EPS

Attachment 2.4

GLENFIELD ECOLOGICAL ASSESSMENT

Prepared for JC & FW Kennett Pty Limited & Figela Pty Limited (Glenfield Waste Services)

Prepared by Environmental Property Services

Cambridge Avenue, Glenfield NSW 2167

ENVIRONMENTAL PROPERTY SERVICES
Reference No: 11009/11012
May 2015

Contact Information and Declaration		
Declaration:	The declaration relates to the submission of this Ecological Assessment Report prepared for JC & FW Kennett Pty Limited & Figela Pty Limited (Glenfield Waste Services) in respect to the Glenfield Waste Services southern parcel of land. The opinions and declarations in this Ecological Assessment are ascribed to Environmental Property Services (EPS) and are made in good faith and trust that such statements are neither false nor misleading. In preparing this Ecological Assessment, EPS has considered and relied upon information obtained from the public domain, supplemented by discussions between key EPS staff, representatives from JC & FW Kennett Pty Limited & Figela Pty Limited and other consultants.	
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Application subject land address:	Cambridge Avenue Glenfield , NSW Lot 91 DP1155962; Lot 3 DP735524; Lot 3 DP 736881; Lot 1 DP113201; Lot 2 DP 333578	
Licences:	*National Parks and Wildlife Act 1974* Scientific Licence number: SL100772	

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EXECUTIVE SUMMARY

Environmental Property Services (EPS) was engaged by landowners JC & FW Kennett P/L & Figela P/L to prepare an Ecological Assessment Report (EA) for Glenfield Waste Services (GWS). This EA was prepared to provide a detailed assessment of the ecological characteristics of the GWS's southern parcel of land located in the Campbelltown LGA including the presence and/or likelihood of occurrence of threatened flora and fauna and their habitat.

There have been a number of previous ecological assessments of the investigation area and a number of ecological assessments within the Local Government Areas of Campbelltown and Liverpool.

The Ecological Assessment revealed that:

- No threatened flora species or endangered flora populations were recorded on site during surveys;
- Some portions in the Southern Parcel of the GWS site are Cumberland Plain Woodland CEEC (under the TSC Act and EPBC Act) and River-Flat Eucalypt Forest EEC (under the TSC Act). The Cumberland Plain Woodland will be subject to impacts by the SSD and Rezoning components, while the River-Flat Eucalypt Forest will be retained and protected as part of the future management of the site;
- A majority of the threatened species initially considered likely to occur or to have suitable habitat were not identified during any surveys and this is considered to be related to the high level of historical disturbance on a majority of the site;
- The threatened species recorded during the targeted surveys were threatened microchiropteran and megachiropteran bats species, being *Pteropus poliocephalus* (Grey-headed Flying-fox), *Saccolaimus flaviventris (*Yellow-bellied Sheathtail-bat), *Mormopterus norfolkensis* (East-coast Freetail-bat), *Miniopterus australis* (Little Bentwing bat) and *Miniopterus schreibersii oceanensis* (Eastern Bentwing bat)
- No threatened frog, waterbird, arboreal mammal, or fish species were identified during surveys and are considered unlikely to occur on the investigation area;
- The investigation area supported a farm dam which provided an area of open, deep water for common waterbird species;
- The investigation area had been regularly slashed and managed such that there was a paucity of leaf litter and fallen timber across the site and was likely to provide some foraging habitat for only common bird species such as the Common Myna, Magpie Lark, Eastern Rosella, Common Starling etc;
- The investigation area supported a relatively high number of hollow bearing trees; and
- The investigation area was bound by a number of significant barriers to fauna movement.

The woodland vegetation in the southern parcel of land on the GWS site has been assessed in detail by a number of ecological consultancies over a period of eight years. The overall conclusion drawn from these previous studies and the more recent work by EPS has determined that this site provides only limited suitable habitat requirements for threatened flora and fauna species due to historical and ongoing disturbance. The site does support partial habitat requirements for a number of common native and exotic flora and fauna species. The habitat characteristic of most value within the area to be impact by the project is the occurrence of numerous hollow-bearing trees. These are considered likely to provide suitable roosting habitat for the recorded threatened bat species and as such nest boxes are proposed to offset the impacts to these species.

The detailed considerations of vegetation within the subject site by SLR have determined that some of the woodland vegetation in these areas would constitute an example of the CPW community – as listed both at State and Federal level.

In regards to the potential future development opportunities on the site and the potential removal of CPW vegetation within the GWS, these activities would not have a direct significant impact that is likely to:

- Result in an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or

- Substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

A biodiversity offset is proposed to provide compensation for the impacts to the Cumberland Plain Woodland.

Further consultation and liaison with the Department of Planning & Environment and the Office of Environment and Heritage is required to determine the best pathway for providing the best possible ecological outcomes whilst still enabling the State Significant Development – Recycling Facility and separate rezoning process to proceed.

An EPBC Referral will be required to be submitted to the Commonwealth Department of Environment to enable impacts to Matters of National Environmental Significance (particularly Cumberland Plain Woodland) to be considered at a Federal level.

Mitigation and compensation measures consist of the following:

1. Site inductions will occur to ensure site worker awareness of ecological sensitivities;
2. Any construction management plans will have an ecological section to highlight the relevant issues;
3. Vegetation disturbance will be limited to the minimum possible footprint;
4. Clearing protocols will be implemented to ensure that clearing of vegetation and in particular the hollow-bearing trees occurs in a sensitive manner;
5. Where possible, storage of construction materials will be limited to disturbed cleared areas on the site;
6. Hygiene and weed management protocols will be implemented during construction on site to avoid pathogen and exotic species spread into retained areas;
7. Disturbance of aquatic habitats will be minimised and erosion and sediment will be managed in accordance with industry standards;
8. Nest boxes will be installed at a compensatory ratio of 2:1 for each tree hollow impacted by the project;
9. The River-Flat Eucalypt Forest EEC will be fully retained and managed in perpetuity into the future for primarily ecological values; and
10. A biodiversity offset strategy will be implemented in relation to the project impacts upon the Cumberland Plain Woodland ecological community.

Combined, the above measures will ensure that ecological impacts of the project will be adequately addressed.

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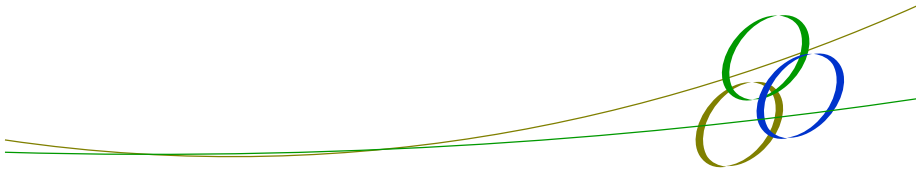

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1 BACKGROUND AND INTRODUCTION

1.1 Background

The Glenfield Waste Site straddles the Campbelltown City Council and Liverpool City Council's Local Government Area Boundary with the northern part of the site situated in the Liverpool Local Government Area (LGA) and the southern part of the site situated within Campbelltown LGA. Combined, the Glenfield Waste Site's northern and southern parcels of land function as the Glenfield Waste Services facility.

The primary land use on the Glenfield Waste Site's northern parcel of land are sandstone and sand extraction and non–putrescible solid waste landfill. To create the landfill cells, soil, sandstone and sand are extracted. The primary land use activity conducted on the Glenfield Waste Site southern parcel of land is recycling of waste.

Environmental Property Services (EPS) has been engaged by landowners JC & FW Kennett P/L & Figela P/L to prepare an Ecological Assessment Report (EA) for Glenfield Waste Services (GWS). This EA was prepared to provide a detailed assessment of the ecological characteristics of the GWS's southern parcel of land located in the Campbelltown LGA including the presence and/or likelihood of occurrence of threatened flora and fauna and their habitat.

The Campbelltown (Urban Area) Local Environmental Plan 2002 zoning map shows the majority of the Glenfield Waste Site's southern parcel of land is Zone 1(a) – Rural A Zone, a strip of land on the boundary of the Georges River is Zone 6(b) Regional Open Space Zone and part of the site adjoining Cambridge Avenue is Zone 5(b) Special Uses Arterial Roads Zone.

Detailed assessment of the likelihood of impacts of the proposal upon threatened species, populations and threatened ecological communities listed at a Commonwealth and State level is required. This EA outlines the results of this required assessment.

1.2 Licensing

Fieldwork was conducted in accordance with *National Parks and Wildlife Act 1974* (NP&W Act) Section 132 (c) Scientific Licence number SL100772. The licence permits the undertaking of biodiversity assessments, species impacts statements, ecological surveys and abiotic sampling as part of flora and fauna surveys.

1.3 Introduction, Local Context and Site Description

The GWS site is approximately 30km south west of the Sydney Central Business District. The Campbelltown LGA is situated within the Sydney Basin Bioregion which lies on the central east coast of NSW and covers an area of approximately 3,624,008 hectares. The bioregion occupies about 4.53% of NSW and is one of 17 bioregions contained within the state. The bioregion extends from just north of Batemans Bay to Nelson Bay, and almost as far west as Mudgee (OEH 2011).

Local Context

The local context has been examined at a radius of both 2km and 5km from the subject site (Figure 1-1). These areas form the boundary of the study area and are representative of the local occurrence of the Cumberland Plain Woodland and in particular the Shale Plains Woodland Critically Endangered Ecological Community (CEEC).

Within the 2km radius of the site the following vegetation areas occur:

- Shale Plains Woodland (CEEC) as mapped by OEH covers approximately 55ha; and
- Cumberland Plain Woodland Priority Recovery Areas cover approximately 256ha.

Within the 5km radius of the site the following vegetation areas occur:

- Shale Plains Woodland (CEEC) as mapped by OEH covers approximately 257ha; and
- Cumberland Plain Woodland Priority Recovery Areas cover approximately 1860ha.

The site is located adjacent to the North West corner of the Holsworthy Military Area. The Holsworthy Military Area is part of a contiguous vegetated area covering 18,000ha south of Sydney. The Georges River separates the Holsworthy Military Area from the GWS site, but likely still allows for the movement of some fauna species and the exchange of genetic material.

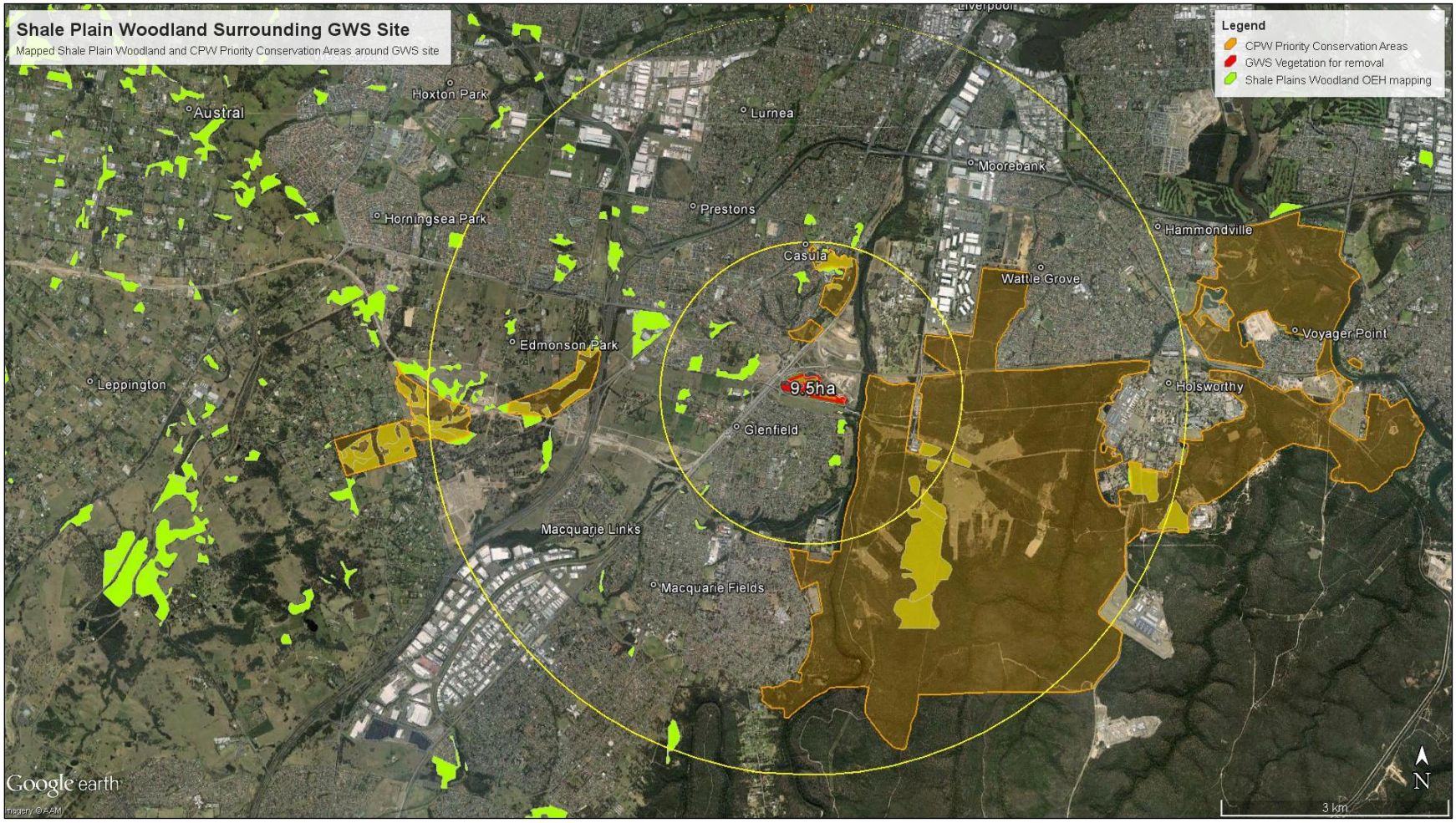

Figure 1-1: Study Area Covering 2km and 5km Radius
(Source: Google Earth Pro under Licence)

Site Description

The GWS southern parcel of land located within Campbelltown LGA, occupies an area of approximately 60 hectares (ha) bounded by the East Hills Railway Line, landfilling, sand and sandstone quarry to the north; the suburb of Glenfield to the south, Georges River to the east and the Southern Rail Line and Canterbury Road to the west.

The features of the southern parcel of land include significant electricity transmission lines and infrastructure impacting the whole of the land located south of Cambridge Avenue, forested riparian vegetation occurring along the river; the East Hills railway line, landfilled areas and non-landfilled areas and a stand of remnant woodland that is regularly underscrubbed for approved fire protection reasons.

A summary of the southern parcel of land details are shown in Table 1-1, while the aerial photograph in Figure 1-2 shows the southern parcel of land, the Glenfield Waste Site and the locality.

Table 1-1: Summary of the Southern Parcel of Land Details

Summary of southern parcel of land details	
Lot and Deposited Plans	Lot 91 DP1155962; Lot3 DP735524; Lot3 DP736881; Lot1 DP113201; Lot2 DP333578
Address	Cambridge Avenue, Glenfield NSW 2167
Topographic Map	1:25000 Campbelltown 9029-1N
Grid Reference	Zone 56, 306519E 6239570N
Local Government Area	Campbelltown
Catchment Management	Sydney Metropolitan
Primary existing Land Use	Landfill recycling of waste & rail and electricity infrastructure
Current Zoning	Zone1(a) Rural A Zone, Zone 6(b) Regional Open Space Zone & Zone 5(b) Special Uses Arterial Roads Zone

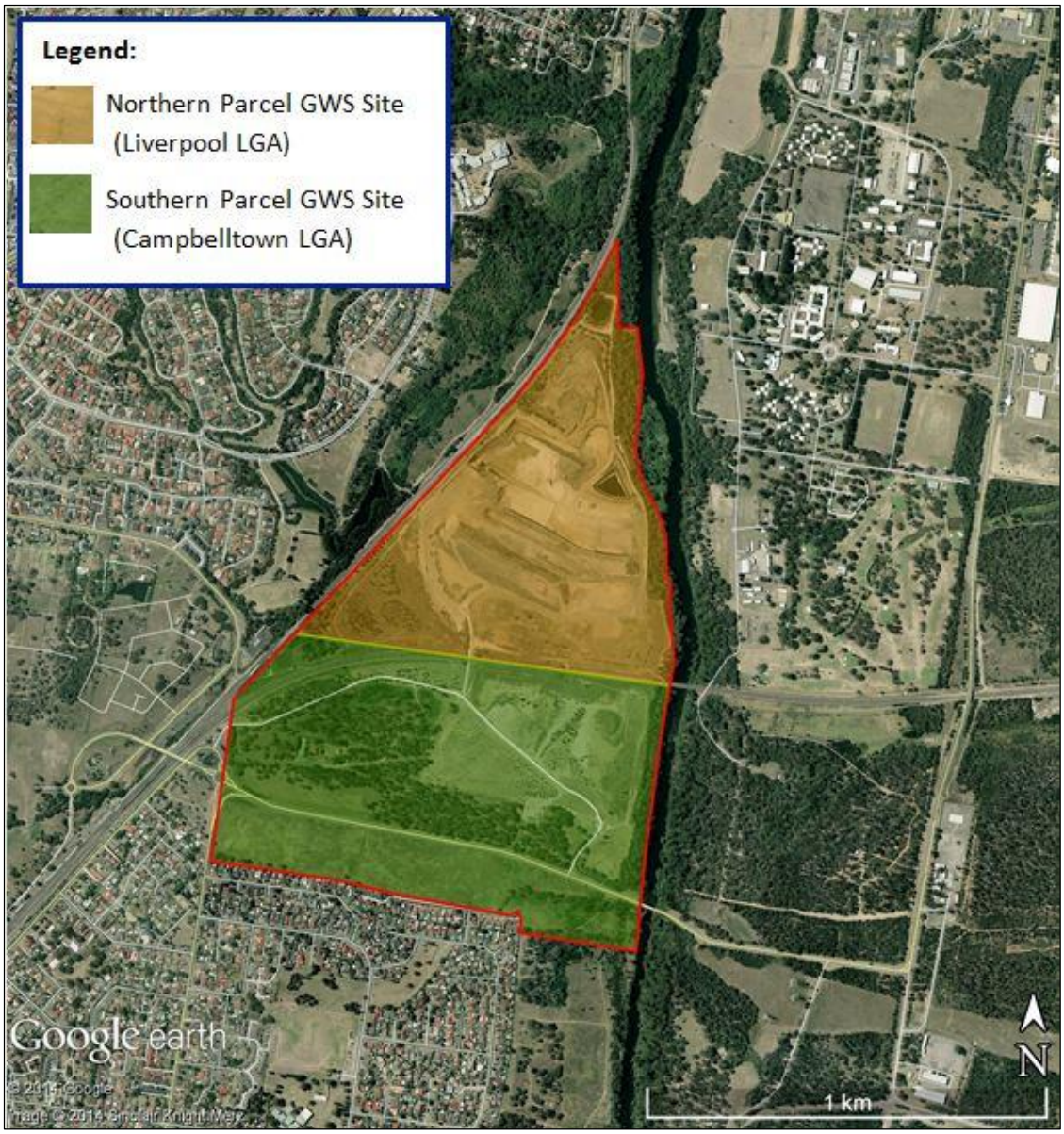

Figure 1-2: GWS site, showing northern and southern parcel of land and LGA boundaries.

The majority of the GWS site has been cleared of native vegetation. Native vegetation is primarily restricted to the Georges River riparian land and woodland on the southern parcel of land. An inspection of the historical aerial photographs (1951, 1961, 1970, 1978, 1986 and 1994) found that the woodland has been present since at least 1951. The understorey appears to have been disturbed by grazing and slashing throughout this period, with understorey clearing evident in 1978 (ACA 2006). Campbelltown City Council has directed the site owners through formal written advice on multiple occasions to maintain the understorey of the vegetation as an Asset Protection Zone to minimise bushfire risk.

1.4 Proposed Development

The proposed development of the GWS site consists of two concurrent projects consisting of firstly, the development of a portion of the site for the operation of a materials recycling facility and secondly, a Planning Proposal to Campbelltown Council to rezone the southern portion of the GWS site to facilitate industrial style employment-generating development. These two proposals are detailed as follows.

It should be noted that this EA assesses the likely impact of both the SSD and the rezoning aspects.

1.4.1 State Significant Development (SSD)

GWS is proposing to develop a materials recycling facility. The project is 'State Significant Development' (SSD) in accordance with Division 4.1 of Part 4 of the EP&A Act, as it is a type listed in Schedule 1 of the *State Environmental Planning Policy* (SEPP) - *State and Regional Development*. As such the proponent is seeking approval for the project under Section 89E of the EP&A Act.

The facility will have a capacity to process 450,000 tonnes per annum of non-putrescible waste, primarily commercial and industrial and construction and demolition waste for reuse in secondary markets. Figure 1-3 outlines the proposed SSD footprint.

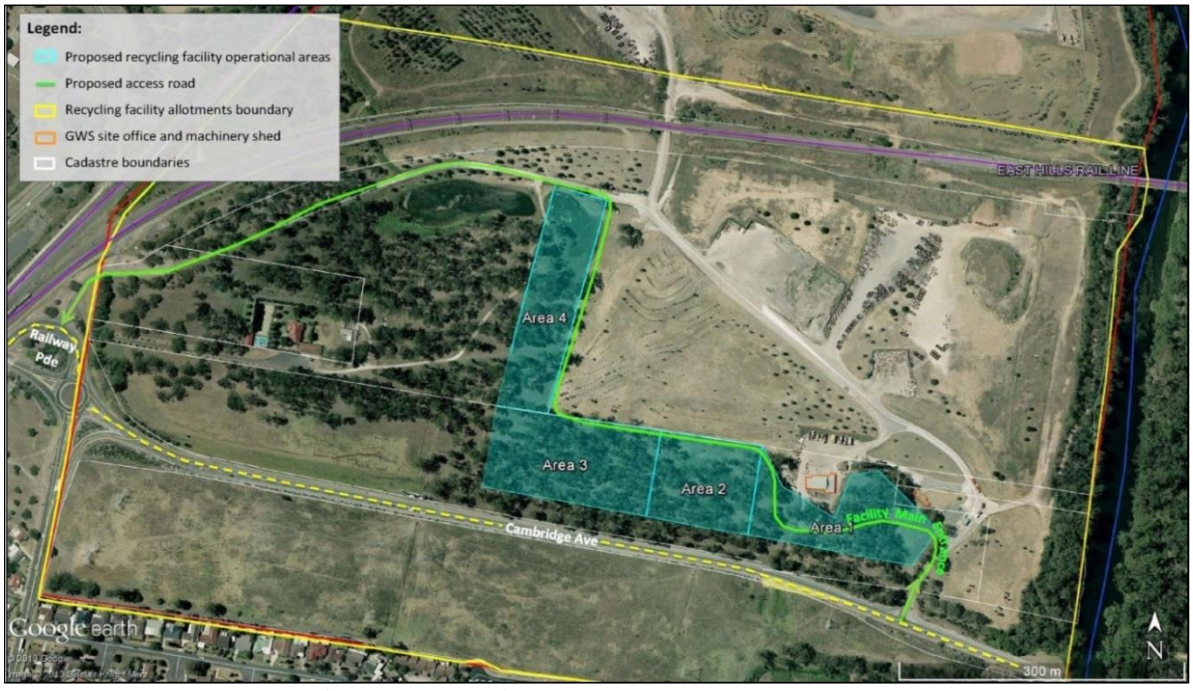

Figure 1-3: Recycling Facility area (approximately 5ha).

1.4.2 Rezoning

The majority of the southern parcel of Glenfield Waste Services land located in the Campbelltown City Council's Local Government Area is Zoned 1(a) – Rural, which reflects the historical rural land uses. The local area is now an established urban area comprising residential, industrial, commercial, education, open space and major public infrastructure land uses. A planning proposal has been produced in order to consider what the site's future function and role should be for the local and regional area. Figure 1-4 below shows the site area outlined in yellow that is intended for rezoning within the boundary of the GWS site.

The rezoning of the southern parcel of land for employment lands is consistent with the regional, subregional and local strategies which strategically guide the management of future population growth in the Sydney Metropolitan area, the South Western Region of Sydney and the Campbelltown LGA.

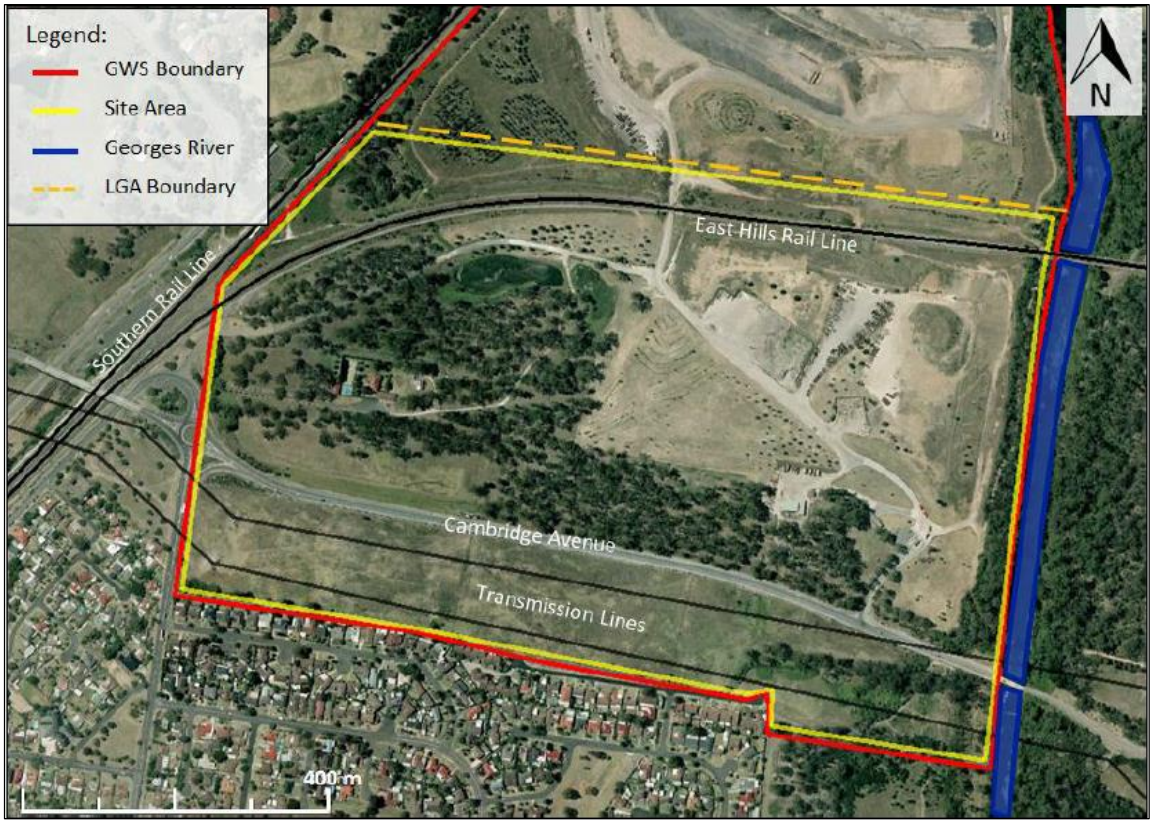

Figure 1-4: Southern parcel of GWS and proposed rezoning site area.

1.5 Consideration of SSD DGRs and Council input

Director-General's Requirements (DGRs) were provided by the Department of Planning in December 2013. Specifically in relation to ecological issues, the DGRs required the following under the heading of Key Issues:

"Biodiversity – including an assessment of any potential impacts on any threatened species, populations, endangered ecological communities, groundwater dependent ecosystems or their habitats in the region."

The DGRs also referred to a number of guidelines for biodiversity considerations.

This report has considered the DGRs for the SSD in terms of survey methodology and assessment approach as and where required.

The report has also been updated from previous versions to consider Campbelltown City Council comments on additional survey and assessment requirements.

2 GUIDELINES, POLICY AND LEGISLATION

This report has been prepared in consideration of the requirements of:

- NSW Office Environment Heritage (OEH) "Field survey methods" - http://www.environment.nsw.gov.au/threatenedspecies/
- OEH draft "Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities" – http://www.environment.nsw.gov.au/resources/nature/TBSAGuidelinesDraft.pdf
- "Threatened species survey and assessment guidelines - field survey methods for fauna: amphibians" – http://www.environment.nsw.gov.au/resources/threatenedspecies/09213amphibians.pdf
- Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act);
- NSW *Environmental Planning and Assessment Act 1979* (EP&A Act);
- NSW *Threatened Species Conservation Act 1995* (TSC Act); and
- NSW *Fisheries Management Act 1994* (FM Act).

2.1 Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

Under an EPBC Act, an approval from the Commonwealth Department of Environment (DoE) is required for actions that are likely to have a significant impact on matters of national environmental significance. An action includes a project, development, undertaking, activity, or series of activities. When a proposal involves taking an action which may need approval under the EPBC Act, a referral for the proposal must be made to the Australian Government Minister for the Environment. The Act identifies the following matters of national environmental significance:

- World Heritage properties (sections 12 and 15A)
- National Heritage places (sections 15B and 15C)
- Wetlands of international importance (sections 16 and 17B)
- Listed threatened species and communities (sections 18 and 18A)
- Listed migratory species (sections 20 and 20A)
- Protection of the environment from nuclear actions (sections 21 and 22A)
- Commonwealth marine environment (sections 23 and 24A)
- Great Barrier Reef Marine Park (sections 24B and 24C)
- A water resource, in relation to coal seam gas development and large coal mining development (sections 24D and 24E)

- The environment, if the action involves Commonwealth land (sections 26 and 27A), including:
    - actions that are likely to have a significant impact on the environment of Commonwealth land (even if taken outside Commonwealth land);
    - actions taken on Commonwealth land that may have a significant impact on the environment generally;
- The environment, if the action is taken by the Commonwealth (section 28)
- Commonwealth Heritage places outside the Australian jurisdiction (sections 27B and 27C)

2.2 NSW Environmental Planning and Assessment Act 1979 (EP&A Act)

Threatened species impact assessment is an integral part of environmental impact assessment. The objective established by Section 5A of the EP&A Act (herein referred as the 'Assessment of Significance') is to improve the standard of consideration afforded to threatened species, populations and ecological communities, and their habitats through the planning and assessment process, and to ensure that the consideration is transparent. The Assessment of Significance is the first step in considering potential impacts.

2.3 NSW Threatened Species Conservation Act 1995 (TSC Act)

Schedules 1 and 2 of the TSC Act contain lists of flora and fauna species and communities, which have been determined by the NSW Scientific Committee as being under threat of serious decline that could ultimately lead to extinction. Schedule 3 of the TSC Act contains a list of 'Key Threatening Processes' which threatens, or could potentially threaten, the survival or evolutionary development of a species, population or ecological community.

2.4 NSW Fisheries Management Act 1994 (FM Act)

The FM Act covers threatened fish and marine vegetation and associated threatening processes and is administered by the Department of Primary Industries. In 2004, the NSW Government amended the FM Act through the introduction of the Threatened Species Legislation Amendment Act 2004. This report considers any impacts that might occur to listed threatened species of fish or aquatic organisms.

3 BACKGROUND RESEARCH

The methods undertaken to complete the EA are divided into two stages, including preliminary/desktop investigations and field surveys and assessments. Preliminary investigations included literature and database reviews. Field surveys included site inspections and targeted sampling of flora, fauna and habitat.

3.1 Database Review

A list of threatened species, populations and ecological communities that had been previously reported or modelled to occur within a defined radius of the subject site (the 'investigation area'), was obtained by undertaking a search of the following online and publicly accessible databases.

3.1.1 NSW Government

The investigation area, or defined radius in which the state search was undertaken included an search of all 'known', 'predicted' and 'recorded' species in both the Liverpool and Campbelltown Local Government Areas. As a result, the 'recorded' species information includes sightings/records from this entire search area and not solely from the Site.

- NSW BioNet - http://www.bionet.nsw.gov.au/
- Threatened Species, Populations, and Ecological Communities of NSW - http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/index.aspx
- SIX Spatial Information Exchange - http://maps.six.nsw.gov.au/apps/channels_3.5/?config=vegetation

Appendix 1 contains the BioNet search results.

3.1.2 Australian Government

- The investigation area or defined radius in which the federal search was undertaken included a 10km radius of the site using the Commonwealth Department of Environment Protected Matters search tool http://www.environment.gov.au/epbc/pmst/index.html.

Appendix 2 contains the EPBC Protected Matters Search Tool Results.

3.2 Literature Review

A review of literature pertaining to the study area, the investigation area and the proposed activity was undertaken. This included internet searches and a review of relevant reports. In this instance, there were a number of previous ecological assessments in the investigation area and a number of ecological assessments undertaken more broadly within the Local Government Areas of Campbelltown and Liverpool.

The vegetation of the Campbelltown LGA was described by Benson and Howell (1990) as a mix of rugged Hawkesbury Sandstone country and rolling hills of woodlands of Grey Box *Eucalyptus moluccana*, Forest Red Gum *Eucalyptus tereticornis*, and Narrow-leaved Ironbark *Eucalyptus crebra*, on the clay soils of the Wianamatta Shale.

The vegetation communities of the Cumberland Plain were mapped by National Parks and Wildlife Services (NPWS) (2002) at a scale of 1:25,000 using aerial photograph interpretation and limited ground survey. Two vegetation communities were mapped on the GWS site, in particular, Shale Plains Woodland and Riparian Forest. The dominant overstorey species were *Eucalyptus moluccana, E. botryoides and E. botryoides/saligna* hybrid. The understorey vegetation was predominantly comprised of exotic grass and weeds (NPWS 2002).

Tozer (2003) identified 21 vascular plant communities on and adjacent to the Cumberland Plain and Hornsby Plateau. Vegetation communities were described using structural features, habitat characteristics and diagnostic species. Contemporary vegetation cover was estimated from 1:16000 scale aerial photography (1997/98) and sorted into six categories based on cover of *Eucalyptus* species. These categories are only approximately related to vegetation condition.

The 1:100 000 scale vegetation mapping accompanying Tozer (2003) was a larger scale version of the 1:25 000 digital maps released on CD Rom by NPWS (2002). The Tozer (2003) and NPWS (2002) communities mapped on the GWS site were equivalent to Endangered Ecological Communities (EECs) listed under the TSC Act (see Table 3-1).

Table 3-1: Previously Mapped Vegetation Communities and Endangered Ecological Communities

Tozer(2003)/NPWS(2002)Communities	Endangered Ecological Communities
10–Shale Plains Woodland	Cumberland Plain Woodland
12–Riparian Forest	River-flat eucalypt forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions

3.2.1 Eco Logical Studies

In 2006, Eco Logical prepared a preliminary ecological assessment of the Glenfield Waste Site (Eco Logical 2006). The assessment involved a review of background literature and mapping and a field survey to validate the condition and recovery potential of the vegetation communities, followed by the application of an OEH (formerly the Department of Environment and Conservation (DEC)) approved ecological constraint analysis process and mapping of outcomes.

The review consisted of a consideration of the DEC Western Sydney Vegetation mapping, as described in NPWS (2002). The investigation area was inspected on 16 March 2006 and flora and fauna species were recorded. A total of 38 plant species were recorded in the forest and riparian vegetation, of which 20 were native and 18 exotic. A total of 23 fauna species (all birds) were recorded by Eco Logical during the March 2006 field survey, with no threatened species observed.

The Eco Logical 2006 report described the woodland vegetation in the western portion of the investigation area as containing more mature and dispersed trees than in the eastern portion, with tree hollows representing potential fauna habitat, a low level of leaf litter and high grass cover with evidence of grazing and slashing. The vegetation in the eastern portion of the investigation area was described as having younger trees with an understorey of scattered shrubs and ground cover, with less grass cover and deeper litter layers than in the west. The vegetation adjacent to the Georges River was described by Eco Logical as riparian forest with weedy banks and a mixed native understorey.

3.2.2 ACA Studies

A study conducted by ACA (2006) described the vegetation in the investigation area as woodland with three characteristic tree species, namely *Eucalyptus eugenioides, E. moluccana* and *E. tereticornis.*

It was concluded that the woodland vegetation recorded on the site meets the criteria for Cumberland Plain Woodland under both the EPBC Act and TSC Act. It was recommended that to come to a conclusive determination as to the classification of woodland vegetation on site further studies were required.

3.2.3 SLR Studies

As discussed in the ACA (2006) Report, further field studies were required in order to come to a conclusive determination as to the classification of woodland vegetation on site. As a result, SLR Consulting were engaged by EPS with the aim of producing a conclusive Cumberland Plain Woodland Assessment Report.

SLR Consulting were tasked with the following:

- To undertake background research regarding any existing vegetation mapping of the subject site;
- To undertake a site survey:
    - To verify the vegetation present;
    - To collect a detailed flora species list;
    - To undertake a series of flora survey quadrats; and
- To determine likely ecological constraints to future rezoning and development of the site.

From the survey work carried out in 2014, SLR has been able to determine the extent, nature and condition of native vegetation on the subject site. The SLR results concluded that significant portions of the subject site have long been cleared, modified and used as part of the existing recycling facility, however, the band of vegetation in the southern, central and western parts contain a canopy of eucalypts which are characteristic of the Cumberland Plain Woodland (CPW) community and would constitute an example of this community (SLR 2014).

As stated by SLR 2014 the CPW community is listed in the TSC Act as a "*critically endangered ecological community*" (CEEC), and is also listed as part of a CEEC in the EPBC Act.

SLR conducted a preliminary assessment on the condition state of the CPW community in accordance with the threshold levels under the EPBC Act. This preliminary assessment indicates that the subject site supports vegetation that meets the criteria for CPW which is listed as being a CEEC under Federal Legislation (SLR November 2014) (Appendix 16).

4 PRELIMINARY ECOLOGICAL INVESTIGATION

4.1 Overview

Preliminary studies and fieldwork were undertaken in the months of March through to July of 2012, refer to Appendix 14 for specific dates. Both flora and fauna surveys were conducted at varying times to assess the likelihood of any threatened flora, fauna or endangered ecological communities being present.

Field surveys were undertaken in consideration of OEH's: *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft, November 2004.*

Targeted field surveys were conducted for arboreal mammals, microchiropteran bats and birds (diurnal and nocturnal). The field surveys for diurnal birds were undertaken during the daylight hours (900hrs-1300hrs) on 30th May 2012 and 21st June 2012 (0800-1400hrs). Field surveys for arboreal mammals and microchiropteran bats were undertaken on the evenings of the 20th and 21st June 2012. General surveys included searches for the presence or signs of any fauna including the presence of tracks, scats (fecal pellets), hair, scratches etc.

4.2 Flora and Vegetation Community Survey

Preliminary floristic surveys of the site occurred on the 30th May and 12th July 2012. Vegetation was surveyed by using the targeted random meander method and by the collection of floristic data using quadrats and transects.

Floristic information was collected from 8 quadrats of 20 x 20 metres in size, distributed across the investigation area. The data recorded in the quadrats were consistent with the standards used by the Office of Environment and Heritage and the Royal Botanic Gardens for general survey as well as with the BioBanking/Biodiversity Certification methodology.

The data recorded included:

- Geographical information (MGA, location, topographic map);
- Physical features (topographic position, elevation, slope, aspect, general soil type);
- Disturbance history (including grazing, clearing/logging, weeds and fire);
- Structural features of the vegetation according to Specht *et al.* (1995) (numbers and types of layers present, their heights, canopy cover, and three most dominant species in each layer); and
- Species and their cover abundance using the following modified Braun-Blanquet seven point scale:
    - 1: <5% cover – rare, 3 or fewer individuals;
    - 2: <5% cover – uncommon, >3 individuals and sparsely scattered;
    - 3: <5% cover – common, individuals consistent throughout the plot;
    - 4a: <5% cover – abundant, many individuals throughout the plot;
    - 4b: 5%-25% cover;
    - 5: 25%-50% cover;
    - 6: 50%-75% cover; and
    - 7: 75%-100% cover.

Specimens of plants were collected for later identification if they were not readily identifiable in the field. Such specimens were identified according to Harden (1990, 1991, 1992, 1993) and the interactive flora (Flora Online) provided online by NSW National Herbarium of the Royal Botanic Gardens (http://plantnet.rbgsyd.nsw.gov.au/floraonline.htm).

4.3 Fauna Survey

Field surveys were undertaken to ascertain the presence, distribution and quality of fauna habitat and a range of fauna including arboreal and terrestrial mammals, bats, birds, amphibians and reptiles. The expectation of the types of animals (and habitats) potentially present on the site, and the design and implementation of field surveys, were based on the review of literature.

During an inspection on 28th March 2012 it was evident that the vegetation supported a disturbed understory comprised of predominantly native and exotic groundcover and grasses. There was no mid-storey nor logs, rocks or leaf litter. It was concluded that the investigation area was unlikely to provide habitat for ground dwelling/terrestrial mammals and as such targeted fauna trapping and reptile searches were not considered applicable or necessary.

Arboreal and Terrestrial Mammals

Mammal surveys were conducted in the evenings of 20th and 21st June 2012. The technique employed involved a person surveying on foot with a spotlight for two separate one hour searches over two consecutive nights. The transect walked during each period, was approximately one kilometre long (Figure 4-1). During the search, the spotlight was shone into the vegetative canopy with the light placed at eye height of the surveyor so that any eye-shine was detected. The weather on the evenings of the surveys was fine with little or no wind.

Bats

Microchiropteran bat surveys were conducted in the evenings of 20th and 21st June 2012 using a commercially available ultrasonic recorder (Anabat) situated within a number of locations, (Figure 4-2) in particular, potential roost sites or flyways as well as near the dam. Surveys were conducted during optimal conditions with little or no wind or rain. Any echolocation calls emitted by bats and detected by the Anabat microphone were recorded (Appendix 11) and sent for identification and interpretation.

Birds

Diurnal bird surveys were conducted on 30th May 2012 from 0900hrs-1300hrs and 21st June 2012 (0800-1400hrs) by an experienced ornithologist in the woodland. All birds were identified by observation or by call. Targeted surveys were undertaken during optimal conditions in the morning with little or no wind or rain. Other bird observations occurred as opportunistic sightings whilst undertaking other assessments.

Nocturnal bird surveys were conducted on evenings of 20th and 21st June 2012. Surveys were undertaken in conjunction with spotlighting and bat detection assessments whereby an ornithologist would detect the presence of any nocturnal birds by either observations or call. Surveys were only undertaken during optimal conditions, such as little or no rain.

Amphibians and Reptiles

Amphibian and reptile surveys were conducted on 30th May 2012 (0900hrs-1300hrs) and 21st June 2012 (0800-1400hrs) as well as on evenings of 20th and 21st June 2012. Surveys were conducted by an experienced ecologist undertaking an area search of the woodland and associated aquatic environs. Other observations occurred as opportunistic sightings whilst undertaking other assessments.

4.4 Habitat Assessment

Habitat is defined under the TSC Act, as an area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community and includes any biotic or abiotic component. The investigation area was surveyed on the 30th May and 21st June 2012 for the presence of fauna habitats, including:

- Nectar and seed producing trees and shrubs;
- Leaf litter and fallen timber;
- Open water, wetlands and soaks;
- Hollow bearing trees; and
- Cleared areas.

The survey for these habitat characteristics was conducted across the investigation area in order to ascertain the type, distribution and abundance of these resources. The location (coordinates) of all nectar and seed producing trees and shrubs, leaf litter and fallen timber, hollow-bearing trees and cleared areas was obtained using a hand-held Global Positioning System (GPS) and recorded on a data sheet. Other habitat data, such as the species of tree, the number and size of hollows, height/density (structure) of vegetation layers, leaf litter, fallen timber, stags, rock shelves, soil type, presence of water and any human-made habitats were also recorded.

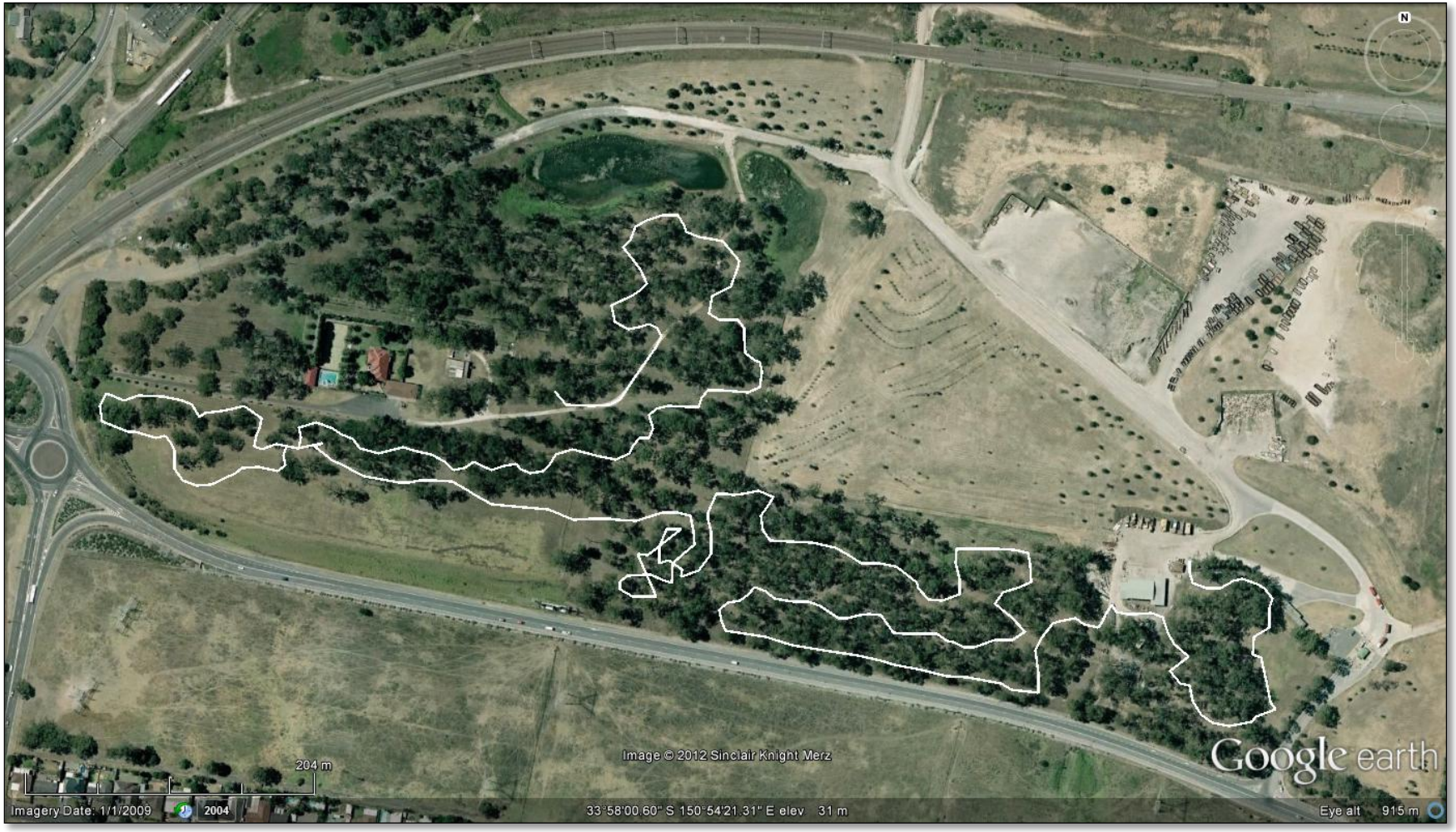

Figure 4-1: Aerial photo of investigation area showing spotlighting transect/survey route (20 June 2012).

Figure 4-2: Investigation area showing the two locations chosen for Anabat recordings on the nights of the 20 and 21 June 2012.

4.5 Results, Discussion and Conclusions from Preliminary Ecological Investigations

This section details the results of desktop assessments, database reviews, and field surveys and provides a brief interpretation and discussion of these results.

4.5.1 Vegetation Survey Results

Eighty six species of flora were observed in the investigation area. Of these, 47 were native and 39 exotic. They were represented by 38 families, the most species being within the Poaceae (15 species). No threatened species or endangered populations were recorded on site during the survey. The flora list can be found in Appendix 9.

The floristic pattern exhibited is typical of grassy woodland and the canopy trees are principally *Eucalyptus moluccana* (Grey Box) with *Eucalyptus tereticornis* (Forest Red Gum) being co-dominant. The canopy trees are in general of an even age and are regrowth estimated no older than 60 years. There were a total of 38 hollow bearing trees with hollows of various sizes present across the investigation area.

4.5.2 Fauna Survey Results

A total of 22 fauna species were recorded, which comprised 19 birds, two frogs and one mammal. In addition, Anabat recordings were undertaken with a number of microchiropteran bat species recorded including two species being the Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) and Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) listed as Vulnerable under the TSC Act.

All bird species recorded are common in urban/semi-urban habitats on the east coast of Australia and are of low conservation significance. Bird species were observed either in trees, on the ground and/or in flight either in or adjacent to the woodland vegetation. Other bird species, mostly waterbirds were observed either in or on the edge of the open water/dam north of the homestead. The fauna list can be found in Appendix 10.

4.5.3 Fauna Habitat

The investigation area supported woodland vegetation with an overstorey predominantly of one age class and strata, with no mid-storey and no juvenile understory or immature tree species present. There was no understory shrub layer present, and as such, the understory lacked any structural complexity, supporting only groundcover and grass species which had been subject to regular mowing and provided some minor foraging habitat for predominantly common fauna species only. The investigation area and study area did not support any declared critical habitat in NSW, listed under the TSC Act.

Nectar and Seed Resources

Fauna habitat comprised of nectar and seed producing Eucalypts, such as Grey Box *Eucalyptus moluccana* and to a lesser extent, Forest Red Gum *E. tereticornis* and Narrow-leaved Ironbark *E. crebra*. Other nectar and seed producing trees comprised White Feather Honey myrtle *Melaleuca decora* and one Broad-leaved Apple *Angophora subvelutina*. The investigation area was dominated by the occurrence of *E. moluccana* and consisted of scattered trees predominantly of one age and strata (canopy) with no mid-storey of juvenile species. As such, the vegetation lacked structural complexity. Other potential seed resources present were from native and exotic grasses as well as River She-Oak *Casuarina cunninghamiana*, which had been planted on the edges of the woodland.

Leaf Litter and Fallen Timber

The investigation area had been regularly slashed and managed and there was a paucity of leaf litter and fallen timber. Two piles of timber occurred at two locations within the woodland and appeared to provide habitat for the European Rabbit *Oryctolagus cuniculus*, with burrows and scats being observed in these areas.

Open Water, Wetlands and Soaks

The investigation area supported an area of open water, which was a farm dam situated directly north of the homestead. This open water provided suitable habitat for common waterbird species such as the Eurasian Coot, Australian White Ibis and Australian Wood Duck. A soak or wet area was observed on the northeast margin of the woodland. Some Common Eastern Froglets and Whistling Tree Frogs were heard calling from this location.

Hollow Bearing Trees

The investigation area supported a relatively high number of hollow bearing trees across most of the investigation area (Appendix 12). The location of these across the investigation area can be seen in Figure 4-3. The dominant hollow bearing tree was *E. moluccana* with hollows occurring either in dead horizontal branches, vertical spouts and dead trunks and/or dead branches or trunk hollows and live and/or dead trees. There was little evidence of these hollows being used by fauna, other than two trees which were supporting Galahs at the time of survey. Hollows were also present in five *E. tereticornis* and one *A. floribunda*.

Cleared Areas

The Glenfield Waste Site has been in single family ownership since the 1800's with the understorey and groundcover being continually maintained for a number of purposes over that period. From aerial photography dating back to the 1930's it is clear that the GWS site was previously used for orchards and farming. In photographs dating from the 1950's through to the 1970's it is evident that the vegetated portion of the site has had the understorey and groundcover managed throughout the woodland. Much of the site, including the woodland portion, has been used for grazing, general agricultural purposes and more recently, slashed for fire hazard reduction at Campbelltown City Council's request. As the investigation area has been regularly slashed and otherwise managed such that a predominantly cleared understorey comprised of native and exotic grasses and herbs occurs across the entire investigation area, the understorey was not likely to provide habitat for threatened bird or mammal species, moreover, the cleared understorey was likely to provide foraging habitat for common bird species such as Common Myna, Magpie Lark, Eastern Rosella, Common Starling etc.

4.5.4 Habitat Connectivity

The investigation area is bounded by a number of significant barriers to fauna movement, including Cambridge Avenue, the Main Southern Railway Line, the Southern Sydney Freight Line, East Hills Railway Line, internal roads, the Georges River and the operational quarry, landfill and recycling areas within the GWS precinct. Similarly, the study area (within 10km) is subject to disturbance and isolation of vegetative areas, thus reducing the potential movement of small and terrestrial mammals, reptiles, amphibians and birds and bats into and through the investigation area. Larger terrestrial mammals that may occur in the locality would be excluded from much of the study area as a result.

Habitat connectivity within the study area is greatest within the riparian vegetation associated with Georges River, which maintains connectivity with riparian vegetation to the north and south. This riparian corridor would facilitate the movement of less mobile species, including cover-dependent species, larger terrestrial mammals and arboreal mammals.

South east and east of the Georges River is the adjacent Holsworthy Military Area. Hyder Consulting (2012) reported that this site supports approximately 18,000 hectares of continuous native vegetation. The diversity of vegetation communities within the Military Area includes forests, woodlands, heath and swamp communities, which in turn provide important habitat to threatened flora and fauna. Highly mobile fauna such as birds and some mammals may predominantly reside within the Holsworthy Military Area and use the limited resources offered by the subject site on a transient basis.

Figure 4-3: Aerial photo of investigation area showing locations of hollow bearing trees.

4.6 Preliminary Study Conclusions

The preliminary studies revealed that:

- A total of 86 species of flora were observed in the investigation area. Of these, 47 were native and 39 exotic. They were represented by 38 families, the most species being within the Poaceae family (15 species);
- No threatened flora species or endangered flora populations were recorded on site during surveys;
- The abiotic characteristics of the investigation area revealed that the site could support some Cumberland Plain Woodland. These include the soil landscape, altitude, topographic position and geographic location;
- The site supports Grey Box and some areas of native understorey consistent with Cumberland Plain Woodland;
- Though none were identified, the investigation area was assessed as having suitable habitat for a total of 16 threatened and migratory fauna species. Of these, there were ten bird species (eight passerines/perching birds and two shorebirds) and six mammal species (bats);
- No threatened frog, threatened waterbird, threatened arboreal mammal, or threatened fish species were considered likely to have habitat within the investigation area or occur on the investigation area;
- Fauna habitat present comprised of nectar and seed producing Eucalypts, such as Grey Box *Eucalyptus moluccana* and to a lesser extent, Forest Red Gum *E. tereticornis* and Narrow-leaved Ironbark *E. crebra*;
- The investigation area supported a farm dam which provided an area of open, deep water for common waterbird species;
- The investigation area had been regularly slashed and managed such that there was a paucity of leaf litter and fallen timber across the site and was likely to provide some foraging habitat for only common bird species such as the Common Myna, Magpie Lark, Eastern Rosella, Common Starling etc;
- The investigation area (woodland) supported a relatively high number of hollow bearing trees; and
- The investigation area is bounded by a number of significant barriers to fauna movement, including Cambridge Avenue, the Main Southern and East Hills Railway Lines, internal roads, and the tip site within the GWS precinct, which would limit the potential use of and movement through the investigation area by threatened fauna.

5 RECENT ECOLOGICAL INVESTIGATIONS

5.1 Background

The following section outlines additional fieldwork undertaken to provide a complete and robust picture of the ecological values of the southern parcel of the GWS site.

Subsequent to the preliminary studies, further assessment has occurred that addresses the comments raised by the Office of Environment and Heritage (OEH) in their letter received November 2013. This has included addressing:

- The likelihood of Cumberland Plain Woodland, listed as a Critically Endangered Ecological Community under the *Threatened Species Conservation Act 1995* (TSC Act) and the *Environmental Protection and Biodiversity Conservation Act 1999* being present on site;
- The likelihood of two bat species Eastern Bentwing-bat (*Minioptera schreibersii*) and the Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) both listed as Vulnerable under the TSC Act being present on site;
- The likelihood of the site being suitable habitat for 16 threatened and migratory fauna species;
- The presence of koala food trees on site; and
- The likelihood of the threatened flora species *Pimelea spicata* (Spiked-rice flower) being present.

Additional surveys were also undertaken in 2015 to ensure that Campbelltown City Council's concerns about previous surveys occurring in cooler seasons were addressed. The 2015 surveys occurred in February and targeted:

- Green and Golden Bell Frog (in accordance with Commonwealth and State guidelines) over four nights;
- Additional microbat surveys over four nights; and
- Opportunistic surveys for all other species of flora and fauna in the surveyed areas, with a focus on threatened species.

These were also the species that Council considered warranted further surveys.

Appendix 14 includes the times and dates of all fieldworks undertaken for recent survey work.

Appendix 9 and 10 includes flora and fauna species respectively recorded during these and previous surveys.

5.2 Database Review

Raw data obtained from the more recent searches of NSW and Commonwealth databases are shown in Appendices 1 and 2 and are summarised below:

- A total of 87 threatened fauna species listed under TSC Act and / or EPBC Act had either been recorded, known or predicted to occur within the Liverpool/Campbelltown Local Government Area / EPBC 10km radius;
- A total of 90 threatened flora species listed under TSC Act and / or EPBC Act had either been recorded, known or predicted to occur within the Liverpool/Campbelltown Local Government Area/ EPBC 10km radius;
- A total of 27 Endangered Ecological Communities (EEC) listed under TSC Act and / or EPBC Act had either been recorded, known or predicted to occur within the Liverpool/Campbelltown Local Government Area/ EPBC 10km radius;
- A total of 34 Listed Migratory species, listed under EPBC Act may occur within the investigation area;
- No critical habitat listed under the TSC Act occurred within the investigation area;
- A total of 34 Key Threatening Processes (KTP's) listed under the TSC Act were predicted to occur within the investigation area;
- A total of 53 invasive species listed under the EPBC Act were predicted to occur within the investigation area; and
- No threatened species or communities as listed under the FM Act have been recorded in the Campbelltown LGA (Department of Primary Industries – Fishing and Aquaculture Threatened & protected species - records viewer).

Each of these species, EEC, KTPs and invasive species were thoroughly considered and assessed to ascertain whether they were likely to occur on the subject site and/or be impacted by the proposed activity (Appendices 3-6).

5.3 Targeted Flora and Vegetation Community Surveys

5.3.1 Plants

In addition to the previous numerous flora surveys, a targeted flora survey was conducted on the 17th (1000-1600) December 2013 to determine the presence or absence of the flora species *Pimelea spicata* (Spiked-rice flower) listed as Endangered under the EPBC Act and TSC Act. In accordance with the OEH *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft, November 2004* the random meander technique was conducted on the southern parcel of the GWS site to search for this particular species. All other threatened flora were also considered during this survey. The search area consisted of those areas primarily within the most suitable habitat. Survey efforts included one hour of targeted surveys per hectare of suitable habitat, or 12 hours for the entire 12 ha of suitable habitat. *Pimelea spicata* was not observed during the field survey. No other threatened flora species were recorded. Further detailed information can be obtained in the Threatened Species Survey Report in Appendix 8. No threatened flora species are therefore known to occur on the southern portion of the GWS site.

5.3.2 Vegetation Communities

SLR (refer to Appendices 15 and 16) undertook further assessments of the vegetation on the site, including vegetation community mapping, BioBanking plot field surveys and assessment of the status of the vegetation communities at a State and Federal level. Refer to these Appendices for detailed information.

Figure 7 in Appendix 15 provides a map of the vegetation communities on the site, including their condition. The occurrence of Cumberland Plain Woodland (EPBC Act CEEC and TSC Act CEEC) and River-Flat Eucalypt Forest (TSC Act EEC) is discussed in detail in those documents. This report includes as assessment of the likely impacts to occur to these vegetation communities as a result of the project.

5.4 Targeted Fauna Survey

Further detailed field surveys were undertaken in the southern portion of the GWS site to ascertain the presence of certain fauna species considered 'likely' to occur on site. This involved using a range of methods such as targeted random meander surveys and spotlighting. To determine which threatened fauna species to target during surveys, a map was created using recorded sightings from the OEH threatened species database. This provided EPS's ecologist with an indication as to those species considered likely to occur on the site. This map can be found in Appendix 18. The records on this map was used in conjunction with the known threatened species records from the locality.

5.4.1 Arboreal and Terrestrial Mammals

Arboreal mammal surveys were conducted on the evenings of 29th of April (1800-2000hrs) and 25th June 2014 (1730-2030hrs). The technique employed involved surveying on foot with a spotlight (for two separate one hour searches over two separate nights). The area walked during each searching period was approximately one kilometre. During the search, the spotlight was shone into the vegetative canopy with the light placed at eye height of the surveyor so that any eye-shine was detected. The weather on the evenings of the surveys was fine with no wind. Subsequent targeted Green and Golden Bell Frog and bat surveys in February 2015 also included some additional opportunistic spotlighting of trees within the woodland area.

5.4.2 Bats

Microchiropteran bat recordings were initially conducted on the evenings of 29th of April and 25th, 26th and 27th June 2014 using a commercially available ultrasonic recorder (Anabat). Surveys were conducted during optimal conditions, during times of little or no wind or rain and were for a period of dusk to dawn. Follow-up microbat surveys using an Anabat were undertaken on the nights of 24th, 25th, 26th and 27th February 2015. See Appendix 14 for details on these surveys.

Recorded echolocation calls were recorded and were sent to Dr Anna McConville at Echo Ecology for interpretation and identification. This Bat Call Identification Report is provided in Appendix 13.

The Bat Call Identification Report confirms that from the May 2014 survey a total of 303 call sequences were able to be analysed and of this number 106 call sequences (35%) were able to be confidently identified to species level. The February 2015 survey resulted in a total of 1,372 call sequences being able to be analysed. Of these bat calls, 326 call sequences (24%) were able to be confidently identified to species level.

The following microbat species were confidently recorded during the EPS surveys:

- *Chalinolobus gouldii* (Gould's wattled bat)
- *Chalinolobus morio* (Chocolate wattled bat)
- ***Miniopterus australis*** **(Little bentwing bat)**
- ***Miniopterus schreibersii oceanensis*** **(Eastern bentwing bat)**
- ***Mormopterus*** **(*Micronomus*)** ***norfolkensis*** **(East-coast freetail bat)**
- *Mormopterus* (*Ozimops*) *ridei* (Eastern freetail bat)
- ***Saccolaimus flaviventris*** **(Yellow-bellied sheathtail bat)**
- *Tadarida australis* (White-striped freetail bat)
- *Vespadelus pumilus* (Eastern forest bat)

Threatened bats recorded are those denoted by bold text in the list above.

Seven other microbat species were considered to potentially occur within the site, however could not be confidently identified. Three of the seven species potentially occurring are threatened species including the Eastern false pipistrelle (*Falsistrellus tasmaniensis*), Large-footed myotis (*Myotis macropus*) and Greater broad-nosed bat (*Scoteanax rueppellii*). These species have been assessed in Appendix 3 and if considered likely to occur on site, they were further assessed through the Seven-part test in Appendix 7.

5.4.3 Koala

The dominant tree species on site consist of Grey Box (*Eucalyptus moluccana*) and to a lesser extent, Forest Red Gum (*E. tereticornis*) and Narrow-leaved Ironbark (*E. crebra*). *Eucalyptus tereticornis* is listed under SEPP 44 Schedule 2 as being a Koala Feed Tree and *Eucalyptus moluccana* is determined to be a 'Secondary' Koala feed tree species as listed under the NSW OEH Koala Recovery Plan in the Sydney Metropolitan Catchment Management Area (DECC 2008). The City of Campbelltown Koala Habitat Planning Map shows the remnant woodland on the site that would be impacted by the projects to be Marginal Koala habitat quality, with proposed retained habitats along the Georges River being shown as Unknown habitat quality for Koalas.

The site is bound by a number of potential barriers to larger terrestrial mammal movement including Cambridge Avenue and Moorebank Avenue, the main south passenger and Southern Sydney Freight railway lines to the west, the East Hills railway line traversing the site and significant residential sprawl surrounding the GWS site. The site is also bounded by a combination of both chain mesh fencing and colourbond fencing that, in combination with the above roads, rail and residential areas, would severely limit Koala movement into the site. The site is exposed, on a daily basis, to considerable anthropogenic disturbance from the operation of the waste facility including noise and dust from truck movement. The site is considered highly degraded and partially fragmented from larger tracts of vegetation that may be used by this species as part of a larger home range.

No anecdotal records or indications of the presence of Koalas were recorded and it is considered unlikely that the remnant woodland on the site is important for the local Koala population.

5.4.4 Birds

Diurnal bird surveys were conducted on 29th April 2014 from 1430hrs-1630hrs and 30th April 2014 from 0800-1000hrs. Additional diurnal bird surveys were also completed on the 24th, 25th, 26th and 27th February 2015. See Appendix 14 for details on these surveys and refer to Appendix 10 for the recorded species list.

All birds were identified by observation or by call interpretation (**Error! Reference source not found.**). Targeted surveys were undertaken during the morning and afternoon period with little or no wind or rain, thus during optimal conditions for detecting the presence of bird species. Other bird observations occurred as opportunistic sightings whilst undertaking other assessments.

Nocturnal bird surveys were conducted on the evening of 29th April (1800-2000hrs) and 25th June 2014 (1730-2030hrs). Surveys were undertaken in conjunction with spotlighting and bat detection assessments by either visual observations or call interpretation. Surveys were only undertaken during optimal conditions, such as little or no rain.

Recorded diurnal and nocturnal bird species were species either highly tolerant to disturbance or those associated with the aquatic environs contained in the dam. No threatened bird species were recorded.

5.4.5 Amphibians and Reptiles

Additional amphibian and reptile surveys were conducted on 29th (1430hrs-1630hrs) and 30th (0800-1100hrs) of April 2014 as well as on the evening of 29th April (1800-2000hrs) and 25th June 2014 (1730-2030hrs). Surveys were conducted by the EPS ecologist in the woodland and adjoining dam. Other observations occurred as opportunistic sightings whilst undertaking other assessments.

A targeted survey was conducted on 29th (1430hrs-1630hrs) and 30th (0800-1100hrs) of April 2014 to determine the presence or absence of *Litoria aurea* (Green and Golden Bell Frog) which is listed as Endangered in the schedules of the TSC Act and Vulnerable under the EPBC Act. In accordance with the OEH *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft, November 2004* the random meander technique was conducted on the southern parcel of the GWS site to search for this species. The edges and surrounding area of the artificial dam/s were examined thoroughly for any evidence of the Green and Golden Bell Frog. Night time spotlighting surveys using call playback technique were also employed.

Due to Council comments on the previous surveys being undertaken in cooler month, follow-up targeted Green and Golden Bell Frog surveys were undertaken in February 2015. Refer to Appendix 14 for details, although surveys were undertaken over total of five days. Survey methodology was in accordance with the Commonwealth and State surveys guidelines for this species and included both diurnal and nocturnal searches, spotlighting, call playback and dip netting for tadpoles.

Figure 5-1 includes targeted fauna survey locations.

Results of all of these combined comprehensive surveys revealed no evidence of the presence of Green and Golden Bell Frog. Eastern Gambusia (*Gambusia holbrooki*) was recorded in high numbers in the main dam and it is a known predatory fish of Green and Golden Bell Frog eggs. The habitat quality was considered to be relatively low for Green and Golden Bell Frog, with limited fringing aquatic vegetation including Typha which covered about 5% of the dam water surface. Numerous surveys over a number of years and seasons have not recorded this species and it is considered unlikely that it is present on the site. Common frogs recorded during surveys included Common Eastern Froglet, Striped Marsh Frog and Whistling Tree Frog and these are generally known to be tolerant of disturbed aquatic habitats.

5.4.6 Cumberland Plain Land Snail

A targeted survey was conducted on 29th (1430hrs-1630hrs) and 30th (0800-1100hrs) of April 2014 to determine the presence or absence of *Meridolum corneovirens* (Cumberland Plain Land Snail), which is listed as Endangered in the schedule of the TSC Act. In accordance with the OEH *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities - Working Draft, November 2004* the random meander technique was conducted on the southern parcel of the GWS site to search for this species (Figure 5-1), particularly being focussed on the remanent woodland area.

Searches involved targeting habitat features likely to provide shelter for these two species such as in and around trees with focus on loose or shedding bark, under manmade objects such as tin sheets, old tyres and wood piles.

No evidence of Cumberland Plain Land Snail (including empty shells) was located during the targeted survey. This is likely linked to the ongoing underscrubbing of the woodland over a number of years for bushfire protection purposes, which has significantly reduced the microhabitat features (such as bark, logs etc) that would otherwise provide habitat for this species.

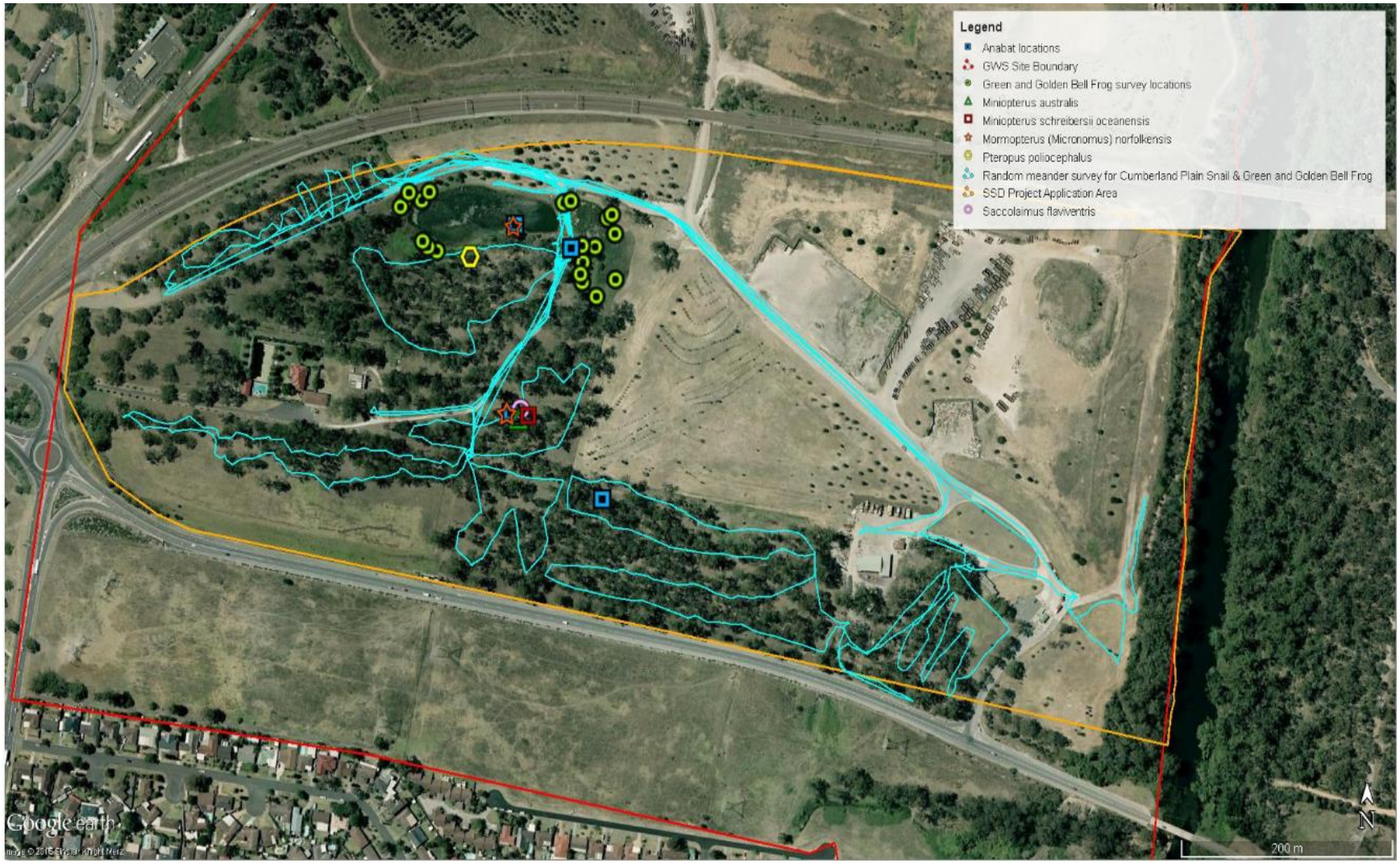

Figure 5-1: Targeted fauna surveys for the Threatened Species Locations.

5.4.7 Opportunistic Observations

A single Grey-headed Flying Fox was observed in a tree at the edge of the dam on the nights of the 24th and 25th February. This species is listed as Vulnerable under both the EPBC Act and TSC Act.

It is likely that this woodland forms part of this species greater foraging habitat in the region.

No permanent camp is known to occur on the site or considered likely. The nearest known camp is located approximately 3.5km to the south at Macquarie Fields and the Commonwealth DoE has identified that the Macquarie Fields camp is Nationally Important.

6 IMPACT ASSESSMENT

6.1 Threatened species assessment

Appendix 3 contains the threatened species assessment table. The table provides an analysis of all threatened species and populations recorded or considered likely, to determine those that require further assessment under a 7 part test or EPBC assessment. Similarly, Appendix 4 contains an assessment of likely threatened ecological communities to determine those that require further detailed impact assessment.

Detailed impact assessment was considered to be warranted for those species, populations and ecological communities known to be present, or with a moderate or higher chance of potential impact or those species that could not be discounted via the targeted surveys.

The following threatened species, populations or ecological communities were recorded on the site and required detailed assessments:

Species

- *Miniopterus australis* (Little bentwing bat) (TSC Act Vulnerable)
- *Miniopterus schreibersii oceanensis* (Eastern bentwing bat) (TSC Act Vulnerable)
- *Mormopterus* (*Micronomus*) *norfolkensis* (East-coast freetail bat) (TSC Act Vulnerable)
- *Saccolaimus flaviventris* (Yellow-bellied sheathtail bat) (TSC Act Vulnerable)
- *Pteropus poliocephalus* (Grey-headed Flying-fox) (TSC Act Vulnerable, EPBC Act Vulnerable)

Populations

- None

Threatened Ecological Communities

- Cumberland Plain Woodland (TSC Act Critically Endangered) / Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (EPBC Act Critically Endangered)
- River-Flat Eucalypt Forest on Coastal Floodplains (TSC Act Endangered)

In additional, as a precautionary measure, impact assessments have been completed for the following species that are considered to have some potential habitat on the site. It should be noted that none of these species were recorded during targeted surveys:

Species

- *Pimelea spicata* (Spiked Rice-flower) (TSC Act Endangered, EPBC Act Endangered)
- *Phascolarctos cinereus* (Koala) (TSC Act Vulnerable, EPBC Act Vulnerable)
- *Litoria aurea* (Green and Golden Bell Frog) (TSC Act Endangered, EPBC Act Vulnerable)
- *Meridolum corneovirens* (Cumberland Plain Land Snail) (TSC Act Endangered)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat) (TSC Act Vulnerable)
- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle) (TSC Act Vulnerable)
- *Myotis macropus* (Large-footed myotis) (TSC Act Vulnerable)

The following sections summarise the results of the detailed assessments under the TSC Act and EPBC Act, which are provided in Appendix 7.

6.2 Environmental Protection and Biodiversity Conservation Act 1999

It is considered that the Matters of National Environmental Significance are well understood on the site as a result of the numerous previous and current investigations. The investigations have revealed the following:

- The Critically Endangered ecological community Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest is present within the subject site and is considered to be the main Matter of National Environmental Significance requiring consideration;
- Individual Grey-headed Flying Fox (Vulnerable under EPBC Act) were recorded at the edge of the woodland next to the dam;
- No other threatened species or truly migratory species were recorded; and
- Potentially occurring species such as Green and Golden Bell Frog, Koala and Spiked Rice Flower were not considered likely to actually occur following specific targeted surveys. The primary reason for this was the isolation of the habitats on the site combined with the high level of historical disturbance being evident in the habitats that do remain.

In terms of the Grey-headed Flying Fox, no camps are present on the site. A camp is known to occur 3.5km to the south at Macquarie Fields. It is likely that this species only uses the eucalypts on the site as part of a greater foraging range throughout the region. The expansive habitats throughout areas such as Holsworthy defence lands mean that it is unlikely that this species would be impacted to any significant degree by the proposals. Based on the EPBC Act guidelines for this species, an EPBC Referral would not be required as the proposal is unlikely to impact the viability of a camp.

Assessments of the occurrence of the Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community have been undertaken and are provided in Appendices 4, 7 and 15.

These assessments concluded that a Referral under the EPBC Act should be submitted in relation to the impacts upon the Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community. This is primarily due to the total area of the community that is to be removed (despite the condition of the community being disturbed by underscrubbing).

6.3 Threatened Species Conservation Act 1995 & Environmental Planning & Assessment Act 1979

An assessment of the SSD and rezoning impacts has been completed under the TSC Act via seven-part tests for the following species and communities (those recorded on-site are in bold text):

Threatened Ecological Communities

Cumberland Plain Woodland
River-Flat Eucalypt Forest on Coastal Floodplains

Fauna

Phascolarctos cinereus	Koala
Litoria aurea	Green and Golden Bell Frog
Meridolum corneovirens	Cumberland Plain Land Snail
Pteropus poliocephalus	**Grey-headed Flying-fox**

Hollow/shelter dependent microbats

Saccolaimus flaviventris	**Yellow-bellied Sheathtail-bat**
Mormopterus norfolkensis	**East-coast Freetail-bat**
Scoteanax rueppellii	Greater Broad-nosed Bat
Falsistrellus tasmaniensis	Eastern False Pipistrelle
Miniopterus australis	**Little Bentwing bat**
Miniopterus schreibersii oceanensis	**Eastern Bentwing bat**
Myotis macropus	Large-footed myotis

Flora

Pimelea spicata	Spiked Rice-flower

It was considered unlikely that a significant impact on these threatened species and communities would occur (see Appendix 7).

Mitigation and compensatory measures for those threatened species to be impacted are outlined in Section 7.

6.4 Fisheries Management Act

The Department of Primary Industries (Fishing and Aquaculture) Records Viewer indicated that there were no know records of threatened species or ecological communities listed under the FM Act. It is considered unlikely that any species listed under the FM Act would be impacted by the proposal.

6.5 Key Threatening Processes

As outlined in Appendix 5 the proposal is likely to contribute to a number of key threatening processes (KTPs) listed under TSC Act in some form, however the KTPs of particular consideration are “clearing of native vegetation” and “loss of hollow-bearing trees”.

The contribution of the proposal to these KTPs is considered to be moderate and as a result, mitigation measures are proposed such as biodiversity offsets and installation of nest boxes.

In addition, equipment hygiene protocols will be enforced during construction and dead wood considered potential habitat will be moved to outside the impact zone to provide ongoing habitat to fauna. Additionally, provided the recommended equipment wash-down and hygiene protocols are followed to minimise weed spread, the proposed activity will not contribute to or enhance the presence of any invasive species listed under the EPBC Act. Refer to Appendix 6 for relevant considered species.

6.6 BioBanking Assessment

In 2014 SLR prepared two documents that inform the BioBanking and offsetting considerations for the site. These are:

- Proposed Rezoning and Expansion – Cumberland Plain Woodland Assessment Report
- BioBanking Credit Assessment (Field Work Report) EPBC Act Cumberland Plain Shale Woodlands Assessment

The earlier Cumberland Plain Woodland Assessment Report included a vegetation type and condition map and identified the classification of the vegetation on the site at a State level. This included identification of the Cumberland Plain Woodland CEEC and River-Flat Eucalypt Forest EEC.

The later report included detailed BioBanking plots being undertaken in the field to inform BioBanking calculations that outline biodiversity credit requirements. It also included an assessment of the presence of Cumberland Plain Shale Woodlands at a Commonwealth level and concluded that it was present and that an EPBC Referral should be made to the DoE.

This information will be considered in developing a biodiversity offset approach for the GWS project.

7 MITIGATION AND COMPENSATION MEASURES

As the SSD and Rezoning projects will result in unavoidable impacts to ecological values, a number of mitigation and compensation measures are proposed.

These measures consist of the following:

- Site inductions will occur to ensure site worker awareness of ecological sensitivities;
- Any construction management plans will have an ecological section to highlight the relevant issues;
- Vegetation disturbance will be limited to the minimum possible footprint;
- Clearing protocols will be implemented to ensure that clearing of vegetation and in particular the hollow-bearing trees occurs in a sensitive manner;
- Where possible, storage of construction materials will be limited to disturbed cleared areas on the site;
- Hygiene and weed management protocols will be implemented during construction on site to avoid pathogen and exotic species spread into retained areas;
- Disturbance of aquatic habitats will be minimised and erosion and sediment will be managed in accordance with industry standards;
- Nest boxes will be installed at a compensatory ratio of 2:1 for each tree hollow impacted by the project;
- The River-Flat Eucalypt Forest EEC will be fully retained and managed in perpetuity into the future for primarily ecological values; and
- A biodiversity offset strategy will be implemented in relation to the project impacts upon the Cumberland Plain Woodland ecological community.

Combined, the above measures will ensure that ecological impacts of the project will be adequately addressed.

8 CONCLUSION

The Ecological Assessment has assessed the ecological attributes of the Glenfield Waste Site, Glenfield NSW and revealed that:

- No threatened flora species or endangered flora populations were recorded on site during surveys;
- Some portions in the Southern Parcel of the GWS site are Cumberland Plain Woodland CEEC (under the TSC Act and EPBC Act) and River-Flat Eucalypt Forest EEC (under the TSC Act). The Cumberland Plain Woodland will be subject to impacts by the SSD and Rezoning components, while the River-Flat Eucalypt Forest will be retained and protected as part of the future management of the site;
- A majority of the threatened species initially considered likely to occur or to have suitable habitat were not identified during any surveys and this is considered to be related to the high level of historical disturbance on a majority of the site;
- The threatened species recorded during the targeted surveys were threatened microchiropteran and megachiropteran bats species, being *Pteropus poliocephalus* (Grey-headed Flying-fox), *Saccolaimus flaviventris (*Yellow-bellied Sheathtail-bat), *Mormopterus norfolkensis* (East-coast Freetail-bat), *Miniopterus australis* (Little Bentwing bat) and *Miniopterus schreibersii oceanensis* (Eastern Bentwing bat)
- No threatened frog, waterbird, arboreal mammal, or fish species were identified during surveys and are considered unlikely to occur on the investigation area;
- The investigation area supported a farm dam which provided an area of open, deep water for common waterbird species;
- The investigation area had been regularly slashed and managed such that there was a paucity of leaf litter and fallen timber across the site and was likely to provide some foraging habitat for only common bird species such as the Common Myna, Magpie Lark, Eastern Rosella, Common Starling etc;
- The investigation area supported a relatively high number of hollow bearing trees; and
- The investigation area was bound by a number of significant barriers to fauna movement.

The woodland vegetation in the southern parcel of land on the GWS site has been assessed in detail by a number of ecological consultancies over a period of eight years. The overall conclusion drawn from these previous studies and the more recent work by EPS has determined that this site provides only limited suitable habitat requirements for threatened flora and fauna species due to historical and ongoing disturbance. The site does support partial habitat requirements for a number of common native and exotic flora and fauna species. The habitat characteristic of most value within the area to be impact by the project is the occurrence of numerous hollow-bearing trees. These are considered likely to provide suitable roosting habitat for the recorded threatened bat species and as such nest boxes are proposed to offset the impacts to these species.

The detailed considerations of vegetation within the subject site by SLR have determined that some of the woodland vegetation in these areas would constitute an example of the CPW community – as listed both at State and Federal level.

In regards to the potential future development opportunities on the site and the potential removal of CPW vegetation within the GWS, these activities would not have a direct significant impact that is likely to:

- Result in an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or

- Substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

A biodiversity offset is proposed to provide compensation for the impacts to the Cumberland Plain Woodland.

Further consultation and liaison with the Department of Planning & Environment and the Office of Environment and Heritage is required to determine the best pathway for providing the best possible ecological outcomes whilst still enabling the State Significant Development – Recycling Facility and separate rezoning process to proceed.

An EPBC Referral will be required to be submitted to the Commonwealth DoE to enable impacts to Matters of National Environmental Significance (particularly Cumberland Plain Woodland) to be considered at a Federal level.

9 REFERENCES

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Appendix 1

Raw Data from the BioNet Atlas of NSW Wildlife Website

Campbelltown LGA

Data from the BioNet Atlas of NSW Wildlife website, which holds records from a number of custodians. The data are only indicative and cannot be considered a comprehensive inventory, and may contain errors and omissions.

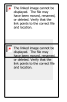
Species listed under the Sensitive Species Data Policy may have their locations denatured (^ rounded to 0.1°; ^^ rounded to 0.01°).

Search criteria : Public Report of all Valid Records of Threatened (listed on TSC Act 1995) or Commonwealth listed Entities in CAMPBELLTOWN LGA returned a total of 1,708 records of 204 species.

Report generated on 10/02/2014 11:48 AM

Kingdom	Class	Family	Species Code	Scientific Name	Exotic	Common Name	NSW status	Comm. status	Records	Info
Animalia	Amphibia	Myobatrachidae	3042	*Heleioporus australiacus*		Giant Burrowing Frog	V,P	V	21	
Animalia	Amphibia	Myobatrachidae	3073	*^Mixophyes balbus*		Stuttering Frog	E1,P,2	V	P	
Animalia	Amphibia	Myobatrachidae	3116	*Pseudophryne australis*		Red-crowned Toadlet	V,P		21	
Animalia	Amphibia	Hylidae	3166	*Litoria aurea*		Green and Golden Bell Frog	E1,P	V	K	
Animalia	Amphibia	Hylidae	3039	*Litoria littlejohni*		Littlejohn's Tree Frog	V,P	V	K	
Animalia	Reptilia	Cheloniidae	2004	*Caretta caretta*		Loggerhead Turtle	E1,P	E	P	
Animalia	Reptilia	Dermochelyidae	2013	*Dermochelys coriacea*		Leatherback Turtle	E1,P	E	P	
Animalia	Reptilia	Varanidae	2287	*Varanus rosenbergi*		Rosenberg's Goanna	V,P		4	
Animalia	Reptilia	Elapidae	2676	*^Hoplocephalus bungaroides*		Broad-headed Snake	E1,P,2	V	7	
Animalia	Aves	Anatidae	0214	*Stictonetta naevosa*		Freckled Duck	V,P		K	
Animalia	Aves	Columbidae	0023	*Ptilinopus superbus*		Superb Fruit-Dove	V,P		K	

Animalia	Aves	Ciconiidae	0183	*Ephippiorhynchus asiaticus*	Black-necked Stork	E1,P		1	
Animalia	Aves	Ardeidae	0197	*Botaurus poiciloptilus*	Australasian Bittern	E1,P	E	K	
Animalia	Aves	Ardeidae	0196	*Ixobrychus flavicollis*	Black Bittern	V,P		K	
Animalia	Aves	Accipitridae	0218	*Circus assimilis*	Spotted Harrier	V,P		1	
Animalia	Aves	Accipitridae	0225	*Hieraaetus morphnoides*	Little Eagle	V,P		10	
Animalia	Aves	Accipitridae	0230	*^^Lophoictinia isura*	Square-tailed Kite	V,P,3		K	
Animalia	Aves	Accipitridae	8739	*^^Pandion cristatus*	Eastern Osprey	V,P,3		K	
Animalia	Aves	Burhinidae	0174	*Burhinus grallarius*	Bush Stone-curlew	E1,P		1	
Animalia	Aves	Burhinidae	0175	*Esacus magnirostris*	Beach Stone-curlew	E4A,P		K	
Animalia	Aves	Haematopodidae	0131	*Haematopus fuliginosus*	Sooty Oystercatcher	V,P		K	
Animalia	Aves	Haematopodidae	0130	*Haematopus longirostris*	Pied Oystercatcher	E1,P		K	
Animalia	Aves	Jacanidae	0171	*Irediparra gallinacea*	Comb-crested Jacana	V,P		K	
Animalia	Aves	Rostratulidae	0170	*Rostratula australis*	Australian Painted Snipe	E1,P	E	K	
Animalia	Aves	Scolopacidae	0161	*Calidris ferruginea*	Curlew Sandpiper	E1,P	C,J,K	K	
Animalia	Aves	Scolopacidae	0167	*Limicola falcinellus*	Broad-billed Sandpiper	V,P	C,J,K	K	
Animalia	Aves	Scolopacidae	0152	*Limosa limosa*	Black-tailed Godwit	V,P	C,J,K	K	
Animalia	Aves	Laridae	0117	*Sternula albifrons*	Little Tern	E1,P	C,J,K	K	
Animalia	Aves	Cacatuidae	0268	*^^Callocephalon fimbriatum*	Gang-gang Cockatoo	V,P,3		8	
Animalia	Aves	Cacatuidae	0265	*^Calyptorhynchus lathami*	Glossy Black-Cockatoo	V,P,2		4	
Animalia	Aves	Psittacidae	0260	*Glossopsitta pusilla*	Little Lorikeet	V,P		14	

Animalia	Aves	Psittacidae	0309	^^*Lathamus discolor*	Swift Parrot	E1,P,3	E	2	
Animalia	Aves	Psittacidae	0302	^^*Neophema pulchella*	Turquoise Parrot	V,P,3		K	
Animalia	Aves	Psittacidae	8913	^^*Pezoporus wallicus wallicus*	Eastern Ground Parrot	V,P,3		K	
Animalia	Aves	Strigidae	0246	^^*Ninox connivens*	Barking Owl	V,P,3		K	
Animalia	Aves	Strigidae	0248	^^*Ninox strenua*	Powerful Owl	V,P,3		9	
Animalia	Aves	Tytonidae	0250	^^*Tyto novaehollandiae*	Masked Owl	V,P,3		K	
Animalia	Aves	Tytonidae	9924	^^*Tyto tenebricosa*	Sooty Owl	V,P,3		K	
Animalia	Aves	Climacteridae	8127	*Climacteris picumnus victoriae*	Brown Treecreeper (eastern subspecies)	V,P		5	
Animalia	Aves	Dasyornithidae	0519	*Dasyornis brachypterus*	Eastern Bristlebird	E1,P	E	P	
Animalia	Aves	Acanthizidae	0504	*Chthonicola sagittata*	Speckled Warbler	V,P		K	
Animalia	Aves	Meliphagidae	0603	*Anthochaera phrygia*	Regent Honeyeater	E4A,P	E	2	
Animalia	Aves	Meliphagidae	0448	*Epthianura albifrons*	White-fronted Chat population in the Sydney Metropolitan Catchment Management Area	E2,V,P		K	
Animalia	Aves	Meliphagidae	0448	*Epthianura albifrons*	White-fronted Chat	V,P		P	
Animalia	Aves	Meliphagidae	0598	*Grantiella picta*	Painted Honeyeater	V,P		K	
Animalia	Aves	Meliphagidae	8303	*Melithreptus gularis gularis*	Black-chinned Honeyeater (eastern subspecies)	V,P		3	

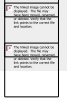
Animalia	Aves	Neosittidae	0549	*Daphoenositta chrysoptera*	Varied Sittella	V,P		50	
Animalia	Aves	Petroicidae	8367	*Melanodryas cucullata cucullata*	Hooded Robin (south-eastern form)	V,P		K	
Animalia	Aves	Petroicidae	0380	*Petroica boodang*	Scarlet Robin	V,P		8	
Animalia	Aves	Petroicidae	0382	*Petroica phoenicea*	Flame Robin	V,P		K	
Animalia	Aves	Estrildidae	0652	*Stagonopleura guttata*	Diamond Firetail	V,P		K	
Animalia	Mammalia	Dasyuridae	1008	*Dasyurus maculatus*	Spotted-tailed Quoll	V,P	E	5	
Animalia	Mammalia	Peramelidae	1710	*Isoodon obesulus obesulus*	Southern Brown Bandicoot (eastern)	E1,P	E	K	
Animalia	Mammalia	Phascolarctidae	1162	*Phascolarctos cinereus*	Koala	V,P	V	959	
Animalia	Mammalia	Burramyidae	1150	*Cercartetus nanus*	Eastern Pygmy-possum	V,P		6	
Animalia	Mammalia	Petauridae	1136	*Petaurus australis*	Yellow-bellied Glider	V,P		3	
Animalia	Mammalia	Petauridae	1137	*Petaurus norfolcensis*	Squirrel Glider	V,P		3	
Animalia	Mammalia	Pteropodidae	1280	*Pteropus poliocephalus*	Grey-headed Flying-fox	V,P	V	22	
Animalia	Mammalia	Emballonuridae	1321	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat	V,P		2	
Animalia	Mammalia	Molossidae	1329	*Mormopterus norfolkensis*	Eastern Freetail-bat	V,P		7	
Animalia	Mammalia	Vespertilionidae	1353	*Chalinolobus dwyeri*	Large-eared Pied Bat	V,P	V	4	
Animalia	Mammalia	Vespertilionidae	1372	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	V,P		5	

Animalia	Mammalia	Vespertilionidae	1369	*Kerivoula papuensis*	Golden-tipped Bat	V,P		K	
Animalia	Mammalia	Vespertilionidae	1346	*Miniopterus australis*	Little Bentwing-bat	V,P		K	
Animalia	Mammalia	Vespertilionidae	1834	*Miniopterus schreibersii oceanensis*	Eastern Bentwing-bat	V,P		17	
Animalia	Mammalia	Vespertilionidae	1357	*Myotis macropus*	Southern Myotis	V,P		299	
Animalia	Mammalia	Vespertilionidae	1361	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V,P		15	
Animalia	Mammalia	Muridae	1455	*Pseudomys novaehollandiae*	New Holland Mouse	P	V	K	
Animalia	Insecta	Chrysomelidae	I008	*Menippus darcyi*	Menippus darcyi population in the Sutherland Shire	E2		K	
Animalia	Gastropoda	Camaenidae	I006	*Meridolum corneovirens*	Cumberland Plain Land Snail	E1		40	
Plantae	Flora	Anthericaceae	7501	*Caesia parviflora var. minor*	Small Pale Grass-lily	E1,P		K	
Plantae	Flora	Apocynaceae	1226	*Cynanchum elegans*	White-flowered Wax Plant	E1,P	E	1	
Plantae	Flora	Apocynaceae	10896	*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	E2		K	

Plantae	Flora	Araliaceae	1200	*Astrotricha crassifolia*	Thick-leaf Star-hair	V,P	V	1	
Plantae	Flora	Casuarinaceae	8320	*Allocasuarina glareicola*		E1,P	E	K	
Plantae	Flora	Convolvulaceae	2234	*Wilsonia backhousei*	Narrow-leafed Wilsonia	V,P		K	
Plantae	Flora	Convolvulaceae	2235	*Wilsonia rotundifolia*	Round-leafed Wilsonia	E1,P		K	
Plantae	Flora	Cupressaceae	2279	*Callitris endlicheri*	Black Cypress Pine, Woronora Plateau population	E2		K	
Plantae	Flora	Dilleniaceae	11422	*Hibbertia puberula*		E1,P		K	
Plantae	Flora	Dilleniaceae	13902	*Hibbertia sp. Bankstown*		E4A,P	CE	K	
Plantae	Flora	Dilleniaceae	14564	*Hibbertia stricta subsp. furcatula*		E1,P		K	
Plantae	Flora	Dilleniaceae	11250	*Hibbertia superans*		E1,P		K	
Plantae	Flora	Elaeocarpaceae	6205	*Tetratheca glandulosa*		V,P		K	
Plantae	Flora	Ericaceae	7752	*Epacris purpurascens var. purpurascens*		V,P		K	
Plantae	Flora	Ericaceae	2618	*Leucopogon exolasius*	Woronora Beard-heath	V,P	V	13	
Plantae	Flora	Ericaceae	9569	*Leucopogon fletcheri subsp. fletcheri*		E1,P		K	
Plantae	Flora	Euphorbiaceae	9851	*Chamaesyce psammogeton*	Sand Spurge	E1,P		P	

Plantae	Flora	Fabaceae (Faboideae)	2853	*Dillwynia tenuifolia*		V,P		K	
Plantae	Flora	Fabaceae (Faboideae)	2974	*Pultenaea aristata*	Prickly Bush-pea	V,P	V	40	
Plantae	Flora	Fabaceae (Faboideae)	3007	*Pultenaea parviflora*		E1,P	V	K	
Plantae	Flora	Fabaceae (Faboideae)	3008	*Pultenaea pedunculata*	Matted Bush-pea	E1,P		9	
Plantae	Flora	Fabaceae (Mimosoideae)	6577	*Acacia baueri subsp. aspera*		V,P		K	
Plantae	Flora	Fabaceae (Mimosoideae)	3728	*Acacia bynoeana*	Bynoe's Wattle	E1,P	V	1	
Plantae	Flora	Fabaceae (Mimosoideae)	7229	*Acacia gordonii*		E1,P	E	K	
Plantae	Flora	Fabaceae (Mimosoideae)	3860	*Acacia pubescens*	Downy Wattle	V,P	V	3	
Plantae	Flora	Grammitidaceae	9471	*^^Grammitis stenophylla*	Narrow-leaf Finger Fern	E1,P,3		K	
Plantae	Flora	Gyrostemonaceae	9411	*^^Gyrostemon thesioides*		E1,P,3		15	
Plantae	Flora	Haloragaceae	9512	*Haloragis exalata subsp. exalata*	Square Raspwort	V,P	V	K	
Plantae	Flora	Haloragaceae	3257	*Haloragodendron lucasii*		E1,P	E	K	
Fungi	Flora	Hygrophoraceae	F006	*Camarophyllopsis kearneyi*		E1,P		K	

Fungi	Flora	Hygrophoraceae	F003	*Hygrocybe anomala var. ianthinomarginata*		V,P		K	
Fungi	Flora	Hygrophoraceae	F004	*Hygrocybe aurantipes*		V,P		K	
Fungi	Flora	Hygrophoraceae	F001	*Hygrocybe austropratensis*		E1,P		K	
Fungi	Flora	Hygrophoraceae	F007	*Hygrocybe collucera*		E1,P		K	
Fungi	Flora	Hygrophoraceae	F008	*Hygrocybe griseoramosa*		E1,P		K	
Fungi	Flora	Hygrophoraceae	F005	*Hygrocybe lanecovensis*		E1,P		K	
Fungi	Flora	Hygrophoraceae	F002	*Hygrocybe reesiae*		V,P		K	
Fungi	Flora	Hygrophoraceae	F015	*Hygrocybe rubronivea*		V,P		K	
Plantae	Flora	Juncaginaceae	3363	*Maundia triglochinoides*		V,P		K	
Plantae	Flora	Lamiaceae	3404	*Prostanthera densa*	Villous Mint-bush	V,P	V	K	
Plantae	Flora	Lobeliaceae	1911	*^^Hypsela sessiliflora*		E1,P,3	X	K	
Plantae	Flora	Marsileaceae	8140	*^^Pilularia novae-hollandiae*	Austral Pillwort	E1,P,3		K	
Plantae	Flora	Myrtaceae	4007	*^^Callistemon linearifolius*	Netted Bottle Brush	V,P,3		2	
Plantae	Flora	Myrtaceae	4024	*Darwinia biflora*		V,P	V	K	
Plantae	Flora	Myrtaceae	4031	*Darwinia*		V,P		K	

				peduncularis					
Plantae	Flora	Myrtaceae	4055	*Eucalyptus benthamii*	Camden White Gum	V,P	V	K	
Plantae	Flora	Myrtaceae	4067	*Eucalyptus camfieldii*	Camfield's Stringybark	V,P	V	K	
Plantae	Flora	Myrtaceae	11892	*Eucalyptus sp. Cattai*		E1,P		P	
Plantae	Flora	Myrtaceae	6809	*Melaleuca biconvexa*	Biconvex Paperbark	V,P	V	K	
Plantae	Flora	Myrtaceae	4248	*Melaleuca deanei*	Deane's Paperbark	V,P	V	17	
Plantae	Flora	Myrtaceae	4274	*Micromyrtus minutiflora*		E1,P	V	K	
Plantae	Flora	Myrtaceae	4293	*Syzygium paniculatum*	Magenta Lilly Pilly	E1,P	V	K	
Plantae	Flora	Orchidaceae	4386	*^Caladenia tessellata*	Thick Lip Spider Orchid	E1,P, 2	V	K	
Plantae	Flora	Orchidaceae	4464	*^Genoplesium baueri*	Bauer's Midge Orchid	E1,P, 2		1	
Plantae	Flora	Orchidaceae	9615	*^Pterostylis saxicola*	Sydney Plains Greenhood	E1,P, 2	E	5	
Plantae	Flora	Poaceae	4875	*Deyeuxia appressa*		E1,P	E	P	
Plantae	Flora	Polygonaceae	5280	*Persicaria elatior*	Tall Knotweed	V,P	V	K	
Plantae	Flora	Proteaceae	10917	*Grevillea juniperina subsp. juniperina*	Juniper-leaved Grevillea	V,P		K	
Plantae	Flora	Proteaceae	10009	*Grevillea parviflora subsp. parviflora*	Small-flower Grevillea	V,P	V	15	
Plantae	Flora	Proteaceae	10777	*Grevillea parviflora subsp. supplicans*		E1,P		K	
Plantae	Flora	Proteaceae	9527	*Persoonia bargoensis*	Bargo Geebung	E1,P	V	K	
Plantae	Flora	Proteaceae	7677	*Persoonia glaucescens*	Mittagong Geebung	E1,P	V	K	
Plantae	Flora	Proteaceae	5458	*^^Persoonia hirsuta*	Hairy Geebung	E1,P, 3	E	7	

Plantae	Flora	Proteaceae	8995	*Persoonia mollis subsp. maxima*		E1,P	E	K	
Plantae	Flora	Proteaceae	5467	*Persoonia nutans*	Nodding Geebung	E1,P	E	8	
Plantae	Flora	Rhamnaceae	5573	*Pomaderris brunnea*	Brown Pomaderris	V,P	V	2	
Plantae	Flora	Rubiaceae	5680	*Galium australe*	Tangled Bedstraw	E1,P		K	
Plantae	Flora	Rutaceae	5840	*Zieria involucrata*		E1,P	V	K	
Plantae	Flora	Santalaceae	5871	*Thesium australe*	Austral Toadflax	V,P	V	K	
Plantae	Flora	Sterculiaceae	6140	*Lasiopetalum joyceae*		V,P	V	K	
Plantae	Flora	Sterculiaceae	6148	*Rulingia prostrata*	Dwarf Kerrawang	E1,P	E	P	
Plantae	Flora	Thymelaeaceae	6965	*Pimelea curviflora var. curviflora*		V,P	V	K	
Plantae	Flora	Thymelaeaceae	6190	*Pimelea spicata*	Spiked Rice-flower	E1,P	E	10	
Plantae	Flora	Zannichelliaceae	6339	*Zannichellia palustris*		E1,P		K	
Community				*Agnes Banks Woodland in the Sydney Basin Bioregion*	Agnes Banks Woodland in the Sydney Basin Bioregion	E3		K	
Community				*Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions*	Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions	E3		K	
Community				*Blue Gum High Forest in the Sydney Basin Bioregion*	Blue Gum High Forest in the Sydney Basin Bioregion	E4B	CE	K	

Community	*Blue Mountains Shale Cap Forest in the Sydney Basin Bioregion*	Blue Mountains Shale Cap Forest in the Sydney Basin Bioregion	E3	CE	K	
Community	*Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion*	Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion	V2		K	
Community	*Castlereagh Swamp Woodland Community*	Castlereagh Swamp Woodland Community	E3		K	
Community	*Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*	Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	V	P	
Community	*Coastal Upland Swamp in the Sydney Basin Bioregion*	Coastal Upland Swamp in the Sydney Basin Bioregion	E3		K	
Community	*Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion*	Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion	E3		K	
Community	*Cumberland Plain Woodland in the Sydney Basin Bioregion*	Cumberland Plain Woodland in the Sydney Basin Bioregion	E4B	CE	K	
Community	*Elderslie Banksia Scrub Forest*	Elderslie Banksia Scrub Forest	E3		K	

Community	*Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*	Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3		K	
Community	*Kurnell Dune Forest in the Sutherland Shire and City of Rockdale*	Kurnell Dune Forest in the Sutherland Shire and City of Rockdale	E3		K	
Community	*Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*	Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	CE	P	
Community	*Moist Shale Woodland in the Sydney Basin Bioregion*	Moist Shale Woodland in the Sydney Basin Bioregion	E3	CE	K	
Community	*O'Hares Creek Shale Forest*	O'Hares Creek Shale Forest	E3		K	
Community	*River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3		K	

Community	*Shale gravel Transition Forest in the Sydney Basin Bioregion*	Shale gravel Transition Forest in the Sydney Basin Bioregion	E3	CE	K	
Community	*Shale/Sandstone Transition Forest*	Shale/Sandstone Transition Forest	E3	E	K	
Community	*Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion*	Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion	E3		K	
Community	*Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3		K	
Community	*Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*	Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3		K	
Community	*Sydney Freshwater Wetlands in the Sydney Basin Bioregion*	Sydney Freshwater Wetlands in the Sydney Basin Bioregion	E3		K	
Community	*Sydney Turpentine-Ironbark Forest*	Sydney Turpentine-Ironbark Forest	E3	CE	K	

Community	*Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions*	Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions	E3		K	
Community	*Western Sydney Dry Rainforest in the Sydney Basin Bioregion*	Western Sydney Dry Rainforest in the Sydney Basin Bioregion	E3	CE	K	
Threat	*Aggressive exclusion of birds from woodland and forest habitat by abundant Noisy Miners Manorina melanocephala*	Aggressive exclusion of birds from woodland and forest habitat by abundant Noisy Miners Manorina melanocephala	KTP		P	
Threat	*Alteration of habitat following subsidence due to longwall mining*	Alteration of habitat following subsidence due to longwall mining	KTP		P	
Threat	*Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands*	Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands	KTP		P	
Threat	*Anthropogenic Climate Change*	Anthropogenic Climate Change	KTP	KTP	P	
Threat	*Bushrock removal*	Bushrock removal	KTP		P	

Threat	*Clearing of native vegetation*	Clearing of native vegetation	KTP	KTP	P	
Threat	*Competition and grazing by the feral European Rabbit, Oryctolagus cuniculus (L.)*	Competition and grazing by the feral European Rabbit, Oryctolagus cuniculus (L.)	KTP	KTP	P	
Threat	*Competition and habitat degradation by Feral Goats, Capra hircus Linnaeus 1758*	Competition and habitat degradation by Feral Goats, Capra hircus Linnaeus 1758	KTP	KTP	P	
Threat	*Competition from feral honey bees, Apis mellifera L.*	Competition from feral honey bees, Apis mellifera L.	KTP		P	
Threat	*Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners*	Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners	KTP		P	
Threat	*Herbivory and environmental degradation caused by feral deer*	Herbivory and environmental degradation caused by feral deer	KTP		P	

Threat	*High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition*	High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition	KTP		P	
Threat	*Importation of Red Imported Fire Ants Solenopsis invicta Buren 1972*	Importation of Red Imported Fire Ants Solenopsis invicta Buren 1972	KTP	KTP	P	
Threat	*Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations*	Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations	KTP	KTP	P	
Threat	*Infection of frogs by amphibian chytrid causing the disease chytridiomycosis*	Infection of frogs by amphibian chytrid causing the disease chytridiomycosis	KTP	KTP	P	
Threat	*Infection of native plants by Phytophthora cinnamomi*	Infection of native plants by Phytophthora cinnamomi	KTP	KTP	P	
Threat	*Introduction of the Large Earth Bumblebee Bombus terrestris (L.)*	Introduction of the Large Earth Bumblebee Bombus terrestris (L.)	KTP		P	

Threat	*Invasion and establishment of exotic vines and scramblers*	Invasion and establishment of exotic vines and scramblers	KTP		P	
Threat	*Invasion and establishment of Scotch Broom (Cytisus scoparius)*	Invasion and establishment of Scotch Broom (Cytisus scoparius)	KTP		P	
Threat	*Invasion and establishment of the Cane Toad (Bufo marinus)*	Invasion and establishment of the Cane Toad (Bufo marinus)	KTP	KTP	P	
Threat	*Invasion of native plant communities by African Olive Olea europaea subsp. cuspidata (Wall. ex G. Don) Cif.*	Invasion of native plant communities by African Olive Olea europaea subsp. cuspidata (Wall. ex G. Don) Cif.	KTP		P	
Threat	*Invasion of native plant communities by Chrysanthemoides monilifera*	Invasion of native plant communities by Chrysanthemoides monilifera	KTP		P	
Threat	*Invasion of native plant communities by exotic perennial grasses*	Invasion of native plant communities by exotic perennial grasses	KTP		P	
Threat	*Invasion of the Yellow Crazy Ant, Anoplolepis gracilipes (Fr. Smith) into NSW*	Invasion of the Yellow Crazy Ant, Anoplolepis gracilipes (Fr. Smith) into NSW	KTP		P	

Threat	*Invasion, establishment and spread of Lantana (Lantana camara L. sens. Lat)*	Invasion, establishment and spread of Lantana (Lantana camara L. sens. Lat)	KTP		P	
Threat	*Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants*	Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants	KTP	KTP	P	
Threat	*Loss of Hollow-bearing Trees*	Loss of Hollow-bearing Trees	KTP		P	
Threat	*Loss or degradation (or both) of sites used for hill-topping by butterflies*	Loss or degradation (or both) of sites used for hill-topping by butterflies	KTP		P	
Threat	*Predation and hybridisation by Feral Dogs, Canis lupus familiaris*	Predation and hybridisation by Feral Dogs, Canis lupus familiaris	KTP		P	
Threat	*Predation by Gambusia holbrooki Girard, 1859 (Plague Minnow or Mosquito Fish)*	Predation by Gambusia holbrooki Girard, 1859 (Plague Minnow or Mosquito Fish)	KTP		P	

Threat	*Predation by the European Red Fox Vulpes Vulpes (Linnaeus, 1758)*	Predation by the European Red Fox Vulpes Vulpes (Linnaeus, 1758)	KTP	KTP	P	
Threat	*Predation by the Feral Cat Felis catus (Linnaeus, 1758)*	Predation by the Feral Cat Felis catus (Linnaeus, 1758)	KTP	KTP	P	
Threat	*Predation, habitat degradation, competition and disease transmission by Feral Pigs, Sus scrofa Linnaeus 1758*	Predation, habitat degradation, competition and disease transmission by Feral Pigs, Sus scrofa Linnaeus 1758	KTP	KTP	P	
Threat	*Removal of dead wood and dead trees*	Removal of dead wood and dead trees	KTP		P	

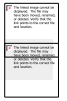
Raw Data from the BioNet Atlas of NSW Wildlife Website
Liverpool LGA

Data from the BioNet Atlas of NSW Wildlife website, which holds records from a number of custodians. The data are only indicative and cannot be considered a comprehensive inventory, and may contain errors and omissions.

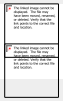
Species listed under the Sensitive Species Data Policy may have their locations denatured (^ rounded to 0.1°; ^^ rounded to 0.01°).

Search criteria : Public Report of all Valid Records of Threatened (listed on TSC Act 1995) or Commonwealth listed Entities in LIVERPOOL LGA returned a total of 836 records of 211 species.

Report generated on 10/02/2014 11:51 AM

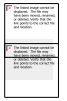
Kingdom	Class	Family	Species Code	Scientific Name	Exotic	Common Name	NSW status	Comm. status	Records	Info
Animalia	Amphibia	Myobatrachidae	3042	*Heleioporus australiacus*		Giant Burrowing Frog	V,P	V	4	
Animalia	Amphibia	Myobatrachidae	3073	*^Mixophyes balbus*		Stuttering Frog	E1,P,2	V	P	
Animalia	Amphibia	Myobatrachidae	3116	*Pseudophryne australis*		Red-crowned Toadlet	V,P		6	
Animalia	Amphibia	Hylidae	3166	*Litoria aurea*		Green and Golden Bell Frog	E1,P	V	14	
Animalia	Amphibia	Hylidae	3039	*Litoria littlejohni*		Littlejohn's Tree Frog	V,P	V	K	
Animalia	Reptilia	Cheloniidae	2004	*Caretta caretta*		Loggerhead Turtle	E1,P	E	P	
Animalia	Reptilia	Dermochelyidae	2013	*Dermochelys coriacea*		Leatherback Turtle	E1,P	E	P	
Animalia	Reptilia	Varanidae	2287	*Varanus rosenbergi*		Rosenberg's Goanna	V,P		K	
Animalia	Reptilia	Elapidae	2676	*^Hoplocephalus bungaroides*		Broad-headed Snake	E1,P,2	V	K	
Animalia	Aves	Anatidae	0214	*Stictonetta naevosa*		Freckled Duck	V,P		K	
Animalia	Aves	Columbidae	0023	*Ptilinopus superbus*		Superb Fruit-Dove	V,P		K	

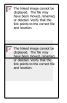
Animalia	Aves	Ciconiidae	0183	*Ephippiorhynchus asiaticus*	Black-necked Stork	E1,P		K
Animalia	Aves	Ardeidae	0197	*Botaurus poiciloptilus*	Australasian Bittern	E1,P	E	K
Animalia	Aves	Ardeidae	0196	*Ixobrychus flavicollis*	Black Bittern	V,P		K
Animalia	Aves	Accipitridae	0218	*Circus assimilis*	Spotted Harrier	V,P		1
Animalia	Aves	Accipitridae	0225	*Hieraaetus morphnoides*	Little Eagle	V,P		13
Animalia	Aves	Accipitridae	0230	*^^Lophoictinia isura*	Square-tailed Kite	V,P,3		2
Animalia	Aves	Accipitridae	8739	*^^Pandion cristatus*	Eastern Osprey	V,P,3		K
Animalia	Aves	Falconidae	0238	*Falco subniger*	Black Falcon	V,P		2
Animalia	Aves	Burhinidae	0174	*Burhinus grallarius*	Bush Stone-curlew	E1,P		2
Animalia	Aves	Burhinidae	0175	*Esacus magnirostris*	Beach Stone-curlew	E4A,P		K
Animalia	Aves	Haematopodidae	0131	*Haematopus fuliginosus*	Sooty Oystercatcher	V,P		K
Animalia	Aves	Haematopodidae	0130	*Haematopus longirostris*	Pied Oystercatcher	E1,P		K
Animalia	Aves	Jacanidae	0171	*Irediparra gallinacea*	Comb-crested Jacana	V,P		K
Animalia	Aves	Rostratulidae	0170	*Rostratula australis*	Australian Painted Snipe	E1,P	E	K
Animalia	Aves	Scolopacidae	0161	*Calidris ferruginea*	Curlew Sandpiper	E1,P	C,J,K	K
Animalia	Aves	Scolopacidae	0167	*Limicola falcinellus*	Broad-billed Sandpiper	V,P	C,J,K	K
Animalia	Aves	Scolopacidae	0152	*Limosa limosa*	Black-tailed Godwit	V,P	C,J,K	K
Animalia	Aves	Laridae	0117	*Sternula albifrons*	Little Tern	E1,P	C,J,K	K
Animalia	Aves	Cacatuidae	0268	*^^Callocephalon fimbriatum*	Gang-gang Cockatoo	V,P,3		2
Animalia	Aves	Cacatuidae	0265	*^Calyptorhynchus lathami*	Glossy Black-Cockatoo	V,P,2		11
Animalia	Aves	Psittacidae	0260	*Glossopsitta pusilla*	Little Lorikeet	V,P		8

Animalia	Aves	Psittacidae	0309	^^*Lathamus discolor*	Swift Parrot	E1,P,3	E	7	
Animalia	Aves	Psittacidae	0302	^^*Neophema pulchella*	Turquoise Parrot	V,P,3		K	
Animalia	Aves	Psittacidae	8913	^^*Pezoporus wallicus wallicus*	Eastern Ground Parrot	V,P,3		K	
Animalia	Aves	Strigidae	0246	^^*Ninox connivens*	Barking Owl	V,P,3		1	
Animalia	Aves	Strigidae	0248	^^*Ninox strenua*	Powerful Owl	V,P,3		17	
Animalia	Aves	Tytonidae	0250	^^*Tyto novaehollandiae*	Masked Owl	V,P,3		K	
Animalia	Aves	Tytonidae	9924	^^*Tyto tenebricosa*	Sooty Owl	V,P,3		K	
Animalia	Aves	Climacteridae	8127	*Climacteris picumnus victoriae*	Brown Treecreeper (eastern subspecies)	V,P		K	
Animalia	Aves	Dasyornithidae	0519	*Dasyornis brachypterus*	Eastern Bristlebird	E1,P	E	P	
Animalia	Aves	Acanthizidae	0504	*Chthonicola sagittata*	Speckled Warbler	V,P		6	
Animalia	Aves	Meliphagidae	0603	*Anthochaera phrygia*	Regent Honeyeater	E4A,P	E	6	
Animalia	Aves	Meliphagidae	0448	*Epthianura albifrons*	White-fronted Chat population in the Sydney Metropolitan Catchment Management Area	E2,V,P		1	
Animalia	Aves	Meliphagidae	0448	*Epthianura albifrons*	White-fronted Chat	V,P		1	
Animalia	Aves	Meliphagidae	0598	*Grantiella picta*	Painted Honeyeater	V,P		K	

Animalia	Aves	Meliphagidae	8303	*Melithreptus gularis gularis*	Black-chinned Honeyeater (eastern subspecies)	V,P		4	
Animalia	Aves	Neosittidae	0549	*Daphoenositta chrysoptera*	Varied Sittella	V,P		22	
Animalia	Aves	Petroicidae	8367	*Melanodryas cucullata cucullata*	Hooded Robin (south-eastern form)	V,P		2	
Animalia	Aves	Petroicidae	0380	*Petroica boodang*	Scarlet Robin	V,P		4	
Animalia	Aves	Petroicidae	0382	*Petroica phoenicea*	Flame Robin	V,P		3	
Animalia	Aves	Estrildidae	0652	*Stagonopleura guttata*	Diamond Firetail	V,P		K	
Animalia	Mammalia	Dasyuridae	1008	*Dasyurus maculatus*	Spotted-tailed Quoll	V,P	E	2	
Animalia	Mammalia	Peramelidae	1710	*Isoodon obesulus obesulus*	Southern Brown Bandicoot (eastern)	E1,P	E	K	
Animalia	Mammalia	Phascolarctidae	1162	*Phascolarctos cinereus*	Koala	V,P	V	26	
Animalia	Mammalia	Burramyidae	1150	*Cercartetus nanus*	Eastern Pygmy-possum	V,P		1	
Animalia	Mammalia	Petauridae	1137	*Petaurus norfolcensis*	Squirrel Glider	V,P		1	
Animalia	Mammalia	Macropodidae	1215	*Petrogale penicillata*	Brush-tailed Rock-wallaby	E1,P	V	1	
Animalia	Mammalia	Pteropodidae	1280	*Pteropus poliocephalus*	Grey-headed Flying-fox	V,P	V	55	
Animalia	Mammalia	Emballonuridae	1321	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat	V,P		3	
Animalia	Mammalia	Molossidae	1329	*Mormopterus norfolkensis*	Eastern Freetail-bat	V,P		30	

Animalia	Mammalia	Vespertilionidae	1353	*Chalinolobus dwyeri*	Large-eared Pied Bat	V,P	V	4	
Animalia	Mammalia	Vespertilionidae	1372	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	V,P		5	
Animalia	Mammalia	Vespertilionidae	1369	*Kerivoula papuensis*	Golden-tipped Bat	V,P		K	
Animalia	Mammalia	Vespertilionidae	1346	*Miniopterus australis*	Little Bentwing-bat	V,P		K	
Animalia	Mammalia	Vespertilionidae	1834	*Miniopterus schreibersii oceanensis*	Eastern Bentwing-bat	V,P		22	
Animalia	Mammalia	Vespertilionidae	1357	*Myotis macropus*	Southern Myotis	V,P		12	
Animalia	Mammalia	Vespertilionidae	1361	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V,P		14	
Animalia	Mammalia	Muridae	1455	*Pseudomys novaehollandiae*	New Holland Mouse	P	V	K	
Animalia	Insecta	Chrysomelidae	I008	*Menippus darcyi*	Menippus darcyi population in the Sutherland Shire	E2		K	
Animalia	Gastropoda	Camaenidae	I006	*Meridolum corneovirens*	Cumberland Plain Land Snail	E1		233	
Plantae	Flora	Anthericaceae	7501	*Caesia parviflora var. minor*	Small Pale Grass-lily	E1,P		K	
Plantae	Flora	Apocynaceae	1226	*Cynanchum elegans*	White-flowered Wax Plant	E1,P	E	K	

Plantae	Flora	Apocynaceae	10896	*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	E2		6	
Plantae	Flora	Araliaceae	1200	*Astrotricha crassifolia*	Thick-leaf Star-hair	V,P	V	K	
Plantae	Flora	Campanulaceae	1937	*Wahlenbergia multicaulis*	Tadgell's Bluebell in the local government areas of Auburn, Bankstown, Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield	E2		K	
Plantae	Flora	Casuarinaceae	8320	*Allocasuarina glareicola*		E1,P	E	1	
Plantae	Flora	Convolvulaceae	2234	*Wilsonia backhousei*	Narrow-leafed Wilsonia	V,P		K	
Plantae	Flora	Convolvulaceae	2235	*Wilsonia rotundifolia*	Round-leafed Wilsonia	E1,P		K	
Plantae	Flora	Dilleniaceae	11422	*Hibbertia puberula*		E1,P		K	
Plantae	Flora	Dilleniaceae	13902	*Hibbertia sp. Bankstown*		E4A,P	CE	K	
Plantae	Flora	Dilleniaceae	14564	*Hibbertia stricta subsp. furcatula*		E1,P		K	
Plantae	Flora	Dilleniaceae	11250	*Hibbertia superans*		E1,P		K	

Plantae	Flora	Elaeocarpaceae	6205	*Tetratheca glandulosa*		V,P		K	
Plantae	Flora	Ericaceae	7752	*Epacris purpurascens var. purpurascens*		V,P		K	
Plantae	Flora	Ericaceae	2618	*Leucopogon exolasius*	Woronora Beard-heath	V,P	V	3	
Plantae	Flora	Ericaceae	9569	*Leucopogon fletcheri subsp. fletcheri*		E1,P		1	
Plantae	Flora	Euphorbiaceae	9851	*Chamaesyce psammogeton*	Sand Spurge	E1,P		P	
Plantae	Flora	Fabaceae (Faboideae)	2853	*Dillwynia tenuifolia*	Dillwynia tenuifolia, Kemps Creek	E2,V,P		18	
Plantae	Flora	Fabaceae (Faboideae)	2853	*Dillwynia tenuifolia*		V,P		25	
Plantae	Flora	Fabaceae (Faboideae)	2974	*Pultenaea aristata*	Prickly Bush-pea	V,P	V	K	
Plantae	Flora	Fabaceae (Faboideae)	3007	*Pultenaea parviflora*		E1,P	V	85	
Plantae	Flora	Fabaceae (Faboideae)	3008	*Pultenaea pedunculata*	Matted Bush-pea	E1,P		12	
Plantae	Flora	Fabaceae (Mimosoideae)	6577	*Acacia baueri subsp. aspera*		V,P		K	
Plantae	Flora	Fabaceae (Mimosoideae)	3728	*Acacia bynoeana*	Bynoe's Wattle	E1,P	V	K	
Plantae	Flora	Fabaceae (Mimosoideae)	7229	*Acacia gordonii*		E1,P	E	K	

Plantae	Flora	Fabaceae (Mimosoideae)	3860	*Acacia pubescens*	Downy Wattle	V,P	V	53	
Plantae	Flora	Grammitidaceae	9471	*^^Grammitis stenophylla*	Narrow-leaf Finger Fern	E1,P,3		K	
Plantae	Flora	Gyrostemonaceae	9411	*^^Gyrostemon thesioides*		E1,P,3		16	
Plantae	Flora	Haloragaceae	9512	*Haloragis exalata subsp. exalata*	Square Raspwort	V,P	V	K	
Plantae	Flora	Haloragaceae	3257	*Haloragodendron lucasii*		E1,P	E	K	
Fungi	Flora	Hygrophoraceae	F006	*Camarophyllopsis kearneyi*		E1,P		K	
Fungi	Flora	Hygrophoraceae	F003	*Hygrocybe anomala var. ianthinomarginata*		V,P		K	
Fungi	Flora	Hygrophoraceae	F004	*Hygrocybe aurantipes*		V,P		K	
Fungi	Flora	Hygrophoraceae	F001	*Hygrocybe austropratensis*		E1,P		K	
Fungi	Flora	Hygrophoraceae	F007	*Hygrocybe collucera*		E1,P		K	
Fungi	Flora	Hygrophoraceae	F008	*Hygrocybe griseoramosa*		E1,P		K	
Fungi	Flora	Hygrophoraceae	F005	*Hygrocybe lanecovensis*		E1,P		K	
Fungi	Flora	Hygrophoraceae	F002	*Hygrocybe reesiae*		V,P		K	
Fungi	Flora	Hygrophoraceae	F015	*Hygrocybe rubronivea*		V,P		K	

Plantae	Flora	Juncaginaceae	3363	*Maundia triglochinoides*		V,P		K	
Plantae	Flora	Lamiaceae	3404	*Prostanthera densa*	Villous Mint-bush	V,P	V	K	
Plantae	Flora	Lobeliaceae	1911	*^^Hypsela sessiliflora*		E1,P,3	X	K	
Plantae	Flora	Marsileaceae	8140	*^^Pilularia novae-hollandiae*	Austral Pillwort	E1,P,3		K	
Plantae	Flora	Myrtaceae	4007	*^^Callistemon linearifolius*	Netted Bottle Brush	V,P,3		3	
Plantae	Flora	Myrtaceae	4024	*Darwinia biflora*		V,P	V	K	
Plantae	Flora	Myrtaceae	4031	*Darwinia peduncularis*		V,P		K	
Plantae	Flora	Myrtaceae	4055	*Eucalyptus benthamii*	Camden White Gum	V,P	V	5	
Plantae	Flora	Myrtaceae	4067	*Eucalyptus camfieldii*	Camfield's Stringybark	V,P	V	K	
Plantae	Flora	Myrtaceae	4134	*Eucalyptus nicholii*	Narrow-leaved Black Peppermint	V,P	V	1	
Plantae	Flora	Myrtaceae	8907	*Eucalyptus scoparia*	Wallangarra White Gum	E1,P	V	1	
Plantae	Flora	Myrtaceae	11892	*Eucalyptus sp. Cattai*		E1,P		P	
Plantae	Flora	Myrtaceae	6809	*Melaleuca biconvexa*	Biconvex Paperbark	V,P	V	K	
Plantae	Flora	Myrtaceae	4248	*Melaleuca deanei*	Deane's Paperbark	V,P	V	9	
Plantae	Flora	Myrtaceae	4274	*Micromyrtus minutiflora*		E1,P	V	K	
Plantae	Flora	Myrtaceae	4293	*Syzygium paniculatum*	Magenta Lilly Pilly	E1,P	V	K	
Plantae	Flora	Orchidaceae	4386	*^Caladenia tessellata*	Thick Lip Spider Orchid	E1,P,2	V	K	
Plantae	Flora	Orchidaceae	4439	*^Diuris aequalis*	Buttercup Doubletail	E1,P,2	V	1	

Plantae	Flora	Orchidaceae	4464	^*Genoplesium baueri*	Bauer's Midge Orchid	E1,P,2		K	
Plantae	Flora	Orchidaceae	7324	^*Pterostylis nigricans*	Dark Greenhood	V,P,2		1	
Plantae	Flora	Orchidaceae	9615	^*Pterostylis saxicola*	Sydney Plains Greenhood	E1,P,2	E	2	
Plantae	Flora	Poaceae	4875	*Deyeuxia appressa*		E1,P	E	P	
Plantae	Flora	Polygonaceae	5280	*Persicaria elatior*	Tall Knotweed	V,P	V	K	
Plantae	Flora	Proteaceae	10917	*Grevillea juniperina subsp. juniperina*	Juniper-leaved Grevillea	V,P		1	
Plantae	Flora	Proteaceae	10009	*Grevillea parviflora subsp. parviflora*	Small-flower Grevillea	V,P	V	15	
Plantae	Flora	Proteaceae	10777	*Grevillea parviflora subsp. supplicans*		E1,P		K	
Plantae	Flora	Proteaceae	9527	*Persoonia bargoensis*	Bargo Geebung	E1,P	V	K	
Plantae	Flora	Proteaceae	7677	*Persoonia glaucescens*	Mittagong Geebung	E1,P	V	K	
Plantae	Flora	Proteaceae	5458	^^*Persoonia hirsuta*	Hairy Geebung	E1,P,3	E	1	
Plantae	Flora	Proteaceae	8995	*Persoonia mollis subsp. maxima*		E1,P	E	K	
Plantae	Flora	Proteaceae	5467	*Persoonia nutans*	Nodding Geebung	E1,P	E	19	
Plantae	Flora	Rhamnaceae	5573	*Pomaderris brunnea*	Brown Pomaderris	V,P	V	K	
Plantae	Flora	Rhamnaceae	5591	*Pomaderris prunifolia*	P. prunifolia in the Parramatta, Auburn, Strathfield and Bankstown Local Government Areas	E2		K	
Plantae	Flora	Rubiaceae	5680	*Galium australe*	Tangled Bedstraw	E1,P		K	

Plantae	Flora	Rutaceae	5840	*Zieria involucrata*		E1,P	V	K	
Plantae	Flora	Santalaceae	5871	*Thesium australe*	Austral Toadflax	V,P	V	K	
Plantae	Flora	Sterculiaceae	6140	*Lasiopetalum joyceae*		V,P	V	K	
Plantae	Flora	Sterculiaceae	6148	*Rulingia prostrata*	Dwarf Kerrawang	E1,P	E	P	
Plantae	Flora	Thymelaeaceae	6965	*Pimelea curviflora var. curviflora*		V,P	V	K	
Plantae	Flora	Thymelaeaceae	6190	*Pimelea spicata*	Spiked Rice-flower	E1,P	E	9	
Plantae	Flora	Zannichelliaceae	6339	*Zannichellia palustris*		E1,P		K	
Community				*Agnes Banks Woodland in the Sydney Basin Bioregion*	Agnes Banks Woodland in the Sydney Basin Bioregion	E3		K	
Community				*Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions*	Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions	E3		K	
Community				*Blue Gum High Forest in the Sydney Basin Bioregion*	Blue Gum High Forest in the Sydney Basin Bioregion	E4B	CE	K	
Community				*Blue Mountains Shale Cap Forest in the Sydney Basin Bioregion*	Blue Mountains Shale Cap Forest in the Sydney Basin Bioregion	E3	CE	K	
Community				*Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion*	Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion	V2		K	

Community	*Castlereagh Swamp Woodland Community*	Castlereagh Swamp Woodland Community	E3		K	
Community	*Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*	Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	V	P	
Community	*Coastal Upland Swamp in the Sydney Basin Bioregion*	Coastal Upland Swamp in the Sydney Basin Bioregion	E3		K	
Community	*Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion*	Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion	E3		K	
Community	*Cumberland Plain Woodland in the Sydney Basin Bioregion*	Cumberland Plain Woodland in the Sydney Basin Bioregion	E4B	CE	K	
Community	*Elderslie Banksia Scrub Forest*	Elderslie Banksia Scrub Forest	E3		K	
Community	*Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*	Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3		K	

Community	*Kurnell Dune Forest in the Sutherland Shire and City of Rockdale*	Kurnell Dune Forest in the Sutherland Shire and City of Rockdale	E3		K	
Community	*Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*	Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	CE	P	
Community	*Moist Shale Woodland in the Sydney Basin Bioregion*	Moist Shale Woodland in the Sydney Basin Bioregion	E3	CE	K	
Community	*O'Hares Creek Shale Forest*	O'Hares Creek Shale Forest	E3		K	
Community	*River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3		K	
Community	*Shale gravel Transition Forest in the Sydney Basin Bioregion*	Shale gravel Transition Forest in the Sydney Basin Bioregion	E3	CE	K	
Community	*Shale/Sandstone Transition Forest*	Shale/Sandstone Transition Forest	E3	E	K	

Community	*Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion*	Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion	E3		K	
Community	*Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3		K	
Community	*Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions*	Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3		K	
Community	*Sydney Freshwater Wetlands in the Sydney Basin Bioregion*	Sydney Freshwater Wetlands in the Sydney Basin Bioregion	E3		K	
Community	*Sydney Turpentine-Ironbark Forest*	Sydney Turpentine-Ironbark Forest	E3	CE	K	

Community	*Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions*	Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions	E3		K	
Community	*Western Sydney Dry Rainforest in the Sydney Basin Bioregion*	Western Sydney Dry Rainforest in the Sydney Basin Bioregion	E3	CE	K	
Threat	*Aggressive exclusion of birds from woodland and forest habitat by abundant Noisy Miners Manorina melanocephala*	Aggressive exclusion of birds from woodland and forest habitat by abundant Noisy Miners Manorina melanocephala	KTP		P	
Threat	*Alteration of habitat following subsidence due to longwall mining*	Alteration of habitat following subsidence due to longwall mining	KTP		P	
Threat	*Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands*	Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands	KTP		P	
Threat	*Anthropogenic Climate Change*	Anthropogenic Climate Change	KTP	KTP	P	
Threat	*Bushrock removal*	Bushrock removal	KTP		P	

Threat	*Clearing of native vegetation*	Clearing of native vegetation	KTP	KTP	P	
Threat	*Competition and grazing by the feral European Rabbit, Oryctolagus cuniculus (L.)*	Competition and grazing by the feral European Rabbit, Oryctolagus cuniculus (L.)	KTP	KTP	P	
Threat	*Competition and habitat degradation by Feral Goats, Capra hircus Linnaeus 1758*	Competition and habitat degradation by Feral Goats, Capra hircus Linnaeus 1758	KTP	KTP	P	
Threat	*Competition from feral honey bees, Apis mellifera L.*	Competition from feral honey bees, Apis mellifera L.	KTP		P	
Threat	*Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners*	Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners	KTP		P	
Threat	*Herbivory and environmental degradation caused by feral deer*	Herbivory and environmental degradation caused by feral deer	KTP		P	

Threat	*High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition*	High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition	KTP		P	
Threat	*Importation of Red Imported Fire Ants Solenopsis invicta Buren 1972*	Importation of Red Imported Fire Ants Solenopsis invicta Buren 1972	KTP	KTP	P	
Threat	*Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations*	Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations	KTP	KTP	P	
Threat	*Infection of frogs by amphibian chytrid causing the disease chytridiomycosis*	Infection of frogs by amphibian chytrid causing the disease chytridiomycosis	KTP	KTP	P	
Threat	*Infection of native plants by Phytophthora cinnamomi*	Infection of native plants by Phytophthora cinnamomi	KTP	KTP	P	
Threat	*Introduction of the Large Earth Bumblebee Bombus terrestris (L.)*	Introduction of the Large Earth Bumblebee Bombus terrestris (L.)	KTP		P	

Threat	*Invasion and establishment of exotic vines and scramblers*	Invasion and establishment of exotic vines and scramblers	KTP		P	
Threat	*Invasion and establishment of Scotch Broom (Cytisus scoparius)*	Invasion and establishment of Scotch Broom (Cytisus scoparius)	KTP		P	
Threat	*Invasion and establishment of the Cane Toad (Bufo marinus)*	Invasion and establishment of the Cane Toad (Bufo marinus)	KTP	KTP	P	
Threat	*Invasion of native plant communities by African Olive Olea europaea subsp. cuspidata (Wall. ex G. Don) Cif.*	Invasion of native plant communities by African Olive Olea europaea subsp. cuspidata (Wall. ex G. Don) Cif.	KTP		P	
Threat	*Invasion of native plant communities by Chrysanthemoides monilifera*	Invasion of native plant communities by Chrysanthemoides monilifera	KTP		P	
Threat	*Invasion of native plant communities by exotic perennial grasses*	Invasion of native plant communities by exotic perennial grasses	KTP		P	
Threat	*Invasion of the Yellow Crazy Ant, Anoplolepis gracilipes (Fr. Smith) into NSW*	Invasion of the Yellow Crazy Ant, Anoplolepis gracilipes (Fr. Smith) into NSW	KTP		P	

Threat	*Invasion, establishment and spread of Lantana (Lantana camara L. sens. Lat)*	Invasion, establishment and spread of Lantana (Lantana camara L. sens. Lat)	KTP		P	
Threat	*Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants*	Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants	KTP	KTP	P	
Threat	*Loss of Hollow-bearing Trees*	Loss of Hollow-bearing Trees	KTP		P	
Threat	*Loss or degradation (or both) of sites used for hill-topping by butterflies*	Loss or degradation (or both) of sites used for hill-topping by butterflies	KTP		P	
Threat	*Predation and hybridisation by Feral Dogs, Canis lupus familiaris*	Predation and hybridisation by Feral Dogs, Canis lupus familiaris	KTP		P	
Threat	*Predation by Gambusia holbrooki Girard, 1859 (Plague Minnow or Mosquito Fish)*	Predation by Gambusia holbrooki Girard, 1859 (Plague Minnow or Mosquito Fish)	KTP		P	

Threat	*Predation by the European Red Fox Vulpes Vulpes (Linnaeus, 1758)*	Predation by the European Red Fox Vulpes Vulpes (Linnaeus, 1758)	KTP	KTP	P	
Threat	*Predation by the Feral Cat Felis catus (Linnaeus, 1758)*	Predation by the Feral Cat Felis catus (Linnaeus, 1758)	KTP	KTP	P	
Threat	*Predation, habitat degradation, competition and disease transmission by Feral Pigs, Sus scrofa Linnaeus 1758*	Predation, habitat degradation, competition and disease transmission by Feral Pigs, Sus scrofa Linnaeus 1758	KTP	KTP	P	
Threat	*Removal of dead wood and dead trees*	Removal of dead wood and dead trees	KTP		P	

Appendix 2

Raw Data EPBC Act Protected Matters Search Tool Results

Australian Government

Department of the Environment

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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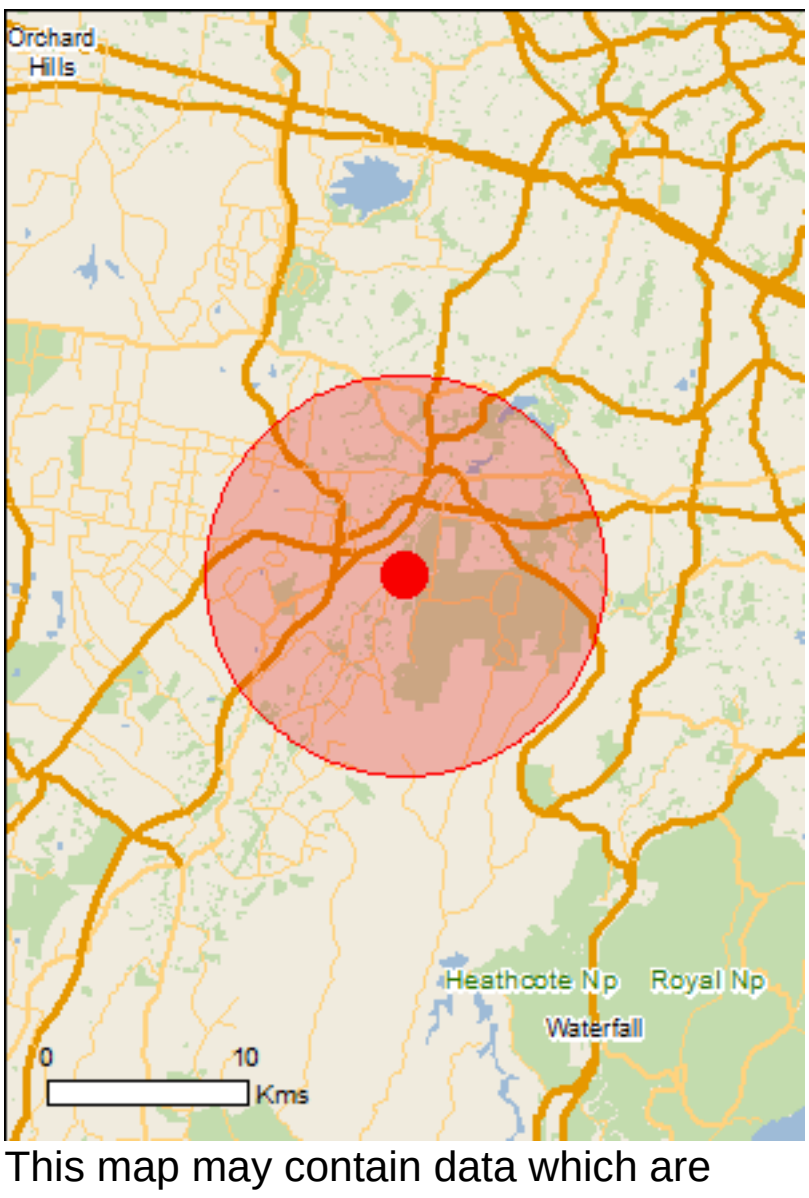

Coordinates

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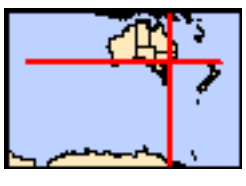

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	1
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Listed Threatened Ecological Communities:	5
Listed Threatened Species:	66
Listed Migratory Species:	34

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place and the heritage values of a place on the Register of the National Estate.

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	17
Commonwealth Heritage Places:	3
Listed Marine Species:	34
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

Place on the RNE:	27
State and Territory Reserves:	3
Regional Forest Agreements:	None
Invasive Species:	55
Nationally Important Wetlands:	2
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

National Heritage Properties [Resource Information]

Name	State	Status
Historic		
Vietnam War Comradeship Memorial	NSW	Nominated place

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest	Critically Endangered	Community likely to occur within area
Shale/Sandstone Transition Forest	Endangered	Community likely to occur within area
Turpentine-Ironbark Forest in the Sydney Basin Bioregion	Critically Endangered	Community likely to occur within area
Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion	Endangered	Community may occur within area
Western Sydney Dry Rainforest and Moist Woodland on Shale	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Endangered	Species or species habitat known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat likely to occur within area
Diomedea epomophora epomophora Southern Royal Albatross [25996]	Vulnerable	Species or species habitat likely to occur within area
Diomedea epomophora sanfordi Northern Royal Albatross [82331]	Endangered	Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Diomedea exulans antipodensis Antipodean Albatross [82269]	Vulnerable	Species or species habitat likely to occur within area
Diomedea exulans exulans Tristan Albatross [82337]	Endangered	Species or species habitat may occur within area
Diomedea exulans gibsoni Gibson's Albatross [82271]	Vulnerable	Species or species habitat likely to occur within area
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Species or species habitat likely to occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant-Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche cauta salvini Salvin's Albatross [82343]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Species or species habitat likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris impavida Campbell Albatross [82449]	Vulnerable	Species or species habitat may occur within area
Fish		
Epinephelus daemelii Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat likely to occur within area
Macquaria australasica Macquarie Perch [66632]	Endangered	Species or species habitat may occur within

Name	Status	Type of Presence
		area
Prototroctes maraena		
Australian Grayling [26179]	Vulnerable	Species or species habitat may occur within area
Frogs		
Heleioporus australiacus		
Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat likely to occur within area
Litoria aurea		
Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat likely to occur within area
Litoria littlejohni		
Littlejohn's Tree Frog, Heath Frog [64733]	Vulnerable	Species or species habitat may occur within area
Litoria raniformis		
Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog [1828]	Vulnerable	Species or species habitat may occur within area
Mixophyes balbus		
Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat likely to occur within area
Mammals		
Chalinolobus dwyeri		
Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat may occur within area
Dasyurus maculatus maculatus (SE mainland population)		
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Isoodon obesulus obesulus		
Southern Brown Bandicoot (Eastern) [68050]	Endangered	Species or species habitat may occur within area
Petrogale penicillata		
Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat known to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus tridactylus		
Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat may occur within area
Pseudomys novaehollandiae		
New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat likely to occur within area
Pteropus poliocephalus		
Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area
Plants		
Acacia pubescens		
Downy Wattle, Hairy Stemmed Wattle [18800]	Vulnerable	Species or species habitat likely to occur within area
Allocasuarina glareicola		
[21932]	Endangered	Migration route known to occur within area
Asterolasia elegans		
[56780]	Endangered	Species or species habitat likely to occur within area
Caladenia tessellata		
Thick-lipped Spider-orchid, Daddy Long-legs [2119]	Vulnerable	Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Cryptostylis hunteriana Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat may occur within area
Cynanchum elegans White-flowered Wax Plant [12533]	Endangered	Species or species habitat likely to occur within area
Eucalyptus camfieldii Camfield's Stringybark [15460]	Vulnerable	Species or species habitat likely to occur within area
Grevillea parviflora subsp. parviflora Small-flower Grevillea [64910]	Vulnerable	Species or species habitat likely to occur within area
Hibbertia puberula subsp. glabrescens [86645]	Critically Endangered	Species or species habitat likely to occur within area
Leucopogon exolasius Woronora Beard-heath [14251]	Vulnerable	Species or species habitat likely to occur within area
Melaleuca biconvexa Biconvex Paperbark [5583]	Vulnerable	Species or species habitat may occur within area
Melaleuca deanei Deane's Melaleuca [5818]	Vulnerable	Species or species habitat likely to occur within area
Pelargonium sp. Striatellum (G.W.Carr 10345) Omeo Stork's-bill [84065]	Endangered	Species or species habitat may occur within area
Persoonia hirsuta Hairy Persoonia [19006]	Endangered	Species or species habitat likely to occur within area
Persoonia nutans Nodding Geebung [18119]	Endangered	Species or species habitat likely to occur within area
Pimelea curviflora var. curviflora [4182]	Vulnerable	Species or species habitat likely to occur within area
Pimelea spicata Spiked Rice-flower [20834]	Endangered	Species or species habitat known to occur within area
Pomaderris brunnea Rufous Pomaderris [16845]	Vulnerable	Species or species habitat likely to occur within area
Pterostylis gibbosa Illawarra Greenhood, Rufa Greenhood, Pouched Greenhood [4562]	Endangered	Species or species habitat known to occur within area
Pterostylis saxicola Sydney Plains Greenhood [64537]	Endangered	Species or species habitat known to occur within area
Pultenaea parviflora [19380]	Vulnerable	Species or species habitat likely to occur within area
Streblus pendulinus Siah's Backbone, Sia's Backbone, Isaac Wood [21618]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Thelymitra sp. Kangaloon (D.L.Jones 18108)		
Kangaloon Sun-orchid [81971]	Critically Endangered	Species or species habitat may occur within area
Reptiles		
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat may occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Hoplocephalus bungaroides		
Broad-headed Snake [1182]	Vulnerable	Species or species habitat likely to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Diomedea antipodensis		
Antipodean Albatross [64458]	Vulnerable*	Species or species habitat likely to occur within area
Diomedea dabbenena		
Tristan Albatross [66471]	Endangered*	Species or species habitat may occur within area
Diomedea epomophora (sensu stricto)		
Southern Royal Albatross [1072]	Vulnerable*	Species or species habitat likely to occur within area
Diomedea exulans (sensu lato)		
Wandering Albatross [1073]	Vulnerable	Species or species habitat likely to occur within area
Diomedea gibsoni		
Gibson's Albatross [64466]	Vulnerable*	Species or species habitat likely to occur within area
Diomedea sanfordi		
Northern Royal Albatross [64456]	Endangered*	Species or species habitat likely to occur within area
Macronectes giganteus		
Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli		
Northern Giant-Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri		
Buller's Albatross [64460]	Vulnerable	Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Thalassarche cauta (sensu stricto) Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Species or species habitat likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Species or species habitat likely to occur within area
Thalassarche impavida Campbell Albatross [64459]	Vulnerable*	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable*	Species or species habitat likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Species or species habitat likely to occur within area
Migratory Marine Species		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat may occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species

Name	Threatened	Type of Presence
		habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Xanthomyza phrygia Regent Honeyeater [430]	Endangered*	Species or species habitat known to occur within area
Migratory Wetlands Species		
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -
Commonwealth Land - Australian Postal Commission
Commonwealth Land - Australian Postal Corporation
Commonwealth Land - Australian Telecommunications Commission
Commonwealth Land - Australian Telecommunications Corporation
Commonwealth Land - Commonwealth Bank of Australia
Commonwealth Land - Commonwealth Trading Bank of Australia
Commonwealth Land - Defence Housing Authority
Commonwealth Land - Defence Service Homes Corporation
Commonwealth Land - Director of War Service Homes
Commonwealth Land - Telstra Corporation Limited
Defence - CAMP SAPPER-EAST HILLS (Lot 2) : CAMP SAPPER TRAINING AREA (Lot 1)
Defence - EAST HILLS BARRACKS - OP SAFE HAVEN
Defence - INGLEBURN AREA (Bardia Barracks)
Defence - MOOREBANK AREA INC SME
Defence - Suite 8, Library Plaza
Defence - WET BRIDGING SITE - CASULA

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Indigenous		
Cubbitch Barta National Estate Area	NSW	Listed place
Historic		
Defence National Storage and Distribution Centre	NSW	Listed place
Old Army / Internment Camp Group Holsworthy	NSW	Listed place

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur

Name	Threatened	Type of Presence within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat likely to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable*	Species or species habitat likely to occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered*	Species or species habitat may occur within area
Diomedea epomophora (sensu stricto) Southern Royal Albatross [1072]	Vulnerable*	Species or species habitat likely to occur within area
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Vulnerable	Species or species habitat likely to occur within area
Diomedea gibsoni Gibson's Albatross [64466]	Vulnerable*	Species or species habitat likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered*	Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant-Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Thalassarche bulleri Buller's Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta (sensu stricto) Shy Albatross, Tasmanian Shy Albatross [64697]	Vulnerable*	Species or species habitat likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Species or species habitat likely to occur within area
Thalassarche impavida Campbell Albatross [64459]	Vulnerable*	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable*	Species or species habitat likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Species or species habitat likely to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat may occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area

Extra Information

Places on the RNE [Resource Information]

Note that not all Indigenous sites may be listed.

Name	State	Status
Natural		
Georges River Wetlands	NSW	Indicative Place
Voyager Point	NSW	Registered
Indigenous		
Cubbitch Barta National Estate Area	NSW	Registered
Historic		
Bankstown Airport	NSW	Indicative Place
Liverpool Fire Station	NSW	Indicative Place
The 13th Jyotirlinga (icon)	NSW	Indicative Place
Defence National Storage and Distribution Centre	NSW	Interim List
Bernera including Site and Knoll	NSW	Registered
Collingwood	NSW	Registered
Denham Court and St Marys Anglican Chapel	NSW	Registered
Glenfield Farm	NSW	Registered
Horningsea Park	NSW	Registered
Hoxton Park Airport	NSW	Registered
Ingleburn Army Camp	NSW	Registered
Kitchener House	NSW	Registered
Liverpool Courthouse (former)	NSW	Registered
Liverpool Dam	NSW	Registered
Liverpool Hospital (former)	NSW	Registered
Macquarie Field Garden	NSW	Registered
Macquarie Field House	NSW	Registered
Old Army / Internment Camp Group Holsworthy	NSW	Registered
Prefabricated Cottages Ingleburn Village	NSW	Registered
Robin Hood Farm	NSW	Registered
St Lukes Anglican Church	NSW	Registered
The Homestead	NSW	Registered
Varro Ville	NSW	Registered

State and Territory Reserves [Resource Information]

Name	State
Gandangara	NSW
Georges River	NSW
Leacock	NSW

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Carduelis chloris European Greenfinch [404]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Frogs		
Bufo marinus Cane Toad [1772]		Species or species habitat likely to occur within area
Rhinella marina Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
[Rattus norvegicus](#) Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
[Rattus rattus](#) Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
[Vulpes vulpes](#) Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
[Alternanthera philoxeroides](#) Alligator Weed [11620]		Species or species habitat likely to occur within area
[Anredera cordifolia](#) Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
[Asparagus aethiopicus](#) Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
[Asparagus asparagoides](#) Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
[Asparagus plumosus](#) Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
[Asparagus scandens](#) Asparagus Fern, Climbing Asparagus Fern [23255]		Species or species habitat likely to occur within area
[Cabomba caroliniana](#) Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
[Chrysanthemoides monilifera](#) Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
[Chrysanthemoides monilifera subsp. monilifera](#) Boneseed [16905]		Species or species habitat likely to occur within area
[Chrysanthemoides monilifera subsp. rotundata](#) Bitou Bush [16332]		Species or species habitat likely to occur within area
[Cytisus scoparius](#) Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
[Dolichandra unguis-cati](#) Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
[Eichhornia crassipes](#) Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
[Genista linifolia](#) Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
[Genista monspessulana](#) Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom		Species or species habitat likely to occur

Name	Status	Type of Presence
[20126]		within area
Genista sp. X Genista monspessulana		
Broom [67538]		Species or species habitat may occur within area
Lantana camara		
Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum		
African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Nassella neesiana		
Chilean Needle grass [67699]		Species or species habitat likely to occur within area
Nassella trichotoma		
Serrated Tussock, Yass River Tussock, Yass Tussock, Nassella Tussock (NZ) [18884]		Species or species habitat likely to occur within area
Opuntia spp.		
Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata		
Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Protasparagus plumosus		
Climbing Asparagus-fern, Ferny Asparagus [11747]		Species or species habitat likely to occur within area
Rubus fruticosus aggregate		
Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla		
Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii		
Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta		
Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis		
Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Ulex europaeus		
Gorse, Furze [7693]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus		
Asian House Gecko [1708]		Species or species habitat likely to occur within area

Nationally Important Wetlands	[Resource Information]
Name	State
Liverpool Military Training Area	NSW
Voyager Point	NSW

Coordinates

-33.9661 150.90721

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World Heritage and Register of National Estate properties, Wetlands of International Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

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-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Geoscience Australia
-CSIRO
-Other groups and individuals

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Please feel free to provide feedback via the Contact Us page.

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Appendix 3

Threatened Flora and Fauna Assessment – Species Assessment Table

Species, populations and communities with a likelihood of occurrence of Moderate or greater have had potential impacts formally assessed using a 7-part test under the *Environmental Planning and Assessment Act 1979* or EPBC Assessment (see Appendix 7).

Species recorded on the site during surveys are denoted by bold text.

E1 - Endangered; E2 - Endangered Population; E3 - Endangered ecological community; E4 Critically endangered; P - Protected; K - Known occurrence; PR - Predicted occurrence; V - Vulnerable; E4 critically endangered

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Amphibians							
Heleioporus australiacus	Giant Burrowing Frog	V, P	V	Distributed in south eastern NSW and Victoria, a northern population largely confined to the sandstone geology of the Sydney Basin and extending as far south as Ulladulla Found in heath, woodland and open dry sclerophyll forest on a variety of soil types except clay based. With a preference to Ridgetop, headwater and slow-flowing or intermittent streams. They have also been observed occupying artificial ponded structures that are still surrounded by other undisturbed habitat. Breeding habitat is generally soaks or pools within first or second order streams.	25	Low. Site is highly disturbed No headwaters or permanent water/streams in close proximity to the subject site.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Mixophyes balbus	Stuttering Frog, Southern Barred Frog	E1, P, 2	V	Stuttering Frogs occur along the east coast of Australia from southern Qld to north-eastern Victoria. Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range. Outside the breeding season adults live in deep leaf litter and thick understorey vegetation on the forest floor.	P	Low. No wet forests or streams.	Low.
Pseudophryne australis	Red-crowned Toadlet	V,P	-	Occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones. Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings. Shelters under rocks and amongst masses of dense vegetation or thick piles of leaf litter.	27	Low. Site is highly disturbed with an absence of low growing dense vegetation, leaf litter or rocky shelter.	Low.
Litoria aurea	Green and Golden Bell Frog	E1, P	V	Distributed from NSW north coast near Brunswick Heads, southwards along NSW coast to Victoria where it extends into east Gippsland. Inhabits marshes, dams and stream-sides, particularly those containing bulrushes or spikerushes. Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (Gambusia holbrooki), have a grassy area nearby and diurnal sheltering sites available. Some sites, particularly in the Greater Sydney region occur in highly disturbed areas.	14	Moderate. Site may provide limited suitable habitat for this species.	Low. Extensive targeted seasonal surveys indicated that it is unlikely that this species is actually present on the site.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Litoria littlejohni	Littlejohn's Tree Frog, Heath Frog	V, P	V	Distribution includes the plateaus and eastern slopes of the Great Dividing Range from Watagan State Forest south to Buchan in Victoria. This species breeds in the upper reaches of permanent streams and in perched swamps. Non-breeding habitat is heath based forests and woodlands where it shelters under leaf litter and low vegetation.	K	Low. No permanent streams, swamps or heath-based forests within the subject site. Site is highly disturbed with an absence of low growing dense vegetation or leaf litter.	Low.
Litoria raniformis	Growling Grass Frog	E	V	Currently, the species is known to exist only in isolated populations in the Coleambally Irrigation Area, the Lowbidgee floodplain and around Lake Victoria. Found mostly amongst emergent vegetation, including Typha sp. (bullrush), Phragmites sp. (reeds) and Eleocharis sp. (sedges), in or at the edges of still or slow-flowing water bodies such as lagoons, swamps, lakes, ponds and farm dams.	-	Low. Subject site is not within the known range for this species. Site is highly disturbed with little suitable habitat for this species. This species was not identified during targeted amphibian surveys.	Low.
Reptiles							

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Caretta caretta	Loggerhead Turtle	E1,P	E	Occur in coral reefs, bays and estuaries in tropical and warm temperate waters off the coast of Queensland, Northern Territory, Western Australia and New South Wales.	P	Low. Subject site is not suitable for this species.	Low.
Dermochelys coriacea	Leatherback Turtle	E1,P	E	Most commonly reported feeding in coastal waters in central eastern Australia.	P	Low. Subject site is not suitable for this species.	Low.
Varanus rosenbergi	Rosenberg's Goanna	V,P	-	Occurs on the Sydney Sandstone in Wollemi National Park to the north-west of Sydney, in the Goulburn and ACT regions and near Cooma in the south. Found in heath, open forest and woodland.	4	Low. Generally known from sandstone environments. Subject site is highly disturbed and fragmented from larger tracts of vegetation. This species was not observed on site during surveys nor was any visual signs of this species observed.	Low.
Hoplocephalus bungaroides	Broad-headed Snake	E1, P, 2	V	The Broad-headed Snake is largely confined to Triassic and Permian sandstones. Shelters in rock crevices and under flat sandstone rocks on exposed cliff edges. Moves from the sandstone rocks to shelters in hollows in large trees within 200m of escarpments in summer.	7	Low. Generally known from sandstone environments. Subject site is not suitable for the presence of this species. No rocky shelters available on site.	Low.
Birds							

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Stictonetta naevosa	Freckled Duck	V,P	-	Found primarily in south-eastern and south-western Australia. 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.	K	Low. The site does not provide suitable habitat requirements for the presence of this species. This species was not observed on site.	Low.
Ptilinopus superbus	Superb Fruit-Dove	V, P		Occurs primarily from north-eastern Qld to north-eastern NSW. It is much less common further south. Inhabits rainforest and similar closed forests where it forages high in the canopy, eating the fruits of many tree species. It may also forage in eucalypt or acacia woodland where there are fruit-bearing trees.	K	Low. The site does not provide suitable habitat requirements for the presence of this species. This species was not observed on site.	Low.
Ephippiorhynchus asiaticus	Black-necked Stork	E1, P	-	Widespread in coastal and sub-coastal northern and eastern Australia, south to central-eastern NSW. Mainly found on shallow, permanent, freshwater terrestrial wetlands, and surrounding marginal vegetation, including swamps, floodplains, watercourses and billabongs, freshwater meadows, wet heathland, farm dams and shallow floodwaters, as well as extending into adjacent grasslands, paddocks and open savannah woodlands.	1	Low-moderate. Site does contain a small artificial dam that may provide suitable habitat conditions as part of a larger home range. It is unlikely that this dam provides significant habitat value to this species.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Botaurus poiciloptilus	Australasian Bittern	E1, P	E	Inhabits terrestrial and estuarine wetlands, generally where there is permanent water. The species prefers wetlands with dense vegetation, including sedges, rushes and reeds.	K	Low. No wetlands or permanent water/wetlands suitable for this species. Little to no vegetation surrounds this artificial dam.	Low.
Ixobrychus flavicollis	Black Bittern	V, P	-	Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves.	K	Low. No wetlands or permanent water/wetlands suitable for this species. Little to no vegetation surrounds this artificial dam.	Low.
Circus assimilis	Spotted Harrier	V,P	-	Grassy open woodland, inland riparian woodland, grassland and shrub steppe. Most commonly found in native grassland but also in agricultural areas.	2	Low. The site may form part of a larger home range however is highly disturbed with very little to no native grasses present.	Low.
Hieraaetus morphnoides	Little Eagle	V,P	-	Found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. Occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used	23	Low-Moderate. Suitable habitat for the presence of this species. This species may use the site as part of a larger home range. Site is highly disturbed with little foraging potential. This species was not identified during field surveys.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Lophoictinia isura	Square-tailed Kite	V,P,3	-	Timbered habitats including dry woodlands and open forests. Prefers timbered watercourses. Specialist hunter of passerines and insects.	2	Low-Moderate. Suitable habitat for the presence of this species. This species may use the site as part of a larger home range. Site is highly disturbed with little foraging potential. This species was not identified during field surveys.	Low.
Pandion cristatus	Eastern Osprey	V,P,3	-	Favour coastal areas, especially the mouths of large rivers, lagoons and lakes	K	Low. Site is not suitable habitat for the presence of this species.	Low.
Falco subniger	Black Falcon	V,P	-	Widely, but sparsely, distributed in New South Wales, mostly occurring in inland regions.	2	Low-moderate. Suitable habitat for the presence of this species. This species may use the site as part of a larger home range. Site is highly disturbed with little foraging potential. This species was not identified during field surveys.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Burhinus grallarius	Bush Stone-curlew	E1,P	-	Wader-like bird that can be difficult to see in its lightly timbered, open forest or woodland habitat. Dry, open grassland and cropland, with cover nearby, may also provide habitat for the species.	3	Low-moderate. Site may provide some suitable habitat requirements for the presence of this species. Site is highly disturbed with only one artificial dam available for use. This species was not identified during field surveys.	Low.
Esacus magnirostris	Beach Stone-curlew	E4A,P	-	Found exclusively along the coast, on a wide range of beaches, islands, reefs and in estuaries, and may often be seen at the edges of or near mangroves.	K	Low. Site is not suitable habitat for the presence of this species.	Low.
Haematopus fuliginosus	Sooty Oystercatcher	V, P	-	Sooty Oystercatchers are found around the entire Australian coast. Favours rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries.	K	Low. Site is not suitable habitat for the presence of this species.	Low.
Haematopus longirostris	Pied Oystercatcher	E1, P	-	The species is distributed around the entire Australian coastline. Favours intertidal flats of inlets and bays, open beaches and sandbanks. Nests mostly on coastal or estuarine beaches although occasionally they use saltmarsh or grassy areas.	K	Low. Site is not suitable habitat for the presence of this species.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Irediparra gallinacea	Comb-crested Jacana	V,P	-	Occurs on freshwater wetlands in northern and eastern Australia, mainly in coastal and subcoastal regions. Inhabit permanent freshwater wetlands, either still or slow-flowing, with a good surface cover of floating vegetation, especially water-lilies, or fringing and aquatic vegetation.	K	Low. Site may provide some suitable habitat requirements for the presence of this species. Site is highly disturbed with only one artificial dam available for use. This species was not identified during field surveys.	Low.
Rostratula Australia	Australian Painted Snipe	E1,P	E	Restricted to Australia. Most records are from the south east, particularly the Murray Darling Basin. In NSW many records are from the Murray-Darling Basin. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	K	Low. Site is not suitable habitat for the presence of this species. Site is highly disturbed with only one artificial dam available for use. This species was not identified during field surveys.	Low.
Calidris ferruginea	Curlew Sandpiper	E1, P	C, J, K	This species is distributed around most of the coastline of Australia. Generally occupies littoral and estuarine habitats, and in NSW is mainly found in intertidal mudflats of sheltered coasts. It also occurs in non-tidal swamps, lakes and lagoons on the coast and sometimes the inland.	K	Low. Site is not suitable habitat for the presence of this species.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Limicola falcinellus	Broad-billed Sandpiper	V, P	C, J, K	Occurs in sheltered coastal areas, favouring estuarine mudflats and occasionally saltmarshes, shallow freshwater lagoons, saltworks and sewage farms, and in areas with large soft intertidal mudflats, which may have shell or sandbanks nearby.	K	Low. Site is not suitable habitat for the presence of this species.	Low.
Limosa limosa	Black-tailed Godwit	V, P	C, J, K	This species is a migratory wading bird that breeds in Mongolia and Eastern Siberia and flies to Australia for the southern summer. Usually found in sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats. Further inland, can be found on mudflats and in water less than 10cm deep, around muddy lakes and swamps.	K	Low. Site is not suitable habitat for the presence of this species.	Low.
Sterna albifrons	Little Tern	E1, P	C, J, K	Found on the north, east and south-east Australian coasts. Almost exclusively coastal, preferring sheltered environments; however may occur several kilometres from the sea in harbours, inlets and rivers. Nests in low dunes or on sandy beaches just above high tide mark near estuary mouths or adjacent to coastal lakes and islands.	K	Low. Site is not suitable habitat for the presence of this species.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Callocephalon fimbriatum	Gang-gang Cockatoo	V, P, 3	-	Distributed from southern Victoria through south- and central-eastern New South Wales. In summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas	10	Low-Moderate. Site may provide suitable habitat and may be used as part of a larger home range. Site is highly disturbed very open woodland. This species was not identified during field surveys.	Low.
Calyptorhynchus lathami	Glossy Black-Cockatoo	V,P,2	-	Feeds almost exclusively on the seeds of Casuarina sp. and Allocasuarina sp. Open forest and woodlands up to 1000m with feed trees present.	15	Low. No mature feed trees suitable on the site. Site is highly disturbed very open woodland. This species was not identified during field surveys.	Low.
Glossopsitta pusilla	Little Lorikeet	V,P	-	Forages in flowering eucalypts and Melaleuca sp. Riparian habitats are particularly used, due to higher soil fertility and greater productivity. Nests in tree hollows.	22	Low-Moderate. This highly mobile species may forage on flowering Eucalyptus sp. within the subject site as part of a larger home range. Site is highly disturbed very open woodland. This species was not identified during field surveys.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Lathamus discolor	Swift Parrot	E1,P,3	E	Migrates to south-eastern mainland Mar-Oct. Winter-flowering trees such as Eucalyptus robusta, Corymbia maculata, C. gummifera, E. sideroxylon and E. albens are important. Breeds in Tasmania.	9	Low-moderate. Preferred winter-flowering tree species absent from the site. This species may use the site as part of a larger home foraging range. Site is highly disturbed very open woodland. This species was not identified during field surveys.	Low.
Neophema pulchella	Turquoise Parrot	V,P,3	-	Range extends from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range. Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland.	K	Low-Moderate. This highly mobile species may use the subject site as part of a larger home range. Site is highly disturbed very open woodland. This species was not identified during field surveys.	Low.
Pezoporus wallicus	Eastern Ground Parrot	V, P, 3	-	This species inhabits south-eastern Australia from southern Queensland through NSW to western Victoria. The Ground Parrot occurs in high rainfall coastal and near coastal low heathlands and sedgelands, generally below one metre in height and very dense (up to 90% projected foliage cover).	K	Low. Site is not suitable habitat for the presence of this species.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Ninox connivens	Barking Owl	V,P,3	-	Woodland and open forest including fragmented remnants and partly cleared farmland. Preferentially hunts small arboreal mammals such as squirrel gliders and ringtail possums. But as prey decreases becomes reliant on birds, invertebrates and terrestrial mammals such as rodents and rabbits. Large tree hollows are used for nesting.	1	Low-Moderate. Potential foraging habitat is present. This is a highly mobile species. Hollow trees are present on site but not of a size required by this species. This species may use the site as part of a larger home range. Site is highly disturbed with little potential for prey to forage on.	Low.
Ninox strenua	Powerful Owl	V,P,3	-	Endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range. Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest.	26	Low-Moderate. Potential foraging habitat is present. This is a highly mobile species. Hollow trees are present on site but not of a size required by this species. This species may use the site as part of a larger home range. Site is highly disturbed with little potential for prey to forage on.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Tyto novaehollandiae	Masked Owl	V,P,3	-	Extends from the coast where it is most abundant to the western plains. Lives in dry eucalypt forests and woodlands from sea level to 1100m.	K	Low-Moderate. Potential foraging habitat is present. This is a highly mobile species. This species may use the site as part of a larger home range. Site is highly disturbed with little potential for prey to forage on.	Low.
Tyto tenebricosa	Sooty Owl	V, P, 3	-	Occurring on the coast, coastal escarpment and eastern tablelands. There is no seasonal variation in its distribution. Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. Roosts by day in the hollow of a tall forest tree or in heavy vegetation.	K	Low. Site is not suitable habitat for the presence of this species.	Low.
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V,P	-	Eucalypt forests and woodlands of inland plains and slopes of the Great Dividing Range. Mainly inhabits woodlands dominated by rough-barked eucalypts, usually with a grassy or sparse shrub understorey. Fallen timber is an important habitat component for foraging. Nests in tree hollows.	5	Low-Moderate. Site may provide suitable habitat for the presence of this species. This is a highly mobile species. This species may use the site as part of a larger home range, although it is considered unlikely.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Dasyornis brachypterus	Eastern Bristlebird	E1, P	E	Habitat is characterised by dense, low vegetation including heath and open woodland with a heathy understorey. Age of habitat since fires (fire-age) is of paramount importance to this species; Illawarra and southern populations reach maximum densities in habitat that has not been burnt for at least 15 years.	P	Low. Site is not suitable habitat for the presence of this species.	Low.
Chthonicola sagittata	Speckled Warbler	V,P	-	Lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies.Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy.	6	Low. Site is not suitable habitat for the presence of this species. Site is highly disturbed with little native grass/shrub understorey.	Low.
Anthochaera phrygia	Regent Honeyeater	E4A,P	E	Dry open forest and woodland. Particularly box-ironbark woodland and riparian forests of river sheoak. Feeds on the nectar from a wide range of eucalypts and mistletoes.	8	Low-Moderate. Potential foraging habitat occurs within the subject site. Site is highly disturbed with a degraded riparian habitat. This species may use the site as part of a larger home foraging range. This species was not identified during field surveys.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Epthianura albifrons	White-fronted Chat population in the Sydney Metropolitan Catchment Management Area	E2,V,P	-	In NSW, it occurs mostly in the southern half of the state, in damp open habitats along the coast, and near waterways in the western part of the state. Along the coastline, it is found predominantly in saltmarsh vegetation but also in open grasslands and sometimes in low shrubs bordering wetland areas.	1	Low. Site is not suitable habitat for the presence of this species.	Low.
Epthianura albifrons	White Fronted chat	V,P	-	In NSW, it occurs mostly in the southern half of the state, in damp open habitats along the coast, and near waterways in the western part of the state. Along the coastline, it is found predominantly in saltmarsh vegetation but also in open grasslands and sometimes in low shrubs bordering wetland areas.	1	Low. Site is not suitable habitat for the presence of this species.	Low.
Grantiella picta	Painted Honeyeater	V,P	-	Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. Feeds on fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus Amyema. Nest from spring to autumn in a small, delicate nest hanging within the outer canopy of drooping eucalypts, she-oak, paperbark or mistletoe branches.	K	Low-Moderate. Site may provide some suitable foraging habitat. This species may use the site as part of a larger home range. Site is highly disturbed and fragmented from larger tracks of vegetation. This species was not identified during field surveys.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V,P	-	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, Blakely's Red Gum and Forest Red Gum. Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river sheoaks (nesting habitat) and tea-trees.	7	Low-Moderate. Site may provide some suitable foraging habitat. This species may use the site as part of a larger home range. Site is highly disturbed and fragmented from larger tracks of vegetation. This species was not identified during field surveys.	Low.
Daphoenositta chrysoptera	Varied Sittella	V,P	-	Eucalypt forests and woodlands, particularly those with rough-barked species, mature smooth-barked gums with dead branches, mallee and Acacia woodland.	72	Low-Moderate. Site may provide some suitable foraging habitat. This species may use the site as part of a larger home range for foraging. Site is highly disturbed and fragmented from larger tracks of vegetation. This species was not identified during field surveys.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	V,P	-	Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses. Often perches on low dead stumps and fallen timber or on low-hanging branches.	2	Low. The site does not provide the structural diversity of shrubs/native grasses required for the presence of this species. Site is highly disturbed and fragmented.	Low.
Petroica boodang	Scarlet Robin	V,P	-	Dry eucalypt forests and woodland with open grassy understorey with few scattered shrubs. Occurs in both mature and regrowth forests and occasionally occurs in mallee, wet forests, wetlands and tea-tree swamps.	12	Low. The site does not provide the structural diversity of shrubs/native grasses required for the presence of this species. Site is highly disturbed and fragmented.	Low.
Petroica phoenicea	Flame Robin	V,P	-	Prefers clearings or areas with open understorey. Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. In winter birds migrate to drier more open habitats in the lowlands (valleys and western slopes and plains).	3	Low-Moderate. Suitable habitat for the presence of this species. The site may provide certain habitat components for the presence of this species as part of a larger home range. This species was not observed during field surveys.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Stagonopleura guttata	Diamond Firetail	V,P	-	Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum Eucalyptus pauciflora Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland. Often found in riparian areas and sometimes in lightly wooded farmland. Feeds exclusively on the ground, on ripe and partly-ripe grass and herb seeds and green leaves, and on insects.	K	Low. The site is highly disturbed with little native grass cover required for feeding.	Low.
Sternula nereis nereis	Australian Fairy Tern	-	V	Occurs along the coasts of Victoria, Tasmania, SA and WA. The subspecies has been known from NSW in the past, but it is unknown if it persists there. Nests on sheltered sandy beaches, spits and banks above the high tide line and below vegetation. Has been found in embayments including offshore, estuarine or lacustrine (lake) islands, wetlands and mainland coastline.	-	Low. Site is not suitable habitat for the presence of this species.	Low.
Apus pacidicus	Fork-tailed Swift	-	Migratory Marine	In NSW, the species is recorded in all regions. Many records occur east of the Great Divide. The Fork-tailed Swift is almost exclusively aerial with them foraging and roosting aerially.	Likely to occur within the area	Low-moderate. This species may use the site occasionally as part of a larger home foraging range. Site is highly disturbed with limited foraging potential.	Low

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Ardea alba	Great Egret, White Egret	-	Migratory Wetland	The Eastern Great Egret has been reported in a wide range of wetland habitats. The species usually frequents shallow waters. May potentially occur at wetlands that also support a range of other waterbirds or shorebirds, such as the Australian Painted Snipe	Known to occur within the area	Low-moderate. The site does contain an artificial dam that may provide some suitable habitat for this species. However, the dam is not of a size that is likely to support any population of this species. Site is highly disturbed and fragmented.	Low.
Ardea ibis	Cattle Egret	-	Migratory Wetland	Two major distributions have been located; from north-east WA to the Top End of the Northern Territory and around south-east Australia. The Cattle Egret occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands. Observed in moist, low-lying poorly drained pastures with an abundance of high grass; it avoids low grass pastures.	Likely to occur within the area	Low-moderate. The site does contain an artificial dam that may provide some suitable habitat for this species. However, the dam is not of a size that is likely to support any population of this species. Site is not the preferred grassland habitat. Site is highly disturbed and fragmented.	Low.
Gallinago hardwickii	Latham's Snip, Japanese Snipe	-	Migratory Wetland	Latham's Snipe is a non-breeding visitor to south-eastern Australia. This species occurs in permanent and ephemeral wetlands up to 2000m above sea-level. They usually inhabit open, freshwater wetlands with low, dense vegetation.	May occur within the area	Low. Site does not provide suitable conditions for the presence of this species. Site is highly disturbed and fragmented.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Rostratula benghalensis	Painted Snipe	-	E Migratory Wetland	Generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. They also use inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains.	Likely to occur within the area	Low. Site does not provide suitable conditions for the presence of this species. Site is highly disturbed and fragmented.	Low.
Haliaeetus leucogaster	White-bellied Sea-Eagle	-	Migratory Terrestrial	Distributed along the coastline of Australia, also extending inland along some larger waterways. Habitat includes large areas of open water. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, forest. Breeding territories are close to water, mainly in tall open forest or woodland, although nests are sometimes located in other habitats such as dense forest, closed scrub or in remnant trees on cleared land.	Known to occur in the area	Low-moderate. Site may provide some suitable habitat for the presence of this species. The site may form part of a larger home foraging range, however is unlikely to form a critical component of habitat for this species. Site is highly disturbed and fragmented.	Low.
Hirundapus caudacutus	White-throated Needletail	-	Migratory Terrestrial	Recorded in all coastal regions of Qld and NSW. In Australia, this species is almost exclusively aerial, almost always foraging aerially. Although it has been recorded roosting in trees in forests and woodlands, both among dense foliage in the canopy or in hollows. Probably recorded most often above wooded areas, including open forest and rainforest.	Known to occur in the area	Low-moderate. Site may provide some suitable habitat for the presence of this species. The site may form part of a larger home foraging range, however is unlikely to form a critical component of habitat for this species. Site is highly disturbed and fragmented.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Merops ornatus	Rainbow Bee-eater	-	Migratory Terrestrial	The Rainbow Bee-eater is distributed across much of mainland Australia occurring mainly in open forests (usually dominated by eucalypts) and woodlands, shrublands, and in various cleared or semi-cleared habitats.	May occur within the area	Low-moderate. Site may provide some suitable habitat for the presence of this species. The site may form part of a larger home foraging range, however is unlikely to form a critical component of habitat for this species. Site is highly disturbed and fragmented.	Low.
Monarcha melanopsis	Black-faced Monarch	-	Migratory Terrestrial	The Black-faced Monarch is widespread in eastern Australia. Mainly occurs in rainforest ecosystems although it can be found in gullies in mountain areas or coastal foothills, softwood scrub dominated by Brigalow (Acacia harpophylla), coastal scrub dominated by Coast Banksia (Banksia integrifolia) and Southern Mahogany.	Known to occur in the area	Low. Site does not provide suitable conditions for the presence of this species. Site is highly disturbed and fragmented.	Low.
Monarcha trivirgatus	Spectacled Monarch	-	Migratory Terrestrial	Occurs in dense rainforests and moist eucalypt forests of eastern and north-eastern Australia, the Spectacled Monarch sometimes also inhabits mangroves and other densely vegetated habitats.	Known to occur in the area	Low. Site does not provide suitable conditions for the presence of this species. Site is highly disturbed open woodland.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Myiagra cyanoleuca	Satin Flycatcher	-	Migratory Terrestrial	The Satin Flycatcher is widespread in eastern Australia. Satin Flycatchers inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests.	Known to occur in the area	Low. Site does not provide suitable conditions for the presence of this species. Site is highly disturbed open woodland.	Low.
Rhipidura rufifrons	Rufous Fantail	-	Migratory Terrestrial	The Rufous Fantail occurs in coastal and near coastal districts of northern and eastern Australia. In east and south-east Australia, this species mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts such as Tallow-wood, Mountain Grey Gum, Narrow-leaved Peppermint, Mountain Ash, Alpine Ash, Blackbutt or Red Mahogany; usually with a dense shrubby understorey often including ferns. They also occur in subtropical and temperate rainforests; for example near Bega in south-east NSW, where they are recorded in temperate Lilly Pilly rainforest, with Grey Myrtle, Sassafras and Sweet Pittosporum subdominants.	Known to occur in the area	Low. Site does not provide suitable conditions for the presence of this species. Site is highly disturbed open woodland with no shrub understorey.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Mammals							
Dasyurus maculatus	Spotted-tailed Quoll	V,P	E	A variety of vegetation such as rainforest, open forest, woodland, coastal heath, inland riparian forest. Have home ranges 750 - 3500 ha. Den sites may be located in hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky cliffs.	7	Low-Moderate. Due to the highly disturbed and fragmented nature of the site, it is unlikely that this species would use the site as part of a larger home range. No evidence of den or latrine sites were found within the subject site. Hollow bearing trees were present but not suitable for this species	Low.
Isoodon obesulus obesulus	Southern Brown Bandicoot (eastern)	E1,P	E	Species is largely crepuscular (active mainly after dusk and/or before dawn). They are generally only found in heath or open forest with a heathy understorey on sandy or friable soils.	K	Low-Moderate. Due to the highly disturbed and fragmented nature of the site, it is unlikely that this species would use the site as part of a larger home range. No shrub understorey is present. No evidence of this species was observed within the subject site.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Phascolarctos cinereus	Koala	V,P	V	Found in eucalypt woodlands and forest foraging on preferred food trees.	985	Moderate. Records of koalas within close proximity to the subject site, koala may potentially be present as part of a larger home range. The fragmentation of the site, adjoining rail lines, river & roadways indicate an unlikely use of this site by this species. There was no evidence of this species observed during the field surveys.	Low. The potential for impact on this species is further assessed in Appendix 7
Cercartetus nanus	Eastern Pygmy-possum	V,P	-	Variety of habitats from rainforest to dry sclerophyll forest and woodland to heath. In most areas they prefer woodlands and heath. Feeds on nectar and pollen from banksias, eucalypts and Callistemon sp., with insects also taken.	7	Low. The exposed, isolated and disturbed nature of the site means that it is unlikely that this species occurs on the site. There was no evidence of this species observed during the field surveys.	Low.
Petaurus australis	Yellow-bellied Glider	V,P	-	Tall mature eucalypt forest, generally in areas with high rainfall and nutrient rich soils. Feed primarily on nectar, sap, honeydew and manna with pollen and insects also taken. Often leave a distinctive V-shaped feeding scar on tree trunks. Den in tree hollows of large trees.	3	Low. Site is generally not suitable habitat for the presence of this species. Site is a highly disturbed fragmented open woodland. No evidence of feeding scars were recorded.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Petaurus norfolcensis	Squirrel Glider	V,P	-	Inhabits mature or old growth box, box-ironbark woodlands and river red gum forest west of the Great Dividing Range. Prefers mixed species stands with a shrub or Acacia midstorey. Uses tree hollows as den sites.	4	Low. Site is generally not suitable habitat for the presence of this species. Site is a highly disturbed fragmented open woodland with no shrub understorey.	Low.
Petrogale penicillata	Brush-tailed Rock-wallaby	E1, P	V	Rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges often facing north.	1	Low. Site is not suitable habitat for the presence of this species.	Low.
Pteropus poliocephalus	**Grey-headed Flying-fox**	**V, P**	**V**	**This species is generally found within 200 km of Australia's eastern coast. Generally occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are commonly found in gullies, close to water, in vegetation with a dense canopy.**	**77**	**High (recorded on-site). Site provides some foraging potential as part of a much larger home range. The site does not contain any known or identifiable permanent roosting sites (camps).**	**Moderate. The potential for impact on this species is further assessed in Appendix 7**

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V,P	-	Wide-ranging species found across northern and eastern Australia. Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows	5	Moderate. Highly mobile species that may forage within the subject site at some stage. Site may provide suitable habitat in the form of tree hollows. There was no evidence of this species observed during the field surveys.	Moderate. The potential for impact on this species is further assessed through a seven part test in Appendix 7
Mormopterus norfolkensis	East-coast Freetail-bat	V, P	-	The Eastern Freetail-bat is found along the east coast from south QLD to southern NSW. Occurs in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark.	37	Moderate. Highly mobile species that may forage within the subject site at some stage. Site may provide suitable habitat in the form of tree hollows. There was no evidence of this species observed during the field surveys.	Moderate. The potential for impact on this species is further assessed through a seven part test in Appendix 7

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Chalinolobus dwyeri	Large-eared Pied Bat, Large Pied Bat	V, P	V	Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin, frequenting low to mid-elevation dry open forest and woodland close to these features. Also found in well-timbered areas containing gullies.	8	Low. Site may provide some foraging potential as part of a much larger home range. The site does not contain any caves for roost sites.	Low.
Falsistrellus tasmaniensis	Eastern False Pipistrelle Eastern falsistrelle	V,P	-	Found on the south-east coast and ranges of Australia, from southern Queensland to Victoria and Tasmania. Prefers moist habitats, with trees taller than 20 m. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings.	10	Moderate. Highly mobile species that may forage within the subject site at some stage. Site may provide suitable habitat in the form of tree hollows. There was no evidence of this species observed during the field surveys.	Moderate. The potential for impact on this species is further assessed through a seven part test in Appendix 7
Kerivoula papuensis	Golden-tipped Bat	V, P	-	Found in rainforest and adjacent wet and dry sclerophyll forest up to 1000m. Also recorded in tall open forest, Casuarina-dominated riparian forest and coastal Melaleuca forests. Roost mainly in abandoned hanging Yellow-throated Scrubwren and Brown Gerygone nests, also in tree hollows, dense foliage and epiphytes; located in rainforest gullies on small first- and second-order streams.	K	Low. Site is not suitable habitat for the presence of this species. Site is open degraded woodland.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Miniopterus australis	Little Bentwing-bat	V,P	-	Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas.Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.	K	High (recorded on-site). Highly mobile species that has been recorded foraging within the subject site. Site may provide suitable habitat in the form of tree hollows.	Moderate. The potential for impact on this species is further assessed through a seven part test in Appendix 7
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V,P	-	Forages in a range of habitat types. Roosts in caves, derelict mines, culverts and other man-made structures. Form maternity colonies that are faithful to particular caves.	39	High (recorded on-site). Highly mobile species that has been recorded foraging within the subject site. Site may provide suitable habitat in the form of tree hollows.	Moderate. The potential for impact on this species is further assessed through a seven part test in Appendix 7

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Myotis macropus	Southern Myotis, Large footed Myotis	V,P	-	Forages over streams and pools catching insects and small fish by raking their feet across the water surface. Roost close to water in caves, mine shafts, tree hollows and man-made structures.	311	Moderate. Highly mobile species that may forage within the subject site at some stage. Site may provide suitable habitat in the form of tree hollows. There was no evidence of this species observed during the field surveys.	Moderate. The potential for impact on this species is further assessed through a seven part test in Appendix 7
Scoteanax rueppellii	Greater Broad-nosed Bat	V, P	-	Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. This species usually roosts in tree hollows.	29	Moderate. Highly mobile species that may forage within the subject site at some stage. Site may provide suitable habitat in the form of tree hollows. There was no evidence of this species observed during the field surveys.	Moderate. The potential for impact on this species is further assessed through a seven part test in Appendix 7
Potorous tridactylus	Long-nosed Potoroo (SE mainland)	V, P	V	Inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature.	May occur within the area	Low. Site does not provide the required habitat features for the presence of this species. Site is heavily degraded cleared open woodland with no shrub understorey present.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Pseudomys novaehollandiae	New Holland Mouse, Pookila	P	V	The New Holland Mouse has a fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Known to inhabit open heathlands, woodlands and forests with a heathland understorey and vegetated sand dunes.	K	Low. Site does not provide the required habitat features for the presence of this species. Site is heavily degraded cleared open woodland with no shrub understorey present.	Low.
Menippus darcyi	Menippus darcyi population in the Sutherland Shire	E2	-	Confined to Grays Point Reserves, Grays Point, and Sutherland Shire. This species has been recorded from only three locations in Australia: Lord Howe Island, coastal North Queensland and Grays Point Reserve. Little is known of ecology. Larvae graze on Celtis paniculata, which grow in littoral rainforest.	K	Low. Site does not provide the required conditions for the presence of this species.	Low.
Meridolum corneovirens	Cumberland Plain Land Snail	E1	-	Primarily inhabits Cumberland Plain Woodland. This community is a grassy, open woodland with occasional dense patches of shrubs. It is also known from Shale Gravel Transition Forests, Castlereagh Swamp Woodlands and the margins of River-flat Eucalypt Forest, which are also listed communities.Lives under litter of bark, leaves and logs, or shelters in loose soil around grass clumps. Occasionally shelters under rubbish.	273	Moderate. Site is highly disturbed and fragmented, however, may provide suitable conditions for the presence of this species. There was no evidence of this species observed during the field surveys.	Low. The potential for impact on this species is further assessed through a seven part test in Appendix 7

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Plants							
Caesia parviflora var. minor	Small Pale Grass-lily	E1,P	-	Found in damp places in open forest on sandstone.	K	Low. Site is not suitable for the presence of this species. Site is highly disturbed and modified. This species was not identified at the site.	Low.
Cynanchum elegans	White-flowered Wax Plant	E1,P	E	Occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; Coastal Tea-tree *Leptospermum laevigatum* – Coastal Banksia *integrifolia* subsp. *integrifolia* coastal scrub; Forest Red Gum *Eucalyptus tereticornis* aligned open forest and woodland; Spotted Gum *Corymbia maculata* aligned open forest and woodland; and Bracelet Honeymyrtle *Melaleuca armillaris* scrub to open scrub. Flowering occurs between August and May, with a peak in November. Flower abundance on individual plants varies from sparse to prolific.	1	Low. Site is not suitable for the presence of this species. Site is highly disturbed and modified. This species was not identified at the site.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
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	E2	-	Grows in vine thickets and open shale woodland.	6	Low. Site is not suitable for the presence of this species. Site is highly disturbed and modified. This species was not identified at the site.	Low.
Astrotricha crassifolia	Thick-leaf Star-hair	V,P	V	Occurs in dry sclerophyll woodland on sandstone.	1	Low-moderate. Site may provide suitable conditions for the presence of this species. However, site is highly disturbed. This species was not identified on site.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Wahlenbergia multicaulis	Tadgell's Bluebell in the local government areas of Auburn, Bankstown, Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield	E2	-	Found in disturbed sites and grows in a variety of habitats including forest, woodland, scrub, grassland and the edges of watercourses and wetlands. Typically occurs in damp, disturbed sites (with natural or human disturbance of various forms), typically amongst other herbs rather than in the open. Usually flowers throughout the year, although a late spring/early summer peak has been observed at some locations Creek.	K	Low-moderate. Site may provide suitable conditions for the presence of this endangered population, however Campbelltown LGA is not included in the listing. Site is generally a dry environment. This species was not identified on site during surveys.	Low.
Allocasuarina glareicola	-	E1,P	E	Found in open woodland with Eucalyptus parramattensis, Eucalyptus fibrosa, Angophora bakeri, Eucalyptus sclerophylla and Melaleuca decora. Common associated understorey species include Melaleuca nodosa, Hakea dactyloides, Hakea sericea, Dillwynia tenuifolia, Micromyrtus minutiflora, Acacia elongata, Acacia brownei, Themeda australis and Xanthorrhoea minor.	1	Low. This tree species was not identified on site. Associated species are generally absent from the site.	Low.
Wilsonia backhousei	Narrow-leafed Wilsonia	V,P	-	Found on the coast between Mimosa Rocks National Park and Wamberal north of Sydney This is a species of the margins of salt marshes and lakes.	K	Low. Site is not suitable for the presence of this species. Site is highly disturbed and modified. This species was not identified at the site.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Wilsonia rotundifolia	Round-leafed Wilsonia	E1,P	-	Known from several sites in the Jervis Bay area, Royal National Park, near Deniliquin and on the lakebeds of Lake George and Lake Bathurst when these are exposed during droughts. Grows in mud in coastal saltmarsh and inland saline or brackish lake beds.	K	Low. Site is not suitable for the presence of this species. Site is highly disturbed and modified. This species was not identified at the site.	Low.
Callitris endlicheri	Black Cypress Pine,Woronora Plateau population	E2	-	The population of Callitris endlicheri on Woronora Plateau, in the local government area of Wollongong, represents the coastal limit of the species' range and is disjunct from other known populations of the species. Throughout its range, the species is usually found on stony hills or ridges, common, from the plains to the coastal ranges.	K	Low. Site is not suitable for the presence of this species. This species was not identified at the site.	Low.
Hibbertia puberula	-	E1,P	-	Occurs on sandy soil often associated with sandstone, or on clay. Habitats are typically dry sclerophyll woodland communities, although heaths are also occupied.	K	Low-moderate. Site may provide suitable conditions for the presence of this species. Site is highly disturbed with a degraded groundcover assemblage. This species was not identified on site.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Hibbertia sp. Bankstown		E4A,P	CE	This species is endemic to New South Wales and is currently known to occur in only one population at Bankstown Airport in Sydney's southern suburbs, in the Bankstown local government area. The airport site is very heavily modified from the natural state, lacks canopy species and is currently a low grass/shrub association with many pasture grasses and other introduced herbaceous weeds.	K	Low-moderate. The site may provide suitable conditions for the presence of this species. This species was not identified on site.	Low.
Hibbertia stricta subsp. furcatula		E1,P	-	Known to occur in two populations, one in the southern outskirts of Sydney, and one near Nowra on the mid-South Coast of NSW. Habitat of the South Coast population is poorly recorded, but appears to be dry sclerophyll forest or woodland associations in sandy soils over sandstone.	K	Low-moderate. The site may provide suitable conditions for the presence of this species. This species was not identified on site.	Low.
Hibbertia superans		E1,P	-	Occurs on sandstone ridgetops often near the shale/sandstone boundary in both open woodland and heathland, and appears to prefer open disturbed areas, such as tracksides.	K	Low-moderate. The site may provide suitable conditions for the presence of this species. This species was not identified on site.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Tetratheca glandulosa		V,P	-	Associated with shale-sandstone transition habitats. Vegetation structure varies from heaths and scrub to woodlands/open woodlands, and open forest. Vegetation communities. Common woodland tree species include: Corymbia gummifera, C. eximia, Eucalyptus haemastoma, E. punctata, E. racemosa, and/or E. sparsifolia, with an understorey dominated by species from the families Proteaceae, Fabaceae, and Epacridaceae.	K	Low. Associated shrub / groundcover species are absent from the site. This species was not identified on site.	Low.
Epacris purpurascens var. purpurascens		V,P	-	Found in a range of habitat types, most of which have a strong shale soil influence.	K	Low-moderate. The site may provide suitable conditions for the presence of this species. The site is highly disturbed and vegetation greatly altered. This species was not identified on site	Low.
Leucopogon exolasius	Woronora Beard-heath	V,P	V	Woronora Beard-heath is found along the upper Georges River area and in Heathcote National Park. The plant occurs in woodland on sandstone.	16	Low-moderate. The site may provide suitable conditions for the presence of this species. The site is highly disturbed and vegetation greatly altered. This species was not identified on site	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Leucopogon fletcheri subsp. fletcheri		E1,P	-	Occurs in dry eucalypt woodland or in shrubland on clayey lateritic soils, generally on flat to gently sloping terrain along ridges and spurs.	1	Low-moderate. The site may provide suitable conditions for the presence of this species. The site is highly disturbed and vegetation greatly altered. This species was not identified on site	Low.
Chamaesyce psammogeton	Sand Spurge	E1,P		Grows on fore-dunes, pebbly strandlines and exposed headlands, often with Spinifex (Spinifex sericeus) and Prickly Couch (Zoysia macrantha).	P	Low. Site does not provide suitable conditions for the presence of this species.	Low.
Dillwynia tenuifolia	Dillwynia tenuifolia, Kemps Creek	E2,V,P	-	The endangered population occurs in the area bounded by Western Road, Elizabeth Drive, Devonshire Road and Cross Street, Kemps Creek in the Liverpool Local Government Area. The population occurs on a small outlier of the Berkshire Park Soil Landscape. The site supports a transition from Castlereagh Ironbark Forest to Castlereagh Scribbly Gum Woodland. Portions of the site contain a form of Shale Gravel Transition Forest	18	Low-moderate. The site may provide suitable conditions for the presence of this species. The site is highly disturbed and vegetation greatly altered. This species was not identified on site	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Dillwynia tenuifolia		V,P	-	May be locally abundant particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays. May also be common in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland.	25	Low-moderate. The site may provide suitable conditions for the presence of this species. The site is highly disturbed and vegetation greatly altered. This species was not identified on site	Low.
Pultenaea aristata	Prickly Bush-pea	V,P	V	The species occurs in either dry sclerophyll woodland or wet heath on sandstone.	40	Low-moderate. The site may provide suitable conditions for the presence of this species. The site is highly disturbed and vegetation greatly altered. This species was not identified on site	Low.
Pultenaea parviflora		E1,P	V	May be locally abundant, particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays.	85	Low-moderate. The site may provide suitable conditions for the presence of this species. The site is highly disturbed and vegetation greatly altered. This species was not identified on site	Low.
Pultenaea pedunculata	Matted Bush-pea	E1,P	-	The Matted Bush-pea 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.	9	Low-moderate. The site may provide suitable conditions for the presence of this species. The site is highly disturbed and vegetation greatly altered. This species was not identified on site	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Acacia baueri subsp. aspera		V,P		Occurs in low, damp heathlands, often on exposed rocky outcrops over a wide range of climatic and topographical conditions.	K	Low. Site does not provide suitable habitat conditions for the presence of this species.	Low.
Acacia bynoeana	Bynoe's Wattle	E1,P	V	Occurs in heath or dry sclerophyll forest on sandy soils. Prefer opens, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Associated overstorey species include Red Bloodwood, Scribbly Gum, Parramatta Red Gum, Saw Banksia and Narrow-leaved Apple.	K	Low-moderate. The site may provide suitable conditions for the presence of this species. This species was not identified on site. Associated overstorey species assemblage is not consistent with the canopy species present on the GWS Site.	Low.
Acacia gordonii		E1,P	E	Grows in dry sclerophyll forest and heathlands amongst or within rock platforms on sandstone outcrops.	K	Low. Site does not provide suitable habitat conditions for the presence of this species.	Low.
Acacia pubescens	Downy Wattle	V,P	V	Occurs on alluviums, shales and at the intergrade between shales and sandstones. Occurs in open woodland and forest, in a variety of plant communities, including Cooks River / Castlereagh Ironbark Forest, Shale/Gravel Transition Forest and Cumberland Plain Woodland.	56	Low-moderate. The site may provide suitable conditions for the presence of this species. The site is highly disturbed and vegetation greatly altered. This species was not identified on site	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Grammitis stenophylla	Narrow-leaf Finger Fern	E1,P,3	-	Moist places, usually near streams, on rocks or in trees, in rainforest and moist eucalypt forest.	K	Low. Site does not provide suitable habitat conditions for the presence of this species.	Low.
Gyrostemon thesioides		E1,P,3	-	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.	31	Low. Site does not provide suitable habitat conditions for the presence of this species.	Low.
Haloragis exalata subsp. exalata	Square Raspwort	V,P	V	Square Raspwort occurs in 4 widely scattered localities in eastern NSW, distributed in the Central Coast, South Coast and North Western Slopes botanical subdivisions of NSW. It appears to require protected and shaded damp situations in riparian habitats.	K	Low. Site does not provide suitable habitat conditions for the presence of this species.	Low.
Haloragodendron lucasii		E1,P	E	The known locations of this species are confined to a very narrow distribution on the north shore of Sydney. Associated with dry sclerophyll forest. Reported to grow in moist sandy loam soils in sheltered aspects, and on gentle slopes below cliff-lines near creeks in low open woodland.	K	Low. Site does not provide suitable habitat conditions for the presence of this species.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Camarophyllopsis kearneyi		E1,P	-	Its occurrence appears to be limited to the Lane Cove Bushland Park. Surveys in potentially suitable habitats elsewhere in the Sydney Basin Bioregion have failed to find Camarophyllopsis kearneyi.	K	Low-moderate. The site may provide suitable conditions for the presence of this species though there is limited detail as to its specific requirements. The site is highly disturbed and vegetation greatly altered. This species was not identified on site	Low.
Hygrocybe anomala var. ianthinomarginata		V,P	-	Occurs in gallery warm temperate forests dominated by Lilly Pilly (Acmena smithii), Grey Myrtle (Backhousia myrtifolia), Cheese Tree (Glochidion ferdinandi) and Sweet Pittosporum (Pittosporum undulatum).	K	Low. Site does not provide suitable habitat conditions for the presence of this species.	Low.
Hygrocybe aurantipes		V,P	-	Occurs in gallery warm temperate forests dominated by Lilly Pilly (Acmena smithii), Grey Myrtle (Backhousia myrtifolia), Cheese Tree (Glochidion ferdinandi) and Sweet Pittosporum (Pittosporum undulatum).	K	Low. Site does not provide suitable habitat conditions for the presence of this species.	Low.
Hygrocybe austropratensis		E1,P	-	Occurs in gallery warm temperate forests dominated by Lilly Pilly (Acmena smithii), Grey Myrtle (Backhousia myrtifolia), Cheese Tree (Glochidion ferdinandi) and Sweet Pittosporum (Pittosporum undulatum).	K	Low. Site does not provide suitable habitat conditions for the presence of this species.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Hygrocybe collucera		E1,P	-	Occurs in gallery warm temperate forests dominated by Lilly Pilly (Acmena smithii), Grey Myrtle (Backhousia myrtifolia), Cheese Tree (Glochidion ferdinandi) and Sweet Pittosporum (Pittosporum undulatum).	K	Low. Site does not provide suitable habitat conditions for the presence of this species.	Low.
Hygrocybe griseoramosa		E1,P	-	Occurs in gallery warm temperate forests dominated by Lilly Pilly (Acmena smithii), Grey Myrtle (Backhousia myrtifolia), Cheese Tree (Glochidion ferdinandi) and Sweet Pittosporum (Pittosporum undulatum).	K	Low. Site does not provide suitable habitat conditions for the presence of this species.	Low.
Hygrocybe lanecovensis		E1,P	-	Occurs in gallery warm temperate forests dominated by Lilly Pilly (Acmena smithii), Grey Myrtle (Backhousia myrtifolia), Cheese Tree (Glochidion ferdinandi) and Sweet Pittosporum (Pittosporum undulatum).	K	Low. Site does not provide suitable habitat conditions for the presence of this species.	Low.
Hygrocybe reesiae		V,P	-	Occurs in gallery warm temperate forests dominated by Lilly Pilly (Acmena smithii), Grey Myrtle (Backhousia myrtifolia), Cheese Tree (Glochidion ferdinandi) and Sweet Pittosporum (Pittosporum undulatum).	K	Low. Site does not provide suitable habitat conditions for the presence of this species.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Hygrocybe rubronivea		V,P	-	Occurs in gallery warm temperate forests dominated by Lilly Pilly (Acmena smithii), Grey Myrtle (Backhousia myrtifolia), Cheese Tree (Glochidion ferdinandi) and Sweet Pittosporum (Pittosporum undulatum).	K	Low. Site does not provide suitable habitat conditions for the presence of this species.	Low.
Maundia triglochinoides		V,P	-	Grows in swamps, lagoons, dams, channels, creeks or shallow freshwater 30 - 60 cm deep on heavy clay, low nutrients.	K	Low. Site does not provide suitable habitat conditions for the presence of this species.	Low.
Prostanthera densa	Villous Mint-bush	V,P	V	Villous Mintbush is generally grows in sclerophyll forest and shrubland on coastal headlands and near coastal ranges, chiefly on sandstone, and rocky slopes near the sea.	K	Low. Site does not provide suitable habitat conditions for the presence of this species.	Low.
Hypsela sessiliflora		E1,P,3	X	Known to grow in damp places, on the Cumberland Plain, including freshwater wetland, grassland/alluvial woodland and an alluvial woodland/shale plains woodland (Cumberland Plain Woodland) ecotone	K	Low-moderate. The site may provide suitable conditions for the presence of this species; however site is very dry with the exception of the small artificial dam. The site is highly disturbed and vegetation greatly altered. This species was not identified on site	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Pilularia novae-hollandiae	Austral Pillwort	E1,P,3	-	Grows in shallow swamps and waterways, often among grasses and sedges. It is most often recorded in drying mud as this is when it is most conspicuous.	K	Low. Site does not provide suitable habitat conditions for the presence of this species.	Low.
Callistemon linearifolius	Netted Bottle Brush	V,P,3	-	Grows in dry sclerophyll forest on the coast and adjacent ranges.	5	Low-moderate. The site may provide suitable conditions for the presence of this species though the site is highly disturbed and vegetation greatly altered. This species was not identified on site	Low.
Darwinia biflora		V,P	V	Occurs on the edges of weathered shale-capped ridges, where these intergrade with Hawkesbury Sandstone. Associated overstorey species include Eucalyptus haemastoma, Corymbia gummifera and/or E. squamosa. The vegetation structure is usually woodland, open forest or scrub-heath.	K	Low-moderate. The site may provide suitable conditions for the presence of this species. The site is highly disturbed and vegetation greatly altered. This species was not identified on site.	Low.
Darwinia peduncularis		V,P		Usually grows on or near rocky outcrops on sandy, well drained, low nutrient soil over sandstone.	K	Low-moderate. The site may provide suitable conditions for the presence of this species though the site is highly disturbed and vegetation greatly altered. This species was not identified on site	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Eucalyptus benthamii	Camden White Gum	V,P	V	Requires a combination of deep alluvial sands and a flooding regime that permits seedling establishment. Recruitment of juveniles appears to be most successful on bare silt deposits in rivers and streams.	5	Low. Site does not provide suitable habitat conditions for the presence of this species. Excepting the Georges River location, a natural riverine environment and associated flooding regime required by this species does not occur. This species was not identified on site.	Low.
Eucalyptus camfieldii	Camfield's Stringybark	V,P	V	Poor coastal country in shallow sandy soils overlying Hawkesbury sandstone. Coastal heath mostly on exposed sandy ridges.	K	Low. Site does not provide suitable habitat conditions for the presence of this species. This species was not identified on site.	Low.
Eucalyptus nicholii	Narrow-leaved Black Peppermint	V,P	V	Typically grows in dry grassy woodland, on shallow soils of slopes and ridges. Found primarily on infertile soils derived from granite or metasedimentary rock.	1	Low. Site does not provide suitable habitat conditions for the presence of this species. This species was not identified on site.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Eucalyptus scoparia	Wallangarra White Gum	E1,P	V	In NSW it is known from only three locations near Tenterfield, including Bald Rock National Park. In Queensland it is equally rare, occurring at three sites of which only one has more than a dozen trees. Found in open eucalypt forest and woodland on well-drained granite hilltops, slopes and rocky outcrops, typically at high altitudes.	1	Low. Site does not provide suitable habitat conditions for the presence of this species. This species was not identified on site.	Low.
Eucalyptus sp. Cattai		E1,P	-	Occurs as a rare emergent tree in scrub, heath and low woodland on sandy soils, usually as isolated individuals or occasionally in small clustered groups. The sites at which it occurs are generally flat and on ridge tops.	P	Low. Site does not provide suitable habitat conditions for the presence of this species. This species was not identified on site.	Low.
Melaleuca biconvexa	Biconvex Paperbark	V, P	V	Biconvex Paperbark generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects.	K	Low. Site does not provide suitable habitat conditions for the presence of this species. This species was not identified on site.	Low.
Melaleuca deanei	Deane's Paperbark	V, P	V	Occurs in two distinct areas, in the Ku-ring-gai/Berowra and Holsworthy/Wedderburn areas respectively. There are also more isolated occurrences at Springwood (in the Blue Mountains), Wollemi National Park, Yalwal (west of Nowra) and Central Coast (Hawkesbury River) areas. The species grows in heath on sandstone.	26	Low. Site does not provide suitable habitat conditions for the presence of this species. This species was not identified on site.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Pelargonium sp. Striatellum	Omeo Stork's-bill	E	E	It has a narrow habitat that is usually just above the high-water level of irregularly inundated or ephemeral lakes, in the transition zone between surrounding grasslands or pasture and the wetland or aquatic communities.	May occur within area	Low. Site does not provide suitable habitat conditions for the presence of this species. This species was not identified on site.	Low.
Micromyrtus minutiflora		E1,P	V	Grows in Castlereagh Scribbly Gum Woodland, Ironbark Forest, Shale/Gravel Transition Forest, open forest on tertiary alluvium and consolidated river sediments.	K	Low-moderate. The site may provide suitable conditions for the presence of this species though the site is highly disturbed and vegetation greatly altered. This species was not identified on site	Low.
Syzygium paniculatum	Magenta Lilly Pilly	E1, P	V	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.	K	Low. Site does not provide suitable habitat conditions for the presence of this species. This species was not identified on site.	Low.
Caladenia tessellata	Thick Lip Spider Orchid	E1,P,2	V	Generally found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil.	K	Low-moderate. The site may provide suitable conditions for the presence of this species. The site is highly disturbed and vegetation greatly altered. This species was not identified on site	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Diuris aequalis	Buttercup Doubletail	E1,P,2	V	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).	1	Low. Site does not provide suitable habitat conditions for the presence of this species. The site is highly degraded open woodland with little shrub/native grass cover. This species was not identified on site.	Low.
Genoplesium baueri	Bauer's Midge Orchid	E1,P,2	-	The species has been recorded at locations now likely to be within the following conservation reserves: Berowra Valley Regional Park, Royal National Park and Lane Cove National Park. May occur in the Woronora, O'Hares, Metropolitan and Warragamba Catchments. Grows in dry sclerophyll forest and moss gardens over sandstone.	1	Low-moderate. The site may provide suitable conditions for the presence of this species though the site is highly disturbed and vegetation greatly altered. This species was not identified on site	Low.
Pterostylis nigricans	Dark Greenhood	V,P,2	-	Coastal heathland with Heath Banksia (Banksia ericifolia), and lower-growing heath with lichen-encrusted and relatively undisturbed soil surfaces, on sandy soils.	1	Low. Site does not provide suitable habitat conditions for the presence of this species. This species was not identified on site.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Pterostylis saxicola	Sydney Plains Greenhood	E1,P,2	E	Most commonly found growing in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines. The vegetation communities above the shelves where Pterostylis saxicola occurs are sclerophyll forest or woodland on shale/sandstone transition soils or shale soils.	7	Low. Site does not provide suitable habitat conditions for the presence of this species. This species was not identified on site.	Low.
Deyeuxia appressa		E1,P	E	A highly restricted NSW endemic known only from two pre-1942 records in the Sydney area. Was first collected in 1930 at Herne Bay, Saltpan Creek, off the Georges River, south of Bankstown. Was then collected in 1941 from Killara, near Hornsby. Given that D. appressa hasn't been seen in over 60 years, almost nothing is known of the species' habitat and ecology.	P	Low. As the conditions for the presence of this species are highly unknown it is difficult to assess whether the site is suitable habitat This species was not identified on site.	Low.
Persicaria elatior	Tall Knotweed	V,P	V	This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.	K	Low. Site does not provide suitable habitat conditions for the presence of this species. This species was not identified on site.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Grevillea juniperina subsp. juniperina	Juniper-leaved Grevillea	V,P	-	Recorded from Cumberland Plain Woodland, Castlereagh Ironbark Woodland, Castlereagh Scribbly Gum Woodland and Shale/Gravel Transition Forest. Associated canopy species within Cumberland Plain Woodland and Shale/Gravel Transition Forest includeEucalyptus tereticornis, E. moluccana, E. crebra, E. fibrosa and E. eugenioides. Understorey species include Bursaria spinosa, Dillwynia sieberi, Ozothamnus diosmifolius, Daviesia ulicifolia, Acacia falcata, Acacia parramattensis, Themeda australis, Aristida ramosa, Cymbopogon refractus, Eragrostis brownii, Cheilanthes sieberi, Dianella revoluta and Goodenia hederacea.	1	Low-moderate. The site may provide suitable conditions for the presence of this species. The site is highly disturbed and vegetation greatly altered. This species was not identified on site	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	V,P	V	Occurs in a range of vegetation types from heath and shrubby woodland to open forest. In Sydney it has been recorded from Shale Sandstone Transition Forest and in the Hunter in Kurri Sand Swamp Woodland. However, other communities occupied include Corymbia maculata - Angophora costata open forest in the Dooralong area, in Sydney Sandstone Ridgetop Woodland at Wedderburn and in Cooks River / Castlereagh Ironbark Forest at Kemps Creek.	30	Low-moderate. The site may provide suitable conditions for the presence of this species though the site is highly disturbed and vegetation greatly altered. This species was not identified on site.	Low.
Hibbertia puberula subsp. glabrescens		CE	CE	Known only from Tertiary alluvial soil along Airport Creek on Bankstown Airport. The plant assemblage is attributable to Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion.	Likely to occur within area	Low-moderate. The site may provide suitable conditions for the presence of this species though the site is highly disturbed and vegetation greatly altered. This species was not identified on site	Low.
Grevillea parviflora subsp. supplicans		E1,P	-	Occurs in heathy woodland associations on skeletal sandy soils over massive sandstones. Has a very restricted known distribution (approximately 8 by 10 km) and is confined to the north-west of Sydney near Arcadia and the Maroota–Marramarra Creek area, in Hornsby and Baulkham Hills local government areas	K	Low. Site does not provide suitable habitat conditions for the presence of this species. This species was not identified on site.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Persoonia bargoensis	Bargo Geebung	E1,P	V	Occurs in woodland or dry sclerophyll forest on sandstone and on heavier, well drained, loamy, gravelly soils of the Wianamatta Shale and .Hawkesbury Sandstone. Restricted to a small area south-west of Sydney on the western edge of the Woronora Plateau and the northern edge of the Southern Highlands.	K	Low-moderate. The site may provide suitable conditions for the presence of this species though the site is highly disturbed and vegetation greatly altered. This species was not identified on site	Low.
Persoonia glaucescens	Mittagong Geebung	E1,P	V	Grows in woodland to dry sclerophyll forest on clayey and gravely laterite. The preferred topography is ridge-tops, plateaux and upper slopes.	K	Low. Site does not provide suitable habitat conditions for the presence of this species. This species was not identified on site.	Low.
Persoonia hirsuta	Hairy Geebung	E1,P,3	E	Found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone.	8	Low-moderate. The site may provide suitable conditions for the presence of this species. The site is highly disturbed and vegetation greatly altered. This species was not identified on site	Low.
Persoonia mollis subsp. maxima		E1,P	E	Occurs in sheltered aspects of deep gullies or on the steep upper hillsides of narrow gullies on Hawkesbury Sandstone. These habitats support relatively moist, tall forest vegetation communities, often with warm temperate rainforest influences.	K	Low. Site does not provide suitable habitat conditions for the presence of this species. This species was not identified on site.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Persoonia nutans	Nodding Geebung	E1,P	E	Northern populations are confined to aeolian and alluvial sediments and occur in a range of sclerophyll forest and woodland vegetation communities, with the majority of individuals occurring within Agnes Banks Woodland or Castlereagh Scribbly Gum Woodland and some in Cooks River / Castlereagh Ironbark Forests. Southern populations also occupy tertiary alluvium, but extend onto shale sandstone transition communities and into Cooks River / Castlereagh Ironbark Forest.	27	Low. Site does not provide suitable habitat conditions for the presence of this species. This species was not identified on site.	Low.
Pomaderris brunnea	Brown Pomaderris	V,P	V	Grows in moist woodland or forest on clay and alluvial soils of flood plains and creek lines. Flowers appear in September and October. Has been found in association with Eucalyptus amplifolia, Angophora floribunda, Acacia parramattensis, Bursaria spinosa and Kunzea ambigua.	2	Low. Site does not provide suitable habitat conditions for the presence of this species. This species was not identified on site.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Pomaderris prunifolia	P. prunifolia in the Parramatta, Auburn, Strathfield and Bankstown Local Government Areas	E2	-	Known from only three sites within the listed local government areas, at Rydalmere, within Rookwood Cemetery and at The Crest of Bankstown. At Rydalmere it occurs along a road reserve near a creek, among grass species on sandstone. At Rookwood Cemetery it occurs in a small gully of degraded Cooks River / Castlereagh Ironbark Forest on shale soils.	K	Low. Site does not provide suitable habitat conditions for the presence of this species. This species was not identified on site.	Low.
Galium australe	Tangled Bedstraw	E1,P	-	In NSW (and ACT Territory in Jervis Bay), Tangled Bedstraw has been recorded in Turpentine forest and coastal Acacia shrubland.	K	Low. Site does not provide suitable habitat conditions for the presence of this species. This species was not identified on site.	Low.
Zieria involucrata		E1,P	V	Occurs primarily on Hawkesbury sandstone. Also occurs on Narrabeen Group sandstone and on Quaternary alluvium. Found primarily in sheltered forests on mid- to lower slopes and valleys, e.g. in or adjacent to gullies which support sheltered forest, although some populations extend upslope into drier vegetation. The canopy typically includes Turpentine, Smooth-barked Apple, Blue-leaved Stringybark and Forest Oak.	K	Low. Site does not provide suitable habitat conditions for the presence of this species. This species was not identified on site.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Thesium australe	Austral Toadflax	V,P	V	Found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Grows in association with *Themeda australis.*	K	Low-moderate. *Thesium australe* is a parasitic plant that grows in association with *Themeda australis. T australis* was identified within a small portion of the site. However, the area and condition of *T. australis* was not sufficient to support a population of this parasitic species. This species was not identified on site.	Low.
Lasiopetalum joyceae		V,P	V	Has a restricted range occurring on lateritic to shaley ridgetops on the Hornsby Plateau south of the Hawkesbury River. Grows in heath on sandstone.	K	Low. Site does not provide suitable habitat conditions for the presence of this species. This species was not identified on site.	Low.
Rulingia prostrata	Dwarf Kerrawang	E1,P	E	Occurs on sandy, sometimes peaty soils in a wide variety of habitats: Snow Gum Woodland and Ephemeral Wetland floor at Rowes Lagoon; Blue leaved Stringybark Open Forest at Tallong; and in Brittle Gum Low Open Woodland at Penrose; Scribbly Gum/ Swamp Mahogany Ecotonal Forest at Tomago. Associated native species may include Imperata cylindrica, Empodisma minus and Leptospermum continentale.	P	Low. Site does not provide suitable habitat conditions for the presence of this species. This species was not identified on site.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Pimelea curviflora var. curviflora		V,P	V	Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands. Also recorded in Illawarra Lowland Grassy Woodland habitat at Albion Park on the Illawaraa coastal plain. Flowers October to May. Often grows amongst dense grasses and sedges. It can survive for some time without any foliage after fire or grazing.	K	Low. Site does not provide suitable habitat conditions for the presence of this species. This species was not identified on site.	Low.
Pimelea spicata	Spiked Rice-flower	E1,P	E	Found on well-structured clay soils. On the Cumberland Plain sites it is associated with Grey Box communities (particularly Cumberland Plain Woodland variants and Moist Shale Woodland) and in areas of ironbark. The co-occurring species in the Cumberland Plain sites are grey box, forest red gum and narrow-leaved ironbark. Blackthorn is often present at sites (and may be important in protection from grazing) and kangaroo grass is usually present in the groundcover.	19	Moderate. Site may provide suitable conditions for the presence of this species. Notwithstanding the targeted meander survey, there was no evidence of this species observed during the field surveys.	Low – not recorded on-site. The potential for impact on this species is further assessed through a seven part test in Appendix 7 See Appendix 8 for full species target report.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Pomaderris brunnea	Rufous Pomaderris		V	Grows in open forest. Has been found in association with Eucalyptus amplifolia, Angophora floribunda, Acacia parramattensis, Bursaria spinosa and Kunzea ambigua. In the Sydney region this species is found typically near the coast, on Sydney Sandstones. In this area is grows in woodland and semi-cleared scrub, on clay and alluvial soils of floodplains and creek lines.	Likely to occur within area	Low-moderate. The site may provide suitable conditions for the presence of this species though the site is highly disturbed and vegetation greatly altered. This species was not identified on site	Low.
Zannichellia palustris		E1,P	-	Known from the lower Hunter and in Sydney Olympic Park. Grows in fresh or slightly saline stationary or slowly flowing water. Flowers during warmer months. NSW populations behave as annuals, dying back completely every summer.	K	Low. Site does not provide suitable habitat conditions for the presence of this species. This species was not identified on site.	Low.
Asterolasia elegans		E	-	Occurs on Hawkesbury sandstone. Found in sheltered forests on mid- to lower slopes and valleys, e.g. in or adjacent to gullies which support sheltered forest. The canopy at known sites includes Turpentine, Smooth-barked Apple), Sydney Peppermint, Forest Oak and Christmas Bush.	Likely to occur within area	Low. Site does not provide suitable habitat conditions for the presence of this species. This species was not identified on site.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Caladenia tessellate	Thick-lipped Spider-orchid, Daddy Long-legs	E1, P, 2	V	This species is endemic to mainland south-east Australia. Favours low, dry sclerophyll woodland with a heathy or sometimes grassy understorey on clay loams or sandy soils.	May occur within area	Low-moderate. The site may provide suitable conditions for the presence of this species though the site is highly disturbed and vegetation greatly altered with very little shrub/native grass understorey. This species was not identified on site.	Low.
Cryptostylis hunteriana	Leafless Tongue-orchid	V, P, 2	V	Does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland. The larger populations typically occur in woodland dominated by Scribbly Gum, Silvertop Ash, Red Bloodwood and Black Sheoak; appears to prefer open areas in the understorey and is often found in association with the Large Tongue Orchid and the Tartan Tongue Orchid.	May occur within area	Low-moderate. The site may provide suitable conditions for the presence of this species though the site is highly disturbed and vegetation greatly altered. This species was not identified on site.	Low.

Scientific Name	Common Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Pterostylis gibbosa	Illawarra Greenhood, Rufa Greenhood, Pouched Greenhood	E1, P, 2	E	In the Illawarra region, grows in woodland dominated by Forest Red Gum Eucalyptus tereticornis, Woollybutt E. longifolia and White Feather Honey-myrtle Melaleuca decora. Near Nowra, grows in an open forest of Spotted Gum Corymbia maculata, Forest Red Gum and Grey Ironbark E. paniculata. In the Hunter region, grows in open woodland dominated by Narrow-leaved Ironbark E. crebra, Forest Red Gum and Black Cypress Pine Callitris endlicheri.	Known to occur within area	Low-moderate. The site may provide suitable conditions for the presence of this species though the site is highly disturbed and vegetation greatly altered. This species was not identified on site	Low.
Streblus pendulinus	Siah's Backbone, Isaac Wood	-	E	On the Australian mainland, this species is found in warmer rainforests, primarily along watercourses. From near sea level to 800m above sea level. The species grows in well-developed rainforest, gallery forest and drier, more seasonal rainforests.	Likely to occur in the area	Low. Site does not provide suitable habitat conditions for the presence of this species. This species was not identified on site.	Low.
Thelymitra sp. Kangaloon	Kangaloon Sun-orchid	CE	CE	Only known to occur on the southern tablelands of NSW in the Moss Vale / Kangaloon / Fitzroy Falls area at 550-700 m above sea level. It is found in swamps in sedgelands over grey silty grey loam soils	May occur within the area	Low. Site does not provide suitable habitat conditions for the presence of this species. This species was not identified on site.	Low.

Appendix 4

Ecological Community Assessment

Communities with a likelihood of occurrence of Moderate or greater have had potential impacts formally assessed using a 7-part test under the *Environmental Planning and Assessment Act 1979* and an EPBC Assessment where required (see Appendix 7).

Ecological communities recorded on the site are denoted by bold text.

E1 - Endangered; E2 - Endangered Population; E3 - Endangered ecological community; E4 Critically endangered; P - Protected; K - Known occurrence; PR - Predicted occurrence; V - Vulnerable; E4 critically endangered

Community Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Agnes Banks Woodland in the Sydney Basin Bioregion	E3	-	Occurs in western Sydney, mostly near Agnes Banks on the east bank of the Hawkesbury River, in the Penrith local government area. Occurs on areas of wind-blown sand which overlay Tertiary Alluvium deposits from ancient river systems. Depending on drainage conditions, there is great variation within the community, from low woodland on higher ridges to sedge-type vegetation in low lying depressions.	K	Low. This site is not representative of this EEC	Low.

Community Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions	E3	-	Bangalay Sand Forest of the Sydney Basin and South East Corner bioregions typically has a dense to open tree canopy, approximately 5 - 20m tall. The most common tree species include Bangalay (Eucalyptus botryoides) and Coast Banksia (Banksia integrifolia subsp. integrifolia), while Blackbutt (Eucalyptus pilularis) and Lilly Pilly (Acmena smithii) may occur in more sheltered situations, and Swamp Oak (Casuarina glauca) may occur on dunes exposed to salt-bearing sea breezes or where Bangalay Sand Forest adjoins Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions.	K	Low. This site is not representative of this EEC	Low.
Blue Gum High Forest in the Sydney Basin Bioregion	E4B	CE	The remnants mainly occur in the Lane Cove, Willoughby, Ku-ring-gai, Hornsby, Baulkham Hills, Ryde and Parramatta LGAs. Occurs only in areas where rainfall is high (above 1100mm/year) and the soils are relatively fertile and derived from Wianamatta shale. In lower rainfall areas, it grades into Sydney Turpentine-Ironbark Forest. The community also occurs on soils associated with localised volcanic intrusions, 'diatremes'.	K	Low. This site is not representative of this EEC	Low.

Community Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Blue Mountains Shale Cap Forest in the Sydney Basin Bioregion	E3	CE	Found on deep fertile soils formed on Wianamatta Shale, on moist sheltered sites at lower to middle altitudes of the Blue Mountains and Wollemi areas. Extensive occurrences of shale are at Springwood, Berambing to Kurrajong Heights, Mountain Lagoon and Colo Heights. Includes vegetation that is part of Map Unit 9a Shale Cap Forest of the Royal Botanic Gardens' 1:100 000 vegetation maps and vegetation that is part of Smith and Smith's Eucalyptus deanei–Syncarpia glomulifera Tall Open Forest. Is a rich habitat for fauna. The Eucalyptus deanei trees are a major provider of nest hollows for owls, parrots, gliders and other hollow dependent fauna including the threatened species Powerful Owl and Glossy Black-Cockatoo.	K	Low. This site is not representative of this EEC	Low.
Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion	V2	-	Occurs almost exclusively on soils derived from Tertiary alluvium, or on sites located on adjoining shale or Holocene alluvium. The shrub understorey includes a number of listed threatened species including Acacia bynoeana, Allocasuarina glareicola, Dillwynia tenuifolia, Grevillea juniperina subsp. juniperina, Micromyrtus minutiflora, Persoonia nutans and Pultenaea parviflora, and may also possibly contain Grevillea parviflora subsp. Parviflora.	K	Low. This site is not representative of this EEC	Low.

Community Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Castlereagh Swamp Woodland Community	E3	-	Occurs in western Sydney in the Castlereagh and Holsworthy areas, on deposits from ancient river systems along today's intermittent creeklines, often in poorly drained depressions. Highly adapted to seasonal fluctuations of wet and dry. Intergrades into Ironbark and Scribbly Gum woodland and is subject to periodic fires.	K	Low. This site is not representative of this EEC	Low.
Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	V	Coastal Saltmarsh occurs in the intertidal zone on the shores of estuaries and lagoons that are permanently or intermittently open to the sea. Characteristic plants include Baumea juncea, Sea Rush (Juncus krausii subsp. australiensis), Samphire (Sarcocornia quinqueflora subsp. quinqueflora), Marine Couch (Sporobolus virginicus), Streaked Arrowgrass (Triglochin striata), Knobby Club-rush (Ficinia nodosa), Creeping Brookweed (Samolus repens), Swamp Weed (Selliera radicans), Seablite (Suaeda australis) and Prickly Couch (Zoysia macrantha).	P	Low. This site is not representative of this EEC	Low.

Community Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Coastal Upland Swamp in the Sydney Basin Bioregion	E3	-	The Coastal Upland Swamp is endemic to NSW and confined to the Sydney Basin Bioregion. Occurs primarily on impermeable sandstone plateaux with shallow groundwater aquifers in the headwaters and impeded drainage lines of streams, and on sandstone benches with abundant seepage moisture. Generally associated with soils that are acidic and vary from yellow to grey mineral sandy loams with a shallow organic horizon to highly organic spongy black peats with pallid subsoils.	K	Low. This site is not representative of this EEC	Low.
Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion	E3	-	Has a very restricted natural distribution and mainly occurs on clay soils derived from the deposits of ancient river systems (alluvium), or on shale soils of the Wianamatta Shales. Can intergrade into Shale-Gravel Transition Forest (where the alluvium is shallow), Castlereagh Swamp Woodland (in moist depressions) and Castlereagh Scribbly Gum Woodland (on sandier soils).	K	Low. This site is not representative of this EEC	Low.

Community Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Cumberland Plain Woodland in the Sydney Basin Bioregion	E4B	CE	Occurs on soils derived from Wianamatta Shale, and throughout the driest part of the Sydney Basin. Typically occurs on heavy clay soils derived from Wianamatta Shale. Cumberland Plain Woodland is habitat for threatened species such as the Cumberland land snail (Meridolum corneovirens).	K	High. Site is suitable species composition for the presence of this EEC. This community occurs on the site in a modified form.	The potential for impact on this community is further assessed in Appendix 7. A separate community specific assessment report has been prepared by SLR Consulting (see Appendix 15).

Community Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Elderslie Banksia Scrub Forest	E3	-	Unique as includes plants, such as coastal Banksia and other sandstone region species, which do not occur in the surrounding Cumberland Plain communities. Occurs only on sand deposits on the old terraces deposited by ancient river systems of what is now the Nepean River, and requires deep sand soil to fully regenerate. Intergrades with Cumberland Plain Woodland and river-flat forest communities.	K	Low. This site is not representative of this EEC	Low.
Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	-	Typically occurs on silts, muds or humic loams in low-lying parts of floodplains, alluvial flats, depressions, drainage lines, backswamps, and lagoons. They are dominated by herbaceous plants and have very few woody species. Generally occur below 20m elevation on level areas. Those that lack standing water most of the time are usually dominated by dense grassland or sedgeland vegetation, often forming a turf less than 0.5 metre tall and dominated by amphibious plants. Where they are subject to regular inundation and drying the vegetation may include large emergent sedges over 1 metre tall.	K	Low. This site is not representative of this EEC. The constructed dam is not considered to form an example of this community as it is artificial in nature. Refer to Appendix 15 for additional explanation.	Low.

Community Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Kurnell Dune Forest in the Sutherland Shire and City of Rockdale	E3	-	Occurs on coastal dune sand. Can be differentiated from the Eastern Suburbs Banksia Scrub (ESBS) endangered ecological community by the following features: Kurnell Dune Forest (KDF) contains a considerable mesomorphic element in the flora, which is absent or less dominant in ESBS; KDF has a forest structure rather than the predominantly scrub structure of ESBS; and KDF occurs on younger sands than those of ESBS.	K	Low. This site is not representative of this EEC	Low.
Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	CE	The plant species of this community are predominantly rainforest species. Several species have compound leaves, and vines may be a major component of the canopy. These features differentiate littoral rainforest from forest or scrub, but while the canopy is dominated by rainforest species, scattered emergent individuals of sclerophyll species, such as Angophora costata, Banksia integrifolia, Eucalyptus botryoides and Eucalyptus tereticornis occur in many stands. The Sutherland Shire Littoral Rainforest Endangered Ecological Community which was listed previously as an endangered ecological community is included within this community.	P	Low. This site is not representative of this EEC.	Low.

Community Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Moist Shale Woodland in the Sydney Basin Bioregion	E3	CE	Usually occurs on soils derived from Wianamatta Shale on high country in the southern half of the Cumberland Plain, and occurs mainly in Wollondilly LGA. Also occurs in smaller amounts further north in the Camden, Campbelltown, Fairfield, Liverpool and Penrith LGAs. Mainly occurs in the hilly country with higher elevations where there is increased rainfall. Occurs on clay soils derived from Wianamatta shale and is intermediate between Cumberland Plain Woodland on drier sites and Western Sydney Dry Rainforest on wetter sites.	K	Low-moderate. The site has characteristics of this EEC. However, field surveys and in-depth reporting have concluded that this EEC is not present on site.	Low.
O'Hares Creek Shale Forest	E3	-	Forms part of a network of vegetation communities that occupy the remnant shales soils that lie above the sandstone plateau. The community is a component of the more broadly occurring Red Bloodwood - Smooth-barked Apple shrubby forest on shale or ironstone of coastal plateau, Sydney Basin community. Trees within the community are distinctively taller than those in the surrounding sandstone woodland vegetation. Locations on the Darkes Forest ridge typically have a more mesic understorey than sites on the smaller shale outcrops further west. The community persists within a narrow mean annual rainfall band of between 950mm and 1100mm and between elevations of 350 and 450 metres above sea level.	K	Low. This site is not representative of this EEC	Low.

Community Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	**E3**		**Found on the river flats of the coastal floodplains. It has a tall open tree layer of eucalypts, (may exceed 40m), but can be considerably shorter in regrowth stands or under conditions of lower site quality. While the composition of the tree stratum varies considerably, the most widespread and abundant dominant trees include Eucalyptus tereticornis (forest red gum), E. amplifolia (cabbage gum), Angophora floribunda (rough-barked apple) and A. subvelutina (broad-leaved apple). Eucalyptus baueriana (blue box), E. botryoides (bangalay) and E. elata (river peppermint) may be common south from Sydney, E. ovata (swamp gum) occurs on the far south coast.**	**K**	**High – this community occurs on-site along the banks of the Georges River.**	**Low. The potential for impact on this community is further assessed through a seven part test due to its presence on the site.**
Shale gravel Transition Forest in the Sydney Basin Bioregion	E3	CE	Occurs primarily where shallow deposits from ancient river systems overlay shale soils, but also associated with localised concentrations of iron-hardened gravel. A transitional plant community which grades into Cumberland Plain Woodland where the influence of gravel soil declines, and grades into Cooks River/Castlereagh Ironbark Forest or Castlereagh Scribbly Gum Woodland where gravel deposits are thick. The shrub understorey includes a number of listed threatened species in the 'pea' flower group.	K	Low-moderate. The site has characteristics of this EEC. However, field surveys and in-depth reporting have concluded that this EEC is not present on site.	Low.

Community Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Shale/Sandstone Transition Forest	E3	E	Some species in areas with greater shale influence regenerate from profuse annual seeding and underground tubers. High-sandstone-influence sites have poor rocky soils, and many shrubs which rely on nitrogen-fixing root nodules and soil/root fungi to obtain nutrients. High-shale-influence sites often have a diverse and moderately dense groundcover stratum, with grasses a prominent and diverse component. Shrubs are usually less abundant and less diverse in shale sites.	K	Low. This site is not representative of this EEC	Low.
Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion	E3	-	The terrain is primarily gentle, with slopes not often exceeding 10°, and where sandstone outcrops occur infrequently. The community is typically associated with sheltered heads and upper slopes of gullies on transitional zones where sandstone outcrops may exist, but where soils are influenced by lateral movement of moisture, nutrients and sediment from more fertile substrates.	K	Low. This site is not representative of this EEC	Low.

Community Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	-	This community is found on the coastal floodplains of NSW. It has a dense to sparse tree layer. Tree diversity decreases with latitude, and Melaleuca ericifolia is the only abundant tree in this community south of Bermagui. The understorey is characterised by frequent occurrences of vines, Parsonsia straminea, Geitonoplesium cymosum and Stephania japonica var. discolor, a sparse cover of shrubs, and a continuous groundcover of forbs, sedges, grasses and leaf litter.	K	Low. This site is not representative of this EEC	Low.
Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E3	-	This swamp community has an open to dense tree layer of eucalypts and paperbarks although some remnants now only have scattered trees as a result of partial clearing. The community also includes some areas of fernland and tall reedland or sedgeland, where trees are very sparse or absent. The most widespread and abundant dominant trees include Eucalyptus robusta (swamp mahogany), Melaleuca quinquenervia (paperbark) and, south from Sydney, Eucalyptus botryoides (bangalay) and Eucalyptus longifolia (woollybutt).	K	Low. This site is not representative of this EEC	Low.

Community Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Sydney Freshwater Wetlands in the Sydney Basin Bioregion	E3	-	Occurs on sand dunes and low-nutrient sandplains along coastal areas in the Sydney Basin bioregion. Largely restricted to freshwater swamps in swales and depressions on sand dunes and low nutrient sandplains such as those of the Warriewood and Tuggerah soil landscapes. Swampy areas on alluvium with a saline influence do not fall within this community.	K	Low. This site is not representative of this EEC	Low.
Sydney Turpentine-Ironbark Forest	E3	CE	Occurs in Sydney and is heavily fragmented. Occurs close to the shale/sandstone boundary on the more fertile shale influenced soils, in higher rainfall areas on the higher altitude margins of the Cumberland Plain, and on the shale ridge caps of sandstone plateaus. A transitional community, between Cumberland Plain Woodland in drier areas and Blue Gum High Forest on adjacent higher rainfall ridges.	K	Low. This site is not representative of this EEC	Low.
Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions	E3	-	Themeda australis is the dominant species in the Themeda Grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner bioregion ecological community. Banksia integrifolia subsp. integrifolia, Westringia fruticosa and Acacia sophorae occurs as an emergent shrub or as a dense cover where they have recruited over grasslands.	K	Low. This site is not representative of this EEC	Low.

Community Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Western Sydney Dry Rainforest in the Sydney Basin Bioregion	E3	CE	Very restricted and occurs most commonly in the far southern section of the Cumberland Plain, in the Razorback Range near Picton. Occurring to a lesser extent in the Baulkham Hills, Camden, Hawkesbury, Parramatta and Ryde LGAs. Restricted to hilly country where it occurs on the sheltered lower slopes and in gullies. Generally found at higher elevation, in areas receiving higher rainfall than much of the Cumberland Plain Woodland. Occurs on clay soils derived from Wianamatta shale. Several species of plants (including Spartothamnella juncea and rare and threatened such as Marsdenia viridiflora) have their southern distribution limit within areas of Western Sydney Dry Rainforest.	K	Low. This site is not representative of this EEC	Low.

Community Name	NSW status	Comm. status	Habitat Description	Records	Likelihood of occurrence	Potential Impacts
Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion	-	E	Generally tall open eucalypt forests found on igneous rock (predominately Tertiary basalt and microsyenite) in, or adjacent to, the Sydney Basin Bioregion. The ecological community occurs in areas of high rainfall, generally ranging from 950 to 1600 mm/year. The ecological community typically occurs at elevations between 650 and 1050 m above sea level. The ecological community typically occurs as an open to tall open forest with a sparse to dense layer of shrubs and vines, and a diverse understorey of native grasses, forbs, twiners and ferns. However, the structure of the ecological community may vary from tall open forest with trees up to and above 30 m tall with a projected foliage cover of 30–70% to woodland with trees 10–30 m tall, with a projected foliage cover of 10–30%.	P	Low. This site is not representative of this EEC	Low.

Appendix 5

Key Threatening Process (KTP) Assessment

Key Threatening Process	NSW status	Comm. status	Likelihood of occurrence	Potential Impacts
Aggressive exclusion of birds from woodland and forest habitat by abundant Noisy Miners *Manorina melanocephala*	KTP		Low. Proposal will not exacerbate this KTP further.	Low.
Alteration of habitat following subsidence due to longwall mining	KTP		Low. No longwall mining occurring	Low.
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands	KTP		Low. No alteration to natural hydrological regimes will occur.	Low.
Anthropogenic Climate Change	KTP	KTP	Low - Moderate. The project will have a minor contribution to overall greenhouse gas emission during construction. However, this will be quite small.	Low.
Bushrock removal	KTP		Low. No bushrock on site.	Low.
Clearing of native vegetation	KTP	KTP	Low-moderate. The project will result in a comparatively minor contribution to this KTP, with some clearing being unavoidable as part of the future development of the GWS site.	Moderate.
Competition and grazing by the feral European Rabbit, *Oryctolagus cuniculus* (L.)	KTP	KTP	Low. The proposal will not exacerbate the competition and grazing by rabbits.	Low.
Competition and habitat degradation by Feral Goats, *Capra hircus* Linnaeus 1758	KTP	KTP	Low. The proposal will not exacerbate the competition and grazing by goats.	Low.

Key Threatening Process	NSW status	Comm. status	Likelihood of occurrence	Potential Impacts
Competition from feral honey bees, *Apis mellifera* L.	KTP		Low. The proposal will not exacerbate the competition by feral honeybees.	Low.
Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners	KTP		Low. The proposal will not provide further habitat for Bell Miners.	Low
Herbivory and environmental degradation caused by feral deer	KTP		Low. The proposal will not exacerbate herbivory by feral deer.	Low.
High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition	KTP		Low. The proposal will not include high frequency fire management.	Low.
Importation of Red Imported Fire Ants *Solenopsis invicta* Buren 1972	KTP		Low. The proposal does not include importing fire ants.	Low.
Infection by Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species and populations	KTP	KTP	Low. The proposal does not expect to transmit bird diseases.	Low.
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis	KTP	KTP	Low. The proposal does not expect to transmit this disease.	Low.
Infection of native plants by *Phytophthora cinnamomi*	KTP	KTP	Low-moderate. The proposal may facilitate the transmission of plant diseases through machinery transportation during construction.	Low. Ensure equipment hygiene protocols are followed.

Key Threatening Process	NSW status	Comm. status	Likelihood of occurrence	Potential Impacts
Introduction of the Large Earth Bumblebee *Bombus terrestris* (L.)	KTP		Low. The proposal does not include importing bees or any associated activities that could cause introduction of bees.	Low.
Invasion and establishment of exotic vines and scramblers	KTP		Low - Moderate. The proposal may facilitate the transmission of plant parts through machinery transportation during construction.	Low. Ensure equipment hygiene protocols are followed.
Invasion and establishment of Scotch Broom (*Cytisus scoparius*)	KTP		Low - Moderate. The proposal may facilitate the transmission of plant parts through machinery transportation during construction.	Low. Ensure equipment hygiene protocols are followed.
Invasion and establishment of the Cane Toad (*Bufo marinus*)	KTP	KTP	Low. The proposal will not involve the transportation of frogs.	Low.
Invasion of native plant communities by African Olive *Olea europaea* L. subsp. *cuspidata* (Wall ex G. Don Cirferri)	KTP		Low - Moderate. The proposal may facilitate the transmission of plant parts through machinery transportation during construction.	Low. Ensure equipment hygiene protocols are followed.
Invasion of native plant communities by *Chrysanthemoides monilifera*	KTP		Low - Moderate. The proposal may facilitate the transmission of plant parts through machinery transportation during construction.	Low. Ensure equipment hygiene protocols are followed.
Invasion of native plant communities by exotic perennial grasses	KTP		Low - Moderate. The proposal may facilitate the transmission of plant parts through machinery transportation during construction.	Low. Ensure equipment hygiene protocols are followed.

Key Threatening Process	NSW status	Comm. status	Likelihood of occurrence	Potential Impacts
Invasion of the Yellow Crazy Ant, *Anoplolepis gracilipes* (Fr. Smith) into NSW	KTP		Low. The proposal does not include importing fire ants or any associated activities that could lead to the invasion of yellow crazy ants.	Low.
Invasion, establishment and spread of Lantana (*Lantana camara* L. sens. Lat)	KTP		Low - Moderate. The proposal may facilitate the transmission of plant parts through machinery transportation during construction.	Low. Ensure equipment hygiene protocols are followed.
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants	KTP	KTP	Low - Moderate. The proposal may facilitate the transmission of plant parts through machinery transportation during construction.	Low. Ensure equipment hygiene protocols are followed.
Loss of Hollow-bearing Trees	KTP		Moderate. Trees containing hollows will need to be removed. The amount to be removed will need to be considered in the overall site redevelopment.	Moderate. A hollow bearing tree assessment has been conducted on site revealing a total of 28 trunk hollows, 81 branch hollows and 1 old termite nest within the GWS site. Nest boxes are proposed to be erected at a 2:1 ratio for each individual hollow proposed for removal and to be placed within the riparian areas on the eastern portion of the site to provide potential nesting/breeding habitat for any common or threatened species likely to occur within the area, particularly threatened Microchiropteran bats.
Loss or degradation (or both) of sites used for hill-topping by butterflies	KTP		Low. The proposal will occupy only a small area and is unlikely to exacerbate this KTP.	Low.

Key Threatening Process	NSW status	Comm. status	Likelihood of occurrence	Potential Impacts
Predation and hybridisation by Feral Dogs, *Canis lupus familiaris*	KTP		Low. The proposal is unlikely to enhance this KTP.	Low.
Predation by *Gambusia holbrooki* Girard, 1859 (Plague Minnow or Mosquito Fish)	KTP		Low. The subject site is not a waterway.	Low.
Predation by the European Red Fox *Vulpes Vulpes* (Linnaeus, 1758)	KTP	KTP	Low. The proposal is unlikely to enhance this KTP.	Low.
Predation by the Feral Cat *Felis catus* (Linnaeus, 1758)	KTP	KTP	Low. The proposal is unlikely to enhance this KTP.	Low.
Predation, habitat degradation, competition and disease transmission by Feral Pigs, *Sus scrofa* Linnaeus 1758	KTP	KTP	Low. The proposal is unlikely to enhance this KTP.	Low.
Removal of dead wood and dead trees	KTP		Low. A small number of trees (approx. 3) contain dead wood and may potentially require removal, however, this small amount is not considered to exacerbate this KTP.	Low.

Appendix 6

Invasive Species Assessment

Scientific Name	Common Name	NSW status	Comm. status	Assessment
Acridotheres tristis	Common Myna, Indian Myna	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Alauda arvensis	Skylark	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Anas platyrhynchos	Mallard	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Carduelis carduelis	European Goldfinch	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Carduelis chloris	European Greenfinch	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Columba livia	Rock pigeon	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Lonchura punctulata	Nutmeg Mannikin	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Passer domesticus	House Sparrow	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Passer montanus	Eurasian Tree Sparrow	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Pycnonotus jocosus	Red-whiskered Bulbul	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Streptopelia chinensis	Spotted Turtle-Dove	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Sturnus vulgaris	Common starling	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Turdus merula	Common blackbird	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Bufo marinus	Cane Toad	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Rhinella marina	Cane Toad	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Bos Taurus	Domestic cattle	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Canis lupus familiaris	Domestic Dog	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP

Scientific Name	Common Name	NSW status	Comm. status	Assessment
Felis catus	Cat	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Mus musculus	House Mouse	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Oryctolagus cuniculus	Rabbit	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Feral Deer	Deer	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Lepus capensis	Brown Hare	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Rattus norvegicus	Brown Rat	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Rattus rattus	Black rat	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Vulpes vulpes	Fox	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Hemidactylus frenatus	Asian House Gecko	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Alternanthera philoxeroides	Alligator Weed	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Anredera cordifolia	Madeira Vine	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Asparagus aethiopicus	Asparagus Fern	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Asparagus asparagoides	Bridal Creeper	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Chrysanthemoides monililfera	Bitou Bush	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Asparagus plumosus	Climbing Asparagus-fern	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Asparagus scandens	Asparagus Fern	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Cabomba caroliniana	Cabomba	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Chrysanthemoides monilifera subsp. Monilifera	Boneseed	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP

Scientific Name	Common Name	NSW status	Comm. status	Assessment
Chrysanthemoides monilifera subsp. rotundata	Bitou Bush	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Eichhornia crassipes	Water Hyacinth, Water Orchid	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Genista linifolia	Flax-leaved Broom	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Genista sp. x Genista monspessulana	Broom	-	Invasive Species	We have recommended equipment wash-down and hygiene protocol and as such the proposed activity is considered unlikely to exacerbate this KTP
Dolichandra unguis-cati	Cat's Claw Vine	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Lantana camara	Lantana	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Lycium ferocissimum	African Boxthorn	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Nassella neesiana	Chilean Needle Grass	-	Invasive Species	We have recommended equipment wash-down and hygiene protocol and as such the proposed activity is considered unlikely to exacerbate this KTP
Nassella trichotoma	Serrated Tussock	-	Invasive Species	We have recommended equipment wash-down and hygiene protocol and as such the proposed activity is considered unlikely to exacerbate this KTP
Opuntia spp.	Prickly Pears	-	Invasive Species	We have recommended equipment wash-down and hygiene protocol and as such the proposed activity is considered unlikely to exacerbate this KTP
Pinus radiata	Radiata Pine	-	Invasive Species	We have recommended equipment wash-down and hygiene protocol and as such the proposed activity

Scientific Name	Common Name	NSW status	Comm. status	Assessment
				is considered unlikely to exacerbate this KTP
Protasparagus plumosus	Climbing Asparagus-fern,	-	Invasive Species	We have recommended equipment wash-down and hygiene protocol and as such the proposed activity is considered unlikely to exacerbate this KTP
Rubus fruticosus aggregate	Blackberry	-	Invasive Species	We have recommended equipment wash-down and hygiene protocol and as such the proposed activity is considered unlikely to exacerbate this KTP
Sagittaria platyphylla	Delta Arrowhead	-	Invasive Species	We have recommended equipment wash-down and hygiene protocol and as such the proposed activity is considered unlikely to exacerbate this KTP
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii	Willows	-	Invasive Species	We have recommended equipment wash-down and hygiene protocol and as such the proposed activity is considered unlikely to exacerbate this KTP
Senecio madagascariensis	Fireweed	-	Invasive Species	We have recommended equipment wash-down and hygiene protocol and as such the proposed activity is considered unlikely to exacerbate this KTP
Salvinia molesta	Salvinia	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP
Ulex europaeus	Gorse, Furze	-	Invasive Species	Proposed activity unlikely to exacerbate this KTP

Appendix 7

Commonwealth and State Impact Assessments

A7.1 Commonwealth Assessment

Two Matters of National Environmental Significance were recorded on the site, being Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest and Grey-headed Flying Fox. Species such as Koala, Green and Golden Bell Frog and *Pimelea spicata* were not recorded despite detailed targeted searches in the correct seasons. No other species or communities listed under the EPBC Act were considered to warrant detailed impact assessments, other than the two recorded entities.

Impact assessments in accordance with the Significant Impact Guidelines 1.1 (2013) are therefore provided below for Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest and Grey-headed Flying Fox.

Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest

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

- ***reduce the extent of an ecological community***

SLR (2014) (Appendix 16) shows that the total area of this community on the site is 13.77ha. Of this, 13.14ha is in very low to low condition and 0.63ha is in moderate condition. The area of woodland (in various conditions) to be removed by the combined impact of the SSD and rezoning will be approximately 9.5ha.

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

The existing patch of this community on the GWS is highly degraded and already partially isolated and fragmented from larger tracts of vegetation within the locality. The removal of this patch of Shale Plains Woodland vegetation will increase fragmentation within the site itself and the areas to be retained will be smaller and more spread out than is currently the case.

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

The majority of this community will be removed as a result of the GWS projects.

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

The majority of this community will be removed as a result of the GWS projects.

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

The majority of this community will be removed as a result of the GWS projects.

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

The majority of this community will be removed as a result of the GWS projects.

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

The majority of this community will be removed as a result of the GWS projects.

Conclusion

It is considered that, while the vegetation to be impacted is in relatively low condition, the impacts of the SSD and rezoning would result in a controlled action due to the removal of over 9ha of this community. A Referral to DoE is therefore recommended in relation to the impacts to the threatened community.

Grey-headed Flying Fox

Specifically in relation to this species, the DoE has prepared two guidelines, being:

- Draft EPBC Act Policy Statement: Camp management guidelines for the Grey-headed and Spectacled flying-fox (2014)
- EPBC Act Administrative Guidelines on Significance - Supplement for the Grey-headed Flying-fox (2003)

Both of those documents generally tend to focus on impacts to "camps", where this species congregate in known important areas. No permanent camp is known to occur on the site or considered likely. The nearest known camp is located approximately 3.5km to the south at Macquarie Fields and the Commonwealth DoE has identified that the Macquarie Fields camp is Nationally Important.

Single flying foxes were recorded foraging in the woodland near the dam in February 2015. Such records indicate that the remnant vegetation is likely to be used as part of the greater foraging range of this highly mobile species. This species has not been previously recorded during the numerous previous surveys.

The factors requiring consideration for this species under the EPBC Act are addressed hereunder.

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

- ***lead to a long-term decrease in the size of an important population of a species***

It is considered unlikely that the removal of the majority of the remnant woodland from the site would lead to a long-term decrease in an important population. Extensive foraging habitat for this species occurs throughout the nearby Holsworthy defence site and this is likely to be retained in perpetuity, along with habitats in National Parks such as Royal National Park.

- ***reduce the area of occupancy of an important population***

It is considered than an important population is not likely to be reduced as a result of the projects, due to the persistence of extensive foraging habitats in the locality.

- ***fragment an existing important population into two or more populations***

This species is highly mobile and it is not considered that the projects would fragment any important populations.

- ***adversely affect habitat critical to the survival of a species***

It is not considered that any habitat critical to the survival of the species occurs on the site.

- ***disrupt the breeding cycle of an important population***

Disruptions of breeding of an important local population is unlikely to occur.

- ***modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline***

The impacts of the project are not likely to result in the decline of this species.

- ***result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat***

This is not considered to be a relevant consideration for this species.

- ***introduce disease that may cause the species to decline, or***

The projects are not likely to result in introduction of disease to this species.

- ***interfere substantially with the recovery of the species.***

The projects are not likely to interfere substantially with the recovery of this species.

Conclusion

It is considered unlikely that the projects would either impact on a known important camp or impact on an important population. An EPBC Referral is not considered to be necessary specifically for this species alone.

A7.2 State Assessment

Considerations of the effects of the proposed development under the guidelines of Section 5A of the *Environmental Planning and Assessment Act 1979 (EPA Act 1979)* for threatened species, populations and / or ecological communities considered to have a greater than moderate likelihood of occurrence (see Appendices 3-4 for likelihood of occurrence assessment) are given below. For the purposes of the Seven-Part Test, where appropriate, threatened species have been grouped into functional 'guilds' based on similar habitat or ecological requirements.

The following Seven-Part Tests have been completed (those recorded on-site are in bold text):

Threatened Ecological Communities

Cumberland Plain Woodland
River-Flat Eucalypt Forest on Coastal Floodplains

Fauna

Phascolarctos cinereus	Koala
Litoria aurea	Green and Golden Bell Frog
Meridolum corneovirens	Cumberland Plain Land Snail
Pteropus poliocephalus	**Grey-headed Flying-fox**

Hollow/shelter dependent microbats

Saccolaimus flaviventris	**Yellow-bellied Sheathtail-bat**
Mormopterus norfolkensis	**East-coast Freetail-bat**
Scoteanax rueppellii	Greater Broad-nosed Bat
Falsistrellus tasmaniensis	Eastern False Pipistrelle
Miniopterus australis	**Little Bentwing bat**
Miniopterus schreibersii oceanensis	**Eastern Bentwing bat**
Myotis macropus	Large-footed myotis

Flora

Pimelea spicata	Spiked Rice-flower

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

No endangered populations were identified during site surveys, nor are they considered likely to occur within the subject site.

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

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

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

The Shale Plain Woodland (Critically Endangered Ecological Community) is present on site in the southern portion of the GWS site. This community has been surveyed and is the subject of a Cumberland Plain Woodland Assessment Report completed by SLR Consulting (Appendix 15). From this report a map was created (Figure 7 in Appendix 15) to delineate the vegetated portion of the site and determine its overall condition status.

Further refinement of this mapping, including additional field work was undertaken by SLR and is contained in Appendix 16. The additional field work included BioBanking plots and determination of the condition of the Cumberland Plain Woodland with reference to the BioBanking condition parameters. This additional work identified that the total area of this community on the site is 13.77ha. Of this, the area of woodland (in various conditions) to be removed by the combined impact of the SSD and rezoning will be approximately 9.5ha.

There are a number of factors to be considered when determining whether the proposed action is likely to have an adverse effect on the extent of this community such that its local occurrence is likely to be placed at risk of extinction. The factors to consider include the following:

Fragmentation of the site

The GWS site is bound by a number of barriers to fauna movement, including Cambridge Avenue to the south, the Main Southern passenger railway, and the Southern Sydney Freight Lines to the west, East Hills Railway Line, which traverses the site in an east-westerly direction dividing the site into north and south parcels of land, Georges River along the eastern side, the landfill, quarry, and recycling operational areas together with the internal roads within the GWS precinct. The site and surrounding lands to the north, east, west and south (within 10km and excluding the south east) are also subject to disturbance as they are urban areas with isolated parcels of vegetative areas in the broader landscape. The land to the south east within 10km is a vast vegetated area and part of the Holsworthy Military Area under ownership of the Commonwealth. These urban and physical barriers reduce the potential movement of small and larger terrestrial (flightless) mammals into and through the Shale Plain Woodland in the southern portion of the site. The more mobile mammal bird and bat species are more likely to have access to the site and may use the site on occasion as part of a larger home range. Larger terrestrial mammals that may occur in the locality are likely to be excluded from much of the study area due to the physical barriers surrounding and within the site, with a major concern being the potential movement of these larger mammals across these barriers potentially leading to fatalities or injuries from cars, trains etc.

Habitat connectivity within the study area appears the greatest within the riparian vegetation associated with Georges River on the eastern side of the site, which maintains connectivity with riparian vegetation to the north and south. This riparian corridor could facilitate the movement of less mobile species, including cover-dependent species, larger terrestrial mammals and arboreal mammals. It is the intention that in conjunction with the proposed development, this connecting strip of riparian vegetation may be rehabilitated including the removal of weeds and the establishment of nesting boxes for use by hollow dependent fauna.

South east of the investigation area to the east of the Georges River is the adjacent Holsworthy Military Area. This site support approximately 18,000 hectares of continuous native vegetation that is part of a larger major contiguous vegetated area of approximately 140,000ha that continues from the site south to between Bowral and Wollongong. The diversity of vegetation communities within the Military Area and beyond includes forests, woodlands, heath and swamp communities, which in turn provide important habitat to locally and regionally occurring, threatened flora and fauna species. Highly mobile fauna species such as birds and some mammals may predominantly reside within the Holsworthy Military Area and utilise the limited resources offered by the study area on a temporary or transient basis.

The overall condition of the woodland

The studies conducted by SLR have determined that there are varying degrees of disturbances to the understorey and groundcover through the CPW area, resulting in areas of 'Very Low', 'Low' and 'Moderate' condition vegetation being mapped on the site. BioBanking Assessment work in Appendix 16 identified that the total area of this community on the site is 13.77ha. Of this, the area of woodland (in various conditions) to be removed by the combined impact of the SSD and rezoning will be approximately 9.5ha. It has been stated by SLR Consulting in their 2013 report that the areas which constitute the CPW community can broadly be described as moderately to highly disturbed, and have been for a considerable period of time.

Previous clearing and continued/historical maintenance of the ground layer

The Glenfield Waste Site has been in single family ownership since the 1800's with the understorey and groundcover being continually maintained for a number of purposes over that period. From aerial photography (Appendix 17) (AHMS 2012) dating back to the 1930's it is clear that the GWS was used for orchards and general farming practices. In photographs dating from the 1950's through to the 1970's it is evident that the woodland portion of the site has had the understorey and groundcover managed. In anecdotal conversations with the landowners regarding the historical management much of the site, including the woodland portion, has been used for grazing of livestock, general agricultural purposes and more recently also managed by slashing. Since the 1980s, under relevant development consents, a large portion of the GWS site has been previously cleared of native vegetation for the purpose of operating as a quarry and waste facility. Vegetation on the GWS site is primarily restricted to the Georges River riparian land and approximately 12.6ha of woodland vegetation located on the southern parcel of land in the Campbelltown LGA. As a result of continual management over the last century the ground layer grass and forb species composition has degraded across much of the site.

Lack of evidence of key fauna species present within the CPW community

In 2006, Eco Logical prepared a preliminary ecological assessment of the GWS with a total of 23 fauna species (birds) recorded with no threatened species observed as part of the survey. Subsequent surveys of the site were conducted by EPS ecologists in 2012, 2013, 2014 and again in 2015. The only threatened species recorded were highly mobile bats that can utilise disturbed habitats. Other species of flora and fauna recorded were those adapted to disturbed habitats. No species requiring large and structurally intact forested habitats were recorded.

Occurrence of this community in the local area

In combination with the vegetation within the Holsworthy Military Area to the south east of the site there are also a number of corridors of vegetation to the south and south-east of the site mapped in OEH SixViewer as CPW community. The GWS may have small areas of mapped 'Low-moderate' condition CPW; however, in the broader landscape this area is generally highly degraded and is unlikely to be preferred habitat considering the corridors of suitable vegetation in the broader landscape.

The GWS contains a small portion of Shale Plain Woodland which has been documented throughout this report as being in fairly low condition and also partially isolated and fragmented from larger patches of this community type in the local area, however this patch of vegetation does form part of a larger contiguous area of the overall ecological community and there is the potential for the movement of flora and fauna species, and therefore the exchange of genetic material across the boundary of the study site.

In determining the risk of extinction to the local occurrence of this CEEC, the proposed action is not likely to have an adverse effect on the extent of this community such that its local occurrence is likely to be placed at risk of extinction in the short term due to the direct actions of clearing this vegetation.

However, it cannot be assumed that the proposed actions will not potentially contribute to the extinction of this community in the long term through any number of indirect actions (beyond the control of this development) in the years to come. The Cumberland Plain Woodland Recovery Plan has been developed as a strategy to effectively manage those areas of the woodland that are considered of greatest significance and relevance to the continued existence of this community within the locality and broader Sydney Basin Bioregion. The site does not form part of the Cumberland Plain Woodland Recovery Plan Priority Conservation Areas.

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

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

In relation to the ecological community present on site, being Shale Plains Woodland the area of woodland to be removed will be approximately 9.5ha (2.58 low condition and 6.91 moderate to good condition). The following table and three figures below provide quantitative information that shows how the Shale Plains Woodland relates to representative CPW community in the wider locality. Within a radius of 2km from the GWS site Shale Plains Woodland comprises 54.6ha with 9.5ha of this on the GWS and proposed for removal which equates to 17% of the total area of this community within 2km radius and 45.1ha remaining within this area (Figure 1).

Within a radius of 5km there is a total of 256.3ha of Shale Plains Woodland and removal of the required 9.5 ha for the proposed development equates to a total of 3.7% of the total area of this community with an area of 246.5ha then remaining within this broader locality (Figure 2). The figures have not been accurately calculated for the 10km radius as shown in Figure 3; however from calculated estimates it is determined that the total area of Shale Plains Woodland is approximately double the area of hectares as calculated for the 5km radius.

Table 1: Hectares and % Shale Plain Woodland in the GWS Locality

	2km		5km	
	Total area (ha)	**% GWS**	**Total area (ha)**	**% GWS**
Shale Plains Woodland	54.6		256.3	
Less GWS	9.5	17%	9.5	3.7%
Residual	**45.1 ha**		**246.8 ha**	

Further consultation is required with Local Government, DoPI and OEH to determine possible impacts and offsetting pathways in order to minimise the impact to this community.

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

The existing patch of vegetation on the GWS is highly degraded and already partially isolated and fragmented from larger tracts of vegetation within the locality. The removal of this patch of Shale Plains Woodland vegetation will increase fragmentation within the site itself and the areas to be retained will be smaller and more spread out than is currently the case.

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

This patch of vegetation is highly degraded and greatly modified with the understorey vegetation having been managed through agricultural practices such as grazing, and then more recently also by slashing and grazing for primarily bush fire protection. This patch of woodland vegetation is considered highly disturbed and partially fragmented. Generally it is considered that the woodland to be impacted on the site is not highly important to the long-term survival of this community in the locality.

Fig

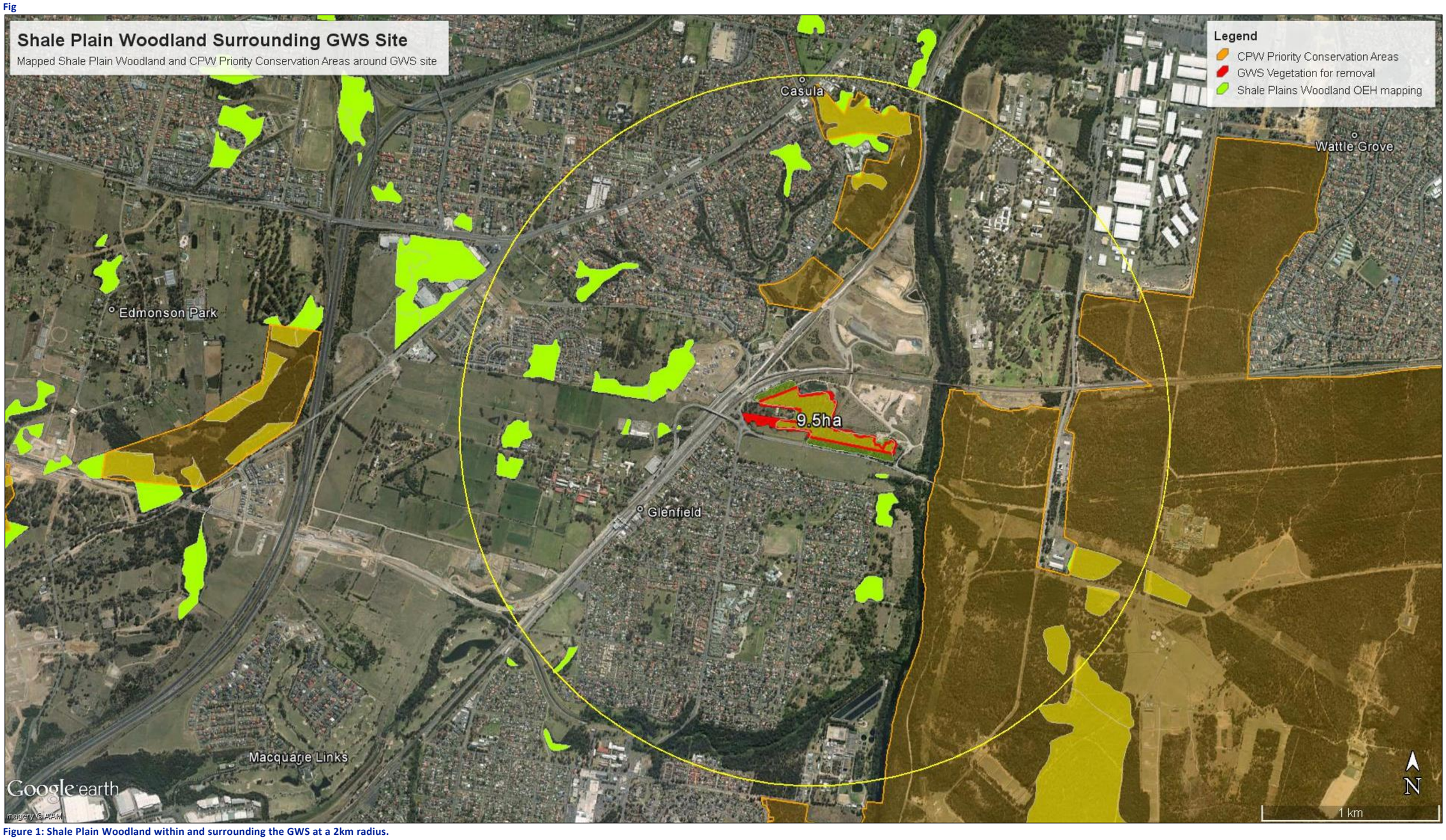

Figure 1: Shale Plain Woodland within and surrounding the GWS at a 2km radius.

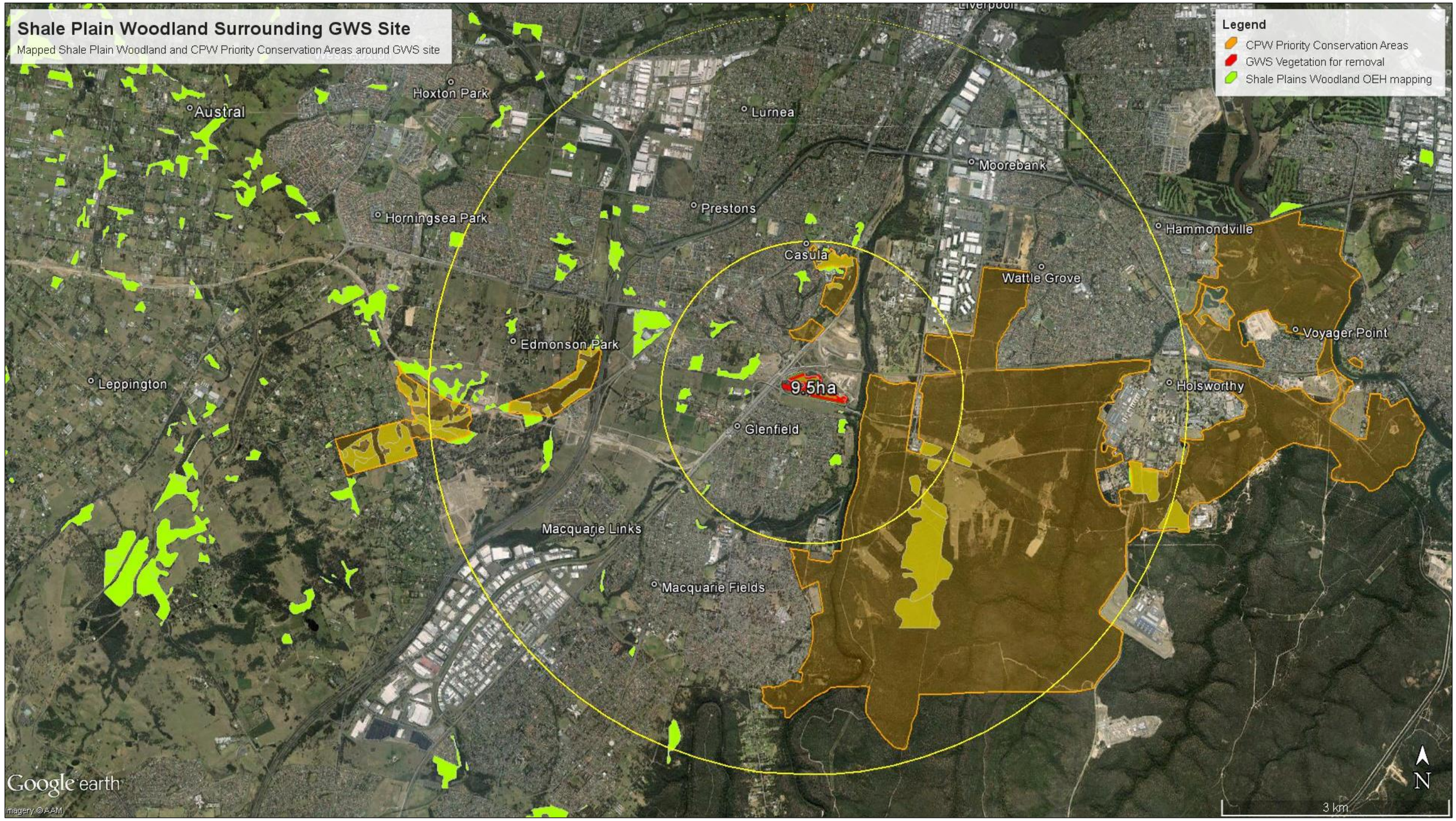

Figure 2: Shale Plain Woodland within and surrounding the GWS at a 5km radius.

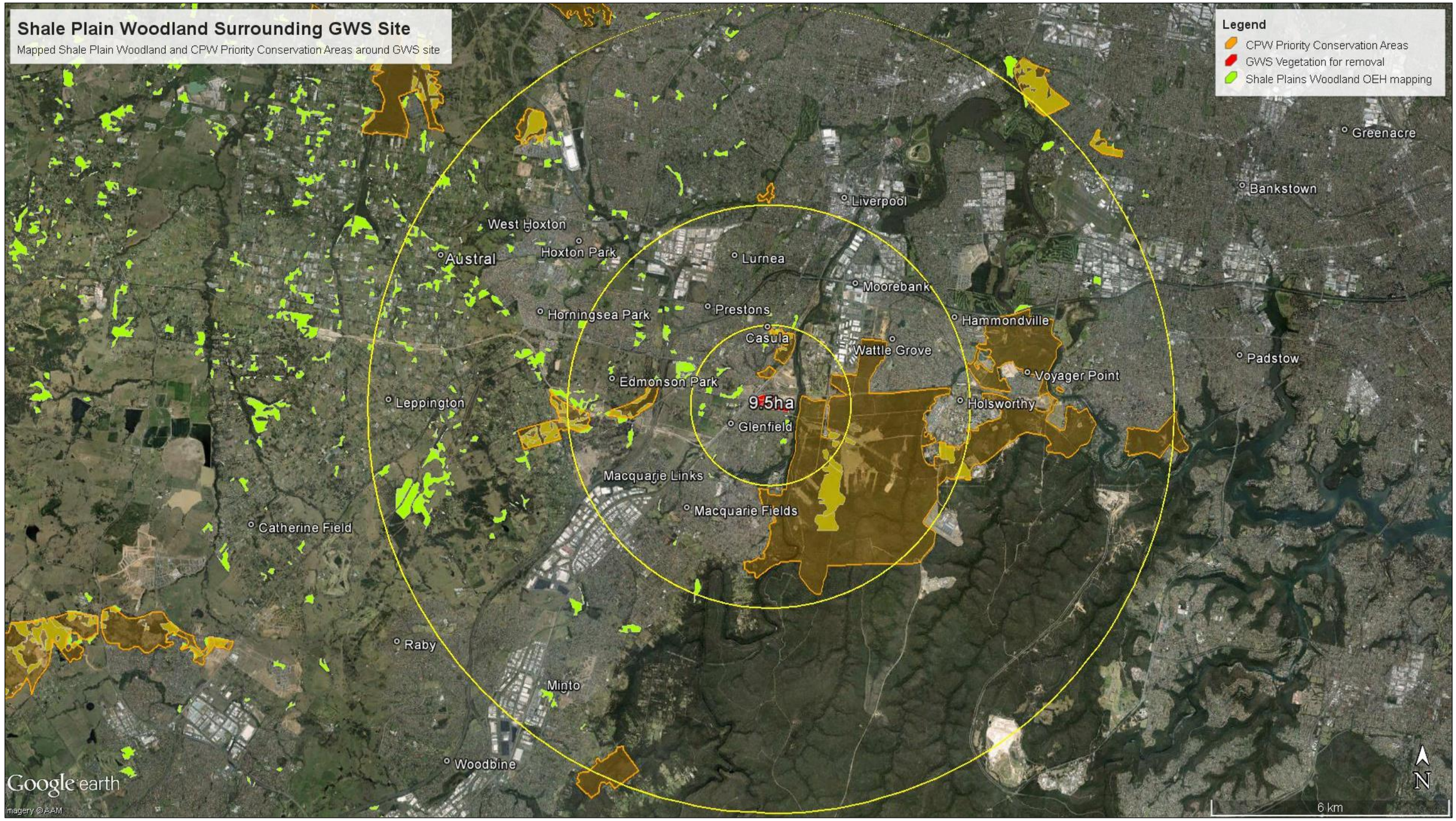

Figure 3: Shale Plain Woodland within and surrounding the GWS at a 10km radius.

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

The subject site is not located near any declared areas of critical habitat.

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

There is a recovery plan in place for the Cumberland Plain Woodland, of which Shale Plain Woodland forms part. It is noted that DECCW (2010) in the *Cumberland Plain Recovery Plan* excluded areas that were "*zoned for residential and industrial purposes*", as well as areas "*that have been identified for future urban growth*". This is largely because of the difficulties in rezoning these areas for conservation purposes - due to their "*higher land values and stronger development pressures*". This is of particular relevance for the GWS site.

The proposal will remove an area of Cumberland Plain Woodland and as such this contradicts recovery strategies for this CEEC. However, this site is highly degraded and partially fragmented.

The recovery plan for the Cumberland Plain Woodland will play a role in determining the offsetting options to mitigate potential impacts to this community and will be used in discussions with Local Government, DoPI and OEH.

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

The potential for key threatening processes (KTPs) to impact the CEEC considered likely to occur on site have been considered in Appendix 5 above. The proposal may increase the operation of the KTP "Clearing of vegetation", "Removal of dead wood and dead trees" and "Loss of Hollow-bearing Trees". The proposal involves the intention to clear native vegetation and as such this is considered a KTP, however, the proposed intension is to remove a generally small portion of already highly degraded, fragmented and isolated native vegetation and as such this is consider a minor contribution to this KTP.

Conclusion

It is considered that pursuant to the seven part test criteria that the removal of the 9.5ha of vegetation in the GWS is unlikely to result in a significant impact to:

- result in a likely adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

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

However, the proposed works have the potential to result in an indirect impact over the long term by contributing to the overall degradation of the wider CPW community. The level of indirect impact is difficult to quantify and the temporal scale for this impact is also unknown.

Therefore, it is recommended that some form of biodiversity offset is proposed for the local area to ameliorate the indirect impact over the long term. It is recommended that a combination of locally orientated biodiversity measures be investigated.

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

No endangered populations were identified during the site surveys, nor are they considered likely to occur within the subject site.

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

> ***(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or***
> ***(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction***

The River-Flat Forest ecological community occurs alongside the Georges River. It is not proposed that this ecological community will be detrimentally affected by the proposal. In fact, it is proposed that this area of ecological community be protected in perpetuity as part of future biodiversity offset outcomes for the GWS site development.

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

> ***(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and***
> ***(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and***
> ***(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality***

The River-Flat Forest ecological community occurs alongside the Georges River. It is not proposed that this ecological community will be detrimentally affected by the proposal. In fact, it is proposed that this area of ecological community be protected in perpetuity as part of future biodiversity offset outcomes for the GWS site development. No significant fragmentation or isolation of this ecological community is considered likely to occur.

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

The subject site is not located near any declared areas of critical habitat.

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

Recovery strategies for threatened communities generally outlined by OEH will play a role in determining the offsetting options to mitigate potential impacts to this community and will be used in discussions with Local Government, DoPI and OEH.

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

The potential of key threatening processes (KTPs) to impact the threatened species and ecological communities considered likely to occur within/on the site have been considered in Appendix 5 above. Future management of issues such as weeds as part of future offset outcomes are likely to reduce KTP's impacting this ecological community.

Koala

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

There are recognised Koala feed trees present on site including *Eucalyptus tereticornis*. However, there was no evidence of scats or scratchings on trees. The site is bound by a number of potential barriers to larger (flightless) mammal movement including Cambridge Avenue and Moorebank Avenue, the main south passenger and Southern Sydney Freight railway lines to the west, the East Hills railway line traversing the site and significant residential sprawl surrounding the GWS site. The site is also bounded by a combination of both chain mesh fencing and colourbond fencing that, in combination with the above roads, rail and residential areas, would severely limit Koala movement into the site. The site is also exposed, on a daily basis, to considerable anthropogenic disturbance from the operation of the waste facility including noise and dust from truck movement. The site is considered highly degraded and partially fragmented from larger tracts of vegetation that may be used by this species as part of a larger home range.

The proposed development will remove only a small portion of potential habitat available to the species and is not considered a suitable/safe site for the presence of Koalas. As such the proposal is not considered likely to have an adverse effect on the life cycle of *P. cinereus* such that a viable local population will be placed at risk of extinction.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

No endangered populations were identified during the site surveys, nor are they considered likely to occur within the subject site.

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

> ***(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or***
>
> ***(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction***

Not applicable.

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

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

Approximately 9.5ha of potential habitat will be affected.

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

The existing patch of vegetation on the GWS site is highly degraded and already isolated and fragmented from larger tracts of vegetation within the area. The removal of this small patch of Shale Plain Woodland vegetation will not further isolate or fragment any patch of vegetation for this species.

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

The habitat within the site represents potential foraging/nesting habitat for highly mobile and also less mobile common and threatened species as part of larger home ranges. The site is already highly degraded and partially fragmented. There are risks associated with larger mammal species accessing the site including impacts from cars using the busy Cambridge Avenue and trains using the railway lines running to the west and through the site. The site is also currently bounded on all sides by both chain/wire topped and colour bond fencing. The road and rail, and the addition of anthropogenic disturbance throughout the site are a limiting factor for safe habitat and possible breeding on site. It is not considered likely that the long term survival of this species will be put at risk with the removal of this vegetation.

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

The subject site is not located near any declared areas of critical habitat.

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

There is a Recovery Plan in place for the Koala. The proposal will remove a small area of native vegetation and as such this contradicts recovery. However, this site is highly degraded and fragmented and through numerous field surveys it has been concluded that presence of this species on the site is unlikely.

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

The potential of key threatening processes (KTPs) to impact the threatened species and ecological communities considered likely to occur within/on the site have been considered in Appendix 5 above. The proposal may increase the operation of the KTP “Clearing of vegetation”, relevant to this species.

Notwithstanding that the proposal is intended on clearing native vegetation and as such this is considered a KTP, however, the proposal involves the intention to clear native vegetation, and as such this is considered a KTP, the proposal is limited to the removal of a small portion of already highly degraded, fragmented and isolated native vegetation. As such this proposal is considered a very small contribution to this KTP.

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

L. aurea may occur within the subject site on occasion as part of a larger home range. However the site is subject to considerable anthropogenic disturbance from the operation of the waste facility and considered highly degraded and partially fragmented from larger tracts of vegetation that may be used by this species as part of a larger home range. There is the potential for species movement on and off the site through possible vehicular transportation, however this is unlikely. In relation to other threatened species and movement on and off the site, this species is not limited by the barrier of the Georges River and as such movement of genetic material is possible. The area around the artificial dam, deemed potential suitable habitat is small in size and is unlikely to provide enough habitat for the presence/ or sustained reproduction of this species. This species was not identified during the targeted diurnal or nocturnal surveys, which were undertaken in accordance with survey guidelines and it is considered unlikely that it actually occurs on the site. The proposal is not considered likely to have an adverse effect on the life cycle of *L. aurea* such that a viable local population will be placed at risk of extinction.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

No endangered populations were identified during the site surveys, nor are they considered likely to occur within the subject site.

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

> ***(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or***
>
> ***(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction***

Not applicable.

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

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

The small dam will be affected by the GWS projects.

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

The existing patch of vegetation on the GWS site is highly degraded and already isolated and fragmented from larger tracts of vegetation within the area. The removal of this small patch of Shale Plain Woodland vegetation and the adjoining dam will not further isolate or fragment any patch of vegetation.

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

The site is already highly degraded and partially fragmented, and the aquatic habitat is considered to be low quality for this species. Only 5% of the fringing vegetation is considered suitable for this species. It is not considered likely that the long term survival of this species will be put at risk with the removal of the habitat on the site.

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

The subject site is not located near any declared areas of critical habitat.

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

There is a draft Recovery Plan in place for the Green and Golden Bell Frog. The proposal will remove a small area of habitat and as such this contradicts recovery strategies for this threatened species. However, this site is highly degraded and fragmented and through numerous field surveys it has been concluded that presence of the species on the site is unlikely.

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

The potential of key threatening processes (KTPs) to impact the threatened species and ecological communities considered likely to occur within/on the site have been considered in Appendix 5 above. In relation to this species no significant exacerbation of KTP's is considered likely.

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

M. corneovirens may occur within the subject site on occasion as part of a larger home range. However the site is subject to considerable anthropogenic disturbance and considered highly degraded and partially fragmented from larger tracts of vegetation that may be used by this species as part of a larger home range. There is the potential for species movement on and off the site through possible vehicular transportation, however this is highly unlikely. This species was not identified during the targeted diurnal or nocturnal surveys. No evidence of egg clutches or empty shells were observed in areas considered potential habitat including under logs, loose bark or old tyres and sheet iron. The proposal is not considered likely to have an adverse effect on the life cycle of *M. corneovirens* such that a viable local population will be placed at risk of extinction.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

No endangered populations were identified during the site surveys, nor are they considered likely to occur within the subject site.

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

> ***(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or***
>
> ***(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction***

Not applicable.

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

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

Approximately 9.5ha of potential habitat will be affected.

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

The existing patch of vegetation on the GWS site is highly degraded and already isolated and fragmented from larger tracts of vegetation within the area. The remaining patches will be further isolated and fragmened from other areas of Cumberland Plain Woodland, although the current patch is quite isolated already.

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

The site is already highly degraded and partially fragmented. Despite targeted searches, no evidence of the occurrence of this species was recorded and this is likely due to the historic understorey disturbance that has occurred on an ongoing basis. It is not considered likely that the long term survival of this species will be put at risk with the removal of this vegetation.

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

The subject site is not located near any declared areas of critical habitat.

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

The proposal will remove a small area of native vegetation and as such this contradicts recovery strategies for threatened species. However, this site is highly degraded and fragmented and through numerous field surveys it has been concluded that presence of this species on the site is unlikely.

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

The potential of key threatening processes (KTPs) to impact the threatened species and ecological communities considered likely to occur within/on the site have been considered in Appendix 5 above. The proposal may increase the operation of the relevant KTP "Clearing of vegetation" and "Removal of dead wood and dead trees".

Notwithstanding that the proposal is intended on clearing native vegetation and as such this is considered a KTP, however, the proposal involves the intention to clear native vegetation, and as such this is considered a KTP, the proposal is limited to the removal of a small portion of already highly degraded, fragmented and isolated native vegetation. As such this proposal is considered a small contribution to this KTP.

Grey-headed Flying Fox

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Single Grey-headed Flying Foxes were recorded in the woodland adjoining the dam in February 2015 on two nights. The woodland habitat is expected to comprise a small proportion of available foraging habitat in the expansive foraging habitats in the locality and region. In addition, the River-Flat Forest will be retained, which provides foraging habitat for this species. It is considered unlikely that the projects would result in a viable local population being placed at risk of extinction.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

No endangered populations were identified during the site surveys, nor are they considered likely to occur within the subject site.

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

> ***(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or***
>
> ***(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction***

Not applicable.

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

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

Approximately 9.5ha of potential habitat will be affected.

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

The existing patch of vegetation on the GWS site is highly degraded and already isolated and fragmented from larger tracts of vegetation within the area. The removal of this patch will increase fragmentation within the site itself and the areas to be retained will be smaller and more spread out than is currently the case.

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

The habitat within the site represents potential foraging/nesting habitat for this highly mobile threatened species as part of larger home ranges. Expansive foraging habitat existing in the locality. The site is already highly degraded and partially fragmented. It is not considered likely that the long term survival of this species will be put at risk with the removal of this vegetation.

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

The subject site is not located near any declared areas of critical habitat.

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

The proposal will remove a small area of native vegetation and as such this contradicts recovery strategies for this species.

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

The potential of key threatening processes (KTPs) to impact the threatened species and ecological communities considered likely to occur within/on the site have been considered in Appendix 5 above. The proposal may increase the operation of the relevant KTP “Clearing of vegetation” to a minor degree.

Hollow/shelter dependent microbats

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Yellow-bellied Sheathtail-bat, East-coast Freetail-bat, Greater Broad-nosed Bat, Eastern False Pipistrelle, Little Bentwing bat, Eastern Bentwing bat and Large-footed myotis were considered likely to forage throughout the site on some occasion. Of these, Yellow-bellied Sheathtail-bat, East-coast Freetail-bat, Little Bentwing bat and Eastern Bentwing bat were recorded foraging within the site.

Hollow-bearing trees with small to medium sized hollows and cracks are present within the subject site. The hollows may be used at some point by these species (particularly The Yellow-bellied Sheathtail-bat and East-coast Freetail-bat) for shelter and breeding.

The clearing of the site is not considered likely to have an adverse effect on the life cycles of these hollow-dependent species such that a viable local population will be placed at risk of extinction. The nearby extensive areas of forest vegetation are likely to contain similar suitable roosting habitat. However it is recommended that an ecologist or Fauna Spotter-catcher be present to supervise vegetation removal within the subject site as a precautionary approach to reduce the risk of harm to fauna. This should include pre-clearance inspections of the tree hollows using a cherry picker. A 2:1 replacement ratio is also to be applied to install nest boxes suitable for these species.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

No endangered populations were identified during the site surveys, nor are they considered likely to occur within the subject site.

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

> ***(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or***
>
> ***(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction***

Not applicable.

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

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

Approximately 9.5ha of known foraging habitat will be affected. This includes approximately 109 hollows that may be suitable for roosting by these species.

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

The existing patch of vegetation on the GWS site is highly degraded and already isolated and fragmented from larger tracts of vegetation within the area. The removal of this patch of Shale Plains Woodland vegetation will increase fragmentation within the site itself and the areas to be retained will be smaller and more spread out than is currently the case.

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

The habitat within the site represents potential foraging/nesting habitat for highly mobile microbats as part of larger home ranges.

The site is already highly degraded and partially fragmented, however there is a high density of tree hollow suitable for these species to roost in. While roosting habitat is not likely to be a limiting factor in the locality, due to the extensive areas of forest habitat in the Holsworthy area, these hollows are still of value for these species locally. Hence nest boxes / replacement hollows at a ratio of 2:1 is proposed to ensure roosting habitat remains available in the immediate locality.

It is not considered likely that the long term survival of these species will be put at risk with the removal of this vegetation.

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

The subject site is not located near any declared areas of critical habitat.

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

The proposal will remove a small area of native vegetation and as such this contradicts recovery strategies for threatened species. However, this site is highly degraded and fragmented and through numerous field surveys it has been concluded that a significant impact upon these species is unlikely.

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

The potential of key threatening processes (KTPs) to impact the threatened species and ecological communities considered likely to occur within/on the site have been considered in Appendix 5 above. The proposal may increase the operation of the KTP "Clearing of vegetation", "Removal of dead wood and dead trees" and "Loss of Hollow-bearing Trees".

Notwithstanding that the proposal is intended on clearing native vegetation and as such this is considered a KTP, however, the proposal involves the intention to clear native vegetation, and as such this is considered a KTP, the proposal is limited to the removal of a small portion of already highly degraded, fragmented and isolated native vegetation. As such this proposal is considered a small contribution to this KTP.

The woodland trees on the site have been surveyed on a number of occasions with a hollow bearing tree assessment having occurred in 2012 and further investigations and observations made in surveys in 2013 and 2014. From this it has been documented that the majority of hollow bearing trees (containing dead limbs) were not being used to a significant extent with only two hollows possibly providing nesting and habitat to Galahs and one hollow providing habitat to European bees. The impact of the proposed development and the removal of hollow bearing trees and dead limbs are considered to be a very small contribution to these two KTP's.

Pimelea spicata

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The site is considered to sustain quite small areas of moderate and low quality Shale Plain Woodland which forms part of this flora species likely habitat. However the site is generally of a poor quality in terms of floristic composition.

This species was the subject of a specific targeted random meander search at a time of year in which this species was known to be flowering at reference sites in close proximity to the GWS site. This species was not identified during this targeted survey.

As the site is highly degraded and fragmented with a high level of anthropogenic disturbance it is considered unlikely that this species is present at this site. The clearing of the site is not considered likely to have an adverse effect on the life cycles of *P. spicata* such that a viable local population will be placed at risk of extinction.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

No endangered populations were identified during the site surveys, nor are they considered likely to occur within the subject site.

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

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

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

Not applicable.

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

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

Approximately 9.5ha of low quality potential habitat will be affected.

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

The existing patch of vegetation on the GWS site is highly degraded and already isolated and fragmented from larger tracts of vegetation within the area. The remaining patch of EEC will be further isolated and fragmented from other areas of Cumberland Plain Woodland, although the current patch is quite isolated already.

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

The site is already highly degraded and partially fragmented. The habitat is considered to be poor for this species due to the regular underscrubbing that is permitted to occur within the woodland. It is not considered likely that the long term survival this threatened species will be put at risk with the removal of this vegetation.

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

The subject site is not located near any declared areas of critical habitat.

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

The proposal will remove a small area of native vegetation and as such this contradicts recovery strategies for this species. However, this site is highly degraded and fragmented and through numerous field surveys it has been concluded that presence of this species on the site is unlikely.

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

The potential of key threatening processes (KTPs) to impact the threatened species and ecological communities considered likely to occur within/on the site have been considered in Appendix 5 above. The proposal may increase the operation of the relevant KTP "Clearing of vegetation".

Notwithstanding that the proposal is intended on clearing native vegetation and as such this is considered a KTP, however, the proposal involves the intention to clear native vegetation, and as such this is considered a KTP, the proposal is limited to the removal of a small portion of already highly degraded, fragmented and isolated native vegetation. As such this proposal is considered a small contribution to this KTP.

Appendix 8

Pimelea spicata Report

EPS

THREATENED SPECIES SURVEY REPORT

Pimelea spicata

ENVIRONMENTAL PROPERTY SERVICES

11009
September 2014

EXECUTIVE SUMMARY

This report outlines the survey assessment requirements for determining the presence of a particular threatened flora species at the Glenfield Waste Services (GWS) site undertaken in December 2013. The objective of the survey was to determine the presence of the flora species *Pimelea spicata* (Spiked-rice flower) listed as endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and as endangered in the schedules of the NSW *Threatened Species Conservation Act 1995*.

This species is endemic to NSW with a relatively scattered distribution occurring in two disjunct areas, the Cumberland Plain (western Sydney) and coastal Illawarra (south of Sydney) (DEC 2005) in the Sydney Basin Bioregion.

The vegetation within the GWS site has been subject to extensive and in some places, ongoing disturbances and is highly modified. Through previous ecological reports the vegetation present within this portion of the site has been surveyed and determined to consist primarily of remnant trees of *Eucalyptus moluccana* and to a lesser extent *Eucalyptus tereticornis* and *Eucalytpus crebra* being of one age class and one stratum. The site has been regularly mown, slashed and managed such that a predominantly cleared understorey occurred across the investigation area.

A targeted survey was undertaken for this species during optimal climatic and seasonal conditions with surveyors following the required methodology as outlined in the NSW Office of Environment and Heritage guidelines. The survey effort has been documented and the results and conclusions are outlined further throughout this report.

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Appendix

1 INTRODUCTION

1.1 Background

This report has been prepared by Environmental Property Services (EPS) in response to the requirements outlined in a letter received from the Office of Environment and Heritage (OEH) department on the 8th November 2013. OEH had requested that a targeted survey be conducted for the threatened species *Pimelea spicata* in order to determine its presence within the southern parcel of land at the Glenfield site. A species profile can be found in Appendix 1 which gives a description of its morphology and habitat preferences.

1.2 Study Area

The study area consists of the southern parcel of land within the Glenfield site with surveys occurring primarily within what has been determined by the EPS ecologist as being suitable habitat for this species. A map showing the location and area surveyed can be seen in Figure 2-1.

Table 1-1: Summary of the southern parcel of land details

Summary of southern parcel of land details	
Lot and Deposited Plans	Lot 91 DP1155962; Lot 3 DP735524; Lot 3 DP 736881; Lot 1 DP113201; Lot 2 DP 333578
Address	2 Cambridge Avenue, Glenfield NSW 2167
Grid Reference	Zone 56, 306519E 6239570N
Local Government Area	Campbelltown
Catchment Management	Sydney Metropolitan
Primary existing Land Use	Recycling of waste & rail and electricity infrastructure
Current Zoning	Zone 1(a) Rural A Zone, Zone 6(b) Regional Open Space Zone & Zone & 5(b) Special Uses Arterial Roads Zone

1.3 Aims and Objectives

The aim of this assessment was to determine the presence of the threatened flora species *Pimelea spicata* using the methodology outlined in the Threatened Biodiversity Survey and Assessment Guidelines for Developments and Activities (Working Draft) (DEC 2004) and the Department of Environment & Climate Change NSW threatened species assessment guidelines August 2007.

2 METHODOLOGY

2.1 Methodology

2.1.1 Targeted Searches

All methodology has been conducted in accordance with the Threatened Biodiversity Survey and Assessment Guidelines for Developments and Activities (Working Draft) (DEC 2004). In order to determine the presence/absence of this species on the site, the random meander technique and by systematically walking along designated transects was used for the southern parcel of land at the Glenfield site (see Figure 2-1). The Environmental Impact Assessment Guidelines – *Pimelea spicata* (NPWS, 2004) state that *P. spicata* needs to be the subject of a specific targeted survey using the random meander method, favouring suitable habitat areas with a survey effort of at least one hour per hectare of suitable habitat.

The area determined suitable habitat was estimated to be approximately 12 hectares in size. Survey efforts included one hour of targeted surveys per hectare of suitable habitat; therefore surveys occurred for 6 hours per person totalling 12 hours, on the 17th December 2013. Two surveyors traversed the site each holding a handheld GPS in order to show the tracks travelled for replication purposes and for any recordings if the species were to be identified on site.

2.1.2 Reference Site

To comply with the OEH requirements a number of enquiries were made regarding known reference sites for this particular species. Contact was made with two employees from the Australian Botanic Gardens, Mt Annan. Both were able to provide information that the species was flowering in a number of locations in Penrith and in the woodlands at Mt Annan at the time of inspection. It was also discussed that at that time, the climatic and seasonal conditions were optimal for flowering to be occurring. Contact was also made with a Bushland Officer from Camden City Council and he also confirmed that the species was flowering at a site within the Camden Golf Course. A field meeting was set up and EPS staff were shown the location of the site and able to visually examine this species in flower on the 17th December 2013.

2.1.3 Survey Conditions

Table 2-1: Climate data

Date	Temp	Wind	Cloud	Rain
17 December 2013	19°C - 29°C	Still	Clear	None

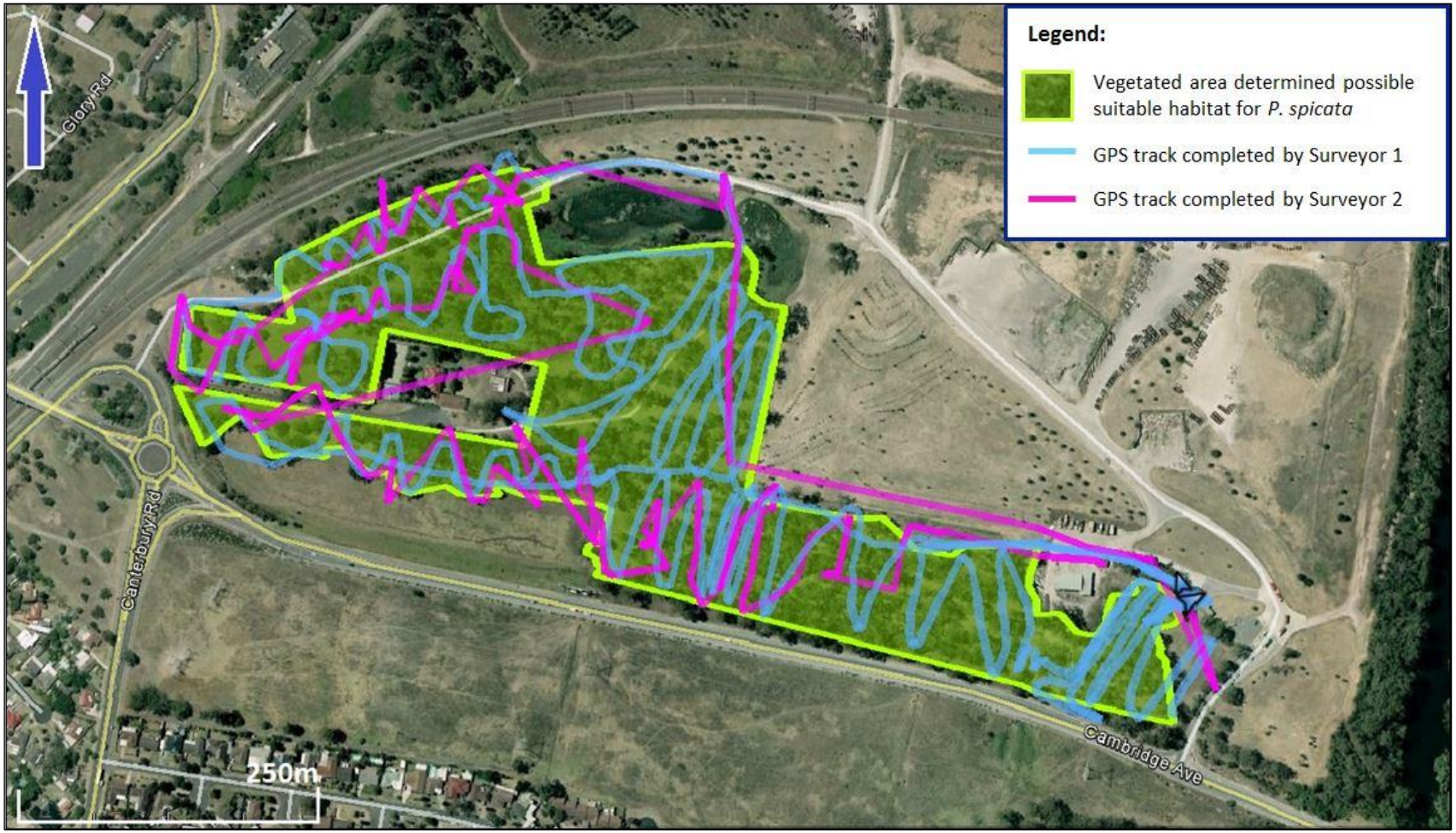


Figure 2-1: Field survey effort for *Pimelea spicata* using the Random Meander Technique.

3 RESULTS & CONCLUSION

The threatened species *Pimelea spicata* was not observed in any of the areas deemed suitable habitat during the field survey. The survey effort has been in accordance with the Methods outlined in the Environmental Impact Assessment Guidelines for *Pimelea spicata* and the 2004 draft OEH guidelines. From this it is concluded that the habitat in the southern parcel of the Glenfield site is not suitable for the presence of this species.

4 REFERENCES

Department of Environment and Conservation (2005) *Pimelea spicata* R.Br. Recovery Plan. Department of Environment and Conservation (NSW), Hurstville NSW.

Department of Environment and Conservation (2004) Environmental Impact Assessment Guidelines – *Pimelea spicata* R.Br. National Parks and Wildlife Service (NPWS), Hurstville NSW.

Department of Environment & Climate Change NSW (2007) Threatened species assessment guidelines – The assessment of significance, Sydney NSW.

Appendix 1

Pimelea spicata - Profile

Pimelea spicata – profile

Scientific name: *Pimelea spicata*
Conservation status in NSW: Endangered
Commonwealth status: Endangered
Profile last updated: 22 Jul 2013

Description

The Spiked Rice-flower is a shrub to 50 cm tall that may be erect or somewhat spreading in habit. The leaves are opposite and elliptical, to 20 mm long by 8 mm wide, and usually held outwards from the stem. The white, pink-tinged flowers are tubular, to 10 mm long, with four spreading petals. They may appear at any time of the year, but are mostly seen in summer as they are probably related to rainfall. Inflorescences start as dense clusters (like most rice flowers) and then extend along an elongating stem as the inflorescences age.

Distribution

Once widespread on the Cumberland Plain, the Spiked Rice-flower occurs in two disjunct areas; the Cumberland Plain (Marayong and Prospect Reservoir south to Narellan and Douglas Park) and the Illawarra (Landsdowne to Shellharbour to northern Kiama).

Habitat and ecology

- In both the Cumberland Plain and Illawarra environments this species is found on well-structured clay soils.
- On the Cumberland Plain sites it is associated with Grey Box communities (particularly Cumberland Plain Woodland variants and Moist Shale Woodland) and in areas of ironbark.
- The co-occurring species in the Cumberland Plain sites are grey box (*Eucalyptus moluccana*), forest red gum (*E. tereticornis*) and narrow-leaved ironbark (*E. crebra*). Blackthorn (*Bursaria spinosa*) is often present at sites (and may be important in protection from grazing) and kangaroo grass (*Themeda australis*) is usually present in the groundcover (also indicative of a less intense grazing history).
- In the coastal Illawarra it occurs commonly in Coast Banksia open woodland with a better developed shrub and grass understorey. Coastal headlands and hilltops are the favoured sites. The IIllawarra populations usually occur in one of two communities a woodland or a coastal grassland. Woodland sites are dominated by forest red gum (*E. tereticornis*) and stringybark (*E. eugenioides*), with a groundcover dominated by kangaroo grass (*Themeda australis*) and matrush (*Lomandra longifolia*). The grassland sites are dominated by kangaroo grass (*Themeda australis*) and matrush (*Lomandra longifolia*), with blady grass (*Imperata cylindrica*). A shrubby layer, where present, is dominated by coastal wattle (*Acacia sophorae*) and coast rosemary (*Westringia fruticosa*) with coast banksia (*Banksia integrifolia*).
- Mature plants spread over short distances through underground rhizomes, and this can assist them to recover from disturbances like fire and irregular grazing. However, the age plants must be, and what proportion recover, is largely unknown.
- Flowers may be self-pollinating, although fruit production is variable. Fruit are not dispersed well, with most seedlings germinating close to the adult (within 30cm or so according to P. Hogbin). A soil seedbank develops and is maintained in the presence of a suitable disturbance regime.

Appendix 9

Flora Recorded During Field Surveys

Family	Scientific Name	Common Name	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Dams	Soak	RM
Acanthaceae	*Brunoniella australis* PD9,PD10,PD28,PD29	Blue Trumpet	2	1									
Adiantaceae	*Cheilanthes sieberi* subsp. *sieberi* C9,PD10,PD28,PD29	Poison Rock Fern	1										
Amaranthaceae	*Alternanthera denticulata*	Lesser Joyweed										X	
Apiaceae	*Cyclospermum leptophyllum*	Slender Celery								1			
Apocynaceae	*Araujia sericifera*	Moth Vine	1		1		1	1	1				
Asparagaceae	*Asparagus asparagoides*	Bridal Creeper						2		2			
Asteraceae	*Bidens pilosa*	Cobbler's Pegs	1		2		2	2	2		X		
Asteraceae	*Calotis lappulacea*	-		1						2			
Asteraceae	*Chondrilla juncea*	Skeleton Weed		1	1							X	
Asteraceae	*Cirsium vulgare*	Spear Thistle	2	2	2	2		1	2	2			
Asteraceae	*Conyza* sp.	-		1						1			
Asteraceae	*Coronidium scorpioides*	-	1										
Asteraceae	*Cotula australis*	-		3			2						
Asteraceae	*Cymbonotus lawsonianus* PD10	Bears-ear								1			
Asteraceae	*Hypochaeris glabra*	Smooth Catsear	2	4b			3	2		2			
Asteraceae	*Senecio madagascariensis*	Fireweed	2	3	3	2	2		3	2		X	
Asteraceae	*Soliva sessilis*	Jojo	2			2							
Asteraceae	*Sonchus oleraceus*	Common Sowthistle	2	2	3	1	2	1	3	2			
Asteraceae	*Taraxacum officinale*	Dandelion	2		2	2	3		2	2			
Asteraceae	*Vittadinia cuneata* PD29	Fuzzweed		1									
Asteraceae	*Vittadinia muelleri*	-	1										
Brassicaceae	*Capsella bursa-pastoris*	Shepherds purse					1						
Brassicaceae	*Sisymbrium officinale*	Hedge Mustard											X
Caryophyllaceae	*Cerastium glomeratum*	Mouse-ear Chickweed	2	2			1	1	2				
Caryophyllaceae	*Paronychia brasiliana*	Brazilian Whitlow					4b						
Casuarinaceae	*Casuarina cunninghamiana*	River Oak											X
Casuarinaceae	*Casuarina glauca*	Swamp Oak											X
Crassulaceae	*Bryophyllum delagoense*	Mother-of-millions									X		
Chenopodiaceae	*Einadia hastata* PD10,PD28,PD29	Berry Saltbush	1										
Chenopodiaceae	*Einadia polygonoides* PD9,PD29	-					4b			3			
Chenopodiaceae	*Einadia trigonos* subsp. *stellulata* PD9,PD28,PD29	Fishweed	1				2	2					
Clusiaceae	*Hypericum japonicum*	-							2				
Convolvulaceae	*Dichondra repens* PD9,PD10,PD28,PD29	Kidney Weed	3	3	2	1	2	2	2	3			

Family	Scientific Name	Common Name	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Dams	Soak	RM
Cyperaceae	*Carex inversa* PD9,PD28,PD29	-						2	2				
Cyperaceae	*Cyperus gracilis* PD9,PD28,PD29	-	2							2			
Cyperaceae	*Cyperus congestus*	-										X	
Euphorbiaceae	*Chamaesyce drummondii*	Caustic Weed								1			
Fabaceae	*Glycine microphylla* PD9,PD10,PD28,PD29	-	2			1	2	2	1	1			
Fabaceae	*Medicago* sp.	Medic					3						
Fabaceae	*Trifolium repens*	White Clover				2							
Fumariaceae	*Fumaria bastardii*	Bastards Fumitory					2			2			
Geraniaceae	*Geranium solanderi* var. *solanderi* PD9	Native Geranium							4b				
Juncaceae	*Juncus subsecundus*	-									X	X	
Lamiaceae	*Plectranthus parviflorus* PD28	Cockspur Flower						1					
Loranthaceae	*Amyema gaudichaudii* PD29	-											X
Malvaceae	*Modiola caroliniana*	Red-flowered Mallow	1		1		2		2	1			
Malvaceae	*Sida rhombifolia*	Paddy's Lucerne	1	1	1	1	2	2	2	1		X	
Mimosaceae	*Acacia decurrens* PD29	Black Wattle									X		
Myrtaceae	*Angophora subvelutina* U9,U10PD29	-							4b				
Myrtaceae	*Eucalyptus crebra* U9,PD10,PD28,PD29	Narrow-leaved Ironbark				4b							
Myrtaceae	*Eucalyptus moluccana* PD9,PD10,PD28,PD29	Grey Box	5	4b	5	4b	4b	4b		5	X	X	
Myrtaceae	*Eucalyptus tereticornis* PD9,PD10,PD28,PD29	Forest Red Gum				4b		4b	4b		X		
Myrtaceae	*Melaleuca decora* PD29	-	4b								X		
Oleaceae	*Olea europaea* subsp. *cuspidata*	African Olive	2	4b	4b			4b	2	2	X		
Orchidaceae	*Cymbidium suave*	Native Cymbidium							1				
Oxalidaceae	*Oxalis corniculata*	Yellow Wood Sorrel			1								
Oxalidaceae	*Oxalis perennans* PD9,PD10,PD28,PD29	-	2	2			1						
Oxalidaceae	*Oxalis sp.*									1			
Pittosporaceae	*Bursaria spinosa* var. *spinosa* PD9,PD10,PD28,PD29	Blackthorn		2	1		1			1			
Plantaginaceae	*Plantago lanceolata*	Ribwort	3	3	3	2	3	3	6	3			
Plantaginaceae	*Plantago varia*	-	2	1									
Poaceae	*Austrodanthonia fulva* PD29	Wallaby Grass	2										
Poaceae	*Austrostipa elegantissima*	Feather Speargrass	2							4b			
Poaceae	*Bromus catharticus*	Prairie Grass			4b	3	4a	3					
Poaceae	*Chloris gayana*	Rhodes Grass											X
Poaceae	*Chloris ventricosa* PD9,PD10,PD28,PD29	Tall Chloris	3	2	2	2	2			2			

Family	Scientific Name	Common Name	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Dams	Soak	RM
Poaceae	*Echinopogon ovatus* C9PD28,PD29	Forest Hedgehog Grass						1					
Poaceae	*Ehrharta erecta*	Panic Veldtgrass			4b			3	3	3			
Poaceae	*Entolasia marginata* PD29	Bordered Panic	2							2			
Poaceae	*Eragrostis leptostachya* PD10,PD29	Paddock Lovegrass											X
Poaceae	*Lolium perenne*	Perennial Ryegrass			2								
Poaceae	*Microlaena stipoides* var. *stipoides* C9,PD10,PD28,PD29	Weeping Rice Grass	6	5	4a	3	4b	2	4a	4a			
Poaceae	*Panicum simile* PD29	Two Colour Panic								2			
Poaceae	*Paspalum dilatatum*	Paspalum									X		
Poaceae	*Setaria parviflora*	Slender Pigeon Grass		2	5		2					X	
Poaceae	*Sporobolus africanus*	Parramatta Grass			2								
Polygonaceae	*Rumex brownii*	Swamp Dock			1								
Polygonaceae	*Rumex* sp.	Dock					1	1			X		
Primulaceae	*Anagallis arvensis*	Scarlet Pimpernel					2			1			
Rubiaceae	*Asperula conferta* PD28,PD29	Common Woodruff							4a				
Solanaceae	*Lycium ferocissimum*	African Boxthorn							1	1			
Solanaceae	*Physalis peruviana*	Cape Gooseberry	1					1					
Solanaceae	*Solanum campanulatum*	-	2		1					2			
Solanaceae	*Solanum chenopodioides*	Whitetip Nightshade		1	1			2		2			
Solanaceae	*Solanum nigrum*	Black Nightshade	1		1				1	1	X		
Typhaceae	*Typha* probably *domingensis*	Narrow-leaved Cumbungi									X		

Appendix 10

Fauna Recorded During Field Surveys

Type/Species	Location/Habitat
Amphibians	
Common Eastern Froglet *Crinia signifera*	Siltation Dam, wet soak/drainage area
Striped Marsh Frog *Limnodynastes peronii*	Siltation Dam
Whistling Tree Frog *Litoria verreauxii verreauxii*	Siltation Dam, wet soak/drainage area
Birds	
Australasian Grebe *Tachybaptus novaehollandiae*	Siltation Dam
Australian Magpie *Gymnorhina tibicen*	Throughout investigation area
Australian Raven *Corvus coronoides*	Throughout investigation area
Australian Wood Duck *Chenonetta jubata*	Siltation Dam
Australian White Ibis *Threskiornis molucca*	Siltation Dam
Black Swan *Cygnus atratus*	Siltation Dam
Common Myna *Acridotheres tristis* *	Throughout investigation area
Common Starling *Sturnus vulgaris* *	Flying over site
Eastern Rosella *Platycercus eximius*	Throughout investigation area
Eurasian Coot *Fulica atra*	Siltation Dam
Galah *Cacatua roseicapilla*	Throughout investigation area; in trees with hollows
Great Egret *Ardea alba*	Siltation dam
Grey Butcherbird *Cracticus torquatus*	Throughout investigation area
Indian Myna *Acridotheres tristis* *	Throughout investigation area
Intermediate Egret *Ardea intermedia*	Siltation dam
Laughing Kookaburra *Dacelo novaeguineae*	Throughout investigation area
Little Corella *Cacatua sanguinea*	Flying over investigation area
Little Pied Cormorant *Microcarbo melanoleucos*	Siltation dam
Magpie Lark *Grallina cyanoleuca*	Throughout investigation area
Noisy Miner *Manorina melanocephala*	Throughout investigation area
Pied Cormorant *Phalacrocorax varius*	Siltation Dam
Purple Swamphen *Porphyrio porphyrio*	Siltation Dam
Rainbow Lorikeet *Trichoglossus haematodus*	Woodland near dam
Red Wattlebird *Anthochaera carunculata*	Woodland
Red-whiskered Bulbul *Pycnonotus jocosus* *	Throughout investigation area
Spotted Pardalote *Pardalotus punctatus*	Throughout investigation area
Spotted Turtledove *Streptopelia chinensis* *	Throughout investigation area
Sulphur-crested Cockatoo *Cacatua galerita*	Throughout investigation area
White-faced Heron *Egretta novaehollandiae*	Siltation Dam; flying over site
White-necked Heron *Ardea pacifica*	Siltation Dam
Willie Wagtail *Rhipidura leucophrys*	Next to dam
Yellow-faced Honeyeater *Lichenostomus chrysops*	Throughout investigation area, in trees

Type/Species	Location/Habitat
Mammals	
Common Ringtail Possum *Pseudocheirus peregrinus*	In tree, within investigation area
Chocolate wattled bat *Chalinolobus morio*	Woodland area / dam
Eastern bentwing bat *Miniopterus schreibersii oceanensis*	Woodland area / dam
East-coast freetail bat *Mormopterus (Micronomus) norfolkensis*	Woodland area / dam
Eastern freetail bat *Mormopterus (Ozimops) ridei*	Woodland area / dam
Eastern forest bat *Vespadelus pumilus*	Woodland area / dam
Gould's wattled bat *Chalinolobus gouldii*	Woodland area / dam
Grey-headed Flying Fox *Pteropus poliocephalus*	In tree at edge of woodland next to dam
Little bentwing bat *Miniopterus australis*	Woodland area / dam
Yellow-bellied sheathtail bat *Saccolaimus flaviventris*	Woodland area / dam
White-striped freetail bat *Tadarida australis*	Woodland area / dam

Note: * denotes introduced species

Species in **bold** text are threatened at a Commonwealth or State level.

Appendix 11

Microchiropteran Bat Data (Anabat)

Call #	Date	Frequency of call (kHz)	Species (frequency range)	Certainty of ID definite/probable/possible
1	20/06/12	47 – 47.5	*Vespadelus regulus* (43.5-46) *Miniopterus schreibersii oceanensis* (44 – 47.)5	Possible *Vespadelus regulus* or possible *Miniopterus schreibersii oceanensis*.
2	20/06/12	45 - 45.5	*Vespadelus regulus* (43.5-46) *Miniopterus schreibersii oceanensis* (44 – 47.5)	Probable *Miniopterus schreibersii oceanensis*. See comment 1
3	20/06/12	28 -32.5	*Chalinolobus gouldii* (27.5 – 32.5)	Definite *Chalinobus gouldii.*
4	20/06/12	40.5 – 42.5	*Vespadelus* sp.	Probable *Vespadelus* sp.
5	22/06/12	46.5 – 47.5	*Miniopterus schreibersii oceanensis* (44 – 47.5)	Probable. See comment 2
5	22/06/12	42.5 – 43.5	*Vespadelus* sp.	Probable See comment 2
6	22/06/12	42 - 45	*Miniopterus schreibersii oceanensis* (44 – 47.5) and *Vespadelus darlingtoni* (40 - 43)	Probable *Miniopterus schreibersii oceanensis*
7	22/06/12	47- 48	*Miniopterus schreibersii oceanensis* (44 – 47.5)	Probable
8	22/06/12	40	*Falsistrellus tasmaniensis* (35.5 – 39)	Possible. See comment 3

Comments

1. Time between calls slightly variable.
2. Two bats calling simultaneously.
3. Frequency a touch high but call shape separates from other species in this range.

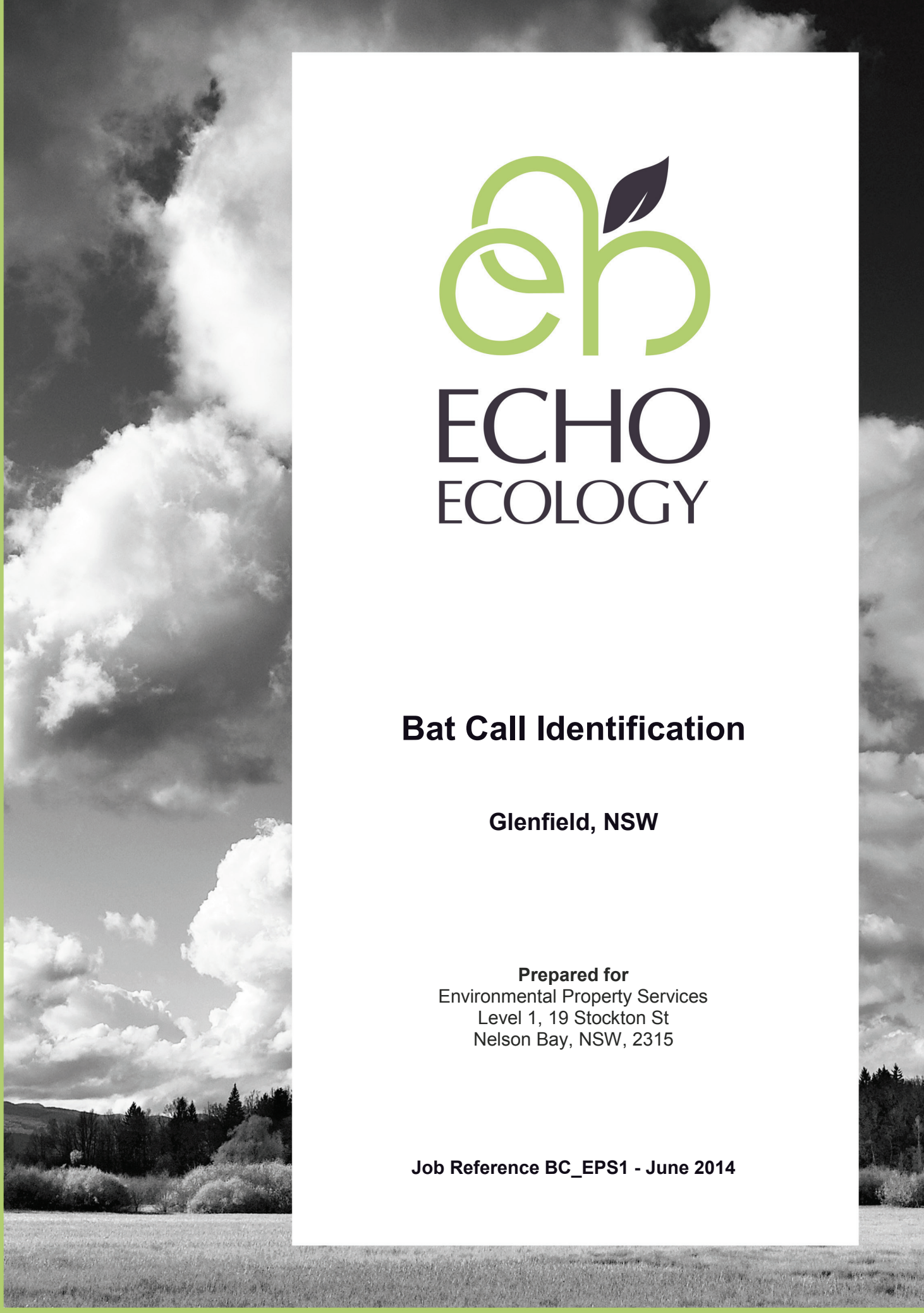
Appendix 12

Hollow Bearing Tree Assessment

Tree ID	Easting	Northing	Species	DBH (cm)	No. Hollows
1	306340	6373660	Dead Tree	40	1 – Trunk Hollow
2	306704	6239378	*E. tereticornis*		3-4 Branch Hollows
3	306681	6239390	*E. tereticornis*		
4	306681	6239396	*E. moluccana*		1 – Trunk Hollow at ground level
5	306650	6239453	*E. moluccana*		1 – Trunk Hollow, vertical spout
6	306587	6239488	*E. moluccana*		5 – Hollows (potential ringtail possum)
7	306565	6239466	*E. moluccana*		1-2 Hollows
8	306532	6239476	*E. moluccana*		3-4 Hollows (horizontal limbs)
9	306530	6239495	*E. moluccana*	85	1 – Hollow, vertical spout
10	306448	6239491	*E. moluccana*	30	1 – Hollow
11	306427	6239494	*E. moluccana*	40	1 – Hollow
12	306414	6239506	*E. moluccana*	40	1 – Trunk Hollow
13	306375	6239512	*E. moluccana*		1 – Open Vertical Spout
14	306356	6239508	*E. moluccana*	30	1 – Trunk Hollow
15	306310	6239511	*E. moluccana*	60	1 – Trunk Hollow (partially dead tree)
16	306259	6239490	*E. moluccana*	100	1 – Horizontal Hollow Branch
17	306260	6239482	*E. moluccana*		Old termite nest, top been removed to form cup shape
18	306233	6239499	*E. moluccana*	35	Hollow trunk (European Bees present)
19	306165	6239524	*E. moluccana*	35	1 – Dead Vertical Branch
20	306094	6239532	*E. moluccana*	50	1 – Trunk Hollow
21	306081	6239540	*E. tereticornis*	100	1 – Trunk Hollow (no scratches present)
22	306542	6239655	*A. floribunda*	50	1 – Branch end hollow
23	306494	6239525	*E. moluccana*	40	1 – Trunk Hollow – 3m above ground
24	306498	6239507	*E. tereticornis*	50	2 – Trunk Hollows
25	306503	6239531	*E. moluccana*	50	2 – branch hollows (spout)
26	306487	6239579	*E. moluccana*	60	6 – Dead Branch Hollows – Galah present
27	306528	6239597	*E. moluccana (dead)*		6 – Trunk Hollows
28	306524	6239611	*E. moluccana*	70	7 – Branch Hollows
29	306520	6239626	*E. moluccana*	70	8 – Branch ends
30	306465	6239620	*E. moluccana*	80	10 – Branch Hollows; 1 – Trunk Hollow (white feathers at base of tree)
31	306501	6239692	*E. tereticornis*	80	1 – Trunk (fork) Hollow
32	306506	6239693	*E. tereticornis*	75	2 – Branch Hollows
33	306452	6239678	*E. moluccana*	90	7 – Branch Hollows
34	306431	6239671	*E. moluccana*	35	2 – Branch Hollows
35	306407	6239672	*E. moluccana*	100	3 – Branch Hollows; 1 – Trunk Hollow (Galah Present, feathers on ground)
36	306386	6239634	*E. moluccana*	85	5 – Trunk Hollows
37	306433	6239541	*E. moluccana*	80	9 – Branch Hollows; 2 – Trunk Hollows
38	306433	6239419	*E. moluccana*	60	3 – Branch Hollows

Appendix 13

Bat Call Identification Report



ECHO ECOLOGY

Bat Call Identification

Glenfield, NSW

Prepared for
Environmental Property Services
Level 1, 19 Stockton St
Nelson Bay, NSW, 2315

Job Reference BC_EPS1 - June 2014

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This report has been prepared to document the analysis of digital ultrasonic bat echolocation calls received from a third party. The data was not collected by the author and as such no responsibility is taken for the quality of data collection or for the suitability of its subsequent use.

This report was authored by

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1.0 INTRODUCTION

This report has been commissioned by Environmental Property Services to analyse bat echolocation call data (Anabat, Titley Electronics) collected from Glenfield, NSW. Data was provided electronically to the author. This report documents the methods involved in analysing bat call data and the results obtained only.

2.0 METHODS

The identification of bat echolocation calls recorded during surveys was undertaken using AnalookW (Version 4.0r) software. The identification of calls was undertaken with reference to Pennay and others (2004) and through the comparison of recorded reference calls from the Sydney Basin. Reference calls were obtained from the NSW database and from the authors personal collection.

Each call sequence ('pass') was assigned to one of five categories, according to the confidence with which an identification could be made, being:

- Definite - Pass identified to species level and could not be confused with another species
- Probable - Pass identified to species level and there is a low chance of confusion with another species
- Possible - Pass identified to species level but short duration or poor quality of the pass increases the chance of confusion with another species
- Species group - Pass could not be identified to species level and could belong to one of two or more species. Occurs more frequently when passes are short or of poor quality
- Unknown - Either background 'noise' files or passes by bats which are too short and/or of poor quality to confidently identify.

Call sequences that were less than three pulses in length were not analysed and were assigned to 'Unknown' and only search phase calls were analysed. Furthermore, some species are difficult to differentiate using bat call analysis due to overlapping call frequencies and similar shape of plotted calls and in these cases calls were assigned to species groups.

The total number of passes (call sequences) per unit per night was tallied to give an index of activity.

It should be noted that the activity levels recorded at different sites may not be readily able to be compared. Such comparisons are dependent on many variables which need to be carefully controlled during data collection and statistically analysed. Influential variables include wind, rain, temperature, duration of recording, season, detector and microphone sensitivity, detector placement, weather protection devices etc.

2.1 Characteristics Used to Differentiate Species

Miniopterus australis was differentiated from *Vespadelus pumilus*, by characteristic frequency or the presence of a down-sweeping tail on pulses. Call sequences which had a majority of pulses containing an up-sweeping tail were assigned to *Vespadelus pumilus*.

Calls from *Mormopterus* sp. were differentiated by the presence of mainly flat pulses. *Mormopterus norfolkensis* was differentiated from *Mormopterus* species 2 in long call sequences where pulses alternated, often with a downward sloping tail.

Chalinolobus gouldii was differentiated from other species by the presence of curved, alternating call pulses.

Scotorepens orion, *Scoteanax rueppellii* and *Falsistrellus tasmaniensis* were unable to be differentiated from one another.

Myotis macropus, Nyctophilus geoffroyi and *Nyctophilus gouldi* were unable to be differentiated from one another.

Tadarida australis were differentiated from other bat species on the basis of characteristic frequency.

3.0 RESULTS

A total of 474 call sequences were recorded, of which 303 call sequences were able to be analysed (ie were not 'noise' files or bat calls of short length). Of the bat calls, 106 call sequences (35 %) were able to be confidently identified (those classified as either definite or probable identifications) to species level (Table 3-1). Species recorded confidently within the site include:

- *Chalinolobus gouldii* (Gould's wattled bat)
- *Mormopterus norfolkensis* (East-coast freetail bat)
- *Mormopterus* species 2 (Eastern freetail bat)
- *Tadarida australis* (White-striped freetail bat)
- *Vespadelus pumilus* (Eastern forest bat)

Additionally, the following bat species potentially occurred within the site, but could not be confidently identified (those calls classified as possible or as a species group):

- *Falsistrellus tasmaniensis* (Eastern falsistrelle)
- *Miniopterus australis* (Little bentwing bat)
- *Miniopterus schreibersii oceanensis* (Eastern bentwing bat)
- *Myotis macropus* (Large-footed myotis)
- *Nyctophilus geoffroyi* (Lesser long-eared bat)
- *Nyctophilus gouldi* (Gould's long-eared bat)
- *Scoteanax rueppellii* (Greater broad-nosed bat)
- *Scotorepens orion* (Eastern broad-nosed bat)
- *Vespadelus darlingtoni* (Large forest bat)
- *Vespadelus regulus* (Southern forest bat)

It should be noted that additional bat species may be present within the site but were not recorded by the detectors and habitat assessment should be used in conjunction with these results to determine the likelihood of occurrence of other bat species.

Table 3-1 below summarises the results of the bat call analysis.

Table 3-1: Results of bat call analysis (number of passes per site per night)

IDENTIFICATION	Anabat 1 25/05/2014	Anabat 1 26/05/2014	Anabat 1 27/05/2014	Anabat 1 28/05/2014
DEFINITE				
Chalinolobus gouldii	-	-	1	-
Mormopterus norfolkensis	1	4	2	-
Mormopterus species 2	8	13	5	-
Tadarida australis	12	9	7	-
PROBABLE				
Chalinolobus gouldii	-	1	-	-
Mormopterus norfolkensis	3	1	2	2
Mormopterus species 2	8	8	14	-
Tadarida australis	-	3	1	-
Vespadelus pumilus	-	-	1	-
POSSIBLE				
Mormopterus norfolkensis	1	1	2	-
Mormopterus species 2	-	-	2	-
Tadarida australis	-	1	-	-
SPECIES GROUPS				
Chalinolobus gouldii / Mormopterus norfolkensis / Mormopterus species 2	16	22	35	2
Chalinolobus gouldii / Mormopterus species 2	7	13	8	-
Falsistrellus tasmaniensis / Scotorepens orion	-	1	-	-
Falsistrellus tasmaniensis / Scotorepens orion / Scoteanax rueppellii	1	3	2	-
Miniopterus australis / Vespadelus pumilus	-	-	2	-
Miniopterus schreibersii oceanensis / Vespadelus darlingtoni / Vespadelus regulus	1	5	2	-

IDENTIFICATION	Anabat 1 25/05/2014	Anabat 1 26/05/2014	Anabat 1 27/05/2014	Anabat 1 28/05/2014
Mormopterus norfolkensis / Mormopterus species 2	7	23	37	1
Myotis macropus / Nyctophilus geoffroyi / Nyctophilus gouldi	1	-	-	-
Vespadelus darlingtoni / Vespadelus regulus	1	-	-	-
UNKNOWN				
'Noise' files	11	13	5	-
Unknown	45	52	43	2
TOTAL	**123**	**173**	**171**	**7**

4.0 SAMPLE CALLS

A sample of the calls actually identified from the site for each species is given below.

Figure 4-1: *Chalinolobus gouldii* definite call

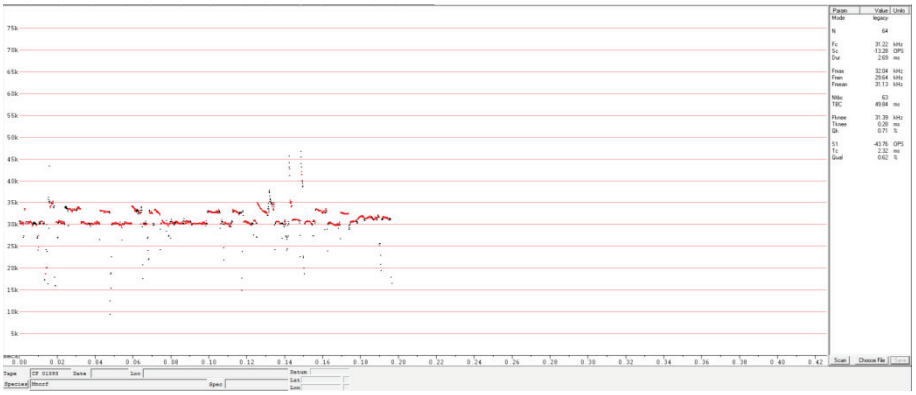

Figure 4-2: *Mormopterus norfolkensis* definite call

Figure 4-3: *Mormopterus* species 2 definite call

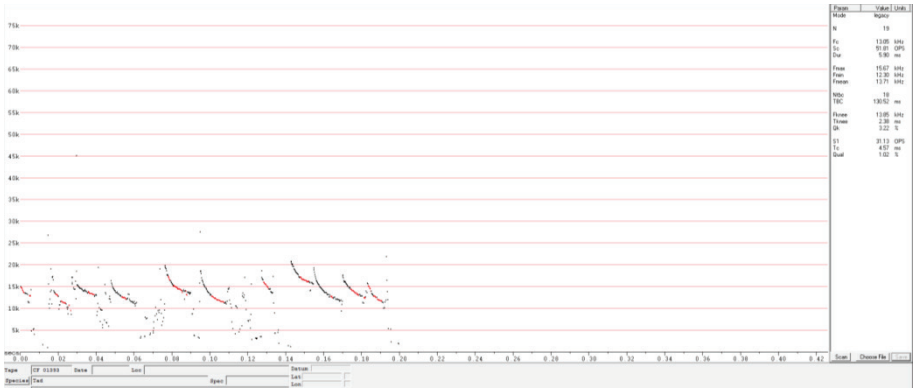

Figure 4-4: *Tadarida australis* definite call

Figure 4-5: *Vespadelus pumilus* probable call

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Appendix 14

Fieldwork Dates Overview

Fieldwork activity	Undertaken by	Date	Time (hr)	year
Preliminary Site investigation	EPS	28th March	Not specified	2012
Diurnal bird Survey	EPS	30th May	0900-1300	2012
Diurnal bird Survey	EPS	21st June	0800-1400	2012
Nocturnal arboreal mammals, birds and microchiropteran Bat Surveys	EPS	20th & 21st June	Night hours x2 separate 1hr searches	2012
Preliminary floristic surveys	EPS	30th May & 12th July	Not specified	2012
Amphibian and Reptile surveys	EPS	30th May	0900-1300	2012
Amphibian and Reptile surveys	EPS	21st June	0800-1400	2012
Targeted Flora Survey *Pimelea spicata*	EPS	17th December	1000-1600	2013
Nocturnal arboreal mammal surveys	EPS	29th April	1800-2000	2014
Nocturnal arboreal mammal surveys	EPS	25th June	1730-2030	2014
Microchiropteran bat recordings	EPS	29th April, 25th, 26th & 27th June	Recorded during night hours	2014
Diurnal Bird surveys	EPS	29th April	1430-1630	2014
Diurnal Bird surveys	EPS	30th April	0800-1000	2014
Nocturnal bird surveys	EPS	29th April	1800-2000	2014
Nocturnal bird surveys	EPS	25th June	1730-2030	2014
Amphibian and Reptile surveys	EPS	29th April	1430-1630	2014
Amphibian and Reptile surveys	EPS	30th April	0800-1000	2014
Amphibian and Reptile surveys	EPS	29th April	1800-2000	2014
Amphibian and Reptile surveys	EPS	25th June	1730-2030	2014
Targeted fauna survey (Green & Golden Bell Frog and Cumberland Plain Land Snail)	EPS	29th April	1430-1700	2014
Targeted fauna survey (Green & Golden Bell Frog and Cumberland Plain Land Snail)	EPS	30th April	0800-1100	2014

Appendix 14

Fieldwork Dates Overview

Fieldwork activity	Undertaken by	Date	Time (hr)	year
Preliminary Site investigation	EPS	28th March	Not specified	2012
Diurnal bird Survey	EPS	30th May	0900-1300	2012
Diurnal bird Survey	EPS	21st June	0800-1400	2012
Nocturnal arboreal mammals, birds and microchiropteran Bat Surveys	EPS	20th & 21st June	Night hours x2 separate 1hr searches	2012
Preliminary floristic surveys	EPS	30th May & 12th July	Not specified	2012
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Nocturnal arboreal mammal surveys	EPS	29th April	1800-2000	2014
Nocturnal arboreal mammal surveys	EPS	25th June	1730-2030	2014
Microchiropteran bat recordings	EPS	29th April, 25th, 26th & 27th June	Recorded during night hours	2014
Diurnal Bird surveys	EPS	29th April	1430-1630	2014
Diurnal Bird surveys	EPS	30th April	0800-1000	2014
Nocturnal bird surveys	EPS	29th April	1800-2000	2014
Nocturnal bird surveys	EPS	25th June	1730-2030	2014
Amphibian and Reptile surveys	EPS	29th April	1430-1630	2014
Amphibian and Reptile surveys	EPS	30th April	0800-1000	2014
Amphibian and Reptile surveys	EPS	29th April	1800-2000	2014
Amphibian and Reptile surveys	EPS	25th June	1730-2030	2014
Targeted fauna survey (Green & Golden Bell Frog and Cumberland Plain Land Snail)	EPS	29th April	1430-1700	2014
Targeted fauna survey (Green & Golden Bell Frog and Cumberland Plain Land Snail)	EPS	30th April	0800-1100	2014
Dip netting for tadpoles & searches targeting Green & Golden Bell Frog	EPS	24th February	1700-2100	2015

Fieldwork activity	Undertaken by	Date	Time (hr)	year
Diurnal Bird surveys	EPS	24th February	1700-1930	2015
Call Playback survey for Green & Golden Bell Frog	EPS	24th February	1930-2105	2015
Micro-chiropteran bat surveys	EPS	24th February	1930-2105	2015
Dip netting for tadpoles & searches targeting Green & Golden Bell Frog	EPS	25th February	1700-2100	2015
Diurnal Bird surveys	EPS	25th February	1700-2000	2015
Call Playback survey for Green & Golden Bell Frog	EPS	25th February	1900-2035	2015
Micro-chiropteran bat surveys	EPS	25th/26th February	Over 1 night from 1900 on the 25th	2015
Dip netting for tadpoles & searches targeting Green & Golden Bell Frog	EPS	26th February	1730-2100	2015
Diurnal Bird surveys	EPS	26th February	1730-1900	2015
Call Playback survey for Green & Golden Bell Frog	EPS	26th February	1900-2020	2015
Micro-chiropteran bat surveys	EPS	26th/27th February	Over 1 night from 1900 on 26th	2015
Micro-chiropteran bat surveys	EPS	27th/28th February	Over 1 night from approximately 1900 on the 27th	2015
Dip netting for tadpoles & searches targeting Green & Golden Bell Frog	EPS	28th February	1730-2100	2015
Diurnal Bird surveys	EPS	28th February	1730-1930	2015
Call Playback survey for Green & Golden Bell Frog	EPS	28th February	1845-2030	2015

Fieldwork activity	Undertaken by	Date	Time (hr)	year
Micro-chiropteran bat surveys	EPS	28th February	1900-2100	2015

Appendix 15

SLR March 2014: Proposed Rezoning and Expansion – Cumberland Plain Woodland Assessment Report

global environmental solutions

Glenfield Waste Services Site
Cambridge Avenue, Glenfield

Proposed Rezoning & Expansion

Cumberland Plain Woodland Assessment Report

28 March 2014

Glenfield Waste Services Site
Cambridge Avenue, Glenfield

Proposed Rezoning & Expansion

Cumberland Plain Woodland Assessment Report

28 March 2014

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610.12154	Version 1.0	November 2013	FI	FDF	F Dominic Fanning
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GLENFIELD WASTE SERVICES SITE
CAMBRIDGE AVENUE, GLENFIELD

PROPOSED REZONING & EXPANSION

CUMBERLAND PLAIN WOODLAND ASSESSMENT REPORT

28 March 2014

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28 March 2014

1 INTRODUCTION

1.1 The Glenfield Waste Services Site

The Glenfield Waste Services Site is located at Cambridge Avenue, Glenfield (Figure 1), approximately 40 kilometres to the southwest of the Sydney Central Business District (CBD). The northern portion of the site is located in the Liverpool City Council Local Government Area (LGA), whilst the southern portion is located within the Campbelltown LGA.

The 'triangular' portion of land occupied by the Glenfield Waste Services operations is approximately 100ha in area, and comprises a total of thirteen lots (Figure 1):

- the southern part (south of the Glenfield-East Hills Railway Line) -
  - Lot 3 in DP 736881 (on each side of Cambridge Avenue)
  - Lot 1 in DP 113201, Lot 2 in DP 333578, Lot 3 in DP 733524 and most of Lot 91 in DP 1155962
- the northern part (north of the Glenfield-East Hills Railway Line) -
  - part Lot 91 in DP 1155962, Lot 92 in DP 1155962 and Lot 5 in DP 833516 – between the Glenfield-East Hills Railway Line and a Road Reserve
  - Lots 101, 102, 103 and 104 in DP 1143827, Lot 51 in DP 515696 and Lot 52 in DP 517310 – in the northernmost part of the land.

The southern portion of Lot 3 in DP 736881 (south of Cambridge Avenue) is occupied by a transmission line and easement (Figure 2), and is predominantly cleared grassland (except at its eastern part).

The East Hills Railway runs in an east-west direction through the centre of the Glenfield Waste Services Site (Figure 1). The land to the north currently operates as the landfill component of the operations (Figure 1), and is largely cleared - with some riparian vegetation along the Georges River and some grassed areas with a few scatters and patches of planted trees. The land to the south of the East Hills Railway Line (Figure 2) currently contains the recycling facility in its eastern portion, with a relatively large area of vegetated land in the west.

The Glenfield Waste Services Site is roughly triangular in shape (Figure 1), and is bound by:

- the Georges River - along its eastern boundary;
- the Main Southern Railway Line - along its western boundary; and
- residential development and part of the Georges River Nature Reserve (south of Cambridge Avenue) - along its southern boundary.

Much of the surrounding area is developed as residential and industrial land typical of western Sydney (Figure 1), although there are substantial portions of vegetated land to the southeast and along the Georges River to the north. Land to the east (east of the Georges River, is to be developed in part for a major transport intermodal facility.

1.2 The Subject Site

The "*subject site*" for the purposes of this assessment consists of the land to the south of the East Hills Railway Line and north of Cambridge Avenue (Figure 1). In particular, the surveys and assessment contained in this *Report* is focussed on the area of alleged or possible Cumberland Plain Woodland (CPW) in the western and southern vegetated portions of the subject site, north of Cambridge Avenue (Figure 2).

The "*subject site*" is approximately 40 hectares in area, and is bound by the East Hills Railway along its northern boundary, Cambridge Avenue along its southern boundary, and the Georges River at the eastern boundary (Figure 2).

This part of the Glenfield Waste Services site is located wholly within the Campbelltown LGA.

1.3 Future Development

The Glenfield Waste Services operations, particularly the recycling facility within the "*subject site*", needs to be relocated and expanded - within the boundaries of the site. Having consulted with the NSW Environmental Protection Authority (EPA), as the regulator of waste management activities on the subject land, it is the desire of Glenfield Waste Services to expand those operations into the vacant portions of land - to the southwest of the existing operations.

In addition, there is a conceptual plan for the future re-zoning of the subject site for industrial purposes. The assessment of the vegetation present contained in this *Report* does not address future development of the "*subject site*" in any detail at this stage.

1.4 Definitions

Definitions for areas used in this *Cumberland Plain Woodland Assessment Report* include:

- *subject land* the Glenfield Waste Services Site at Cambridge Avenue, Glenfield (Figure 1)

- *subject site* the southern central portion of the subject land - which is being investigated to determine the presence or otherwise of the CPW community (Figure 2)
- *general locality* an area of 10km radius around the *"subject site"*

1.5 Brief from EPS

The brief from EPS for this project included the following points:

- *The aim of the proposed Cumberland Plain Woodland Assessment of the Glenfield Waste Services site southern section of land is to collect detailed information on the presence or otherwise of Cumberland Plain Woodland as part of the statutory requirements for a Development Application for a proposed recycling facility and for the proposed rezoning.*
- *Undertake a detailed field survey of the site in accordance with relevant legislation, policy and guidelines to identify the presence or absence of Cumberland Plain Woodland (CPW) and the condition or varying condition of the CPW.*
- *Map the location of the CPW on the site.*
- *Provide detailed discussion of the CPW including:*
  - *The condition or varying condition of the CPW;*
  - *Determining the precise distribution of vegetation that satisfies the CPW criteria and the vegetation that does not satisfy the criteria;*
  - *Assessing the CPW against the criteria in the Final Determination for the CPW community pursuant to the NSW Threatened Species Conservation Act 1995 (TSC Act) including any legal interpretation of the Final Determination for the CPW community; and*
  - *Assessing the possible CPW against the criteria in the Commonwealth Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) including any legal interpretation of the criteria in the EPBC Act.*

1.6 Scope and Aims of this Report

The aims of this *Cumberland Plain Woodland Assessment Report* with respect to the subject site at Cambridge Avenue, Glenfield are to fulfil the brief of EPS as detailed above. In particular, this *Report* aims:

- to undertake background research regarding any existing vegetation mapping of the subject site;
- to undertake a site survey:
  - to verify the vegetation present;
  - to collect a detailed flora species list;
  - to undertake a series of flora survey quadrats;
- to determine likely ecological constraints to future rezoning and development of the site;

- to provide initial recommendations with respect to any restrictions to development activities that might apply and/or identifications of areas of vegetation that will or may need to be retained; and
- to provide an initial consideration of the requirement for, and extent of, any biodiversity offsets that may be required.

Consideration of the *Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act 1999) is also provided.

This *Cumberland Plain Woodland Assessment Report* has taken into account *inter alia* relevant statutory and planning policies, and agency *Guidelines*, including:

- the *Environmental Planning & Assessment Act 1979* (EP&A Act);
- the *Threatened Species Conservation Act 1995* (TSC Act);
- the *Native Vegetation Act 2003* (NV Act);
- the *Water Management Act 2000* (WM Act);
- the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act);
- the OEH *Principles for the Use of Biodiversity Offsets in NSW* (2011);
- the OEH *Threatened Species Survey & Assessment Guidelines* (dated 2004);
- OEH documents regarding the Cumberland Plain, including *inter alia*:
  - Sydney Catchment Management Authority and OEH vegetation mapping (CMA/OEH 2009 – Figure 4);
  - vegetation mapping of the subject site and surrounds by the OEH (Tozer *et al* 2010 – Figure 5);
  - the *Cumberland Plain Recovery Plan* (DECCW 2011);
  - *Recovering Bushland on the Cumberland Plain: Best Practice Guidelines for the Management and Restoration of Bushland* (DEC 2005); and
  - the NOW *Guidelines for Riparian Corridors on Waterfront Land* (July 2012).

2 INFORMATION BASE

Existing information regarding relevant threatened and other native biota was obtained from:

- previous investigations undertaken by Gunninah Environmental Consultants[1], Environmental InSites[2] and SLR Ecology on lands in the vicinity of the subject site (*eg* on Council land at Groundsel Avenue, Macquarie Fields and the Culgoa Circuit site at Wattle Grove);
- inspection of the NPWS 2002 vegetation mapping of vegetation in western Sydney (Figure 4), CMA/OEH 2009 vegetation mapping of the locality (Figure 5) and the Tozer *et al* 2010 vegetation mapping (Figure 6); and
- the general published literature on the Cumberland Plain Woodland (see *Bibliography*).

A detailed site survey was undertaken on the 30th of September and 1st of October 2013, to provide specific data and observations for this *Cumberland Plain Woodland Assessment Report*.

The site investigations involved:

- the conduct of a 'Random Meander' survey *sensu* Cropper 1993 (Figure 3);
  - to collect a series of photo points (Figure 2) - to document the various conditions of the vegetation across the site (Appendix A); and
  - to obtain a comprehensive flora species list (Appendix C); and
- the undertaking of 20m x 20m flora survey quadrats (Figure 3) – involving the identification of all species present by intensive walked survey, and the recording of Blaun–Blanquet ratings of abundance/cover for all species (Appendix D).

1 The principal author of this *Report* was previously the owner and Director of Gunninah Environmental Consultants.

2 The authors of this *Report* were previously the Environmental Division of Whelans InSites, Sydney.

3 FLORA and VEGETATION

3.1 Existing vegetation

The subject site is characterised by the existing recycling facility and its operations in its eastern half, and a series of paddocks with a dwelling and large artificial wetland in its western portion (Figure 2; Appendix A). Along the western side of the subject site there is a narrow band of riparian vegetation along the Georges River, which is heavily infested by noxious weeds (such as Wandering Jew, Privet, Lantana and African Olive).

There is also a canopy of Grey Box and occasionally other eucalypts (Forest Red Gum, Stringybark, Narrow-leaved Ironbark and Rough-barked Apple) in a band which extends along the southern central boundary and into the northwestern portion of the site. These trees are characteristic canopy species of the Cumberland Plain Woodland (CPW) community - which is a "*critically endangered ecological community*" (CEEC) listed in the NSW *Threatened Species Conservation Act 1995* (TSC Act), and part of a CEEC listed in the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act) – as discussed in detail in Chapter 4.

Detailed site surveys by SLR Ecology (Figures 2 and 3) have determined that there are varying degrees of disturbances to the understorey and groundcover through the subject site, resulting in areas of 'Very Low', 'Low' and 'Moderate' condition vegetation being mapped on the site (Figure 6).

In addition, the recent survey has determined that there are no areas of native grassland present. Areas of native grassland (were they to be present) could potentially constitute the CPW community.

The vegetation across the subject site includes:

- Red Gum – Stringybark Riparian Forest – all of which is in 'Very Low' condition because of the understory of dense noxious weeds.
- Artificial Cumbungi Wetland – which is in 'Low' condition because of its artificial nature and because of the dominance of exotic species around its banks (notwithstanding the extent of Cumbungi and Water Primrose within the wetland).
- Grey Box–Red Gum Woodland - which is in:
  - 'Very Low' condition – where it possesses an entirely cleared understorey and groundcover, or areas of exotic groundcover; and/or
  - 'Low' condition – where there is a mixture of native and exotic species throughout the groundcover.
- Red Gum – Ironbark Woodland - which is in:
  - 'Very Low' condition – where it possesses a largely exotic groundcover; and
  - 'Moderate' condition – where there is a diverse native understorey and groundcover (notwithstanding areas of weed invasion and regular mowing).

The remainder of the subject site contains built and developed land and/or areas which have been subjected to clearing, turfing and planting of horticultural specimens.

3.1.1 Artificial Cumbungi Wetland

There are two artificial wetlands along the northern boundary of the subject site, which are bisected north-south by a bunded dirt track (Figure 7). These wetlands collect surface water from the subject site for treatment and/or re-use.

The western wetland comprises a large area of open water and is fringed by Cumbungi vegetation. The smaller eastern wetland contains dense Cumbungi and Water Primrose. There is also a narrow artificial channel entering from beneath the railway line which feeds into the northwestern corner of the large wetland. This area is dominated by dense Cumbungi and Pampas Grass.

The Cumbungi (*Typha* sp.) and Water Primrose which dominate the wetlands are native species, which are listed as 'characteristic' in the *Final Determination* for the *Freshwater Wetlands on Coastal Floodplains* (FWCF) community - which is listed as an "*endangered ecological community*" (EEC) in the TSC Act.

That EEC is not present, however, as detailed in Chapter 4.

3.1.2 Grey Box – Red Gum Woodland

The Grey Box – Red Gum Woodland occupies much of the vegetated band along the southern portion of the subject site and the paddocks in the centre of the subject site at Cambridge Avenue, Glenfield (Figure 6). The canopy in this vegetation is dominated by Grey Box, with some occasional Forest Red Gum. There is also a mid-canopy of *Melaleuca decora* in a small patch along the southern boundary of the site.

There is virtually no shrub layer throughout this area - with the exception of a few scattered specimens of Blackthorn, African Olive and Africa Boxthorn at the base of trees - which escaped the slashing and mowing for grazing and/or asset protection maintenance.

The groundcover generally comprises scattered and/or sparse patches of grasses and herbs including:

- native grasses (Weeping Grass, Stout Bamboo Grass) and herbs (Blue Trumpet, Kidney Weed, Berry Saltbush and other *Einadia* species); and/or
- exotic grasses (Prairie Grass, Perennial Rye Grass, Kikuyu and Common Couch) and weeds (Cobblers Pegs, Fishweed, Paddy's Lucerne, Red-flowered Mallow, Scarlet Pimpernel and Lamb's Tongue).

Five detailed flora survey quadrats were sampled within this vegetation type, to capture the varying condition of the groundcover throughout the site and to attempt to determine whether the groundcover layer was dominated by native species or exotic species.

The following notes provide a summary of the floristic information detailed in Appendix D for these five quadrats.

- Quadrat 1 -
  - 'Low-Moderate' condition - with 11 natives (all CPW species) and 11 exotics.
  - Dominated by Weeping Grass (native) and Perennial Rye Grass (exotic), with a substantial cover of Lamb's Tongue and *Petrorhagia velutina* (both exotics).

- Quadrat 2
    - ‘Low’ condition - with 8 natives (7 CPW species) and 11 exotics.
    - Dominated by Weeping Grass (native), Perennial Ryegrass and Lamb’s Tongue (both exotics).
- Quadrat 3
    - ‘Moderate’ condition - with 17 natives (16 CPW) and 6 exotics.
    - Dominated by Wallaby Grass (*Rytidosperma racemosum*), Winter Apple, Plump Windmill Grass and Blue Trumpet.
- Quadrat 6
    - ‘Low’ condition - with 8 natives (7 CPW) and 11 exotics.
    - Dominated by Couch, Prairie Grass and Perennial Rye Grass (all exotics), and only scattered native species.
- Quadrat 7
    - ‘Very Low’ condition - with 8 natives (7 CPW) and 10 exotics.
    - Dominated by Stout Bamboo Grass, Panic Veldt Grass and Fishweed (all exotics), and only scattered specimens of native groundcover species.

3.1.3 Red Gum – Ironbark Woodland

The Red Gum – Ironbark Woodland is restricted to a small band along the northwestern boundary and at the western end of the subject site at Cambridge Avenue, Glenfield (Figure 7). The canopy is dominated by Forest Red Gum, Narrow-leaved Ironbark and Grey Box, with occasional specimens of Thin-leaved Stringybark and Rough-barked Apple.

In the northern strip of Red Gum-Ironbark Woodland there is a scattered and patchy shrub layer of mainly Black Wattle, Blackthorn and regrowth eucalypts, with a few patches of Native Cherry and scattered specimens of Gorse Bitter Pea, White Dogwood and *Dillwynia sieberi*. A number of exotic and noxious weed (such as African Olive) are also present.

The groundcover in the southern patch of this community (west of the residence – Quadrat 5) is mown and disturbed, but the northern patch (Quadrat 4) maintains a dense grassy groundcover dominated by Kangaroo Grass. A diversity of native species (including the Eastern Flame Pea, False Coral Pea, Tall Bluebell and *Bossiaea prostrate*) were found within this area of vegetation, but were not observed in any other areas on the subject site.

- Quadrat 4
    - ‘Moderate’ condition - with 19 natives (18 CPW) and 16 exotics.
    - Groundcover dominated by introduced African Love Grass and other weeds, with moderate cover of native (mostly CPW) species.

- Quadrat 5
    - ‘Very Low’ condition - with 4 natives (3 CPW) and 6 exotics.
    - Dominated by introduced Couch lawn grass (exotic).

3.1.4 Red Gum – Stringybark Riparian Forest

This strip of vegetation adjoins the Georges River - along the eastern boundary of the subject site (Figure 7). It is dominated by Forest Red Gum and Stringybark, with a dense tall mid-canopy of noxious African Olive and Privet, as well as specimens of Black Wattle and Coast Myall. Other weeds include Lantana and Cape Ivy through the shrub layer, and Wandering Jew in the groundcover.

This vegetation type would constitute a very highly degraded form of River-flat Eucalypt Forest on Coastal Floodplains (REFCF) - which is an "*endangered ecological community*" (EEC) listed in the TSC Act.

No flora survey quadrats were undertaken in the Red Gum-Stringybark Riparian Forest – because there is no prospect of any development activities in this area. The zoning of this strip of land (for *Environmental Protection* purposes) and the constraints imposed by the *Water Management Act 2000* would essentially prevent any activities other than vegetation rehabilitation works at this location.

3.2 Flora Species

Random Meander and systematic botanical surveys conducted as part of this investigation have recorded a total of 132 plant species from within the subject site (Appendix C). Of these, a total of 71 native species were recorded, along with 61 exotic species. A few of the exotic species (including Privet and African Olive) are also listed as noxious in NSW.

Forty nine of the plant species recorded on the subject site (Appendix C) are listed as "*characteristic*" species in the *Final Determination* (Scientific Committee website 2013) for the CPW community.

4 ENDANGERED ECOLOGICAL COMMUNITIES

The vegetation mapping of the subject site by the OEH/CMA 2009 (Figure 5) and by Tozer *et al* 2010 (Figure 6) indicate the presence of two "*threatened ecological communities*" (as listed in the TSC Act) - known as:

- Cumberland Plain Woodland (CPW) – which is listed as a "*critically endangered ecological community*" (CEEC) in the TSC Act, and as part of a CEEC listed in the EPBC Act; and
- River-flat Eucalypt Forest on Coastal Floodplains (REFCF) – which is listed as an EEC in the TSC Act.

Ground-truthing of the vegetation present on the subject site at Glenfield by SLR Ecology (Figure 7) has determined that:

- there is a highly disturbed narrow band of REFCF vegetation along the eastern boundary of the site (adjoining the Georges River); and
- there is a variously disturbed band of CPW vegetation along the southern boundary and in the western parts of the subject site.

4.1 Cumberland Plain Woodland

4.1.1 The CPW Community – TSC Act

The following points from the *Final Determination* are relevant in determining the presence (or otherwise) of CPW on the subject site at Glenfield:

- Paragraph 2 - "*Cumberland Plain Woodland .. typically comprises an open tree canopy, a **near-continuous groundcover dominated by** **[native]** **grasses and herbs**, sometimes with layers of shrubs and/or small trees*" (emphasis added);
- Paragraph 3 - the "*assemblage of species*" by which the "*Cumberland Plain Woodland is **characterised***" (emphasis added) does not contain any introduced or exotic plant species. All of the "*grasses and herbs*" which are characteristic of the CPW community are native species;
- Paragraph 5 - "*The ground cover **is dominated** by a diverse range of* [native] *grasses*" (emphasis added) and "*The ground cover also includes a **diversity** of* [native] *forbs*" (emphasis added);
- Paragraph 6 - "***Either or both** of the upper storey and mid-storey **may be absent** from the community*" (emphases added); and
- Paragraph 6 - "*Native grasslands derived from clearing of the woodland and forest are also part of this community if they contain characteristic non-woody species listed in paragraph 3*".

Based on the above considerations, it is concluded that much of the woodland vegetation on the subject site does constitute the CPW community, despite being only in 'Low' to 'Moderate' condition.

However, some of the vegetation on the "*subject site*" arguably does not constitute the CPW community because, whilst there is a canopy of "*scattered trees*", which are "*characteristic*" of the CPW community:

- the groundcover is **not** "***dominated** by a **diverse** range of* [native] *grasses*";
- the groundcover layer does **not** include "*a **diversity** of* [native] *forbs*"; and
- the *Final Determination*, whilst specifically allowing for the absence of the "*upper storey or mid-storey*", does not countenance, anywhere, the absence of a native groundcover layer. Indeed, the antithesis is the case (*ie* 'derived grassland' = "*groundcover alone can constitute CPW*").

The vegetation on the subject site mapped as 'Very Low' condition (Figures 7 and 8) is not considered by SLR Ecology to conform to the definitions outlined within the *Final Determination* for CPW - based on the scarcity of native groundcover and understorey plants, and the dominance of exotic species in the groundcover layer (as discussed above).

4.1.2 The CPW Community – EPBC Act

In addition to its listing as a CEEC in the TSC Act, the Cumberland Plain Woodland (CPW) community is listed as part of a CEEC in the *Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act).

However, unlike the TSC Act (in which trees are not necessary for the CPW community to be present), the EPBC Act explicitly states that trees are necessary for a stand of vegetation to be classified as CPW.

Importantly (and most valuably), the EPBC Act listing also provides *Threshold Criteria* for CPW vegetation, which requires *inter alia* that:

- the area of the patch of vegetation be larger than one hectare; and
- at least 30% of the groundcover species be native plants typical of the CPW community.

The patch of vegetation on the subject site at Glenfield certainly constitutes an area greater than 1 hectare in size.

Consideration of the criteria with respect to understorey species and groundcover species, pursuant to the EPBC Act listing and the criteria identified above, reveals a similar outcome to that identified above with respect to the TSC Act.

Those areas of vegetation which are in 'Very Low' condition are not regarded as satisfying the EPBC Act criteria for the CPW community (as part of a CEEC) – because they are dominated by introduced groundcover species, and have only scattered native groundcover species with low diversity. However, those areas of vegetation which are in 'Low' or 'Moderate' condition are considered likely to satisfy the criteria for the CPW community as listed in the EPBC Act.

Depending on the extent of vegetation proposed to be removed, it is possible (likely in fact) that a formal *Referral* of the project to the Commonwealth will be required. The success of any such *Referral* will be dependent on the extent of removal of CPW vegetation, and on the offsets proposed.

4.1.3 The Cumberland Plain Recovery Plan

The *Cumberland Plain Recovery Plan* is a document prepared by the then DECCW (2010) which *inter alia* identifies actions required for the recovery of threatened biota across the geographic region of the Cumberland Plain, including the Cumberland Plain Woodland CEEC and other "*threatened ecological communities*" (TECs), as well as threatened species associated with that vegetation.

As one element of the *Recovery Plan*, an array of areas have been identified as "*priority conservation lands*" (PCLs) - defined by DECCW (2010) as those which "*represent the best remaining opportunities in the region to maximise long-term biodiversity benefits for the lowest possible cost, including the least likelihood of restricting land supply*". These areas occupy a total area within the Sydney Basin of approximately 25,566ha, and are considered by DECCW "*to be the highest priority for future efforts to conserve the threatened biodiversity of the region*".

DECCW (2010) note that "*it is important that prioritisation and investment in the recovery program be guided by sound principles. These principles, based upon the best available ecological evidence, are that*":

- "*the protection and management of large, intact remnants is more effective and efficient than for smaller, fragmented remnants*";
- "*recovery efforts need to aim to ensure that a representative sample of biodiversity is conserved*";
- "*active management to best practice standards is needed to prevent the degradation of bushland in a fragmented landscape*"; and
- *"where impacts on biodiversity cannot be avoided, they should be offset using appropriate means*".

In regard to the retention of large intact patches of vegetation, the *Recovery Plan* notes:

- *"evidence clearly suggests that larger remnants have a better prospect for long-term survival. Larger remnants are usually more diverse and resilient than smaller remnants, and are less susceptible to 'edge effects', catastrophic events, and the expected impacts of climate change*"; and
- *"threatened woodland birds such as the Brown Treecreeper and Hooded Robin have persisted in the larger, better connected remnants. These remnants are not dominated by aggressive bird species and retain the characteristic habitat requirements for woodland bird fauna. Similarly, a number of mammal species have been recorded from the larger connected remnants*"*.*

The Georges River Nature Reserve and Holsworthy Military Reserve are located to the south of subject site (Figure 7), and include large contiguous areas of native vegetation. Some of the larger tracts of vegetation in the vicinity have been identified as *Priority Conservation Lands* (PCLs) in the *Cumberland Plain Recovery Plan* (DECCW 2010) – but vegetation on the subject land and the subject site has not been identified as a PCL (Figure 8).

In contrast to the PCLs, the vegetation on the subject site is small in extent, and is significantly modified and degraded (Appendix A). In addition, it is isolated from the nearby PCLs and other notable areas of vegetation by the existing uses of the eastern part of the site, and by other clearing, disturbance and development (Figures 1, 2 and 8).

It is noted that DECCW (2010) in the *Cumberland Plain Recovery Plan* excluded areas that were "*zoned for residential and industrial purposes*", as well as areas "*that have been identified for future urban growth*". This largely because of the difficulties in rezoning these areas for conservation purposes - due to their "*higher land values and stronger development pressures*".

According to the *Recovery Plan*, a total of 39% of the extant Cumberland Plain Woodland vegetation is located within the PCLs, and is (theoretically at least) protected by the *Recovery Plan*. The subject site was not considered by DECCW to constitute even part of a PCL (Figure 8).

4.2 Cumberland Plain Woodland - Conclusions

On the basis of all of the considerations documented above, some of the open forest and woodland vegetation on the subject site at Glenfield would clearly satisfy the criteria identified in the *Cumberland Plain Recovery Plan* for the Cumberland Plain Woodland (CPW) community – as listed both in the TSC Act and EPBC Act. The areas which do constitute the CPW community, however, are moderately to highly disturbed, and have been so for a considerable period.

Some of the woodland vegetation present, however, is not considered to satisfy the criteria for the listing of the CPW community pursuant to either the TSC Act or EPBC Act. This view is based on:

- the depauperate nature portions of the vegetation present (particularly the dominance of introduced species in the groundcover layer);
- the deliberations within the *Cumberland Plain Recovery Plan*; and
- the mapping of vegetation in this part of Sydney by Tozer *et al* 2010 (Figure 6) – which indicates potential areas of vegetation which do not satisfy the criteria identified in the *Cumberland Plain Recovery Plan*.

There are a number of areas of vegetation which are very highly modified and degraded, which do not, in the opinion of SLR Ecology, satisfy the criteria for the CPW community (Figure 7).

4.3 Freshwater Wetlands on Coastal Floodplains

The *Final Determination* for the listing of the Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions (FWCF) community as "*endangered ecological community*" (EEC) in the TSC Act, states *inter alia* (in paragraph 4) that:

- "*Artificial wetlands created on previously dry lands specifically for purposes such as sewage treatment, stormwater management and farm production, are not regarded as part of this community*".

The watercourses and freshwater ponds contained within the Glenfield Waste Services site are all artificial in nature, and have been constructed specifically for the purposes of "*stormwater management*". Notwithstanding the floristics of some of these features, which conform in part at least to the floristic assemblage for the FWCF community, that EEC is not present (because of the artificial nature of the relevant features).

5 CONCLUSIONS

A detailed investigation of vegetation within the "*subject site*" (*ie* part of the Glenfield Waste Services site at Glenfield) has been undertaken in order to determine the extent, nature and condition of native vegetation on the subject site. As discussed above in the *Report*, the subject site constitutes the land between Cambridge Avenue (to the south), the Georges River (to the east) and the Glenfield-East Hills railway line (to the north and northwest).

Significant portions of the subject site have long been cleared and modified, and have long been used in part for an existing waste recycling facility, as well as associated structures (offices, parking areas and a weigh bridge). However, there is a band of native vegetation in the southern, central and western parts of the subject site - which contain a tree canopy of eucalypts which are characteristic of the Cumberland Plain Woodland (CPW) community. There is also a narrow band of highly disturbed open forest along the western edge of the subject site, adjacent to the Georges River.

The CPW community is listed in the *Threatened Species Conservation Act 1995* (TSC Act) as a "*critically endangered ecological community*" (CEEC), and is also listed as part of a CEEC in the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act).

The detailed considerations of vegetation within the subject site by SLR Ecology have determined that some of the woodland vegetation in these areas would constitute an example of the CPW community – as listed both at state and federal level. The woodland vegetation in 'Low' to 'Moderate' condition would satisfy the criteria required to constitute an example of the CPW CEEC.

Conversely, there are areas of vegetation which retain a CPW canopy but which are highly degraded and depauperate. These are identified as being in 'Very Low' condition, and are not considered by SLR Ecology to satisfy the criteria for the CPW community, at either the state or federal level.

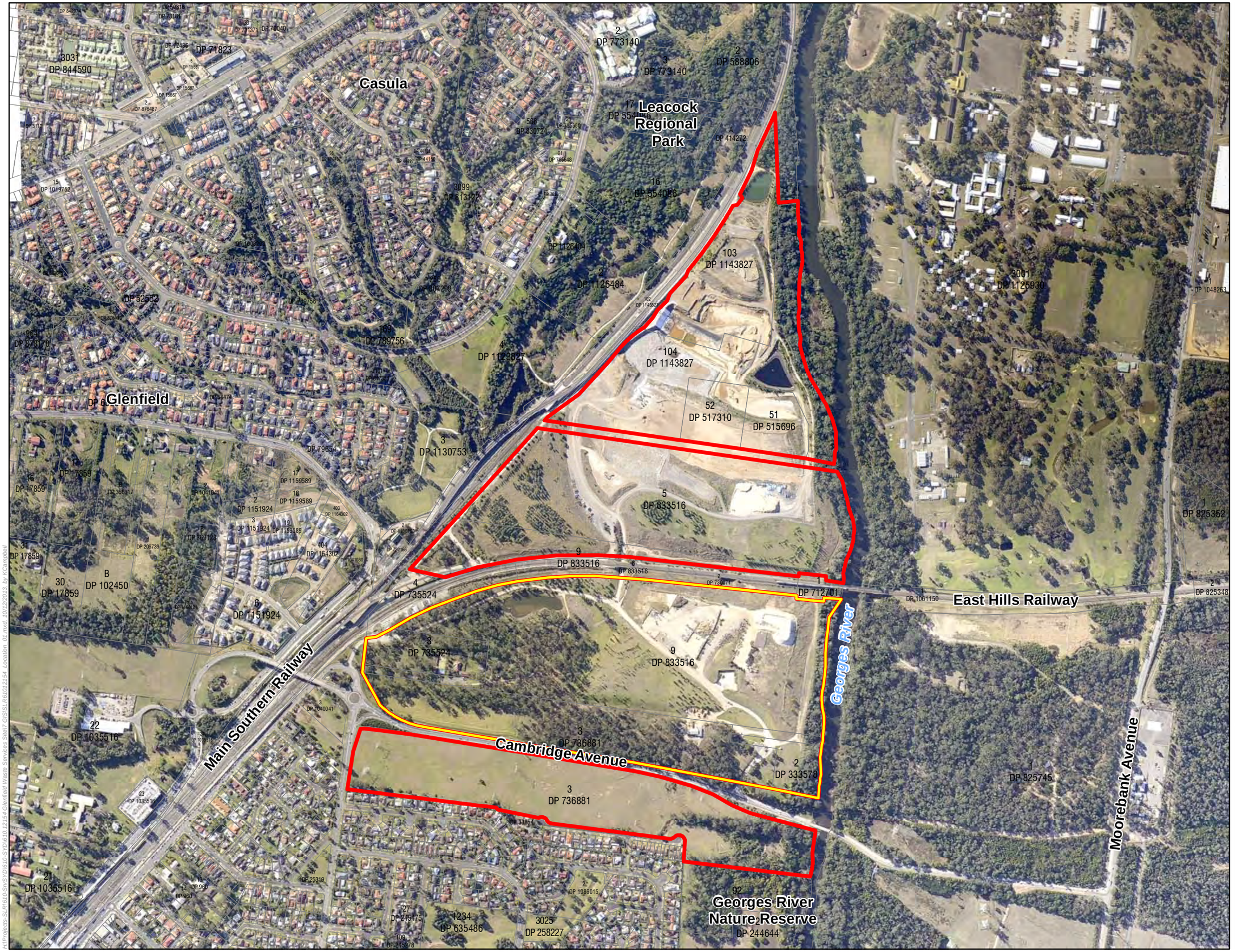
There are artificial ponds and drainage lines on parts of the subject site at Glenfield. These have been constructed for the purposes of "*stormwater management*", and have been colonised by an array of native aquatic and semi-aquatic plant species. Notwithstanding their floristics, these features do not constitute an example of the Freshwater Wetlands on Coastal Floodplains (FWCF) EEC (listed in the TSC Act) - because of the artificial nature of these features.

It is noted, however, that the mere presence of the CPW community does not prohibit development on the subject site, but requires further detailed consideration with respect to:

- the extent of vegetation which can reasonably be removed;
- the need for and quantity of "*biodiversity offsets*" required - to compensate for the removal of CPW vegetation; and
- the relevant considerations to be given to the retention, rehabilitation and long-term management of some of the areas of CPW on the site.

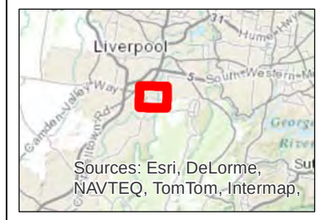
These matters will need further consideration in consultation with Council and the Office of Environment & Heritage (OEH).

Figure 1 Location of the Glenfield Waste Services Site at Glenfield



LEGEND

- Glenfield Waste Services Site
- Subject Site
- Cadastre



N

0 50 100 200 300

Metres

NOTES

1. Digital cadastral database (DCDB) © 2012 NSW Dept of lands.
2. Aerial imagery courtesy of Nearmap, 14 August 2013
3. Map locator courtesy of ESRI 'World Topo Map'
4. All features are approximate only and subject to detailed survey

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Prepared for:
LA Kennett Enterprises Pty Ltd

Project No: **610.12154**

Scale	Date
1:750,000 @ A3	10/12/2013
Drafted: Kelly Campbell	Approved: Fiona Iolini

Figure 2 Details of the subject site at Glenfield

LEGEND

- Subject Site
- Water Feature Corridor
- Road Corridor
- Transmission Easement
- Cadastre
- Photo Points

0 50 100 Metres

N

NOTES

1. Digital cadastral database (DCDB) © 2012 NSW Dept of lands.
2. Aerial imagery courtesy of Nearmap, 14 August 2013
3. Photo Point surveyed by SLR Ecology on the 30th of September and 1st of October 2013
4. All features are approximate only and subject to detailed survey

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1:3,500 @ A3	31/03/2014

Drafted	Approved
Kelly Campbell	Fiona Iolini

Figure 3

Recent flora surveys on the subject site at Glenfield

LEGEND

- Subject Site
- Flora Meander
- Flora Quadrats
- Cadastre

0 50 100
Metres

N

NOTES

1. Digital cadastral database (DCDB) © 2012 NSW Dept of lands.
2. Aerial imagery courtesy of Nearmap, 14 August 2013
3. Flora Meander and Quadrats surveyed by SLR Ecology on the 30th of Septenber and 1st of October 2013
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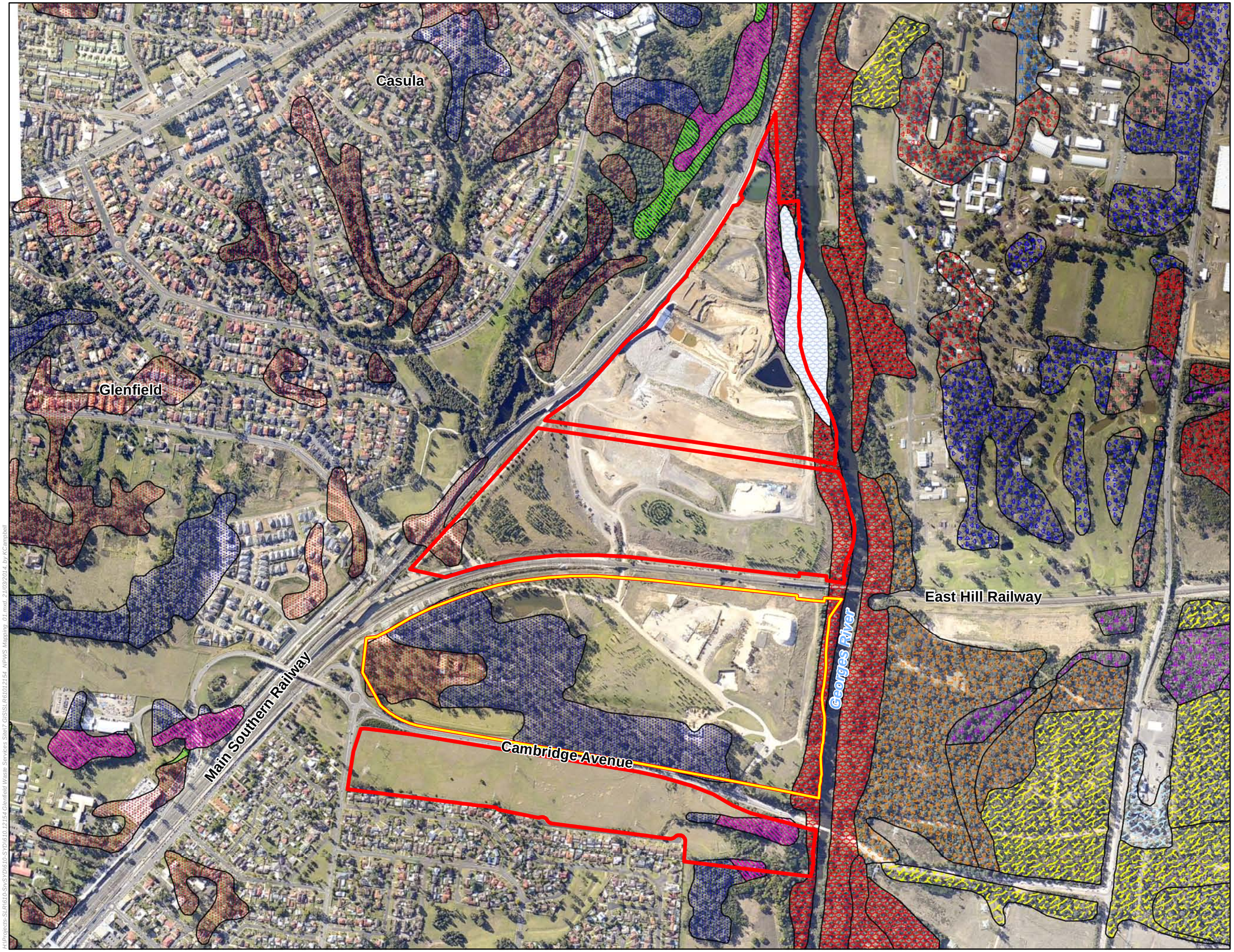
Figure 4 Vegetation mapping by NPWS (2002) of the subject site and surrounds at Glenfield



LEGEND

- Subject Site
- Glenfield Waste Services Site

NPWS Vegetation Mapping

Greater than 10% cover

- 103 - Shale/Gravel Transition Forest
- 6 - Castlereagh Scribbly Gum Woodland
- 4 - Castlereagh Swamp Woodland
- 12 - Riparian Forest
- 3 - Cooks River Castlereagh Ironbark Forest
- Alluvial Woodland
- Shale Plains Woodland

Less than 10% cover

- 4 - Castlereagh Swamp Woodland
- 12 - Riparian Forest
- 3 - Cooks River Castlereagh Ironbark Forest
- Alluvial Woodland
- Shale Plains Woodland

Less than 10% cover and urbanised

- 103 - Shale/Gravel Transition Forest
- 4 - Castlereagh Swamp Woodland
- 12 - Riparian Forest
- 3 - Cooks River Castlereagh Ironbark Forest

0 50 100 200 300
Metres

N

NOTES

1. Digital cadastral database (DCDB) © 2012 NSW Dept of lands.
2. Aerial imagery courtesy of Nearmap, 14 August 2013
3. Map locator courtesy of ESRI 'World Topo Map'
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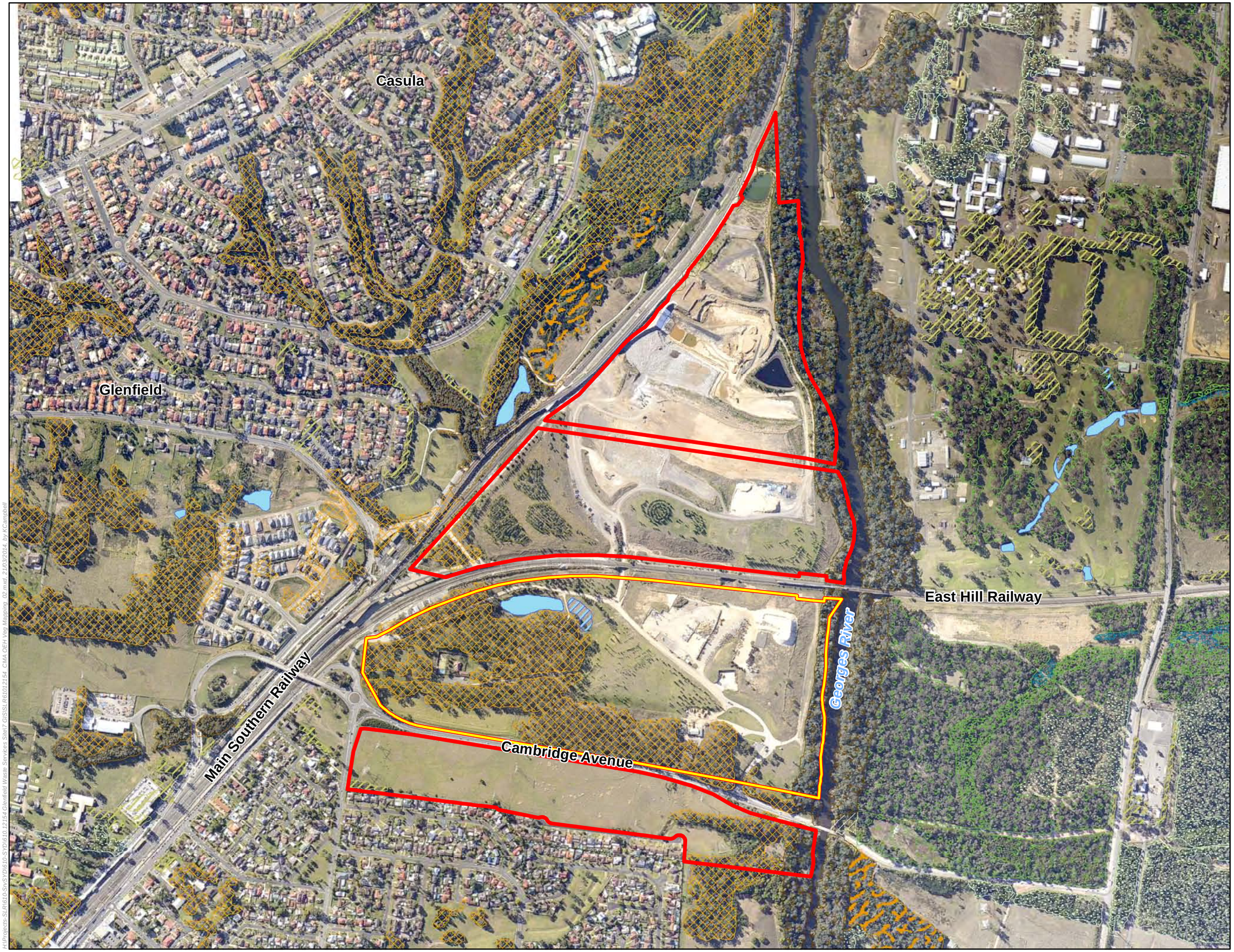
Figure 5 Vegetation mapping by the CMA/OEH (2009) of the subject site and surrounds at Glenfield



LEGEND

- Subject Site
- Glenfield Waste Services Site
- Cumberland Moist Shale Woodland
- Cumberland Shale Plains Woodland
- Castlereagh Shale-Gravel Transition Forest
- Castlereagh Scribbly Gum Woodland
- Castlereagh Swamp Woodland
- Coastal Freshwater Reedland
- Cumberland Riverflat Forest
- Cumberland Swamp Oak Riparian Forest
- Hinterland Flats Eucalypt Forest
- Urban Exotic/Native
- Weeds and Exotics
- Artificial Wetland
- Water

0 50 100 200 300
Metres

N

NOTES

1. Digital cadastral database (DCDB) © 2012 NSW Dept of lands.
2. Aerial imagery courtesy of Nearmap, 14 August 2013
3. Map locator courtesy of ESRI 'World Topo Map'
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Drafted	Approved
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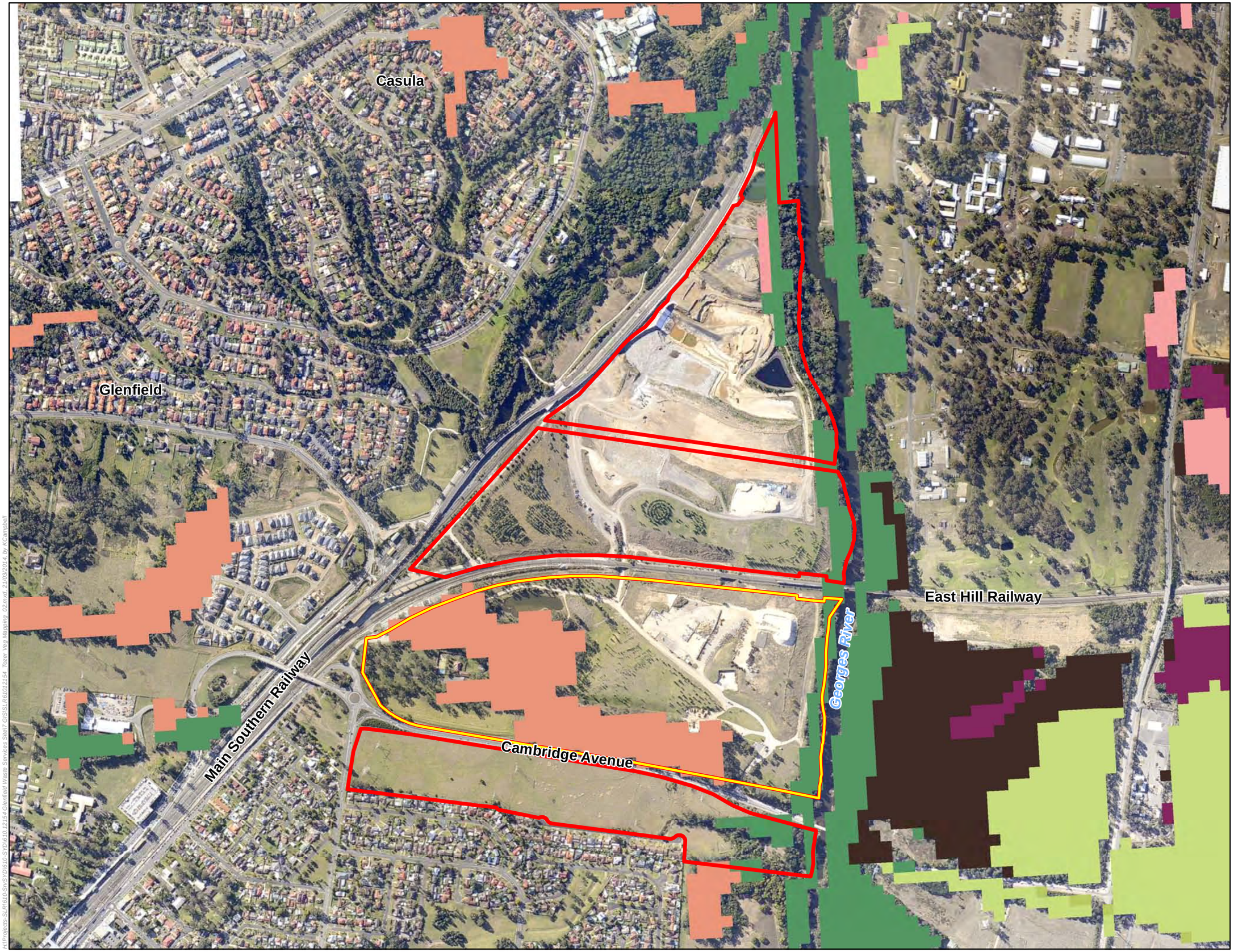
Figure 6 Vegetation mapping by the Tozer (2010) of the subject site and surrounds at Glenfield



LEGEND

- Subject Site
- Glenfield Waste Services Site
- Castlereagh Ironbark Forest
- Castlereagh Scribbly Gum Woodland
- Castlereagh Shale-Gravel Transition Forest
- Castlereagh Swamp Woodland
- Cleared
- Coastal Sandstone Plateau Heath
- Cumberland River Flat Forest
- Cumberland Shale Plains Woodland
- Cumberland Shale Sandstone Transition Forest

0 50 100 200 300
Metres

N

NOTES

1. Digital cadastral database (DCDB) © 2012 NSW Dept of lands.
2. Aerial imagery courtesy of Nearmap, 14 August 2013
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Scale	Date
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Drafted	Approved
Kelly Campbell	Fiona Iolini

Figure 7 SLR Ecology vegetation condition mapping on the subject site at Glenfield

East Hills Railway

Existing Recycling Facility

Cambridge Avenue

Georges River

Man-made and surrounded by dense Kikuyu

Mowing and weed invasion

Man-made and surrounded by dense Kikuyu

Man-made and surrounded by dense Kikuyu

Weed invasion

Exotic ground cover

Exotic groundcover

Mixed native and exotic groundcover

Exotic groundcover

Cleared understorey and groundcover

Exotic groundcover

Exotic groundcover

Cleared understorey and groundcover

Exotic groundcover

Dense noxious weeds

LEGEND

- Subject Site
- Cadastre

Artificial Cumbungi Wetland

- Very low (1.34Ha)

Grey Box - Red Gum Woodland

- Very Low (3.48Ha)
- Low - Moderate (7.55Ha)

Red Gum - Ironbark Woodland

- Very Low (0.9Ha)
- Low (0.06Ha)
- Moderate (0.63Ha)

Red Gum - Stringybark Riparian Forest

- Very low (1.41Ha)

N

0 50 100

Metres

NOTES

1. Digital cadastral database (DCDB) © 2012 NSW Dept of lands.
2. Aerial imagery courtesy of Nearmap, 14 August 2013
3. Vegetation mapping undertaken by SLR Ecology on the 30th of September and 1st of October 2013
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Drafted	Approved
Louise Hibbert	Fiona Iolini

Figure 8

Priority Conservation Lands

LEGEND

- Glenfield Waste Services Site
- Subject Site
- Priority Conservation Lands

N

0 500 1,000 2,000 3,000

Metres

NOTES

1. Digital cadastral database (DCDB) © 2012 NSW Dept of lands.
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global environmental solutions

Glenfield Waste Services Site
Cambridge Avenue, Glenfield

Proposed Rezoning & Expansion

Cumberland Plain Woodland Assessment Report

Appendix A
Photographs of the Subject Site

March 2014

Appendix A Photographs from the site on the 30th of September and 1st of October 2013.

Photo Point 1

- NW – exotic grass area with Grey Box and some Red Gum

Photo Point 2

- S – patch of Cobblers Pegs along fence

Photo Point 3

- Couch Grass along fence

Photo Point 4

- Bund with exotic Nasella Grass ?

Photo Point 5

- NE – highly disturbed groundcover in the vicinity of the compound

Photo Point 6

- Grey Box with highly disturbed groundcover - maintained for asset protection to the landfill

Appendix A Photographs from the site on the 30th of September and 1st of October 2013.

Photo Point 7

- NW – from on top of the bund showing the Grey Box with *Melaleuca decora* at this location

Photo Point 8

- W – areas dominated by Weeping Grass

Photo Point 9

- W – asset protection involving complete removal of groundcover for approximately 50m south of the landfill

Photo Point 10

- SW – Grey Box woodland with mixed native and exotic groundcover and colour bond fence along southern boundary (Cambridge Avenue)

Photo Point 11

- W – Grey Box with dry grassy groundcover

Photo Point 12

- N – mesh fence running north-south here. Note – colourbond fence along southern boundary stops at the mesh fence, but bund continues to the west.

Appendix A Photographs from the site on the 30th of September and 1st of October 2013.

Photo Point 13

- W – grass is mostly Weeping Grass at this point

Photo Point 14

- W – paddock wire fencing to the mesh fence

Photo Point 15

- NW - all exotic grass

Photo Point 16

- W – almost entirely exotic grasses

Photo Point 17

- Grey Box trees with exotic grasses

Photo Point 18

- Grey Box trees with Kikuyu and Couch

Appendix A Photographs from the site on the 30th of September and 1st of October 2013.

Photo Point 19

- W - Grey Box trees with exotic grasses and weeds

Photo Point 20

- NW - Grey Box trees with exotic grasses (mainly Kikuyu) and row of planted Swamp Oaks at entrance gates

Photo Point 21

- E – Driveway planted out with exotic deciduous trees

Photo Point 22

- S – planted trees

Photo Point 23

- NE – paddock of exotic lawn grass with Grey Box, Narrow-leaved Ironbark and Stringybark

Photo Point 24

- NW – small wedge of regrowth eucalypts, Wattles and Weeping Grass

Appendix A Photographs from the site on the 30th of September and 1st of October 2013.

Photo Point 25

- E – exotic lawn

Photo Point 26

- SW - Exotic paddock

Photo Point 27

- E – mainly exotic grasses

Photo Point 28

- E – two rows of planted Swamp Oaks

Photo Point 29

- SE – Grey Box with mixed native/exotic grassland

Photo Point 30

- S – exotic lawn with scattered trees in the vicinity of the house

Appendix A Photographs from the site on the 30th of September and 1st of October 2013.

Photo Point 31

- S – Grey Box with mixed native/exotic grassland

Photo Point 32

- NE – Grey Box with mixed native/exotic grassland

Photo Point 33

- S – fairly exotic grass cover along this boundary where it is lower lying

Photo Point 34

- W – band of regrowth and/or planted eucalypts and Swamp Oaks with exotic grass and weeds

Photo Point 35

- Exotic lawn grass and plantings

Photo Point 36

- NW – drainage channel enters site from under train line and flows south to artificial wetland

Appendix A Photographs from the site on the 30th of September and 1st of October 2013.

Photo Point 37

- SE – artificial wetland with Cumbungi

Photo Point 38

- NE – Red Gum, Stringybark, Ironbark and Rough-barked Apple with some native understorey and mown mixed native/exotic grassland

Photo Point 39

- W – moderate condition CPW vegetation, which is highly diverse but mown, with some weed invasion

Photo Point 40

- E – lower slope is exotic

Photo Point 41

- W – artificial wetland with exotic grasses and weeds around edges

Photo Point 42

- N – riparian Red Gum and Stringybark with Wattles, African Olive and Lantana

Appendix A Photographs from the site on the 30th of September and 1st of October 2013.

Photo Point 43

- NE – riparian vegetation is highly disturbed by weed invasion and rubbish

Photo Point 44

- S – Georges River

Photo Point 45

- N – riparian vegetation with similar dry CPW species to the remainder of the site

global environmental solutions

Glenfield Waste Services Site
Cambridge Avenue, Glenfield

Proposed Rezoning & Expansion

Cumberland Plain Woodland Assessment Report

Appendix B
Final Determination for CPW

March 2014

Environment & Heritage

You are here: Home > Threatened species > Scientific Committee > Determinations

Cumberland Plain Woodland in the Sydney Basin Bioregion - critically endangered ecological community listing

NSW Scientific Committee - final determination

The Scientific Committee, established by the Threatened Species Conservation Act, has made a Final Determination to list the Cumberland Plain Woodland in the Sydney Basin Bioregion as a CRITICALLY ENDANGERED ECOLOGICAL COMMUNITY in Part 2 of Schedule 1A of the Act and as a consequence, to omit reference to Cumberland Plain Woodland from Part 3 of Schedule 1 (Endangered Ecological Communities) of the Act. The listing of Critically Endangered Ecological Communities is provided for by Part 2 of the Act.

The Scientific Committee has found that:

1. Cumberland Plain Woodland was listed as an Endangered Ecological Community under the *Threatened Species Conservation Act* 1995 in June 1997 (NSW Scientific Committee 1997). Since this listing, a large volume of new data and analyses have become available. In addition, a nomination to change the status of Cumberland Woodland to Critically Endangered status has been received. This Determination addresses additional information now available in accordance with current listing criteria under the *Threatened Species Conservation Regulation* 2002.

2. Cumberland Plain Woodland is the name given to the ecological community in the Sydney Basin bioregion associated with clay soils derived from Wianamatta Group geology, or more rarely alluvial substrates, on the Cumberland Plain, a rainshadow area to the west of Sydney's Central Business District. The mean annual rainfall of this area is typically in the range of 700-900 mm, and is generally lower than that received on more elevated terrain that partially surrounds the Plain. The community typically occurs on flat to undulating or hilly terrain up to about 350 m elevation but may also occur on locally steep sites and at slightly higher elevations. Cumberland Plain Woodland is characterised by the assemblage of species listed in paragraph 3 and typically comprises an open tree canopy, a near-continuous groundcover dominated by grasses and herbs, sometimes with layers of shrubs and/or small trees. Shrubs may sometimes occur in locally dense stands. Less disturbed stands of the community may have a woodland or forest structure. Small trees or saplings may dominate the community in relatively high densities after partial or total clearing, and the groundcover may be relatively sparse, especially where densities of trees or shrubs are high. The community also includes 'derived' native grasslands which result from removal of the woody strata from the woodlands and forests.

3. Cumberland Plain Woodland is characterised by the following assemblage of species:

Acacia implexa	*Ajuga australis*
Aristida ramosa	*Aristida vagans*
Arthropodium milleflorum	*Arthropodium minus*
Asperula conferta	*Austrodanthonia caespitosa*
Austrodanthonia racemosa var. *racemosa*	*Austrodanthonia tenuior*
Bossiaea prostrata	*Bothriochloa decipiens*
Bothriochloa macra	*Brunoniella australis*
Bursaria spinosa	*Carex inversa*
Centaurium spicatum	*Centella asiatica*
Cheilanthes distans	*Cheilanthes sieberi* subsp. *sieberi*
Chloris truncata	*Chloris ventricosa*
Chorizema parviflorum	*Chrysocephalum apiculatum*
Clematis glycinoides var. *glycinoides*	*Commelina cyanea*
Crassula sieberiana	*Cymbonotus lawsonianus*
Cymbopogon refractus	*Cyperus gracilis*
Daucus glochidiatus	*Daviesia ulicifolia*

Desmodium brachypodium	*Desmodium varians*
Dianella longifolia	*Dichanthium sericeum*
Dichelachne micrantha	*Dichelachne parva*
Dichondra repens	*Dichopogon fimbriatus*
Dichopogon strictus	*Digitaria diffusa*
Dillwynia sieberi	*Dodonaea viscosa* subsp. *cuneata*
Echinopogon caespitosus var. *caespitosus*	*Echinopogon ovatus*
Einadia hastata	*Einadia nutans*
Einadia polygonoides	*Einadia trigonos*
Elymus scaber var. *scaber*	*Eragrostis leptostachya*
Eremophila debilis	*Eriochloa pseudoacrotricha*
Eucalyptus crebra	*Eucalyptus eugenioides*
Eucalyptus moluccana	*Eucalyptus tereticornis*
Euchiton sphaericus	*Exocarpus cupressiformis*
Fimbristylis dichotoma	*Galium migrans*
Galium propinquum	*Geranium homeanum*
Geranium solanderi var. *solanderi*	*Glossogyne tannensis*
Glycine clandestina	*Glycine microphylla*
Glycine tabacina	*Goodenia hederacea subsp. hederacea*
Hardenbergia violacea	*Hypericum gramineum*
Hypoxis hygrometrica	*Hypoxis pratensis* var. *pratensis*
Indigofera australis	*Juncus usitatus*
Lachnagrostis avenacea var. avenacea	*Lomandra filiformis* subsp. *filiformis*
Lomandra multiflora subsp. *multiflora*	*Mentha diemenica*
Microlaena stipoides var. *stipoides*	*Opercularia diphylla*
Oxalis perennans	*Panicum effusum*
Paspalidium distans	*Phyllanthus virgatus*
Plantago debilis	*Plantago gaudichaudii*
Plectranthus parviflorus	*Poa labillardieri* var. *labillardieri*
Pratia purpurascens	*Pultenaea microphylla*
Rubus parvifolius	*Scleria mackaviensis*
Scutellaria humilis	*Senecio diaschides*
Senecio hispidulus var. *hispidulus*	*Sida corrugata*
Solanum cinereum	*Solanum prinophyllum*
Sorghum leiocladum	*Sporobolus creber*
Sporobolus elongatus	*Stackhousia viminea*
Themeda australis	*Tricoryne elatior*
Vernonia cinerea var. cinerea	*Veronica plebeia*
Wahlenbergia gracilis	*Wahlenbergia stricta subsp. stricta*
Wurmbea dioica subsp. dioica	*Zornia dyctiocarpa var. dyctiocarpa*

Other tree species occurring less frequently in this community include:

Angophora bakeri	*Angophora floribunda*
Angophora subvelutina	*Corymbia maculata*
Eucalyptus amplifolia	*Eucalyptus baueriana*
Eucalyptus bosistoana	*Eucalyptus fibrosa*
Eucalyptus globoidea	*Eucalyptus longifolia*
Eucalyptus paniculata	*Eucalyptus punctata*
Syncarpia glomulifera	

4. The total species list of the community is larger than that given above, with many species present in only one or two sites or in low abundance. The species composition of a site will be influenced by the size of the site, recent rainfall or drought conditions and by its disturbance (including grazing, land clearing and fire) history. The number and relative abundance of species will change with time since fire, and may also change in response to changes in fire frequency or grazing regime. At any one time, above-ground individuals of some species may be absent, but the species may be represented below-ground in soil seed banks or as dormant structures such as bulbs, corms, rhizomes, rootstocks or lignotubers. Benson and Howell (2002) and Benson & von Richter (2008) document the temporal variability in the species composition of the community. The list of species given above is mainly of vascular plant species, however the community also includes micro-organisms, fungi, cryptogamic plants and a diverse fauna, both vertebrate and invertebrate. The mammalian and avian components of the fauna have been described by Leary (*in litt*. August 2007) and Farrell (in litt. June 2007). Other components of the community are poorly documented (although see Benson & von Richter 2008).

5. Cumberland Plain Woodland is characterised by an upper-storey that is usually dominated by *Eucalyptus moluccana* (Grey Box) and *E. tereticornis* (Forest Red Gum), often with *E. crebra* (Grey Ironbark), *E. eugenioides* (Narrow-leaved Stringybark), *Corymbia maculata* (Spotted Gum) or other less frequently occurring eucalypts, including *Angophora floribunda, A. subvelutina* (Broad-leaved Apple), *E. amplifolia* (Cabbage Gum) and *E. fibrosa* (Broad-leaved Ironbark). The community may have an open stratum of small trees that may include any of these eucalypts, as well as species such as *Acacia decurrens* (Black Wattle), *A. parramattensis* (Parramatta Wattle), *A.implexa* (Hickory Wattle) or *Exocarpos cupressiformis* (Native Cherry). Shrubs are typically scattered in the understorey but may be absent or locally dense as a result of clearing activity or changes in grazing or fire regimes. *Bursaria spinosa* (Blackthorn) is usually dominant, while other species include *Daviesia ulicifolia* (Gorse Bitter Pea), *Dillwynia sieberi, Dodonaea viscosa* subsp. *cuneata* and *Indigofera australis* (Native Indigo). The ground cover is dominated by a diverse range of grasses including *Aristida ramosa* (Purple Wiregrass), *A. vagans* (Threeawn Speargrass), *Cymbopogon refractus* (Barbed Wire Grass), *Dichelachne micrantha* (Plumegrass), *Echinopogon caespitosus* (Forest Hedgehog Grass), *Eragrostis leptostachya* (Paddock Lovegrass), *Microlaena stipoides* (Weeping Grass), *Paspalidium distans* and *Themeda australis* (Kangaroo Grass), and with graminoids *Carex inversa* (Knob Sedge), *Cyperus gracilis, Lomandra filiformis* subsp. *filiformis* (Wattle Mat-rush) and *L. multiflorus* subsp. *multiflorus* (Many-flowered Mat-rush). The ground cover also includes a diversity of forbs such as *Asperula conferta* (Common Woodruff), *Brunoniella australis* (Blue Trumpet), *Desmodium varians* (Slender Tick Trefoil), *Dianella longifolia* (Blue Flax Lily), *Dichondra repens* (Kidney Weed), *Opercularia diphylla*, *Oxalis perennans* and *Wahlenbergia gracilis* (Australian Bluebell), as well as scramblers, *Glycine* spp. and *Hardenbergia violacea* (Native Sarsaparilla) and the fern *Cheilanthes sieberi* (Poison Rock Fern).

6. The structure of the community varies depending on past and current disturbances, particularly clearing, fire and grazing. Contemporary tree-dominated stands of the community are largely relics or regrowth of originally taller forests and woodlands, which are likely to have had scattered shrubs and a largely continuous grassy groundcover. At some sites, mature trees may exceed 30m tall, although regrowth stands may be shorter than 10 m tall. After total or partial clearing, the tree canopy may remain sparse or may regrow to form dense stands of saplings and small trees, which are typically associated with a ground layer of reduced cover and diversity. Either or both of the upper-storey and mid-storey may be absent from the community. Native grasslands derived from clearing of the woodland and forest are also part of this community if they contain characteristic non-woody species listed in paragraph 3.

7. Cumberland Plain Woodland includes: 'Shale Hills Woodland' (map unit 9) and 'Shale Plains Woodland' (map unit 10) of Tozer (2003); 'Spotted Gum Forest' (map unit 9b), 'Grey Box Woodland' (map unit 10c) and 'Grey Box – Ironbark Woodland' (map unit 10d) of Benson (1992); and 'Cumberland Plain Woodlands' of Benson & Howell (1990a; b). Tindall *et al*. (2004) and Tozer *et al*. (2006) subsequently reproduced Tozer's (2003) classification and mapping, re-labelling map units 9 and 10 as 'Cumberland Shale Hills Woodland' (map unit GW p28) and 'Cumberland Shale Plains Woodland' (map unit GW p29), respectively. Cumberland Plain Woodland belongs to the Coastal Valley Grassy Woodlands vegetation class (Keith 2004).

8. Several other ecological communities listed under the *Threatened Species Conservation Act* 1995 may intergrade with Cumberland Plain Woodland. These include Cooks River/ Castlereagh Ironbark Forest in the Sydney Basin Bioregion; Moist Shale Woodland in the Sydney Basin Bioregion; Shale / Sandstone Transition Forest; Shale Gravel Transition Forest in the Sydney Basin Bioregion; and Sydney Turpentine-Ironbark Forest. While Tozer (2003) provides information on the features that distinguish these communities, some transitional stands will be difficult to assign to a single community with a high level of confidence (Keith 2009). Transitional stands between Cumberland Plain Woodland and other communities listed under the *Threatened Species*

Conservation Act 1995 are considered part of a listed community, and should be assigned to the community with which they share greatest resemblance in species composition and other properties.

9. Cumberland Plain Woodland in the Sydney Basin Bioregion is included within the critically endangered ecological community listed under the *Environment Protection and Biodiversity Conservation Act* as "Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest". However the Commonwealth listing advice excludes some patches, here regarded as Cumberland Plain Woodland, on the basis of condition or structure thresholds.

10. The following threatened species have been recorded from Cumberland Plain Woodland:

Invertebrates

Cumberland Land Snail	*Meridolum corneovirens*	Endangered

Birds

Gang Gang Cockatoo	*Callocephalon fimbriatum*	Vulnerable
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	Vulnerable
Brown Treecreeper	*Climacteris picumnus*	Vulnerable
Painted Honeyeater	*Grantiella picta*	Vulnerable
Swift Parrot	*Lathamus discolor*	Endangered
Square-tailed Kite	*Lophoictinia isura*	Vulnerable
Hooded Robin (south-eastern form)	*Melanodryas cucullata cucullata*	Vulnerable
Black-chinned Honeyeater (eastern subspecies)	*Melithreptus gularis gularis*	Vulnerable
Turquoise Parrot	*Neophema pulchella*	Vulnerable
Barking Owl	*Ninox connivens*	Vulnerable
Powerful Owl	*Ninox strenua*	Vulnerable
Speckled Warbler	*Pyrrholaemus sagittatus*	Vulnerable
Diamond Firetail	*Stagonopleura guttata*	Vulnerable
Masked Owl	*Tyto novaehollandiae*	Vulnerable
Sooty Owl	*Tyto tenebricosa*	Vulnerable
Regent Honeyeater	*Xanthomyza phrygia*	Endangered

Mammals

Large-eared Pied Bat	*Chalinolobus dwyeri*	Vulnerable
Spotted-tail Quoll	*Dasyurus maculata*	Vulnerable
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	Vulnerable
Eastern Bent-wing Bat	*Miniopterus schreibersii*	Vulnerable
Eastern Freetail Bat	*Mormopterus norfolkensis*	Vulnerable
Southern Myotis	*Myotis macropus*	Vulnerable
Yellow-bellied Glider	*Petaurus australis*	Vulnerable
Squirrel Glider	*Petaurus norfolkensis*	Vulnerable
Koala	*Phascolarctos cinereus*	Vulnerable
Grey-headed Flying-fox	*Pteropus poliocephalus*	Vulnerable
Yellow-bellied Sheathtail Bat	*Saccolaimus flaviventris*	Vulnerable
Greater Broad-nosed Bat	*Scoteanax rueppellii*	Vulnerable

Plants

Downy Wattle	*Acacia pubescens*	Vulnerable
Juniper-leaved Grevillea	*Grevillea juniperina* subsp. *juniperina*	Vulnerable
Native Pear	*Marsdenia viridiflora* subsp. *viridiflora*	Endangered Population
Narrow-leaved Geebung	*Persoonia nutans*	Endangered
Spiked Riceflower	*Pimelea spicata*	Endangered
Matted Bush-pea	*Pultenaea pedunculata*	Endangered
Sydney Plains Greenhood	*Pterostylis saxicola*	Endangered

11. Cumberland Plain Woodland is restricted to the Sydney Basin Bioregion (*sensu* Thackway and Cresswell) and is currently known to occur within the local government areas of Auburn, Bankstown, Baulkham Hills, Blacktown, Camden, Campbelltown, Fairfield, Hawkesbury, Holroyd, Liverpool, Parramatta, Penrith and Wollondilly, but may occur elsewhere within the bioregion. Using map data from Tozer (2003), Cumberland Plain Woodland was estimated to occur within an extent of occurrence of 2810 km2, and an area of occupancy of just under 2 100 km2 based on 2 x 2 km grid cells, the spatial scale recommended by IUCN (2008) for assessing areas of occupancy for species.

12. Small areas of Cumberland Plain Woodland have been recorded from Kemps Creek, Mulgoa and Windsor Downs Nature Reserves, Scheyville National Park, and Leacock, Rouse Hill and Western Sydney Regional Parks.

13. Based on aerial photography flown in November 1998, Tozer (2003) estimated the total extent of woody vegetation referred to as Cumberland Plain Woodland was 11 054 (±1 564) ha (upper and lower plausible bounds, *sensu* Keith et al. 2009), representing 8.8 (±1.2)% of the pre-European distribution of the community. Patches of the community lacking woody vegetation are very small in extent and can be considered to be included within the plausible bounds. For that part of the community's distribution to the east of the Hawkesbury-Nepean River, earlier mapping at coarser resolution by Benson & Howell (1990b) suggests a similar level of depletion, with an estimated 6 420 ha of 'Cumberland Plain Woodlands', representing 6% of the pre-European distribution east of the Hawkesbury-Nepean River. An update of Tozer's (2003) map, based on interpretation of imagery flown in January-March 2007 shows that the extent of Cumberland Plain Woodland east of the Hawkesbury – Nepean River had declined by 442±46 ha, a reduction of 5.2±0.6% in 9 years (NSW Scientific Committee & Simpson 2008). These estimates indicate that the geographic distribution of the community has undergone a very large reduction over a time frame appropriate to the life cycle and habitat characteristics of its component species.

14. Some areas of Cumberland Plain Woodland subjected to a history of partial clearing and grazing have recently undergone a change in management to conserve the community. Examples include Mt Annan Botanic Garden, Scheyville National Park, Western Sydney Regional Park, Elizabeth Macarthur Agricultural Institute, Orchard Hills Defence Site and the former Australian Defence Industries site at St Marys. Experience from these areas suggests that the community is capable of some recovery, provided the soil has not been disturbed by earthworks, cultivation, fertiliser application or other means of nutrient or moisture enrichment (Benson & Howell 2002; Pellow 2003; Keith *et al*. 2005; J. Howell *in litt*. August 2007; J. Sanders *in litt*. January 2008). In contrast, restoration of Cumberland Plain Woodland has proved to be problematic on sites that have been exposed to such soil disturbance. At Western Sydney Regional Park, for example, Wilkins *et al*. (2003), Nichols (2005) and Nichols *et al.* (2005) studied the recovery of abandoned pastures that had been planted with more than 20 native tree and shrub species of Cumberland Plain Woodland. Over 10 years they found no evidence of convergence in species composition with nearby remnant stands of the community and the species composition of restored areas remained indistinguishable from untreated pastures. There was some evidence that restored vegetation had begun to develop more species-rich assemblages of moths and butterflies compared to untreated pastures, although after 10 years, it lacked a number of species characteristic of remnant woodland (Lomov *et al.* 2006). Ant communities also showed marked differences between restored and remnant vegetation although some ecological processes, such as pollination and seed dispersal, showed some evidence of development at restored sites (Lomov 2005). These results suggest that sites with a history of soil disturbance will be extremely slow to recover characteristics of Cumberland Plain Woodland, if at all, and that experimentation with alternative restoration technologies is required. As a large proportion of the former distribution of the community has either undergone similar histories of soil disturbance or are now occupied by urban development, opportunities for restoration of the community across

significant areas appear limited.

15. The reduction in the geographic distribution of Cumberland Plain Woodland was initially due to tree-felling for timber and clearing for crops and pastures (Benson & Howell 1990a). Benson & Howell (1990b) estimated that the community had been reduced to approximately half of its pre-European extent by 1850. Following World War II, there was a marked acceleration in urban and industrial development, which continues to deplete the distribution of the community to the present day. These trends appear likely to continue into the future as the urban area continues to expand to accommodate Sydney's increasing population, which is projected to grow by 1.0-1.1 million people during the 20 years 2007-2026 and 2.2-3.3 million during the 50 years 2007-2056 (Australian Bureau of Statistics 2008). Recent draft plans to develop growth centres in north-west and south-west Sydney, for example, identify staged release of land for residential and employment development over the next 25 years. These areas contain approximately 2000 ha (one-fifth) of the estimated remaining Cumberland Plain Woodland based on Tozer (2003), of which about two-thirds will be available for development, the loss of which is planned for offsetting through voluntary land acquisition and/or the establishment of conservation agreements on lands outside the Growth Centres (Growth Centres Commission 2007) for the primary purpose of biodiversity conservation. While important examples of Cumberland Plain Woodland are represented within conservation reserves, much of the remaining area of the community occurs on private land or on public easements, where it is at risk from small-scale clearing associated with housing, industrial development and transport infrastructure. There are significant logistic and technological constraints and time lags associated with efforts to restore the community (Wilkins *et al*. 2003; Nichols 2005; Nichols *et al*. 2005). 'Clearing of native vegetation' is listed as a Key Threatening Process under the *Threatened Species Conservation Act* 1995.

16. Fragmentation of habitat associated with clearing has resulted in a very large reduction in the ecological function of Cumberland Plain Woodland. The remaining area of the community is severely fragmented, with more than half of the remaining tree cover mapped by Tozer (2003) occurring in patches of less than 80 ha and half of all mapped patches being smaller than 3 ha (Tozer *in litt*. October 2007). The integrity and survival of small, isolated stands is impaired by the small population size of many species, enhanced risks from environmental stochasticity, disruption to pollination and dispersal of fruits or seeds, and likely reductions in the genetic diversity of isolated populations (Young *et al*. 1996; Young & Clarke 2000). The impacts of fragmentation and associated processes are most evident in the loss of vertebrate fauna from the community (Farrell 2005; Farrell *in litt*. June 2007; Leary 2005; *in litt*, August 2007). As well, some invertebrate species, such as the Endangered Cumberland Land Snail, appear to be in decline, at least in the smaller fragments (M. Shea *in litt*. June 2007). The dieback of eucalypt canopies observed in stands of Cumberland Plain Woodland at Scheyville (D. Keith pers. comm. October 2008) may be a result of complex interactions involving insect attack, weed invasion, nutrient enrichment and drought, in which fragmentation also plays a role (Reid & Landsberg 2000; Wardell-Johnson *et al*. 2006). Despite their history of fragmentation, some very small and apparently degraded remnants may contain a surprisingly high diversity of species and important examples of rare species, particularly plants (James *et al*. 1999; Benson & Keith 1984; McBarron *et al*. 1988; Benson & Howell 1990a; Kirkpatrick & Gilfedder 1995). However, clearing and continuing degradation of these patches reduces the likelihood that all of these species will persist, particularly because a large proportion of species are known from very few locations which are not clustered in predictable ways (Benson & Howell 2002; Tozer 2003). Fragmentation also results in reduced fire frequencies within some patches, which may reduce the viability of some native plant populations, and hence the diversity of species within the patches (Clarke 2000; Watson 2005).

17. Changes in structure contribute to a very large reduction in the ecological function of Cumberland Plain Woodland. Almost all of the remaining area of the community is regrowth forest and woodland from past clearing activities (Benson & Howell 1990a). Mean tree densities in contemporary stands of the community were found to be substantially higher than historical estimates and tree sizes were thought to be smaller (Benson 1992). Large trees approximating the stature of the community prior to European settlement occur very sparsely within remnant patches of vegetation or remain as isolated individuals within paddocks or urban areas. Scheyville National Park, for example, which contains a large remnant of Cumberland Plain Woodland, was extensively logged and partially cleared over many decades prior to its reservation and is thought to contain as few as five large old trees likely to date from pre-European times (J. Sanders, *in litt*. January 2008). Loss of these large trees, which provide habitat resources for a range of fauna, is associated with declines and local extinctions of numerous birds and mammals that were once more common on the Cumberland Plain (Farrell 2005; T. Leary *in litt*. August 2007). Changes in understorey are difficult to assess, as responses to anthropogenic disturbances are confounded with responses to climatic variability (Benson & Howell 2002). Nevertheless, other structural changes to the community include the removal of fallen woody debris and standing dead trees, the removal of woody understorey plants, or conversely the development of regrowth stands with very high densities of eucalypt saplings or shrubs, notably *Bursaria spinosa*, which

may suppress the ground flora. Botanist Allan Cunningham noted high densities of *B. spinosa* in farmland near Liverpool as early as 1817 (Lee 1927; Benson 1992), while similar phases of high shrub abundance have been observed recently at Mt Annan and Scheyville in response to abandonment of farming practices (Benson & Howell 2002; J. Sanders, *in litt.* January 2008). Some areas of the community now devoid of woody plant species may retain a substantial suite of native grasses and herbs in the ground layer. The Orchard Hills Defence Site includes outstanding examples of this phenomenon (Pellow 2003; Keith *et al*. 2005). 'Loss of hollow-bearing trees' and 'Removal of dead wood and dead trees' are listed as Key Threatening Processes under the *Threatened Species Conservation Act* 1995.

18. While a sample of the original fauna of Cumberland Plain Woodland persists, some components have already been lost and others continue to decline (Leary 2005; *in litt*. Aug. 2008). The original mammal fauna of the Cumberland Plain was estimated to include approximately 60 species (NPWS 1997), of which less than 40 were detected in recent intensive surveys and only 14 species are now considered to be relatively common and widespread (Leary 2005; *in litt*. August 2008). The majority of these latter species are micro-bats, while small ground-dwelling mammals are unexpectedly scarce. A systematic survey involving 22 000 trap nights and 14 000 hair tube nights across conservation reserves containing Cumberland Plain Woodland failed to detect any native rodents or dasyurids, except at sites on the periphery of the plain, close to larger vegetated areas on sandstone (Leary 2005; *in litt*. August 2008). Long-nosed Bandicoots have recently been recorded in inner western Sydney (NSW Scientific Committee 2008), but remain scarce and have not been recorded during the systematic fauna surveys of Cumberland Plain Woodland. A number of bird species have also disappeared from or markedly declined on the Cumberland Plain (Keast 1995; Farrell 2005; Leary 2005; *in litt*. August 2008). A sequence of repeated surveys in Scheyville National Park, the largest remnant of Cumberland Plain Woodland, have documented disappearance of the Black-chinned Honeyeater, Brown Treecreeper, Diamond Firetail, Zebra Finch, Hooded Robin, Red-capped Robin, Scarlet Robin, Flame Robin and Black-eared Cuckoo, while declines have been observed in populations of the Speckled Warbler, Fuscous Honeyeater, Jacky Winter, Weebill and Buff-rumped Thornbill (Farrell 2005; *in litt*. June 2008). Repeated surveys of Nurragingy Reserve near Blacktown indicate that all of these species have also been lost from the reserve, except for the Fuscous Honeyeater and Weebill (Farrell 2005; *in litt*. June 2008). Many of these species either feed or nest on or near the ground. Declines of reptiles and amphibians on the Cumberland Plain have been less well documented, but include at least three species of frog, one species of turtle, one skink, possibly two species of goanna and one species of snake (Leary 2005; *in litt*. August 2008). Two species of plants, *Swainsona monticola* and *Thesium australe*, are presumed to have gone extinct in Cumberland Plain Woodland (Benson & Howell 2002), while James *et al*. (1999) list many other species that have undergone substantial declines, including threatened species such as *Acacia pubescens, Pimelea spicata* and *Pterostylis saxicola*. In addition to these losses and declines across a wide range of biota within the community, Benson & Howell (1990a; 2002) describe other changes in species composition that indicate a very large reduction in the ecological function of Cumberland Plain Woodland.

19. Weed invasion also poses a major threat to Cumberland Plain Woodland. While very large numbers of weed species have invaded many different areas of the community, principal weed species include (Benson 1992; Tozer 2003; Benson & von Richter 2008):

Anagallis arvensis	Scarlet Pimpernel
Araujia serciflora	Moth Vine
Asparagus asparagoides	Bridal Creeper
Aster subulatus	Wild Aster, Bushy Starwort
Centaurium tenuiflorum	
Chloris gayana	Rhodes Grass
Cyclospermum leptophyllum	Slender Celery
Cirsium vulgare	Thistle
Conyza sumatrensis	Tall Fleabane
Ehrharta erecta	Panic Veldtgrass
Eragrostis curvula	African Lovegrass
Heliotropium amplexicaule	Blue Heliotrope
Hypochaeris radicata	Catsear
Lantana camara	Lantana
Leontodon taraxacoides subsp. *taraxacoides*	Lesser Hawkbit, Hairy Hawkbit
Ligustrum sinense	Small-leaf Privet
Nassella neesiana	Chilean Needlegrass
Olea europaea subsp. *cuspidata*	African Olive
Paspalum dilatatum	Paspalum

Plantago lanceolata	Lamb's Tongues, Plantain
Richardia stellaris	
Senecio madagascariensis	Fireweed
Setaria gracilis	Slender Pigeon Grass
Sida rhombifolia	Paddy's Lucerne
Solanum spp.	Nightshades
Sonchus oleraceus	Common Sowthistle
Sporobolus africanus	Parramatta Grass

Several of these species, particularly grasses, form a dense ground layer capable of smothering indigenous plants, reducing both reproduction and survival, and inhibiting emergence and establishment of their seedlings. The propagules of weeds are spread into Cumberland Plain Woodland by stormwater, dumping of refuse, frugivorous birds and wind (Benson & Howell 1990b), making it difficult to abate the invasion process, especially for those species capable of establishing in sites that have been exposed to relatively little disturbance (J. Sanders, *in litt.* January 2008). Hill *et al*. (2005) found that high species richness and abundance of weeds was associated with remnants that either had a history of clearing and grazing, were in close proximity to creeks or downslope from sealed roads. They also found some relationship between weeds and elevated total soil phosphorus, conductivity and water retention capacity, but relationships with these soil properties were weak and varied between sites with different types of disturbance history. The dramatic recent expansion of African Olive poses the greatest invasive threat to Cumberland Plain Woodland. Initially introduced to south-western Sydney in the 1820s, it was generally confined to the Camden-Picton area until the 1970s and now occurs frequently throughout the distribution of the community (Tozer 2003; Cuneo & Leishman 2006). Roberts (1999) mapped approximately 1000 ha of Cumberland Plain Woodland (c. 10% of total remaining) which had a dense understorey of African Olive that was visible on aerial photographs flown in November 1997. Tozer (2003) recorded African Olive in 43% of 198 plots surveyed throughout the distribution of Cumberland Plain Woodland. Cuneo *et al*. (2009) found that 837 ha of Cumberland Plain Woodland in south-west Sydney was invaded by African Olive (8.5% of the area assessed). The species is highly fecund, with fleshy fruit spread widely by a range of frugivorous birds, and seedlings establish readily in relatively undisturbed bushland, as well as fragmented edges (Cuneo & Leishman 2006). As shrubs grow, their canopies cast deep shade and suppress and ultimately eliminate most native shrub and groundcover species. Cook *et al*. (2005) and Tozer (*in litt*. October 2007, based on data from Tozer 2003), both recorded strong inverse relationships between the cover abundance of African Olive and the diversity and cover of native ground layer species. Other weeds that pose future threats to the community include *Ailanthus altissima, Asparagus asparagoides, Acer negundo, Gleditsia triacanthos* and *Macfadyena unguis-cati* (Benson & Howell 2002; J. Howell *in litt*. August 2007; J. Sanders *in litt*. January 2008; L. Harrold pers comm. 2009). The invasion and establishment of exotic weeds is resulting in a very large reduction in the ecological function of Cumberland Plain Woodland. 'Invasion of exotic perennial grasses' and 'Invasion and establishment of exotic vines and scramblers' are listed as Key Threatening Processes under the *Threatened Species Conservation Act* 1995.

20. Moderate to heavy grazing of Cumberland Plain Woodland by livestock and rabbits results in the decline and disappearance of palatable plant species, including shrubs and herbs, and compaction and erosion of topsoil, making re-establishment of a diverse native understorey problematic. The effects of such overgrazing may be exacerbated under drought conditions. Habitat degradation associated with overgrazing and erosion contributes to a large reduction in ecological function of the community.

21. The soils of Cumberland Plain Woodland have undergone chemical and structural modification associated with agricultural land uses. Trampling by livestock has resulted in localised areas of soil compaction, primarily around watering points. Research carried out at the University of Western Sydney found that mean soil inorganic nitrogen levels were two to three times higher in areas of former agricultural land use than in remnant woodland, but was unable to detect differences in other soil properties (E. C. Morris *in litt*. June 2007). Addition of carbon and burning reduced soil inorganic nitrogen and reduced growth of exotic ground layer species relative to native species, suggesting that elevated soil inorganic nitrogen could favour exotics to the detriment of natives in Cumberland Plain Woodland (E. C. Morris *in litt*. June 2007). Hill *et al*. (2005) found elevated levels of phosphorus and conductivity in former agricultural areas compared to remnant woodland, but did not examine soil nitrogen. The sources of nutrient addition to soils of Cumberland Plain Woodland include addition of fertilisers during previous agricultural land use, deposition of livestock dung, rubbish dumping and stormwater runoff from urban areas. Expansion of urban land uses across the Cumberland Plain is likely to increase urban runoff from sealed surfaces into remaining bushland fragments, resulting in further nutrient enrichment of soils and associated replacement of native

flora by exotic species. Disruption of ecological processes and degradation of habitat associated with nutrient enrichment contributes to a very large reduction in ecological function of the community.

22. Fire regimes influence the plant species composition and vegetation structure of Cumberland Plain Woodland (Benson & Howell 2002; Watson 2005) and are also likely to influence other components of the biota. Based on a study of Cumberland Plain Woodland remnants with varying fire histories, Watson (2005) found that variable intervals of 4 - 12 years between successive fires are likely to maintain populations of most understorey species in the community, including resprouting and obligate-seeding shrubs, grasses and herbs. Fragmentation of Cumberland Plain Woodland may exclude fire from some patches for extended periods by reducing fire spread. The consequent reduction in fire frequency sometimes leads to increased dominance of shrubs and associated declines in diversity of grasses and herbs (Watson 2005), as well as increased abundance of woody exotic species, such as African Olive (Benson & Howell 2002; Watson 2005; von Richter *et al*. 2005), which is likely to further reduce the flammability of the community. Conversely, high frequencies of fires may result where fragmentation increases the interface between urban areas and bushland, as this results in increased arson, car dumping, planned fuel-reduction fires and accidental ignitions. High fire frequencies are associated with reduced diversity of native plant species in Cumberland Plain Woodland (Watson 2005). 'High frequency fire resulting in disruption of life cycle processes in plants and animals and loss of vegetation structure and composition' is listed as a Key Threatening Process under the *Threatened Species Conservation Act* 1995. The season of fire, which may be altered as a consequence of hazard reduction fires, may also influence the species composition of the grassy woodland understorey (Knox & Clarke 2006; Benson & von Richter 2008). Disruption of ecological processes associated with alteration of fire regimes contributes to a very large reduction in ecological function of the community.

23. Cumberland Plain Woodland in the Sydney Basin Bioregion is eligible to be listed as a Critically Endangered Ecological Community as, in the opinion of the Scientific Committee, it is facing an extremely high risk of extinction in New South Wales in the immediate future, as determined in accordance with the following criteria as prescribed by the *Threatened Species Conservation Regulation* 2002:

Clause 25

The ecological community has undergone, is observed, estimated, inferred or reasonably suspected to have undergone or is likely to undergo within a time span appropriate to the life cycle and habitat characteristics of its component species:

(a) a very large reduction in geographic distribution.

Clause 27

The ecological community has undergone, is observed, estimated, inferred or reasonably suspected to have undergone or is likely to undergo within a time span appropriate to the life cycle and habitat characteristics of its component species:

(a) a very large reduction in ecological function,

as indicated by any of the following:

(d) a change in community structure

(e) a change in species composition

(f) disruption of ecological processes

(g) invasion and establishment of exotic species

(h) degradation of habitat

(i) fragmentation of habitat.

Dr Richard Major

Chairperson

Scientific Committee

Proposed Gazettal date: 18/12/09

Exhibition period: 18/12/09 – 05/03/10

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Glenfield Waste Services Site
Cambridge Avenue, Glenfield

Proposed Rezoning & Expansion

Cumberland Plain Woodland Assessment Report

Appendix C
Flora Species List

March 2014

Appendix C Flora surveyed from the site on the 23rd and 24th of September 2013.

KEY	
Symbol	**Description**
Status	
*	Exotic species
**	Noxious species declared in the Campbelltown LGA
+	Native but not endemic
CPW	Species is listed as "*characteristic*" within the *Final Determination* (Scientific Committee 2009) for the Cumberland Plain Woodland (CPW), which is listed as a "*critically endangered ecological community*" on the TSC Act and *Environmental Protection & Biodiversity Conservation Act* 1999 (EPBC Act)
Location	- the location of a species record where habitat was restricted on the subject site at Glenfield
MC	Species detected only in the more floristically diverse area of 'Moderate Condition' woodland along the northern boundary
GR	Species detected within the riparian vegetation along the 'Georges River'
AW	Species detected within the 'Artificial Wetlands' near the northern boundary
Frequency	- the frequency at which each species was observed across the subject site at Glenfield
C	Common
M	Moderately common
U	Uncommon
R	Rare

Status	Species name	Common name	Location	Frequency
	Acanthaceae			
CPW	*Brunoniella australis*	Blue Trumpet		C
	Amaranthaceae			
	Alternanthera denticulata	Lesser Joyweed		U
	Antheriaceae			
CPW	*Arthropodium milleflorum*	Pale Vanilla-lily		M
CPW	*Arthropodium minus*	-		U
	Apiaceae			
*	*Foeniculum vulgare*	Fennel		R
	Apocynaceae			
*	*Araujia sericifera*	Moth Vine		M
*	*Gomphocarpus fruticosus*	Narrow-leaved Cotton Bush		R
*	*Vinca major*	Greater Periwinkle		R
	Arecaceae			
*	*Phoenix canariensis*	Canary Island Date Palm		U
	Asparagaceae			
*	*Asparagus aethiopicus*	Asparagus 'Fern'		U
**	*Asparagus asparagoides*	Bridal Creeper		M
*	*Asparagus officinalis*	Asparagus		R

Appendix C Flora surveyed from the site on the 23rd and 24th of September 2013.

Status	Species name	Common name	Location	Frequency
	Asteraceae			
*	*Arctotheca calendula*	Capeweed		R
*	*Bidens pilosa*	Cobblers Peg		C
*	*Cirsium vulgare*	Spear Thistle		M
*	*Conyza bonariensis*	Flaxleaf Fleabane		R
*	*Delairea odorata*	Cape Ivy	GR	U
CPW	*Euchiton sphaericus*	-	MC	R
*	*Gamochaeta calviceps*	Cudweed		U
*	*Gamochaeta purpurea*	Purple Cudweed		U
*	*Hypochaeris radicata*	Catsear		M
**	*Onopordum acanthium*	Scotch Thistle		U
	Ozothamnus diosmifolius	White Dogwood	MC	R
*	*Senecio madagascariensis*	Fireweed		M
	Seneico quadridentatus	Cotton Fireweed		R
*	*Sonchus oleraceus*	Common Sowthistle		U
*	*Taraxacum officinale*	Dandelion		M
CPW	*Vernonia cinerea*	-		U
	Vittadinia cuneata	Fuzzweed	MC	R
	Brassicaceae			
*	*Lepidium africanum*	-		R
	Cactaceae			
**	*Opuntia stricta*	Common Prickly Pear		R
	Campanulaceae			
CPW	*Wahlenbergia stricta* subsp. *stricta*	Tall Bluebell	MC	R
	Caryophyllaceae			
*	*Cerastium glomeratum*	Mouse-ear Chickweed		M
*	*Petrorhagia velutina*	-		C
	Casuarinaceae			
+	*Casuarina glauca*	Swamp Oak		U
	Celastraceae			
	Maytenus silvestris	Narrow-leaved Orangebark	GR	R
	Chenopodiaceae			
CPW	*Einadia hastata*	Berry Saltbush		C
CPW	*Einadia nutans* subsp. *linifolia*	-		C
CPW	*Einadia trigonos*	Fishweed		C
	Clusiaceae			
**	*Hypericum perforatum*	St. Johns Wort		U
	Commelinaceae			
CPW	*Commelina cyanea*	Native Wandering Jew		R
*	*Tradescantia fluminensis*	Wandering Jew	GR	C
	Convolvulaceae			
	Convolvulus erubescens	Blushing Bindweed		R
CPW	*Dichondra repens*	Kidney Weed		C
	Crassulaceae			
**	*Bryophyllum delagoense*	Mother-of-millions		U

Appendix C Flora surveyed from the site on the 23rd and 24th of September 2013.

Status	Species name	Common name	Location	Frequency
	Fabaceae – Faboideae			
CPW	*Bossiaea prostrata*	-	MC	R
CPW	*Chorizema parviflorum*	Eastern Flame Pea	MC	R
CPW	*Daviesia ulicifolia*	Gorse Bitter Pea	MC	R
CPW	*Dillwynia sieberi*	-	MC	R
CPW	*Glycine clandestina*	-		M
CPW	*Glycine tabacina*	-		M
CPW	*Hardenbergia violaceae*	False Sarsaparilla	MC	R
CPW	*Indigofera australis*	Australian Indigo		R
*	*Lotus angustissimus*	Slender Birds-foot Trefoil		M
*	*Trifolium arvense*	Haresfoot Clover		M
*	*Trifolium repens*	White Clover		M
*	*Vicia sativa* subsp. *nigra*	Narrow-leaved Vetch		M
	Fabaceae – Mimosoideae			
	Acacia binervia	Coast Myall	GR	M
	Acacia decurrens	Black Wattle		M
	Acacia parramattensis	Parramatta Wattle		U
	Lamiaceae			
CPW	*Plectranthus parviflorus*	Cockspur Flower		U
	Lauraceae			
**	*Cinnamomum camphora*	Camphor Laurel		R
	Linaceae			
*	*Linum trigynum*	French Flax		U
	Lomandraceae			
CPW	*Lomandra multiflora*	Many-flowered Mat-rush	MC	U
	Loranthaceae			
	Amyema miquelii	-		U
	Malvaceae			
*	*Modiola caroliniana*	Red-flowered Mallow		C
*	*Sida rhombifolia*	Paddy's Lucerne		C
	Myrsinaceae			
*	*Anagallis arvensis*	Scarlet Pimpernel		C
	Myrtaceae			
CPW	*Angophora floribunda*	Rough-barked Apple	MC	R
+	*Corymbia maculata*	Spotted Gum		R
CPW	*Eucalyptus crebra*	Narrow-leaved Ironbark		U
CPW	*Eucalyptus eugenioides*	Thin-leaved Stringybark		U
CPW	*Eucalyptus moluccana*	Grey Box		C
CPW	*Eucalyptus tereticornis*	Forest Red Gum		M
+	*Lophostemon confertus*	Brush Box		R
	Melaleuca decora	-		M
	Oleaceae			
**	*Ligustrum lucidum*	Large-leaved Privet		M
**	*Ligustrum sinense*	Small-leaved Privet		C
**	*Olea europaea* subsp. *cuspidata*	African Olive		C
	Onagraceae			
	Ludwigia peploides subsp. *montevidensis*	Water Primrose	AW	M
	Oxalidaceae			
CPW	*Oxalis perennans*	-	MC	R

Appendix C Flora surveyed from the site on the 23rd and 24th of September 2013.

Status	Species name	Common name	Location	Frequency
	Phormiaceae			
CPW	*Dianella longifolia*	Blueberry Lily		U
	Dianella revoluta	Blueberry Lily		U
	Pinaceae			
*	*Pinus radiata*	Radiata Pine		R
	Pittosporaceae			
	Billardiera scandens	Hairy Apple Berry	GR	R
CPW	*Bursaria spinosa*	Blackthorn		C
	Plantaginaceae			
*	*Plantago lanceolata*	Lamb's Tongue		C
	Poaceae			
CPW	*Aristida ramosa*	Purple Wire Grass	MC	R
CPW	*Aristida vagans*	Threeawn Spear Grass		R
	Austrostipa ramosissima	Stout Bamboo Grass		C
*	*Avena barbata*	Bearded Oats		M
*	*Briza subaristida*	-		U
*	*Bromus catharticus*	Prairie Grass		C
*	*Chloris gayana*	Rhodes Grass		C
CPW	*Chloris truncata*	Windmill Grass		R
CPW	*Chloris ventricosa*	Plump Windmill Grass		M
**	*Cortaderia selloana*	Pampas Grass	AW	U
CPW	*Cymbopogon refractus*	Barbed Wire Grass	MC	R
+	*Cynodon dactylon*	Common Couch		C
CPW	*Echinopogon caespitosus* var. *caespitosus*	Tufted Hedgehog Grass		U
CPW	*Echinopogon ovatus*	Forest Hedgehog Grass		U
*	*Ehrharta erecta*	Panic Veldt Grass		M
**	*Eragrostis curvula*	African Love Grass		M
	Entolasia stricta	Wiry Panic		R
CPW	*Eragrostis leptostachys*	Paddock Love Grass		U
	Lachnagrostis aemula	Blowngrass		R
*	*Lolium perenne*	Perennial Rye Grass		C
CPW	*Microlaenea stipoides*	Weeping Grass		M
CPW	*Panicum effusum*	Hairy Panic		U
CPW	*Paspalidium distans*	-		R
*	*Paspalum dilatatum*	Paspalum		U
*	*Pennisetum clandestinum*	Kikuyu		C
*	*Poa annua*	Winter Grass		U
CPW	*Rytidosperma racemosum* var. *racemosum*	-		U
CPW	*Rytidosperma tenuius*	-		U
*	*Setaria parviflora*	-		M
CPW	*Themeda australis*	Kangaroo Grass	MC	U
*	*Vulpia muralis*	-		M
	Pteridaceae			
CPW	*Cheilanthes sieberi* subsp. *sieberi*	Poison Rock Fern	MC	R
	Ranunculaceae			
CPW	*Clematis glycinoides var. glycinoides*	Headache Vine		M
	Rubiaceae			
*	*Galium murale*	Small Bedstraw		U
CPW	*Opercularia diphylla*	-		U

Appendix C Flora surveyed from the site on the 23rd and 24th of September 2013.

Status	Species name	Common name	Location	Frequency
	Santalaceae			
CPW	*Exocarpos cupressiformis*	Cherry Ballart	MC	R
	Scrophulariaceae			
CPW	*Eremophila debilis*	Winter Apple		M
	Solanaceae			
**	*Lycium ferocissimum*	African Boxthorn		M
*	*Solanum chenopodioides*	Whitetip Nightshade		M
*	*Solanum nigrum*	Black-berry Nightshade		M
CPW	*Solanum prinophyllum*	Forest Nightshade		U
*	*Solanum pseudocapsicum*	Madeira Winter		U
	Typhaceae			
	Typha sp.	Cumbungi	AW	C
	Verbenaceae			
**	*Lantana camara*	Lantana	GR	M
*	*Verbena bonariensis*	Purpletop		U
	Total native	71		
	Total exotic	61		
	Total CPW	49		

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Glenfield Waste Services Site
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Cumberland Plain Woodland Assessment Report

Appendix D
Flora Quadrat Data

March 2014

Appendix D Quadrats surveyed from the site on the 30th of September and 1st of October 2013.

KEY	
Symbol	**Description**
Status	
*	Exotic species
**	Noxious species declared in the Campbelltown LGA
+	Native but not endemic
CPW	Species is listed as "*characteristic*" within the Final Determination (Scientific Committee 2013) for the Cumberland Plain Woodland (CPW), which is listed as a "*critically endangered ecological community*" on the TSC Act and *Environmental Protection & Biodiversity Conservation Act* 1999 (EPBC Act)
Record	
Q1	Quadrat 1 sampled from the 'Low' condition Grey Box – Red Gum Woodland (Figure 3)
Q2	Quadrat 2 sampled from the 'Very Low' condition Grey Box – Red Gum Woodland (Figure 3)
Q3	Quadrat 3 sampled from the 'Low' condition Grey Box – Red Gum Woodland (Figure 3)
Q4	Quadrat 4 sampled from the 'Moderate' condition Red Gum – Ironbark Woodland (Figure 3)
Q5	Quadrat 5 sampled from the 'Very Low' condition Red Gum – Ironbark Woodland (Figure 3)
Q6	Quadrat 6 sampled from the 'Low' condition Grey Box – Red Gum Woodland (Figure 3)
Q7	Quadrat 7 sampled from the 'Very low' condition Grey Box – Red Gum Woodland (Figure 3)
	* Quadrat of Braun-Blanquet Cover Abundance from the subject site; • 1 (<5% uncommon); • 2 (<5% common); • 3 (5-25% common); • 4 (25-50%); • 5 (50-75%); • 6 (75-100%)

Appendix D Quadrats surveyed from the site on the 30th of September and 1st of October 2013.

Quadrat 1 For location, see Figure 3

Status	Species name	Common name	Q
*	*Araujia sericifera*	Moth Vine	1
CPW	*Arthropodium milleflorum*	Pale Vanilla-lily	2
*	*Bromus catharticus*	Prairie Grass	2
CPW	*Brunoniella australis*	Blue Trumpet	2
CPW	*Bursaria spinosa*	Blackthorn	1
CPW	*Chloris ventricosa*	Plump Windmill Grass	1
CPW	*Clematis glycinoides var. glycinoides*	Headache Vine	1
CPW	*Dichondra repens*	Kidney Weed	2
*	*Ehrharta erecta*	Panic Veldt Grass	2
CPW	*Einadia hastata*	Berry Saltbush	2
CPW	*Eremophila debilis*	Winter Apple	2
CPW	*Eucalyptus moluccana*	Grey Box	3
*	*Lolium perenne*	Perennial Rye Grass	4
CPW	*Microlaenea stipoides*	Weeping Grass	4
**	*Olea europaea* subsp. *cuspidata*	African Olive	2
*	*Petrorhagia velutina*	-	3
*	*Plantago lanceolata*	Lamb's Tongue	3
*	*Senecio madagascariensis*	Fireweed	2
*	*Sida rhombifolia*	Paddy's Lucerne	2
*	*Solanum chenopodioides*	Whitetip Nightshade	1
*	*Sonchus oleraceus*	Common Sowthistle	1
CPW	*Vernonia cinerea*	-	1
	Total native species	11	
	Total exotic species	11	
	Total CPW species	11	

Appendix D Quadrats surveyed from the site on the 30th of September and 1st of October 2013.

Quadrat 2 For location, see Figure 3

Status	Species name	Common name	Q
*	*Anagallis arvensis*	Scarlet Pimpernel	1
*	*Araujia sericifera*	Moth Vine	1
CPW	*Arthropodium milleflorum*	Pale Vanilla-lily	1
*	*Bidens pilosa*	Cobblers Pegs	2
*	*Bromus catharticus*	Prairie Grass	5
CPW	*Brunoniella australis*	Blue Trumpet	1
CPW	*Commelina cyanea*	Native Wandering Jew	1
+	*Cynodon dactylon*	Common Couch	2
CPW	*Dichondra repens*	Kidney Weed	2
*	*Ehrharta erecta*	Panic Veldt Grass	2
CPW	*Einadia nutans* subsp. *linifolia*	-	1
CPW	*Eucalyptus moluccana*	Grey Box	4
*	*Lolium perenne*	Perennial Rye Grass	3
CPW	*Microlaenea stipoides*	Weeping Grass	3
*	*Modiola caroliniana*	Red-flowered Mallow	2
**	*Olea europaea* subsp. *cuspidata*	African Olive	1
*	*Paspalum dilatatum*	Paspalum	1
*	*Plantago lanceolata*	Lamb's Tongue	3
*	*Solanum chenopodioides*	Whitetip Nightshade	1
	Total native species	8	
	Total exotic species	11	
	Total CPW species	7	

Appendix D Quadrats surveyed from the site on the 30th of September and 1st of October 2013.

Quadrat 3 For location, see Figure X

Status	Species name	Common name	Q
*	*Araujia sericifera*	Moth Vine	1
CPW	*Aristida vagans*	Three-awn Spear Grass	2
CPW	*Arthropodium milleflorum*	Pale Vanilla-lily	2
*	*Asparagus aethiopicus*	Asparagus 'Fern'	1
**	*Asparagus asparagoides*	Bridal Creeper	2
CPW	*Brunoniella australis*	Blue Trumpet	3
CPW	*Bursaria spinosa*	Blackthorn	2
CPW	*Chloris ventricosa*	Plump Windmill Grass	3
CPW	*Dichondra repens*	Kidney Weed	2
CPW	*Einadia hastata*	Berry Saltbush	2
CPW	*Einadia nutans* subsp. *linifolia*	-	2
CPW	*Einadia trigonos*	Fishweed	2
CPW	*Eremophila debilis*	Winter Apple	3
CPW	*Eucalyptus moluccana*	Grey Box	3
CPW	*Indigofera australis*	Australian Indigo	1
	Melaleuca decora	-	2
CPW	*Microlaenea stipoides*	Weeping Grass	2
**	*Olea europaea* subsp. *cuspidata*	African Olive	1
CPW	*Panicum effusum*	Hairy Panic	2
CPW	*Paspalidium distans*	-	1
CPW	*Rytidosperma racemosum* var. *racemosum*	-	3
*	*Senecio madagascariensis*	Fireweed	1
*	*Vinca major*	Greater Periwinkle	1
	Total native species	17	
	Total exotic species	6	
	Total CPW species	16	

Appendix D Quadrats surveyed from the site on the 30th of September and 1st of October 2013.

Quadrat 4 For location, see Figure 3

Status	Species name	Common name	Q
	Acacia decurrens	Black Wattle	2
*	*Araujia sericifera*	Moth Vine	1
CPW	*Aristida ramosa*	Purple Wire Grass	1
**	*Asparagus asparagoides*	Bridal Creeper	2
*	*Avena barbata*	Bearded Oats	1
*	*Bidens pilosa*	Cobblers Peg	2
CPW	*Bossiaea prostrata*	-	1
CPW	*Brunoniella australis*	Blue Trumpet	2
CPW	*Bursaria spinosa*	Blackthorn	3
*	*Chloris gayana*	Rhodes Grass	1
CPW	*Chloris ventricosa*	Plump Windmill Grass	1
CPW	*Chorizema parviflorum*	Eastern Flame Pea	1
*	*Conyza bonariensis*	Flaxleaf Fleabane	1
CPW	*Daviesia ulicifolia*	Gorse Bitter Pea	2
CPW	*Dichondra repens*	Kidney Weed	2
CPW	*Einadia hastata*	Berry Saltbush	1
**	*Eragrostis curvula*	African Love Grass	5
CPW	*Eragrostis leptostachys*	Paddock Love Grass	1
CPW	*Eucalyptus crebra*	Narrow-leaved Ironbark	1
CPW	*Eucalyptus moluccana*	Grey Box	1
CPW	*Eucalyptus tereticornis*	Forest Red Gum	3
CPW	*Euchiton sphaericus*	-	1
CPW	*Glycine clandestina*	-	2
**	*Hypericum perforatum*	St. Johns Wort	1
*	*Hypochaeris radicata*	Cats-ear	2
*	*Linum trigynum*	French Flax	1
*	*Lolium perenne*	Perennial Rye Grass	1
CPW	*Lomandra multiflora*	Many-flowered Mat-rush-	1
*	*Paspalum dilatatum*	Paspalum	1
*	*Plantago lanceolata*	Lamb's Tongue	2
*	*Senecio madagascariensis*	Fireweed	2
*	*Setaria parviflora*	-	1
*	*Sida rhombifolia*	Paddy's Lucerne	2
CPW	*Themeda australis*	Kangaroo Grass	3
CPW	*Wahlenbergia stricta* subsp. *stricta*	Tall Bluebell	2
	Total native species	19	
	Total exotic species	16	
	Total CPW species	18	

Appendix D Quadrats surveyed from the site on the 30th of September and 1st of October 2013.

Appendix D Quadrats surveyed from the site on the 30th of September and 1st of October 2013.

Quadrat 5 For location, see Figure 3

Status	Species name	Common name	Q
*	*Bidens pilosa*	Cobblers Peg	2
+	*Cynodon dactylon*	Common Couch	6
CPW	*Dichondra repens*	Kidney Weed	2
CPW	*Eucalyptus moluccana*	Grey Box	3
CPW	*Eucalyptus tereticornis*	Forest Red Gum	2
*	*Lolium perenne*	Perennial Rye Grass	2
*	*Modiola caroliniana*	Red-flowered Mallow	2
*	*Plantago lanceolata*	Lamb's Tongue	2
*	*Senecio madagascariensis*	Fireweed	2
*	*Sida rhombifolia*	Paddy's Lucerne	2
	Total native species	4	
	Total exotic species	6	
	Total CPW species	3	

Appendix D Quadrats surveyed from the site on the 30th of September and 1st of October 2013.

Quadrat 6 For location, see Figure 3

Status	Species name	Common name	Q
CPW	*Arthropodium minus*	-	1
*	*Bidens pilosa*	Cobblers Peg	2
*	*Bromus catharticus*	Prairie Grass	3
+	*Cynodon dactylon*	Common Couch	5
CPW	*Dichondra repens*	Kidney Weed	2
*	*Ehrharta erecta*	Panic Veldt Grass	1
CPW	*Einadia trigonos*	Fishweed	2
**	*Eragrostis curvula*	African Love Grass	2
CPW	*Eucalyptus moluccana*	Grey Box	2
CPW	*Glycine clandestina*	-	1
*	*Lolium perenne*	Perennial Rye Grass	3
**	*Lycium ferocissimum*	African Boxthorn	1
*	*Modiola caroliniana*	Red-flowered Mallow	1
*	*Plantago lanceolata*	Lamb's Tongue	2
CPW	*Rytidosperma racemosum* var. *racemosum*	-	2
*	*Senecio madagascariensis*	Fireweed	2
*	*Sida rhombifolia*	Paddy's Lucerne	2
*	*Solanum chenopodioides*	Whitetip Nightshade	1
CPW	*Vernonia cinerea*	-	1
	Total native species	8	
	Total exotic species	11	
	Total CPW species	7	

Appendix D Quadrats surveyed from the site on the 30th of September and 1st of October 2013.

Quadrat 7 For location, see Figure 3

Status	Species name	Common name	Q
*	*Araujia sericifera*	Moth Vine	2
**	*Asparagus asparagoides*	Bridal Creeper	2
	Austrostipa ramosissima	Stout Bamboo Grass	6
CPW	*Brunoniella australis*	Blue Trumpet	2
CPW	*Bursaria spinosa*	Blackthorn	2
CPW	*Dichondra repens*	Kidney Weed	2
*	*Ehrharta erecta*	Panic Veldt Grass	3
CPW	*Einadia trigonos*	Fishweed	3
CPW	*Eucalyptus moluccana*	Grey Box	4
**	*Lycium ferocissimum*	African Boxthorn	1
*	*Modiola caroliniana*	Red-flowered Mallow	1
**	*Olea europaea* subsp. *cuspidata*	African Olive	1
*	*Plantago lanceolata*	Lamb's Tongue	2
CPW	*Plectranthus parviflorus*	Cockspur Flower	1
*	*Senecio madagascariensis*	Fireweed	2
*	*Sida rhombifolia*	Paddy's Lucerne	2
*	*Solanum chenopodioides*	Whitetip Nightshade	1
CPW	*Solanum prinophyllum*	Forest Nightshade	1
	Total native species	8	
	Total exotic species	10	
	Total CPW species	7	

Appendix 16

SLR November 2014: Biobanking Credit Assessment, EPBC Act Cumberland Plain Shale Woodlands Assessment

global environmental solutions

BioBanking Credit Assessment (Field Work Report)

EPBC Act Cumberland Plain Shale Woodlands Assessment

Proposed Recycling Facility

Report Number 630.11018-R2

25 November 2014

Glenfield Waste Services

Version: Draft 2

BioBanking Credit Assessment (Field Work Report)

EPBC Act Cumberland Plain Shale Woodlands Assessment

Proposed Recycling Facility

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1 INTRODUCTION

1.1 Background

SLR Consulting Australia (SLR) has been engaged by Glenfield Waste Services to prepare the following:

- Biobanking credit assessments of the proposed development and a series of proposed offset areas within the subject site.

- Assessment of woodland vegetation to determine whether the threatened ecological community Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest is present on the subject site (specifically the development footprint). This community is listed as critically endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The purpose of Item 1 is to obtain preliminary advice on the likely BioBanking credit requirement to offset the proposed development impacts, as well as likely BioBanking credits that could be generated by proposed 'offset' (or biobank) areas dedicated under a Biobanking Agreement pursuant to the NSW *Threatened Species Conservation Act 1995* (or equivalent mechanism).

Item 2 will assist in the decision on whether to refer the project to the Commonwealth Department of the Environment for consideration under the EPBC Act.

The current version of this report represents an update of the desktop assessment prepared in October 2014. It presents updated results which are derived from field survey data collected during a two day survey conducted by SLR ecologists on 3 and 4 November 2014. The aims of the survey were two-fold:

- To collect sufficient data, in accordance with the Biobanking Assessment Methodology (BBAM), to improve the accuracy of credit calculations in the Biobanking Credit Calculator, for both the credit requirements for removal of native vegetation associated with the proposal and for credits generated by the creation of a biobank across the site; and

- To collect sufficient data to determine the extent of Cumberland Plain Shale Woodlands, as defined under the EPBC Act, across the subject site.

Further details on study methods for each of the above elements are provided in Section 2.1 and 3.1, respectively.

1.2 The Site

The Glenfield Waste Services site (the 'subject site') is a triangular portion of land occupied by Glenfield Waste Services and is approximately 100 hectares (ha) in area and comprises 9 lots:

- Lot 3 in DP 735524 – in the southwestern corner;

- Lot 3 in DP 736881 - along the southern boundary;

- Lot 2 in DP 333578 – in the southeastern corner;

- Lots 5 and 9 in DP 833516 – either side of the railway through the centre;

- Lot 51 in DP 515696 – along the eastern boundary in the north of the site;

- Lot 52 in DP 517310 – in the central north of the site; and
- Lots 103 and 104 in DP 1143827 – in the north and northwestern portions of the site.

Lot 3 in DP 736881 (also part of the subject site) is occupied by a transmission line easement which runs along the southern boundary of the existing operations area. The East Hills Railway runs in an east-west direction through the centre of the subject site. The land within the northerly portion of the subject site operates as a landfill and is largely cleared with some riparian vegetation along the Georges River and some grassed areas with a few patches of mostly planted trees.

The land to the south of the East Hills Railway contains a recycling facility within the easterly portion of this area with a relatively large patch of woodland in the westerly portion of this area. This woodland patch, comprising approximately 9.5 ha, is proposed to be cleared under the current development plan. Small patches of woodland have been identified around the periphery of the subject site as potential rehabilitation and/or offset areas.

The subject site is roughly triangular in shape, and is bounded by:

- the Georges River along its eastern boundary;
- the Main Southern Railway along its western boundary; and
- Cambridge Avenue and residential development along its southern boundary.

Reference to the subject site in this report means the entire site (not just the land subject to the proposed development), as shown in Figure 1.

1.3 The Proposed Development

Glenfield Waste Services is proposing to develop a materials recycling facility within the southern portion of the subject site, south of the East Hills Rail Line and north of Cambridge Avenue. The facility will have a capacity to process and/or recycle approximately 450,000 tonnes per annum of non-putrescible waste; primarily commercial and industrial (C&I) and construction and demolition (C&D) wastes for re-use in secondary markets. The proposal will be located across approximately 5 ha, in four differentiated but contiguous areas, and positioned to avoid existing landfill cells. Site entry and egress for transport of wastes and processed materials will utilise existing site access locations along Cambridge Avenue and Railway Parade, respectively.

The proposal is deemed to be 'State Significant Development' (SSD) pursuant to Part 4.1 of the NSW *Environmental Planning and Assessment Act 1979*.

2 BIOBANKING ASSESSMENT

2.1 Methods

2.1.1 Overview

A biobanking assessment of the proposal was carried out according to the *BioBanking Assessment Methodology 2014* (BBAM 2014), with reference to the following key documents:

- *BioBanking Assessment Methodology 2014* (OEH 2014a);
- *Framework for Biodiversity Assessment* (OEH 2014b);
- *BioBanking Assessment Methodology and Credit Calculator Operational Manual* (DECC 2009a); and
- *Assessors guide to using the BioBanking Credit Calculator v.2* (OEH 2012).

The BioBanking methodology must be applied separately for proposed development sites and for proposed offset (or 'biobank') sites. The methodology can be divided into three distinct phases:

1. Preliminary Assessment;
2. Field Data Collection; and
3. Generating Credit Profile.

The current investigation involved items 2 and 3, including field data collection and the subsequent generation of a credit profile for both the development impacts and the proposed offset areas. The required vegetation plot/transect data was collected in accordance the BBAM as described in Section 2.1.2).

Information regarding the vegetation types and their condition within the subject site was previously obtained (for the desktop assessment) from two key documents:

- SLR (2014) Cumberland Plain Woodland Assessment Report; and
- Keystone Ecological - Flora Assessment, Glenfield Waste Services, Cambridge Avenue, Glenfield (Ashby 2012).

Both studies involved vegetation surveys and collection of floristic data from quadrats. However, the data was not collected in accordance with the BBAM and so could not be entered as plot data into the Credit Calculator. Hence, field data was required to properly assess site value for the purposes of credit calculations in the current assessment. None-the-less, the distribution, extent, and condition of identified vegetation within the subject site as represented in these reports were used in the current assessment. Both field surveys covered the southern part of the subject site, extending south from the East Hills Rail Line to Cambridge Avenue and east to the site entrance off Cambridge Avenue and west to the Main Southern Railway. Information on vegetation north of the East Hills Rail Line was obtained from mapping of the Cumberland Plain by NPWS (2002), aerial photo interpretation and the collection of plots data at discrete locations, as described in Section 2.1.2.

2.1.2 Site Value Score - BBAM Field Surveys

Field surveys according to the BBAM were conducted on the subject site on 3 and 4 November 2014.

In the Biobanking Credit Calculator, site value score is derived through data collected from a series of transects and plots. The site attributes are assessed to calculate the number of ecosystem credits that are able to be created at a biobank site. Transects and plots are established in each vegetation zone to collect the site attribute data used to measure site value according to the techniques set out in Appendix 2 of DECC (2009a).

Initially, the subject site was stratified into vegetation zones as part of the desktop assessment. Vegetation zones are relatively homogenous areas of the same vegetation type and similar condition. Each vegetation zone is a distinct vegetation type (according to the *NSW Vegetation Types Database*) and similar broad condition state (being either 'moderate to good' or 'low'). Vegetation in low condition always forms a separate zone from vegetation that is in moderate to good condition.

The minimum number of plots per vegetation zone was calculated using Table 3 in OEH (2014a). The number of plots required (and established during field work) in each vegetation zone within the development area is listed in Table 1 and within the proposed offset areas in Table 2.

Table 1 Development area - plot/transects per vegetation zone

Veg Zone	NSW Vegetation Type	Condition	Area (ha)	No. Plots
1	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin	Low	2.58	1
2	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin	Moderate to Good	6.91	3

Table 2 Biobank (offset) areas – plot/transects per vegetation zone

Veg Zone	NSW Vegetation Type	Condition	Area (ha)	No. Plots
1	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin	Moderate to Good	1.15	1
2	Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin	Low	13.81	2
3	Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin	Low	7.70	2

At each plot a 20 m X 20 m quadrat was established. A species list with cover/abundance score according to the Braun-Blanquet system (see Poore 1955) for each species was compiled. Additionally, a 50 m transect is used to score a selection of seven variables relating to vegetation cover and structure. A further three variables are gathered including:

- total length of fallen logs in a 50 m x 20 m plot;
- number of trees with hollows in a 50 m x 20 m plot; and
- proportion of regeneration in the canopy across the vegetation zone.

Field data was entered in to standard biobanking field sheet templates (DECC 2009b), including:

- Transect plot worksheet; and
- Quadrat species list.

Transect and plot data was then tallied into the following DECC (2009b) templates:

- Transect tally table; and

- Transect plot data sheet.

Data compiled into the transect plot datasheet was then imported into the Credit Calculator.

2.1.3 Credit Calculations

Credit calculations for the desktop assessment were completed using version 2.1 of the Credit Calculator. However, the updated Credit Calculator for Major Projects & Biobanking was released online on 30 October 2014, which contains amendments to reflect the *Biobanking Assessment Methodology 2014* (OEH 2014a) and *Framework for Biodiversity Assessment* (FBA, OEH 2014b).

A new run of the Credit Calculator was conducted on 24 November 2014, which incorporated both the site value data collected during the current field survey and the new elements of BBAM 2014 built into the Calculator. The new elements can be summarised as follows:

- Landscape score – the same landscape assessment circles and associated results (used in the desktop assessment) were utilised; however, BBAM 2014 requires an assessment of whether the development site (or biobank site) affects the riparian values of higher order streams, wetlands, estuaries or significant biodiversity corridors. For the purposes of the current assessment, it was assumed (in the absence of available GIS data) that the Georges River is at least a regional biodiversity corridor and/or a 5th order stream (under the Strahler system);

- Site value score – the BBAM 2014 no longer requires threatened species subzones to be included. Site survey data for each vegetation zone, as described in Section 2.1.2, was imported into the Calculator. No changes to vegetation zone boundaries or condition classes were required following the field survey. Management scores for were set to default values.

- Threatened species – some of the threatened species predicted to occur for ecosystem credits and some requiring surveys for species credits have changed with the advent of BBAM 2014. No threatened species have been recorded on site to date and targeted threatened species surveys were not part of the current assessment. Consequently, assessment of species credit requirements did not form part of the credit calculations.

All credit calculations in this report were completed by Jeremy Pepper, Principal Ecologist and Biobanking accredited assessor No.0107.

Development Credits

Assumptions that were used in running the Credit Calculator for the proposed development impacts are listed in Appendix A and those for the biobank are listed in Appendix B.

The key elements of the credit calculation for the proposed development impacts are:

- The area of impact is a 9.5 ha area centred on the proposed recycling facility and is based on a polygon supplied by EPS (see Figure 2); and

- All vegetation within the development footprint would be permanently removed.

In terms of the landscape value score, percentage woody cover of native vegetation within the 100 ha and 1000 ha circles was estimated in GIS using NPWS (2002) vegetation mapping. The landscape circles are shown in Figure 3.

Vegetation zones were determined by combining vegetation patches into combined patches in either 'low' or 'moderate to good' condition according to the BBAM, and translating vegetation types into one or more of the *NSW Vegetation Types*. The vegetation types and condition as mapped by SLR (2014) are displayed in Figure 4 and the resulting vegetation zones are mapped in Figure 5.

Biobank Credits

Assumptions that were used in running the Credit Calculator for the biobank areas are listed in Appendix B. The key elements of the credit calculation are:

- The proposed biobank areas are as supplied by EPS and digitised by SLR (see Figure 2); and
- The areas are largely cleared of vegetation and so it is assumed that they would be revegetated and would become fully vegetated with woody native vegetation over the life of the biobank.

In terms of the landscape value score, percentage woody cover of native vegetation within the 100 ha and 1000 ha circles was estimated in GIS using NPWS (2002) vegetation mapping. The landscape assessment circles for the biobank assessment are shown in Figure 6.

Vegetation zones were determined by combining vegetation patches into combined patches in either 'low' or 'moderate to good' condition according to the BBAM, and translating vegetation types into one or more of the NSW Vegetation Types. The biobank vegetation zones are mapped in Figure 7.

2.2 Results

2.2.1 Credits required for clearing (development impacts)

The credit results for the development impacts are provided in Appendix C. The results of the current investigation indicate:

- 296 ecosystem credits of the type known as Grey Box - Forest Red Gum grassy woodland, a form of the Cumberland Plain Woodland endangered ecological community (EEC) would be required to offset the proposed development impacts;
- 224 ha of the Grey Box - Forest Red Gum grassy woodland vegetation type is listed as a 'red flag' (being an EEC). It should be noted that Director-General approval to vary the red flag rules for development proposals is not applicable to major projects (SSD);
- No 'species credits' are listed as being required in the BioBanking Credit Calculator BBCC. However, as noted in the assumptions table (refer to Appendix A), targeted surveys for a few such species during the spring survey period might be warranted to demonstrate to the NSW Government (including the Office of Environment and Heritage) that no species credits will be required to offset the development. Examples include the Green & Golden Bell Frog, Little Eagle, *Pimelea spicata*, *Pterostylis saxicola* (orchid) and *Caladenia tessellata* (orchid). The survey periods for these species all overlap in September and October.

2.2.2 Credits generated by offset areas

The credit report for the biobank areas is provided in Appendix D. The results indicate that creation of a biobank encompassing the areas shown in Figure 2 would generate a total of 238 ecosystem credits, comprising:

- 85 ecosystem credits of the type known as Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin, a form of the River-flat Forest on coastal floodplains EEC;

- 153 ecosystem credits for Grey Box - Forest Red Gum grassy woodland, a form of Cumberland Plain Woodland EEC); and

- No 'species credits' are listed in the Credit Calculator. However, as noted above, targeted surveys for a selection of species credit species during the spring survey period might be prudent, in this case to try to increase the value of the biobank by generating species credits.

3 EPBC ACT CPW ASSESSMENT

3.1 Methods

This section has been updated following the completion of field surveys in early November 2014, which involved the collection of quadrat data within each nominated patch of potential or actual EPBC Act Cumberland Plain Shale Woodland.

3.1.1 Desktop Patch Assessment

All patches of woodland vegetation within the subject site were assessed for whether they conform to the definition of *Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest* ('Cumberland Plain Shale Woodlands'), which is listed as a 'critically endangered' ecological community under the EPBC Act. The Commonwealth guidelines for this listed community, entitled *Policy Statement 3.31* (DEWHA 2009), were utilised to determine the presence of this community on the subject site.

The following method was applied to the EPBC Act CPW assessment:

- Compiling previous mapping of the site by SLR (2014) and Ashby (2012) and mapping all areas of woodland vegetation on the subject site that were either previously mapped as Cumberland Plain Woodland, or were likely to constitute Cumberland Plain Shale Woodlands. Regional mapping of the Cumberland Plain by NPWS (2002) was used to map areas within the subject site not covered by SLR or Ashby. Areas of the subject site lying north of the East Hills Rail Line and south of Cambridge Avenue were not surveyed and mapped previously by SLR or by Ashby. NPWS (2002) mapping was used to assess these areas at a desktop level. (Field verification of these areas would be required to confirm the results outlined in this Section).

- Mapping 'patches' of woodland vegetation, according to the definition of a 'patch' on p10 of DEWHA (2009);

- Running through the diagnostic criteria on p11 of DEWHA (2009). A copy of the flow chart of 'key diagnostic features' is provided in Appendix E. This included assessing for each patch:
    - area (in hectares) of each patch using GIS software;
    - presence of 'typical dominant tree species' of the canopy layer, by referring to quadrat data in Appendix D of SLR (2014) and in Table 2 of Ashby (2012);
    - average foliage projective cover (FPC) of the canopy; and
    - percentage of native understorey vegetation cover[1] (with 50% native cover being the threshold criterion).

Where patches that contain typical dominant trees species with greater than 10% FPC in the canopy layer, are greater than 0.5 ha in area, but have less than 50% native perennial understorey, the following additional criteria were assessed:

- Patch size (whether 5 ha or greater);

- Whether the patch is linked to an adjoining patch of 5 ha or greater;

- Where the patch is not linked to an adjoining patch of >5 ha; whether the patch contains at least one tree per hectare that is large (>=80 cm dbh) or has a hollow; and

- Whether 30% of the perennial understorey cover is native.

1 Perennial plant species of shrub and ground layers with life cycles > 2 growing seasons.

3.1.2 Field Assessment

Quadrat surveys were conducted on 3 and 4 November 2014 within each patch of woodland identified during the desktop assessment, as mapped in Figure 8. The following data were collected from each quadrat:

- presence of 'typical dominant tree species' of the canopy layer;
- average foliage projective cover (FPC) of the canopy; and
- percentage of native perennial understorey vegetation cover.

The locations of quadrats are shown in Figure 8. A total of six quadrats were established as part of BBAM surveys, but also specifically located to ensure that sufficient data was collected to sample the variation in condition of Cumberland Plain Shale Woodlands within each patch. The quadrats established for each patch are listed in Table 3.

Table 3 Quadrats established in CPW patches

CPW Patch	Size (ha)	BBAM Quadrat
1	12	DZ1A, DZ2A, DZ2B, DZ2C
2	0.63	BZ1A
3	1.15	BZ2C
4	1.653	not surveyed - not a distinct patch of CPW

Critical to any assessment of EPBC Act criteria for Cumberland Plain Shale Woodlands is the composition of the understorey. In this case, neither SLR nor Ashby had collected data that addressed this criterion totally; therefore, a key objective of the current field survey was to obtain quadrat results for the percentage native perennial understorey component. Field verification was necessary to determine more accurately the scores for this criterion in each patch of woodland on the subject site.

No areas of 'derived native grassland' have been mapped on the subject site and hence no such vegetation was included in the assessment.

3.2 Results

The updated results for the Cumberland Plain Shale Woodlands assessment are compiled in an MS Excel spreadsheet, which is attached in Appendix F. The Cumberland Plain Shale Woodlands patches are mapped in Figure 8.

The results of the field investigations are largely consistent with those of the desktop study, revealing that the subject site contains areas of vegetation that meet the definition of Cumberland Plain Shale Woodlands, as set out in the DEWHA (2009) guidelines. Stands of Cumberland Plain Shale Woodlands are restricted to areas lying south of the East Hills Rail Line, and exclude areas of planted vegetation, exotic grasslands and the riparian vegetation that lines the Georges River on the eastern site boundary (which comprises 'Alluvial Woodland', which is a subunit of the River-flat Forest EEC[2]).

The updated results are presented in Appendix F and summarised in Table 4. A total of 13.77 ha of Cumberland Plain Shale Woodlands has been surveyed and mapped across the site, as listed in Table 4 and shown in Figure 8.

2 *River-flat eucalypt forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions* (NSW Scientific Committee 2011).

The majority of the vegetation that has been assessed as complying with the DEWHA (2009) definition of Cumberland Plain Shale Woodlands lies within CPW Patch 1, with 12 ha of this vegetation mapped within the central and western parts of the subject site (Figure 8). Of this, 9.5 ha lies within the development footprint for the proposed recycling facility and would be completely removed. This vegetation contains a mosaic of condition classes, ranging from cleared land, through low condition to moderate condition. However, the definition of a 'patch' in the DEWHA (2009) guideline means that all areas of low condition vegetation are still considered as part of the same patch of Cumberland Plain Shale Woodlands.

Table 4 Patch analysis – EPBC Act Cumberland Plain Shale Woodlands

CPW Patch*	Size (ha)	SLR Veg Types	NPWS (2002)	EPBC Act CPW?
1	11.99	Grey Box _ Red Gum Woodland _ Very Low; Grey Box _ Red Gum Woodland _ Low; Red Gum - Ironbark Woodland_low; Red Gum - Ironbark Woodland_very low	Shale Plains Woodland	Yes
2	0.63	Red Gum - Ironbark Woodland_Moderate	Shale Plains Woodland	Yes
3	1.15	Grey Box _ Red Gum Woodland _ Low	Shale Plains Woodland	Yes
4	(<0.5)	(not surveyed – re-evaluated as not forming a patch of CPW)	Shale Plains Woodland	No
Total CPW	**14.27**			

Two additional patches mapped by NPWS (2002) as Shale Plains Woodland (>10% cover class) lie in the southeastern parts of the subject site. These areas were not surveyed by SLR (2014) or Ashby (2012), but were surveyed during the recent site survey. These two areas were previously mapped as patches 3 and 4 (Table 4 and Figure 8) and contain 'typical dominant' CPW canopy trees with an FPC of >10%. Patch 3 has been re-mapped as part of the current investigation and extends to the eastern site boundary. Its new area has been calculated in GIS as 1.15 ha. This means Patch 3 is now above the minimum size threshold of 0.5 ha and so meets the definition of the EPBC Act listed community. Field surveys revealed that Patch 4 is not a distinct patch of CPW vegetation and so does not meet the definition of Cumberland Plain Shale Woodlands.

Only very small patches of EPBC Act Cumberland Plain Shale Woodlands lie within the proposed offset areas, as follows:

- Patch 2, a 0.63 ha patch of Shale Plains Woodland (named 'Red Gum – Ironbark Woodland' in SLR 2014) in moderate condition in the western part of the subject site, between an internal road and the East Hills Rail Line and north of the homestead; and

- Patch 3, small patch of woodland with an area of 1.15 ha mapped as 'Shale Plains Woodland' (by NPWS 2002), in the far southeast of the subject site, would also fall within one of the offset areas. This patch is a narrow belt of woodland that follows a small drainage line that flows east into the Georges River.

Both of the above patches are degraded by weed invasion, human access, edge effects and feral animals. Importantly, Patch 2 is in moderate to good condition, with a high diversity of groundcover species (the highest out of all patches surveyed) but is subject to invasion by the exotic perennial grass African Lovegrass *Eragrostis curvula*. Consequently, these (and other) patches proposed for conservation in offset areas would benefit from weed control, exclusion of grazing and/or slashing, access control and possibly controlled (low intensity 'ecological') burns.

4 CONCLUSIONS AND RECOMMENDATIONS

4.1 Biobanking Credits

The current desktop assessment indicates the following:

- 296 ecosystem credits are required for the proposed development (see Appendix C); and
- 238 ecosystem credits would be generated by the creation of a biobank on the site (see Appendix D).

As shown in Appendix C, the 296 credits for development can be offset (i.e. 'offset options') using the two credit types available in the proposed biobank:

- Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin, (ME018); and
- Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin (ME020).

This would still leave a credit deficit of 58 ecosystem credits (Grey Box - Forest Red Gum grassy woodland) that would be required to be purchased or generated on another biobank site elsewhere in the Sydney Metro catchment management area (CMA).

Once it is established that the necessary credits are commercially available and that BioBanking is a viable solution for the subject site, a full BioBanking assessment would need to be conducted. Under the new offsetting policy (see Section 4.2), payments to a NSW Government biobanking fund would be available if the above listed credits are not commercially available and/or the credits generated by the proposed offset areas are not sufficient to offset the project impacts.

4.2 New Biobanking Methodology and Offsetting Policy

The *BioBanking Assessment Methodology 2014* (BBAM 2014) came into effect on 1 October 2014, along with the new *Biodiversity Offsets Policy for Major Projects* (the Offsets Policy) and the related *Framework for Biodiversity Assessment* (FBA). The Offsets Policy applies to state significant development and state significant infrastructure under the *Environmental Planning and Assessment Act 1979*. The credit calculations presented in this report (Appendices C and D) were completed using the new version of Credit Calculator.

We note that, according to the FBA, a *Biodiversity Assessment Report* must be prepared for SSD projects. This report does not constitute and *Biodiversity Assessment Report* (BAR), but would form a supporting document to a BAR.

4.3 EPBC Act CPW

The current assessment indicates that the subject site supports vegetation that meets the criteria for Cumberland Plain Shale Woodlands, which is listed as critically endangered under the EPBC Act. Approximately 14 ha of Cumberland Plain Shale Woodlands has been surveyed and mapped across the site, of which 9.5 ha would be removed for the proposal. Field work conducted as part of the current investigation confirms that Patches 1, 2 and 3 met the definition of Cumberland Plain Shale Woodlands, as they contain the characteristic canopy species with a canopy FPC >10%, are larger than 0.5 ha and have at least 50% native perennial species in the understorey.

We note that previous assessments by Ashby (2012) and SLR (2014) also come to similar conclusions. Ashby states that the subject site "is largely occupied by the Critically Endangered Ecological Community Cumberland Plain Woodland. This is listed under both NSW and Commonwealth legislation". SLR (2014) note that "some of the open forest and woodland vegetation on the subject site would clearly satisfy the criteria identified in the Cumberland Plain Recovery Plan for the Cumberland Plain Woodland (CPW) community – as listed both in the TSC Act and EPBC Act". Furthermore, SLR states that "…areas of vegetation that are in 'Low' or 'Moderate' condition are considered likely to satisfy the criteria for the CPW community as listed in the EPBC Act".

On the basis of the current and previous findings, we recommend that the project be referred to the Commonwealth Department of the Environment for determination pursuant to the EPBC Act. The impacts described herein would likely constitute a 'controlled action' under the EPBC Act, with due consideration to the *Significant Impact Guidelines 1.1* (Dept. of the Environment 2013).

5 REFERENCES

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LEGEND

Subject Site

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BioBanking Credit Assessment

Subject Site
Proposed Recycling Facility
Glenfield NSW

FIGURE 1

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Environmental Planning Services

BioBanking Credit Assessment

Proposed Development Footprint & Potential Onsite Rehab Areas

FIGURE 2

LEGEND

- Subject Site
- Vegetation For Removal
- Woody Cover
- 100Ha Landscape Assessment
- 1000Ha Landscape Assessment

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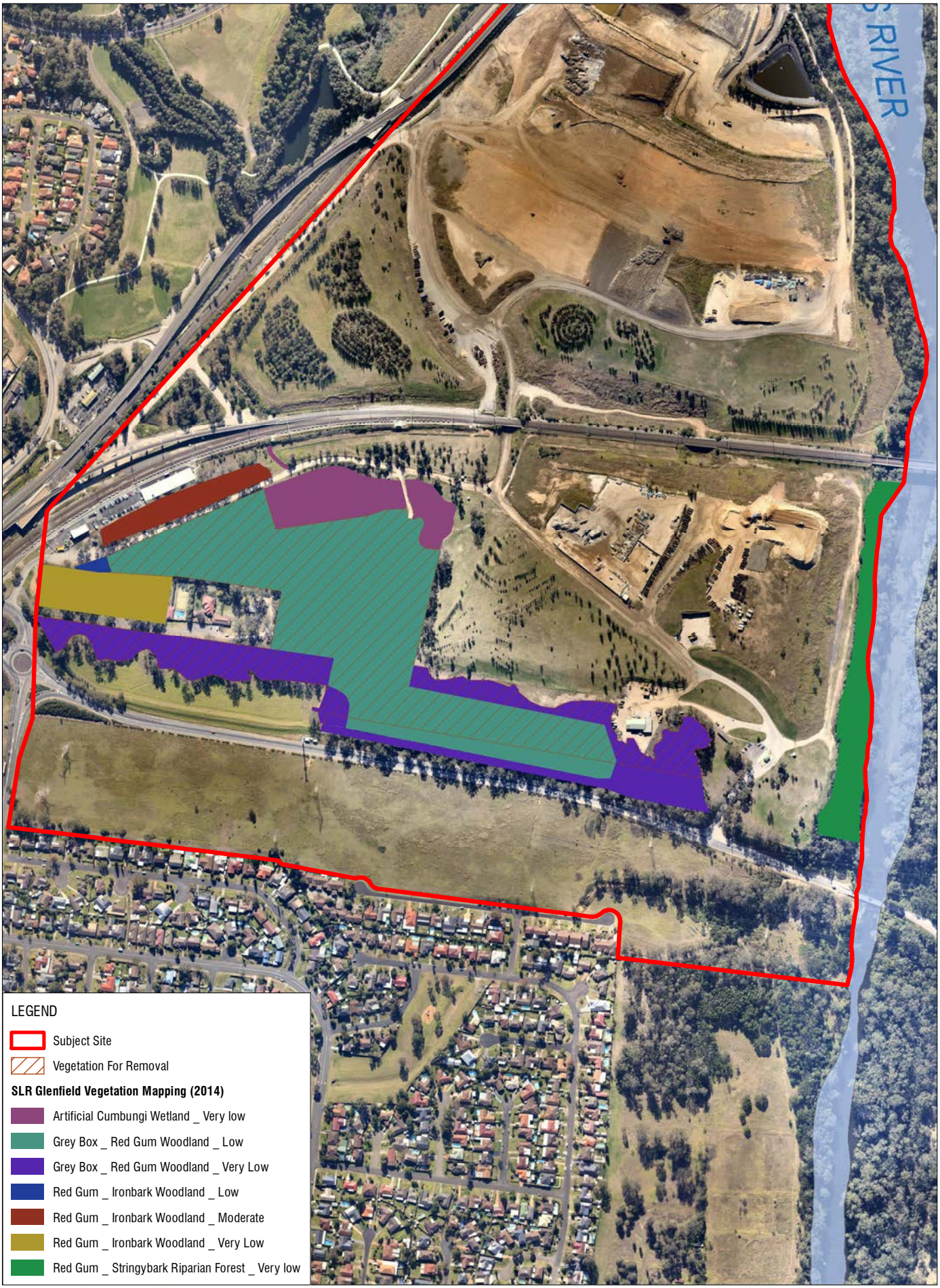
BioBanking Credit Assessment

Development Impacts
Woody Cover in Landscape Assessment Circles

FIGURE 3



LEGEND

- Subject Site
- Vegetation For Removal

SLR Glenfield Vegetation Mapping (2014)

- Artificial Cumbungi Wetland _ Very low
- Grey Box _ Red Gum Woodland _ Low
- Grey Box _ Red Gum Woodland _ Very Low
- Red Gum _ Ironbark Woodland _ Low
- Red Gum _ Ironbark Woodland _ Moderate
- Red Gum _ Ironbark Woodland _ Very Low
- Red Gum _ Stringybark Riparian Forest _ Very low

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BioBanking Credit Assessment

SLR (2014) Vegetation Mapping

FIGURE 4

LEGEND

Subject Site

Vegetation Zones Types and Conditions

Zone 1 - Grey Box - Forest Red Gum, Grassy Woodland - Low

Zone 2 - Grey Box - Forest Red Gum, Grassy Woodland - Mod Good

SLR Biobanking Plots

Veg Zone Number	Area (ha)	No. Plots Required
1	2.58	1
2	6.91	3

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BioBanking Credit Assessment

Proposed Development Footprint Vegetation Zones

FIGURE 5

LEGEND

- Subject Site
- Vegetation Rehabilitation Areas
- Woody Cover
- 100Ha Landscape Assessment
- 1000Ha Landscape Assessment

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BioBanking Credit Assessment

Offset Areas
Woody Cover in Landscape Assessment Circles

FIGURE 6

LEGEND

- Subject Site
- Zone 1 - Grey Box - Forest Red Gum, Grassy Woodland - Mod Good
- Zone 2 - Grey Box - Forest Red Gum, Grassy Woodland - Low
- Zone 3 - Forest Red Gum - Rough Barked, Apple Grassy Woodland - Low
- SLR Biobanking Plots

Veg Zone Number	Area (ha)	No. Plots Required
1	1.15	1
2	13.81	2
3	7.70	2

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BioBanking Credit Assessment

Offset Areas
Vegetation Zones

FIGURE 7

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Environmental Planning Services

BioBanking Credit Assessment

Cumberland Plain Woodland
EPBC Act
Patches For Assessment

FIGURE 8

BioBanking variable – development credits	Assumption (Credit Calculator input)
Landscape Value	
Map assessment circles	100 ha and 1000 ha assessment circles were placed on the centroid of the proposed development area (see Figure 3).
% native vegetation cover	Calculated for 100 ha and 1000 ha circles in GIS using NPWS (2002) mapping of the vegetation of Cumberland Plain
Adjacent remnant area	Calculated using GIS mapping of vegetation by SLR (2014), and interpretation of this and translation of mapped polygons into either patches of 'moderate to good' or 'low' condition (as per BBAM). Assumed to not extend east to the riparian corridor of the Georges River, as the riparian vegetation on the River is separated from the moderate to good vegetation within the site by a patch of low condition vegetation >100 m in width.
Patch size	Calculated as per adjacent remnant area, but including patches of low condition vegetation (not separated from the vegetation on site by gaps of > 100 m)
Connectivity value Connectivity value class	For the purposes of the connectivity score the following assumptions were adopted: • Georges River is a 5th order stream at this location (ie adjoining the eastern boundary of the site); • The Georges River constitutes a state or regional biodiversity corridor (although no information could be obtained to confirm this at time of writing); • There are no important wetlands or estuaries within or adjacent to the site Vegetation clearing associated with the proposal would not involve clearing the following: • 20m either side of a 4th or 5th order stream (being the Georges River); • 50 either side of a 6th order stream; • Within 50 m of an important wetland or estuary; • State or regional biodiversity corridor
Connectivity width and condition	The primary link is assumed to be theoretically located in an east-west direction across the development area and across to the Georges River, which is located to the east of the development area. However, the development area is not linked to the adjoining riparian vegetation of the Georges River due to a patch of low condition vegetation that is greater than 100 m in width and contains a 'hostile gap' (ie the entrance to the Glenfield Waste facility). The limiting width class of the primary link is taken to be 0-5 m before development and after development. Based on field survey results, the following linkage condition classes were entered for the primary link: • Canopy PFC < 25% of lower benchmark; and • PFC of mid-storey/groundcover 50% Number of linkage width classes crossed = 0
Vegetation zones	Veg zones were created by combining vegetation mapping polygons of SLR (2014), with the following classifications of condition: • All areas of vegetation mapped as 'very low' condition by

BioBanking variable – development credits	Assumption (Credit Calculator input)
	SLR (2014) are assumed to meet the definition of 'low condition' in BBAM; • All areas mapped by SLR as 'low-moderate' or are assumed to meet the definition of 'moderate to good' in the BBAM. These assumptions were verified by the current field surveys in Nov 2014.
Threatened species sub-zones	(No longer included in BBAM 2014).
Geographical/habitat features	Four features are listed in the Credit Calculator for the subject site: 1. Green and Golden Bell Frog *Litoria aurea* (land within 100 m of emergent aquatic or riparian vegetation); 2. Matted Bush-pea *Pultenaea pedunculata* (land within 5 km of coast in South East Coastal Plains CMA subregion) 3. Cumberland Plain Land Snail (land containing bark or leaf litter accumulation) 4. *Hypsela sessiliflora* (wet and damp areas only) Although some parts of the site are within 100 m of emergent freshwater vegetation within the large dam (or stormwater pond) located in the north of the site, Green & Golden Bell Frogs have not been recorded on the site (and are assumed to be absent from the site). Accordingly, these features are assumed to be not present on the site (and are 'switched off' in the Credit Calculator). Targeted field surveys for listed threatened species during the recommended survey period would be required to determine likely presence or absence from the site.
Site survey details	10 species are listed as potentially occurring species that generate species credits. None of these species have been recorded on the site, although it noted that previous surveys by SLR (2014) and Ashby (2012) were not ideal for the detection of threatened plants. Recommended survey dates for each species are listed (for information only). 17 'predicted species' are listed for ecosystem credits in the Credit Calculator. No such species were assumed to be on site.
Site values Plot data vs benchmark data	For each veg zone, plot/transect data collected on 3 and 4 Nov 2014 was entered to obtain site value score for each veg zone.
Low condition vegetation	All areas of vegetation mapped as 'very low' condition by SLR (2014) are assumed to meet the definition of 'low condition' in BBAM. This assumption was verified by field data collection.
Scoring of site attributes	For each veg zone, plot/transect data collected on 3 and 4 Nov 2014 was entered to obtain site value score for each veg zone.
Management zones	Assumed to match area of each veg zone. Management zone site scores with development all set to default of zero (0) based on assumption that all vegetation within each management zone will be removed by the proposed development.

BioBanking variable – development credits	Assumption (Credit Calculator input)
	Areas of each vegetation zone/management zone to be removed are based on SLR digitisation of a polygon of the development area supplied by EPS (Job ref: 11012, dated 16/07/14).
Threatened species survey results	None of the threatened species listed in the Credit Calculator have been recorded on the site. Hence, all listed species were assumed to not be impacted by the proposed development. ID method (for threatened species) entered is 'survey', based on the findings of SLR (2014) and Ashby (2012), with the date of survey entered as 30 September 2013 (the date of the most recent survey by SLR). It is noted that threatened plants and threatened fauna were not targeted by SLR (2014), as this study was primarily focussed on mapping of vegetation. No threatened species were recorded on the site by Ashby (2012). However, it is noted that the field survey was conducted during winter (30 May and 12 July 2012) when most threatened plants would not be flowering and threatened fauna are less active. Hence, the timing of the Ashby survey was not suitable for the detection of cryptic threatened plants (i.e. only detectable during flowering) or threatened fauna.

BioBanking variable – biobank/offset areas	Assumption (Credit Calculator input)
Landscape Value	
Map assessment circles	100 ha and 1000 ha assessment circles were placed on the centroid of the proposed offset (biobank) areas (see Figure 6).
% native vegetation cover	Calculated for 100 ha and 1000 ha circles in GIS using NPWS (2002) mapping of the vegetation of Cumberland Plain
Adjacent remnant area	Calculated using mapping of Cumberland Plain vegetation by NPWS (2002), and interpretation of this and translation of mapped polygons into either patches of 'moderate to good' or 'low' condition (as per BBAM). All vegetation mapped in NPWS as >10% cover assumed to represent 'moderate to good' condition woody vegetation at benchmark. For biobank veg zones, assumed to extend north and south along the riparian corridor of the Georges River, but not over the East Hills Rail Line, which is considered a 'hostile gap' in any future biobank corridor.
Patch size	Calculated as per adjacent remnant area, but including patches of 'mod-good' and low condition vegetation (not separated from the vegetation on site by gaps of > 100 m). For veg zone 1 (Figure 7), patch size is limited to the woody vegetation mapped within the subject site, as the vegetation cover is separated from the riparian zone of the Georges River by a gap >100 m. For veg zones 2 and 3 (Figure 7), patch is assumed to extend across the Georges River to the extensive bushland areas to the southeast. Patch size is therefore >500 ha.
Connectivity value Strategic location	For the purposes of the connectivity score the following assumptions were adopted: • The proposed biobank is located within a strategic location, being a riparian buffer area on one side of a 4th or 5th order stream
Vegetation zones	Veg zones were created by combining vegetation mapping polygons of SLR (2014), with the following classifications of condition: • All areas of vegetation mapped as 'very low' condition by SLR (2014) are assumed to meet the definition of 'low condition' in BBAM; • All areas mapped by SLR as 'low-moderate' or are assumed to meet the definition of 'moderate to good' in the BBAM. These assumptions were verified by field data collection as described in this report.
Threatened species sub-zones	(No longer included in BBAM 2014).
Geographical/habitat features	Three features are listed in the Credit Calculator for the subject site: 1. Tadgell's Bluebell *Wahlenbergia multicaulis* endangered population (damp disturbed sites) 2. Green and Golden Bell Frog *Litoria aurea* (land within 100 m of emergent aquatic or riparian vegetation); 3. Matted Bush-pea Pultenaea pedunculata (land within 5 km of coast in South East Coastal Plains CMA subregion) Although some parts of the site are within 100 m of emergent freshwater vegetation within the large dam (or stormwater pond) located in the north of the site, Green & Golden Bell

BioBanking variable – biobank/offset areas	Assumption (Credit Calculator input)
	Frogs have not been recorded on the site (and are assumed to be absent from the site). Accordingly, these features are assumed to be not present on the site (and are 'switched off' in the Credit Calculator). Targeted field surveys for listed threatened species during the recommended survey period would be required to determine likely presence or absence from the site.
Site survey details	8 species are listed as potentially occurring species that generate species credits. None of these species have been recorded on the site, although it noted that previous surveys by SLR (2014) and Ashby (2012) were not ideal for the detection of threatened plants. Recommended survey dates for each species are listed (for information only). 18 'predicted species' are listed for ecosystem credits in the Credit Calculator. No such species were assumed to be on site.
Site values Plot data vs benchmark data	For each veg zone, plot/transect data collected on 3 and 4 Nov 2014 was entered to obtain site value score for each veg zone.
Low condition vegetation	All areas of vegetation mapped as 'very low' condition by SLR (2014) are assumed to meet the definition of 'low condition' in BBAM. This assumption was verified by field data collection.
Scoring of site attributes	For each veg zone, plot/transect data collected on 3 and 4 Nov 2014 was entered to obtain site value score for each veg zone.
Management zones	Assumed to match area of each veg zone and linked to single threatened species sub-zone. Management zone site scores with development all set to default increased score.
Threatened species survey results	None of the threatened species listed in the Credit Calculator have been recorded on the site. ID method (for threatened species) entered is 'survey', based on the findings of SLR (2014) and Ashby (2012), with the date of survey entered as 30 September 2013 (the date of the most recent survey by SLR). It is noted that threatened plants and threatened fauna were not targeted by SLR (2014), as this study was primarily focussed on mapping of vegetation. No threatened species were recorded on the site by Ashby (2012). However, it is noted that the field survey was conducted during winter (30 May and 12 July 2012) when most threatened plants would not be flowering and threatened fauna are less active. Hence, the timing of the Ashby survey was not suitable for the detection of cryptic threatened plants (i.e. only detectable during flowering) or threatened fauna.

APPENDIX C

Biobanking Credit Results – Development Impacts

BioBanking credit report

This report identifies the number and type of credits required at a DEVELOPMENT SITE.

Date of report: 25/11/2014 Time: 6:43:40PM Calculator version: v2.1

Development details

Proposal ID:	0107/2014/1362D
Proposal name:	Glenfield Waste BioBanking Statement
Proposal address:	Cambridge Avenue Glenfield NSW 2167
Proponent name:	Glenfield Waste Services
Proponent address:	Cambridge Avenue Glenfield NSW 2167
Proponent phone:	(02) 4981-1600
Assessor name:	Jeremy Pepper
Assessor address:	Level 3 10 Kings Road New Lambton NSW 2305
Assessor phone:	02 4037 3200
Assessor accreditation:	0107

Improving or maintaining biodiversity

An application for a red flag determination is required for the following red flag areas

Red flag	Reason
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Vegetation type being > 70% cleared; or it contains an endangered ecological community;

The application for a red flag determination should address the criteria set out in the BioBanking Assessment Methodology. Please note that a biobanking statement cannot be issued unless the determination is approved.

Additional information required for approval:

☐ Change to percent cleared for a vegetation type/s

- Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
- Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion

☐ Use of local benchmark

- Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
- Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion

☐ Change negligible loss

☐ Expert report...

☐ Request for additional gain in site value

☐ Predicted threatened species not on site

- Black-chinned Honeyeater (eastern subspecies) Melithreptus gularis subsp. gularis

■ Brown Treecreeper (eastern subspecies)	Climacteris picumnus subsp. victoriae
■ Bush Stone-curlew	Burhinus grallarius
■ Diamond Firetail	Stagonopleura guttata
■ Eastern False Pipistrelle	Falsistrellus tasmaniensis
■ Eastern Freetail-bat	Mormopterus norfolkensis
■ Gang-gang Cockatoo	Callocephalon fimbriatum
■ Greater Broad-nosed Bat	Scoteanax rueppellii
■ Hooded Robin (south-eastern form)	Melanodryas cucullata subsp. cucullata
■ Little Eagle	Hieraaetus morphnoides
■ Little Lorikeet	Glossopsitta pusilla
■ Painted Honeyeater	Grantiella picta
■ Speckled Warbler	Chthonicola sagittata
■ Spotted Harrier	Circus assimilis
■ Swift Parrot	Lathamus discolor
■ Varied Sittella	Daphoenositta chrysoptera
■ Yellow-bellied Sheathtail-bat	Saccolaimus flaviventris

☐ Change threatened species response to gain (Tg value)

Ecosystem credits summary

Vegetation type	Area (ha)	Credits required	Red flag
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	2.59	71.99	No
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	6.91	224.45	Yes
Total	9.50	296	

Credit profiles

1. Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion, (ME020)

Number of ecosystem credits created	72
CMA sub-region	Cumberland - Sydney Metro
Minimum percent native vegetation cover class	>70%
Minimum adjacent remnant area class	0-5 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion, (ME018) Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion, (ME020)	Cumberland - Sydney Metro Pittwater (Part A) Sydney Cataract - Sydney Metro Pittwater (Part B) Sydney Metro - marine zone

2. Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion, (ME020)

Number of ecosystem credits created	224
CMA sub-region	Cumberland - Sydney Metro
Minimum percent native vegetation cover class	>70%
Minimum adjacent remnant area class	5-25 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion, (ME020)	Cumberland - Sydney Metro

Species credits summary

APPENDIX D

Biobanking Credit Results – Biobank Sites

BioBanking credit report

This report identifies the number and type of credits required at a BIOBANK SITE

Date of report: 25/11/2014 Time: 6:45:43PM Calculator version: v2.1

Biobank details

Proposal ID:	0107/2014/1381B
Proposal name:	Glenfield Waste BioBank
Proposal address:	Cambridge Avenue Glenfield NSW 2167
Proponent name:	Glenfield Waste Services
Proponent address:	Cambridge Avenue Glenfield NSW 2167
Proponent phone:	02 4981 1600
Assessor name:	Jeremy Pepper
Assessor address:	Level 3 10 Kings Road New Lambton NSW 2305
Assessor phone:	02 4037 3200
Assessor accreditation:	0107

Additional information required for approval:

☐ Use of local benchmark

- Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion
- Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
- Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion

☐ Expert report...

☐ Request for additional gain in site value

Ecosystem credits summary

Vegetation type	Area (ha)	Credits created
Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	7.70	85.00
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	14.96	153.00
Total	22.66	238

Credit profiles

1. Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion, (ME018)

Number of ecosystem credits created	85
CMA sub-region	Cumberland - Sydney Metro
Minimum percent native vegetation cover class	>70%
Minimum adjacent remnant area class	0-5 ha

2. Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion, (ME020)

Number of ecosystem credits created	141
CMA sub-region	Cumberland - Sydney Metro
Minimum percent native vegetation cover class	>70%
Minimum adjacent remnant area class	0-5 ha

3. Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion, (ME020)

Number of ecosystem credits created	12
CMA sub-region	Cumberland - Sydney Metro
Minimum percent native vegetation cover class	>70%
Minimum adjacent remnant area class	5-25 ha

Species credits summary

Additional management actions

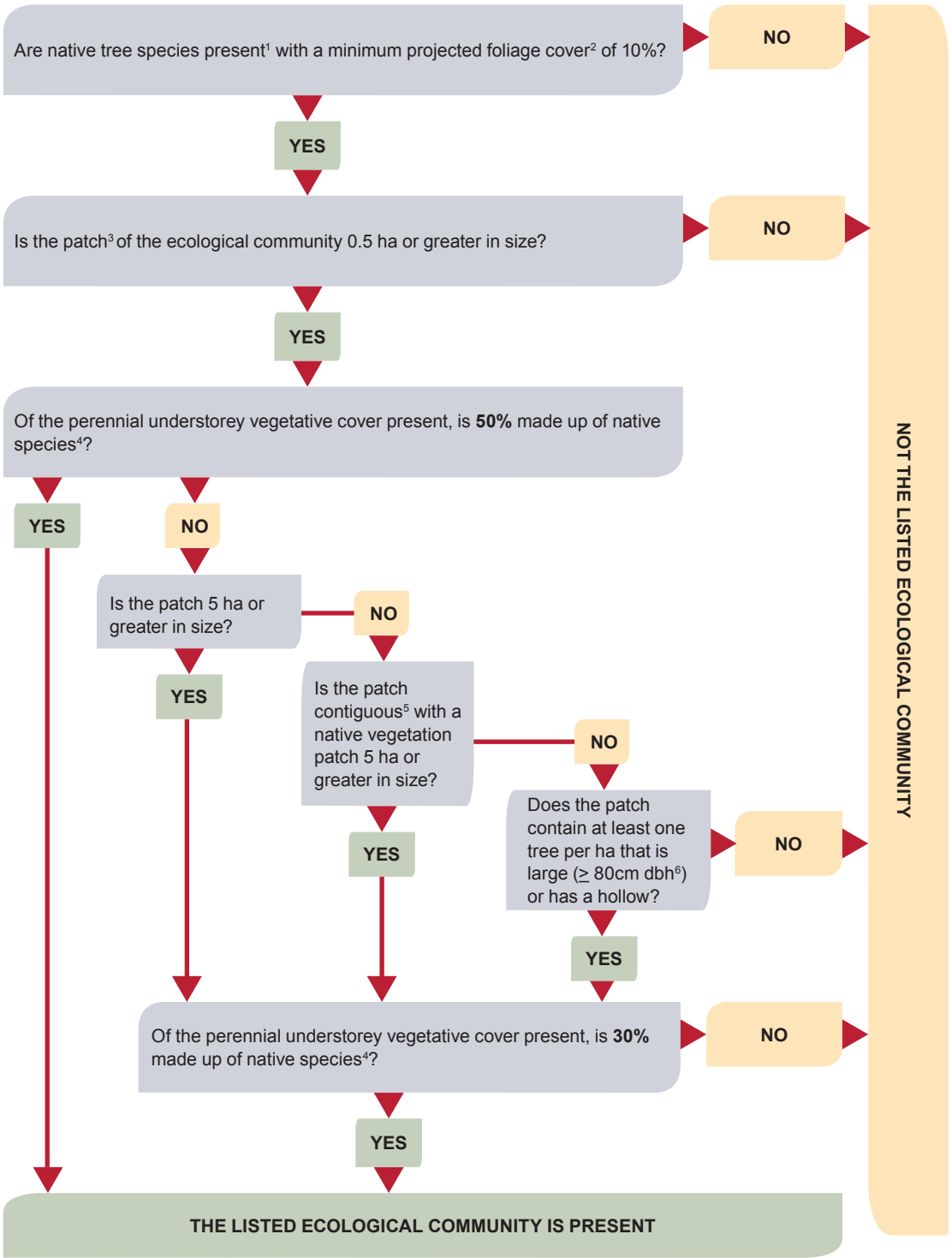
Additional management actions are required for:

Vegetation type or threatened species	Management action details
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Exclude commercial apiaries
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Exclude miscellaneous feral species
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Feral and/or over-abundant native herbivore control
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Fox control

APPENDIX E

DEWHA (2009) Cumberland Plain Woodland Diagnostic Chart

Flowchart of key diagnostic features and condition thresholds to identify the Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community



Notes: See page 10 for notes.

APPENDIX F

EPBC Act Cumberland Plain Woodland patch analysis

CPW Patch	Size (ha)	SLR quadrats*	Typical dominant' trees in canopy	Canopy FPC** >=10%	Patch > 0.5ha	Understorey*** 50% native	Linked to Patch >5 ha	Understorey*** 30% native	CPW?
1.00	11.99		Y	Y	Y	Y			Y
2.00	0.63		Y	Y	Y	Y			Y
3.00	1.15		Y	Y	Y	Y			Y
4.00	< 0.5		Y	Y	No				No

Notes:
* refer SLR Figure 8
** 'Typical dominant' tree species present with a minimum projected foliage cover of 10% (typical spp = ***E. tereticornis, E. moluccana*** & ***E. crebra;*** dominant = 50% of the canopy)

Sub-Patch No.	SLR Veg Type	Area (ha)
9	Grey Box _ Red Gum Woodland _ Very Low	0.78
8	Grey Box _ Red Gum Woodland _ Very Low	0.25
7	Grey Box _ Red Gum Woodland _ Very Low	0.39
6	Grey Box _ Red Gum Woodland _ Very Low	0.16
13	Grey Box _ Red Gum Woodland _ Low	7.55
12	Grey Box _ Red Gum Woodland _ Very Low	0.52
5	Grey Box _ Red Gum Woodland _ Very Low	1.39
4	Red Gum - Ironbark Woodland	0.90
3	Red Gum - Ironbark Woodland	0.06
2	Red Gum - Ironbark Woodland	0.63
10	Shale Plains Woodland	0.16
11	Shale Plains Woodland	0.20
		12.99

Patch 1

SLR Quadrat	**% Native perenn understorey**
DZ1A	30
DZ2A	55
DZ2B	60
DZ2C	55
Mean % native cover:	**50**

Patch 2

SLR Quadrat	**% Native perenn understorey**
BZ1A	60
Mean % native cover:	**60**

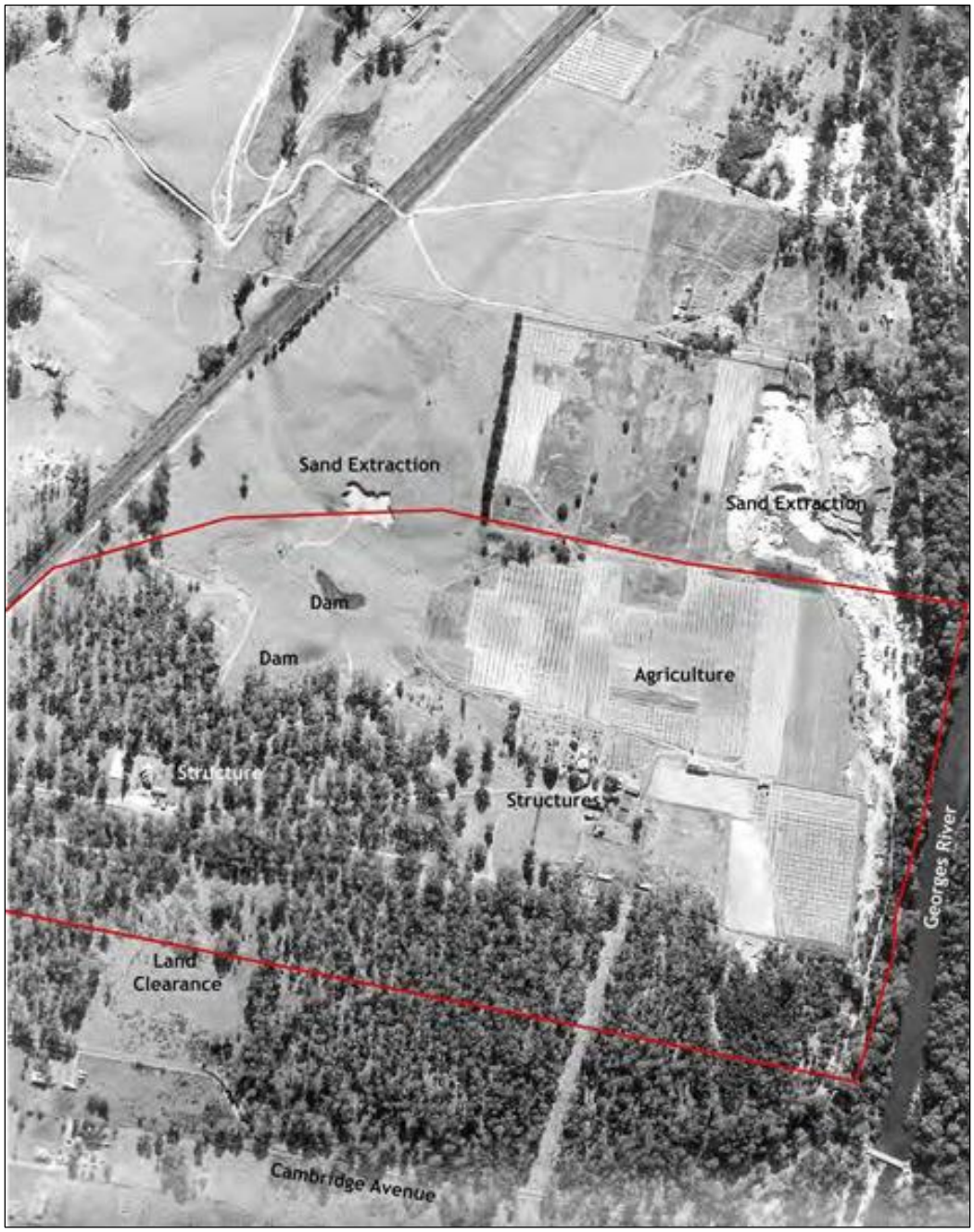
Patch 3

SLR Quadrat	**% Native perenn understorey**
BZ2C	50
Mean % native cover:	**50**

Appendix 17

Historical Aerial Photography

Historical aerial photograph of the subject area from 1951. One of the original tributaries running through the site is evident, as is the extensive agriculture in the eastern quadrant. With the exception of a structure, the western quadrant is relatively undisturbed (source: Land & Property Information Services).



Historical aerial photograph of the subject area from 1961. By this time, extraction along the river's edge is occurring, as well as modifications to the north quadrant of the subject area. Some clearance is also occurring on the transmission line. Note the different alignment of Cambridge Avenue – this previous alignment would have impacted GWD 2 discussed in Section 8.1 (source: Land & Property Information Services)

Historical aerial photograph of the subject area from 1970. Extensive quarrying and/or sand extraction has now encroached on much of the northern quadrants of the subject area. The dam and surrounding area in the northwest have also been expanded. The west and southwest quadrants still appear relatively undisturbed (source: Land & Property Information Services).

Appendix 18

Threatened Species Mapping from OEH Database