting and maintaining the cultural significance of the heritage items and potential heritage items identified in this report, including areas of archaeological sensitivity. Section 5.10 in the Standard Instrument provides the key objectives and conditions for consent for the development of heritage items. Additional detailed guidelines should be included in the DCP for the Precincts.

Development controls regarding the density, height, mass and scale of new buildings, or the character of vegetation and landscaping, could also be used to interpret historic land grant and subdivision patterns in the area, and to minimise impacts on individual heritage items and the proposed Austral Town Centre Conservation Area.

Recommendation 4

General objectives and controls for development in the vicinity of heritage items and heritage conservation areas that could be incorporated in the DCP for the Austral and Leppington North Precincts are:

Objectives

- ***To conserve and enhance the heritage significance of the item or conservation area;***
- ***To ensure that changes to an item or conservation area are based on an understanding of the heritage significance of the place;***
- ***To retain an appropriate landscape setting for the item or conservation area, and views associated with the place;***
- ***To understand the research potential of archaeological resources;***
- ***To facilitate opportunities to improve public understanding and/or appreciation of the environmental heritage of the item or conservation area;***

- *To encourage ongoing use of heritage items, including adaptive reuse where this will contribute to the conservation of the item or conservation area;*

- *To encourage a cautious approach to change. If changes are likely to detract from the heritage significance of the item or place, encourage changes that are reversible;*

- *To acknowledge that past changes to heritage items may contribute to the history of the place;*

- *To encourage the conservation of significant interior elements of built heritage items, including fixtures and fittings; and*

- *To encourage routine maintenance of heritage items and heritage conservation areas to retain their heritage significance.*

Recommended Controls

- *Retain features which contribute to the heritage significance of the item or conservation area.*

- *Retain features which contribute to an understanding of the history of the item, or key periods of its development.*

- *Retain significant landscape elements and/or views associated with the item.*

- *Retain significant historical property boundaries, if identified as part of the significance of the item.*

- *Retain significant uses, if identified as part of the significance of the item, or a similar/compatible use.*

- *Remove unsympathetic elements from the item or conservation area, where this will contribute to the heritage significance the item or conservation area.*

- *For identified archaeological sites, undertake an Archaeological Assessment in accordance with Heritage Branch guidelines to address the archaeological potential of the site prior to its development.*

- *New work in the vicinity of built heritage items should be sympathetic to the form, scale, massing, setback and overall character of the item, and should not detract from its appreciation.*

- *New work should be readily identifiable as such.*

- *Alterations and additions should be located away from significant and/or primary elevations, and behind and below the main ridge line of built heritage items.*

- *Existing fabric, use, associations and meanings should be adequately recorded before any changes are made.*

7.3 Upper Nepean Scheme – Upper Canal

The Upper Nepean Scheme – Upper Canal, which is listed on the SHR, is the most significant element of European built heritage within the study area. An increase in the density of houses and people living in the vicinity of the Canal is likely to incur gradual and cumulative impacts on the physical fabric of the Canal and its associated elements. These include problems associated with incremental changes in surface drainage patterns and related impacts on water quality, which may in turn impact on the historic and technical significance of the Canal as an operational element of Sydney's water supply system. Intensified residential development adjacent to the Canal corridor will also have an adverse impact on its rural landscape setting and associated picturesque elements of the Canal corridor. Mitigation of these impacts will require long-term solutions, which should be addressed in consultation with SCA and the NSW Heritage Council, and should be consistent with the recommendations of the CMP for the Canal. Standard provisions for the development assessment of housing, roads and road infrastructure in the immediate vicinity of the Canal should be strengthened in the SEPP or DCP to address potential impacts on the SHR values of the Canal.

Recommendation 5

Cumulative and long-term impacts of intensified development along the Upper Canal should be addressed in consultation with SCA and the NSW Heritage Council. A supplementary heritage management document should be prepared to guide development in the vicinity of the Canal corridor, and to manage the impacts of intensified housing, roads and road infrastructure in the vicinity of the Canal corridor on the SHR values of the Canal. Objectives and development controls addressing these impacts should be incorporated in the DCP for the Precincts.

Objectives

Development in the vicinity of the Upper Canal should aim to:

- ***maintain the form, fabric, and operational utility of the Canal;***
- ***preserve technological evidence of nineteenth century hydraulic engineering and Canal building techniques, as illustrated by the Upper Canal, and progressive improvements in the construction of associated elements, including culverts, flumes and overbridges;***
- ***conserve picturesque elements of the Canal, including its serpentine route, evidence of its original rural setting, and associated cultural plantings;***
- ***conserve evidence of the historic relationship between the alignment of the Upper Canal and Cowpasture Road;***
- ***maintain appropriate access to and security for the Canal and its historic heritage curtilage, to preserve the quality of the water and prevent inadvertent damage and/or intentional vandalism to the physical fabric of the Canal; and***
- ***interpret the heritage significance of the Upper Canal to the general public, to foster an appreciation of its history and ongoing value to the community.***

7.3.1 Perimeter Road and Open Landscape Buffer

SCA supports the notion of local perimeter road running parallel to the route of the Canal, to maintain access to the Canal for management and maintenance purposes, provided that the road acts as a local internal road only. In sections where a perimeter road is not already in place, the ILP makes

provision for a perimeter road, to be provided by developers. SCA also suggests that local housing should be designed to address the road, so that they overlook the Canal corridor, providing passive surveillance and security for the Canal.

The proposed development will bring about irreversible change to the rural landscape setting associated with the Canal. The impacts of change could be mitigated by the provision of additional open landscape buffering adjacent to the Canal along the east side of proposed perimeter road reserve. Stormwater and flood controls required by SCA to prevent runoff, sediment, and other pollutants entering the Canal corridor could be engineered in association with the road verge, without blocking direct views into the Canal corridor.

Recommendation 6

The perimeter road should be designed to deter heavy through traffic to prevent impacts of vibration on the physical fabric of the Upper Canal. The creation of additional open landscape buffering along the alignment of the Canal in association with the perimeter road and walking or cycling trails would reinforce its historic rural setting, whilst maintaining passive surveillance and security for the Canal.

The DCP should provide design guidelines for the perimeter road and road infrastructure, to support traffic calming and additional open landscape buffering adjacent to the Canal corridor, without interrupting significant view corridors. The roadside verge adjacent to the Canal corridor should be a minimum width of five metres to provide for a broad, grassed area and a pedestrian/cycling path, and car parking should be restricted to the west side of the road.

Recommendation 7

The DCP should provide design guidelines for housing adjacent to the Canal corridor. Houses should address the road and Canal corridor to provide passive surveillance for the Canal infrastructure. In areas where there are clear sightlines to the Canal corridor, landscaping could be limited to low shrubs and intermittent trees.

7.3.2 Overbridges

The ILP indicates that there will be three major road crossings over the Upper Canal to connect the Austral and Leppington North Precincts with areas to the east. These crossings are located on existing traffic corridors at Camden Valley Way, Bringelly Road, and Fifteenth Avenue. A fourth major crossing at the Sixth Avenue overbridge may in future provide a link to a proposed regional sporting facility within the Western Sydney Parklands. All these crossing are likely to require augmentation of the existing overbridges to accommodate increased vehicle traffic.

Impacts of augmentation of the Bringelly Road and Camden Valley Way overbridges, which have been assessed in the CMP as having little or no heritage significance, will be addressed by the RTA as part of the Review of Environmental Factors being undertaken for the upgrade works for those roads. The Sixth and Fifteenth Avenue overbridges have been assessed as having considerable (high) heritage significance; as such site specific statements of heritage impact should be prepared prior to works to address the impacts of augmentation on the heritage values of the Canal. Augmentation should be restricted to one side only, particularly where there is evidence of other recent modification, while preserving evidence of the historic form and construction techniques on the other side. The physical assessment has indicated that one side of the Fifteenth Avenue bridge has already been substantially modified, as part of previous upgrades to the road.

Recommendation 8

Road crossings over the Upper Canal adjacent to the Precincts should be limited to extant reinforced concrete beam bridges. Site specific SoHIs should be prepared to address the impact of new, augmented or modified Canal crossings on the SHR values of the Upper Canal. Applications for approval to the NSW Heritage Council should be made in accordance with Section 60 of the Heritage Act, or an exemption gazetted under Section 57(2) of the Act.

There are five additional overbridges immediately adjacent to the Precincts, which will be maintained for SCA access to the Canal corridor. Some of these overbridges may also be used by pedestrians and cyclists to access the Western Sydney Parklands. These crossings provide an opportunity to open up significant views of the Canal to the general public, but should not allow public access to the Canal corridor or otherwise compromise the security of the Canal. These crossings could also be used as the focus of interpretive signage, designed to explain the history and significance of the Canal, and to engage the general public in the ongoing maintenance of its heritage values.

Recommendation 9

Pedestrian/cyclist crossings over the Upper Canal adjacent to the Precincts should be limited to extant overbridges. These crossings represent an opportunity to interpret the heritage significance of the Canal to the general public. Interpretative signage should be placed at key points along the proposed Perimeter Road, near the pedestrian crossings, addressing open views of the Canal corridor wherever possible: for example near Bringelly Road, Sixth, Tenth, Thirteenth, Fifteenth and Eighteenth Avenues.

7.4 Leppington Public School

Leppington Public School currently occupies four lots, which define the *lot boundary heritage curtilage* of the school (Figure 7.2). This curtilage forms an appropriate setting for the buildings and associated plantings that have been identified as key elements of the heritage significance of the school, or which contribute to the overall significance of the place as an education precinct. However, the ILP presupposes that the school will at some time in the future be decommissioned and relocated by DEC, as part of the long-term future development of Leppington Town Centre. As such, consideration should be given to a sympathetic function for the school, which retains the key weatherboard buildings, ablutions block and mature plantings in their original location, and adapts them for another use which respects the historic, social and aesthetic significance of the place. Adaptive reuse may include a child care centre, information centre, or other community/educative function. It may be noted that TAFE has considered and rejected the area as a potential future campus, and that Camden Council will not acquire the land. It is therefore likely that the land will be managed by a private owner/developer in the long-term.

A *reduced heritage curtilage* would focus on the original 1923 boundary of the school, comprising two acres at the south side of the site, and may form part of a broader civic centre or public open space. In the long-term, it would provide a 30m buffer for the original Raby school building (Building H), retaining its existing garden setting, and reducing the impacts of increased traffic noise and visual overshadowing by neighbouring commercial buildings. It would also incorporate Buildings J and Q, and key cultural plantings, listing of which are supported by DEC.

A reduced curtilage may eventually result in the loss of integrity of the overall school grounds, including the loss of Building D, which has been identified as complementary to the weatherboard Building J, being a later brick example by the same architect. However, in general, the brick Van der Steen buildings are well represented in NSW public schools. It may also result in the loss of

recognition of individuals currently remembered at the school through the commemorative naming of elements outside the proposed curtilage, such as the J Peck Oval. It would therefore be appropriate to develop a memorialisation and naming policy for buildings within the reduced heritage curtilage, to ensure continued recognition of people significant to public education in Leppington.

The definition of heritage curtilage will ensure that the elements of high heritage value are protected in the short- to medium-term while the staged development of the Town Centre takes place. The definition of a *reduced heritage curtilage* should not prevent the ongoing development and/or expansion of the school by DEC to accommodate new buildings or other facilities appropriate to the normal functioning of the school, including new buildings within the curtilage, provided that the elements identified as having high heritage value are also maintained in their current location within this curtilage (Figure 7.2). Appropriate maintenance also includes pruning trees where they may prove a safety issue.

Guidelines for development adjacent to the school grounds should be addressed in the DCP for the Precincts. The Leppington Town Centre ILP indicates that the school will eventually be situated opposite the Retail Core area on Rickard Road, and surrounded by Business Park to the north, south and east. New buildings in the immediate vicinity of the weatherboard group of buildings should not overwhelm the scale or massing of the individual buildings, which are modest in character, and it may be appropriate to define development controls which support a maximum of one or two storeys in areas immediately adjacent to the school boundary, stepping back to larger heights.

Recommendation 10

New buildings in the immediate vicinity of Leppington Public School's reduced heritage curtilage should be sympathetic to the scale, massing, and character of the significant weatherboard buildings and their garden setting. Ongoing augmentation of the school facilities by DEC in the short- to medium- term is compatible with the historic and social significance of the place.

Recommendation 11

New commercial and/or retail buildings should not exceed one (1) or two storeys immediately adjacent to Leppington Public School's reduced heritage curtilage, stepping back to greater heights 10-20m beyond the reduced heritage curtilage.

Figure 7.2 Leppington Public School lot boundary curtilage (red) and reduced curtilage (blue)

7.5 Austral Town Centre Conservation Area

The ILP indicates that the proposed Austral Town Centre Conservation Area will form part of a small Retail/Commercial node surrounded by a discrete area of medium density housing. This zoning is consistent with the historic (and existing) function of the proposed conservation area, namely a small mixed use precinct with a strong community focus.

Listing as a conservation area presents an opportunity to maintain and strengthen the historic character of this neighbourhood centre by preserving a cohesive grouping of modest, mid-twentieth century buildings, historically associated with the development of a discrete area during the 1930s-1940s on the west side of Edmondson Avenue by Emma and H G Starr, Austral Postmaster. The building styles are complementary in their character and scale, and illustrate a range of functions important to the town as it developed in the mid-twentieth century, including the general store, Progress Hall, and post office. The ongoing development of the town centre is closely linked to that of the broader Austral Area, which underwent a major period of change and agricultural intensification in the years immediately before and following after WWII.

Listing as a conservation area would also provide an opportunity to preserve a representative sample of three mid-twentieth century fibro houses within the new Precincts. This report has identified the working class fibro house as an unassuming, but ubiquitous element of the study area, reflecting the same major period of development in the area during the years immediately before and after WWII. This building type will become increasingly rare as the area is developed as part of the SWGC. Listing the houses as contributory elements in the proposed conservation area may entail less onerous regulatory control by permitting some modifications to the houses, while focusing on the protection of the form and character of the street-facing facades and overall character of the streetscape.

Recommendation 12

The proposed Austral Town Centre Conservation Area should be conserved as a cohesive group of mid-twentieth century commercial, civic and residential buildings on the west side of Edmondson Avenue, between Tenth and Eleventh Avenues.

Listing as a conservation area does not preclude further development of the vacant land between Ian's Hardware and the H J Starr Progress Hall, nor to the rear of the fibro houses. On the contrary, new retail, community or other commercial development would contribute positively to the ongoing use of significant heritage buildings as active elements of a neighbourhood centre. That being said, new development in the vicinity of the conservation area should not detract from the character of the conservation area. Detailed design guidelines for development within and immediately adjacent to the conservation area should be addressed in the DCP for the Precincts.

Recommendation 13

Objectives and controls for development in the vicinity of Austral Town Centre Conservation Area that could be incorporated in the DCP for the Precincts are:

Objectives

- ***To retain the conservation area as a small-scale community centre and mixed-use precinct, with a strong mid-twentieth century character; and***
- ***To ensure that changes to the conservation area, including infill development, are based on an understanding of the heritage significance of the place.***

Recommended Controls

- ***Retain elements of built heritage which contribute to the overall heritage significance of the Austral Town Centre Conservation Area (contributory items).***
- ***Retain the principal built form of contributory items, including roof lines, street-facing and side elevations, door and window-openings. Minor alterations that do not have a significant impact on the architectural form and character of the original building may be permitted.***
- ***When required, replace asbestos cement sheeting on contributory items with fibre cement sheet, in accordance with appropriate OH&S standards.***
- ***Infill development should be of a modern design, which responds sympathetically to the historic character and setting of the conservation area, and to the form, scale, massing, orientation and setback of its contributory items. Where possible, new infill buildings should address the street.***

- ***Infill development should not overwhelm the contributory items within the conservation area, in height or massing. A maximum of one (1) storey on the street-facing elevation is appropriate.***

- ***Infill development or additions may be permitted at the rear of contributory items, where the design will achieve an aesthetically cohesive relationship between new and old, and the proposal is consistent with the character of the site and the broader conservation area.***

Figure 7.3 Boundary of the proposed Austral Town Centre Conservation Area and contributory items.

7.6 W V Scott Memorial and Park, Austral

The Leppington Town Centre ILP identifies the area of the W V Scott Memorial Park, at the junction of Bringelly Road and Edmondson Avenue, as the site of a future regional Aquatic and Indoor Recreation Centre. Development as a built recreation centre will have a substantial impact on the original landscape setting of the present war memorial and sports field. The widening of Bringelly

Road may also have an adverse impact on the original site of the war memorial. However, the proposed redevelopment will ensure that the land continues to be used for public, recreational purposes, compatible with the original intent of a memorial sports field, and relevant to the changing needs of this growing suburban community. Retaining the name W V Scott Memorial for the proposed centre will ensure that the original commemorative purpose of the sports field is not lost to future generations.

Future redevelopment of the land for a regional Aquatic and Indoor Recreation Centre should also incorporate a commemorative monument to W V Scott at the main entrance, in keeping with the local community's desire not to forget the sacrifice of local residents in WWII. The monument should retain the inscription recorded on the present monument, which replicates that of the original bubbler monument, and a garden setting, which respects the recent history of the monument and its association with Liverpool RSL and Austral Public School. Future redevelopment should be undertaken in consultation with relevant stakeholders, including descendants of WV Scott, Austral Public School, Liverpool RSL, Liverpool Council, and the local community.

Recommendation 14

The proposed redevelopment of the W V Scott Memorial Park as a regional Aquatic and Indoor Recreation Centre should be compatible with the historic heritage significance of the place. Continuity in the use of the land for community recreational purposes, retention of the name 'W V Scott Memorial' for any future recreational facilities, and ongoing conservation of a commemorative monument to W V Scott are in keeping with the local community's desire not to forget the sacrifice of local residents in WWII and will contribute to the conservation of the social and historic significance of the place. The commemorative monument should retain the inscription recorded on the present monument, and should be located at the main entrance to the facility, within an appropriate garden setting.

7.7 Historic Subdivision Patterns and Road Alignments

Roads and property boundaries provide an important, tangible link with the history of land use and settlement of the area, but are generally unlikely to warrant individual heritage listing or other special protections. Redevelopment of the Austral and Leppington North Precincts represents an opportunity to interpret the historic road alignments and subdivision patterns associated with the early European history of the area to future generations.

In general, the ILP for the Austral and Leppington North Precincts has retained key historic roads along their original alignments, and the historic grid pattern of roads and streets associated with the late nineteenth century Hoxton Park Estate subdivision will be retained substantially intact. Bringelly, Edmondson and Fifteenth Avenue will be upgraded, retaining their historic and technical significance as important local transport and communications corridors. In contrast, new local roads within the precincts will generally cut across pre-existing property boundaries. This will gradually reduce the physical evidence of historic roads and early property boundaries within the landscape.

Eastwood Road provides physical evidence of the boundary between two early land grants: to Alexander Riley, *Raby* (1816), and Hannibal Macarthur, *Eastwood* (1819). The Leppington Town Centre ILP indicates that the alignment of Eastwood Road will be altered to accommodate new traffic conditions at the intersection of Eastwood and Bringelly Roads. The northern end of Eastwood Road will be moved to the west, to meet with a proposed new road corridor north of Bringelly Road, and the disused section of the Eastwood Road corridor will be rezoned for Light Industrial uses. Considering that the footprint of any new industrial buildings will likely obscure physical evidence of the historic road alignment, it is appropriate to require that this historic road alignment is interpreted for future generations in some form of visual media or signage. An embossed bronze medallion set

Cardno
Shaping the Future

Austral & Leppington North Precincts

Water Cycle Management
Responses to Exhibition Submissions

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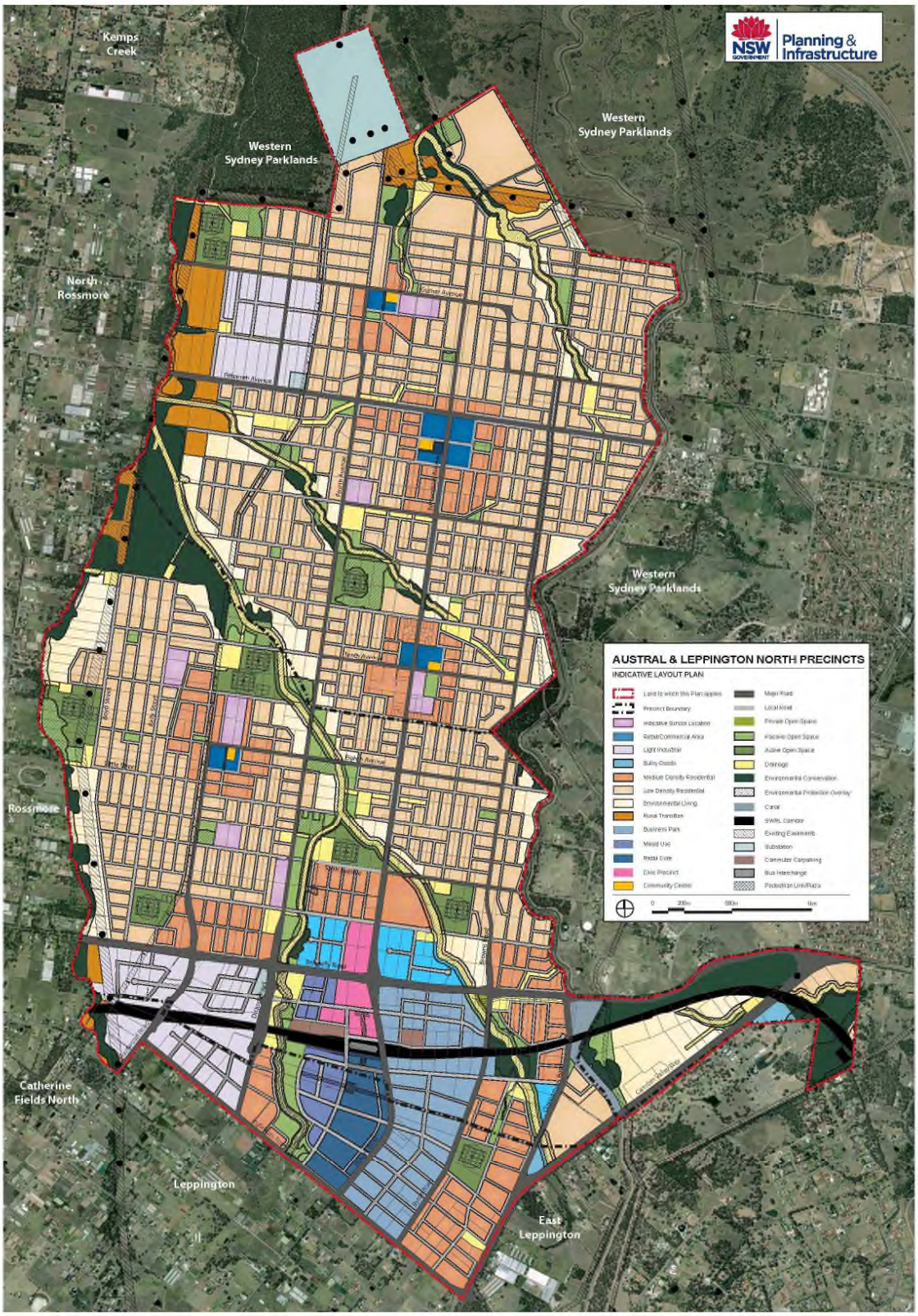
1 Introduction

This Report summarises additional assessments undertaken to date in response to submissions received during the Exhibition of the draft Precinct Plan for the Austral and Leppington North Precincts. These assessments will inform the finalisation of the Precinct Plan and the final Indicative Layout Plan (ILP) shown in Figure 1-1.

The following tasks have been completed as part of these assessments:

- Review of Stream Categorisation;
- Review of South Creek Flood Study and Bringelly Road concept design;
- Surveying of existing natural channels and additional road crossings;
- Comparison of the natural channel survey to ALS data and adjustment of ALS by lowering the surface level along the natural channels to reflect the findings of the ground survey;
- Review of detention basin locations in light of comments received during the public exhibition of the draft Precinct Plan and Water Cycle Management report;
- Assessment of basin overtopping implications during extreme storm events;
- Further modelling assessments of the Leppington Town Centre (LTC) that inform the requirements of lot based On-Site Detention (OSD), the configuration of an on-line basin located on Scalibrini Creek and the location of bioretention;
- Updating the TUFLOW model of existing conditions and the re-assessment of the 2yr, 20yr, 100yr, 500yr ARI and PMF events;
- Investigation of opportunities to increase the capacity of the trunk drainage system and to narrow and reduce the length of overland flow paths;
- Investigation of the impact of further filling of the floodplain under developed conditions on 100 year ARI flood levels;
- Updating the TUFLOW model of post-development conditions and re-assessing the 2yr, 20yr, 100yr, 500yr ARI and PMF events;
- Nomination of rain garden footprints for sub-catchments that do not drain to a combined detention basin / biofilter;
- Updating of Section 94 cost estimates;
- Updating of the flood emergency response strategy; and
- Formulation of provisions for a Leppington Town Centre DCP.

Figure 1-1: Austral Leppington North ILP



2 Review of Stream Categorisation

Discussions were undertaken both with NSW DP&I and NOW regarding stream categorisation within the Precincts. The outcome of these discussions was that several Category 3 streams were removed and the lengths of several streams were shortened. A summary of the main changes is described below:

- Stream ID 24 has been reduced in status to an overland flow path;
- Stream ID 25 is a Category 3 stream which has been shortened to extend only as far as the limit of medium category vegetation;
- Stream ID 27 remains a Category 3 stream ;
- Stream ID 31 is a Category 3 stream and which has been shortened while maintaining sufficient channel width for drainage purposes;
- Stream ID 29 is a Category 3 stream which has been shortened, realigned and re-sized to incorporate an additional existing channel adjacent to Fourteenth Avenue. Calculations were undertaken using Manning's equation to estimate the channel dimensions required to convey the 2 year ARI peak discharge from the tributary and Basin 17. Results indicate a total channel width of 15 m is sufficient to cater for the 2 yr ARI flow should the channel depth be approximately 1.2 m and the channel roughness value around 0.07.

Recently the approach to delineating riparian corridors has changed from the Riparian Corridor Management Strategy (RCMS, 2004) to the Strahler Stream Order and Waterway Classification System. This has been adopted by the NSW Office of Water in order to streamline the approach to riparian corridor management and eliminating the subjectivity in assigning the Category of a waterway using the RCMS.

The Strahler method is based on waterways being assigned an "order" according to the number of additional tributaries associated with each waterway. The Strahler method proposes core riparian zone widths depending on watercourse "order" and also allows the use of on-line detention basins for first and second order streams. The Strahler based approach also eliminates the requirement for a vegetated buffer on all first and second order streams. Otherwise the riparian corridor widths are similar to the previous approach where a first order stream is equal to a Category 3 , second order is equal to a Category 2 and third order and above is equal to a Category 1.

As RCMS guidelines were in place during initial assessment of stream categorisation they are referred to in this Report. However, the final ILP is based on the Strahler method.

Further details of the revised Riparian Corridor Management approach can be found at www.water.nsw.gov.au/controlledactivities

3 Data Review

3.1 Upper South Creek Flood Study

The South Creek Flood Study (SCFS) was prepared by WMAwater for Camden Council to predict flood behaviour under existing conditions. Kemps Creek and Bonds Creek are tributaries to South Creek and are therefore included in the flood study.

Calibration of the hydraulic model used for the Flood Study was made with rainfall data and flood marks of an event in 1988. The return period (likelihood of occurrence of a flood event) for the event is estimated to be approximately 30 years and it was found that the results of the model correlated reasonably well to the recorded flood marks. Frequency duration curves were plotted to gain an understanding of the event duration and return period.

The SCFS TUFLOW hydraulic model was built with a 1D/2D modelling approach using hydrological inflows from XP RAFTS. The hydraulic model uses a 1D natural channel link based on Mike-11 cross sections used in the 1990 Flood Study. The data of the 1990 study is based on ground survey that is more than 30 years old and may no longer represent the channel geometry today. It is likely that the channel would undergo change due to fluvial processes and physical disturbance due to channel diversion, filling and sedimentation.

A 50% blockage factor is applied to the 20 structures included in the model to predict flood levels in existing conditions. The application of the blockage is based on recent experiences in Wollongong (1998) and Newcastle (2007) where blockage was the main factor in reducing the ability for trunk drainage to alleviate flooding.

Results of the model at Bringelly Road are summarised in **Table 3.1**.

Table 3-1: Comparison of Flood Levels D/S of Bringelly road (m AHD)

	Kemps Creek			Bonds Creek		
Event	20 year ARI	100year ARI	PMF	20 year ARI	100year ARI	PMF
SCFS	74.1	74.2	74.8	73.6	73.7	74.4
Cardno	74.07	74.15	74.8	73.5	73.8	74.7

It is clear from a comparison of the results in **Table 3.1** that good agreement is achieved between the two flooding assessments. The main difference between the modelling approaches has been:

- The Cardno model used a 2D modelling approach for the natural channels where the ALS terrain is depressed to account for inaccuracy of the ground elevations in natural channels, (see Item 3 for details).
- The resolution of the terrain grid size is 10 m x 10 m in the SCFS while it is 5 m x 5 m in the Cardno model. Thus the terrain within the Precincts has been modelled in greater detail than in the SCFS.

It is concluded that the results of the Cardno model have been verified by the calibrated model results reported in the SCFS. Furthermore it is expected that the Precincts have been modelled in greater detail by Cardno.

3.2 Bringelly Road Concept Design

Bringelly Road acts as an important arterial road corridor within the South West Growth Centre and it has been advised that it is to be upgraded given the future developments within the Growth Centre.

Cardno have reviewed the Bringelly Road Upgrade REF, dated November 2011, which included a hydraulic assessment and design recommendations made by Lyall & Associates. The Kemps, Scalibrini and Bonds Creek crossings were all recommended for upgrade in order to make the road serviceable in the 100 year ARI flood. This generally involved raising the road crown and increasing culvert capacity to discharge the flows that would normally overtop the road. Different levels of culvert blockage were adopted depending on the perceived flood sensitivity of properties in the vicinity of the crossing. Hence a uniform 50% blockage factor was not applied.

The method of hydraulic assessment undertaken used a HEC-RAS model based on ground survey of the road corridor, with the model(s) only extending approximately 50-100m up and downstream of the corridor. Peak flows were estimated using the Probabilistic Ration Method detailed in Australian Rainfall & Runoff. It was reported that in general the discharge estimates were higher than those reported in previous studies (Perrens, 2003). Downstream boundary conditions were based on water levels reported in previous studies. This approach is suitable for a detailed assessment of a road crossing independent of proposed changes in the precincts. It is therefore concluded that the assessed afflux due to the proposed culverts would be accurate; however the assumed downstream boundary conditions are based on a previous flood study that has now been revised by the findings of the Upper South Creek Flood Study and the hydraulic modelling reported herein. It is therefore recommended that the road design be reviewed in light of the subsequent flood studies.

Preliminary assessment by Cardno has indicated that the upgraded Bringelly Road may have a significant effect on flood behaviour with localised increases in flood levels. However, these preliminary results are not considered a true representation of the design which may be due to differences in detailed survey data being adopted for the road design, by Lyall & Associates, and ALS data adopted for the Water Cycle Management strategy by Cardno.

The detailed survey accurately identifies the creek cross-section and culvert details while the ALS data can be less accurate as found in recent ground survey discussed in Section 6.1. ALS data is the topographic data used for broad-scale flooding assessment and has been used for the Austral and Leppington North Precincts. Ground survey of the Bonds, Kemps and Scalibrini Creeks was not available at the time of the Cardno flood modelling.

3.3 South West Rail Link

The South West Rail Link (SWRL) is currently under construction and will connect Leppington with the Main South railway line. A detailed hydraulic assessment was undertaken by John Holland using a 2D TUFLOW modelling approach. Hydrographs were estimated using RAFTS with parameters and assumptions that vary for each of the 50, 100, 200 year ARI and PMF events. This approach assumes that the rainfall losses associated with infiltration and surface irregularity reduce as the magnitude of the storm increases. Other model parameters including the BX factor and roughness values were informed by previous studies (Perrens 2003) and by hydrological modelling guidelines (Willing and Partners, 2003). It is concluded that the hydrology model approach is suitable for the design of the crossings and it would be expected that the design discharges are slightly higher than those predicted for the Precincts.

The hydraulic TUFLOW model was built using ALS data obtained from AAM Hatch in 2008 for the floodplain and from field survey of the creeks, where available. Detailed adjustments were made to the terrain in TUFLOW to accurately model ground irregularities, creek banks, artificial filling and farm dams. This represents a higher level of detail than that adopted for the hydraulic modelling of the Precincts. The modelling approach adopted for assessing the SWRL is of a suitable level of detail for design purposes. It is therefore expected that the results of the flood study are acceptable. However, it is reported that the SWRL results in increased flood levels at the crossings of Kemps and Bonds Creek located in the Precincts of up to 0.4m and an increase of up to 0.1 m at the Scalibrini Creek crossing. This afflux is expected to occur in the vicinity of the SWRL corridor and appropriate works are recommended to ensure that this does not adversely impact on existing properties. This is described as removal of a on-line property dam for Scalibrini Creek and in the form of creek training for Kemps and Bonds Creeks.

Cardno tested the hydraulic behaviour of the railway line in the TUFLOW model for the Precincts by including bridge openings over the existing model terrain. The results of these trials indicated a significant adverse impact on flood levels in the surrounding areas.

The results of the trial are preliminary only and differences in the assessed impacts may be attributed to differences between detailed survey used for the SWRL design and ALS data adopted for the Water Cycle Management strategy. In order to effectively assess the SWRL, a more detailed approach to modelling the waterway crossing would be required. This would be in the form of obtaining the ground survey used for the corridor design and characterising the bridge crossing design in greater detail. However, as this work is being undertaken as part of the detailed design for SWRL and in accordance with the Ministers Conditions of Approval for the project, it is not necessary to investigate impacts of the rail line in detail as part of the Precinct Planning process.

4 Review of Detention Basin Locations

A review of detention basin locations was undertaken. The main results of this review are outlined as follows.

4.1 Basin 29

It is proposed that Basin 29 be relocated from the upstream side of Seventeenth Avenue to the upstream side of Sixteenth Avenue.

The preliminary assessment found that the basin would receive flows from a reduced catchment area of approximately 97.31ha (a 12% reduction in contributing catchment) due to the relocation of the basin further upstream. This results in a smaller retarding basin with analysis indicating a basin area of 14,596 m^2 would be required. The outlet configuration remains the same as previously advised (2yr ARI outlet width = 3.28m and 100yr ARI outlet width = 6.03m) in order to attenuate the expected developed 2yr ARI and 100yr ARI peak flows to existing condition peak flows.

Basin 25 and Basin 27 are both located downstream of Basin 29. They are both offline basins and therefore not hydraulically linked. Hence any changes to Basin 29 does not affect these downstream basins.

However an additional 13.5ha of catchment will outflow un-retarded to the un-named Creek. In order to compensate for these uncontrolled flows, it is recommended that the relocated Basin 29 retain its original size of 16,614m^2 to further retard the local catchment runoff.

4.2 Other Basins

Basin 15 is located in the optimum location south of Fifth Avenue. Alternative locations have been considered but the location of the retirement village to the north of Fifth Avenue prevents its relocation.

Basin 17 has been relocated slightly further west in light of reduced flood extents resulting from the updated hydraulic modelling.

Offline Basins 1, 2, 3 and 7 have been removed due to the development of lot based on-site detention (OSD) for the Leppington Town Centre (LTC). Refer to Section 5.3 for further information.

A new online basin is proposed on Scalibrini Creek, south of Bringelly Road within the LTC. This is discussed further in Section 5.3.1.

Basin 35 is located in the southeast corner of the Precinct and will attenuate runoff from medium density residential areas within the LTC. It is not possible to relocate this basin east of Camden Valley Way as it would be located within the Liverpool LGA. Liverpool City Council has indicated they would not agree to a detention basin in their LGA to attenuate runoff generated in the Camden LGA.

5 Leppington Town Centre

A regional centre has been included in the Precinct Plan to provide a range of medium density residential, business, commercial and industrial land uses in proximity to public transport (SWRL) and arterial roads (Bringelly Road). The Leppington Town Centre (LTC) is located in the southern portion of the Precinct as shown in **Figure 5-1.** The approach to Water Cycle Management within the Town Centre would be refined in response to increased intensity of the land uses and to ensure water conservation objectives are met.

5.1 LTC WCM Strategy

The LTC is proposed to be an urban space characterised by an increased intensity of commercial/retail/business land uses with a higher lot utilisation and higher building heights. Therefore the impact on the existing water cycle regime would greater than in residential areas of the Precinct. As a result the WSUD strategy requires refinement within the LTC and is described by **Table 5-1**. Water conservation for residential development needs to comply with the BASIX requirements.

Table 5-1: LTC WCM Strategy

Element	WCM Measure	Description
Rainwater	Rainwater Tanks	Reduce potable water demand by supplying reclaimed water for toilet flushing, laundry use, garden irrigation around buildings and irrigation of dedicated passive recreational areas.
	Green Roofs	The use of gardens in the roof space is encouraged for commercial, business, industrial and multi storey residential buildings. This would reduce impervious surfaces, improve air quality, amenity, ambient air temperature, building insulation, bird habitat, and aesthetic quality of the urban environment.
Stormwater Quality	Gross Pollutant Trap (GPT)	Gross pollutant traps are to be provided to collect litter, debris and sediment prior to biofiltration. Propriety products are most appropriate for underground drainage systems and inlet controls are most appropriate for biofilters that receive surface runoff.
	End of Pipe Biofiltration (residential land use)	Bioretention basins located in within retarding basins or in open space outside of the core riparian zone have been proposed in the WCM strategy to control stormwater quality. These basins would incorporate a bio-filter at the low point to accept flows from the drainage system. The bio-filter would be sized to meet best practice targets for TSS, TP and TN.
	Private Domain Biofiltration for commercial and industrial land use	Opportunities to collect and treat stormwater could consist of street trees, rain gardens or bio-swales to treat stormwater either at source or in conveyance. The location of these measures could either be in association or external to lot OSD measures.

Element	WCM Measure	Description
	Public Domain Biofiltration for commercial and industrial land use	The roads and paved surfaces of the public domain are to be treated either at source or in conveyance with street trees and raingardens. The measures can be located either in the tree planting or parking bays of the road reserve.
Stormwater Quantity	Lot based OSD	For land uses other than residential the increase in stormwater discharge is to be managed by lot based on-site detention (OSD). The OSD device may be above and/or below ground and retarded flows would discharge to the drainage system.
	Retarding Basins	Offline retarding basins are proposed for residential areas where lot based OSD is not provided. On-line retardation may be included to allow for the management of post development discharges from the public domain that are not managed by lot based OSD. On-line configurations are only allowed in specific locations in accordance with the Riparian Corridor Strategy.
Reclaimed Water	Stormwater Harvesting	Stormwater is a resource that can be harvested and re-used for irrigation, wash down, fire control and/or car washing. Opportunities to harvest stormwater should be investigated to reduce potable water consumption. In future stages of the design process these opportunities should be explored further.
	Effluent Reuse	Reclaimed water is routinely used for irrigation purposes. However it may also contain chemical contaminants which may be detrimental to public health and the environment. Design criteria for effluent reuse are stricter than stormwater harvesting. Opportunities for effluent reuse could be investigated further at the design stage.
	Cooling Towers	Potential exists for reuse of harvested rainwater or stormwater in cooling towers to reduce the use of potable water. This may be applicable to proposed industrial development within the Precinct and should be investigated further at the design stage.

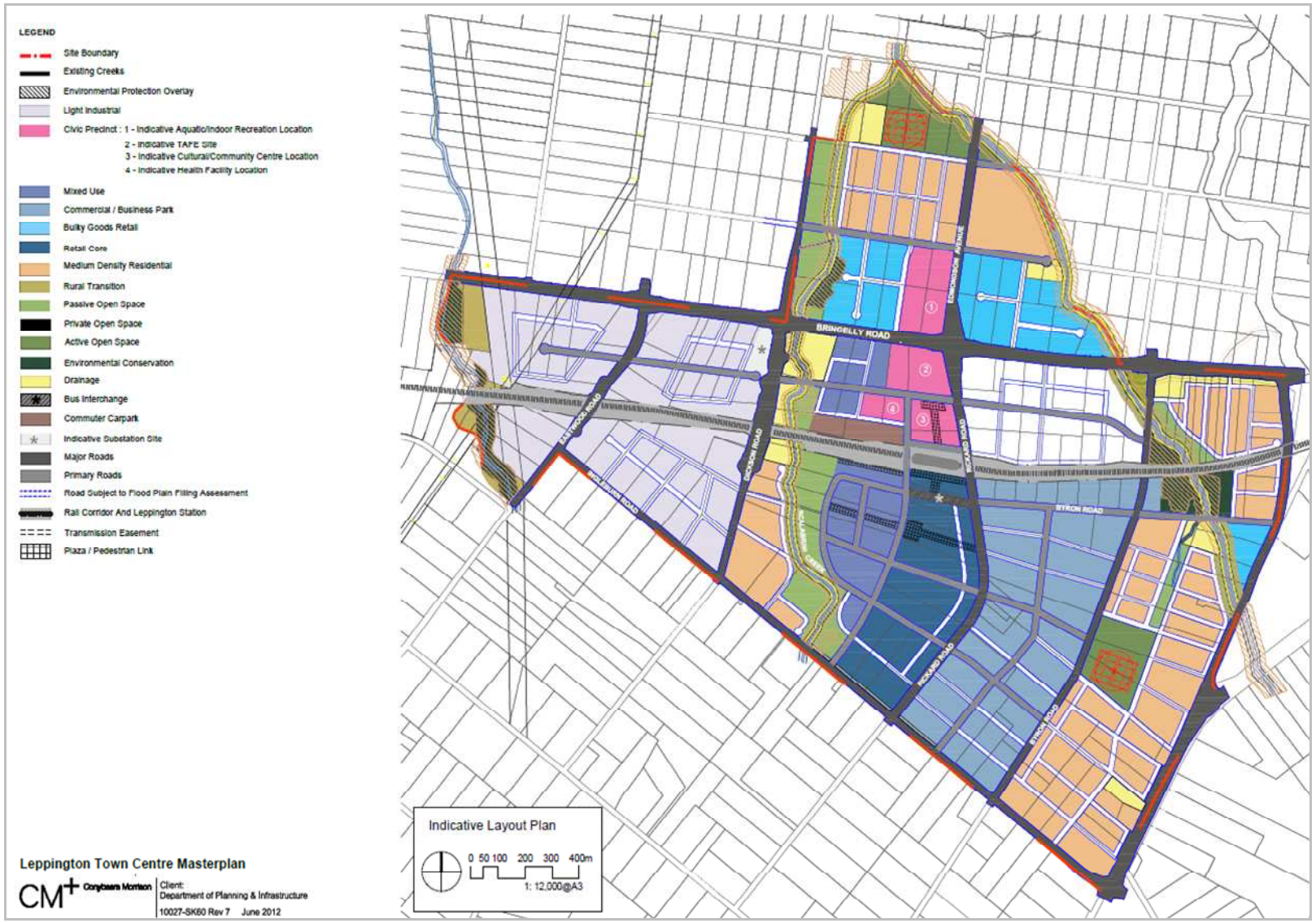


Figure 5-1: Leppington Town Centre ILP

5.2 Review of WSUD Measures

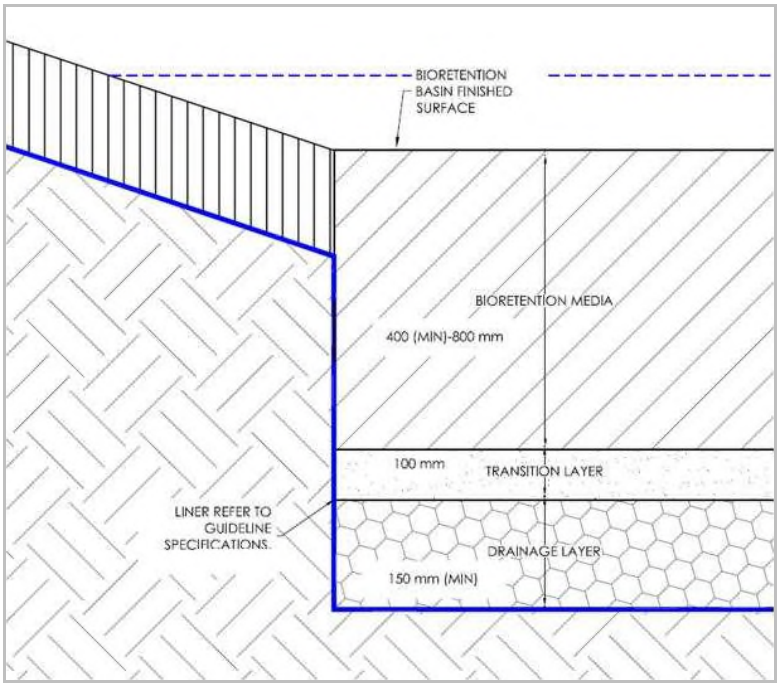
The selection of appropriate stormwater management devices is carried out according to a set of criteria that would rank a range of options. The approach taken in this instance is in the form of a qualitative matrix assessment as that shown in Table 5-2. Note that the assessment is limited to treatment measures to remove TSS, TP and TN. Devices that are suitable for Gross Pollutant removal are readily available as proprietary devices and were excluded from the assessment.

It was found from the qualitative assessment that biofiltration is the most suitable WSUD measure for the precincts as it is the best suited for use in the moderate-high saline soils of the area and should be economical to maintain.

5.2.1 Typical Bioretention Devices

Some examples of stormwater treatment measures that would be suitable for the LTC are provided herein. Each biofiltration/bioretention device has a common profile of filter, transition and drainage layer. A typical cross section through a bioretention system is shown in **Figure 5-2**.

Figure 5-2: Typical Bioretention Detail



Source: Sydney Metropolitan CMA, Typical Drawings for WSUD

A key criterion is the selection of the filter media to provide sufficient hydraulic conductivity while retaining sufficient water to support vegetation growth. A minimum 400mm filter depth is required for plant establishment. The transition layer separates the bioretention media from the drainage layer below. The drainage layer contains perforated pipes which convey treated stormwater to the drainage system.

Table 5-2: Stormwater Treatment Measure Assessment Matrix

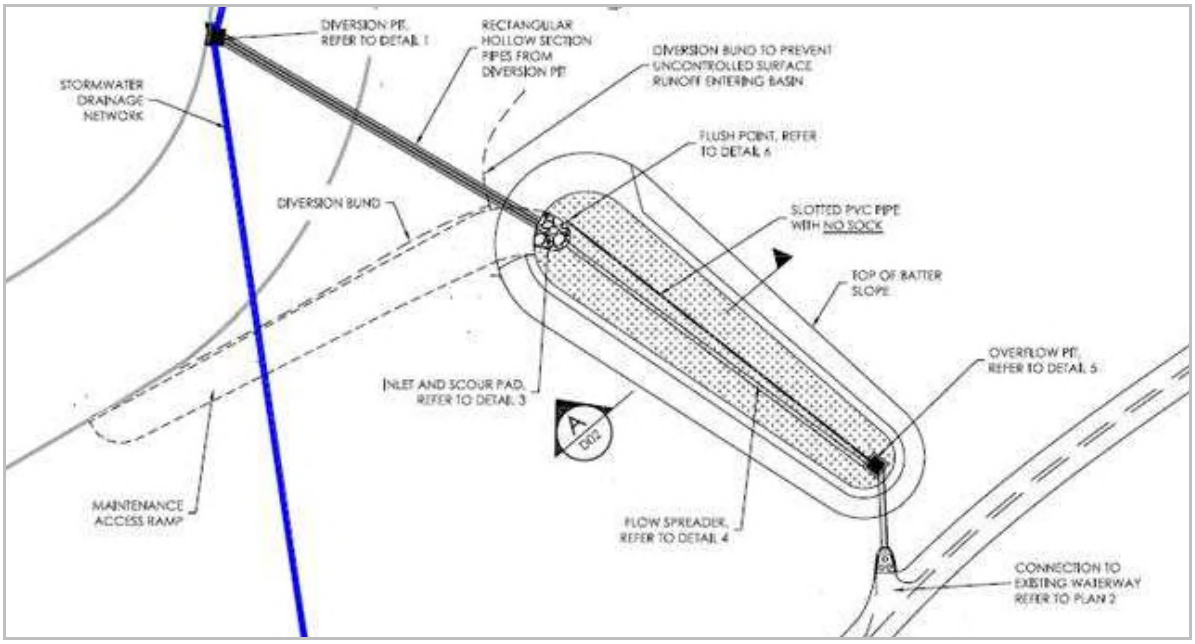
Criteria	Measure					
	End of Pipe Bioretention Basin	Small scale Biofiltration	Bio-Swales	Constructed Wetland	Sand filter with Hydrocon exfiltration pipe	Proprietary Filtration Devices (Stormwater 360, Stormfilter)
Description	• A basin with inset filter trench located at the low point of a sub-catchment accepting flows from the local drainage network. • A GPT would be located upstream of this device • Consists of a vegetated surface, extended detention overflow pit, filter media, sub-surface drainage and flushing points	• Raingardens and street trees located throughout the roads, footpaths and open spaces of the private and/or public domain • A GPT would not be located upstream of this device • Consists of a vegetated surface, filter media, sub-surface drainage and flushing points	• Open vegetated drains in the road reserve having a longitudinal biofiltration trench • Consists of a vegetated surface, edge strip, filter media, sub-surface drainage, overflow pits, check weirs and flushing points	• A series of basins including inlet pond and wetland zone to support macrohpyte plant species • Water is retained to assist with sediment and nutrient removal	• An underground trench comprising Hydrocon pipe and sand media with opportunity for extended detention in a basin above • Above surface is available for passive recreational use	• An underground pit comprising several filter cartridges and temporary storage chamber • Can be located under road/footpath pavement and carparks
Landtake	• Approx 0.5% of catchment area for most land uses	• Varies depending on catchment size, land use and constraints	• Requires a portion of the road reserve either within a median or on verge • Can interfere with traffic movements and cause ponding in the road reserve	• Approx 3% of catchment area for residential land use and 5% for commercial land use	• Footprint if Approx 0.5% of catchment area for most land uses	• Underground pit size dependant on design flow rate • Approximately 0.1% of catchment area
Topography	• Suits locations where the surface has a grade of 5% or less • Can be configured for steeper terrain with use of terracing	• Suits locations where the surface has a grade of 5% or less	• Suits locations where the road length has a grade of 0.5-5%	• Suits locations where the surface has a grade of 5% or less • Can be configured for steeper terrain with use of terracing	• Ideal for all types of topography	• Ideal for locations where constraints limit the opportunity to use other options such as dense urban applications

Criteria	Measure					
	End of Pipe Bioretention Basin	Small scale Biofiltration	Bio-Swales	Constructed Wetland	Sand filter with Hydrocon exfiltration pipe	Proprietary Filtration Devices (Stormwater 360, Stormfilter)
Soils	• Can be configured for a range of soil types • Infiltration can be included or excluded with the choice of appropriate lining • Impermeable lining recommended to suit locations having ASS or high salinity	• Can be configured for a range of soil types • Infiltration can be included or excluded with the choice of appropriate lining	• Can be configured for a range of soil types • Infiltration can be included or excluded with the choice of appropriate lining	• Not suited to ASS or moderate - high salinity • water retention not advised in saline soils • Plant species are sensitive to salinity & ASS	• Can be configured for a range of soil types • Infiltration can be included or excluded with the choice of appropriate lining	• Can be configured for a range of soil types • Impermeable lining recommended to suit locations having ASS or mod-high salinity
Maintenance Tasks	• Remove debris from surface • Irrigate vegetation • Weed removal • Sediment removal from surface • Inspect/clean of drainage system • Replacement of filter media required when stormwater ponding (without additional inflow) exceeds 24 hours duration	• Remove debris from surface • Irrigate vegetation • Weed removal • Sediment removal from surface • Inspect/clean of drainage system • Replacement of filter media required when stormwater ponding (without additional inflow) exceeds 24 hours duration	• Mow grass areas and prune vegetation • Remove debris from surface • Irrigate vegetation • Weed removal • Sediment removal from surface • Inspect/clean drainage system • Replacement of filter media required when stormwater ponding (without additional inflow) exceeds 24 hours duration	• Remove litter and debris from surface • Irrigate vegetation • Weed removal • Monthly water quality monitoring during 24 month establishment • Drain inlet pond and remove sediment • Inspect/clean of hydraulic controls • Drain wetland zone, remove sediment and replace dead vegetation	• An eduction vacuum system is used to clean out the pipes. • Filter media does not need to be replaced in this system as most solids are collected in the pipe.	• Backflushing for maintenance is not needed. • Determination of when cartridge needs replacement cannot be done visually. Frequency of cartridge replacement is determined by MUSIC Modeling, and by sampling the water quality regularly.
Maintenance Frequency	• Weekly inspections during 3 month establishment • Quarterly inspections • Annual monitoring of filter media • Media replacement 10-20	• Weekly inspections during 3 month establishment • Monthly inspections • Annual monitoring of filter media	• Weekly inspections during 3 month establishment • Quarterly inspections • Annual monitoring of filter media	• Monthly inspections and water quality monitoring during 2 year establishment period	• Eduction of hydrocon pipes once per year • Inspection of sand media once every three years	• One inspection and clean out per year. • Replacement of cartridges as required

Criteria	Measure					
	End of Pipe Bioretention Basin	Small scale Biofiltration	Bio-Swales	Constructed Wetland	Sand filter with Hydrocon exfiltration pipe	Proprietary Filtration Devices (Stormwater 360, Stormfilter)
	years	• Media replacement 5-10 years	• Media replacement 10-20 years	• Annual drainage of inlet pond • Drainage of wetland zone as required		
Design Life	• 20 to 30 years subject to routine maintenance	• 20 to 30 years subject to routine maintenance	• 30 years plus subject to routine maintenance	• 10 to 20 years subject to routine maintenance	• 50 + years	• 50 year design life
Summary	• Suitable for the LTC as the constraints of mod-high salinity can be managed and maintenance is less complex than other options • This option has been selected as the preferred approach and has been included in preliminary sizing calculations. Other suitable options can be explored in future stages of the design process.	• May be included as an option for stormwater treatment in the private domain • Filter media is likely to require replacement more frequently due to more intense loading directly from pavements with no GPT upstream	• Not suitable for the precinct due to complications with traffic movements, mowing requirements and ponding in the road reserve	• Not suitable for the precinct due to the high land take requirements and mod-high soil salinity	• May be included as an option where combined WSUD and passive open space use is preferred.	• May be included as an option where treatment in required within a densely urbanised space and biofiltration is not appropriate • The capital cost of this option is generally far greater.

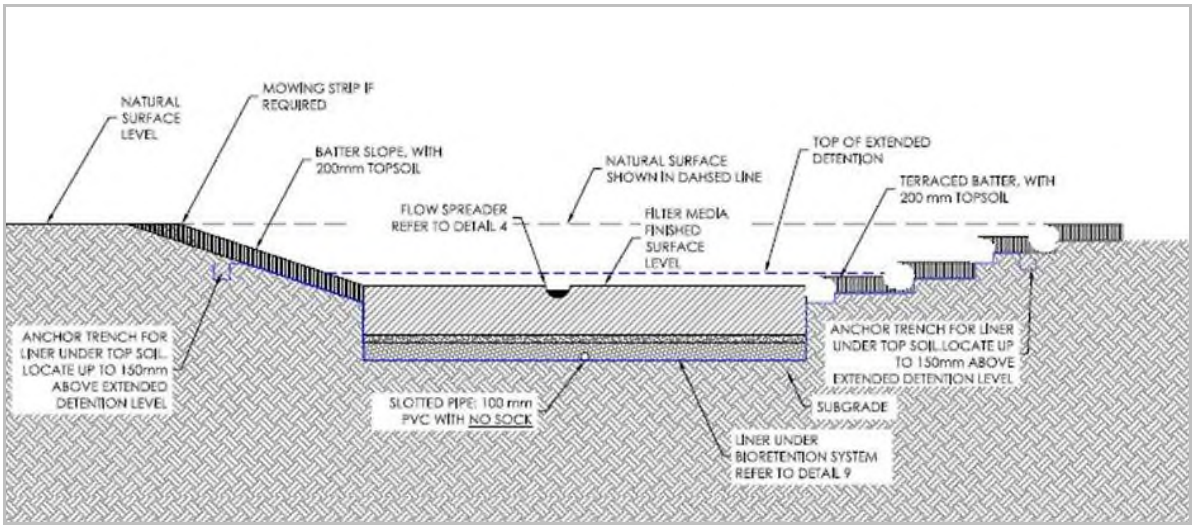
Bioretention measures may take the form of basins, swales and tree pits depending on contributing catchment size. Potential bioretention system locations are included in **Figure 5-8** and are indicative only at this stage. Typical details for bioretention measures are shown in the following **Figures 5.3** to **5.7**.

Figure 5-3: Typical Bioretention Layout – Flat Terrain (Slope <5%)



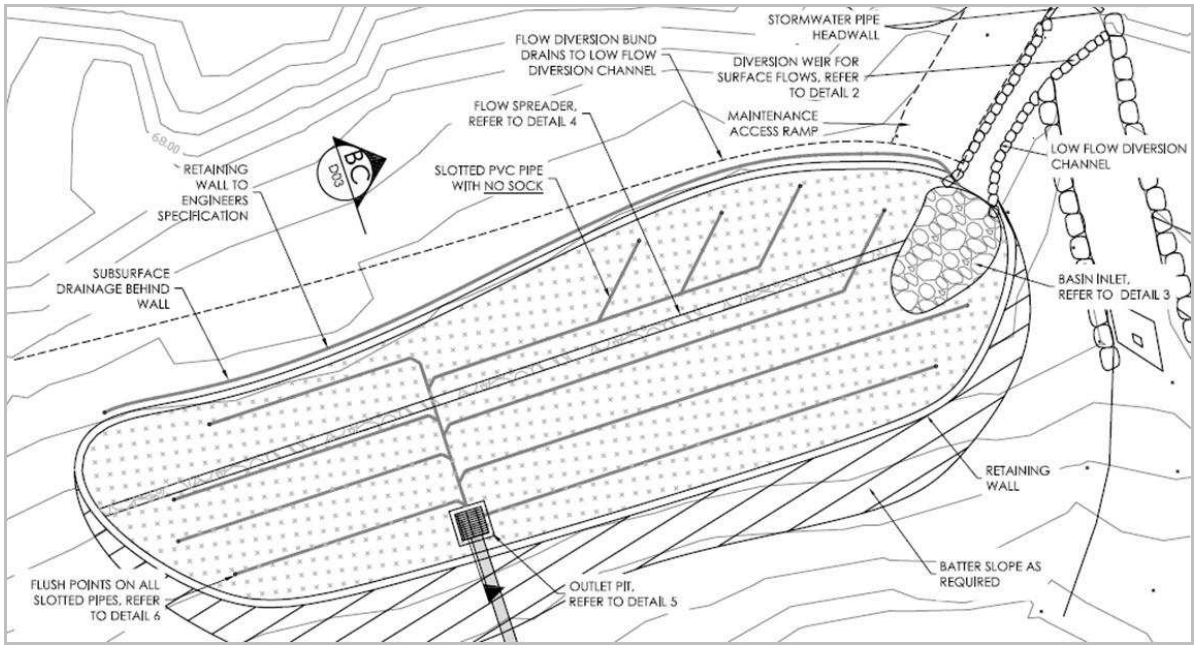
Source: Sydney Metropolitan CMA, Typical Drawings for WSUD

Figure 5-4: Typical Bioretention Detail - Flat Terrain (Slope <5%)



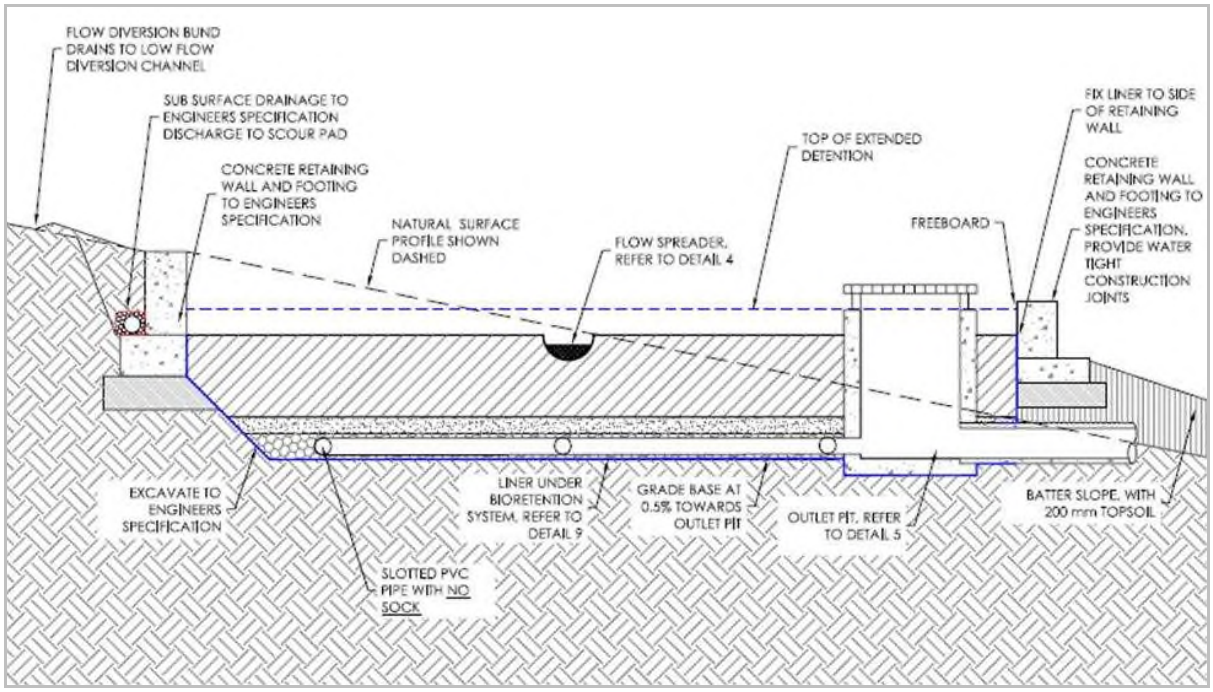
Source: Sydney Metropolitan CMA, Typical Drawings for WSUD

Figure 5-5: Typical Bioretention Layout – Steep Terrain (Slope >5%)



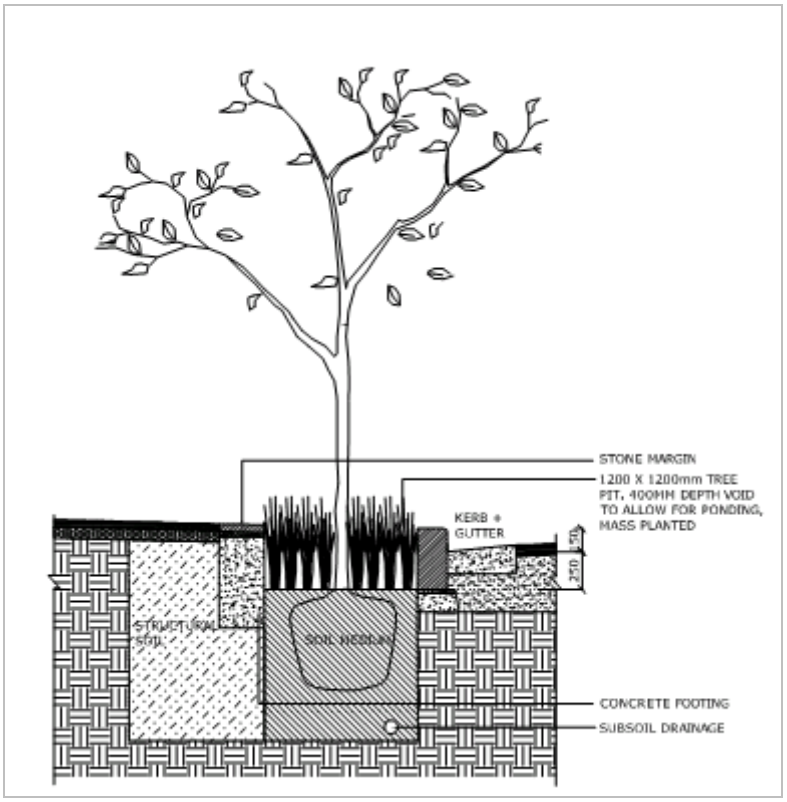
Source: Sydney Metropolitan CMA, Typical Drawings for WSUD

Figure 5-6:Typical Bioretention Detail - Steep Terrain (Slope >5%)



Source: Sydney Metropolitan CMA, Typical Drawings for WSUD

Figure 5-7: Typical Street Tree with bioretention



Source: City of Ryde, Public Domain Manual

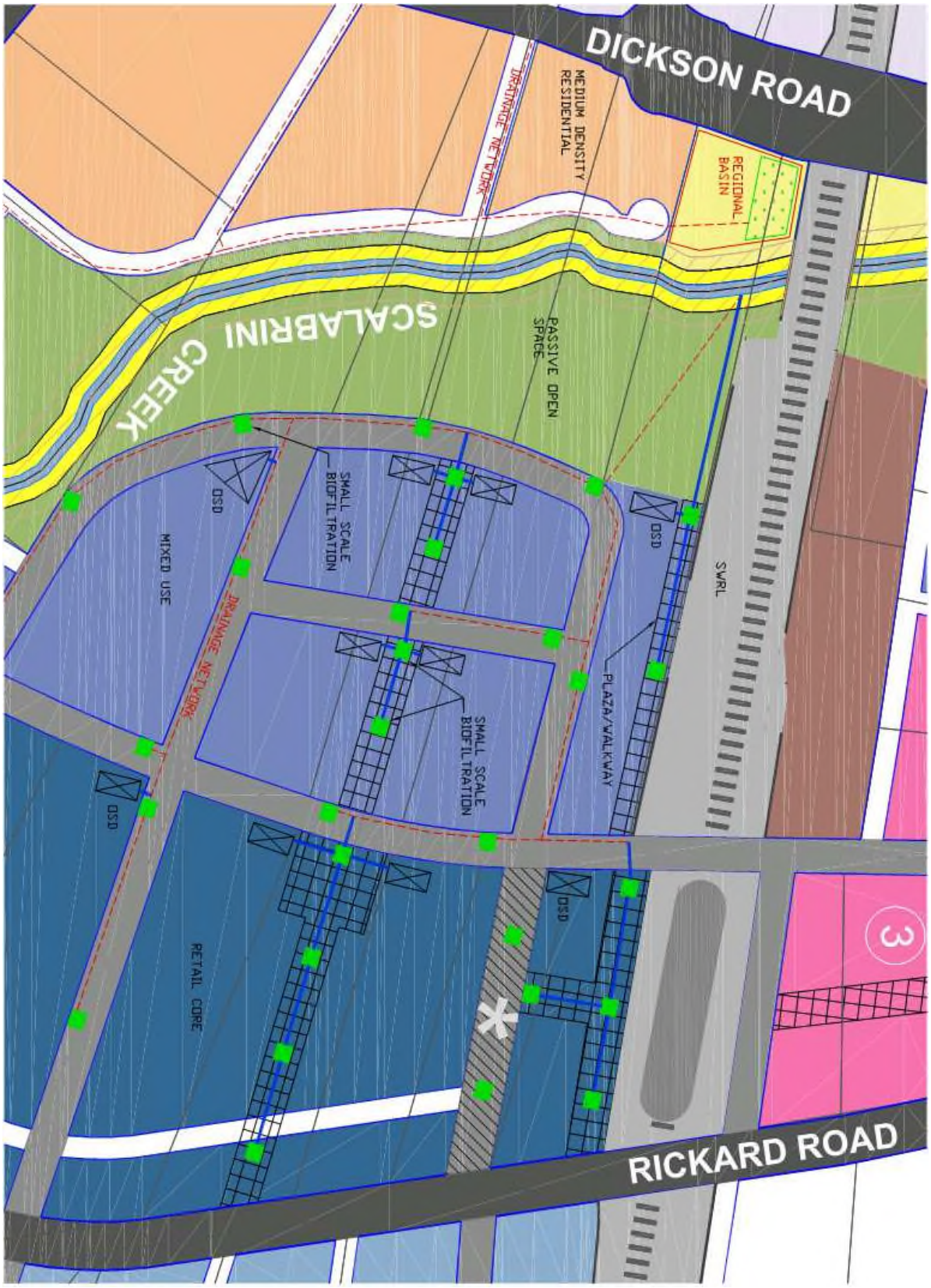
5.2.2 Typical Stormwater Treatment Train

The management of stormwater in the LTC would be separated in the private domain, with lot based OSD and stormwater treatment, and from the public domain with single or multiple biofiltration measures (street trees and raingardens). Some thought is then required to structure the treatment train so that the objectives of stormwater quality and quantity management are met without compromising local flooding or increasing the likelihood of stormwater system blockage.

Figure 5-8 is an example of how a part of the LTC could be structured so that the stormwater is managed appropriately with OSD in lots for commercial/industrial/business land uses and retarding basin for medium density residential use. Some suggestions are also made for inclusion of bioretention in the private domain that could be represented with street trees as per that displayed in **Figure 5-7**. The inclusion of biofiltration at source and in conveyance would sufficiently reduce pollutants to required levels.

The traditional approach to lot based OSD would be to install a tank or storage structure that only meets the stormwater quantity objective to reduce post development peak discharge. There are, however, opportunities to modify the OSD configuration for multiple uses. For example the provision of stormwater collection and detention presents an opportunity to provide additional treatment and retention for non-potable re-use.

Figure 5-8: Typical Stormwater Treatment Train in LTC



Note: GPTs are not shown above but would be normally located directly upstream of the inlet of a regional basin or at the inlet of a biofiltration measure

Figure 5-9: Typical lot OSD layout in LTC

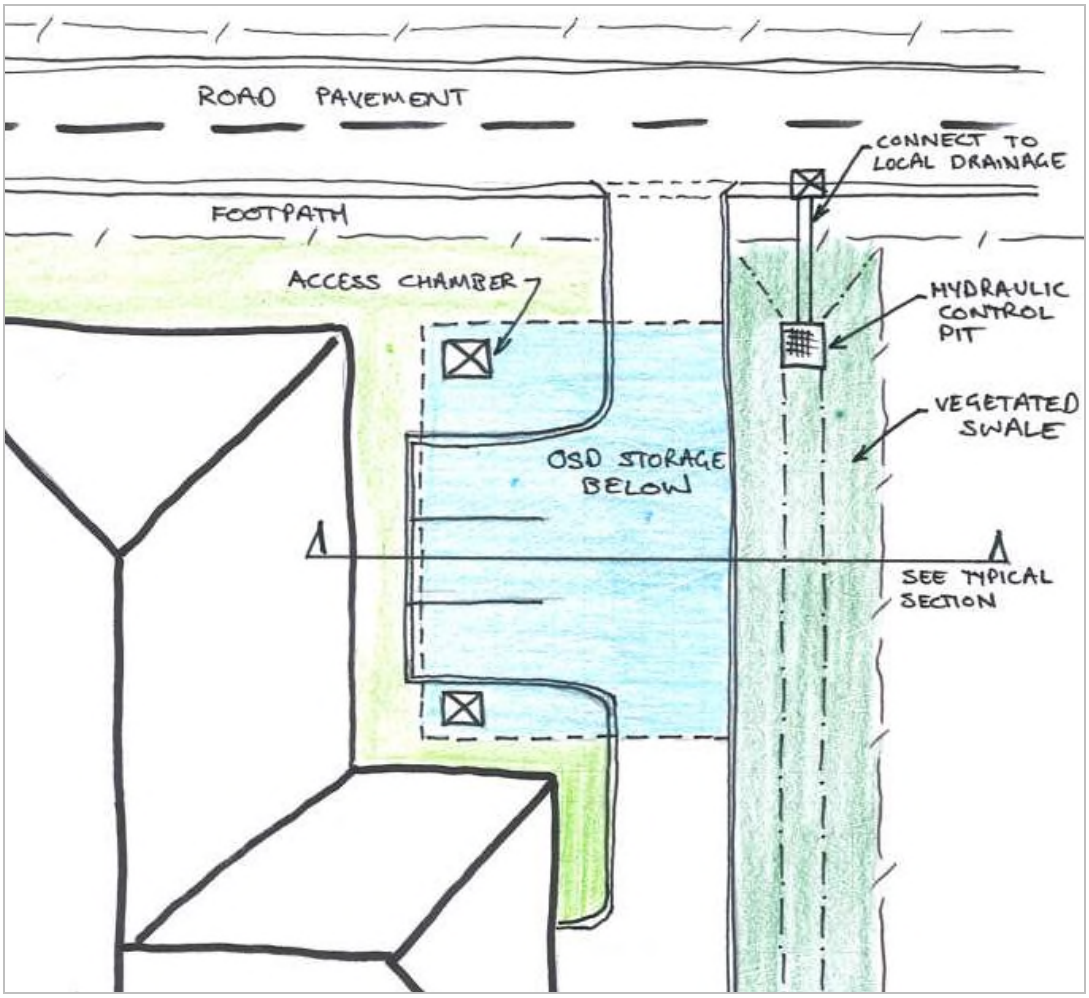
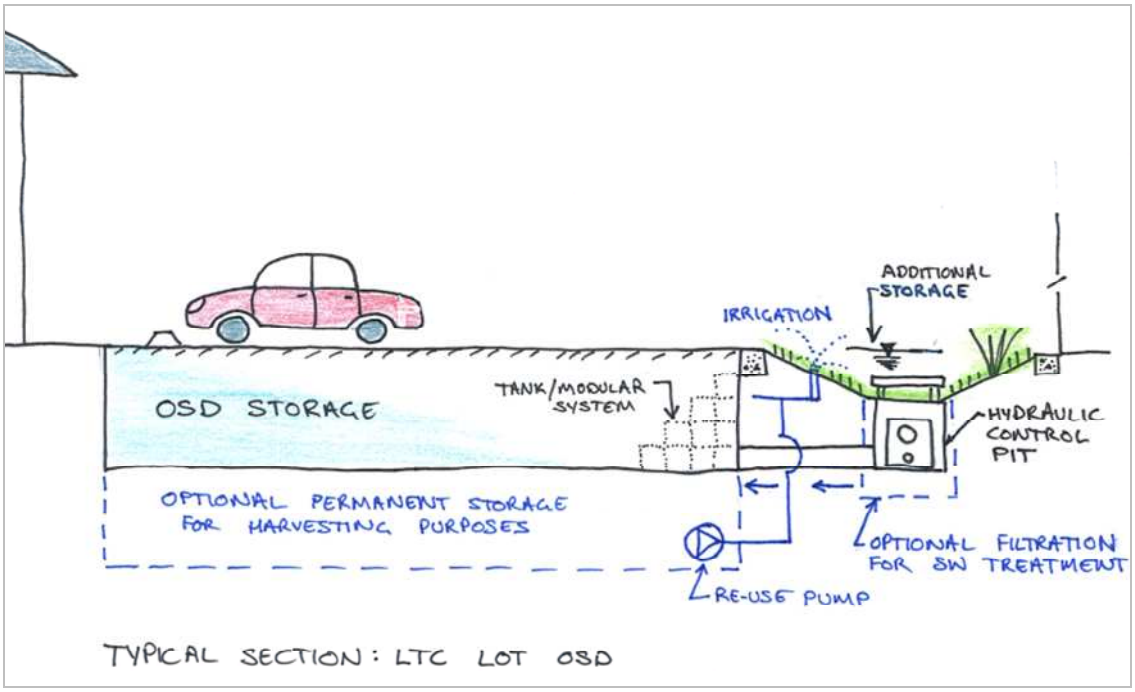


Figure 5-10: Lot OSD typical section in LTC



The DCP provisions that require lot based OSD could also promote stormwater harvesting and re-use, see Section 9.2 for details. An example of lot based OSD with provision for stormwater treatment and harvesting is shown in **Figure 5-9** and **Figure 5-10.**

5.3 On-site Detention in the Leppington Town Centre

During the development of the ILP it was identified that On-site Detention (OSD) would be included in commercial/industrial lots. This is a departure from the strategy elsewhere in the precincts where retarding basins which receive runoff from the whole subcatchment are strategically located on the floodplain adjacent to perennial streams. The lot based OSD approach would aim to retard post-development flows to pre-development levels within the private domain.

The approach to OSD was based on the following two guiding principles:

1. To ensure that future development has a negligible impact on existing flood behaviour; and
2. To conserve stream stability in perennial streams (Stream Categories 2 and 3).

Since the OSD would be located on individual lots within the commercial/industrial areas runoff from the public domain (road reserves, etc) would not be retarded. Therefore consideration was given also to the public domain runoff and how it may impact on the two guiding principles above. In general, the public domain represents a modest portion of the total catchment area and thus does not have much impact on flood behaviour during large storm events. While the conversion of existing undeveloped land into roads can significantly increase the local runoff it is typically exceeded by the runoff from the far greater area of lots. The installation of OSD on lots also separates the peaks of runoff from the public domain (roads) and the retarded outflows from the lots. As such the first guiding principle is in general satisfied in the case where OSD is implemented on lots alone.

However in smaller storm events such as the 2 year ARI the effect of land use change in the public domain is more pronounced. In this case, the second guiding principle requires consideration of measures to retard post-development runoff from the public domain in frequent storms in combination with lot based OSD. This was the basis of the preliminary investigation of an OSD strategy for the Leppington Town Centre where it is proposed to locate high density commercial, industrial and business related development.

5.3.1 Preliminary OSD Analysis

Study Area

A preliminary assessment of lot based OSD was undertaken for a number of sub-catchments draining to Scalibrini Creek. The findings of these investigations will inform a suitable approach for the remainder of the LTC. The study area is shown in **Figure 5-11**.

Table 5-3 summarises the land use breakdown for each local catchment.

Figure 5-11: Study Area for Preliminary lot based OSD Assessment

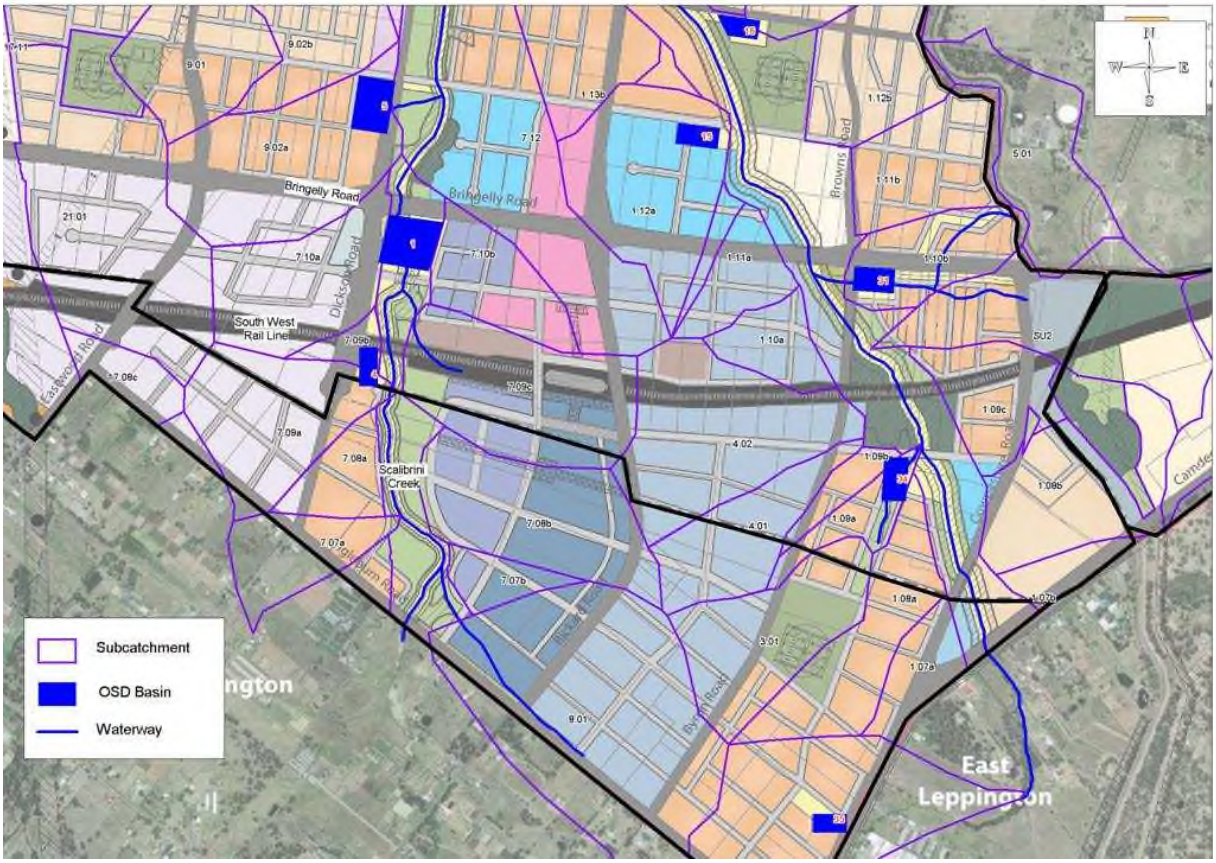


Table 5-3: Study Area Catchment Breakdown

Catchment ID	Total Area (ha)	Commercial / Industrial Lots controlled by OSD (ha)	Medium Density Residential / Road / Open Space (ha)
8.01	46.54	23.44	23.10
*7.07a	8.66	0.00	8.66
7.07b	5.56	3.15	2.41
*7.08a	13.34	0.00	13.34
7.08b	19.24	15.39	3.85
7.09b	4.63	0.74	3.90
7.09c	21.59	16.26	5.33
7.10a	16.86	12.20	4.66
7.10b	13.25	8.36	4.89
7.11b	4.45	0.00	4.45
	154.12	79.54	74.59
		52%	48%

**These catchments have medium density residential land uses and would not be managed by lot based OSD. Hence Basin 4 has been retained from the previous strategy for these areas.*

Hydrology

Runoff from the study area was estimated using an **xprafts** hydrological model. Models of the existing and proposed land uses were prepared to assess runoff in the 2 year and 100 year ARI events. These two ARIs are guided by the approach adopted by the Upper Parramatta River Catchment Trust when preparing the fourth edition of its OSD handbook (UPCRT , 2005) and in accordance with the guiding principles for OSD stated above. The 2 year ARI is generally representation of a bankfull flow condition (DNR, 2007) that would satisfy stream stability objectives while the 100 year ARI is the benchmark for determining flood planning levels (NSW Government, 2005) that would satisfy the flooding objective.

The setup of the model is consistent with the methods documented in the Water Cycle Management reports prepared by Cardno for public exhibition (Cardno, 2011). The imperviousness of land uses were based on values given in the Camden Council Engineering Design Specification. For the purposes of this investigation, the flows at Bringelly Road are of particular importance because it is a suitable location for an on-line retarding basin. The catchments upstream of the precinct boundary were assumed to be developed with residential land use and retarding basins that would not increase peak flows in 2 yr ARI and 100 yr ARI events.

Recently the approach to delineating Riparian Corridors has changed from the Riparian Corridor Management Strategy (RCMS, 2004) to the Strahler Method. The new approach would allow basins to be located on-line on second order streams such as Scalibrini Creek. This offers an opportunity to reduce the number of offline basins within the developable areas of the Leppington Town Centre. Within the two Precincts numerous basins were proposed in the ILP exhibited to the public including Basins 1, 2, 3, 4 and 7. The revised strategy of lot based OSD for the private domain (commercial/industrial lots) and an on-line basin at Bringelly Road could obviate the need for offline Basins 1, 2, 3 and 7. Note that this does not take into account any water quality treatment requirements.

Lot based OSD

The post-development hydrological model was then modified to include OSD within lots using the OSD feature in **xprafts**. This feature allows the user to nominate a stage-storage relationship and permissible site discharge (PSD) for each of the sub-catchments. The hydrology model then continually stores a portion of the basin inflow with outflows released according to a defined stage discharge relationship. A similar stage discharge relationship was adopted to that used for the regional basins. The model would then limit the basin outflow according to the peak flow of the existing hydrograph. In this manner the lower level outlet and upper level outlet are considered in the design storms modelled. Results for the site storage requirements are listed in **Table 5.4** and results for PSD are included in **Table 5.5**.

A summary of the Site Storage Requirement (SSR) and PSD for each sub-catchment is given in **Table 5.6**. It is shown that similar results are estimated to those reported in the 2011 exhibition report (Cardno 2011). A comparison is also given to the requirements of the Upper Parramatta River Catchment Trust OSD handbook (UPCRT 2005). The comparison shows that the PSD and SSR are slightly different because of the physical conditions of the existing catchment and that the proposed land use would not be consistent between the study areas. For example the proposed LTC land use includes an impervious percentage of

90 that would be higher than for the general urban land use for the Parramatta River catchment modelled for existing conditions in 1990. Notwithstanding the PSD and SSR values are within reasonable bounds of what would be expected in comparison to the UPCRT values.

Table 5-4: Lot based OSD Results

ID	Lot Area (ha)	2yr ARI Lot ARI OSD Vol (m^3)	2yr ARI SSR (m^3/ha)	100yr ARI Lot OSD volume (m^3)	100yr ARI SSR (m^3/ha)
8.01	23.44	6,755.1	288	13,639	582
7.07a	0				
7.07b	3.15	950	302	1,898	603
7.08a	0				
7.08b	15.39	4,644	302	9,268	602
7.09b	0.74	230	311	446	603
7.09c	16.26	4,904.6	302	9,604	591
7.10a	12.2	3,620	297	7,212	591
7.10b	8.36	2,471	296	4,895	586
7.11b	0				
Average			300		594

Table 5-5: Comparison of Peak Flows

Catchment	Total Area (ha)	Existing 2yr ARI			Existing 100 year ARI		
		Peak Flow (m^3/s)	Peak Flow/ Total Area (m^3/s/ha)	Critical Duration (hours)	Peak Flow (m^3/s)	Peak Flow/ Total Area (m^3/s/ha)	Critical Duration (hours)
8.01	34.04	0.85	0.02	12	4.10	0.12	9
7.07a	3.294	0.20	-	12	0.94	0.29	9
7.07b	5.564	0.29	0.05	12	1.42	0.26	9
7.08a	5.673	0.22	-	12	1.04	0.18	9
7.08b	19.244	0.37	0.02	12	1.83	0.10	9
7.09b	2.137	0.11	0.05	12	0.54	0.25	12
7.09c	21.592	0.43	0.02	12	2.12	0.10	9
7.10a	15.645	0.25	0.02	12	1.33	0.09	9
7.10b	9.475	0.21	0.02	12	1.09	0.12	9
Average	12.00		0.03			0.17	

Table 5-6: Comparison of SSR

Source	2yr ARI SSR (m^3/ha)	2yr ARI PSD (l/s/ha)	100yr ARI SSR (m^3/ha)	100yr ARI PSD (l/s/ha)
Cardno 2011	350	28	630	100
UPRCT 2005	300	40	455	150
Current Study	300	30	594	170

Bringelly Road Crossing of Scalibrini Creek

A comparison of the estimated hydrographs at Bringelly Road under existing and proposed land use is presented in **Figure 5-12** and **Figure 5-13.**

It is shown that development has a far greater impact on the 2 year ARI peak flows than the 100 year ARI peak flows. It was also found that the 12 hour and 9 hour storm duration are critical for sizing OSD in lots and basins for the 2 yr ARI and 100 yr ARI events respectively. It is evident that the lot based OSD goes a long way to replicating the existing 100 year ARI runoff. However the agreement between the 2 yr ARI flows under existing conditions and with the lot based OSD is not as good due to the increased volume of runoff due to development. Therefore if the agreement with the existing condition hydrograph is to be improved then further storage in the form of an on-line basin would be necessary. This has been assessed using a hydraulic model.

Figure 5-12: 2yr ARI Hydrographs

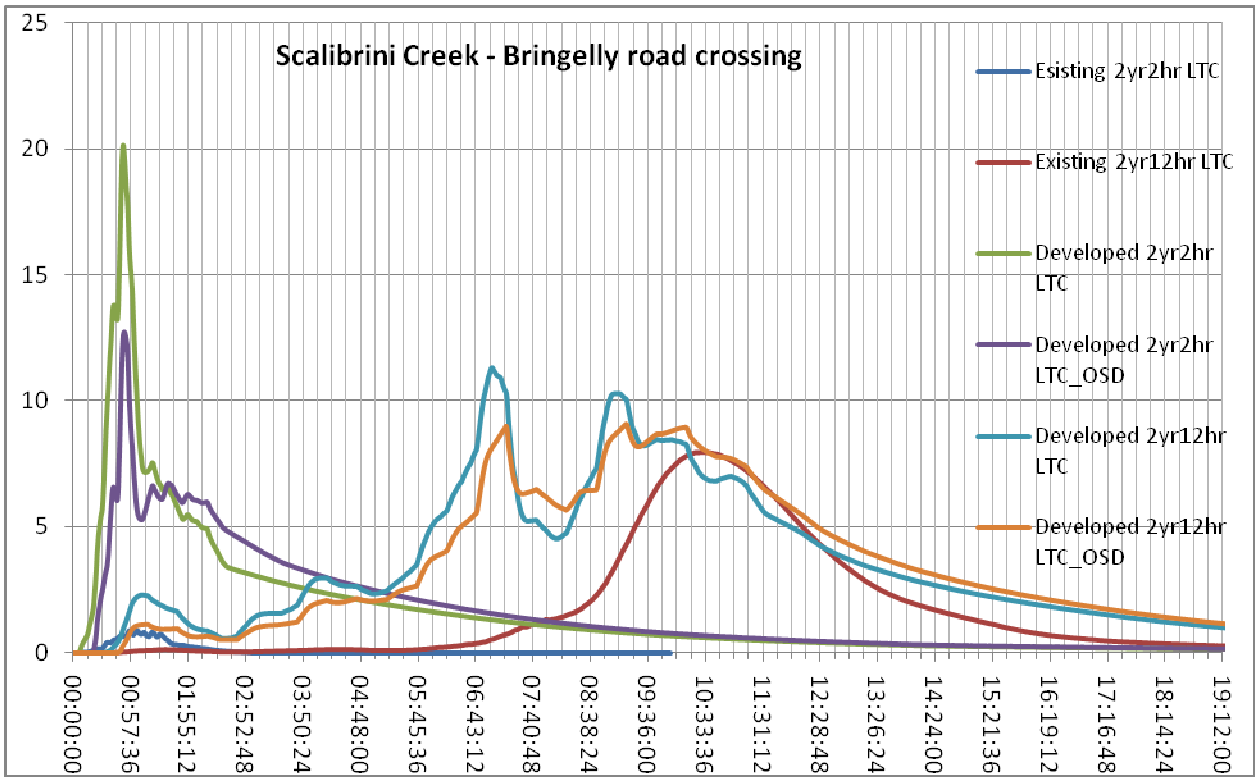
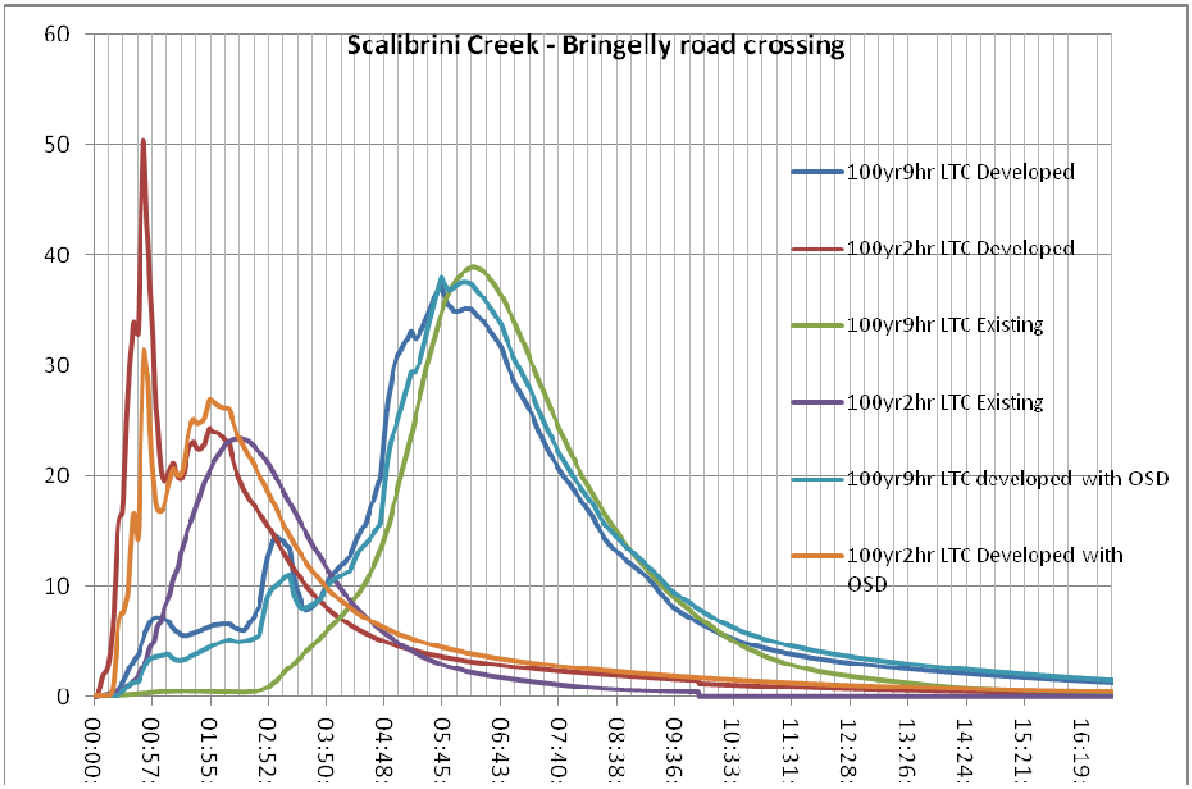


Figure 5-13:100yr ARI Hydrographs



Hydraulic Investigation

The inclusion of an on-line basin directly upstream of Bringelly Road was investigated. This location is suitable as both Dickson Road and Bringelly Road are to be upgraded and the basin wall could be incorporated into the road verge, subject to agreement with RMS. In addition the upgrade of the road crossing of Scalibrini Creek also offers an opportunity to configure the crossing in a manner that controls flows. The basin footprint is indicated in Figure 1 as Basin #1 and represents an approximate area of 2ha. Preliminary sizing of the storage was undertaken using the **xprafts** model of the 2 year 12hr duration storm event. Using the optimisation tool it was found that the site storage requirement was approximately 20,000 m^3. Therefore proposed Basin 1 would need to provide storage of around this volume for 2 yr ARI runoff. It was estimated that approximately 0.5 – 1 m depth of excavation would be required across the 2ha footprint of the basin to achieve this storage volume.

A nominal stage - storage relationship was then developed as given in **Table 5.7**.

The results of the hydrological assessment are shown in **Figure 5-14** and **Figure 5-15**.

Table 5-7: On-line basin stage storage relationship

RL (m AHD)	Storage (m^3)	Description
71.0	0	Creek invert
72.3	1,500	Top of bank
73.0	20,000	Top of basin bund
73.7	35,000	Top of Bringelly Road
74.0	50,000	Upper limit

Figure 5-14: 2 year ARI hydrographs for On-line Basin

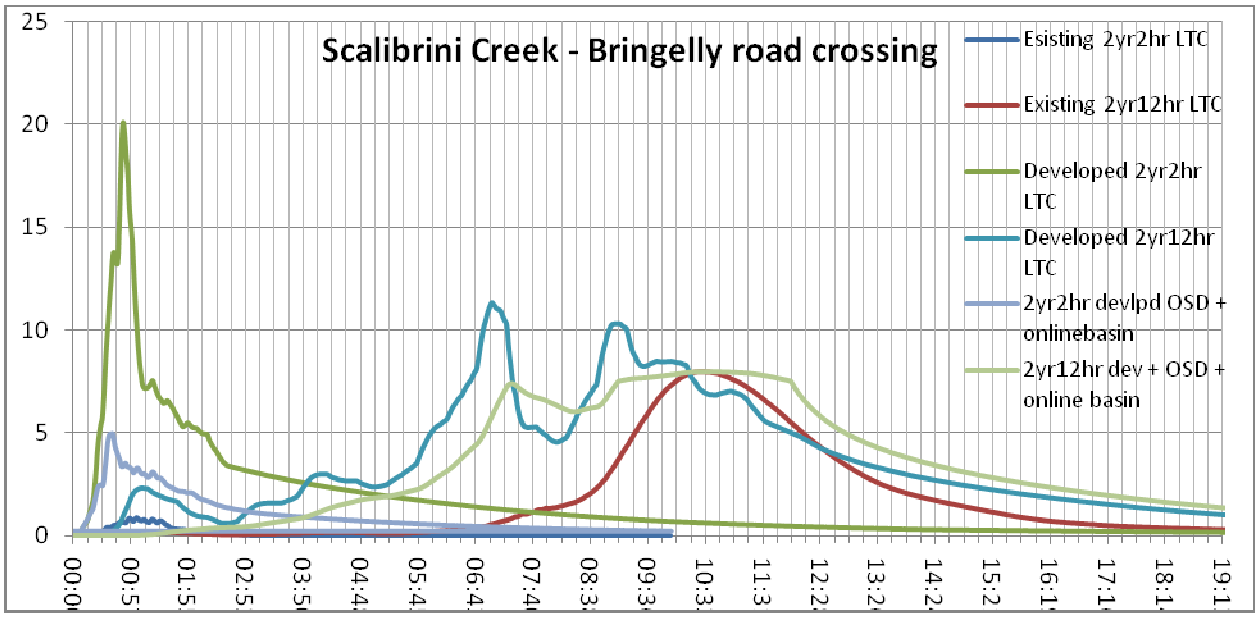
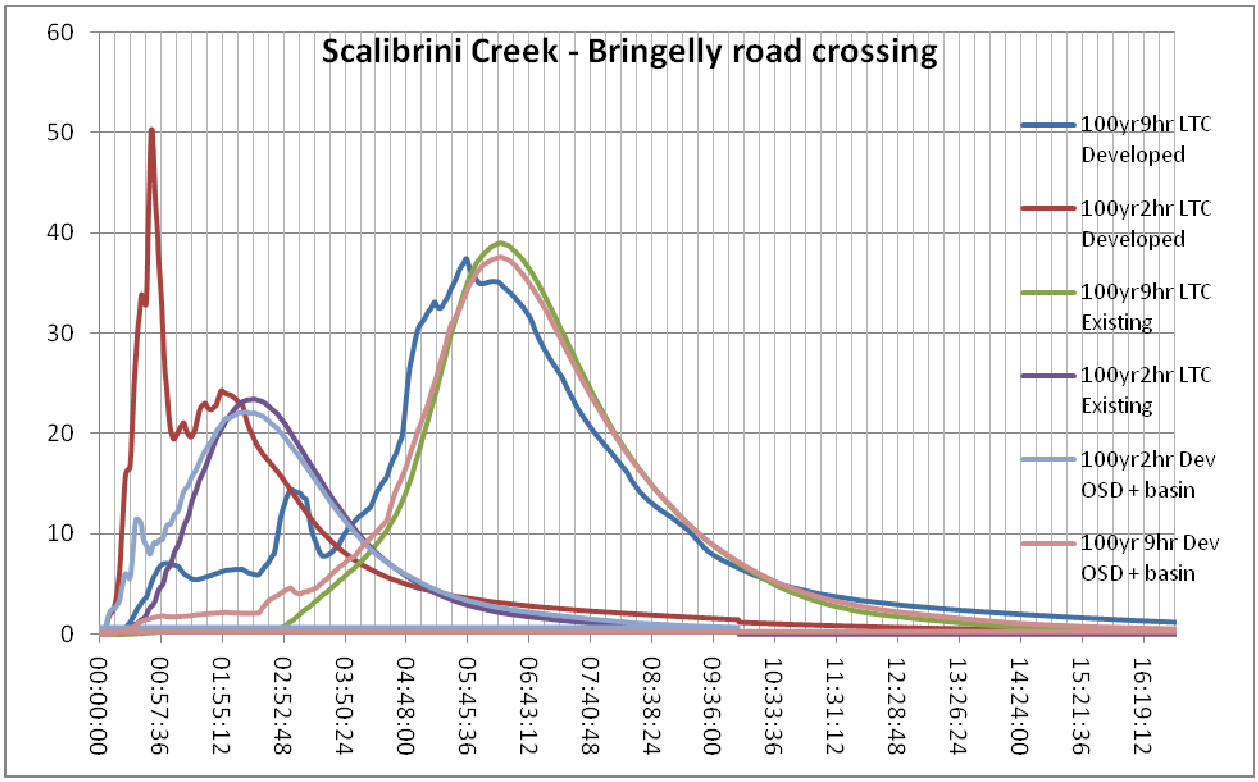


Figure 5-15: 100 year ARI hydrographs for On-line Basin



An **xpswmm1D** model was then developed. The model includes the natural channel of Scalibrini Creek commencing at the Precinct boundary and extending to a location 100 m downstream of Bringelly Road. The model is indicative of the creek channel and floodplain to a total width of 250 m and is based on the invert levels recorded from ALS data at each of the proposed road crossings. Bringelly Road was included in the model as a culvert and road crossing based on the RMS ground survey of existing conditions. The 100 year ARI hydrographs under existing conditions were exported from the **xprafts** model and were imported into the **xpswmm1D** model. Adjustments were made until a flood level of 73.7 m AHD was achieved upstream of Bringelly Road compared with the existing flood level of 73.72 m AHD estimated by the TUFLOW model. The model was then used to assess a number of scenarios. This approach has been chosen to provide a rapid assessment of various scenarios that would inform the OSD strategy for Leppington Town Centre. Once a preferred approach has been agreed the OSD strategy would be applied across the entire LTC area in the TUFLOW model.

The proposed development was modelled by importing hydrographs for both the 2 year ARI and 100 year ARI events under post-development conditions with Basin 4 and lot based OSD. Then the stage-storage relationship of Table 5-7 was inserted directly upstream of Bringelly Road. The key component to explore in the hydraulic model was the configuration of an outlet under Bringelly Road so that the existing flood levels directly downstream of Bringelly Road and at the SWRL can be maintained. The design of both Bringelly Road upgrade and the SWRL has been completed and therefore both are sensitive to any changes in flood behaviour. However it has been advised that there may be some flexibility in the Bringelly Road design. **Table 5-8** lists the scenarios modelled.

Table 5-9 outlines results of the scenarios modelled:

Flood profiles for the scenarios are provided in **Figure 5-16**.

Table 5-8: 1D Hydraulic Model Scenarios

Scenario	Culvert Size	Description
A	1 x 1.2 m (H) x 2.4 m (W) RCBC + 4 x 0.6 m (H) x 2.1 m (W) RCBC	Raise Bringelly Road crown to 75.0 m AHD to prevent overtopping of the road
B	1 x 1.2 m (H) x 2.4 m (W) RCBC + 4 x 0.6 m (H) x 2.1 m (W) RCBC	Maintain Bringelly Road at existing level allowing for overtopping of the road in a 100 year ARI event
C	1 x 1.2 m (H) x 2.4 m (W) RCBC + 9 x 0.6 m (H) x 2.1 m (W) RCBC	Raise Bringelly Road crown to 74.2 m AHD to prevent overtopping of the road

Notes: Existing Bringelly Road crown level ~73.6 m AHD.

1200 mm (H) x 2400 mm (W) RCBC @ IL 71.0 m AHD (2 yr ARI);

600 mm (H) x 2100mm (W) RCBC @ IL 72.4 m AHD (100 yr ARI)

Table 5-9: 1D Hydraulic Model Results

Location		100yr ARI Water Level (m AHD)			
		Existing	Scenario A	Scenario B	Scenario C
1	Upstream of SWRL	78.19	78.16	78.16	78.16
2	Downstream of SWRL	74.44	74.81	74.40	74.40
3	Bringelly Road	73.70	74.80	73.72	73.94
4	Downstream of Bringelly Road	72.31	72.12	71.96	72.00

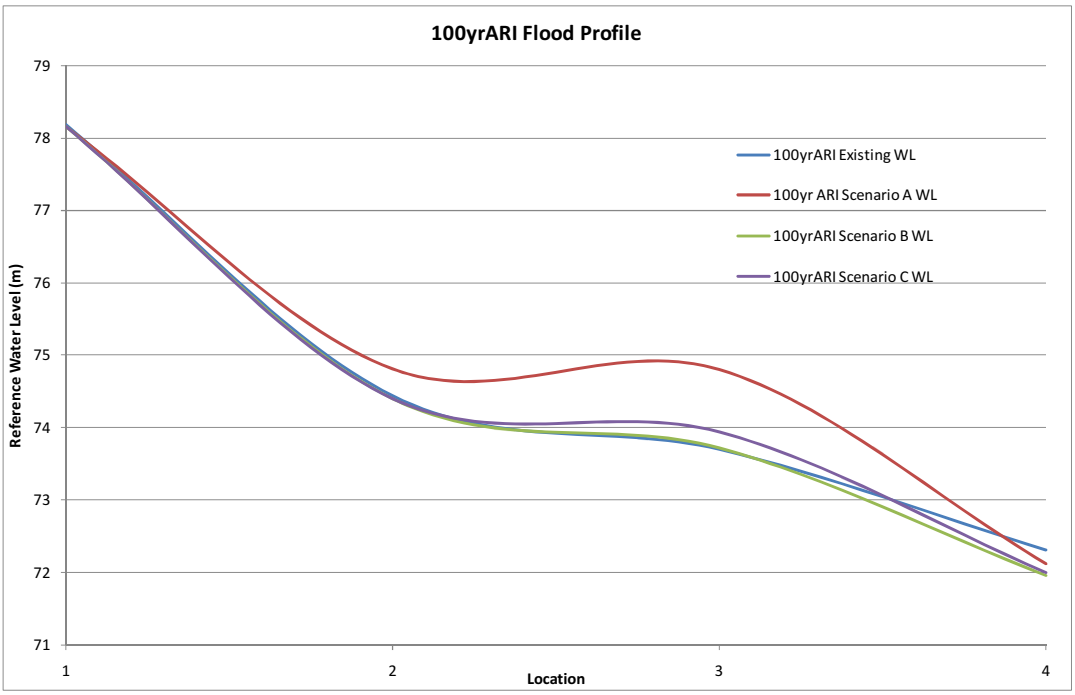


Figure 5-16: 100yr ARI Flood Profiles

The 1D model has found that the lot based OSD strategy coupled with an on-line basin at Bringelly Road would achieve negligible flood impact for Scenario B or C while the impact under Scenario A is far greater.

Scenario B is preferred as it provides negligible impact on flood levels and would not require any regrading of Bringelly Road. However it does permit the 100 year ARI to overtop the road as under existing conditions. It is expected that one of the design objectives adopted by the RMS is to eliminate overtopping of Bringelly Road in the 100 year ARI event. If overtopping is not acceptable to RMS then Scenario C would be the preferred approach where the road crown would need to be raised 500 mm and multiple culverts would need to be installed.

The ultimate configuration of the on-line basin would be subject to further design development by RMS. At the time of writing it is understood that a brief has been advertised for design of Bringelly road upgrade including the Scalibrini Creek crossing. For the ultimate development TUFLOW model, Scenario C was adopted and the configuration is described by **Figure 5-17** and **Figure 5-18**.

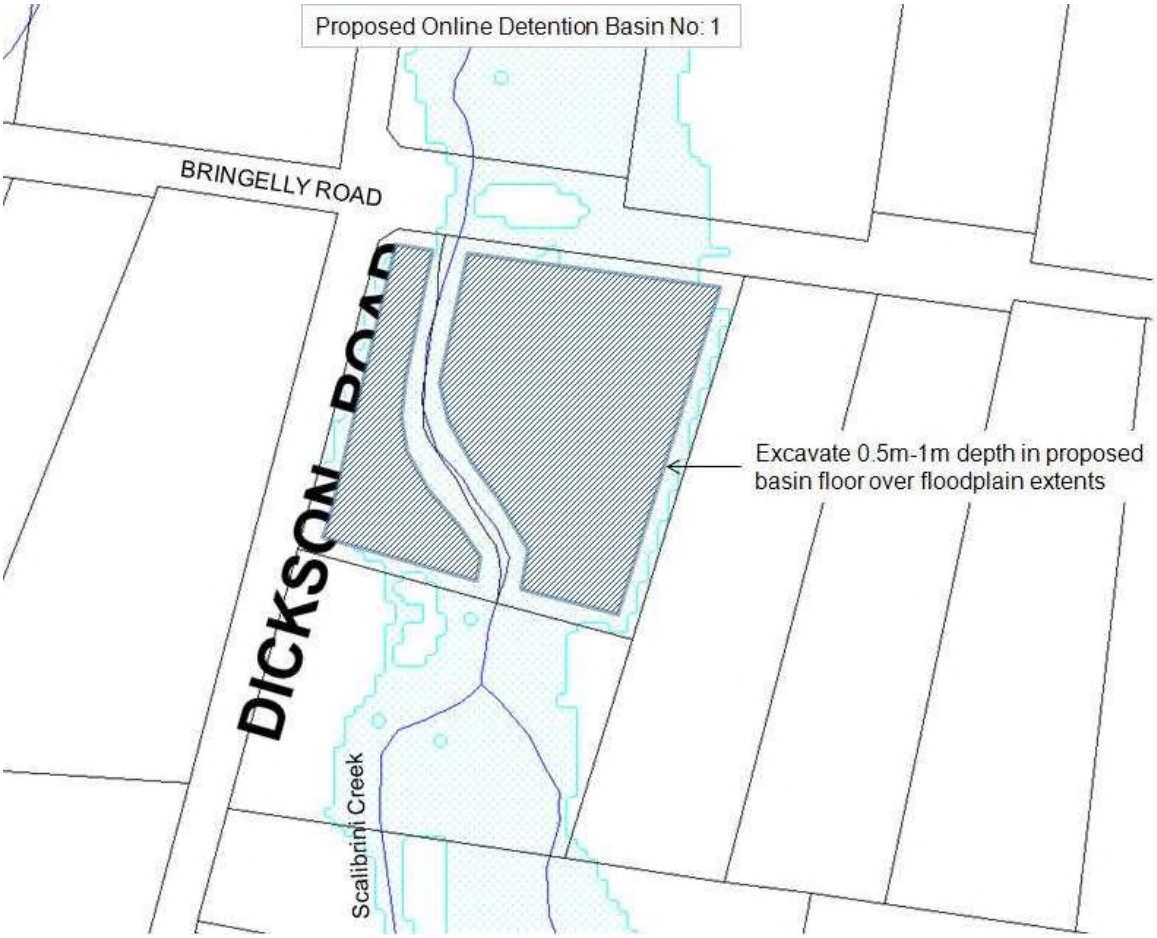


Figure 5-17: Basin 1 Layout included in Ultimate Development TUFLOW Model

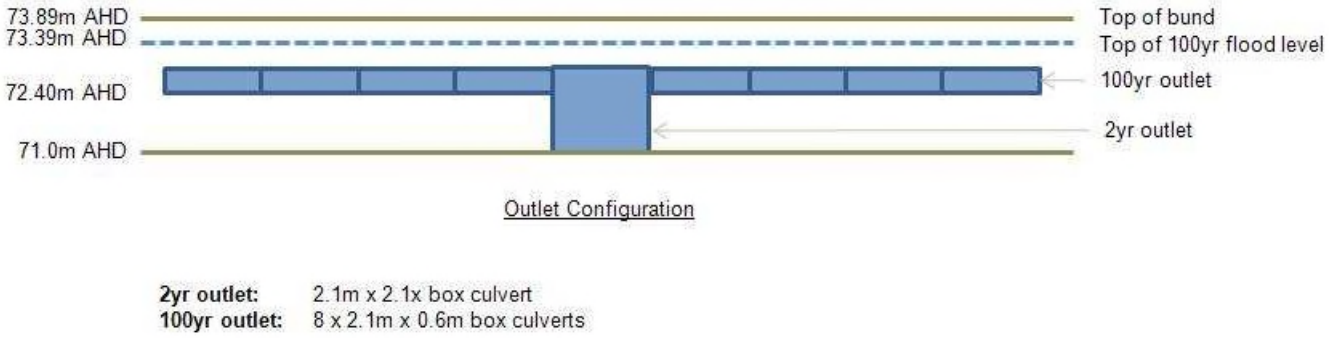


Figure 5-18: Basin 1 Outlet Elevation included in the Ultimate Development TUFLOW Model

6 Hydraulic Modelling

Additional hydraulic modelling was undertaken and included:

- Updating the TUFLOW model of existing conditions and the re-assessment of the 2yr, 20yr, 100yr, 500yr ARI and PMF events;
- Investigation of opportunities to increase the capacity of the trunk drainage system and to narrow and reduce the length of overland flow paths;
- Investigation of the impact of further filling of the floodplain under developed conditions on 100 year ARI flood levels;
- Updating the TUFLOW model of post-development conditions and re-assessing the 2yr, 20yr, 100yr, 500yr ARI and PMF events;

6.1 Additional Survey

Cardno conducted a topographic survey of several natural channel cross sections and road crossings in April 2012. The locations surveyed are shown in **Appendix B**.

Cross sections were extracted at the same locations as the ground survey using the ALS data in order to identify any differences between the ALS data and surveyed ground levels. In general the ALS levels are higher than the ground survey within the natural channels. This is a common finding and is usually a result of dense vegetation within the channel which hinders the ALS signal from reaching the actual ground. The natural channels of Kemps, Bonds and Scalibrini Creeks along with their tributaries were all observed to contain dense vegetation during site inspections. Comparisons of the cross sections are included in **Appendix B**. A general trend was interpreted as follows:

- Where the channel is approximately 5 m wide the ALS levels are approximately 1 m higher than the surveyed invert level of the channel; and
- Where the channel is approximately 10 m wide or greater, the ALS levels are approximately 0.5 m higher than the ground survey nor does it delineate the full base width of the channel.

6.2 Adjustments to Watercourse Levels

The results of the flood model are highly dependent on the geometry of the watercourses located within the precincts. Therefore it is expected that the accuracy of the flood levels and extents would be improved by adjusting the ALS levels in the location of the watercourses based on the outcome of the comparison of ALS levels and survey levels. Due to the relative inaccuracy of the ALS levels in the watercourses, the following adjustments were made to the terrain:

- Where the channel is approximately 5 m wide the ALS levels were lowered by 1 m; and
- Where the channel is approximately 10m wide or greater, the ALS levels were lowered by 0.5m.

Adjustment of the channels across the precincts is appropriate given that site observations confirmed that dense vegetation exists throughout.

6.3 Model Runs

The TUFLOW model of Existing Conditions within the precincts was updated using the information and approach discussed in **Sections 6.1** and **6.2**.

6.3.1 Existing Conditions

The TUFLOW model of Existing Conditions was re-run for the 2 yr, 20 yr, 100 yr, 500 yr ARI and PMF events. Amended plots of the flood extents, depths, hazards and velocities are included in **Appendix B** as follows:

- The estimated peak flood extents for 2 yr, 20 yr, 100 yr, 500 yr ARI and PMF events are shown in **Figures D1** to **D5**;
- The estimated peak flood depths for 2 yr, 20 yr, 100 yr, 500 yr ARI and PMF events are shown in **Figures D6** to **D10**;
- The estimated hazard for 2 yr, 20 yr, 100 yr, 500 yr ARI and PMF events are shown in **Figures D11** to **D15**; and
- The estimated peak flood velocities for the 2 yr, 20 yr, 100 yr, 500 yr ARI and PMF events are shown in **Figures D16** to **D20**.

In general the flood levels are up to 0.1 m lower resulting in slightly narrower flood extents. This is mainly due to the refinement of the natural channel geometry within the model. The accuracy of the model is improved and verification of the model has been discussed in **Section 3.1**.

6.3.2 Flood Filling Assessment

As a result of the ALS adjustments and additional culvert survey, it was found that the revised Existing Conditions flood levels are lower than previously identified. This results in a narrower flood extent and provides an opportunity to fill some parts of the floodplain, subject to more detailed assessments for any development proposals that include floodplain filling.

The assessment of the impact of filling was undertaken in a similar manner to the approach which was documented in the Exhibition report (Cardno, 2011). The approach adopted was to fill those areas of the floodplain where the 100 yr ARI flood depth is less than 300 mm to minimise any increase in flood risk under future development. The filling is capped at the 100 yr ARI flood level such that larger storm events are permitted to overtop the fill areas in a similar manner to existing conditions.

This assessment does not include any compensatory excavation in other parts of the floodplain to offset the impacts of filling. This is due to the highly fragmented pattern of land ownership which makes compensatory works on other properties impractical in most situations.

6.3.3 Developed Conditions

The TUFLOW model of post-development conditions was run for the 2 yr, 20 yr, 100 yr, 500 yr ARI and PMF events. The model includes the floodplain filling assessment outlined in Section 6.3.2.

Amended plots of the flood extents, depths, hazards and velocities are included in **Appendix B** as follows:

- The estimated peak flood extents for 2 yr, 20 yr, 100 yr, 500 yr ARI and PMF events are shown in **Figures D21** to **D25**;
- The estimated peak flood depths for 2 yr, 20 yr, 100 yr, 500 yr ARI and PMF events are shown in **Figures D26** to **D30**;
- The estimated hazard for 2 yr, 20 yr, 100 yr, 500 yr ARI and PMF events are shown in **Figures D31** to **D35**;
- The estimated peak flood velocities for the 2 yr, 20 yr, 100 yr, 500 yr ARI and PMF events are shown in **Figures D36** to **D40**;
- The impact of planned development on 100 yr ARI flood levels is shown in **Figure D41**; while
- The impact of adjustments to the terrain on 100 yr ARI flood levels under Existing Conditions (as outlined previously in Cardno, 2011) is shown in **Figure D42**.

Under Post-development Conditions the floodplain is well defined because there is little difference between the flood extents under the various design storm events. Furthermore it is shown that the flood depth and provision hazard is high along the watercourses in most reaches. Broad expanses of lower flood depths and provisional low hazard are evident on the floodplain on both sides of the watercourses. Exceptions to this general observation exist at the confluence of Kemps and Bonds Creek and the reach of Kemps Creek downstream of the confluence. These exceptions are most likely due to the natural channel having the less capacity (in ARI terms) in comparison with other watercourses in the Precincts. Therefore the floodplain is inundated to a greater depth in Kemps Creek and a higher provisional hazard is evident as a result. Due to the expanse of floodplain and low flood depths the indicative filling has a limited impact on existing flood behaviour.

Planned land use in the ILP for areas on the fringe of the floodplain is appropriate provided that flood risk management controls are applied. In low provisional hazard areas some land uses such a passive/active open space, environmental living and roads have been proposed and are suitable with flood risk management measures. Relevant measures for these land uses would include constructing habitable floors above the flood planning level, constructing roads with footpaths where pedestrian egress from floods is safe, ensuring active recreation uses are above say the 20 year ARI flood extent and constructing shared pathways so that safe pedestrian egress can be achieved during floods. Detailed flood risk management measures should be investigated in future stages of the urban design.

Figure D41 indicates that a general reduction in 100 yr ARI peak flood levels is expected in Bonds, Kemps and Scalibrini Creeks within the Precincts with minor local increases of up to 50 mm in some locations. Any increases would be contained within the riparian corridor and do not adversely affect existing flood behaviour in areas external to the precincts in Kemps Creek. Some negligible flood level increases of 1-3 cm are identified downstream of the Austral Precinct for a tributary of Kemps Creek to the north east of the transmission sub-station. This area remains undeveloped and as such the increases are considered to be of minor impact.

The impact of adjustments to the terrain (floodplain filling) on 100 yr ARI flood levels under Existing Conditions are evident in **Figure D42** with a reduction in 100 yr ARI peak water levels of greater than 0.1 m apparent throughout the Precincts.

6.4 Emergency Response Strategy

At the time when an extreme flood event is experienced there may be the need for residents and/or workers located in the floodplain to safely vacate the floodplain prior to or during a flood. Response to the extreme flood emergency may be in the form of departing the floodplain and travelling to a suitable point of refuge for the duration of the flood. If the duration of the PMF is predicted to be greater than 24 hours then the refuge should be equipped with suitable facilities and provision of food and water. The duration of the PMF in the case of the Precincts is 2 hours and therefore it is predicted that response to the extreme flood should be to vacate the floodplain or evacuate to the nearest hospital or refuge if necessary. Cases where evacuation is required is only expected if the resident/worker is in need of the local hospital or their property is significantly damaged by flood.

At the time of this assessment suitable points of refuge have not been identified and therefore an evacuation strategy has been prepared on the basis that evacuation by vehicle from the precinct would be required. A more detailed evacuation strategy could be prepared in consultation with the NSW SES, with one or more refuges identified within the precincts, during future stages of the urban design or in a Floodplain Risk Management Study for the catchment.

The criterion for safe evacuation that has been adopted is for vehicles to be able safely traverse a road crossing during the 500 year ARI event i.e. a velocity depth product for floodwaters overtopping any crossing of less than 0.6 m^2/s. The results for the 500 yr ARI event under Post-development Conditions are used for the assessment. It should be noted that the existing topography and road crossings for all roads are included in this model.

The assessment of the velocity depth product at various road crossing is included in **Appendix B** and the suitable routes of evacuation are shown in **Figure 6-1**. It is shown that evacuation could be made to the east of the Precincts to access critical infrastructure such as Campbelltown and Camden hospitals and the NSW SES is also located in this direction. The primary evacuation routes to the east are Bringelly Road for the Leppington North Precinct or 15th Avenue for the Austral Precinct.

6.5 Dam Break Assessment

An assessment of a scenario where a number of retarding basins would fail was undertaken using a dam breech method in the XP_RAFTS software. The user inserts a number of parameters that would model a failure in the dam wall. The failure would occur at a user defined time, width and duration. This is undertaken using the Fuseplug function of the storage node in RAFTS. A dam breech hydrograph is then estimated by the model for each of the basins that are chosen for failure. The hydrographs were then inserted to the developed TUFLOW model to estimate the difference between flood level and extents for the 100 year and 500 year ARI. **Table 6-1** includes some of the parameters used.

Table 6-1: Details Dam Breech for the 100 year ARI

Basin ID	100yr ARI Basin Depth (m)	100yr ARI Breech time (min)	100yrARI Maximum Breech width (m)	Surcharge Depth (m)	100yr ARI Decay Rate (m/hr)
1	2.85	5	6.66	0.002	79.94
5	1.084	8	4.19	0.002	31.42
8	1.505	7	4.02	0.002	34.44
11	1.618	6	5.05	0.002	50.51
14	1.232	7	4.12	0.002	35.34
17	1.61	6	5.63	0.002	56.35
22	1.44	7	4.30	0.002	36.88
29	1.373	7	4.75	0.002	40.72
32	1.142	8	4.02	0.002	30.13
34	1.048	8	2.30	0.002	17.27

Where Breech Width = 0.1803 x K x (V)^0.32 x (H)^0.19
K = 1 for earthen dam
V = volume
H = Breech head

Table 6-2: Results of the Dam Breech Hydrology

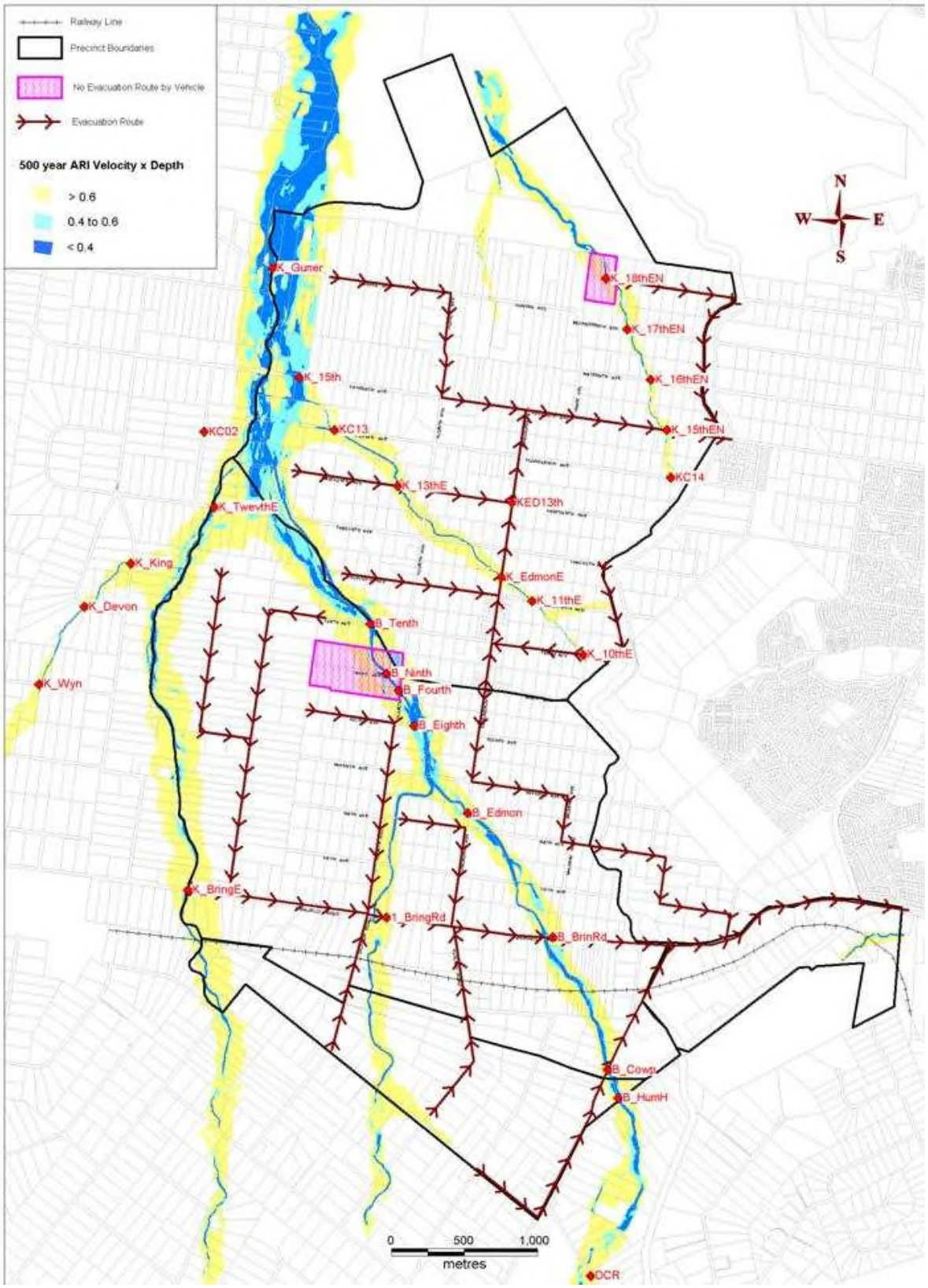
Basin ID	100yr ARI Basin Outflow (m3/s)	100yr ARI Basin Breech Outflow (m^3/s)	500yr ARI Basin Outflow (m3/s)	500yr ARI Basin Breech Outflow (m3/s)
1	37.22	77.22	42.72	85.32
5	3.01	9.23	3.73	10.96
8	2.59	11.3	3.29	13.29
11	6.28	19.8	7.72	23.39
14	4.56	11.83	5.11	13.28
17	7.04	22.87	8.56	27.3
22	6.07	14.86	7.47	17.30
29	13.06	22.33	14.95	25.46
32	4.75	10.98	5.27	12.12
34	2.08	3.93	2.48	4.25

Results of the TUFLOW model for the Dam Break Assessment are shown in **Figure D43 - D46**. It is shown that the Basins selected for the assessment do have an impact on flood

levels as a result of the dam breech. The magnitude of the impact ranges from 0-0.5m as shown in Figures D43 and D44. The amount of flood level impact is dependent on the capacity of the receiving waterway. Where the waterway is broad and carries a significant volume of overland flow from upstream there is negligible impact. There is more notable impact where the waterway capacity is less than the basin breech volume.

It is shown in Figures D45 and D46 that the dam breech would pose minimal lateral expansion of the developed case flood extent. This is due to the high definition of the floodplain where the difference in both flood level and flood extent between the ARIs is minimal. Therefore the flood behaviour is less sensitive to scenarios such as dam break than would be expected elsewhere.

Figure 6-1: Draft Evacuation Strategy



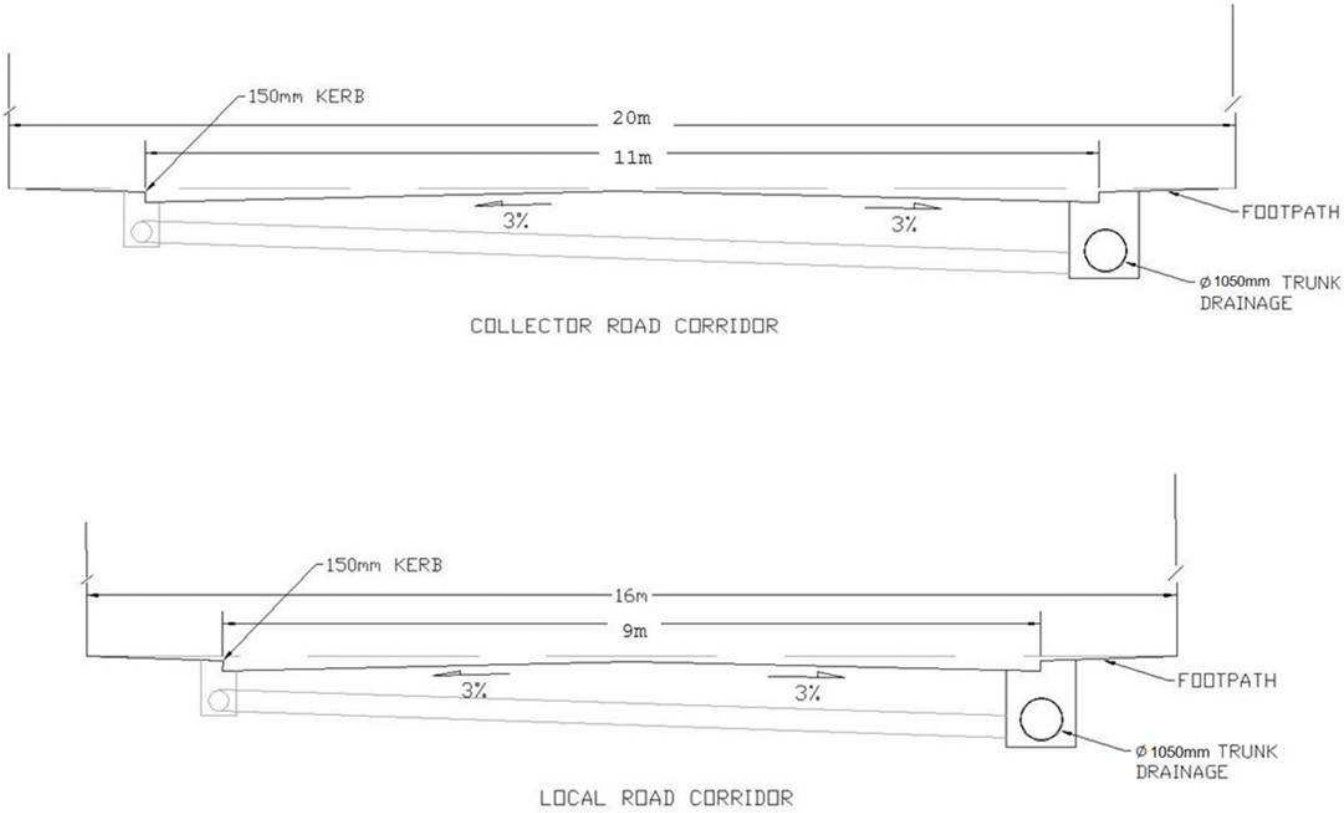
7 Review of Trunk Drainage Capacity

The headwater sub-catchments for the Austral and Leppington North Precincts were assumed to have the following properties:

- Approximate Area = 20ha;
- Imperviousness = 70%, and;
- Critical Storm Duration = 2hrs.

Generic road corridor sections were prepared based on planning guidelines provided in Camden Councils DCP. It is predicted that overland flows within headwater sub-catchments will commonly be conveyed by two road types namely; collector roads and local roads. In determining the design hydraulic capacity of the road corridors, it has been assumed that a 1050 mm drainage pipe will be installed for both road types. Standard cross sections of the two road corridors are given in Figure 7-1**.**

Figure 7-1: Standard Collector and Road Corridors



The capacity of the two roads were calculated using Manning's equation assuming a flow depth of approximately 100 mm above the top of kerb, and 250 mm at toe of kerb. The roughness value used for the road was 0.025. The calculated capacities of the two roads for slopes of 1%, 3%, and 5% are summarised in **Table 7-1**.

It was determined that the slopes of the headwater sub-catchments could be approximated as either a 1%, 3% or 5% slope. The estimated peak discharges for 5 yr, 20 yr and 100 yr ARI events are summarised in Table 7-1.

Table 7-1: Peak Flows (m3/s) for 20ha Catchment and various Drainage System Designs

Scenario	Catchment Slope		
	1%	3%	5%
20ha Catchment Design Storms			
5yr 2hr Peak Flow	3.69	4.23	4.36
20yr 2hr Peak Flow	5.05	5.69	5.74
100yr 2hr Peak Flow	6.38	7.08	7.14
Drainage Design Capacity**			
1050mm dia. Pipe Capacity	3.00	5.20	7.00
Total Minor Road Capacity* (Includes 1050mm dia. Pipe)	7.00	12.13	15.95
Total Collector Road Capacity* (Includes 1050mm dia. Pipe)	7.43	12.87	16.90

* Road design capacity assumes a depth of 0.1 m above top of kerb

** Calculated using Manning's equation

The 100 year ARI flow is conveyed as both pipe flow and overland flow on the roadway. As indicated in Table 7-1**,** a 1050 mm drainage pipe in combination with the two road types listed above is able to convey at least the 100 year ARI flow. It should be noted that these assessed capacities have not considered whether or not the road flows exceed pedestrian or vehicular safety criteria and would be reviewed at the detailed design stage.

7.1 Overland Flow and Category 3 Streams

Within the Austral and Leppington North Precincts there are a number of overland flowpaths (OFP) or Category 3 streams (CAT3) that convey flows from headwater sub-catchment to perennial streams. The location of these flowpaths is shown in Figure 7-2**.**

There are 20 sub-catchments that have a flowpath connecting a headwater sub-catchment to a perennial stream. It is expected that these flowpaths will need to be formalised during development and will require the construction of a channel section capable of conveying the 100 year ARI peak flows to manage flood risk in adjoining urban areas. The current topography and stream channel typically does not have sufficient hydraulic capacity to convey post-development 100 yr ARI flows. Therefore augmentation of the channel capacities will be required. This needs to be undertaken in a manner that meets the management objectives for riparian corridors while achieving a 100 yr ARI capacity.

Figure 7-2: Category 3 Stream Types and Overland Flowpaths

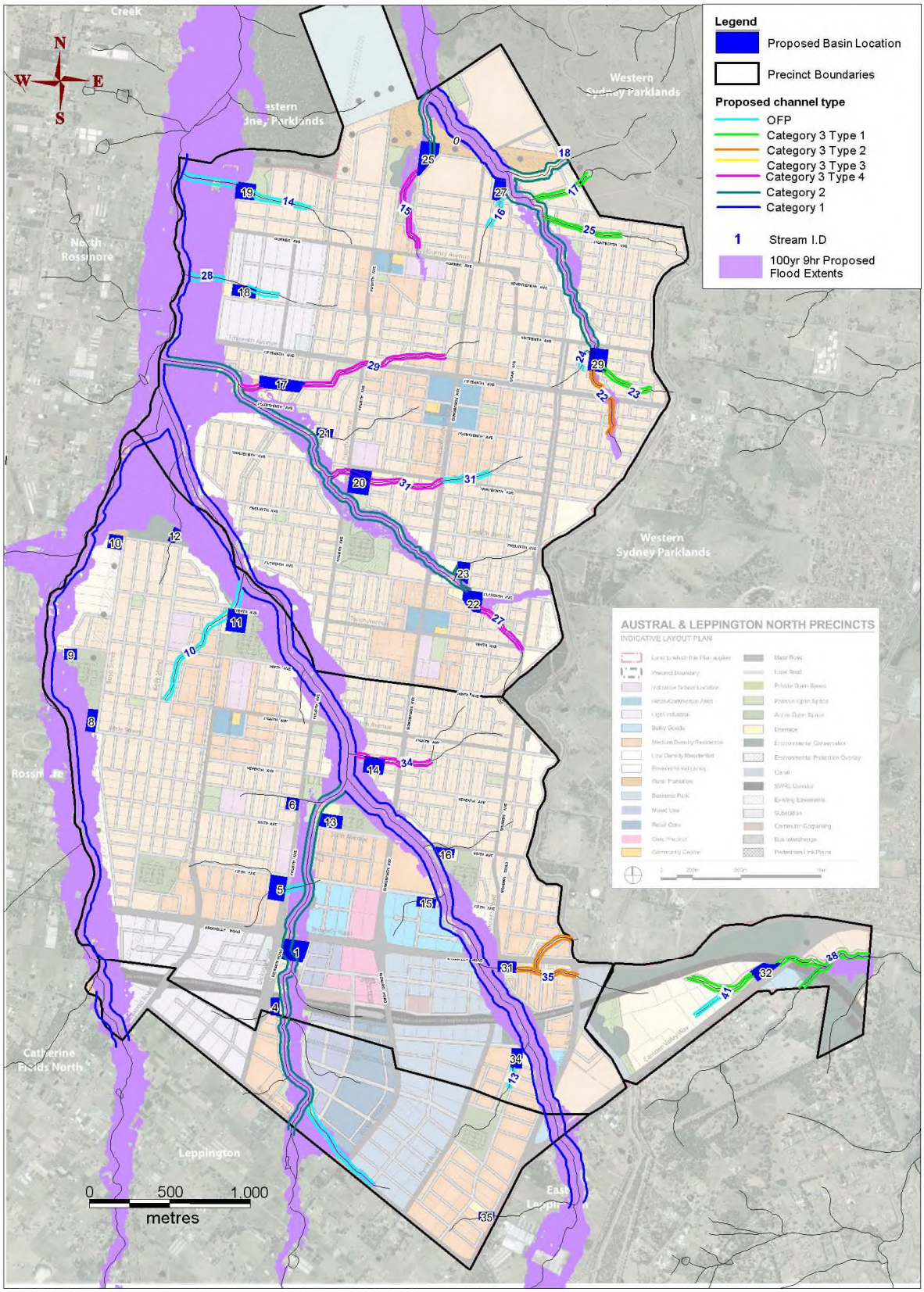
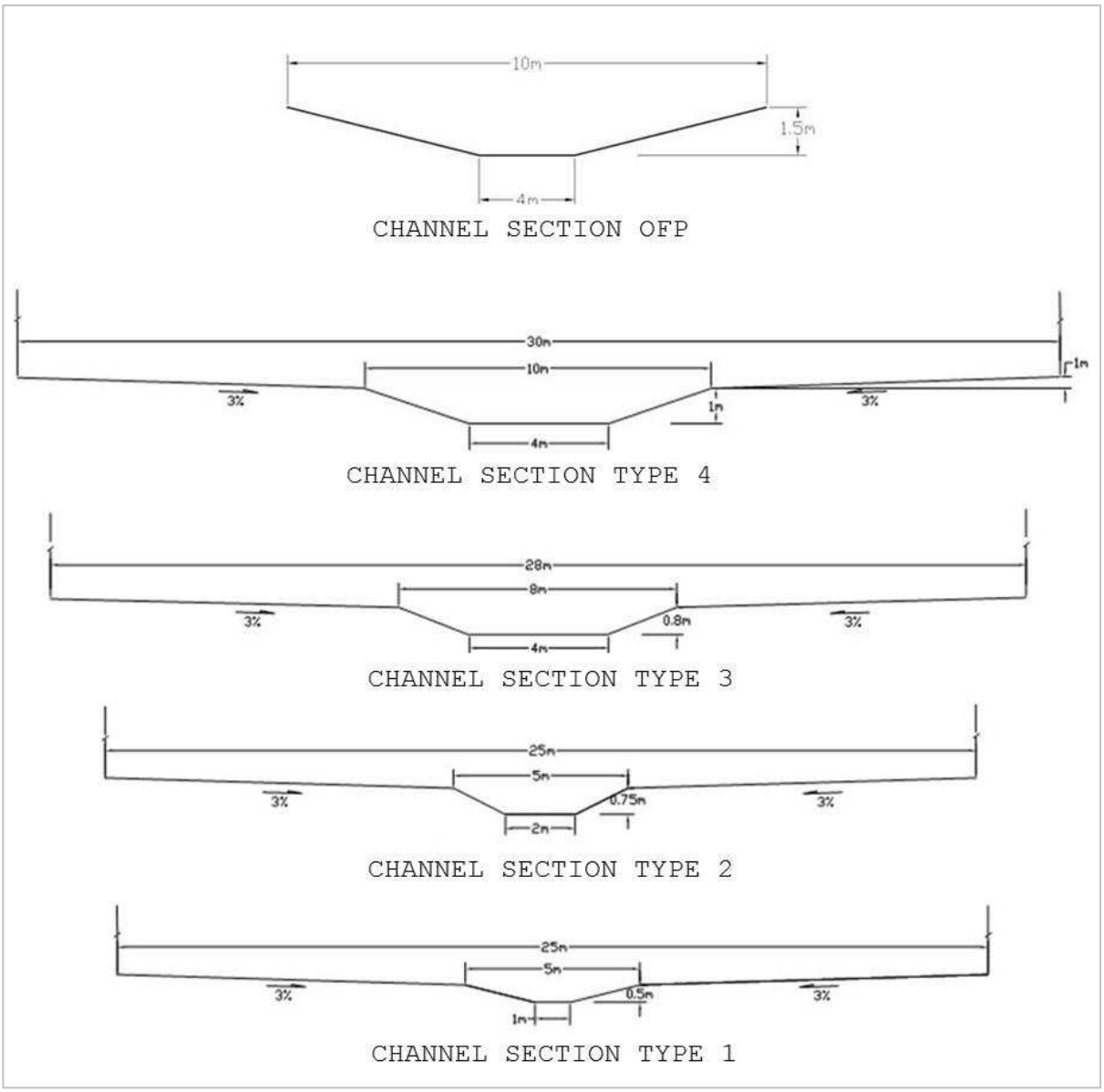


Figure 7-3: Typical Channel Types and Sections



Due to the variation in the required capacity for the 20 flowpaths, five channel types shown in **Figure 7-3** were assessed. Channel sections based on the representative natural channel geometries are the preferred form of overland flowpath to maintain waterway health through connectivity with perennial streams, to achieve stable banks and to improve water quality. The cross section shape and width has been selected to replicate existing conditions, as far as practical, where streams typically have small channels inset in a broad floodplain.

The hydraulic capacity of the channels was estimated using Manning's Equation with an assumed roughness value of 0.06. These capacities are summarised in **Table 7-2**.

Table 7-2: Estimated Channel Capacity (m3/s) for Various Channel Slopes

Channel Type	Slope = 1%	Slope = 3%	Slope = 5%
1	3.8	6.7	8.6
2	5.1	8.8	11.4
3	7.6	13.2	17.0
4	13.3	23.0	29.7
OFP	12.1	20.9	27.0

The 100 year ARI peak flow was estimated for each of the 20 flowpaths and each flowpath was categorised into a slope category of 1%, 3%, or 5%. A design channel section was then allocated to each of the flowpaths by comparing design peak flows to the hydraulic capacity of each of the three channel types above. Results of this assessment are shown in Table 7-3.

Table 7-3: Channel Assessment

Stream ID	Basin ID	Type	100yr ARI Peak Flow (m^3/s)	Avg Slope (%)	Rounded Slope (%)	Channel Type	Corridor Width (m)
10	Basin 11	OFP	15.5	0.98	1	5	10
34	Basin 14	CAT3	11.7	1.88	1	4	30
*	Basin 35	-	8.3	1.23	1	-	-
13		OFP	8.5	1.49	1	5	10
35	Basin 31	CAT3	4.2	1.27	1	2	25
14	Basin 19	OFP	12.5	0.68	1	5	10
28	Basin 18	OFP	7.0	1.2	1	5	10
	Basin 1	OFP	14.0	1.59	1	5	10
*	Basin 5	-	7.8	1.45	1	-	-
	Basin 5	OFP	7.7	1.45	1	5	10
27	Basin 22	CAT3	11.4	1.36	1	4	30
31	Basin 20	CAT3	15.0	1.17	1	4	30
29	Basin 17	CAT3	17.6	1.15	1	4	30
17		CAT3	2.3	4.65	5	1	25
16	Basin 27	OFP	8.7	1.64	1	5	10
23	Basin 29	CAT3	4.5	2.07	3	1	25
24	Basin 29	OFP	7.7	1.3	1	5	10
25		CAT3	4.5	4.44	5	2	25
15	Basin 25	CAT3	11.7	2.39	3	1	25
22	Basin 29	CAT3	10.3	2.39	3	2	25

**This channel is no longer required due to the 20ha headwater criterion eliminating the requirement for an overland flowpath. Instead a trunk drainage system would connect to Basins 5 & 35.*

The locations of the 20 overland flowpaths / Category 3 streams are presented in **Figure 7-2**. It is noted that the map is indicative and stream centre lines should be offset during the planning process to achieve adequate widths for the overland flow requirements.

8 Water Sensitive Urban Design

The WSUD strategy includes treatment of water quality with biofilters placed in the floor of retarding basins for the majority of subcatchments in the Precincts. During the development of the ILP various sub-catchments could not be drained to a retarding basin with a biofilter. As a result, in the draft Precinct Plan no water quality treatment was nominated for those catchments and indicative land take requirements for alternative treatment measures were provided in the Austral and Leppington North Precincts WSUD report dated July 2011.

Since exhibition, both Camden Council and Liverpool City Council have indicated a preference for water quality to be treated in these catchments using more centralised biofilter basins for sub-catchments with residential land uses. The overall footprint of biofilter and the strategy to meet the water quality objectives may comprise the installation of a single or multiple biofiltration devices within each sub-catchment. **Figure 8-1** outlines all catchments within the Precinct not draining to sub-regional biofilters located within basins. Note that where commercial/retail, business and industrial land uses are found, WSUD would be provided on a lot scale. Stormwater from the public domain would be captured in biofiltration measures located in road reserves and other paved areas. It is recommended that street trees and raingardens would be the most appropriate measures for this application.

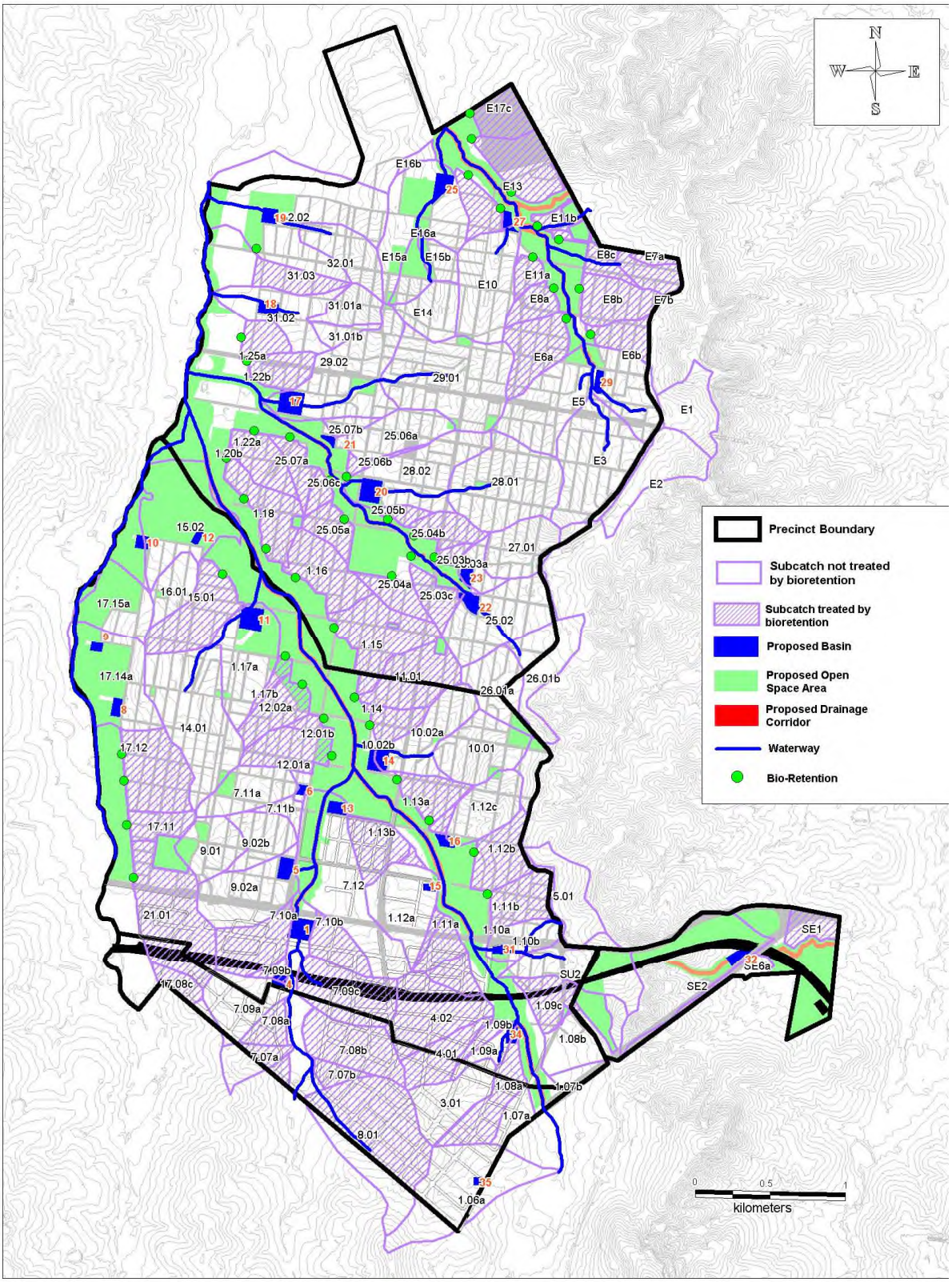
An assessment of each sub-catchment has been undertaken using MUSIC and the total bioretention area requirements for sub-catchments no draining to basins are summarised in **Table 8-1**.

Table 8-1: Bioretention Area for Subcatchments not draining to a Basin

Catchment Reference	Treatment Area (ha)	Bioretention Footprint (m^2)	Catchment Reference	Treatment Area (ha)	Bioretention Footprint (m^2)
1.14	6.95	208	7.07b	2.85	142.3
1.15	22.96	689	7.08b	3.85	192.4
1.16	16.40	492	7.09a	3.94	197
1.18	14.95	448	7.09b	0.93	46.3
4.01	2.30	115.2	7.09c	4.32	215.9
4.02	4.85	242.3	7.10a	3.37	168.6
8.01	9.31	465.4	7.10b	2.65	132.5
11.01	18.68	560	7.11b	2.02	101
15.01	20.56	617	E11a	5.01	150
17.11	7.26	218	E11b	3.48	104
17.12	22.18	665	E13	24.84	745
21.01a	20.80	1040	E16b	1.20	60
21.01b	5.28	264	E17c	5.86	293
31.03	5.28	264	E6a	9.38	469
1.07a	3.34	167	E6b	4.78	239
1.07b	2.08	104	E7a	1.08	54
1.08b	9.70	485	E7b	4.36	218
1.09c	9.63	481.5	E8a	3.94	197
1.10a	2.28	114.2	E8b	8.26	413
1.11a	1.66	83.1	E8c	2.98	149
1.11b	12.80	640	SE1	3.90	195
1.12b	10.84	542	SE6a	1.94	97
1.13a	5.66	283	E17d	0.28	13.83
1.13b	11.70	585	E17c	0.24	12.05
1.17b	0.76	38	E18	0.28	14.06
1.20b	0.26	13	SE5	0.07	3.26
1.22a	6.66	333			
1.22b	5.26	263			
1.25a	3.96	198			
12.01a	6.80	340			
12.01b	1.04	52			
12.02a	5.46	273			
17.08c	3.34	167			
25.03b	1.99	60			
25.03c	7.13	214			
25.04a	7.04	211			
25.04b	7.99	240			
25.05a	7.30	219			
25.05b	2.79	84			
25.06b	2.32	69			
25.06c	3.11	93			
25.07a	6.09	183			
25.07b	1.84	92			

Highlighted Areas Indicate the Road Area of a Commercial/Industrial Land Use Catchment in LTC where biofiltration could be provided in the public domain in concert with lot based measures

Figure 8-1: Bioretention Locations for Subcatchments Not Draining to Basins



Note – Where bioretention locations are not shown, the strategy allows for biofiltration within the road reserve in the form of raingardens and street trees.

Potential locations for the biofilters have been reviewed and are shown in **Figure 8-1.** It is noted that these locations are based on existing topography and the land use layout given in the Final ILP. Bioretention basins will require outlet pipe connections to the stormwater network or nearest open channel to convey treated flows. Refinement of the biofilter configuration, location and layout is expected to occur during future stages of the detailed design.

9 LTC DCP Recommendations

9.1 WSUD

A specific DCP is proposed for the Leppington Town Centre to control development in a manner that reflects the strategy outlined above. Recommendations and provisions for the DCP are outlined below:

9.1.1 Objectives

- To ensure an integrated approach to water cycle management through the use of water sensitive urban design principles and to replicate, as far as possible, existing hydrology so that there is minimal impact on flood behaviour and stability of existing watercourses;
- To integrate stormwater controls into the private domain to mimic the natural water cycle and improve the amenity of commercial, business, retail and industrial zones;
- To encourage the use of green roofs so that air quality, ambient air temperature, aesthetics and the quality of roof runoff is improved;
- To include stormwater controls in passive open spaces and the riparian corridor to optimise water management and recreation uses;
- To Apply a “green engineering” approach to the structural elements of stormwater controls to increase visual amenity and to enhance the landscape; and
- To as far as possible consolidate stormwater quality and quantity controls into sub-regional facilities in order to manage construction and maintenance costs and to rationalise the land take for water management measures.

9.1.2 Guiding principles/documents

- *Growth Centres Development Code,* NSW Government Growth Centres Commission (2006)
- *Evaluating Options for WSUD – A National Guide,* Prepared by the Joint Steering Committee for Water Sensitive Cities (2009)
- *Managing Urban Stormwater – Environmental Targets,* Sydney Metro CMA (2007)
- *Camden Council Engineering Design Specification* (2009)
- *Camden Council DCP 2011 – Environmental Management*
- Camden Council’s *Building in Saline Prone Environments Policy*
- Camden Council’s *Flood Policy*
- *Upper South Creek Floodplain Development Matrix*

9.1.3 Provisions

Green Roofs

(1) New buildings having a footprint of greater than 2,000m^2 are encouraged to consider the installation of part or all of it's roof as a green roof;

(2) Any garden beds in the roof area should to be planted with native plants (preferably endemic to the Leppington region) in a suitable depth of soil to sustain the species selected; and

(3) A detailed landscape plan of the roof design is to be provided with the development application.

Stormwater Management

(1) Development is to undertake a Stormwater Quality Assessment to demonstrate that the development will meet the following post-development pollutant reduction targets:

- Litter and vegetation larger than 5 mm: 90% reduction on the Benchmark Average Annual Gross Pollutant Load;
- Total Suspended Solids: 85% reduction on the Benchmark Average Annual TSS Pollutant Load;
- Total Phosphorous: 65% reduction on the Benchmark Average Annual TP Pollutant Load; and
- Total Nitrogen: 45% reduction on the Benchmark Average Annual TN Pollutant Load.

The Benchmark Average Annual Pollutant Load is defined as the average annual Post-development pollutant load that would be discharged from the site in the absence of stormwater or rainwater harvesting and reuse or of any treatment measures.

(2) The Stormwater Quality Assessment is to be prepared by a suitably qualified engineer with experience in WSUD and include:

- Estimation of the Benchmark Average Annual Pollutant Loads and the assessment of the performance of the nominated WSUD measures using an industry standard water quality modeling package;
- The design of WSUD devices used to achieve the post-development pollutant load standards; and
- Maintenance schedules of any proposed WSUD device that requires maintenance and/or full replacement including the likely recycling disposal location of any wastes that may be generated.

WSUD measures could include (but are not limited to) rainwater and / or stormwater harvesting and re-use, street tree bioretention systems, rain garden bioretention systems, bioretention swale systems and gross pollutant traps. Swales and constructed wetlands are not recommended in the Leppington Town Centre.

(3) Where filtration and bio-retention measures are proposed, they are to be designed to capture, filter and provide temporary storage of stormwater prior to drainage to the drainage system and/or a local drainage line or watercourse;

(4) Development proposals for commercial and industrial zones where HAZCHEM and liquid waste would be stored / produced on-site are to capture all site generated runoff up to the 3 month ARI event within a purpose built device such as a grease trap or retention tank/basin. The device must reduce the risk of runoff polluted by contaminants deposited or spilled on the site from being discharged to the receiving environment. The critical duration storm for the property and the 24 hour duration storm should be analysed; and

(5) Drainage and waste disposal from commercial and industrial zones is to be conducted to the levels specified by the NSW Environmental Protection Authority.

On-site Detention

(1) The maximum post-development discharge from the site shall not exceed the pre-development flows for the 2 year and 100 year ARI for the critical duration storm duration under pre-development conditions. The critical duration is to be determined through an examination of a full range of design storms durations;

(2) The stormwater drainage system (including surface grades, gutters, pipes, surface drains and overland flowpaths) for the property must:

- Be able to collect and convey all site runoff to the OSD system in a 100-year ARI event in the post-development critical storm; and
- Ensure that the all runoff from any upstream properties bypasses the OSD storage. in all storms up to and including the 100-year ARI event.

The required OSD storage can be achieved through either below ground or above ground storage or a combination of below ground and above ground storage and ideally should be integrated with other WSUD measures where possible. Any above ground storage is to be designed in such a manner that public safety and the integrity of property is not compromised and it does not interfere with overland flowpaths or adversely affect flood behavior.

(3) The duration of the stream forming flow under post development conditions should be less than 3.5 to 5 times the duration under existing conditions. The stream forming flow is 50% of the peak 2-year flow rate estimated under pre-development conditions. The hydrograph of the OSD outlet shall be used to estimate the stream forming flow under post-development conditions.

The required upper and lower limits for sizing the OSD shall be informed by the following:

Table 9-1: On Site Detention SSR and PSD Sizing Limits

2yr ARI SSR (m^3/ha)	2yr ARI PSD (l/s/ha)	100yr ARI SSR (m^3/ha)	100yr ARI PSD (l/s/ha)
300	30	594	170

- All above-ground OSD basins and below ground OSD tanks shall be located outside any overland flow paths;
- Below-ground OSD tanks will be approved for commercial and industrial developments only with an approved mesh screen and a minimum orifice outlet diameter of 25 mm;
- Discharge from above-ground OSD basins during storms in excess of the adopted pipe system capacity, shall be via a weir designed to have a maximum depth of flow of 150 mm in a 100 year ARI storm;
- All above-ground OSD basin outlets and below-ground OSD tank orifices shall be protected by a screening device to minimise blockage;
- An emergency overland flow path shall be provided for all OSD system in case of extremely large flows or blockage of OSD outlet; and
- All stormwater must drain by gravity to an approved drainage system. Discharge by use of mechanical pump system, or pressurised lines, is not allowed.

Specific Requirements

A local drainage management plan is required with each development application. This management plan is to be prepared by a suitably qualified engineer with experience in drainage design and WSUD. The plan is to assess the site drainage requirements for the proposed development, and prepare the required site drainage plan in accordance with the provisions of this DCP. Specifically the plan must address:

- The hydrology of the site and its relationship to the drainage system;
- Drainage system design;
- WSUD device design;
- The distribution of soil types and any measures to prevent infiltration in sodic soils;
- Any expected rise in ground water level due to development;
- The role of the principal landscape components (including any green roofs) on the site for water conservation and on-site detention;
- Details of any on-site stormwater detention and retention, including the collection of water for re-use;

- How any detrimental impacts on the hydrology and water quality of the receiving environment are proposed to be minimised;
- Consideration of suitable methods to manage salinity; and
- Integration of stormwater management devices and open spaces.

9.2 Water Harvesting and Reclaimed Water

The main objective of water harvesting and the use of reclaimed water is to reduce the use of potable water within the Town Centre. The capture and reuse of rainwater and stormwater provides significant environmental benefits for local waterways including Bonds Creek, Kemps Creek and Scalibrini Creek through the reduction of pollutant loads, runoff volumes and flow rates.

Both rainwater and stormwater harvesting are being considered at the Growth Centre with potential uses as follows:

Rainwater Harvesting

Rainwater harvesting is typically implemented on residential properties with collection of roof runoff in an above-ground tank with reuse for garden watering and/or toilet flushing. There is scope to include rainwater harvesting tanks as part of LTC medium density residential and mixed use development.

Greywater Harvesting

Greywater harvesting on residential properties collects wastewater from showers, baths, washing machines and dishwashers with its reuse for the purpose of garden watering. This is mostly applicable to low density residential land use and would not be included in LTC.

Stormwater Harvesting

Stormwater harvesting involves the harvesting of stormwater runoff generated from roads and pavements and landscaped areas /open space in the public domain for reuse for the purpose of public space irrigation. The harvested stormwater contains greater levels of pollutants than roof runoff and stormwater treatment is typically required prior to reuse.

There is great potential for stormwater harvesting within the LTC given the predominant commercial and industrial land uses. Reuse options include irrigation of nearby parks and public open space.

The integration of stormwater harvesting measures into the on-site detention systems proposed for LTC is possible and should be investigated at the design stage.

9.3 Guiding Documents

- *Growth Centres Development Code*, NSW Government Growth Centres Commission (2006);
- *Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 2) – Stormwater Harvesting and Reuse*, National Water Quality Management Strategy (2009);

- *Camden Council Engineering Design Specification* (2009)

9.4 Provisions

Recommended provisions for water harvesting and the use of reclaimed water are outlined as follows:

- Development proposals that propose to capture and to reuse runoff from paved surfaces for irrigation and/or wash down purposes are to incorporate treatment measures into the development to ensure that the harvested water is fit for purpose and that contaminants such as litter, sediment and oil are captured prior to re-use;

- Where possible, water used for irrigation of public and private open space is to be drawn from reclaimed water or harvested rainwater sources;

- Where stormwater harvesting is proposed for irrigation of passive and active open spaces, the design and management of such systems is to be undertaken in accordance with the NWQMS Australian Guidelines for Stormwater Harvesting (2009). All harvested stormwater must be treated prior to re-use to be 'fit for purpose'.

- Rainwater harvested from a roof and stored in rainwater tanks can be used for toilet flushing, laundry uses, car washing, swimming pools, water features, irrigation and as a source of cooling tower make-up water;

- For residential development rainwater storage is required to harvest rainwater from rooves to supply garden watering, toilet flushing and laundry as a minimum. Efficiency of supply to meet the demands is to be 90% i.e. reclaimed water will supply the non-potable demands (toilet flushing and laundry) 90% of the time;

- Where possible, rainwater tanks should be installed for all non-residential developments, including major alterations and additions, and plumbed to appropriate end uses;

- Any proposed rainwater tank should be:

  (a) Equipped with a 'first flush' diversion system to exclude the initial wash-off (first 5mm of rainfall) from a roof;
  (b) Connected to toilet, laundry and /or garden irrigation fixtures;
  (c) Provided with screens on inlets and overflows to reduce mosquito risk;
  (d) Where a tank is used for toilet flushing or other indoor uses it is to have a low level float valve to allow top-up from the mains supply in order to maintain a small residual volume in the bottom of the tank; and
  (e) Provide an appropriate air gap in accordance with Sydney Water requirements;

  The following preventative measures may assist with ensuring rainwater contamination does not occur:

- Ensuring the roof area draining to rainwater tanks do not have overhanging vegetation such as tree branches which provide roosting points for birds and can provide access for small animals such as rodents, cats and possums;
- Preventing access by small animals and birds into rainwater tanks by screening all tank inlets and overflows, keeping access hatches closed and by maintaining the integrity of tank rooves;
- Preventing the entry of surface runoff from areas other than the roof catchment into below-ground tanks. Rooves should be secure and the sides and bottom of tanks should be sealed to prevent ingress;

- Rainwater tanks are to be designed, installed and operated in accordance with:

  (a) NSW Health Guideline - Rainwater Tanks Where a Public Water Supply is Available - Use of (GL2007_009) June 2007;
  (b) Sydney Water Guidelines for Rainwater Tanks on Residential Properties where it is on a residential property;
  (c) Australian Standard 3500: Plumbing; and
  (d) Sydney Water's Backflow Prevention Policy and the New South Wales Code of Practice: Plumbing and Drainage where it is on a non-residential property, and;

- Recycled water schemes for development that is not a single residential dwelling are to be designed and operated in accordance with NWQMS Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (2006).

Specific Requirements

- Details of rainwater and stormwater harvesting are to be included in the local drainage management plan with each development application.
- A risk management would be required for stormwater harvesting and effluent recycling schemes in accordance with the NWQMS.

10 References

Camden Council *(2009) Engineering Design Specification*

Camden Council *DCP 2011 – Environmental Management*

Cardno 2011 *Austral Leppington North Flooding and Riparian Assessment*

John Holland (2011) *Glenfield to Leppington Rail Line, Flood Study*, Issue B

Joint Steering Committee for Water Sensitive Cities (2009) *Evaluating Options for WSUD – A National Guide*

Lyall & Associates (2011) *Bringelly Road Upgrade REF Vol 2, Initial Assessment of Drainage Requirements*

National Water Quality Management Strategy (2009) *Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 2) – Stormwater Harvesting and Reuse*

NSW Government Growth Centres Commission (2006) *Growth Centres Development Code*

Sydney Metro CMA (2007) *Managing Urban Stormwater – Environmental Targets*

Appendix A

Hydrology

Table C.1 HydrologicaL Sub-catchments Peak Flows

2 year ARI Peak Flow (m^3/s)								
Developed Node ID	Developed 2yr 9hr	Developed 2yr 12hr	Developed Critical Duration (hrs)	Developed Critical Peak Flow (m3/s)	Existing Node ID	Existing Critical Duration (hrs)	Existing Critical Peak Flow (m3/s)	Difference (Developed Less Exist) (m3/s)
1.01	5.76	5.82	12hr	5.82	1.01	12hr	1.81	4.00
1.02	9.59	9.67	12hr	9.67	1.02	12hr	3.25	6.42
1.03	19.78	19.72	9hr	19.78	1.03	12hr	6.12	13.67
1.04	21.82	20.77	9hr	21.82	1.04	12hr	7.13	14.68
1.05	25.07	22.92	9hr	25.07	1.05	12hr	8.69	16.38
1.14	0.41	0.42	12hr	0.42	1.14	18hr	0.11	0.31
1.15	1.23	1.27	12hr	1.27	1.15	12hr	0.75	0.52
1.16	1.07	1.10	12hr	1.10	1.16	12hr	0.55	0.55
1.18	1.03	1.04	12hr	1.04	1.18	18hr	0.34	0.70
1.21	2.27	2.30	12hr	2.30	1.21	12hr	0.79	1.51
1.23	0.94	0.95	12hr	0.95	1.23	12hr	0.30	0.65
1.24	0.88	0.89	12hr	0.89	1.24	18hr	0.22	0.66
1.26	0.29	0.43	12hr	0.43	1.26	12hr	0.43	0.00
1.27	52.35	58.73	12hr	58.73	1.27	18hr	55.74	2.99
1.28	53.57	59.35	12hr	59.35	1.28	18hr	56.43	2.92
2.01	9.32	9.41	12hr	9.41	2.01	18hr	2.61	6.80
3.01	0.79	0.82	12hr	0.82	3.01	12hr	0.43	0.40
4.01	0.59	0.60	12hr	0.60	4.01	12hr	0.31	0.28
4.02	1.82	1.83	12hr	1.83	4.02	12hr	0.85	0.98
5.01	0.17	0.24	12hr	0.24	5.01	12hr	0.24	0.00
7.01	1.04	1.06	12hr	1.06	7.01	12hr	0.46	0.60
7.02	4.17	4.20	12hr	4.20	7.02	12hr	1.55	2.65
7.03	7.37	7.42	12hr	7.42	7.03	12hr	2.79	4.62
7.04	8.88	8.85	9hr	8.88	7.04	12hr	3.43	5.44
7.05	11.12	11.31	12hr	11.31	7.05	12hr	4.53	6.79
7.06	12.43	12.10	9hr	12.43	7.06	12hr	5.03	7.40
7.12	1.19	1.19	12hr	1.19	7.12	18hr	0.59	0.60
8.01	1.49	1.50	12hr	1.50	8.01	12hr	0.85	0.65
9.01	0.68	0.70	12hr	0.70	9.01	12hr	0.34	0.36
10.01	1.01	1.04	12hr	1.04	10.01	12hr	0.52	0.51
11.01	0.96	0.98	12hr	0.98	11.01	12hr	0.48	0.51
14.01	1.91	1.94	12hr	1.94	14.01	12hr	0.83	1.11
15.01	1.04	1.06	12hr	1.06	15.01	12hr	0.46	0.60
15.02	0.96	0.99	12hr	0.99	15.02	12hr	0.60	0.39
16.01	0.47	0.48	12hr	0.48	16.01	12hr	0.22	0.26
17.01	1.03	1.05	12hr	1.05	17.01	12hr	0.47	0.58
17.02	3.34	3.38	12hr	3.38	17.02	12hr	1.33	2.05
17.03	7.84	7.88	12hr	7.88	17.03	12hr	2.69	5.19
17.04	11.58	11.68	12hr	11.68	17.04	12hr	3.98	7.70
17.06	14.51	14.04	9hr	14.51	17.06	12hr	5.10	9.41
17.07	16.44	15.87	9hr	16.44	17.07	12hr	5.96	10.48
17.09	1.53	1.54	12hr	1.54	17.09	18hr	0.46	1.08
17.11	0.46	0.47	12hr	0.47	17.11	12hr	0.23	0.24
17.12	1.23	1.25	12hr	1.25	17.12	12hr	0.51	0.73
17.13	0.94	0.95	12hr	0.95	17.13	12hr	0.29	0.66
17.16	20.77	20.42	9hr	20.77	17.16	12hr	16.86	3.90
18.01	1.83	1.86	12hr	1.86	18.01	12hr	0.77	1.09
18.02	2.79	2.83	12hr	2.83	18.02	12hr	1.21	1.62
20.01	1.37	1.39	12hr	1.39	20.01	12hr	0.59	0.80
22.01	2.47	2.49	12hr	2.49	22.01	12hr	0.79	1.70
23.01	0.98	0.99	12hr	0.99	23.01	12hr	0.33	0.65
24.01	1.33	1.34	12hr	1.34	24.01	12hr	0.52	0.82
24.02	3.29	3.31	12hr	3.31	24.02	12hr	1.19	2.13

100 year ARI Peak Flow (m^3/s)								
Developed Node ID	Developed 100yr 9hr	Developed 100yr 12hr	Developed Critical Duration (hrs)	Developed Critical Peak Flow (m3/s)	Existing Node ID	Existing Critical Duration (hrs)	Existing Critical Peak Flow (m3/s)	Difference (Developed Less Exist) (m3/s)
1.01	15.12	16.31	12hr	16.31	1.01	9hr	9.31	6.99
1.02	25.25	27.26	12hr	27.26	1.02	9hr	16.25	11.00
1.03	51.73	55.36	12hr	55.36	1.03	9hr	31.71	23.65
1.04	57.74	59.02	12hr	59.02	1.04	9hr	36.39	22.64
1.05	67.31	66.18	9hr	67.31	1.05	9hr	43.79	23.52
1.14	1.10	1.20	12hr	1.20	1.14	12hr	0.71	0.49
1.15	4.23	4.76	12hr	4.76	1.15	9hr	3.56	1.20
1.16	3.20	3.49	12hr	3.49	1.16	12hr	2.65	0.84
1.18	2.90	3.20	12hr	3.20	1.18	9hr	1.87	1.33
1.21	6.05	6.54	12hr	6.54	1.21	9hr	3.87	2.67
1.23	2.47	2.68	12hr	2.68	1.23	9hr	1.56	1.12
1.24	2.21	2.39	12hr	2.39	1.24	12hr	1.20	1.20
1.26	2.30	2.22	9hr	2.30	1.26	9hr	2.30	0.00
1.27	216.33	223.88	12hr	223.88	1.27	9hr	251.85	-27.97
1.28	218.18	226.20	12hr	226.20	1.28	9hr	253.48	-27.28
2.01	23.87	25.83	12hr	25.83	2.01	9hr	13.58	12.26
3.01	2.04	2.19	12hr	2.19	3.01	12hr	2.08	0.11
4.01	1.41	1.48	12hr	1.48	4.01	12hr	1.51	-0.03
4.02	4.32	4.55	12hr	4.55	4.02	12hr	4.08	0.47
5.01	1.27	1.19	9hr	1.27	5.01	9hr	1.27	0.00
7.01	2.90	3.13	12hr	3.13	7.01	9hr	2.23	0.90
7.02	11.07	12.02	12hr	12.02	7.02	9hr	7.55	4.47
7.03	19.47	21.16	12hr	21.16	7.03	9hr	13.43	7.73
7.04	23.63	25.16	12hr	25.16	7.04	9hr	16.65	8.51
7.05	30.30	32.50	12hr	32.50	7.05	9hr	21.98	10.52
7.06	34.08	34.94	12hr	34.94	7.06	9hr	24.72	10.22
7.12	2.76	2.92	12hr	2.92	7.12	9hr	3.03	-0.11
8.01	3.49	3.69	12hr	3.69	8.01	9hr	4.09	-0.40
9.01	1.96	2.11	12hr	2.11	9.01	12hr	1.66	0.45
10.01	2.92	3.13	12hr	3.13	10.01	12hr	2.53	0.60
11.01	2.74	2.94	12hr	2.94	11.01	12hr	2.32	0.62
14.01	5.40	5.88	12hr	5.88	14.01	9hr	3.96	1.92
15.01	3.25	3.59	12hr	3.59	15.01	9hr	2.36	1.23
15.02	3.61	4.06	12hr	4.06	15.02	9hr	3.20	0.86
16.01	1.30	1.41	12hr	1.41	16.01	12hr	1.06	0.35
17.01	2.88	3.11	12hr	3.11	17.01	12hr	2.27	0.85
17.02	9.02	9.78	12hr	9.78	17.02	9hr	6.38	3.40
17.03	20.48	22.16	12hr	22.16	17.03	9hr	13.51	8.65
17.04	30.30	32.90	12hr	32.90	17.04	9hr	20.07	12.83
17.06	38.49	39.53	12hr	39.53	17.06	9hr	26.00	13.53
17.07	44.19	45.13	12hr	45.13	17.07	9hr	30.28	14.85
17.09	3.98	4.31	12hr	4.31	17.09	9hr	2.42	1.89
17.11	1.51	1.69	12hr	1.69	17.11	9hr	1.17	0.52
17.12	3.60	3.94	12hr	3.94	17.12	9hr	2.52	1.42
17.13	2.48	2.70	12hr	2.70	17.13	9hr	1.54	1.16
17.16	76.74	70.26	9hr	76.74	17.16	9hr	82.84	-6.10
18.01	5.03	5.43	12hr	5.43	18.01	9hr	3.66	1.78
18.02	7.69	8.32	12hr	8.32	18.02	9hr	5.77	2.55
20.01	3.78	4.10	12hr	4.10	20.01	9hr	2.82	1.29
22.01	6.50	7.02	12hr	7.02	22.01	9hr	4.00	3.02
23.01	2.61	2.82	12hr	2.82	23.01	9hr	1.71	1.11
24.01	3.59	3.89	12hr	3.89	24.01	9hr	2.52	1.37
24.02	8.70	9.41	12hr	9.41	24.02	9hr	5.84	3.57

2 year ARI Peak Flow (m^3/s)								
Developed Node ID	Developed 2yr 9hr	Developed 2yr 12hr	Developed Critical Duration (hrs)	Developed Critical Peak Flow (m3/s)	Existing Node ID	Existing Critical Duration (hrs)	Existing Critical Peak Flow (m3/s)	Difference (Developed Less Exist) (m3/s)
24.03	4.80	4.85	12hr	4.85	24.03	12hr	1.78	3.07
24.04	5.58	5.34	9hr	5.58	24.04	12hr	2.19	3.40
24.05	6.57	6.30	9hr	6.57	24.05	12hr	2.71	3.86
24.06	7.71	7.29	9hr	7.71	24.06	12hr	3.22	4.49
25.01	0.26	0.38	12hr	0.38	25.01	12hr	0.37	0.00
25.02	2.06	2.10	12hr	2.10	25.02	12hr	1.25	0.85
27.01	0.89	0.95	12hr	0.95	27.01	12hr	0.73	0.22
28.01	1.76	1.78	12hr	1.78	28.01	12hr	0.72	1.07
28.02	2.92	2.94	12hr	2.94	28.02	12hr	1.22	1.72
29.01	2.18	2.21	12hr	2.21	29.01	12hr	0.84	1.36
29.02	3.51	3.53	12hr	3.53	29.02	12hr	1.41	2.12
30.01	1.22	1.24	12hr	1.24	30.01	12hr	0.52	0.72
30.02	3.37	3.41	12hr	3.41	30.02	12hr	1.30	2.11
31.02	1.78	1.81	12hr	1.81	31.02	12hr	0.67	1.14
32.01	0.70	0.72	12hr	0.72	32.01	12hr	0.36	0.36
32.02	2.40	2.43	12hr	2.43	32.02	12hr	1.14	1.29
1.06a	0.00	0.00	12hr	0.00	1.06a	12hr	0.72	-0.72
1.06b	27.49	24.24	9hr	27.49	1.06b	12hr	9.78	17.71
1.07a	0.00	0.00	12hr	0.00	1.07a	12hr	0.33	-0.33
1.07b	0.57	0.83	12hr	0.83	1.07b	12hr	0.82	0.01
1.08a	0.00	0.00	12hr	0.00	1.08a	12hr	0.37	-0.37
1.08b	0.83	0.87	12hr	0.87	1.08b	12hr	0.52	0.34
1.09a	0.79	0.82	12hr	0.82	1.09a	12hr	0.55	0.27
1.09b	0.00	0.00	12hr	0.00	1.09b	12hr	0.15	-0.15
1.09c	0.61	0.63	12hr	0.63	1.09c	12hr	0.36	0.28
1.10a	11.50	12.69	12hr	12.69	1.10a	12hr	14.02	-1.32
1.10b	1.20	1.19	9hr	1.20	1.10b	12hr	0.74	0.46
1.11a	0.42	0.43	12hr	0.43	1.11a	12hr	0.21	0.21
1.11b	0.65	0.68	12hr	0.68	1.11b	12hr	0.42	0.26
1.12a	0.90	0.91	12hr	0.91	1.12a	12hr	0.49	0.42
1.12b	12.56	13.73	12hr	13.73	1.12b	12hr	15.81	-2.08
1.12c	0.79	0.80	12hr	0.80	1.12c	12hr	0.37	0.44
1.13a	0.55	0.57	12hr	0.57	1.13a	12hr	0.32	0.24
1.13b	0.00	0.00	12hr	0.00	1.13b	12hr	0.42	-0.42
1.17a	2.68	2.72	12hr	2.72	1.17a	12hr	1.29	1.42
1.17b	0.19	0.26	12hr	0.26	1.17b	12hr	0.25	0.00
1.20a	0.12	0.16	12hr	0.16	1.20a	12hr	0.16	0.00
1.20b	0.09	0.12	12hr	0.12	1.20b	12hr	0.12	0.01
1.22a	0.63	0.64	12hr	0.64	1.22a	30min	0.34	0.30
1.22b	0.46	0.47	12hr	0.47	1.22b	30min	0.14	0.33
1.25a_Com	0.31	0.31	12hr	0.31	1.25a	18hr	0.22	0.09
1.25a_Rest	0.24	0.25	12hr	0.25				0.25
1.25b	3.87	3.88	12hr	3.88	1.25b	12hr	1.44	2.44
10.02a	1.94	1.98	12hr	1.98	10.02a	12hr	0.97	1.01
10.02b	0.08	0.09	12hr	0.09	10.02b	12hr	0.09	0.00
12.01a	9.86	10.29	12hr	10.29	12.01a	12hr	10.01	0.27
12.01b	0.16	0.21	12hr	0.21	12.01b	12hr	0.20	0.01
12.02a	0.51	0.53	12hr	0.53	12.02a	12hr	0.29	0.24
12.02b	0.05	0.06	12hr	0.06	12.02b	12hr	0.06	0.00
17.08a	0.88	0.89	12hr	0.89	17.08a	12hr	0.37	0.52
17.08b	0.52	0.53	12hr	0.53	17.08b	12hr	0.24	0.29
17.08c_Com	0.34	0.34	12hr	0.34	17.08c	12hr	0.35	-0.01
17.08cRest	1.34	1.36	12hr	1.36				1.36
17.08d	0.05	0.05	12hr	0.05	17.08d	12hr	0.03	0.03

100 year ARI Peak Flow (m^3/s)								
Developed Node ID	Developed 100yr 9hr	Developed 100yr 12hr	Developed Critical Duration (hrs)	Developed Critical Peak Flow (m3/s)	Existing Node ID	Existing Critical Duration (hrs)	Existing Critical Peak Flow (m3/s)	Difference (Developed Less Exist) (m3/s)
24.03	12.65	13.77	12hr	13.77	24.03	9hr	8.74	5.02
24.04	15.03	15.34	12hr	15.34	24.04	9hr	10.65	4.70
24.05	18.02	18.33	12hr	18.33	24.05	9hr	13.11	5.22
24.06	21.37	21.04	9hr	21.37	24.06	9hr	15.69	5.68
25.01	1.87	1.89	12hr	1.89	25.01	9hr	1.84	0.05
25.02	6.98	7.86	12hr	7.86	25.02	9hr	6.04	1.82
27.01	3.59	4.07	12hr	4.07	27.01	9hr	3.51	0.56
28.01	4.75	5.13	12hr	5.13	28.01	9hr	3.45	1.68
28.02	8.06	8.80	12hr	8.80	28.02	9hr	5.92	2.87
29.01	5.78	6.23	12hr	6.23	29.01	9hr	4.02	2.21
29.02	9.63	10.51	12hr	10.51	29.02	9hr	6.90	3.62
30.01	3.35	3.64	12hr	3.64	30.01	9hr	2.51	1.12
30.02	9.06	9.81	12hr	9.81	30.02	9hr	6.25	3.56
31.02	3.68	4.00	12hr	4.00	31.02	9hr	3.30	0.70
32.01	2.02	2.16	12hr	2.16	32.01	12hr	1.76	0.40
32.02	7.57	8.44	12hr	8.44	32.02	9hr	5.71	2.73
1.06a	0.00	0.00	12hr	0.00	1.06a	9hr	3.46	-3.46
1.06b	74.41	70.70	9hr	74.41	1.06b	9hr	48.95	25.47
1.07a	0.00	0.00	12hr	0.00	1.07a	9hr	1.57	-1.57
1.07b	4.04	3.98	9hr	4.04	1.07b	9hr	3.95	0.09
1.08a	0.00	0.00	12hr	0.00	1.08a	9hr	1.78	-1.78
1.08b	2.91	3.23	12hr	3.23	1.08b	9hr	2.51	0.72
1.09a	2.04	2.19	12hr	2.19	1.09a	12hr	2.64	-0.45
1.09b	0.00	0.00	12hr	0.00	1.09b	12hr	0.72	-0.72
1.09c	1.99	2.18	12hr	2.18	1.09c	12hr	1.74	0.44
1.10a	59.64	53.11	9hr	59.64	1.10a	9hr	68.29	-8.65
1.10b	3.99	4.27	12hr	4.27	1.10b	9hr	3.53	0.75
1.11a	1.01	1.06	12hr	1.06	1.11a	12hr	1.04	0.03
1.11b	2.32	2.58	12hr	2.58	1.11b	12hr	2.11	0.47
1.12a	2.13	2.25	12hr	2.25	1.12a	12hr	2.41	-0.16
1.12b	63.58	56.51	9hr	63.58	1.12b	9hr	75.26	-11.68
1.12c	2.22	2.39	12hr	2.39	1.12c	12hr	1.80	0.59
1.13a	1.88	2.10	12hr	2.10	1.13a	9hr	1.58	0.52
1.13b	0.00	0.00	12hr	0.00	1.13b	9hr	2.07	-2.07
1.17a	8.00	8.81	12hr	8.81	1.17a	9hr	6.22	2.59
1.17b	1.24	1.29	12hr	1.29	1.17b	9hr	1.22	0.08
1.20a	0.77	0.76	9hr	0.77	1.20a	9hr	0.77	0.00
1.20b	0.59	0.63	12hr	0.63	1.20b	12hr	0.57	0.06
1.22a	1.81	2.04	12hr	2.04	1.22a	12hr	1.44	0.60
1.22b	1.24	1.37	12hr	1.37	1.22b	12hr	0.82	0.55
1.25a_Com	0.72	0.76	12hr	0.76	1.25a	9hr	1.17	-0.41
1.25a_Rest	1.03	1.15	12hr	1.15				1.15
1.25b	10.17	11.00	12hr	11.00	1.25b	9hr	6.99	4.01
10.02a	5.50	5.94	12hr	5.94	10.02a	12hr	4.59	1.35
10.02b	0.41	0.45	12hr	0.45	10.02b	12hr	0.45	0.00
12.01a	42.07	37.02	9hr	42.07	12.01a	9hr	48.33	-6.26
12.01b	0.95	1.02	12hr	1.02	12.01b	12hr	0.97	0.05
12.02a	1.69	1.87	12hr	1.87	12.02a	9hr	1.41	0.46
12.02b	0.30	0.30	12hr	0.30	12.02b	12hr	0.30	0.00
17.08a	2.41	2.61	12hr	2.61	17.08a	9hr	1.80	0.81
17.08b	1.44	1.56	12hr	1.56	17.08b	9hr	1.13	0.43
17.08c_Com	0.81	0.85	12hr	0.85	17.08c	9hr	1.71	-0.86
17.08cRest	3.48	3.74	12hr	3.74				3.74
17.08d	0.14	0.16	12hr	0.16	17.08d	12hr	0.13	0.02

2 year ARI Peak Flow (m^3/s)								
Developed Node ID	Developed 2yr 9hr	Developed 2yr 12hr	Developed Critical Duration (hrs)	Developed Critical Peak Flow (m3/s)	Existing Node ID	Existing Critical Duration (hrs)	Existing Critical Peak Flow (m3/s)	Difference (Developed Less Exist) (m3/s)
17.10a	0.70	0.71	12hr	0.71	17.10a	12hr	0.26	0.45
17.10b	1.09	1.11	12hr	1.11	17.10b	12hr	0.37	0.74
17.14a	0.98	1.01	12hr	1.01	17.14a	12hr	0.59	0.42
17.14b	0.75	0.77	12hr	0.77	17.14b	12hr	0.32	0.44
17.15a	0.73	0.74	12hr	0.74	17.15a	12hr	0.35	0.39
17.15b	0.25	0.28	12hr	0.28	17.15b	12hr	0.19	0.09
21.01_Com	1.58	1.58	12hr	1.58				1.58
21.01_Rest	0.53	0.54	12hr	0.54				0.54
25.03a	1.17	1.19	12hr	1.19	25.03a	12hr	0.85	0.34
25.03b	0.13	0.16	12hr	0.16	25.03b	12hr	0.13	0.03
25.03c	0.38	0.39	12hr	0.39	25.03c	12hr	0.19	0.21
25.04a	0.76	0.77	12hr	0.77	25.04a	12hr	0.30	0.47
25.04b	0.46	0.47	12hr	0.47	25.04b	12hr	0.23	0.24
25.05a	0.49	0.50	12hr	0.50	25.05a	12hr	0.20	0.29
25.05b	0.18	0.19	12hr	0.19	25.05b	12hr	0.14	0.05
25.06a	0.77	0.78	12hr	0.78	25.06a	12hr	0.30	0.48
25.06b	0.47	0.48	12hr	0.48	25.06b	12hr	0.44	0.05
25.06c	0.14	0.16	12hr	0.16	25.06c	12hr	0.12	0.04
25.07a	0.42	0.43	12hr	0.43	25.07a	12hr	0.21	0.22
25.07b	0.14	0.20	12hr	0.20	25.07b	12hr	0.17	0.03
26.01a	0.76	0.78	12hr	0.78	26.01a	12hr	0.33	0.44
26.01b	0.28	0.39	12hr	0.39	26.01b	12hr	0.39	0.00
3.01Comm	0.34	0.35	12hr	0.35				0.35
31.03_Comm	0.44	0.44	12hr	0.44				0.44
31.03_Rest	0.29	0.30	12hr	0.30				0.30
					31.01a	12hr	0.23	
					31.01b	12hr	0.11	
33.01a	0.39	0.50	12.00	0.50	33.01a	12hr	0.43	0.07
33.01b	0.47	0.63	12.00	0.63	33.01b	12hr	0.55	0.08
7.07a	0.00	0.00	12.00	0.00	7.07a	12hr	0.20	-0.20
7.07b	0.20	0.20	12.00	0.20	7.07b	12hr	6.08	-5.88
7.08a	0.00	0.00	12.00	0.00	7.08a	12hr	0.22	-0.22
7.08b	0.98	0.98	12.00	0.98	7.08b	12hr	0.37	0.61
7.09a	0.85	0.86	12.00	0.86	7.09a	12hr	0.35	0.51
7.09b	0.05	0.05	12.00	0.05	7.09b	12hr	0.11	-0.06
7.09c	1.03	1.04	12.00	1.04	7.09c	12hr	0.43	0.61
7.10a	0.78	0.78	12.00	0.78	7.10a	18hr	0.25	0.53
7.10b	0.53	0.53	12.00	0.53	7.10b	12hr	0.21	0.32
7.11a	0.73	0.75	12.00	0.75	7.11a	12hr	0.34	0.41
7.11b	0.52	0.51	9.00	0.52	7.11b	12hr	0.45	0.08
9.02a	0.39	0.40	12.00	0.40	9.02a	12hr	0.46	-0.06
9.02b	1.27	1.29	12.00	1.29	9.02b	12hr	0.59	0.69
Al_Com_B18	0.97	0.98	12.00	0.98				0.98
DumB1	0.87	0.82	9.00	0.87				0.87
DumB10	0.36	0.36	12.00	0.36				0.36
DumB11	1.32	1.32	9.00	1.32				1.32
DumB12	0.60	0.61	12.00	0.61				0.61
DumB13	0.40	0.39	9.00	0.40				0.40
DumB14	1.01	0.94	9.00	1.01				1.01
DumB15	0.37	0.34	9.00	0.37				0.37
DumB16	0.38	0.36	9.00	0.38				0.38
DumB17	1.45	1.49	12.00	1.49				1.49
DumB18	1.23	1.11	9.00	1.23				1.23
DumB19	1.16	1.20	12.00	1.20				1.20

100 year ARI Peak Flow (m^3/s)								
Developed Node ID	Developed 100yr 9hr	Developed 100yr 12hr	Developed Critical Duration (hrs)	Developed Critical Peak Flow (m3/s)	Existing Node ID	Existing Critical Duration (hrs)	Existing Critical Peak Flow (m3/s)	Difference (Developed Less Exist) (m3/s)
17.10a	1.87	2.03	12hr	2.03	17.10a	9hr	1.29	0.74
17.10b	2.91	3.15	12hr	3.15	17.10b	9hr	1.91	1.24
17.14a	3.47	3.91	12hr	3.91	17.14a	9hr	2.87	1.04
17.14b	2.07	2.25	12hr	2.25	17.14b	9hr	1.56	0.69
17.15a	2.21	2.44	12hr	2.44	17.15a	9hr	1.72	0.72
17.15b	0.98	1.12	12hr	1.12	17.15b	9hr	0.90	0.22
21.01_Com	3.65	3.85	12hr	3.85				3.85
21.01_Rest	1.46	1.59	12hr	1.59				1.59
25.03a	4.30	4.84	12hr	4.84	25.03a	9hr	4.11	0.73
25.03b	0.64	0.72	12hr	0.72	25.03b	12hr	0.63	0.10
25.03c	1.13	1.24	12hr	1.24	25.03c	9hr	0.89	0.34
25.04a	2.11	2.31	12hr	2.31	25.04a	9hr	1.49	0.82
25.04b	1.40	1.56	12hr	1.56	25.04b	9hr	1.10	0.46
25.05a	1.37	1.50	12hr	1.50	25.05a	9hr	1.01	0.49
25.05b	0.72	0.83	12hr	0.83	25.05b	9hr	0.66	0.17
25.06a	2.03	2.21	12hr	2.21	25.06a	9hr	1.45	0.76
25.06b	2.14	2.22	12hr	2.22	25.06b	9hr	2.14	0.08
25.06c	0.58	0.65	12hr	0.65	25.06c	12hr	0.58	0.08
25.07a	1.26	1.40	12hr	1.40	25.07a	12hr	1.04	0.36
25.07b	0.81	0.90	12hr	0.90	25.07b	12hr	0.80	0.09
26.01a	2.11	2.29	12hr	2.29	26.01a	9hr	1.61	0.68
26.01b	1.90	1.89	9hr	1.90	26.01b	9hr	1.90	0.00
3.01Comm	0.82	0.86	12hr	0.86				0.86
31.03_Comm	1.01	1.07	12hr	1.07				1.07
31.03_Rest	1.21	1.36	12hr	1.36				1.36
					31.01a	12hr	1.10	
					31.01b	12hr	0.54	
33.01a	2.02	2.29	12.00	2.29	33.01a	12hr	2.13	0.16
33.01b	2.56	2.88	12.00	2.88	33.01b	12hr	2.72	0.16
7.07a	0.00	0.00	12.00	0.00	7.07a	12hr	0.94	-0.94
7.07b	0.48	0.50	12.00	0.50	7.07b	9hr	29.85	-29.35
7.08a	0.00	0.00	12.00	0.00	7.08a	9hr	1.04	-1.04
7.08b	2.29	2.42	12.00	2.42	7.08b	9hr	1.83	0.60
7.09a	2.03	2.15	12.00	2.15	7.09a	9hr	1.72	0.43
7.09b	0.11	0.12	12.00	0.12	7.09b	12hr	0.54	-0.42
7.09c	2.43	2.57	12.00	2.57	7.09c	9hr	2.12	0.44
7.10a	1.81	1.91	12.00	1.91	7.10a	9hr	1.33	0.57
7.10b	1.24	1.31	12.00	1.31	7.10b	9hr	1.09	0.23
7.11a	2.06	2.23	12.00	2.23	7.11a	12hr	1.65	0.58
7.11b	2.10	2.29	12.00	2.29	7.11b	12hr	2.21	0.08
9.02a	0.93	0.98	12.00	0.98	9.02a	9hr	2.25	-1.26
9.02b	3.52	3.83	12.00	3.83	9.02b	12hr	2.84	0.99
Al_Com_B18	2.31	2.43	12.00	2.43				2.43
DumB1	2.35	2.35	12.00	2.35				2.35
DumB10	1.73	1.73	12.00	1.73				1.73
DumB11	6.29	6.24	9.00	6.29				6.29
DumB12	3.27	3.22	9.00	3.27				3.27
DumB13	1.57	1.50	9.00	1.57				1.57
DumB14	4.37	4.56	12.00	4.56				4.56
DumB15	1.51	1.57	12.00	1.57				1.57
DumB16	1.72	1.79	12.00	1.79				1.79
DumB17	7.04	6.89	9.00	7.04				7.04
DumB18	3.24	3.28	12.00	3.28				3.28
DumB19	5.94	5.73	9.00	5.94				5.94

2 year ARI Peak Flow (m^3/s)								
Developed Node ID	Developed 2yr 9hr	Developed 2yr 12hr	Developed Critical Duration (hrs)	Developed Critical Peak Flow (m3/s)	Existing Node ID	Existing Critical Duration (hrs)	Existing Critical Peak Flow (m3/s)	Difference (Developed Less Exist) (m3/s)
DumB2	0.00	0.00	12.00	0.00				0.00
DumB20	1.25	1.27	12.00	1.27				1.27
DumB21	0.31	0.31	12.00	0.31				0.31
DumB22	1.27	1.25	9.00	1.27				1.27
DumB23	0.82	0.81	9.00	0.82				0.82
DumB25	1.32	1.23	9.00	1.32				1.32
DumB27	0.60	0.58	9.00	0.60				0.60
DumB29	2.74	2.75	12.00	2.75				2.75
DumB3	0.48	0.43	9.00	0.48				0.48
DumB31	0.78	0.76	9.00	0.78				0.78
DumB32	1.05	0.94	9.00	1.05				1.05
DumB34	0.61	0.57	9.00	0.61				0.61
DumB35	0.00	0.00	12.00	0.00				0.00
DumB4	0.35	0.32	9.00	0.35				0.35
DumB5	0.66	0.66	12.00	0.66				0.66
DumB6	0.35	0.34	9.00	0.35				0.35
DumB7	0.54	0.50	9.00	0.54				0.54
DumB8	0.52	0.54	12.00	0.54				0.54
DumB9	0.60	0.60	12.00	0.60				0.60
Dummy1	9.18	10.21	12.00	10.21	Dummy1	12hr	10.42	-0.21
Dummy10	9.86	10.29	12.00	10.29	Dummy10	12hr	9.69	0.60
Dummy11	0.82	0.72	9.00	0.82	Dummy11	12hr	7.08	-6.26
Dummy12	5.51	5.81	12.00	5.81	Dummy12	12hr	6.25	-0.44
Dummy13	23.16	24.34	12.00	24.34	Dummy13	12hr	26.84	-2.50
Dummy14	23.68	25.30	12.00	25.30	Dummy14	12hr	27.50	-2.19
Dummy15	25.46	27.91	12.00	27.91	Dummy15	12hr	29.14	-1.23
Dummy16	26.43	29.16	12.00	29.16	Dummy16	12hr	30.20	-1.04
Dummy17	42.11	48.05	12.00	48.05	Dummy17	12hr	46.99	1.06
Dummy18	19.64	19.19	9.00	19.64	Dummy18	12hr	7.55	12.09
Dummy19	7.63	8.32	12.00	8.32	Dummy19	12hr	7.87	0.45
Dummy2	9.73	10.92	12.00	10.92	Dummy2	12hr	11.41	-0.48
Dummy20	11.07	11.44	12.00	11.44	Dummy20	12hr	10.01	1.43
Dummy21	16.37	15.60	9.00	16.37	Dummy21	12hr	12.71	3.66
Dummy22	2.37	2.36	9.00	2.37	Dummy22	12hr	2.40	-0.03
Dummy23	3.25	3.18	9.00	3.25	Dummy23	12hr	2.90	0.35
Dummy24	4.83	4.56	9.00	4.83	Dummy24	12hr	4.42	0.42
Dummy25	5.35	5.08	9.00	5.35	Dummy25	12hr	4.92	0.43
Dummy26	7.05	6.92	9.00	7.05	Dummy26	12hr	6.65	0.40
Dummy27	47.65	54.64	12.00	54.64	Dummy27	18hr	52.22	2.41
Dummy28	9.68	10.08	12.00	10.08	Dummy28	12hr	10.12	-0.04
Dummy29	1.21	1.25	12.00	1.25	Dummy29	12hr	0.69	0.56
Dummy3	10.00	11.22	12.00	11.22	Dummy3	12hr	12.05	-0.83
Dummy30	1.77	2.13	12.00	2.13	Dummy30	12hr	1.85	0.28
Dummy31	3.79	3.60	9.00	3.79	Dummy31	12hr	3.78	0.01
Dummy32	5.45	5.42	9.00	5.45	Dummy32	12hr	5.57	-0.13
Dummy33	11.42	12.73	12.00	12.73	Dummy33	12hr	12.77	-0.04
Dummy34	13.36	13.66	12.00	13.66	Dummy34	12hr	10.98	2.69
Dummy35	15.22	14.87	9.00	15.22	Dummy35	12hr	12.01	3.21
Dummy36	8.07	8.76	12.00	8.76	Dummy36	12hr	8.30	0.46
Dummy37	8.74	9.48	12.00	9.48	Dummy37	12hr	8.93	0.55
Dummy38	14.51	14.55	12.00	14.55	Dummy38	12hr	11.73	2.83
Dummy39	16.72	15.95	9.00	16.72	Dummy39	12hr	12.98	3.74
Dummy4	10.71	11.96	12.00	11.96	Dummy4	12hr	13.24	-1.29
Dummy40	19.58	19.30	9.00	19.58	Dummy40	12hr	16.14	3.44

100 year ARI Peak Flow (m^3/s)								
Developed Node ID	Developed 100yr 9hr	Developed 100yr 12hr	Developed Critical Duration (hrs)	Developed Critical Peak Flow (m3/s)	Existing Node ID	Existing Critical Duration (hrs)	Existing Critical Peak Flow (m3/s)	Difference (Developed Less Exist) (m3/s)
DumB2	0.00	0.00	12.00	0.00				0.00
DumB20	5.99	5.92	9.00	5.99				5.99
DumB21	1.45	1.45	9.00	1.45				1.45
DumB22	6.08	6.09	12.00	6.09				6.09
DumB23	4.01	4.13	12.00	4.13				4.13
DumB25	5.88	5.99	12.00	5.99				5.99
DumB27	2.72	2.78	12.00	2.78				2.78
DumB29	12.70	13.07	12.00	13.07				13.07
DumB3	1.54	1.55	12.00	1.55				1.55
DumB31	3.56	3.46	9.00	3.56				3.56
DumB32	4.46	4.75	12.00	4.75				4.75
DumB34	1.90	2.08	12.00	2.08				2.08
DumB35	0.00	0.00	12.00	0.00				0.00
DumB4	1.41	1.44	12.00	1.44				1.44
DumB5	3.02	2.94	9.00	3.02				3.02
DumB6	1.58	1.65	12.00	1.65				1.65
DumB7	1.65	1.64	9.00	1.65				1.65
DumB8	2.60	2.52	9.00	2.60				2.60
DumB9	2.92	2.89	9.00	2.92				2.92
Dummy1	48.86	45.44	9.00	48.86	Dummy1	9hr	52.06	-3.20
Dummy10	42.07	37.02	9.00	42.07	Dummy10	9hr	46.84	-4.77
Dummy11	2.94	2.97	12.00	2.97	Dummy11	9hr	34.51	-31.54
Dummy12	26.86	25.45	9.00	26.86	Dummy12	9hr	30.57	-3.71
Dummy13	105.28	91.19	9.00	105.28	Dummy13	9hr	125.87	-20.59
Dummy14	107.25	95.94	9.00	107.25	Dummy14	9hr	128.61	-21.36
Dummy15	112.45	105.02	9.00	112.45	Dummy15	9hr	135.25	-22.80
Dummy16	116.19	111.14	9.00	116.19	Dummy16	9hr	140.28	-24.09
Dummy17	182.61	183.51	12.00	183.51	Dummy17	9hr	218.91	-35.40
Dummy18	53.80	55.25	12.00	55.25	Dummy18	9hr	37.48	17.77
Dummy19	39.39	35.97	9.00	39.39	Dummy19	9hr	38.96	0.42
Dummy2	52.38	48.32	9.00	52.38	Dummy2	9hr	56.89	-4.52
Dummy20	47.61	40.72	9.00	47.61	Dummy20	9hr	50.00	-2.40
Dummy21	58.52	52.05	9.00	58.52	Dummy21	9hr	62.90	-4.39
Dummy22	11.24	11.19	9.00	11.24	Dummy22	9hr	11.53	-0.29
Dummy23	13.97	13.56	9.00	13.97	Dummy23	9hr	14.04	-0.06
Dummy24	21.39	20.60	9.00	21.39	Dummy24	9hr	21.36	0.03
Dummy25	23.81	22.84	9.00	23.81	Dummy25	9hr	23.68	0.13
Dummy26	32.24	30.75	9.00	32.24	Dummy26	9hr	31.89	0.35
Dummy27	204.40	209.53	12.00	209.53	Dummy27	9hr	240.75	-31.22
Dummy28	43.81	43.94	12.00	43.94	Dummy28	9hr	44.93	-0.99
Dummy29	3.54	3.78	12.00	3.78	Dummy29	12hr	3.22	0.56
Dummy3	53.70	48.96	9.00	53.70	Dummy3	9hr	59.88	-6.19
Dummy30	8.15	9.25	12.00	9.25	Dummy30	12hr	8.46	0.79
Dummy31	16.61	17.15	12.00	17.15	Dummy31	9hr	17.10	0.05
Dummy32	24.57	25.43	12.00	25.43	Dummy32	9hr	25.10	0.33
Dummy33	55.73	54.23	9.00	55.73	Dummy33	9hr	56.27	-0.54
Dummy34	51.31	44.30	9.00	51.31	Dummy34	9hr	54.78	-3.46
Dummy35	55.61	49.00	9.00	55.61	Dummy35	9hr	59.87	-4.26
Dummy36	41.20	36.86	9.00	41.20	Dummy36	9hr	41.33	-0.13
Dummy37	43.80	38.81	9.00	43.80	Dummy37	9hr	44.83	-1.03
Dummy38	54.56	47.78	9.00	54.56	Dummy38	9hr	58.48	-3.92
Dummy39	59.68	53.26	9.00	59.68	Dummy39	9hr	64.00	-4.32
Dummy4	56.91	51.07	9.00	56.91	Dummy4	9hr	65.09	-8.18
Dummy40	74.24	68.15	9.00	74.24	Dummy40	9hr	79.39	-5.15

2 year ARI Peak Flow (m^3/s)								
Developed Node ID	Developed 2yr 9hr	Developed 2yr 12hr	Developed Critical Duration (hrs)	Developed Critical Peak Flow (m3/s)	Existing Node ID	Existing Critical Duration (hrs)	Existing Critical Peak Flow (m3/s)	Difference (Developed Less Exist) (m3/s)
Dummy41	19.72	19.50	9.00	19.72	Dummy41	12hr	16.25	3.46
Dummy42	11.43	12.63	12.00	12.63	Dummy42	12hr	13.82	-1.19
Dummy43	0.59	0.53	9.00	0.59	Dummy43	12hr	7.54	-6.95
Dummy44	23.25	24.44	12.00	24.44	Dummy44	12hr	26.93	-2.49
Dummy45	24.07	26.07	12.00	26.07	Dummy45	12hr	27.91	-1.84
Dummy46	25.77	28.31	12.00	28.31	Dummy46	12hr	29.49	-1.18
Dummy47	0.81	0.95	12.00	0.95	Dummy47	12hr	0.72	0.22
Dummy48	2.09	2.06	9.00	2.09	Dummy48	12hr	2.10	-0.02
Dummy49	47.85	54.82	12.00	54.82	Dummy49	18hr	52.43	2.39
Dummy50	48.62	55.40	12.00	55.40	Dummy50	18hr	52.90	2.50
Dummy51	49.85	56.49	12.00	56.49	Dummy51	18hr	53.59	2.90
Dummy52	50.05	56.60	12.00	56.60	Dummy52	18hr	53.80	2.80
Dummy53	51.24	57.70	12.00	57.70	Dummy53	18hr	54.72	2.98
Dummy54	13.78	14.09	12.00	14.09	Dummy54	12hr	11.42	2.67
Dummy55	1.78	1.81	12.00	1.81	Dummy55	12hr	0.34	1.48
Dummy56	0.80	0.91	12.00	0.91	Dummy56	12hr	0.91	0.00
Dummy57	0.74	0.92	12.00	0.92	Dummy57	12hr	0.92	0.00
Dummy58	2.39	2.89	12.00	2.89	Dummy58	12hr	2.96	-0.06
Dummy59	1.66	1.68	12.00	1.68	Dummy59	12hr	1.05	0.63
Dummy6	11.77	12.96	12.00	12.96	Dummy6	12hr	14.44	-1.48
Dummy60	10.29	11.50	12.00	11.50	Dummy60	12hr	12.38	-0.87
Dummy7	12.72	13.82	12.00	13.82	Dummy7	12hr	16.34	-2.52
Dummy8	9.12	9.45	12.00	9.45	Dummy8	12hr	8.82	0.63
Dummy9	5.48	5.48	12.00	5.48	Dummy9	12hr	7.98	-2.50
DummyO1	9.18	10.21	12.00	10.21				10.21
DummyO2	4.80	5.20	12.00	5.20				5.20
DummyO3	7.20	7.90	12.00	7.90				7.90
DummyO4	3.16	3.37	12.00	3.37				3.37
DummyO5	1.40	1.49	12.00	1.49				1.49
E1	0.38	0.42	12.00	0.42	E1	12hr	0.42	0.00
E10	1.29	1.32	12.00	1.32	E10	12hr	0.58	0.73
E11a	5.72	5.74	12.00	5.74	E11a	12hr	5.88	-0.14
E11b	6.89	7.12	12.00	7.12	E11b	12hr	7.26	-0.14
E12	0.42	0.46	12.00	0.46	E12	12hr	0.46	0.00
E13	1.44	1.63	12.00	1.63	E13	12hr	1.19	0.44
E14	0.59	0.61	12.00	0.61	E14	12hr	0.33	0.28
E15a	0.33	0.35	12.00	0.35	E15a	12hr	0.19	0.15
E15b	0.29	0.30	12.00	0.30	E15b	12hr	0.17	0.13
E16a	2.38	2.42	12.00	2.42	E16a	12hr	1.28	1.14
E16b	0.09	0.13	12.00	0.13	E16b	12hr	0.11	0.02
E17a	0.39	0.48	12.00	0.48	E17a	12hr	0.48	0.00
E17b	0.36	0.44	12.00	0.44	E17b	12hr	0.44	0.00
E17c	1.63	2.11	12.00	2.11	E17c	12hr	2.10	0.01
E17d	0.46	0.57	12.00	0.57	E17d	12hr	0.56	0.00
E18	0.54	0.75	12.00	0.75	E18	30min	0.89	-0.13
E2	0.42	0.49	12.00	0.49	E2	12hr	0.48	0.00
E3	1.52	1.61	12.00	1.61	E3	12hr	0.95	0.67
E5	3.69	3.79	12.00	3.79	E5	12hr	2.89	0.90
E6a	0.80	0.83	12.00	0.83	E6a	12hr	0.45	0.39
E6b	0.49	0.59	12.00	0.59	E6b	12hr	0.46	0.13
E7a	0.23	0.28	12.00	0.28	E7a	12hr	0.26	0.02
E7b	0.74	0.96	12.00	0.96	E7b	12hr	0.86	0.09
E8a	0.38	0.40	12.00	0.40	E8a	12hr	0.26	0.15
E8b	0.67	0.69	12.00	0.69	E8b	12hr	0.40	0.29

100 year ARI Peak Flow (m^3/s)								
Developed Node ID	Developed 100yr 9hr	Developed 100yr 12hr	Developed Critical Duration (hrs)	Developed Critical Peak Flow (m3/s)	Existing Node ID	Existing Critical Duration (hrs)	Existing Critical Peak Flow (m3/s)	Difference (Developed Less Exist) (m3/s)
Dummy41	74.64	68.59	9.00	74.64	Dummy41	9hr	79.86	-5.22
Dummy42	59.38	52.82	9.00	59.38	Dummy42	9hr	67.53	-8.15
Dummy43	1.72	1.72	9.00	1.72	Dummy43	9hr	36.66	-34.94
Dummy44	105.61	91.78	9.00	105.61	Dummy44	9hr	126.27	-20.66
Dummy45	108.31	98.18	9.00	108.31	Dummy45	9hr	130.33	-22.02
Dummy46	113.39	106.83	9.00	113.39	Dummy46	9hr	136.79	-23.40
Dummy47	3.67	4.17	12.00	4.17	Dummy47	9hr	3.51	0.66
Dummy48	10.08	10.20	12.00	10.20	Dummy48	9hr	10.12	0.08
Dummy49	204.93	210.09	12.00	210.09	Dummy49	9hr	241.61	-31.52
Dummy50	206.57	212.15	12.00	212.15	Dummy50	9hr	243.09	-30.94
Dummy51	209.29	215.47	12.00	215.47	Dummy51	9hr	245.29	-29.82
Dummy52	209.83	216.08	12.00	216.08	Dummy52	9hr	245.93	-29.86
Dummy53	212.95	219.92	12.00	219.92	Dummy53	9hr	248.66	-28.75
Dummy54	53.48	46.35	9.00	53.48	Dummy54	9hr	57.00	-3.52
Dummy55	3.68	4.00	12.00	4.00	Dummy55	12hr	1.64	2.36
Dummy56	3.96	4.39	12.00	4.39	Dummy56	12hr	4.39	0.00
Dummy57	4.37	4.45	12.00	4.45	Dummy57	12hr	4.45	0.00
Dummy58	13.78	14.11	12.00	14.11	Dummy58	9hr	13.88	0.23
Dummy59	4.45	4.81	12.00	4.81	Dummy59	9hr	5.08	-0.26
Dummy6	60.62	54.21	9.00	60.62	Dummy6	9hr	69.83	-9.20
Dummy60	54.79	49.75	9.00	54.79	Dummy60	9hr	61.37	-6.58
Dummy7	64.13	57.86	9.00	64.13	Dummy7	9hr	77.17	-13.04
Dummy8	39.54	34.79	9.00	39.54	Dummy8	9hr	42.58	-3.04
Dummy9	12.68	13.42	12.00	13.42	Dummy9	9hr	38.99	-25.56
DummyO1	48.86	45.44	9.00	48.86				48.86
DummyO2	24.57	23.37	9.00	24.57				24.57
DummyO3	37.41	34.80	9.00	37.41				37.41
DummyO4	15.61	14.61	9.00	15.61				15.61
DummyO5	7.00	6.81	9.00	7.00				7.00
E1	1.84	2.04	12.00	2.04	E1	12hr	2.04	0.00
E10	3.60	3.90	12.00	3.90	E10	12hr	2.79	1.11
E11a	25.71	26.53	12.00	26.53	E11a	9hr	26.41	0.12
E11b	31.94	32.87	12.00	32.87	E11b	9hr	32.60	0.27
E12	1.94	2.12	12.00	2.12	E12	12hr	2.12	0.00
E13	5.87	6.47	12.00	6.47	E13	12hr	5.60	0.87
E14	1.75	1.86	12.00	1.86	E14	12hr	1.60	0.26
E15a	0.99	1.05	12.00	1.05	E15a	12hr	0.92	0.12
E15b	0.85	0.90	12.00	0.90	E15b	12hr	0.80	0.10
E16a	7.14	7.81	12.00	7.81	E16a	12hr	6.00	1.80
E16b	0.51	0.58	12.00	0.58	E16b	12hr	0.53	0.05
E17a	2.28	2.31	12.00	2.31	E17a	12hr	2.31	0.00
E17b	2.10	2.15	12.00	2.15	E17b	12hr	2.15	0.00
E17c	10.04	10.04	12.00	10.04	E17c	9hr	9.87	0.17
E17d	2.69	2.79	12.00	2.79	E17d	12hr	2.70	0.08
E18	3.64	3.69	12.00	3.69	E18	12hr	3.69	0.00
E2	2.13	2.35	12.00	2.35	E2	12hr	2.34	0.00
E3	4.92	5.29	12.00	5.29	E3	12hr	4.50	0.79
E5	13.74	15.49	12.00	15.49	E5	12hr	13.08	2.41
E6a	2.43	2.62	12.00	2.62	E6a	12hr	2.18	0.44
E6b	2.23	2.49	12.00	2.49	E6b	12hr	2.24	0.25
E7a	1.15	1.28	12.00	1.28	E7a	12hr	1.24	0.04
E7b	3.86	4.37	12.00	4.37	E7b	12hr	4.10	0.27
E8a	1.34	1.46	12.00	1.46	E8a	12hr	1.24	0.22
E8b	2.22	2.43	12.00	2.43	E8b	12hr	2.01	0.43

2 year ARI Peak Flow (m^3/s)								
Developed Node ID	Developed 2yr 9hr	Developed 2yr 12hr	Developed Critical Duration (hrs)	Developed Critical Peak Flow (m3/s)	Existing Node ID	Existing Critical Duration (hrs)	Existing Critical Peak Flow (m3/s)	Difference (Developed Less Exist) (m3/s)
E8c	0.98	1.24	12.00	1.24	E8c	12hr	1.15	0.09
E9	0.54	0.60	12.00	0.60	E9	12hr	0.60	0.00
MDRes	1.98	1.99	12.00	1.99				1.99
node1	0.52	0.53	12.00	0.53				0.53
node2	0.75	0.76	12.00	0.76				0.76
node3	0.05	0.05	12.00	0.05				0.05
node4	0.20	0.21	12.00	0.21				0.21
node5	6.24	6.46	12.00	6.46				6.46
node6	6.71	6.84	12.00	6.84				6.84
OnlineB1	9.39	9.34	9.00	9.39				9.39
OnlinB1Dum	8.49	8.81	12.00	8.81				8.81
Openspace	0.18	0.25	12.00	0.25				0.25
Out	63.08	65.10	12.00	65.10	Out	18hr	60.42	4.68
Rest_B18	0.84	0.86	12.00	0.86				0.86
Rest30.1	0.46	0.48	12.00	0.48				0.48
Roads	2.23	2.23	9.00	2.23				2.23
SE_out	3.19	3.88	12.00	3.88	SE_out	12hr	3.91	-0.02
SE1	0.66	0.68	12.00	0.68	SE1	30min	0.59	0.10
SE2	1.96	2.01	12.00	2.01	SE2	12hr	1.01	1.00
SE3	0.97	1.34	12.00	1.34	SE3	12hr	1.34	0.00
SE5	0.48	0.58	12.00	0.58	SE5	12hr	0.57	0.01
SE6a	1.21	1.68	12.00	1.68	SE6a	12hr	1.67	0.01
SE6b	3.19	3.88	12.00	3.88	SE6b	12hr	3.91	-0.02
SU2	0.87	0.78	9.00	0.87	SU2	12hr	0.51	0.36
SU3	1.05	1.06	12.00	1.06	SU3	12hr	0.34	0.72

100 year ARI Peak Flow (m^3/s)								
Developed Node ID	Developed 100yr 9hr	Developed 100yr 12hr	Developed Critical Duration (hrs)	Developed Critical Peak Flow (m3/s)	Existing Node ID	Existing Critical Duration (hrs)	Existing Critical Peak Flow (m3/s)	Difference (Developed Less Exist) (m3/s)
E8c	5.16	5.62	12.00	5.62	E8c	12hr	5.37	0.25
E9	2.60	2.81	12.00	2.81	E9	12hr	2.81	0.00
MDRes	4.91	5.26	12.00	5.26				5.26
node1	0.81	0.83	12.00	0.83				0.83
node2	1.21	1.22	12.00	1.22				1.22
node3	0.08	0.08	12.00	0.08				0.08
node4	0.32	0.33	12.00	0.33				0.33
node5	29.25	27.50	9.00	29.25				29.25
node6	30.65	28.66	9.00	30.65				30.65
OnlineB1	37.92	35.19	9.00	37.92				37.92
OnlinB1Dum	37.23	32.96	9.00	37.23				37.23
Openspace	1.21	1.18	9.00	1.21				1.21
Out	232.46	244.44	12.00	244.44	Out	12hr	271.50	-27.06
Rest_B18	2.34	2.50	12.00	2.50				2.50
Rest30.1	1.56	1.69	12.00	1.69				1.69
Roads	4.88	5.10	12.00	5.10				5.10
SE_out	18.36	18.78	12.00	18.78	SE_out	9hr	18.46	0.32
SE1	1.92	2.06	12.00	2.06	SE1	12hr	1.75	0.31
SE2	5.64	6.06	12.00	6.06	SE2	12hr	4.78	1.28
SE3	6.32	6.22	9.00	6.32	SE3	9hr	6.32	0.00
SE5	2.63	2.86	12.00	2.86	SE5	12hr	2.77	0.09
SE6a	7.80	7.59	9.00	7.80	SE6a	9hr	7.92	-0.12
SE6b	18.36	18.78	12.00	18.78	SE6b	9hr	18.46	0.32
SU2	2.82	2.95	12.00	2.95	SU2	9hr	2.43	0.53
SU3	2.79	3.01	12.00	3.01	SU3	9hr	1.77	1.24

Table C.2 Properties of Regional Basins located with the Austral and Leppington North Precincts

Basin ID	Basin Node	Catchment Area (ha)	Basin Area (m2)	Basin / Catchment Area	100 yr ARI Ave Basin Depth (m)	Indicative Unit Vol (m3/ha)	2yr ARI Outlet Width (m)	100yr ARI Total Outlet Width (m)
1	OnlineB1	455.39	20,000	0.5%	2.94	129	2.4*	23.4*
4	7.09a	17.05	5,992	3.5%	1.39	489	0.46	1.24
5	Dummy59	48.91	16,347	3.3%	1.36	455	1.07	3.57
6	7.11a	14.81	5,103	3.4%	1.25	431	0.5	1.36
8	17.12	29.61	8,505	2.9%	1.51	434	0.61	1.42
9	17.14a	30.93	5,246	1.7%	1.62	275	0.74	1.18
10	17.15a	17.78	4,371	2.5%	1.52	374	0.46	0.98
11	1.17a	65.30	15,491	2.4%	1.62	384	1.14	2.79
12	15.02	43.64	4,690	1.1%	1.69	182	0.71	1.29
13	7.12	41.12	10,847	2.6%	1.61	425	0.64	1.55
14	10.02a	39.27	12,416	3.2%	1.26	398	1.06	3.59
15	1.12a	20.90	7,336	3.5%	1.28	449	0.61	1.99
16	1.12c	15.87	4,608	2.9%	1.45	421	0.45	1.23
17	29.02	77.34	21,966	2.8%	1.61	457	1.16	3.47
18	31.02	31.60	5,813	1.8%	1.48	340	0.71	1.95
19	32.02	73.39	13,927	1.9%	1.72	326	1.03	2.31
20	28.02	63.68	17,901	2.8%	1.59	447	1.04	3.06
21	25.06a	15.06	5,310	3.5%	1.40	495	0.41	1.04
22	25.02	61.89	11,294	1.8%	1.44	263	1.42	2.73
23	25.03a	39.93	5,120	1.3%	1.48	190	1.02	1.85
24								
25	E16a	54.45	13,576	2.5%	1.38	345	1.24	3.73
26								
27	E10	26.11	8,713	3.3%	1.34	445	0.7	1.94
28								
29	E5	110.82	16,614	1.5%	1.40	209	3.28	6.03
30								
31	1.10b	33.95	7,843	2.3%	1.35	312	0.69	3.64
32	SE2	39.51	13,196	3.3%	1.18	393	1.19	4.03
33								
34	1.09a	21.29	2,660	1.2%	1.19	494	0.65	2.89
35	1.06a	36.76	6,992	1.9%	1.60	305	0.83	1.45

* Basin 1 is an Online Basin and therefore doesn't have a weir

Table C.3 Estimated Performance of Regional Basins located within the Precincts in a 2 yr ARI Event under Developed Condition

Basin ID	Basin Name	Peak Flow Existing (m^3/s) (a)	Existing Critical Duration (hr)	Peak Flow Developed without Basin (m^3/s)	Critical Duration Developed without Basin (hr)	Peak Flow Developed with Basin (m^3/s) (b)	Critical Duration Developed with Basin (hr)	Peak Average Basin Depth (m)	Difference in Peak Flows (m^3/s) (b) - (a)	Original: Peak Flow Dev A with Basin (m^3/s) (b)	Original: Critical Duration Dev A with Basin (hr)	Original: Peak Average Basin Depth (m)	Difference Peak Flow (Revised - Original) (m^3/s)	Difference Average Depth (Revised - Original) (m)
1	OnlineB1	8.00	12	21.42	6	7.09	12	2.45	-0.91	7.85	12	no online basin	-0.76	*
4	7.09a	0.35	12	2.89	0.5	0.34	9	0.70	-0.01	0.36	9 and 12	0.71	-0.02	-0.02
5	Dummy59	1.05	12	7.47	0.5	0.66	12	0.52	-0.39	1.08	9	0.71	-0.42	-0.18
6	7.11a	0.34	12	2.49	0.5	0.35	9	0.64	0.01	0.35	9	0.65	0.00	0.00
8	17.12	0.51	12	4.83	0.5	0.54	12	0.73	0.03	0.54	12	0.73	0.00	0.00
9	17.14a	0.59	12	3.16	0.5	0.60	12	0.66	0.01	0.60	12	0.66	0.00	0.00
10	17.15a	0.35	12	2.34	0.5	0.36	12	0.72	0.01	0.36	12	0.72	0.00	0.00
11	1.17a	1.29	12	7.17	0.5	1.32	9	0.77	0.03	1.32	9	0.77	0.00	0.00
12	15.02	0.60	12	2.35	1	0.61	12	0.70	0.01	0.61	12	0.70	0.00	0.00
13	7.12	0.59	18	4.83	0.5	0.40	9	0.59	-0.19	0.65	12	0.78	-0.25	-0.20
14	10.02a	0.97	12	5.57	0.5	1.01	9	0.67	0.04	1.01	9	0.67	0.00	0.00
15	1.12a	0.49	12	3.60	0.5	0.37	9	0.58	-0.12	0.51	9	0.69	-0.14	-0.11
16	1.12c	0.37	12	2.62	0.5	0.38	9	0.76	0.01	0.38	9	0.76	0.00	0.00
17	29.02	1.41	12	8.54	0.5	1.49	12	0.82	0.08	1.49	12	0.82	0.00	0.00
18	31.02	0.67	12	3.47	1	1.23	9	0.97	0.56	0.69	9	0.75	0.54	0.22
19	32.02	1.14	12	6.04	1	1.20	12	0.79	0.06	1.20	12	0.79	0.00	0.00
20	28.02	1.22	12	7.11	0.5	1.27	12	0.81	0.05	1.27	12	0.81	0.00	0.00
21	25.06a	0.30	12	2.52	0.5	0.31	12	0.72	0.01	0.31	12	0.72	0.00	0.00
22	25.02	1.25	12	5.69	0.5	1.27	9	0.63	0.02	1.27	9	0.63	0.00	0.00
23	25.03a	0.85	12	3.50	0.5	0.82	9	0.62	-0.03	0.85	2	0.63	-0.03	-0.01
25	E16a	1.28	12	5.47	1	1.32	9	0.71	0.04	1.32	9	0.71	0.00	0.00
27	E10	0.58	12	4.26	0.5	0.60	9	0.69	0.02	0.60	9	0.69	0.00	0.00
29	E5	2.89	12	10.85	0.5	2.75	12	0.58	-0.14	2.90	2	0.60	-0.15	-0.02
31	1.10b	0.74	12	1.68	0.5	0.78	9	0.82	0.04	0.78	9	0.82	0.00	0.00
32	SE2	1.01	12	6.64	0.5	1.05	9	0.63	0.04	1.05	9	0.63	0.00	0.00
34	1.09a	0.55	12	3.81	0.5	0.61	9	0.72	0.06	0.58	9	0.70	0.03	0.01
35	1.06a	0.72	12	4.08	0.5	0.73	12	0.68	0.01	0.73	9	0.68	0.01	0.00

Table C.4 Estimated Performance of Regional Basins located within the Precincts in a 100 yr ARI Event under Developed Condition

Basin ID	Basin Name	Peak Flow Existing (m^3/s) (a)	Existing Critical Duration (hr)	Peak Flow Developed without Basin (m^3/s)	Critical Duration Developed without Basin (hr)	Peak Flow Developed with Basin (m^3/s) (b)	Critical Duration Developed with Basin (hr)	Peak Average Basin Depth (m)	Difference in Peak Flows (m^3/s) (b) - (a)	Original: Peak Flow Dev A with Basin (m^3/s) (b)	Original: Critical Duration Dev A with Basin (hr)	Original: Peak Average Basin Depth (m)	Difference Peak Flow (Revised - Original) (m^3/s)	Difference Average Depth (Revised - Original) (m)
1	OnlineB1	38.63	9	37.45	9	29.61	9	2.95	-9.02	37.67	9	no online basin	-8.06	*
4	7.09a	1.72	9	5.98	0.5	1.44	12	1.28	-0.28	1.72	12	1.39	-0.28	-0.11
5	Dummy59	5.08	9	15.68	0.5	3.02	9	1.08	-2.06	5.05	12	1.36	-2.03	-0.28
6	7.11a	1.65	12	5.16	2	1.65	12	1.25	0.00	1.65	12	1.25	0.00	0.00
8	17.12	2.52	9	10.32	0.5	2.60	9	1.50	0.08	2.60	9	1.51	0.00	-0.01
9	17.14a	2.87	9	6.65	0.5	2.92	9	1.62	0.05	2.92	9	1.62	0.00	0.00
10	17.15a	1.72	9	4.92	0.5	1.73	12	1.52	0.01	1.73	12 and 9	1.52	0.00	0.00
11	1.17a	6.22	9	15.51	2	6.29	9	1.62	0.07	6.29	9	1.62	0.00	0.00
12	15.02	3.20	9	5.19	1	3.27	9	1.69	0.07	3.27	9	1.69	0.00	0.00
13	7.12	3.03	9	10.32	0.5	1.57	9	1.17	-1.46	3.17	9	1.61	-1.60	-0.44
14	10.02a	4.59	12	11.91	0.5	4.56	12	1.26	-0.03	4.56	12	1.26	0.00	0.00
15	1.12a	2.41	12	7.49	0.5	1.57	12	1.07	-0.84	2.39	12	1.28	-0.82	-0.21
16	1.12c	1.80	12	5.42	0.5	1.79	12	1.45	-0.01	1.79	12	1.45	0.00	0.00
17	29.02	6.90	9	18.35	0.5	7.04	9	1.61	0.14	7.04	9	1.61	0.00	0.00
18	31.02	3.30	9	7.61	1	3.28	12	1.48	-0.02	3.30	12	1.48	-0.02	0.00
19	32.02	5.71	9	13.43	1	5.94	9	1.72	0.23	5.94	9	1.72	0.00	0.00
20	28.02	5.92	9	15.56	1	5.99	9	1.59	0.07	5.99	9	1.59	0.00	0.00
21	25.06a	1.45	9	5.24	0.5	1.45	9	1.40	0.00	1.45	9	1.40	0.00	0.00
22	25.02	6.04	9	12.50	0.5	6.09	12	1.44	0.05	6.09	12	1.44	0.00	0.00
23	25.03a	4.11	9	7.37	2	4.13	12	1.48	0.02	4.13	12	1.48	0.00	0.00
25	E16a	6.00	12	11.95	1	5.99	12	1.38	-0.01	5.99	12	1.38	0.00	0.00
27	E10	2.79	12	8.86	0.5	2.78	12	1.34	-0.01	2.78	12	1.34	0.00	0.00
29	E5	13.08	12	22.79	0.5	13.06	12	1.40	-0.02	13.07	12	1.40	0.00	0.00
31	1.10b	3.53	9	4.27	12	3.56	9	1.35	0.03	3.56	9	1.35	0.00	0.00
32	SE2	4.78	12	13.85	2	4.75	12	1.18	-0.03	4.75	12	1.18	0.00	0.00
34	1.09a	2.64	12	8.51	2	2.08	12	1.08	-0.56	2.61	12	1.19	-0.53	-0.11
35	1.06a	3.46	9	8.56	0.5	3.51	12	1.60	0.05	3.51	9	1.60	0.00	0.00

Appendix B

Hydraulics

Table D1 Road Crossing Flood Depth, Velocity, Velocity x Depth, and Evacuation Safety Assessment

Watercourse	Road	Model ID	2 year 9 hour			20 year 9 hour			100 year 9 hour			PMF 2 hour			500 year 9 hour			Suitable for crossing during 500yr 9hr storm*
			Depth (m)	Velocity (m/s)	VxD (m^2/s)	Depth (m)	Velocity (m/s)	VxD (m^2/s)	Depth (m)	Velocity (m/s)	VxD (m^2/s)	Depth (m)	Velocity (m/s)	VxD (m^2/s)	Depth (m)	Velocity (m/s)	VxD (m^2/s)	
Bond Creek	Bringelly Rd	B_BrinRd	0.15	0.42	0.06	0.29	0.69	0.20	0.37	0.92	0.34	1.3	1.82	2.37	0.43	1.02	0.44	Vehicles
Bond Creek	Cowpasture Rd	B_Cowp	0	0	0.00	0.05	0.52	0.03	0.17	0.63	0.11	1.01	2.46	2.48	0.24	1.02	0.25	Pedestrians
Bond Creek	Edmonson Ave	B_Edmon	0	0	0.00	0.16	1.89	0.30	0.25	2.19	0.55	1.17	2.86	3.35	0.31	2.37	0.72	Not Stable
Bond Creek	Eighth Ave	B_Eighth	0.31	1.24	0.38	0.45	1.17	0.53	0.6	1.36	0.82	1.95	2.28	4.45	0.71	1.45	1.02	Not Stable
Bond Creek	Fourth Ave	B_Fourth	0.1	1.36	0.14	0.17	2.06	0.35	0.26	2.28	0.59	1.2	2.91	3.49	0.33	2.44	0.78	Not Stable
Bond Creek	Hume Highway	B_HumH	0.07	0.95	0.07	0.51	1.34	0.68	0.65	1.44	0.94	1.88	2.08	3.91	0.75	1.5	1.13	Not Stable
Bond Creek	Ninth Ave	B_Ninth	0.12	2.15	0.26	0.39	2.29	0.89	0.57	1.95	1.11	1.82	2.63	4.79	0.68	1.99	1.35	Not Stable
Bond Creek	Tenth Ave	B_Tenth	0.03	0.18	0.01	0.38	3.17	1.20	0.5	2.05	1.03	1.83	2.35	4.30	0.57	2.04	1.17	Not Stable
Bond Creek	Denham Court Rd	DCR	0.13	0.23	0.03	0.29	0.55	0.16	0.35	0.66	0.23	0.96	1.51	1.45	0.39	0.73	0.29	Pedestrians
Branch	Devonshire Rd	K_Devon	0.04	0.27	0.01	0.12	0.7	0.08	0.17	0.8	0.14	1.07	1.8	1.93	0.19	1.54	0.3	Pedestrians
Branch	Kind Street	K_King	0.06	0.71	0.04	0.17	1.37	0.23	0.19	1.47	0.28	0.51	1.44	0.73	0.21	1.55	0.33	Pedestrians
Branch	Wynyard Ave	K_Wyn	0	0	0.00	0.13	1.01	0.13	0.17	1.27	0.22	0.64	1.94	1.24	0.2	1.4	0.27	Pedestrians
Branch	Fourteenth Ave	KC13	1.52	0.57	0.87	1.75	0.94	1.65	1.81	1.02	1.85	2.54	1.51	3.84	1.87	1.1	2.06	Not Stable
Branch	Edmonson Ave /	K_ED13th	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0	Pedestrians
Kemps Creek	Fifteenth Ave	K_15th	0.15	0.17	0.03	0.57	0.77	0.44	0.73	0.94	0.69	2.32	1.67	3.87	0.83	1.04	0.87	Not Stable
Kemps Creek	Bringelly Rd	K_BringE	0	0	0.00	0.03	0.56	0.02	0.06	0.86	0.05	0.64	1.54	0.99	0.08	0.94	0.07	Pedestrians
Kemps Creek	Gumer Ave	K_Guner	0.27	0.86	0.23	0.62	1	0.62	0.78	1.11	0.87	2.37	1.78	4.22	0.9	1.18	1.06	Not Stable
Kemps Creek	Twelth Ave	K_TwevthE	0.27	0.73	0.20	0.49	1.32	0.65	0.56	1.49	0.83	1.56	2.1	3.28	0.61	1.59	0.97	Not Stable
Kemps Creek	Herley Ave	KC02	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0.00	0	0	0	Pedestrians
Trib 1	Bringelly Rd	1_BringRd	0	0	0.00	0.17	0.12	0.02	0.31	0.3	0.09	1.25	1.36	1.70	0.4	0.4	0.16	Pedestrians
Trib 2	Tenth Ave	K_10thE	0.02	0.59	0.01	0.04	0.99	0.04	0.04	1.06	0.04	0.14	1.83	0.26	0.05	1.03	0.05	Pedestrians
Trib 2	Eleventh Ave	K_11thE	0.35	0.66	0.23	0.44	1.06	0.47	0.46	1.2	0.55	0.89	1.69	1.50	0.47	1.27	0.6	Not Stable
Trib 2	Thirteenth Ave	K_13thE	0.05	1.73	0.09	0.13	2.17	0.28	0.17	2.23	0.38	0.72	1.83	1.32	0.21	2.36	0.49	Vehicles
Trib 2	Edmonson Ave	K_EdmonE	0	0.18	0.00	0.04	1.17	0.05	0.05	1.33	0.07	0.31	2.63	0.82	0.06	1.42	0.08	Pedestrians
Trib 3	Fifteenth Ave	K_15thEN	0.19	0.54	0.10	0.29	0.72	0.21	0.31	0.78	0.24	0.64	1.36	0.87	0.33	0.82	0.27	Pedestrians
Trib 3	Sixteenth Ave	K_16thEN	0	0	0.00	0.05	0.95	0.05	0.07	1.07	0.07	0.35	2.87	1.00	0.08	1.22	0.09	Pedestrians
Trib 3	Seventeenth Ave	K_17thEN	0.04	0.83	0.03	0.29	0.82	0.24	0.35	0.81	0.28	0.95	1.37	1.30	0.39	0.84	0.33	Pedestrians
Trib 3	Eighteenth Ave	K_18thEN	0.2	1.08	0.22	0.41	1.63	0.67	0.46	1.71	0.79	1.1	2.31	2.54	0.5	1.79	0.88	Not Stable
Trib 3	Fourtheenth Ave	KC14	0.03	0.28	0.01	0.05	0.66	0.03	0.05	0.71	0.04	0.19	1.35	0.26	0.06	0.75	0.04	Pedestrians

***Pedestrian and Vehicular Stability**

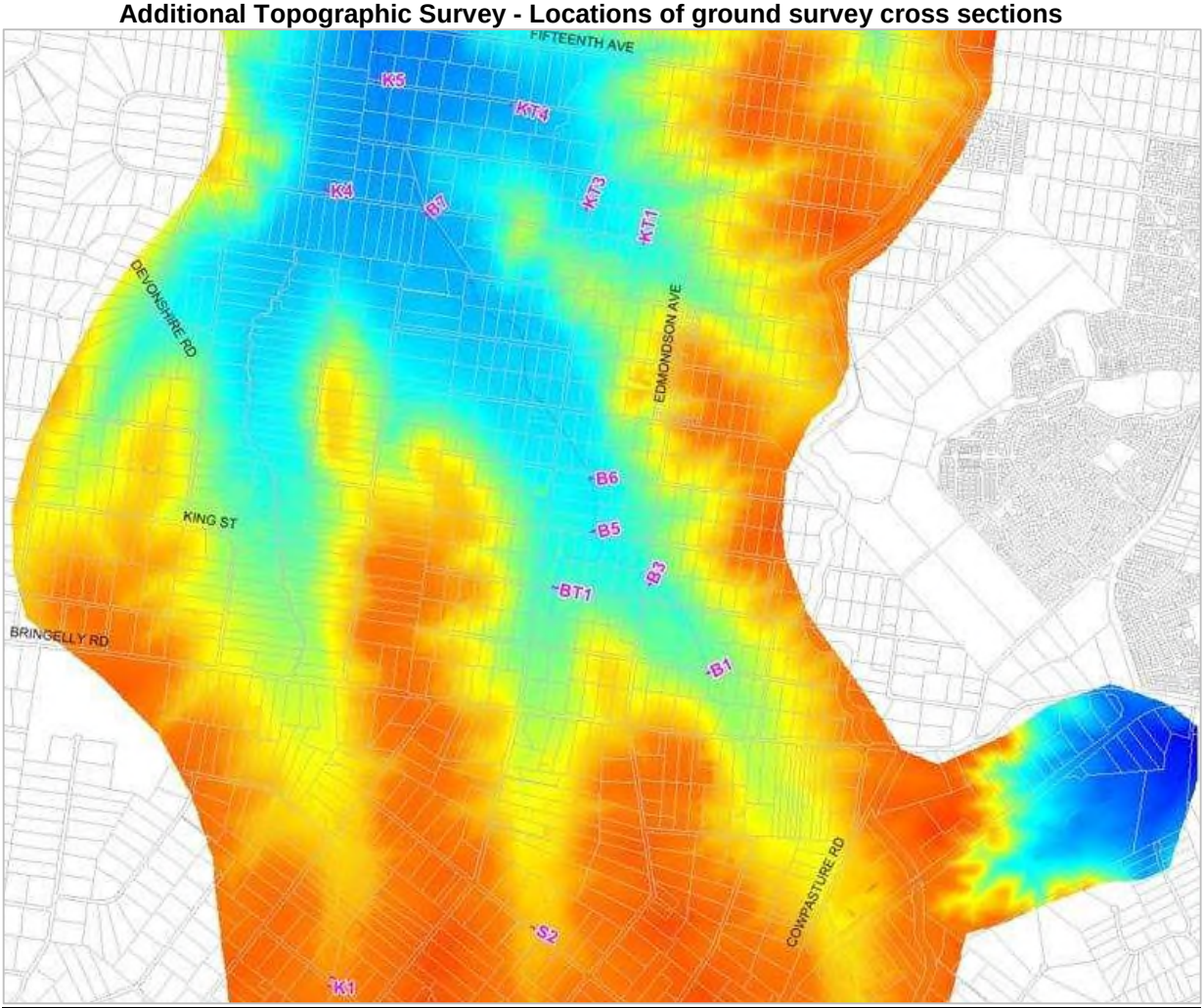
Evacuation Type	Safe VxD Range (m2/s)
Pedestrians	< 0.4
Vehicles	0.4< VxD < 0.6
Not Stable	> 0.6

Table D.2 Road Crossing Peak Water Level Height (all in m AHD)

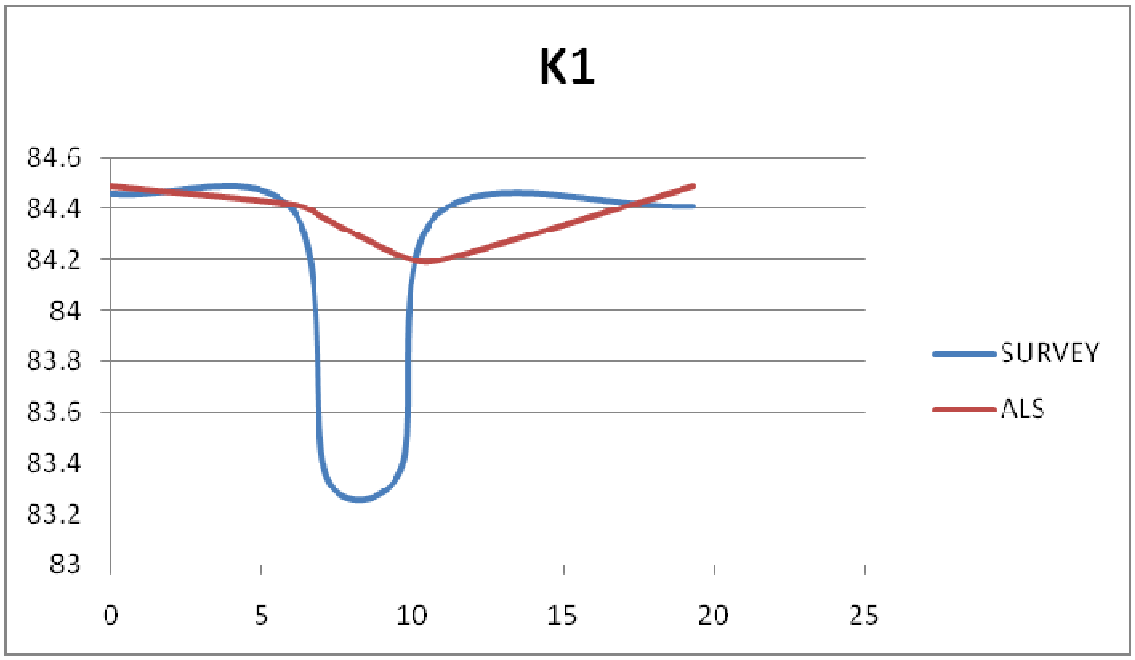
Watercourse	Road	Model ID	2 year 9 hour			20 year 9 hour			100 year 9 hour			500 year 9 hour			PMF 2 hour		
			Developed	Existing	Difference (m)	Developed	Existing	Difference (m)	Developed	Existing	Difference (m)	Developed	Existing	Difference (m)	Developed	Existing	Difference (m)
			(a)	(b)	(a) - (b)	(c)	(d)	(c)- (d)	(e)	(f)	(e) - (f)	(g)	(h)	(g) - (h)	(i)	(j)	(i) - (j)
Bond Creek	Bringelly Rd	B_BrinRd	73.65	0	*	73.79	73.77	0.02	73.87	73.88	-0.01	73.93	73.94	-0.01	74.79	74.8	-0.01
Bond Creek	Cowpasture Rd	B_Cowp	0	0	0	78.52	78.47	0.05	78.64	78.65	-0.01	78.72	78.72	0	79.48	79.48	0
Bond Creek	Edmonson Ave	B_Edmon	0	0	0	68.49	68.47	0.02	68.58	68.59	-0.01	68.64	68.65	-0.01	69.4	69.5	-0.1
Bond Creek	Eighth Ave	B_Eighth	65.81	0	*	65.96	65.93	0.03	66.11	66.1	0.01	66.21	66.19	0.02	67.33	67.46	-0.13
Bond Creek	Fourth Ave	B_Fourth	64.79	64.68	0.11	64.97	64.96	0.01	65.06	65.07	-0.01	65.13	65.12	0.01	65.89	66	-0.11
Bond Creek	Hume Highway	B_HumH	78.56	0	*	79.01	78.96	0.05	79.15	79.16	-0.01	79.25	79.26	-0.01	80.37	80.38	-0.01
Bond Creek	Ninth Ave	B_Ninth	63.58	63.43	0.15	63.99	63.97	0.02	64.17	64.19	-0.02	64.28	64.29	-0.01	65.32	65.42	-0.1
Bond Creek	Tenth Ave	B_Tenth	62.31	62.03	0.28	62.78	62.77	0.01	62.9	62.91	-0.01	62.97	62.98	-0.01	64.12	64.23	-0.11
Bond Creek	Denham Court Rd	DCR	86.13	86.1	0.03	86.29	86.27	0.02	86.35	86.35	0	86.39	86.39	0	86.96	86.96	0
Branch	Devonshire Rd	K_Devon	66.3	66.17	0.13	66.61	66.57	0.04	66.74	66.74	0	66.8	66.8	0	67.69	67.69	0
Branch	Edmonson Ave /	K_ED13th															
Branch	Kind Street	K_King	64.35	64.3	0.05	64.51	64.49	0.02	64.54	64.54	0	64.56	64.56	0	64.86	64.86	0
Branch	Wynyard Ave	K_Wyn	0	0	0	71.51	71.5	0.01	71.54	71.54	0	71.57	71.57	0	72.01	72.01	0
Branch	Fourteenth Ave	KC13	58.75	58.55	0.2	58.98	58.9	0.08	59.04	58.99	0.05	59.1	59.04	0.06	59.7	59.77	-0.07
Kemps Creek	Fifteenth Ave	K_15th	56.65	0	*	57.07	57.05	0.02	57.23	57.23	0	57.33	57.33	0	58.77	58.82	-0.05
Kemps Creek	Bringelly Rd	K_BringE	0	0	0	74.24	74.23	0.01	74.29	74.3	-0.01	74.33	74.33	0	74.89	74.89	0
Kemps Creek	Gumer Ave	K_Guner	54.77	54.65	0.12	55.12	55.1	0.02	55.28	55.31	-0.03	55.4	55.42	-0.02	56.82	56.87	-0.05
Kemps Creek	Twelth Ave	K_TwevthE	60.07	59.96	0.11	60.29	60.27	0.02	60.36	60.36	0	60.4	60.41	-0.01	61.37	61.36	0.01
Kemps Creek	Herley Ave	KC02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trib 1	Bringelly Rd	1_BringRd	0	0	0	73.1	73.05	0.05	73.39	73.22	0.17	73.34	73.28	0.06	74.1	74.19	-0.09
Trib 2	Tenth Ave	K_10thE	77.2	77.19	0.01	77.24	77.23	0.01	77.25	77.25	0	77.26	77.26	0	77.44	77.44	0
Trib 2	Eleventh Ave	K_11thE	72.44	72.39	0.05	72.56	72.54	0.02	72.58	72.57	0.01	72.59	72.59	0	72.95	73.02	-0.07
Trib 2	Thirteenth Ave	K_13thE	62.71	62.51	0.2	62.93	62.88	0.05	62.97	62.95	0.02	63.01	63	0.01	63.52	63.52	0
Trib 2	Edmonson Ave	K_EdmonE	70.16	0	*	70.29	70.26	0.03	70.32	70.31	0.01	70.34	70.33	0.01	70.68	70.68	0
Trib 3	Fifteenth Ave	K_15thEN	76.38	76.33	0.05	76.47	76.47	0	76.5	76.49	0.01	76.52	76.51	0.01	76.83	76.83	0
Trib 3	Sixteenth Ave	K_16thEN	0	0	0	71.36	71.34	0.02	71.39	71.38	0.01	71.43	71.41	0.02	71.85	71.85	0
Trib 3	Seventeenth Ave	K_17thEN	68.01	67.87	0.14	68.29	68.26	0.03	68.34	68.33	0.01	68.39	68.38	0.01	68.94	68.94	0
Trib 3	Eighteenth Ave	K_18thEN	65.58	65.48	0.1	65.81	65.78	0.03	65.86	65.84	0.02	65.9	65.89	0.01	66.5	66.5	0
Trib 3	Fourtheenth Ave	KC14	81.06	81.05	0.01	81.1	81.1	0	81.11	81.11	0	81.12	81.12	0	81.26	81.26	0

* Locations where there are flood extents for Developed scenario but not under Existing Conditions

Additional Topographic Survey - Locations of ground survey cross sections



Individual cross sectional results and comparison with ALS data are shown in the following Figures.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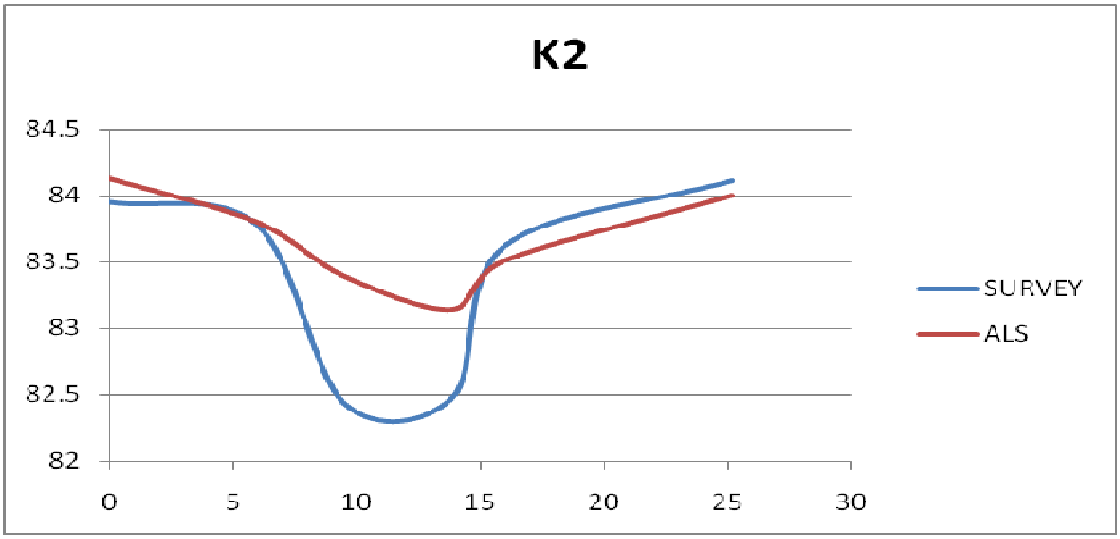
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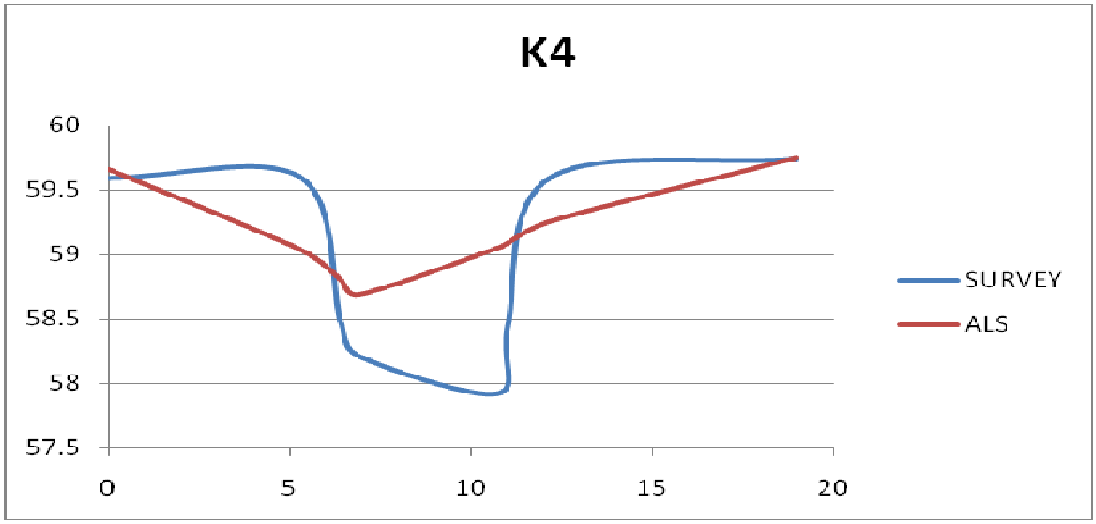
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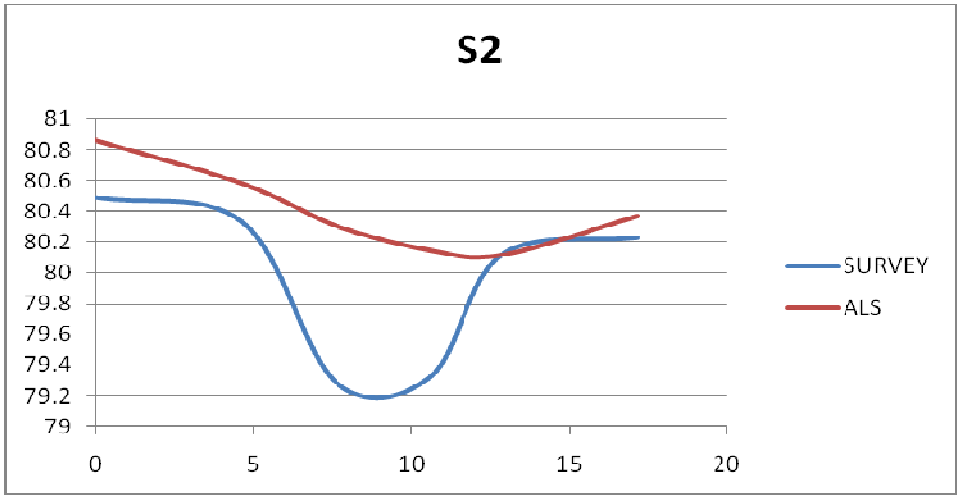
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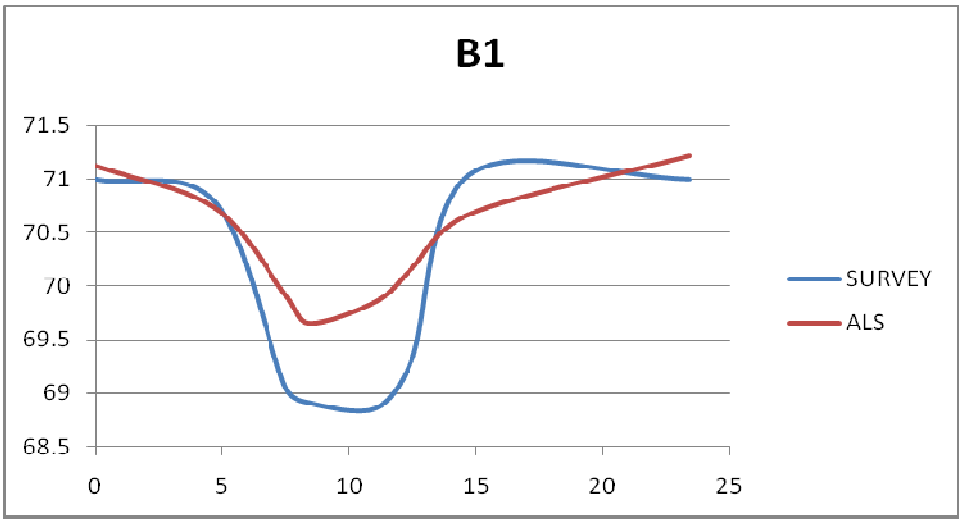
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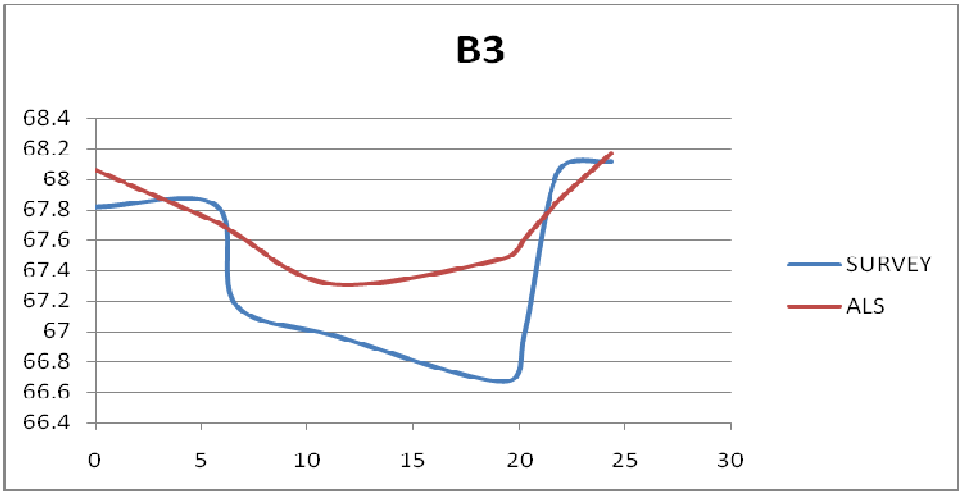
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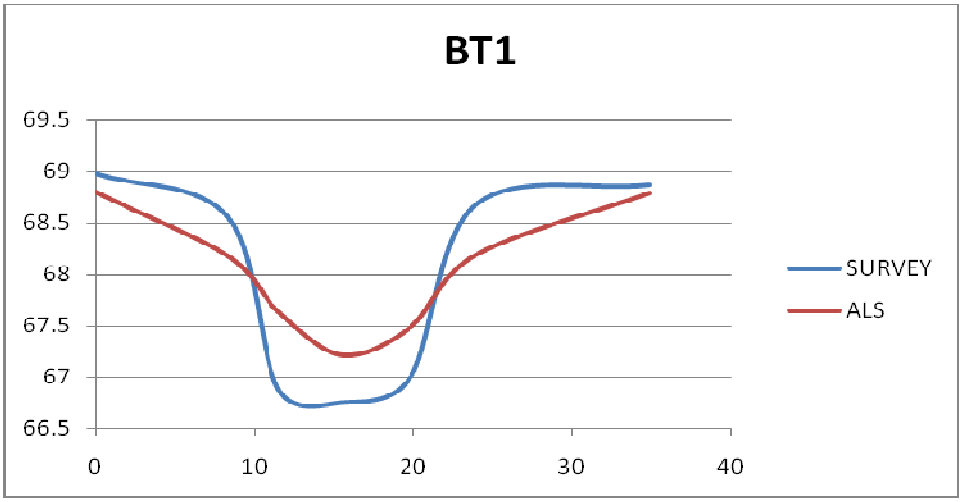
ALS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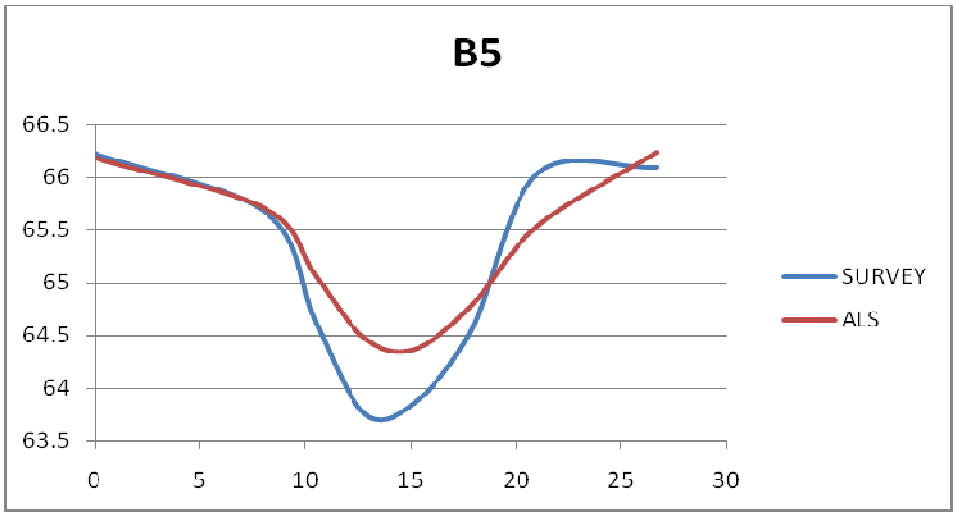
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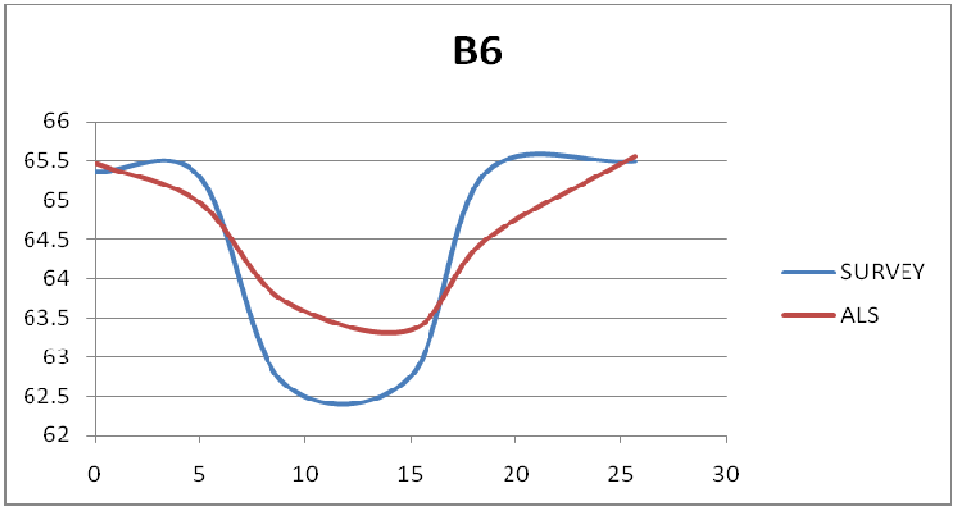
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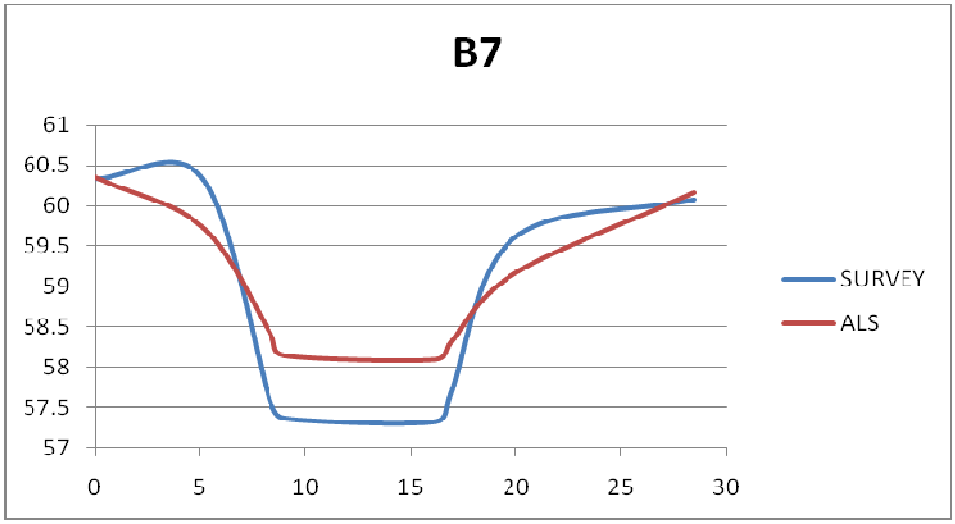
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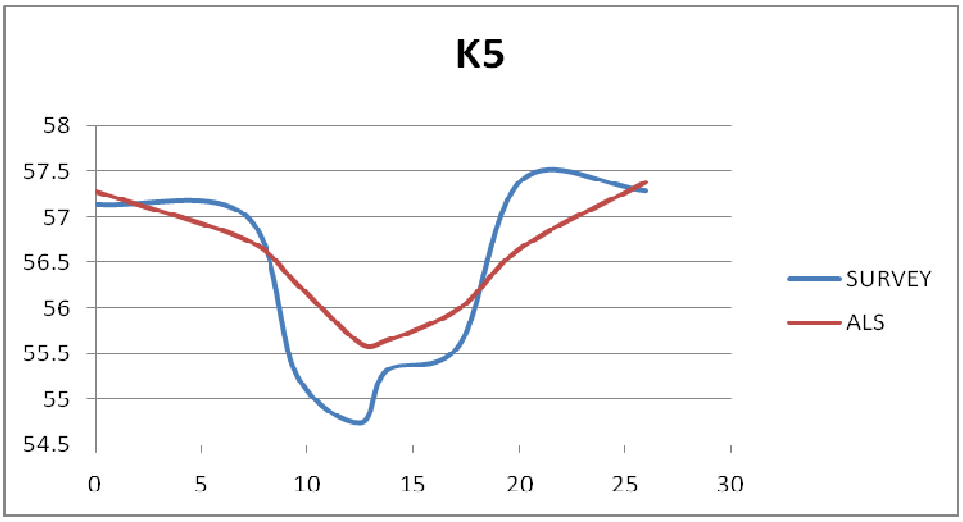
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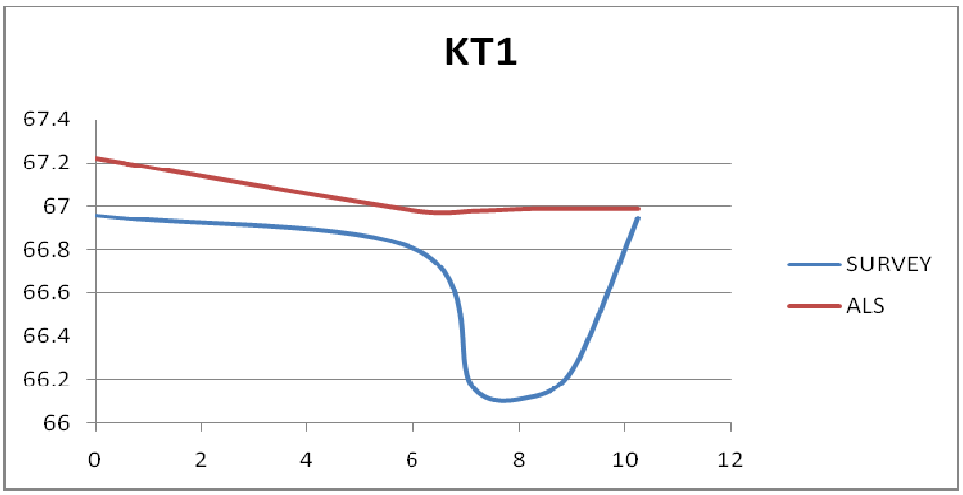
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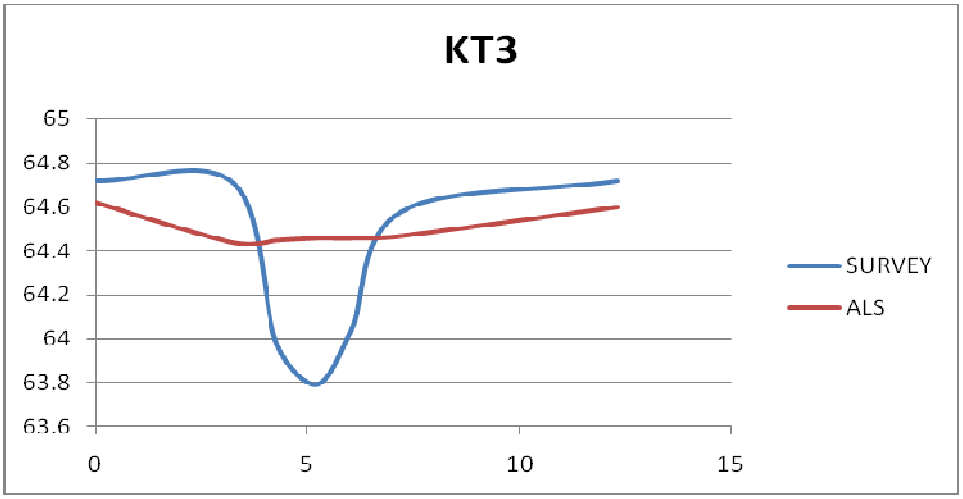
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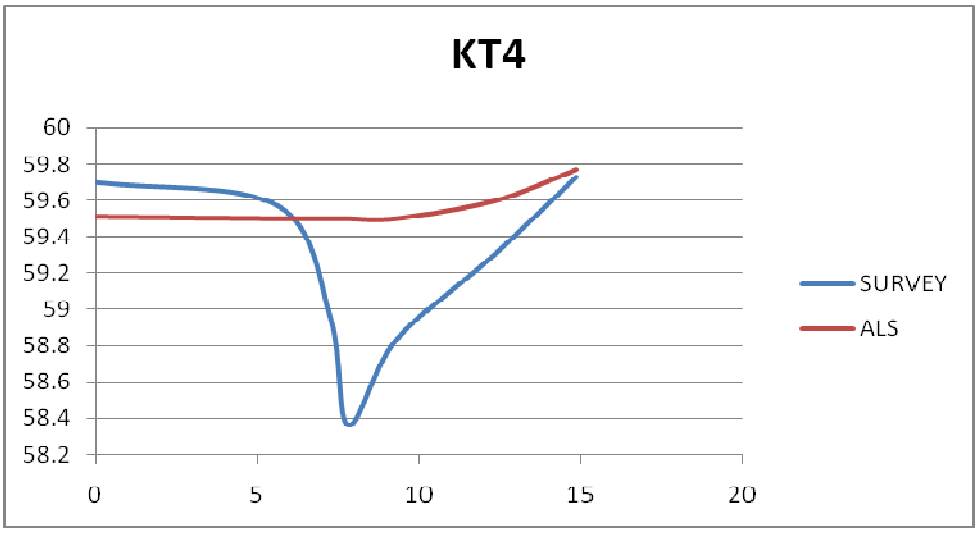
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SURVEY
ALS