Appendix 14

Infrastructure Report

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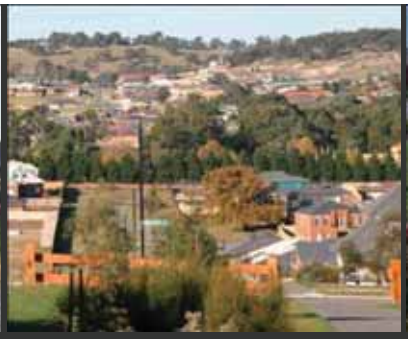

Environmental Property Services Services Report

L.A. Kennett Enterprises Glenfield

May 2012

SMEC Urban Ref No.: 31177679

urban design | planning | engineering | transport planning | surveying | landscape architecture | project management

Quality Assurance – Report Record

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1 Background

SMEC Urban have been engaged by Environmental Property Services to undertake a review and prepare a report on its findings in relation to the availability of utility services on and adjacent to a landholding owned by L.A.Kennett Enterprises at Cambridge Avenue, Glenfield. This report is to be included with an application to Campbelltown Council for rezoning of the majority of the land to the Standard Instrument LEP Zone IN1 General Industrial.

2 The Study Area

The entire landholding owned by Kennett Enterprisers has an approximate area of 100 ha area comprised of 10 contiguous parcels**.** Together they roughly form a triangular shape bounded on the north western boundary by the Macarthur Rail Corridor, on the east by the Georges River, on the south by residential development in Fergusson Street and Goodenough Street, and then on the west by Canterbury Road and the Glenfield Road Overpass. Cambridge Avenue, and the East Hills Rail Corridor bisects the southern portion of the site in an east / west direction.

The site falls within the Local Government Area (**LGA**) of Liverpool City Council and Campbelltown City Council. The Local Government boundary between Liverpool and Campbelltown approximates the northern boundary of Lot 91 adjacent to the northern alignment of the East Hills rail line.

The study area the subject of this report is the southern portion of the landholding within the Campbelltown LGA. It is comprises of five lots with a total area of 59Ha bounded on the south by residential development in Fergusson Street and Goodenough Street, on the west by Canterbury Road and the Glenfield Road Overpass, on the north by the LGA boundary between Liverpool and Campbelltown being the northern boundary of Lot 91 , and finally on the east by the Georges River.

3 Study Area Title Particulars

Title Reference	Lot & Deposited Plan	Proprietor	Area (Ha)
Auto Consol 14018-92	Lot 1 DP 113201	JC&FW Kennett P/L	0.1418 ha
	Lot 2 DP 333578		1.346 Ha
	Lot 91 DP 1155962		29.96 Ha
3/735524	Lot 3 DP 735524	Figela Pty Ltd	2.432 Ha
3/736881	Lot 3 DP 736881	Figela Pty Ltd	25.21 Ha

That part of Lot 3 DP 736881 on the south side of Cambridge Avenue is burdened by an electrical easement effecting most of the land.

Lot 91 is effected by stratum Lots 7 and 8 in DP 833516 that have a small impact on the useable area adjacent to the East Hills rail corridor.

4 Existing Infrastructure

4.1 Electricity

Development in the immediate vicinity of the site is mainly urban land use. As a result there is minimal high voltage reticulation in place to service the area. Power and street lighting is provided on the southern side of Cambridge Avenue. Connection to the waste depot is assumed to occur at the eastern end of Cambridge Avenue. There are two existing 330kV transmission lines running in the electrical easement on the southern side of Cambridge Avenue.

The 11kV feeders for the existing reticulation are from the Prestons Zone Substation (Cnr Bernera Road and Camden Valley Way) and the Macquarie Fields Zone Substation (Cnr Macquarie and Fields Streets). It appears from our initial enquires with Endeavour Energy that these feeders do not have additional capacity to support industrial land use.

4.2 Sewer

Existing residential development adjacent to the site is reticulated by gravity mains that fall to 2 sewer pump stations, one near the intersection of Railway Parade and Canterbury Road, the other within public reserve in Trobriand Crescent. The pump stations then pump via pressure main to a ridge further south and then by gravity main to the Glenfield treatment plant. The subject site is not reticulated to sewer.

4.3 Water

The residential precincts adjacent to the site are currently serviced from a 300mm diameter water main running along Glenfield Road down into Canterbury Road past the intersection with Cambridge Avenue. There are not any water mains laid in Cambridge Avenue. It is unlikely there will be additional capacity in the 300 diameter main to service the proposed land use.

4.4 Telecommunications

- AAPT have installed optic fibre cable some distance from the study area closer to Glenfield Station, and will not be in a position to bring trunk services to site.
- Optus fibre optic cable is located within Telstra conduits in Railway Parade extending to end to the roundabout intersection with Cambridge Avenue and Canterbury Road. From there it passes under the State Rail interchange infrastructure before heading north to service Glenfield Road and Leacocks Lane,
- Visionstream run their cables within the same third party conduits used by Optus in Railway Parade and Glenfield Road,
- A Telstra underground service runs in a single conduit from the intersection roundabout at Canterbury Road along the northern side of Cambridge Avenue for approximately 500m in an easterly direction to a communications tower. Other Telstra service are contained within the southern side of the East Hills rail corridor.

4.5 Gas

- APA Group manages a high pressure ethane pipeline on behalf of Gorodok. The pipeline runs within Lot 91 parallel to the southern side of the East Hills Rail Corridor and passes under the rail corridors towards the western end of the site near Glenfield Road. The pipeline is a dedicated service for the ICI petrochemical plant at Botany and cannot be accessed to service the proposed development of the site. Building restriction will apply adjacent to the pipeline.
- A Jemena high pressure 1050kPa 150mm steel natural gas main is located within Canterbury Road, and passes under the Cambridge Ave intersection and the rail junctions into Glenfield Road. It currently services the subject site.

5 Site Generated Infrastructure Demands

Given the sites location proposed zoning classification as IN1 General Industrial, it is assumed development will take the form of warehousing, and logistics. Given also the site constrains, it had been assumed that the site area available for rezoning is 28 Ha.

5.1 Electricity

For the purposes of determining likely power demand requirements it is assumed after allowing for setbacks, new roads, hard stand, and trafficable area, that the nett useable building area will be in the order of 20 Ha.

Endeavour Energy advised an expected load of 5 MVA assuming the site is development for mainly warehouse use. If other uses such as data centres or cold storage are proposed, this would increase the requirement significantly. In this circumstance, specific information would be required by Endeavour Energy before demand calculations could be determined.

Under current Endeavour standards an 11kV feeder is able to carry 4.5 MVA necessitating two feeders for the site. As advised elsewhere in this report the closest existing zone substation is located at Prestons. An additional zone substation is currently under construction in Box Road Casula and is expected to be completed in 2014.The likely feeder distances would be:

- Casula – 3.1 km
- Preston -- 5.5km

See Appendix A for route maps.

Actual availability to supply the proposal will be determined by Endeavour at the time a formal request is made for connection and cannot at this stage be guaranteed from any particular zone substation.

Supply to the site would be via spare existing 150mm ducts within the road reserves, however additional road crossing may need to be under bored where crossing major roads such as Camden Valley Way and the M5. There may be other location along the route that will require under boring of Council roads at additional cost. We are advised that ducts are available for use to cross under the railway lines subject to approval. Should these duct be in use prior to the feeders being installed there will be additional costs to install additional ducts and a delay of up to three years to achieve the necessary approvals.

Reticulation of an industrial subdivision would also include a requirement for provision of pad mounted substations at strategic locations within the subdivision. In addition, each separate development on individual lots would also require a dedicated 1000kVA pad mount substation to service specific power requirements.

5.2 Sewer

The subject land on the northern side of Cambridge Avenue ultimately falls to the north eastern corner of the site adjacent to the Georges River. Development of the site would therefore likely drain by gravity sewer to this point before being pumped via a new rising main to either the pump station in Trobriand Crescent or an alternative route if required. Given the disturbed nature of the landform in the north east corner, a site level survey would assist at the appropriate time to confirm the area of the site that can be serviced by sewer and confirm the number of pump stations needed. Additional grading of the site may assist in ensuring all of the site is able to be serviced by sewer.

Alternatively, a gravity system that drains to a pump station located adjacent to the existing water bodies in the middle of lot 91 and thence by rising main to Trobriand Crescent could service the site.

The position of any pump station and final route for a rising main would be determined by Sydney Water after detailed analysis of the existing system including the capacity of the existing pump stations and downstream gravity systems to accommodate additional flow.

Conservatively, Sydney Water guidelines for determining design flows for future industrial development based on 150 EP per ha, suggest a discharge of 83 litres per second. Depending upon the final approved land use zone and development controls this figure may be able to be reduced.

Reticulation of a gravity system within the site is dependant upon the layout of road and lot patterns proposed. Costing for site reticulation is therefore sensitive to this and may ultimately require careful lot grading and design to avoid additional costs associated with installing additional rising mains and pump stations.

See Appendix B for rising main route options

5.3 Water

As noted elsewhere in this report the existing 300mm diameter water main in Canterbury Road is unlikely to have capacity to service the proposed development.

There is a 375mm diameter main within Glenfield Road some distance away from the site that may be able to be able to be extended to service the site. If it were extended to the existing 300mm diameter main where it exits from beneath the rail line in Glenfield Road the likely mains required could be as follows;

- Glenfield Road 375 mm main - 800m
- Cambridge Avenue 150 mm main - 500m
- Site reticulation 100mm main - 1600m

If the 375mm main requires upgrading at the rail crossing there will be considerable time delay and costs associated with gaining the necessary approvals and under boring the rail lines.

The above information is an estimate only and will require an application to Sydney Water for a feasibility study to determine the capacity of the existing main and how the site could be serviced.

See Appendix C for trunk water main location.

5.4 Telecommunications

Telstra, Optus and Visionstream have services within close proximity of the site. Each provider will have different costs associated with extending service to the site. Once the preferred provider is determined an application will need to be made to confirm costs. Again, site demand and costs will be determined by the configuration of the ultimate development pattern.

5.5 Gas

Jemena advise that the 1050kPa main in Canterbury Road has capacity to service the proposed industrial land use. Demand will be site specific to individual end users on site. Generally, experience has shown there is little demand for gas supply to warehousing. An exception to this may be where a user proposes gas for cogeneration of electricity.

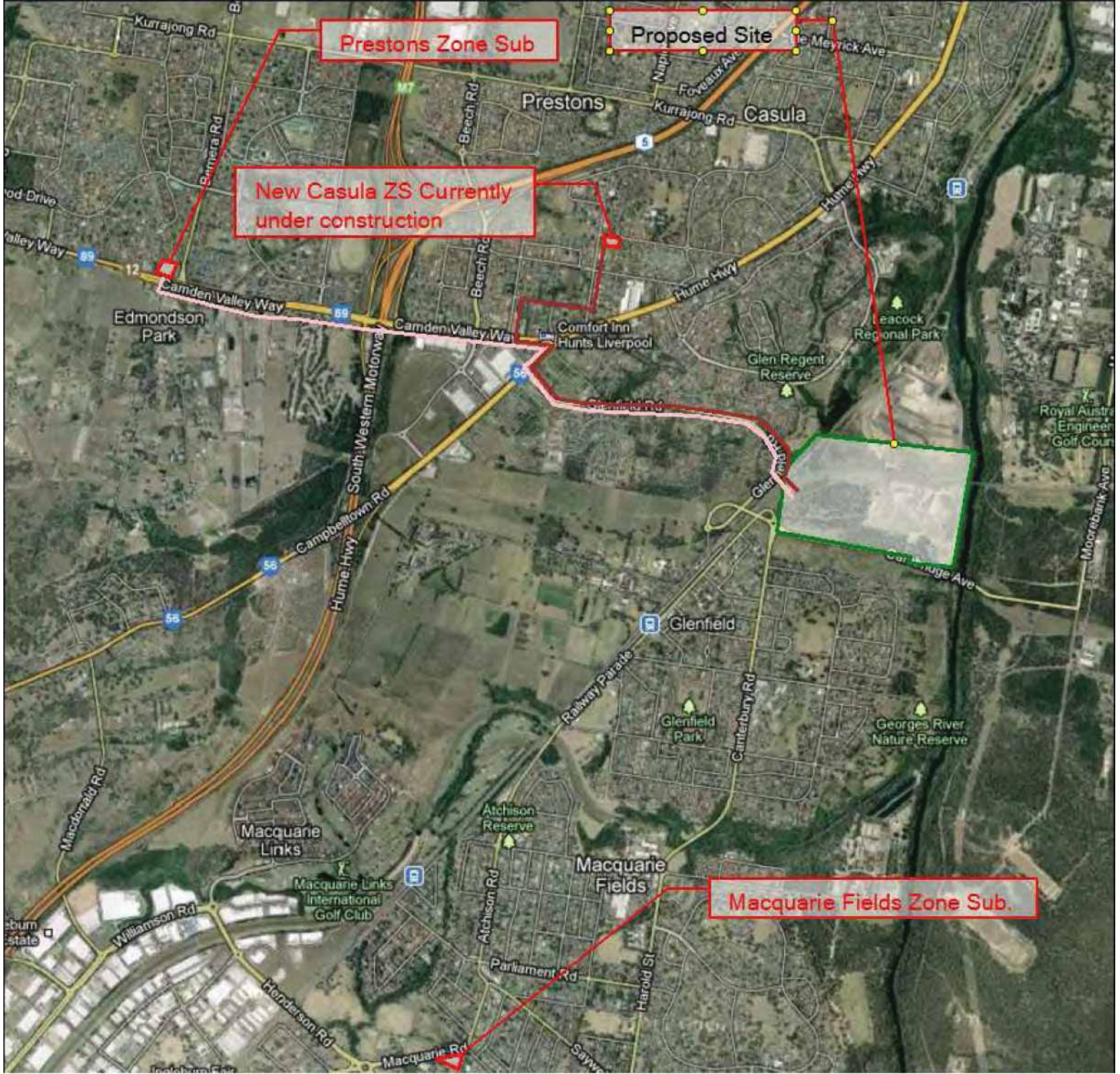
Jemena policy is not to extend network to new industrial subdivisions without a known gas load to a specific end user .

6 Conclusion

Our investigations of the study area confirms all major utility services are currently within the vicinity of the subject site. Given the area of land proposed for rezoning, it would be appropriate to make a formal approach to Sydney Water and Endeavour Energy as early as practical, to identify likely future utility requirements for the site . This will assist the service authorities in their long term network planning and ensure that when needed, utility services are available.

This report has considered provision of utility servicing to the site via upgrades to existing services only. There may be opportunities in the future with improvements in technology to investigate alternative methods of service provision. These could include harnessing of methane gas or solar energy for electrical generation, or onsite management of waste water. The long term viability of alternatives will need to address cost differentials, installation costs, maintenance and service agreements with authorities, continuity of supply, and acceptance in the marketplace, to be able to be successfully utilised at this site.

Appendix A


Prestons Zone Sub
Proposed Site
New Casula ZS Currently under construction
Macquarie Fields Zone Sub.
Kurrajong Rd
Prestons
Casula
Beech Rd
Barners Rd
Hume Hwy
Camden Valley Way
Edmondson Park
Comfort Inn Hunts Liverpool
Glen Regent Reserve
Leacock Regional Park
South Western Motorway
Campbelltown Rd
Glenfield
Railway Parade
Canterbury Rd
Glenfield Park
Georges River Nature Reserve
Macquarie Links
Macquarie Links International Golf Club
Atchison Reserve
Macquarie Fields
Atchison Rd
Parkland Rd
Harold St
Williamson Rd
Henderson Rd
Macquarie Rd
Macdonald Rd
Moorebank Ave

Appendix B

PLAN OF POTENTIAL SEWER UPGRADE

SCALE 1:2500

REVISION		DATE	DES/DFT	APP'D
A	INITAL ISSUE	18/05/12	MP/MN	--

Principal
L.A. KENNETT ENTERPRISES

Designed
M. PLETKAN

Drawn
M. NEILSON

Checked
P. PARFENOW

Authorised
P. G. McNAMARA

Date
MAY 2012

N

Scale @ A1
1:2500

0 25 50 100

ABN 47 065 475 149

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GLENFIELD
CAMBRIDGE AVENUE
CAMPBELLTOWN CITY COUNCIL
SERVICES REPORT
PLAN SHOWING POTENTIAL SEWER UPGRADE

Drawing No. 77679.00.P02 **Rev A**

Sheet No. 1 of 1

Check Print
For internal discussion only

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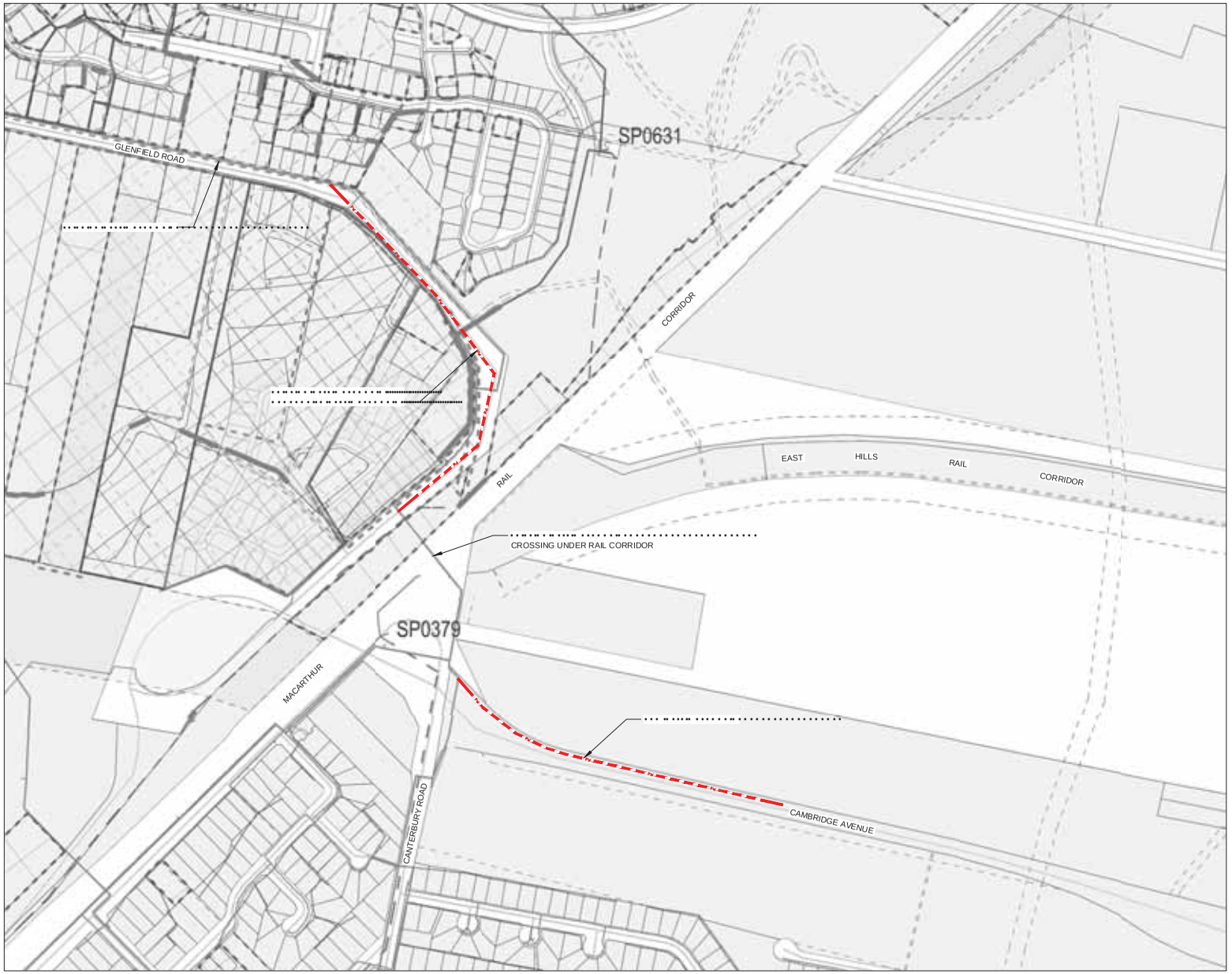
Appendix C



LEGEND:

PROPOSED WATER

PLAN OF POTENTIAL WATERMAIN UPGRADE

SCALE 1:2500

REVISION		DATE	DES/DFT	APP'D
A	INITAL ISSUE	18/05/12	MP/MN	--

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Authorised
P. G. McNAMARA

Date
MAY 2012

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Scale @ A1
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GLENFIELD

CAMBRIDGE AVENUE
CAMPBELLTOWN CITY COUNCIL
SERVICES REPORT
PLAN SHOWING POTENTIAL WATERMAIN UPGRADE

Drawing No. 77679.00.P01 **Rev** A

Sheet No. 1 of 1

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For internal discussion only

Appendix 15

Traffic and Transport Report

AECOM

25 May 2012

Glenfield Waste Services Rezoning

Traffic and Transport Review

Glenfield Waste Services Rezoning

Traffic and Transport Review

Prepared for

L.A Kennett Enterprises

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60267281

AECOM in Australia and New Zealand is certified to the latest version of ISO9001 and ISO14001.

Quality Information

Document Glenfield Waste Services Rezoning

Ref 60267281

Date 25 May 2012

Prepared by Riley Dayhew

Reviewed by Dan Riley

Revision History

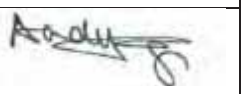
Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
1	25-May-2012	Draft Traffic and Transport Review	Andy Yung Principal Transport Planner	

Table of Contents

1.0 Introduction

AECOM has been engaged by L.A Kennett Enterprises to undertake a traffic and transport review of a 60ha site within the Glenfield Waste Services operational land area in support of a rezoning submission report for Campbelltown City Council (Council). This will form part of Council's preparation of a Standard Instrument Local Environmental Plan (SILEP) for the Campbelltown LGA.

This report will review existing traffic and transport conditions surrounding the site, as well as provide detail on the likely future traffic conditions of the local road network, including impacts arising from surrounding development. The potential traffic and transport impacts of rezoning land on the site will be considered, and potential use of public and active transport discussed.

This report has been prepared in advance of collecting traffic data or undertaking quantitative analysis. A detailed traffic impact assessment will be required at the development application stage.

1.1 Study Area

1.1.1 Description of subject site

The Glenfield Waste Services land is 100ha overall and includes a licenced non-putrescible waste facility which was first granted consent for use in 1979. The facility includes recycling operations, a quarry, weigh bridge and site offices. The land is divided by a local government area boundary, with 40ha of land to the north located within the Liverpool City Council LGA and the remaining 60ha (the site) within the Campbelltown City Council LGA.

Note that "the site" that this report considers only includes the 60ha southern portion of Glenfield Waste Services land and this is highlighted in **Figure 1**. The site is bordered to the west by the Southern railway line, to the north by the Liverpool City Council LGA boundary, to the east by the Georges River, and to the south by residential housing around Goodenough Street.

In terms of operations, the recycling and administration element of Glenfield Waste Services is located on the 60ha site (the current land fill area is located in the remaining 40ha area north of the site in the Liverpool City Council LGA). The site also includes an area adjacent to Georges River currently zoned "6 (b) Regional Open Space". Under the SILEP, a portion of the area will be re-zoned "RE1 Public Recreation" (the extent of which is not known and has been estimated at 3.0ha). A large residential property also exists on the site, as well as transmission lines, which run through the site south of Cambridge Avenue.

Primary access to all 100ha of land (including the site) is provided from Cambridge Avenue, a main road linking Glenfield with Holsworthy and Moorebank. A secondary access is located off Railway Parade, which is not used to access Glenfield Waste Services, but to provide service access to the rail line for Railcorp and access to the single residential property.

Figure 1: Site Area

Source: EPS, 2012

1.1.2 Surrounding land uses

The site is fairly isolated from surrounding land uses by natural vegetation around the Georges River and Leacock Regional Park, which adjoins the main southern railway line. Further past these natural buffers, army barracks are located to the east, with residential development in the west and south. Glenfield railway station and a small retail area are located approximately 1 km from the site. The site is bordered to the south by the Glenfield residential area. A buffer separating future development from the residential area will likely be retained in the form of the transmission lines easement.

1.2 Report structure

The report has been structured as follows:

- **Chapter 2** provides a summary of the existing traffic and transport conditions on the surrounding road network.
- **Chapter 3** details planned land uses and infrastructure in the surrounding area.
- **Chapter 4** outlines the rezoning proposal and the likely traffic generated as a result of the rezoning of the site.
- **Chapter 5** summarises the potential impacts arising from future traffic generation.
- **Chapter 6** provides the conclusions and recommendations of the study.

2.0 Existing Traffic and Transport Conditions

This chapter of the report summarises the existing travel behaviour and transport conditions in the vicinity of the study area based on background documents and site visits.

2.1 Existing travel behaviour

Journey to work (JTW) data includes details of the origin and destination of trips, together with characteristics of the journey such as mode of travel. JTW data from the 2006 census has been analysed to determine the current distribution of trips from the area and the proportion of mode of travel usage.

Given the use of the site is likely to be industrial uses, the mode splits for Travel zone 1261 (Minto) and North Campbelltown SLA (as a destination) have been considered to understand the likely travel behaviour should the rezoning take place at this site.

Analysis of the 2006 JTW destination data for Travel zone 1261 (Minto) and North Campbelltown SLA is summarised in **Table 1**.

Table 1: 2006 JTW mode split data for TZ 1261 and North Campbelltown SLA

Area	Total trips	Vehicle driver	Vehicle passenger	Bus	Train	Others *
TZ 1261	2,327	78%	8%	1%	5%	8%
North Campbelltown SLA	18,536	72%	8%	1%	4%	15%

*- including 'other modes', 'modes not stated' and 'worked at home or did not go to work'.

Source: BTS Journey-to-work data, 2006

According to the 2006 Census data, travel to both Minto and North Campbelltown SLA (as a journey to work destination) is characterised by the private motor vehicle, with over 80% of those trips are made by car as a driver or a passenger. Public transport use is low, which is especially the case for buses, although this could be attributed to low levels of public transport service frequency in many suburbs of Campbelltown and may not accurately reflect the existing travel behaviour at the site.

The South West Sub-regional Strategy identifies that on an average weekday 79 per cent of trips by South West residents are made by private vehicle, 8.1 per cent by public transport and 12.3 per cent by walking or cycling, which is consistent with the JTW data presented above.

2.2 Existing site access and operations

2.2.1 Site access

The site currently has two accesses at the following locations:

- Cambridge Avenue approximately 200m west of the Georges River Causeway.
- Railway Parade approximately 60m north of the Glenfield Road/Canterbury Road/Cambridge Avenue/Railway Parade Roundabout.

The location of both access points is shown in **Figure 2**. The access at Cambridge Avenue serves as the main access to the Glenfield Waste Services site and receives all staff and visitor traffic.

The Railway Parade access is not used by visitors or staff. This access is used to access the residential property and has been gazetted by RailCorp for rail maintenance and construction activities.

Figure 2: Site Access Location

Source: AECOM, 2012

2.2.2 Site operations

A visual audit undertaken by site operators in November 2010 determined that an average of approximately 84 trips per day were made by visitors in a normal operating year. During a busy year it has been observed that the number of visitor trips can rise to129 trips per day. The nature of operations at the Glenfield Waste Services site shows that visitor trips are spread out across the day, rather than focused on any particular peak period.

The type of vehicles accessing the site range from small cars to articulated trucks. The site is B-Double access approved to the west only via Cambridge Avenue and Glenfield Road (RMS, November 2011). Based on Austroads vehicle classifications, approximately 36% of vehicles accessing the site on weekdays are small vehicles or vans, while the remaining 64% are trucks and heavy vehicles (visual audit Nov 2010). This equates to an average of 49 heavy vehicles per day during an average operating year and approximately 75 heavy vehicles per day during a busy year. Note that on the weekend, the majority of vehicles accessing the site are small private vehicles.

Approximately 54% of vehicles accessing the Glenfield Waste Services site during the week arrive from the east via Moorebank Avenue and approximately 46% of vehicles accessing the Glenfield Waste Services site arrive from the west via Glenfield Road. The origin trip distribution on the neighbouring road network is shown in **Table 2**.

Table 2: Existing average trip distribution onto the adjacent road network

Road Network	Average number of customer trips to the site each weekday	Percentage of total customer trips to the site each weekday
M5 Highway	20	25%
M7 Highway	5	6%
Campbelltown Road	2	2%
Canterbury Road	7	9%
Glenfield Road	16	20%
Hume Highway	13	17%
Moorebank Avenue	43	54%
Railway Parade	13	16%

Source: Glenfield Waste Services, November 2011

The site has approximately 15 employees arriving at 6:00am and departing at 5:00pm. This represents a minimal overall impact upon the existing traffic network. Car parking is provided on-site for employees and customers visiting the site offices.

2.3 Road network

The site is located close to the intersection of the M5 Motorway and M7 Motorway and has good connectivity to the sub-regional road network (including the Hume Highway, Campbelltown Road and Camden Valley Way). These roads are classified as RMS State Roads. The site accesses the wider road network via Moorebank Avenue, Glenfield Road, Canterbury Road and Railway Parade. The surrounding road network context is highlighted in **Figure 3**.

2.3.1 The Motorway network

The M5 Motorway provides access to the Sydney CBD and the airport to the north of the site and to Campbelltown, the Southern Highlands and Canberra to the south. The nearest interchange to the M5 Motorway from the site is located at Camden Valley Way for traffic to and from all directions, except the southbound on-ramp at Campbelltown Road. Another interchange to the M5 Motorway is located at Moorebank Avenue.

The M7 Motorway provides access to Sydney's north and west. Vehicles can access the M7 Motorway via the interchange at Camden Valley Way.

2.3.2 Sub-regional road network

The Hume Highway, Camden Valley Way and Campbelltown Road form the sub-regional road network in the vicinity of the site that provides direct connections to the Sydney Motorway network described above. These roads also connect the site to major centres in Sydney's South West including Liverpool and Campbelltown / Macarthur.

2.3.3 Local road network

Moorebank Avenue provides connectivity from Cambridge Avenue to the M5 Motorway and Holsworthy. It is a Commonwealth owned, two lane road with a posted speed limit of 60km/h.

Glenfield Road is a two lane road with a posted speed limit of 60km/h, which provides connectivity from the Hume Highway and Campbelltown Road to the site via Cambridge Avenue. Glenfield Road also connects to the local road network on its eastern end via an overpass above the Southern railway line, feeding into a roundabout which provides access to Cambridge Avenue, Railway Parade and Canterbury Road. The roundabout has two lanes, giving it enough capacity to manage continued traffic growth in the local area.

Canterbury Road is a four lane road in the vicinity of the site, providing access from the intersection of Cambridge Avenue, Railway Parade and Glenfield Road, south through the residential area of Glenfield to Macquarie Fields.

Railway Parade provides local access to Glenfield railway station and the Glenfield local shops. It runs from the intersection of Glenfield Road, Cambridge Avenue and Canterbury Road in the north, to Macquarie Fields in a south westerly direction. It is a two lane collector road with a posted speed limit of 50 km/h.

Cambridge Avenue provides primary access to the site, and provides an important linkage between Glenfield and the Holsworthy/Moorebank area. It is a two lane road with a posted speed limit of 60 km/h. The causeway section of Cambridge Avenue over the Georges River, to the east of the site could act as a potential capacity constraint to this road if traffic continues to grow in the local area.

Figure 3 Road network context

Source: AECOM, 2012

2.3.4 Traffic volumes

The most recent available Annual Average Daily Traffic (AADT) data (2005) collected by the Roads and Maritime Services (RMS) at two locations near the site are described below:

- 15,903 vehicles per day - Moorebank Avenue adjacent to the railway crossing.
- 12,232 vehicles per day - Glenfield Road immediately to the north of the bridge.

Vehicle flows along Cambridge Avenue are likely to be similar to those on Moorebank Avenue, as the data collection point on Moorebank Avenue is located only 700m north of the intersection with Cambridge Avenue. These levels of traffic observed at Moorebank Avenue, Glenfield Road (and likely on Cambridge Avenue) are typical of a two lane road with some reserved road capacity to cater for additional traffic.

Traffic volume data has also been obtained from a Traffic and Transport Report for Glenfield Junction TA300 (prepared by Global Arc for Transport Infrastrcuture Development Corporation, 2009). **Table 3** shows 2008 AM and PM peak hour traffic flows along Railway Parade, Cambridge Avenue and Canterbury Road in both directions.

Table 3: Peak hour traffic flows (2008)

Location	AM peak (vehs/hr)		PM peak (vehs/hr)	
	NB / EB	SB / WB	NB / EB	SB / WB
Railway Parade (north of Trafalgar Street)	427	253	272	483
Cambridge Avenue (east of Canterbury Road)	1,240	209	310	1,022
Glenfield Road (west of Canterbury Road)	426	604	537	477
Canterbury Road (south of Cambridge Street)	1,332	285	457	1,068

Source: Global Arc, 2009

The traffic data shows a large amount of traffic on Cambridge Avenue in the peak hours, however the hourly traffic volumes still fall within the general capacity of a two-way two-lane road (approximately 1,500 vehs/hr per lane, Austroads Standards). Significant spare capacity is experienced on Canterbury Road as this is a four lane road (with two lanes in each direction).

The report also highlights that the intersection of Glenfield Road / Canterbury Road / Cambridge Avenue performs acceptably at LoS B and A in the AM and PM peak hours respectively. The intersection also operates with spare capacity in both peak hours; approximately 28 per cent in the AM peak hour and 56 per cent in the PM peak hour.

Traffic in the area was observed as free flowing during the morning peak hour in May 2012, with the majority of vehicles travelling in an easterly direction along Cambridge Avenue toward Moorebank Avenue. It was also noted during site visits that traffic outside the peak hours was relatively light.

2.4 Public transport

2.4.1 Train services

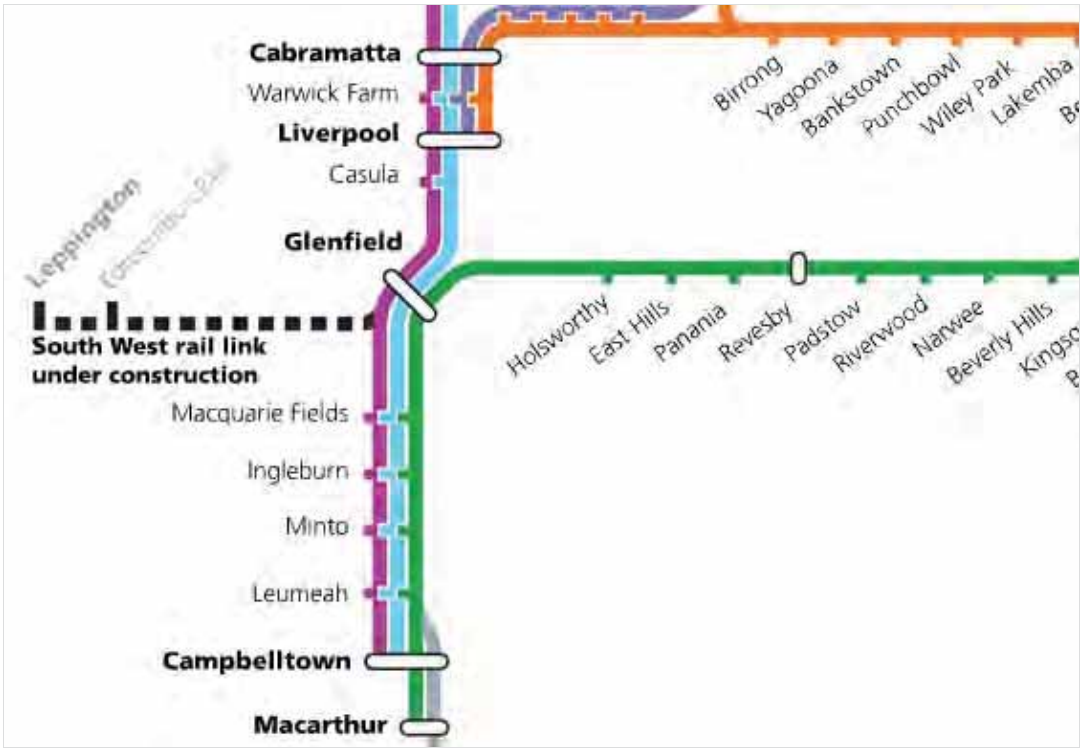
Glenfield railway station is located approximately 1km from the site (1.9km from the Cambridge Avenue site access), providing connectivity to the wider Cityrail network. As illustrated in **Figure 4**, the station is located at the interchange of three railway lines, including:

- The South Line (Campbelltown to City Circle via Granville).
- The Cumberland Line (Campbelltown to Blacktown).
- The Airport and East Hills Line (Macarthur to City Circle via East Hills and Sydney Airport).

These lines provide access from Glenfield to the wider rail network including Campbelltown / Macarthur, Liverpool, Cabramatta, Parramatta, Strathfield, the Airport and the CBD.

Glenfield is regularly serviced by trains during peak hours, with approximately 35 city bound services between 6 am and 9am. Services on the South and Airport/East Hills lines operate with a 10 minute frequency in each direction. Services on the Cumberland line generally operate with a 30 minute frequency in each direction.

Figure 4: Glenfield Station on the Cityrail network



Source: CityRail website, 2012

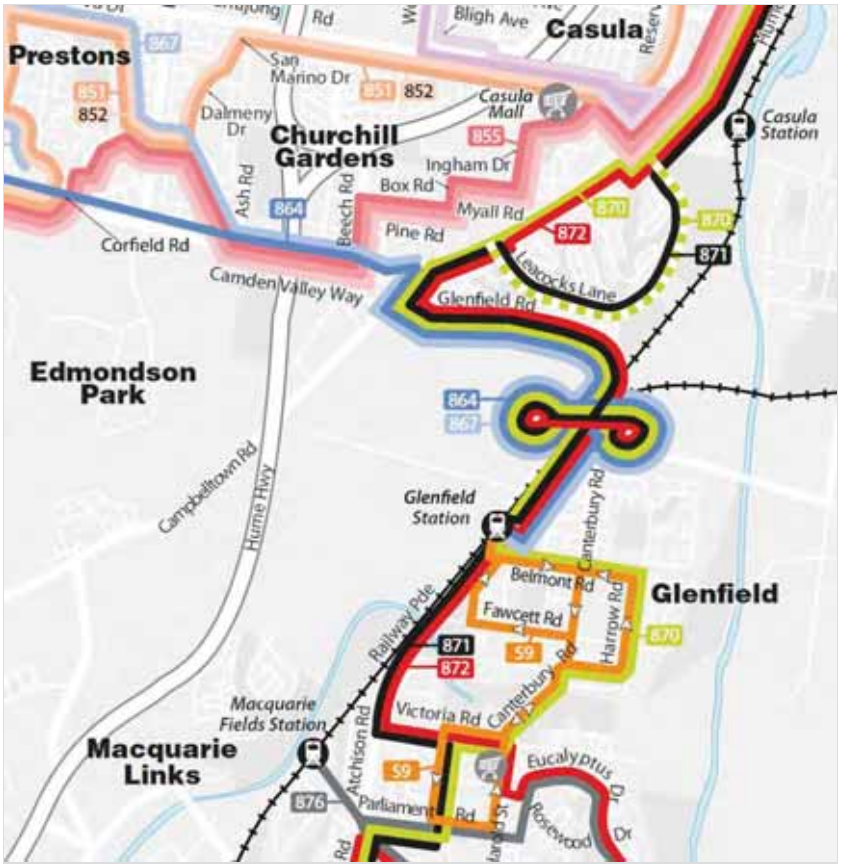
2.4.2 Bus services

Bus services in the Glenfield area are provided by Busabout and Interline and are shown in **Figure 5**. There are no bus routes operating along Cambridge Avenue. The five bus routes currently serving the site operate from Railway Parade, with bus stops located approximately 300m south of the site's Railway Parade access. These services are shown below:

- Route 864 Carnes Hill – Glenfield via Horningsea Park.
- Route 867 Prestons – Glenfield via Prestons.
- Route 870 Campbelltown – Ingleburn – Liverpool via Harrow Road and Glenfield.
- Route 871 Campbelltown – Ingleburn – Liverpool via Glenfield and Leacocks Lane.
- Route 872 Campbelltown – Ingleburn – Glenfield – Liverpool via Macquarie Fields .

In general, these bus routes are providing half hourly services during the peak hours to Campelltown, Liverpool, Ingleburn, Prestons and Carnes Hill.

Figure 5: Bus services in the Glenfield area



Source: Busabout, 2012

2.5 Pedestrian and cycle facilities

2.5.1 Pedestrian

There is a low provision of pedestrian facilities in the vicinity of the site. Georges River and the Holsworthy Barracks act as a natural barrier to walking at the eastern end of the site. However, Glenfield Station and the local shops are located within an approximately 15 to 20 minute walk from the site.

Footpaths are located along parts of nearby roads, including Railway Parade and Canterbury Road, providing access to the railway station, retail and other residential areas. There is currently an underpass leading from the site travelling beneath Cambridge Avenue that connects north of Cambridge Avenue to south of Cambridge Avenue. Pedestrian connectivity from the site to Glenfield Rail Station would need to be improved to meet the needs of any intensified land use on the site.

2.5.2 Cycle

The site is well located in terms of opportunities for cycling, being located close to the Liverpool-Parramatta Rail Trail and the M7 Motorway Cycleway. Together these cycleways provide approximately 60km of cycleways through Western Sydney.

Observations from site visits indicate that there are limited cycling activities in the local area. A low provision of cycle facilities in the Glenfield area means cyclists either share footpaths with pedestrians or cycle on-road. According to Council's Bike Plan, an on-road route exists along Glenfield Road from its intersection with Campbelltown Road, although no road markings exist along the route. An off-road route does exist at the southern end of Glenfield near Canterbury Road, running to Macquarie Fields. Other more informal routes also exist to the east of the Glenfield residential area, adjacent to the Georges River.

2.6 Summary

Based on a desktop review of available information and site observations, the following traffic and transport opportunities and constraints in the vicinity of the site are observed:

- Heavy reliance on cars in the North Campbelltown area, especially trips made to this area as a destination. This is consistent with the Draft South West Sub-regional Strategy in which it is identified that 79 per cent of trips are made by private vehicle in the South West.
- Good connectivity and direct access to Sydney's Motorway Network and the surrounding sub-arterial road network.
- Spare capacity on the surrounding local road network with flexibility of upgrading the local road network such as Cambridge Avenue to cater for some future traffic growth.
- Spare capacity at the key intersection of Glenfield Road / Canterbury Road / Cambridge Avenue / Railway Parade to cater for future traffic growth in the area.
- Good access to rail and bus services at Glenfield Station.
- Access to regional cycleway infrastructure that provides a more sustainable alternative mode of travel.
- Low provision of walking facilities in the area.

3.0 Planned Land Use & Infrastructure

This section of the report considers the strategic employment, land use and transport direction for the South West, planned development and potential infrastructure upgrades in the vicinity of the site and how these planned activities would affect / benefit the proposed rezoning of the site.

3.1 Strategic direction for the South West

3.1.1 Draft South West Sub-regional Strategy

The Draft South West Sub-regional Strategy identifies an employment capacity target of 89,000 additional jobs by 2031 in the South West Sub-region. This target is broken down for the four main LGAs within the South West; Liverpool LGA (35,000 additional jobs), **Campbelltown LGA (26,000 additional jobs)**, Camden LGA (26,000 additional jobs) and Wollondilly LGA (2,000 additional jobs).

The Draft Strategy also identifies that the South West is one of two sub-regions with strongly growing industrial activities. It identifies that the Glenfield Waste Centre on Cambridge Avenue could provide Employment Land for light manufacturing, local industry and urban services.

The Draft Strategy has also identified the need to encourage growth in jobs and services in or around existing or proposed centres within the South West sub-region in order to reduce the need for cross regional trips and to reduce the need to travel by private vehicle.

In response to this, key directions for transport in the South West Sub-region have been developed including improving transport between Sydney's Centres.This includes the planned South West Rail Link (SWRL) that will connect the South West Growth Centre (SWGC) to the existing rail network at Glenfield. This connection to Glenfield will reinforce the role of this station as an important transport interchange and gateway in the South West Sub-region and will aim to achieve an increase in public transport mode share in the sub-region.

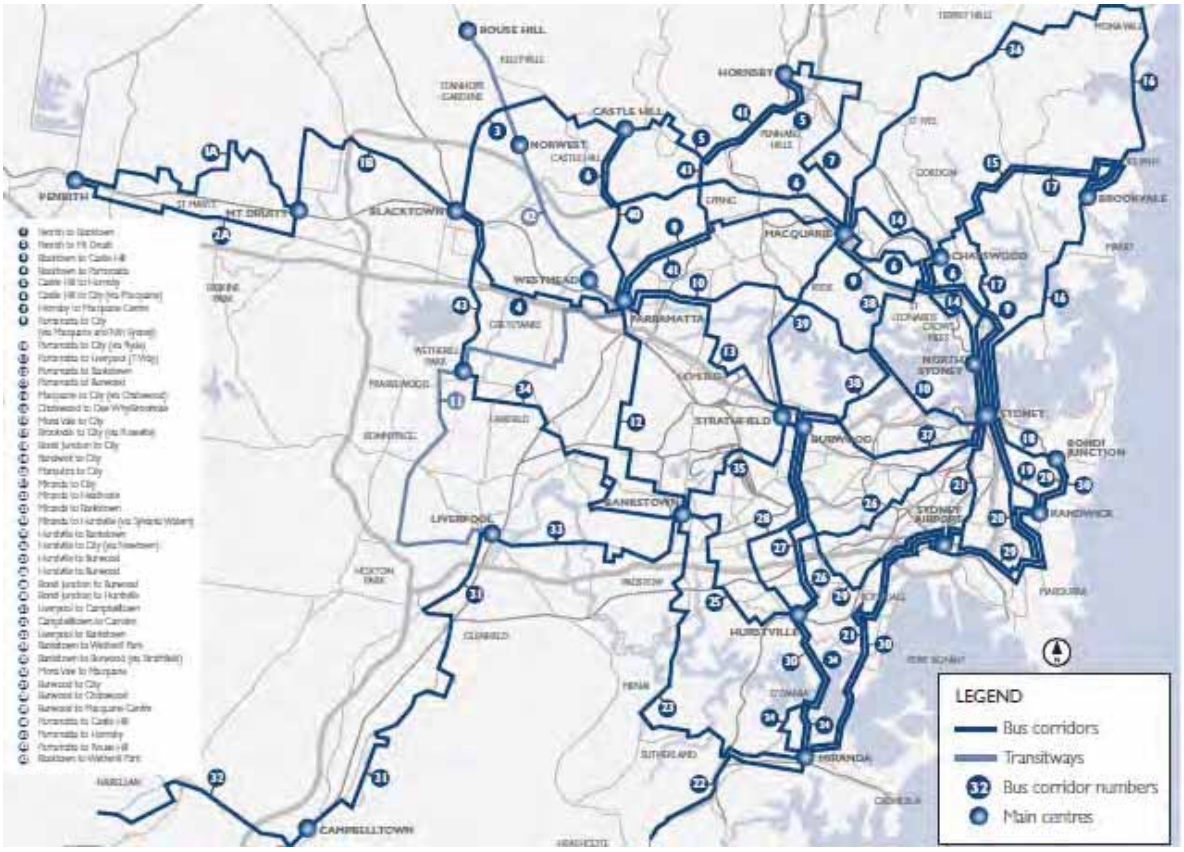
Another key direction of the Strategy is to implement Strategic Bus Corridors that provide fast, frequent, direct and convienient bus services between Sydney's Strategic Centres. The Strategy states that the Strategic Bus Corridor services will target a 25km/hr average bus speed on each corridor and be supported by new integrated bus networks linking into the Strategic Corridors. The Strategy identifies four Strategic Bus Corridors in the South West namely; Liverpool to Parramatta Transitway (Corridor 11), Liverpool to Campbelltown (Corridor 31), Liverpool to Bankstown (Corridor 32) and Campelltown to Camden (Corridor 32) as shown in **Figure 6.** Corridor 31 that travels between Liverpool and Campbelltown travels along Glenfield Road and Canterbury Road in the vicinity of the site. These strategic bus corridors will also aim to achieve an increase in public transport mode share in the South West.

Improvements to the existing transport system have been identified including; improving reliability and increasing capacity of rail services, improving the integration of public transport and improving the operational management of existing transport networks.

The Draft South West Sub-regional Strategy also highlights that due to the low proportion of trips made by walking or cycling in the South West (12 per cent), improvement to local and regional walking and cycling networks is required by providing better facilities and a better alignment of the local walking and cycling networks with public transport routes.

This strategy sets the direction for future development at this site, supported by significant public transport network investment, aiming to improve accessibility to this site and reduce car reliance in the area.

Figure 6: Strategic bus corridors



Source: RMS, 2012

3.1.2 South West Sector Bus Servicing Plan

The South West Sector Bus Servicing Plan identifies a short term and long term bus route that will travel in the vincinity of the site. The short term proposed bus service (route 858) will travel between Glenfield Station and Ingleburn via Canterbury Road and Glenfield Road. The long term bus route (P2) will also travel along Canterbury Road and Glenfield Road between Glenfield Station and Leppington every 15 minutes in the peak periods. These bus routes will provide a additional connections between the site and Glenfield Station.

3.2 Planned development

3.2.1 Moorebank Intermodal Terminal Facilities

Two intermodal terminal facilities have been proposed on Department of Defence land and privately owned land in Moorebank. The proposed facility to the east of Moorebank Avenue is privately owned by the SIMTA alliance, while the Commonwealth Government is planning to develop a larger intermodal terminal to the west of Moorebank Avenue. The Commonwealth intermodal terminal facility site is proposed to be located on a 220 hectare parcel of land currently occupied by the School of Military Engineering (SME) and other Department of Defence uses, to the west of Moorebank Avenue.

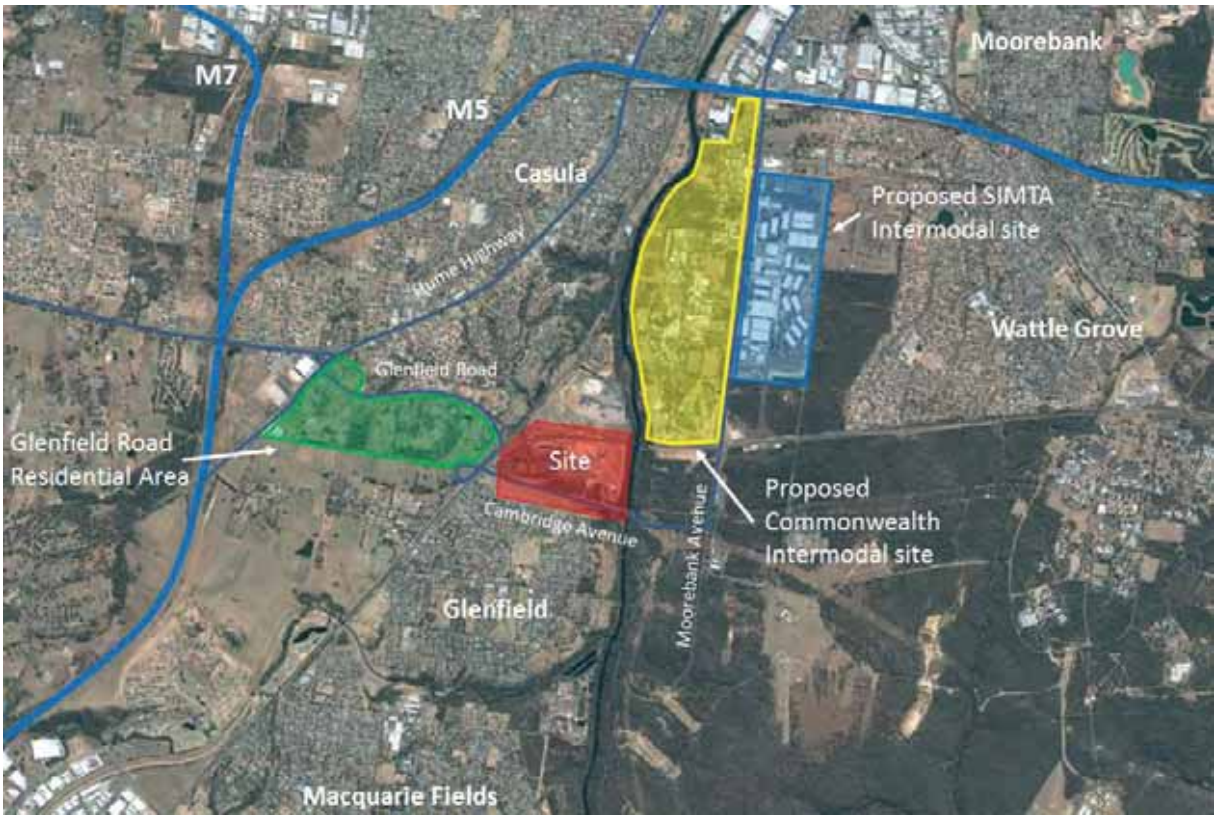
The location of the Moorebank Intermodal Terminal Facilities is shown in **Figure 7**.

The SIMTA intermodal proposal would have a capacity of 1 million containers per year (twenty foot equivalent), while the Commonwealth proposal would be expected to have a capacity of 1.5 million per year.

The Moorebank area is well positioned for intermodal terminal facility development due to its positioning near the proposed Southern Sydney Freight Line, as well as the regional road network including the M5 and M7 Motorways. High industry growth rates in Western Sydney will see greater demand for these facilities, and will serve to take truck movements off Sydney's roads.

It is anticpated that the Moorebank Intermodal Terminal will have the effect of reducing the number of truck movements between Port Botany and Moorebank along the M5 corridor in the order of 2,700 movements per day.

Figure 7: Planned development in the vicinity of the site



Source: AECOM, 2012

A new rail link is proposed to connect the new terminal facility site with the Southern Sydney Freight Line, taking a significant number of trucks currently travelling to Port Botany off inner Sydney roads. The SIMTA facility would accommodate 300,000 square metres of offices and warehousing space, as well as 8,000 square metres of driver facilities. Approximately 2,260 employees would work on site at full development (Hyder, 2011).

The Environmental Impact Assessment prepared for the SIMTA intermodal proposal highlights that there will be a number of potential traffic and transport impacts, including truck traffic generation and employee trip generation. The site could generate up to approximately 2,600 daily truck movements at full development, with approximately 3,600 daily car movements to the site during a 24 hour average weekday. The Traffic Assessment for the SIMTA intermodal proposal details that the traffic distribution will result in 98% of traffic travelling north along Moorebank Avenue to the M5, while two percent would travel south, past the Glenfield Waste Services site.

Using the daily truck and car movement figures provided in the Traffic Assessment, it can be estimated that there could be 124 movements per day past the site as a result of the development of the SIMTA Intermodal Terminal Facility. Taking into consideration current traffic levels along Cambridge Avenue, these additional movements would not be expected to have significant adverse impacts to the road near Glenfield Waste Services, preserving the majority of the existing reserved capacity on the surrounding road network between the site and Campbelltown Road.

On the other hand, the cumulative impacts of SIMTA and the Commonwealth intermodal terminal facility on the surrounding area may represent a significant traffic impact. The impacts of the Commonwealth Intermodal Terminal Facility are currently being quantified with an Environmental Impact Statement (EIS), including the investigation of traffic, transport and access issues. Once the EIS is completed, more details will be available in relation to traffic impacts on the surrounding road network. Note that given the constraint of the Georges River causeway, it is expected the majority of the traffic generated by the Commonwealth intermodal terminal facility will be directed toward the M5 Motorway.

3.2.2 Glenfield Road residential development area

The Glenfield Road residential development area lies south of Glenfield Road between the railway corridor and Campbelltown Road, as shown in **Figure 7**.

It provides for low density and town house residential development, and is one of the largest urban release areas in the Campbelltown Local Government Area. As part of the precinct's Development Control Plan (DCP), the development must increase opportunities for choice in mode of transport by ensuring all lots are within 400 metres of a serviced bus stop. The development must also encourage walking and cycling by providing safe, convenient and legible movement networks within and beyond the development, resulting in a developed network of pathways west of the site towards Campbelltown Road.

3.3 Planned infrastructure

3.3.1 Campbelltown Road upgrade

Roads and Maritime Services (RMS) are currently planning to upgrade Campbelltown Road between Camden Valley Way (at the Cross Roads) and Denham Court Road. The upgrade is 5.1km in length, and is aimed at improving road safety and operational efficiency as well as meeting the future land use and traffic demands of the South West Growth Centre (SWGC).

Campbelltown Road is a 13.5km corridor running north-south between Camden Valley Way to the north and Moore Street to the south. The road functions as an arterial road linking major urban and rural areas and is an integral component of the transport network in the south-west region of Sydney. The corridor is the main road through the suburbs of Edmondson Park, Denham Court, St Andrews, Raby and Woodbine.

The concept design for the proposal would include the following key features:

- General widening to four lanes (two lanes in each direction) with a wide central median.
- The wide central median will allow for future widening to six lanes, when required in the future.
- Three new signalised intersections for improved access with the Edmondson Park precinct and town centre including a new railway station and bus interchange.
- The existing roundabout at Denham Court Road would be replaced with a signalised intersection.
- Duplication of a bridge over F5 Freeway/Hume Highway for widening Campbelltown Road.
- Improved safety by providing a divided carriageway, shared path and pedestrian crossings at signalised intersections.
- Improved public transport by providing improved access to the Edmondson Park station on the South West Rail Link.
- Urban design, including landscaping, an off-road shared pedestrian and bicycle path, integrated with the planning of the Edmondson Park development.

This road upgrade will provide additional capacity to the Campbelltown Road corridor (particularly at the intersection at Glenfield Road) required to cater for the likely traffic generated by the South West Growth Centre. The proposed shared path facilities and pedestrian crossings at signalised intersections proposed as part of this upgrade will improve pedestrian and cycle accessibility to the wider network.

3.3.2 South West Rail Link (SWRL)

In 2009, the NSW Government announced the construction of a new 11 kilometre rail line – South West Rail Link (SWRL) from Glenfield to Leppington in South West Sydney. The project includes upgrades to Glenfield Rail Station and the line itself as it passes through the Glenfield Waste site.

The SWRL will enhance opportunities for public transport travel to and from Glenfield, as such the planning of the site should maximise the opportunity presented by this new infrastructure to minimise the need for car travel.

Upon completion, the total number of services through Glenfield Station during the weekday peak hour will increase from eight to a maximum of 12. By the year 2020 the number of services is forecast to rise to 20 during the weekday peak hour. This improved rail accessibility will enhance public transport opportunities for the site and likely result in an increase in mode share for rail users.

3.3.3 Glenfield Transport Interchange upgrade

The Glenfield Transport Interchange comprises an upgrade to Glenfield Station to accommodate the introduction of the planned South West Rail Link, as well as the construction of a multi-storey commuter car park. The project is currently under construction, with completion due in 2013. The improvements to Glenfield Station aim to enhance interchange facilities including a new station building and enhanced bicycle facilities (Global Arc, 2009).

The upgrade includes changes to Railway Parade to offer enhanced interchange opportunities. This will be achieved through:

- Enhanced bus facilities, including priority bus measures.
- Increased provision for kiss and ride.
- Improved pedestrian crossing opportunities.
- Widening of the Railway Parade cycle lanes to 1.5 metres.

The provision of additional commuter parking will result in an overall increase from 720 to 1,254 spaces located in Roy Watts Road, Railway Parade and Seddon Park.

The Glenfield Transport Interchange upgrade aims to increase the attractiveness of public transport services to meet expectations of regular users, as well as increase its mode share of travel to and from the area. Any increase of public transport mode share to the site would reduce private vehicle trips, and reduce any subsequent traffic impact on the local road network.

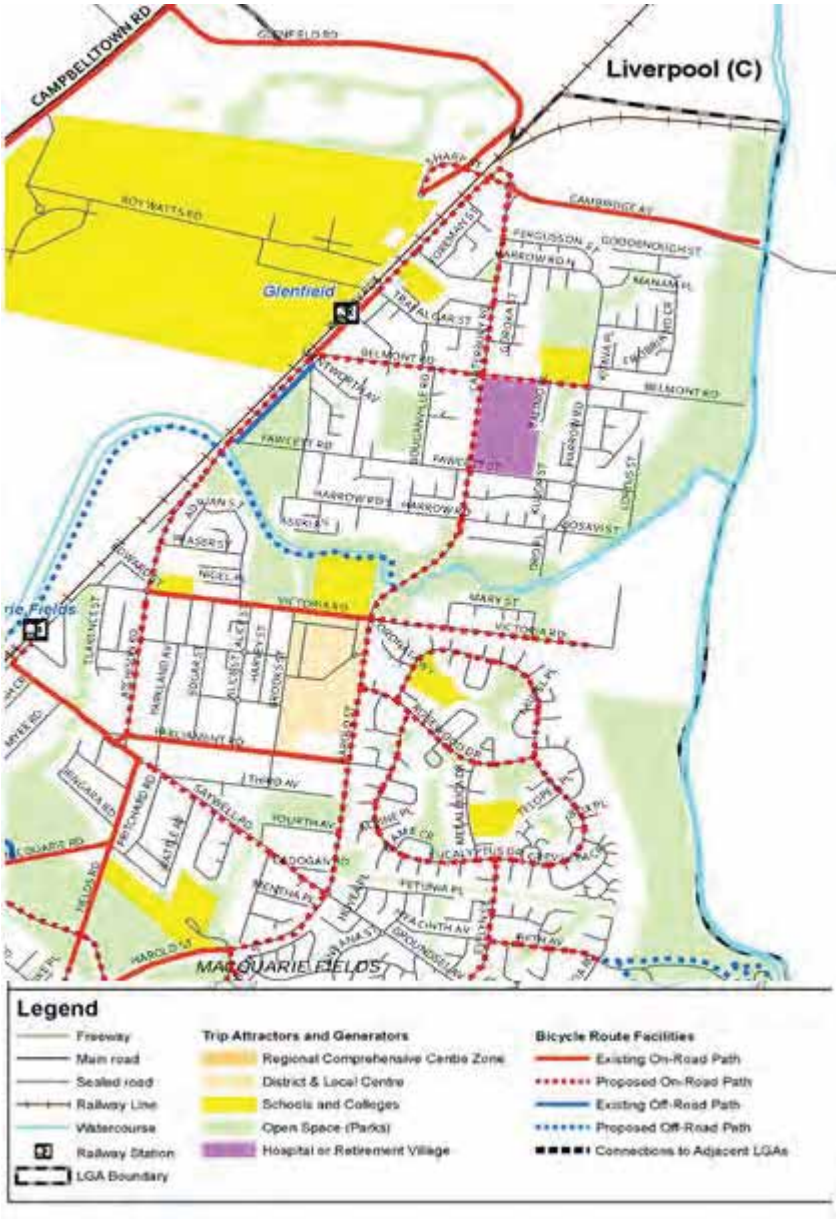
The Draft South West Sub-regional Strategy identifies that the planned South West Rail Link (SWRL) will connect the South West Growth Centre (SWGC) to the existing rail network at Glenfield .This connection to Glenfield will reinforce the role of this station as an important transport interchange in the South West Sub-region facilitating transfers between services on the East Hills Line, the Main South Line and the Cumberland line and will help to achieve an increase in public transport mode share in the South West.

3.3.4 Planned walking and cycling infrastructure

Campbelltown City Council has a footpath improvement program in place to identify areas of path which need to be replaced, as well as determine where new footpaths could be provided to achieve maximum use. Council uses a weighting system to assess which areas of footpath to upgrade, as well as where new footpaths should be situated.

Campbelltown City Council's Bike Plan provides details of where cycle facility upgrades are planned to be located in the vicinity of the study area, as shown in **Figure 8**. The on-road bicycle lane along Railway Parade is planned to be extended further north to the site, as well as south to Macquarie Fields. An on-road route is also planned to extend down Canterbury Road, from the intersection with Cambridge Avenue in the north, connecting to the wider network in Macquarie Fields and Ingleburn. These new cycle routes will provide enhanced connectivity to the site for cycle commuters, and provide greater incentive for workers to shift from private car to bicycle travel.

Figure 8: Cycleway network, current and planned facilities



Source: Campbelltown City Council, 2012

The NSW Bike Plan also identifies a regional proposed cycle route between Liverpool and Campbelltown as shown in **Figure 9**. The proposal along the Hume Highway and the M5 Motorway will improve general attractiveness and accessibility to cycle to the proposed site.

Figure 9: NSW Bike Plan

Source: TfNSW, 2010

4.0 Proposed site use

The current proposal is to rezone the 60ha site within the Campbelltown City Council LGA from its current 1(a) Rural A Zone to a 'IN1 General Industrial' Zone, which permits the site to be used for industrial purposes.

The existing operations at Glenfield Waste Services are to be retained at the existing level. Services and facilities within the site will be shifted to Glenfield Waste Services land immediately to the north (within the Liverpool City Council LGA) of the site where operations will be consolidated.

The proposed land use would also help to achieve the State Government's employment targets as outlined in the Draft South West Sub-regional Strategy and as discussed in **Section 3.1.1.**

4.1 Proposed development yield

Of the 60ha site considered, certain areas are considered not appropriate for future development including:

- Approximately 12ha of land south of Cambridge Avenue (due to the transmission easement).
- Approximately 3ha of land adjoining the Georges River.
- Approximately 15 hectares of land fill that includes the area between the East Hills Railway Line and Council's LGA boundary.
- Approximately 2 hectares for setbacks, buffers, open space and infrastructure including required setbacks to existing rail lines.

Therefore, the total amount of developable area on this site is approximately 28 ha. The land considered for rezoning is shown in **Figure 10**. The proposed land uses include large scale industrial warehouses, which are intended to capitalise on the excellent accessibility of the site to the regional transport network and its proximity to the proposed Moorebank Intermodal Terminal Facilities.

Figure 10 Indicative site layout (yet to be confirmed)

Source: EPS, 2012

The anticipated number of employees forecast to occupy the site depends upon the refined developable area, the final Floor Space Ratio approved in the master plan and the specific type of businesses operating on site. Since these are not yet known, the following lower and upper estimates of potential employment numbers have been made:

- Lower estimate: 780 employees. This is based upon 28 employees per developable hectare (RTA Guide to Traffic Generating Development 2002).
- Upper estimate: 1,250 employees. This is based upon an estimate of GFA and FSR on the site whereby:
    - The estimated GFA is approximately 200,000sqm with estimated FSR of 1:1 (other than 15ha which is 0.3:1).
    - The estimate of employee density at the site is 1 employee per 160sqm GFA (based on the typical warehouse employment densities expected at the site).

4.2 Proposed site access

The number and nature of vehicles entering the site in the future will result in additional access requirements, particularly as the number of heavy vehicles accessing the Glenfield Waste Site will be maintained at existing levels. In addition, it is unlikely that the secondary access from Railway Parade will be able to accommodate any significant increase in additional movements.

Therefore, it is proposed that an additional access to be provided at Cambridge Avenue (to the west of the existing access), as shown in **Figure 7**. This new access will be the primary access to the new industrial and warehouse site, which segregates from the existing heavy vehicle access to the Glenfield Waste Site. A new access point at Cambridge Avenue should be feasible given its straight horizontal alignment. The exact location and form of the access will be subject to further assessment and detailed design once the final land uses and development areas are confirmed at the development application stage.

4.3 Proposed car parking

Car parking spaces for future employees and visitors of the new industrial and warehouse development will be provided on-site based on the car parking requirements of the relevant Development Control Plan (DCP).

To provide an indicative assessment, it is currently estimated that on site car parking requirements will be in the order of 1, 300 total spaces. This is based upon an assumed floor area of 200,000 square metres with a ratio of 10% office use and 90% warehouse use.

5.0 Potential Impacts

This section provides a summary of potential impacts that may stem from the rezoning of the site for industrial type employment uses. At this preliminary stage, the assessment is strategic in nature and the findings of this section will require further analysis at a the development application stage to determine detailed traffic impacts of the site.

5.1 Potential trip generation

The RTA (RMS) Guide to Traffic Generating Developments (2002) notes that the amount of trips generated by industrial land use is highly variable depending upon the specific number and type of business operating on site. As the specific type of business is not known, general industrial land use trip generation guidelines have been followed as outlined within the document.

For the purpose of this review, the likely employment numbers of the site has been assumed to be ranging between 780 and 1,250.

Trip generation estimates have been determined based upon the number of employees as outlined above and Table 3.4 in the RTA Guide for Traffic Generating Developments (2002). Based on the trip generation distribution of industrial estates for a situation of 1000 employees in a wide range of factory types, the indicative trip generation rates are as follows:

- 0.318 total trips per employee during the AM peak hour of (8-9am).
- 0.365 total trips per employee during the PM peak hour of (5-6pm).
- 2.3 total trips per employee during a typical day (7am to 7pm).

The indicative trip rates suggested that approximately 14 per cent of the expected daily trips will be generated during the AM peak hour and approximately 16 per cent of the expected daily trips will be generated during the PM peak hour, with the rest of the trips spread out throughout the rest of the day.

The total likely trip generation for the overall (proposed industrial and existing use) use of the site is summarised below (**Table 4**):

Table 4: Likely Trip Generation

Time Period	Estimated Employment Number	Indicative Industrial Trip Rates	Additional Industrial Trips (Range)	Retained Waste Site Trips	Likely Total Trips (Range)
AM Peak (hr)	780 – 1,250	0.318	250 - 400	7*	260 - 410
PM Peak (hr)		0.365	280 - 460	15*	300 - 470
Standard Weekday (7am-7pm)		2.3	1,800 - 2,880	126*	1,920 – 2,880

*- Includes recorded visitor trips to the Glenfield Waste Site as well as staff trips.

Source: RTA (RMS) Guide to Traffic Generating Developments 2002

Based on the potential employment level of the site, it is estimated that the site could generate up to an additional 470 trips in the PM peak hour and 2,880 trips in a typical weekday.

5.2 Potential impacts and mitigation

5.2.1 Car

Given the estimated future trip generation represents an increase on the existing situation, there is likely to be some impact upon the local traffic network. Further work will be required to assess intersections at key locations likely to be impacted by the additional traffic generated under proposed future conditions. This includes traffic generated by both the site and neighbouring developments such as the Moorebank Intermodal Terminal Facilities.

However, intersection analysis undertaken in 2008 on the Cambridge Avenue / Canterbury Road / Glenfield Road intersection indicates that the intersection performs acceptably and with spare capacity in both peak hours. Further assessments are needed to ensure the road network and other transport infrastructure is able to accommodate future traffic demands.

Based on the potential employment level of the site, it is estimated that the site could generate up to an additional 470 trips in the PM peak hour and 2,880 trips in a typical weekday. It should be noted that the trip generation could be varied based on the refined developable area, the final Floor Space Ratio approved in the master plan and the specific type of businesses operating on site.

Of these likely additional trips to the future site, some of the key routes leading to the site would include:

- M5 / M7 Motorway – Camden Valley Way / Hume Highway – Campbelltown Road – Glenfield Road – Cambridge Avenue.
- Pembroke Road – Minto Road – Collins Promenade – Harold Street – Canterbury Road – Cambridge Avenue.
- Moorebank Avenue – Cambridge Avenue.

Considering the level of existing vehicle flows and the likely trip generation, further study will be required into the ability of Cambridge Avenue to accommodate future traffic demands expected to be generated by both the site and neighbouring developments such as the two proposed Moorebank Intermodal Terminal Facilities. Other potential constraints that should be further investigated include:

- Campbelltown Road / Glenfield Road signalised intersection.
- Glenfield Road roundabouts and railway bridge.
- Glenfield Road / Canterbury Road / Cambridge Avenue roundabout.
- Cambridge Avenue causeway over Georges River.

However, the trip generation for private vehicles is based on proposed floor area and number of employees. It does not take into full account the proximity of the site to Glenfield Station and frequent train and bus services that would service the station, which would potentially reduce the number of trips by private vehicle, as outlined in the Draft South West Sub-regional Strategy and South West Sector Bus Servicing Plan. These public transport infrastructure upgrades combined with improvements to the walking and cycling network in the study area would also help to reduce the amount of private vehicle trips, thus reducing the impact to the local road network.

Travel Demand Management (TDM) measures could also be implemented at the site including preparation of a Work Place Travel Plan for employees at the site. A Work Place Travel Plan includes iniatives and measures aimed at reducing the need to travel by private vehicle and encouraging travel by public and active transport, which in turn would also reduce the impact to the local road network.

5.2.2 Walking

Assuming (on the basis of current journey to work mode split proportions) that between two and five per cent of the employment population of the site would walk to work, this would be between 20 and 60 pedestrians. There will also be an additional five to eight per cent train commuters that could also walk between Glenfield Station and the proposed site. This could add up to another 100 pedestrians on the surrounding network.

Footpaths should be provided along Cambridge Avenue to provide connectivity between the site and the surrounding residential areas within the walking catchment of the site. A safe and efficient pedestrian connection to Glenfield Station should be encouraged to maximise the walking population to the site.

A pedestrian connection should be considered between Goodenough Street and Cambridge Avenue (connecting to the existing underpass beneath Cambridge Avenue that could link to the site) to reduce walking distances to Macquarie Fields and to provide an alternative route to Glenfield Station. The opportunity to create a pedestrian connection along Georges River adjacent to the site should also be considered. This may in future assist in the development of a leisure trail to connect adjacent communities.

The layout of the site should include footpaths on all roads, in accordance with relevant guidance including Planning Guidelines for Walking & Cycling Guidelines (Department of Planning, 2004) and Guide to Traffic Engineering Practice Part 13: Pedestrians (Austroads, 1995).

5.2.3 Cycling

As with walking trips, cycle access to the site would likely be in the order of two to five percent. This would equate to between 20 and 60 trips. All cycle facilities should be provided in accordance with the NSW Bicycle Guidelines (RTA, 2003).

Within the site, consideration should be given to cyclists. Due to the likely high proportion of heavy goods vehicles, off-street shared paths may be appropriate. Cycle connections would be required to connect local communities. This would likely include a cycleway on Cambridge Avenue, the form of which (on-street or off-street) would need to confirmed when likely vehicle numbers on Cambridge Avenue are known.

Further from the site, the opportunity exists to link the site to other regional cycleway including the M7 Cycleway. This will improve the attractiveness of future workers to cycle to and from work in a safe environment.

5.2.4 Bus

At current mode splits, bus use to the site would be minimal with some 10 to 20 passengers in the morning peak hour (or 6 passengers per bus at a 30 minute frequency).

A number of opportunities exist to improve bus mode share from current levels such as:

- Improving bus services (frequencies to existing bus routes) to Glenfield Station to match the potential increase train patronage due to the completion of Glenfield Transport Interchange and the South West Rail Link (consistent with the South West Bus Servicing Plan).
- Extending / diverting existing bus services to operate along Cambridge Avenue and Moorebank Avenue to service significant increase in employment population of the site and the Moorebank Intermodal Terminal Facilities, linking these new employment areas with Campbelltown, Liverpool and Glenfield.

These opportunities should be further discussed with Transport for NSW and local bus operators. They would encourage people working within the site to take public transport as an alternative to the private car, serving to alleviate trips generated by the site.

The internal road network should also be designed to accommodate bus operation such that a shuttle bus service can be operated between Glenfield Station and the site, prior to the warrant of the extension of a local public bus service.

5.2.5 Rail

Rail is likely to account for around five to eight percent of journeys to the site. These levels are similar to those for walking and cycling modes and could equate to up to 100 people travelling by train during the peak hours, depending on the employment projections.

This level of demand is likely to be accommodated within existing rail services as well as the expected service / capacity improvements due to the completion of South West Rail Link. Connectivity between the site and Glenfield Station will be important to maximise the rail potential of the site.

It should also be noted that the commission of the SWRL can potentially increase the amount of employees that live in the SWGC to travel to work by train. This will further reduce the amount of vehiclur trips generated on the surrounding road network.

6.0 Summary and Recommendations

AECOM has been engaged by L.A Kennett Enterprises to undertake a traffic and transport review of a 60ha site within the Glenfield Waste Services operational land area in support of a rezoning submission report for Campbelltown City Council (Council). This will form part of Council's preparation of a Standard Instrument Local Environmental Plan (SILEP) for the Campbelltown LGA.

Based on a desktop review of available information and site observations, a number of traffic and transport opportunities and constraints in the vicinity of the site are observed:

- Heavy reliance on cars in the North Campbelltown area, especially trips made to this area as a destination.
- Good connectivity and direct access to Sydney's Motorway Network and the surrounding sub-arterial road network.
- Capacity on the local road network with flexibility of upgrading the local road network such as Cambridge Avenue to cater for some future traffic growth.
- Spare capacity at the key intersection of Glenfield Road / Canterbury Road / Cambridge Avenue to cater for future traffic growth in the area.
- Good access to rail and bus services at Glenfield Station.
- Access to regional cycleway infrastructure that provides a sustainable alternative mode of travel.
- Low provision of walking facilities in the area.

The site occupies an area with good public transport access, with the Glenfield Rail Station and bus stops within practical walking distance of the site. It is also likely that public transport services will be enhanced in the future as SWRL is completed and a number of other major developments are being considered in the vicinity of the site, including the two Moorebank Intermodal Facilities that should be developed with a package of infrastructure upgrades and public and active transport measures to minimise the reliant of car trips and to reduce the impacts on the surrounding road network.

Based on assumptions regarding building densities and employment ratios, the site is likely to employ between 780 and 1,250 employees. This is expected to generate between 280 and 460 private vehicle trips during the evening peak hour. However this number is likely to be less in reality as it does not take into full account the site's high level of accessibility to public transport including the SWRL and improvements to bus services as Glenfield Station. The number of private vehicles trips is also likely to be reduced further due to the planned future public and active transport infrastructure and initiatives.

On the basis of the preliminary review, the site would appear to be appropriate for "IN1 General Industrial" from a transport perspective, subject to further detailed traffic impact assessment to determine the capacity of the existing road network and identify the extent of required infrastructure improvements. This includes:

- Obtaining detailed traffic data to ascertain the level of spare capacity on the existing road network.
- Refining detailed land uses and projections for site occupancy (employment, floor area).
- Focusing on improving public transport infrastructure to encourage a shift away from private car use.
- Reviewing bus operations in the vicinity of the site in conjunction with Transport for NSW and bus operators.
- An investigation into the opportunities for linking the site to walking and cycling networks in the area, particularly to Glenfield Rail Station.
- Detailed trip generation and trip distribution by all modes of transport.
- Understanding likely impacts of Moorebank Intermodal Facilities.
- An assessment of the intersections likely to be impacted by future traffic volumes.
- A detailed assessment of site access requirements.
- Consultation with all relevant transport stakeholders.

Aside from the potential impacts to the local road network the site might produce, it should be noted that the site would be contributing to the State Government's employment targets as outlined in the Draft South West Sub-regional Strategy. The fact that the site is located close to public transport and has the opportunity to increase active transport to and from the site strengthens its appropriateness for "IN1 General Industrial" land use.

Appendix 16

Flood Map

IMPORTANT NOTE:
This plan is prepared for Environmental Property Services from a combination of field survey and existing records for the purpose of designing new constructions on the land and should not be used for any other purpose.
The title boundaries shown hereon were not marked by the author at the time of survey and have been determined by plan dimensions only and not by field measurement.

A services search of the area surveyed above has not been undertaken.
Visible services shown hereon have been located where possible by field survey.
Prior to any demolition, excavation or construction on the site, the relevant authority should be contacted for possible location of further underground services and detailed locations of all services.
This note is an integral part of this plan.

LEGEND:

1 In 100 Year Flood RL 12.5 to RL 11.5

REVISION	DATE	DESCRIPTION	CCAD REF	APPROVED
00	07-08-2012	ORIGINAL ISSUE	115831AA	PH

SCALE: HORZ. NOT TO SCALE VERT.
CONTOUR INTERVAL: MAJOR 1.0 MINOR 0.2
B1

HORIZONTAL ORIGIN
COORD. SYSTEM: MGA
MARK ADOPTED: PM 33561
COORDINATES: E 308 018.886 N 6 239 408.040

VERTICAL DATUM
DATUM: AHD
BM ADOPTED: PM 33561 RL: 22.068

HARD & FORESTER
HARD & FORESTER
23–25 Frederick Street
PO Box 175
Rockdale NSW 2216
DX11116 Kogarah
t: (02) 9597 9700
f: (02) 9599 2146
e: survey@hardforester.com.au
w: www.hardforester.com.au
Consulting Surveyors
Hard & Forester Pty Ltd ABN 67 009 841 948

SURVEYED	DRAWN	CHECKED	PASSED
TM	JC	PH	PH

PROJECT:
Southern Flood Parcel
Flood Analysis
(1 in 100 year)

CLIENT: Enviromental Property Services

SHEET 1 OF 1

DRAWING NUMBER	REV
115831003	00

Appendix 17

Ecology Report

EPS

ECOLOGY ASSESSMENT

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

Prepared by Environmental Property Services

ENVIRONMENTAL PROPERTY SERVICES
Reference No. 11012
May 2013

Contact Information and Declaration	
Declaration:	The declaration relates to the submission of this Ecological Assessment Report (EA) prepared for JC & FW Kennett Pty Limited & Figela Pty Limited (Glenfield Waste Services) in respect oto the Glenfield Waste Services Southern parcel of land. The opinions and declarations in this EA 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 EA, 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.
Prepared by:	Peter Ekert, Senior Ecologist Bachelor Applied Science (Environmental Resource Management) Scientific Licence number SL100772 Environmental Property Services PO Box 348 NELSON BAY NSW 2315 Ph: 02 4981 1600
Rezoning Submission prepared by:	Simon Duffy Bachelor of Legal Studies Senior Environmental Planner Environmental Property Services PO Box 348 NELSON BAY NSW 2315 Ph: 02 4981 1600
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

Quality Assurance & Version Control Table				
Project: Ecological Assessment – Glenfield Waste Services, Cambridge Avenue, Glenfield nsw				
Client:	Glenfield Waste Services			
Rev No.	**Date**	**Our Reference**	**Author**	**Reviewer**
V01	27 August 2012	11092	P. Ekert	
V02	17 October 2012	11092	P. Ekert	Jeff Burns
V03	24 May 2013	11092	P. Ekert	Smon Duffy
Checked by	Simon Duffy			
Approved by	Jeff Burns			

ENVIRONMENTAL PROPERTY SERVICES	
Hunter Level 1, 19 Stockton Street, Nelson Bay NSW 2315 (02) 4981 1600	Sydney Level 33, 264 George Street, Sydney NSW 2000 (02) 9258 1985
Website: www.enviroproperty.com.au	

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.

The Glenfield Waste Site straddles the Campbelltown City Council and Liverpool City Council's Local Government 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 Disposal facility.

The primary land use activities conducted on the Glenfield Waste Site's northern parcel of land are soil and sand extraction and non–putrescible solid waste land fill. To create the land fill cells soil and sand are extracted and stockpiled for later use. The primary land use activity conducted on the Glenfield Waste Site southern parcel of land is recycling of waste and in particular construction and demolition waste.

The methods undertaken to complete the EA are divided into two specific stages, including (1) Preliminary/Desktop Investigations and (2) Field Surveys and Assessments. Preliminary investigations undertaken to complete this assessment included literature and database reviews and field surveys undertaken to complete this assessment included site inspections and targeted sampling of flora, fauna and habitat. To ensure a robust desktop assessment, preliminary investigations also included a site visit in order to ground truth information and/or assist in the preparation and design of the ensuing field surveys.

A review of literature pertaining to the study area, the investigation area and the proposed activity was undertaken. This included internet searches, review of relevant reports and liaison with the site manager and Campbelltown City Council. In this instance, there were a number of previous ecological assessments undertaken on the investigation area and a number of ecological assessments undertaken within the Local Government Areas of Campbelltown and Liverpool.

The floristic survey was physically undertaken with site surveys on 30th May and 12th July 2012. The vegetation was surveyed by a targeted random meander and the collection of floristic data in quadrats and transects across the investigation area.

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 types of animals (and habitats) potentially present on the site, and the design and implementation of field surveys, were based on the preliminary review of literature, field assessment and investigations.

Field surveys were undertaken in accordance with 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 30 May 2012 and 21 June 2012 (0800-1400hrs). Field surveys for arboreal mammals, Microchiropteran Bats were undertaken on the evenings of the 20 and 21 June 2012. Non-targeted surveys included searches for the presence or signs of any fauna including the presence of tracks, scats (fecal pellets), hair, scratches etc.

The Ecological Assessment 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 this or any previous survey;
- All of the abiotic characteristics of the investigation area revealed that the site should support some Cumberland Plain Woodland. These include the soil landscape, altitude, topographic position and geographic location;
- In relation to Cumberland Plain Woodland, biotic characteristics of the investigation area revealed that the site supported Grey Box and some areas of native understorey consistent with Cumberland Plain Woodland;
- The investigation area was assessed as having suitable habitat for a total of 16 threatened and migratory fauna species. Except for the bat species referred to in Clause 4.6 none of the 16 threatened and migratory fauna species were identified at the time of the site inspection. Of these, there were ten bird species (eight passerines/perching birds and two shorebirds) and six mammal species (bats);
- No threatened frog, threatened waterbird, 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 man-made dam which provided an area of open, deep water for common waterbird species;

- The investigation area had been regularly mown, slashed and managed such that there was a paucity of leaf litter and fallen timber across the site;
- The investigation area supported a relatively high number of hollow bearing trees across most of the investigation area;
- The investigation area had been regularly mown, slashed and managed such that a predominantly cleared understorey occurred across the investigation area. This was likely to provide some foraging habitat for only common bird species such as the Common Myna, Magpie Lark, Eastern Rosella, Common Starling etc; and
- The investigation area was bound 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.

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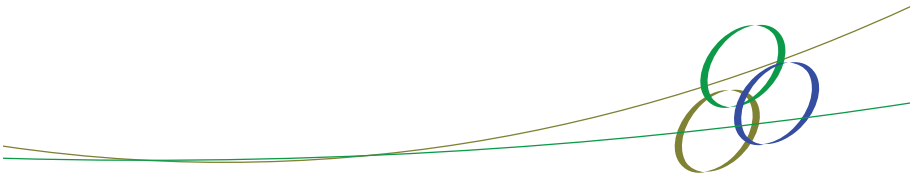

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1 BACKGROUND AND INTRODUCTION

1.1 Background

The Glenfield Waste Site straddles the Campbelltown City Council and Liverpool City Council's Local Government 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 Disposal facility.

The primary land use activities conducted on the Glenfield Waste Site's northern parcel of land are soil and sand extraction and non–putrescible solid waste land fill. To create the land fill cells soil and sand are extracted and stockpiled for later use. The primary land use activity conducted on the Glenfield Waste Site southern parcel of land is recycling of waste and in particular construction and demolition 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 with 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.

Cambridge Avenue Glenfield provides access and egress to and from the southern and northern parcels of land. The southern parcel of land accommodates the gate house, weigh bridge, plant and equipment workshop, staff amenities, the site office and the site manager's premises/offices. The southern parcel of land provides the access to the northern parcel of land via an underpass under the East Hills Railway line.

1.2 Licensing

The field work component of this EA was conducted in accordance with a *National Parks and Wildlife Act 1974* (NP&W Act) Section 132 (c) Scientific Licence. In particular, EPS holds 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 survey work.

1.3 Introduction, Local Context and Site Description

The GWS site is located approximately 30km south west of the Sydney Central Business District (CBD). The Campbelltown LGA is situated within the Sydney Basin Bioregion of NSW 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 on the Central Coast, and almost as far west as Mudgee (OEH 2011).

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 and sand mining 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, land filled areas and non-land filled areas and a stand of remnant Cumberland Shale Plain Woodland.

A summary of the southern parcel of land details are shown in Table 1, while the aerial photograph in Figure 1 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; Lot 3 DP735524; Lot 3 DP 736881; Lot 1 DP113201; Lot 2 DP 333578
Address	2 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	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

Figure 1-1: Aerial Photograph of the GWS site, the southern parcel of land and the locality.

The majority 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 25ha of woodland vegetation located on the southern parcel of land in the Campbelltown LGA. A search of the historical aerial photographs (1951, 1961, 1970, 1978, 1986, 1994) held at the NSW Department of Lands 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, (cited in Anne Clements & Associates Pty Limited 2006 report)(ACA 2006).

2 GUIDELINES, POLICY AND LEGISLATION

This report has also been prepared in accordance with the requirements of:

- NSW Office Environment Heritage (OEH) "Field survey methods"
- www.threatenedspecies.environment nsw.gov.au ;
- OEH draft "Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities" www.dpi.nsw.gov.au/fisheries/species-protection/conservation/what- current ;
- Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act);
- NSW Environmental Planning and Assessment Act 1979 (EP&A Act); and
- NSW Threatened Species Conservation Act 1995 (TSC Act).

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

Under an EPBC Act assessment, an approval from the Federal Department of Sustainability, Environment, Water, Populations and Communities (SEWPaC) 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 seven matters of national environmental significance:

- World Heritage properties;
- National Heritage places;
- Wetlands of international importance (Ramsar);
- Listed threatened species and communities;
- Migratory species listed under international agreements;
- Commonwealth marine areas; and
- Nuclear actions.

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. When a significant effect is likely, further consideration is required and is more appropriately carried out through the preparation of a Species Impact Statement (SIS).

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. Threats to threatened species and other plants and animals in NSW include: pest animals, weeds, diseases, habitat loss or change.

3 METHODS AND SURVEY ASSESSMENT TECHNIQUES

The methods undertaken to complete the EA are divided into two specific stages, including (1) Preliminary/Desktop Investigations and (2) Field Surveys and Assessments. Preliminary investigations undertaken to complete this assessment included literature and database reviews and field surveys undertaken to complete this assessment included site inspections and targeted sampling of flora, fauna and habitat. To ensure a robust desktop assessment, Preliminary investigations also included a site visit in order to ground truth information and/or assist in the preparation and design of the ensuing field surveys.

3.1 Literature Review

A review of literature pertaining to the study area, the investigation area and the proposed activity was undertaken. This included internet searches, review of relevant reports and liaison with the site manager and Campbelltown City Council. In this instance, there were a number of previous ecological assessments undertaken on the investigation area and a number of ecological assessments undertaken within the Local Government Areas of Campbelltown and Liverpool.

3.2 Database Review

A list of threatened species, populations and ecological communities that had been previously reported or modelled to occur within a 10 kilometre (km) radius of the investigation area, was obtained by undertaking a search of the following online and publicly accessible databases:

3.2.1 NSW Government

- 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 - https://six.nsw.gov.au/wps/portal/

3.2.2 Australian Government

- Commonwealth Department of Sustainability, Environment, Water, Population and Communities Protected Matters search tool http://www.environment.gov.au/epbc/pmst/index.html

Based on information such as vegetation mapping on the NSW Government's Spatial Information Exchange (SIX) and the known biological requirements of these threatened species (acquired from OEH Threatened Species Profiles), a further review of the likelihood of any of these threatened species occurring on or using the investigation area as an essential part of a foraging range/habitat was undertaken (see Appendices 3-5).

3.3 Flora and Vegetation Community Survey

The floristic survey was physically undertaken with site surveys on 30th May and 12th July 2012. The vegetation was surveyed by a targeted random meander and the collection of floristic data in quadrats and transects across the investigation area.

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 vegetation around the dams and a small soak observed in the woodland was characterised by a species list, rather than the sampling of quadrats. This was deemed sufficient due to the small size of the soak, the dominance of weed species around the large western dam and the monoculture of *Typha* in the smaller eastern dam.

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
    - **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).

3.4 Fauna Survey

During an inspection of the vegetation present on the investigation area on 28 March 2012 conducted by EPS, it was evident that the vegetation present on the investigation area supported a disturbed understory comprised of predominantly native and exotic groundcover and grasses. There was no mid-storey present with shrubs or regrowth Eucalypts and there were no logs, rocks or leaf litter and quite an open overstorey. It was concluded that the investigation area was unlikely to provide habitat for ground dwelling/terrestrial mammals and as such, the employment of targeted fauna trapping and reptile searches was not considered applicable or necessary.

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 types of animals (and habitats) potentially present on the site, and the design and implementation of field surveys, were based on the preliminary review of literature, field assessment and investigations. Field surveys were undertaken in accordance with 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 30 May 2012 and 21 June 2012 (0800-1400hrs). Field surveys for arboreal mammals, Microchiropteran Bats were undertaken on the evenings of 20 and 21 June 2012. Non-targeted surveys included searches for the presence or signs of any fauna including the presence of tracks, scats (fecal pellets), hair, scratches etc.

3.4.1 Arboreal and Terrestrial Mammals

Arboreal mammal surveys were conducted in the evenings of 20 and 21 June 2012. The technique employed involved a person surveying on foot with a spotlight (12volt; 100watt) for two separate one hour searches over two consecutive 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 (When light shines into the eye of an animal having a tapetum lucidum, the pupil appears to glow) was detected. The weather on the evenings of the surveys was fine with little or no rain or wind.

3.4.2 Bats

Microchiropteran Bat surveys were conducted in the evenings of 20 and 21 June 2012. The technique employed involved the use of a commercially available ultrasonic recorder (Anabat) situated within a number of locations within the investigation area (see Figure 3). In particular, in locations identified as potential roost sites or flyways (road tracks) as well as near the dam. Surveys were conducted during optimal conditions, in particular, during times of little or no wind or rain and were for a period of dusk to dawn. Any echolocation calls emitted by bats and detected by the Anabat microphone were recorded. Calls were sent to Keystone Ecological for identification and interpretation.

3.4.3 Birds

Diurnal Bird surveys were conducted on 30 May 2012 (0900hrs-1300hrs) and 21 June 2012 (0800-1400hrs). Surveys were conducted by an experienced EPS ornithologist undertaking an area search of the woodland. All birds were identified by direct (visual) observation or by call interpretation. Targeted surveys were undertaken during the morning period with little or no wind or rain, thus during optimal conditions for detecting the presence of bird species (Bibby *et al.* 1992). Other bird observations occurred as opportunistic sightings whilst undertaking other assessments.

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

3.4.4 Amphibians and Reptiles

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

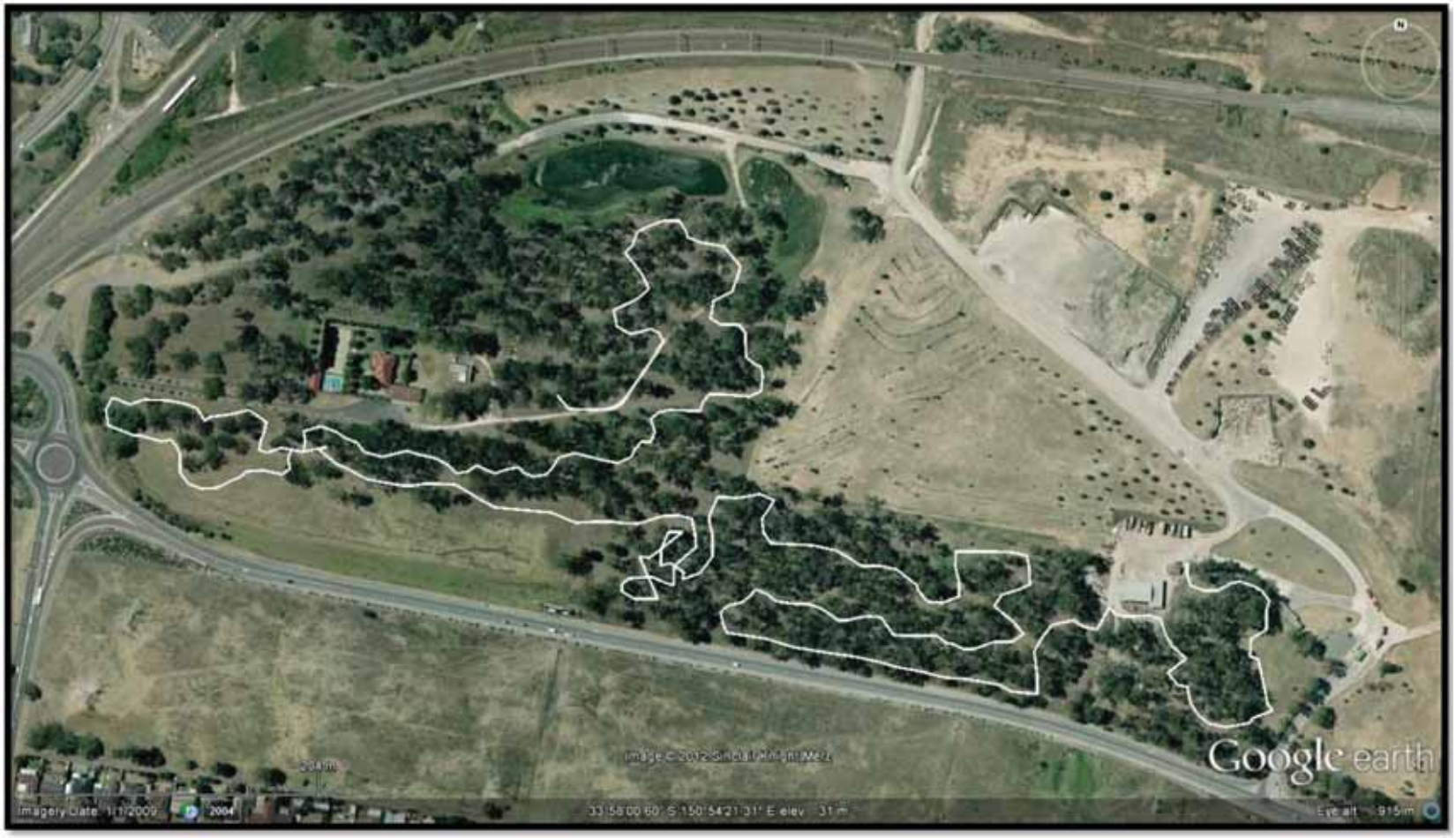

Figure 3-1: Aerial Photograph pf Investigation Area showing Spotlight transect/survey route (20 and 21 June 2012).

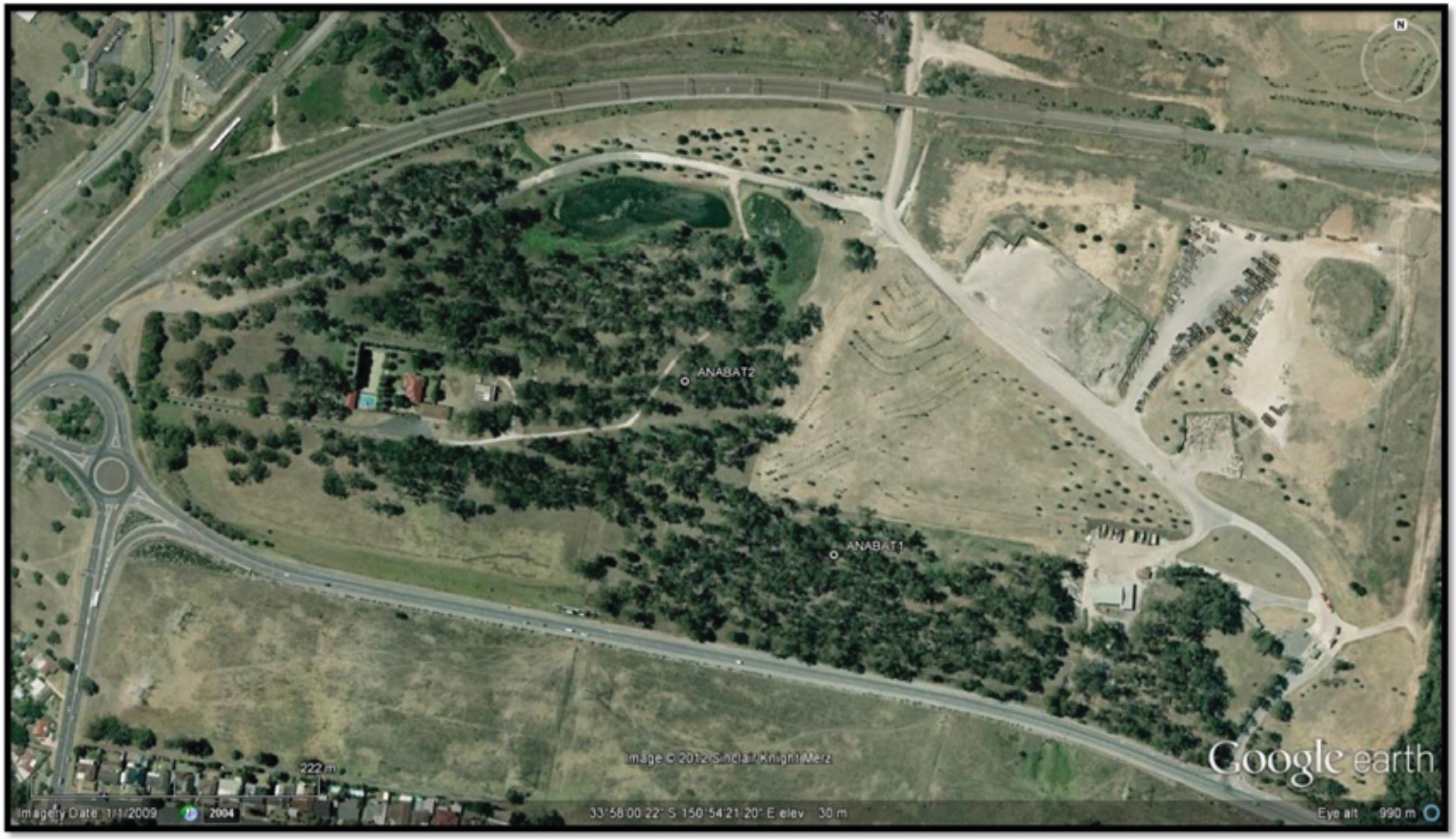

Figure 3-2: Aerial Photo of Investigation Area showing the two Locations of the Anabat Recordings.

3.4.5 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 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 aforementioned habitat characteristics was conducted across the investigation area in order to ascertain the type, distribution and abundance of these resources across the investigation area. 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.

4 RESULTS AND DISCUSSION

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

4.1 Previous Studies

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 1:25000 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) used multivariate analysis of quantitative field surveys to identify 21 vascular plant communities occurring on and adjacent to the Cumberland Plain and Hornsby Plateau. Vegetation communities were described using structural features, habitat characteristics and diagnostic species. Diagnostic species were identified using statistical fidelity measures. 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 (EEC's) listed under the TSC Act (Table 2).

Table 4-1: 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

In 2006, Eco Logical prepared a preliminary ecological assessment of the Glenfield Waste Depot 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 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 observed 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 (birds) are recorded as having been observed by Eco Logical during the March 2006 field survey, with no threatened species observed as part of the survey.

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 and understorey of scattered shrubs and ground cover, with less grass cover and higher litter layers than in the west. The vegetation adjacent to the Georges River was described by Ecological as riparian forest with weedy banks and a mixed native understorey.

The ACA 2006 report described the vegetation in the investigation area as that supporting a woodland structure with three characteristic tree species recorded, namely *Eucalyptus eugenioides, E. moluccana and E. tereticornis.* It was concluded that the woodland vegetation recorded on the site did not fit the descriptions of any of the map units identified by Benson (1992), namely Spotted Gum Forest, Ironbark Forest, Shale/gravel Transition Forest, Grey Box Woodland, Grey Box-Ironbark Woodland. It was also concluded by ACA 2006 that the results were preliminary and that more field surveys were required for a comprehensive assessment of the woodland vegetation.

4.2 Vegetation – Preliminary Studies

A total of 25 threatened flora species, two EECs, and one endangered flora population listed under NSW and Commonwealth Legislation, had been previously recorded within 10km of the investigation area (study area) (Appendices 3-5). Each of these species, populations and EECs were critiqued to ascertain whether they were likely to occur on the investigation area. (Table 4-4).

Table 4-2: Threatened flora species recorded within 10km of the investigation area and an assessment of their likelihood to occur on the investigation area

Species	TSC Act	EPBC Act	Suitable Habitat
Acacia pubescens Downy Wattle	E	V	Yes
Asterolasia elegans	E	E	No
Caladenia tessellata Thick-lipped Spider-orchid	E	V	No
Callistemon linearifolius Netted Bottlebrush	V	-	No
Cryptostylis hunteriana Leafless Tongue-orchid	V	V	No
Cynanchum elegans White-flowered Wax Plant	E	E	No
Diuris aequalis Buttercup Doubletail	E	V	No
Eucalyptus nicholii Narrow-leaved Black Peppermint	V	V	No
Grevillea parviflora subsp. Parviflora Small-flower Grevillea	V	V	No
Gyrostemon thesioides	E	-	No
Hibbertia sp. Bankstown (R.T. Miller & C.P. Gibson s.n. 18/10/06)	CE	CE	No
Leucopogon exolasius Woronora Beard-heath	V	V	No
Melaleuca biconvexa Biconvex Paperbark	V	V	No
Melaleuca deanei Deane's Paperbark	V	V	No
Persoonia hirsuta Hairy Geebung	E	E	No
Persoonia nutans Nodding Geebung	E	E	No
Pimelea curviflora var. curviflora	V	V	No
Pimelea spicata Spiked Rice-flower	E	E	Yes
Pomaderris brunnea	V	V	No
Pultenaea parviflora	E	V	No
Pultenaea pedunculata Matted Bush-pea	E	-	No
Pterostylis gibbosa	E	E	No
Pterostylsis nigricans Dark Greenhood	V	-	No
Pterostylsis saxicola Sydney Plains Greenhood	E	E	No
Thelymitra sp. Kangaloon (D.L. Jones 18108)	CE	CE	No

Key:
TSC Act – Threatened Species Conservation Act 1995 EPBC Act – Environment Protection and Biodiversity Conservation Act 1999 V = Vulnerable E = Endangered CE = Critically Endangered M = Migratory

Table 4-3: Endangered Ecological Communities and threatened flora populations recorded within the study area (10km of the investigation area) and an assessment of their likelihood to occur on the investigation area

Name	TSC Act	EPBC Act	Type	Suitable Habitat
Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (EPBC); Cumberland Plain Woodland in the Sydney Basin Bioregion (TSC Act)	CE	CE	Community	Yes
Shale/Sandstone Transition Forest	-	E	Community	Yes
Marsdenia viridiflora subsp. *Viridiflora* Marsdenia population in the Bankstown, Blacktown, Camden, Campbelltown,	E2	-	Population	Yes

Key:
TSC Act – Threatened Species Conservation Act 1995 EPBC Act – Environment Protection and Biodiversity Conservation Act 1999 V = Vulnerable E = Endangered CE = Critically Endangered M = Migratory

It was ascertained that the investigation area provides potential habitat for the following threatened species and populations:

1. *Marsdenia viridiflora* subsp. *viridiflora* – listed as an Endangered Population
2. *Pultenaea pedunculata* – listed as an Endangered species under NSW legislation
3. *Acacia pubescens* - listed as a Vulnerable species under NSW and Commonwealth legislation
4. *Pimelea spicata* - listed as an Endangered species under NSW and Commonwealth legislation

4.3 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 this or any previous survey.

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 probably no older than 60 years. There were a total of 38 hollow bearing trees across the investigation area. These hollows were of various sizes and may provide potential habitat for hollow-nesting birds and mammals.

The dams support a different type of vegetation to the grassy woodland, although large woodland trees are drowned at the water's edge. Principally, the vegetation around and in the dams are made up of aquatic and weedy species. The bigger dam has a large area of open water and the smaller dam to the east of the dividing track is entirely occupied by *Typha*, a native perennial aquatic capable of choking slow-moving or still water.

4.4 Endangered Ecological Communities

Previous investigations of the site have suggested that the site may support some components of Cumberland Plain Woodland (Eco Logical 2006, ACA 2006 and Fanning (2011). The survey results revealed that some of the abiotic characteristics of the investigation area indicate Cumberland Plain Woodland. These include the soil landscape, altitude, topographic position and geographic location. The biotic characteristics recorded during the investigation, such as the overstorey trees and some of the native understorey also indicate Cumberland Plain Woodland.

4.5 Fauna – Preliminary Studies

Records obtained from State and Federal databases revealed that a total of 54 threatened fauna species (no endangered populations), listed as either Vulnerable, Endangered or Migratory species under NSW and Commonwealth Legislation, had been previously recorded within the 10km study area (Appendix 5).

A total of 17 threatened and migratory fauna species were assessed as having suitable habitat within the investigation area and therefore being potentially likely to occur within the investigation area. Of these, 10 were bird species (eight passerines/perching birds and two shorebirds), and six mammal species (six bats). No threatened frogs, threatened waterbirds, threatened fish species, threatened arboreal mammals or threatened Gastropods were considered likely to have habitat within the investigation area or occur on the investigation area.

Table 4-4: Threatened fauna species recorded within the study area (10km of the investigation area) and an assessment of their likelihood to occur on the investigation area

Type/Species	TSC Act	EPBC Act	FM Act	Suitable Habitat
Frogs				
Giant Burrowing Frog *Heleioporus australiacus*	V	V	-	No
Green and Golden Bell Frog *Litoria aurea*	E	V	-	No
Growling Grass Frog *Litoria raniformis*	V	V	-	No
Littlejohn's Tree Frog *Litoria littlejohni*	V	V	-	No
Stuttering Frog *Mixophyes balbus*	E	V	-	No
Red-crowned Toadlet *Psueudophryne australis*	V	-	-	No
Birds				
Passerines				
Barking Owl *Ninox connivens*	V	-	-	No
Black-chinned Honeyeater *Melithreptus gularis gularis*	V	-	-	No
Black-faced Monarch *Monarcha melanopsis*	-	M	-	No
Eastern Bristlebird *Dasyornis brachypterus*	E	E	-	No
Flame Robin *Petroica phoenicea*	V	-	-	No
Fork-tailed Swift *Apus pacificus*	-	M	-	Yes
Gang-gang Cockatoo *Callocephalon fimbriatum*	V	-	-	No
Little Eagle *Hieraaetus morphnoides*	V	-	-	No
Little Lorikeet *Glossopsitta pusilla*	V	-	-	Yes
Powerful Owl *Ninox strenua*	V	-	-	No
Rainbow Bee-eater *Merops ornatus*	-	M	-	Yes
Regent Honeyeater *Anthochaera phrygia*	E	E	-	Yes
Rufous Fantail *Rhipidura rufifrons*	-	M	-	No
Satin Flycatcher *Myiagra cyanoleuca*	-	M	-	No
Scarlet Robin *Petroica boodang*	V	-	-	No
Speckled Warbler *Chthonicola sagittata*	V	-	-	No
Spotted Harrier *Circus assimilis*	V	-	-	No
Square-tailed Kite *Lophoictinia isura*	V	-	-	No
Swift Parrot Lathamus discolour	E	E	-	Yes
Varied Sittella Daphoenositta chrysoptera	V	-	-	Yes
White-bellied Sea-Eagle Haliaeetus leucogaster	-	M	-	Yes
White-fronted Chat Epthianura albifrons	V	-	-	No
White-throated Needletail Hirundapus caudacutus	-	M	-	Yes
Shorebirds				
Australian Painted Snipe *Rostratula benghalensis*	E	V, M	-	No
Cattle Egret *Ardea ibis*	-	M	-	Yes
Great Egret *Ardea alba*	-	M	-	Yes
Latham's Snipe *Gallinago hardwickii*	-	M	-	No
Waterbirds				
Australasian Bittern *Botaurus poiciloptilus*	E	E	-	No
Bush Stone-curlew *Burhinus grallarius*	E	-	-	No

Type/Species	TSC Act	EPBC Act	FM Act	Suitable Habitat
Mammals				
Brush-tailed Rock-wallaby *Petrogale penicillata*	E	V	-	No
Eastern Bentwing-bat *Miniopterus schreibersii oceanensis*	V	-	-	Yes
Eastern False Pipistrelle *Falsistrellus tasmaniensis*	V	-	-	Yes
Eastern Freetail-bat *Mormopterus norfolkensis*	V	-	-	Yes
Greater Broad-nosed Bat *Scoteanax rueppellii*	V	-	-	Yes
Grey-headed Flying-fox *Pteropus poliocephalus*	V	V	-	Yes
Koala *Phascolarctus cinereus*	V	V	-	No
Large-eared Pied Bat *Chalinolobus dwyeri*	-	V	-	No
Little Bentwing-bat *Miniopterus australis*	V	-	-	No
Long-nosed Potoroo *Potorous tridactylus tridactylus*	V	V	-	No
New Holland Mouse *Pseudomys novahollandiae*	-	V	-	No
Southern Brown Bandicoot *Isoodon obesulus obesulus*	E	E	-	No
Southern Myotis *Myotis macropus*	V	-	-	Yes
Spotted-tailed Quoll *Dasyurus maculatus*	V	E	-	No
Squirrel Glider *Petaurus norfolcensis*	V	-	-	No
Yellow-tailed Sheathtail-bat *Saccolaimus flaviventris*	V	-	-	Yes
Gastropods				
Cumberland Plain Land Snail *Meridolum corneovirens*	E	-	-	No
Fish				
Australian Grayling Prototroctes maraena	-	V	-	No
Macquarie Perch Macquaria australasica	-	E	E	No

4.6 Fauna Survey Results

Lists of fauna species recorded during field surveys are shown in Appendix 7, analysis of Anabat recordings is shown in Appendix 8. A total of 22 fauna species were recorded, which comprised 19 birds, two frogs and one mammal. Of the bat recordings, a number of Microchiropteran bat species were recorded. Of these, two species Eastern Bentwing-bat *Miniopterus schreibersii oceanensis* and Eastern False Pipistrelle *Falsistrellus tasmaniensis* are listed as Vulnerable under the TSC Act.

All bird species recorded were considered common birds of urban/semi-urban habitats on the east coast of Australia 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 that was present at the investigation area. Other bird species, mostly waterbirds were observed either in or on the edge of the open water/dam that occurred north of the homestead.

All 16 threatened and migratory fauna species listed as having suitable habitat within the investigation area were not recorded during the field surveys.

4.7 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.

4.7.1 Nectar and Seed Resources

Fauna habitat across the investigation area 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*. Other nectar and seed producing trees comprised White Feather Honeymyrtle *Melaleuca decora* and one Broad-leaved Apple *Angophora subvelutina*. The investigation area was dominated by the occurrence of *E. moluccana.* These tree species occurred as scattered trees predominantly of one age class and strata (canopy) with no mid- storey of juvenile or immature species. As such, the vegetation lacked any 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.

4.7.2 Leaf Litter and Fallen Timber

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

4.7.3 Open Water, Wetlands and Soaks

The investigation area supported an area of open water, which was a man-made siltation 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.

4.7.4 Hollow Bearing Trees

The investigation area supported a relatively high number of hollow bearing trees across most of the investigation area (Appendix 8). The location of these across the investigation area can be seen in Figure 4. 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 these hollows being used by fauna, with two trees supporting Galahs at the time of survey. Hollows were also present in five *E. tereticornis* and one *A. floribunda*.

4.7.5 Cleared Areas

The investigation area had been regularly mown, slashed and managed such that a predominantly cleared understorey comprised of native and exotic grasses and herbs occurred across the entire investigation area. The cleared 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 the Common Myna, Magpie Lark, Eastern Rosella, Common Starling etc.

Figure 4-1: Aerial Photograph of Investigation Area showing locations of Hollow Bearing Trees.

4.8 Habitat Connectivity

The investigation area is bound by a number of significant barriers to fauna movement, including Cambridge Avenue, the Main Southern Railway Line, the Southern Freight Line, East Hills Railway Line, internal roads, the George's River and the tip site within the GWS precinct. Similarly, the study area (within 10km) is subject to disturbance to and isolation of vegetative areas. This would reduce 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 appears the greatest within the riparian vegetation associated with Georges River, which maintains connectivity with riparian vegetation to the north and south, including the GWS site. This riparian corridor would facilitate the movement of less mobile species, including cover-dependent species, larger terrestrial mammals and arboreal mammals (Hyder Consulting 2012). However, the riparian corridor is not vegetatively connected to the GWS.

South east of the investigation area to the east of the George's River is the adjacent Holsworthy Military Area. Hyder Consulting (2012) reported this site to support 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 locally and regionally occurring, and 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.

4.9 Key Threatening Processes

The following Key Threatening Processes, listed under the TSC Act, were observed within the investigation area and areas adjacent to the investigation area during field survey:

4.9.1 Clearing of Native Vegetation

The investigation area supported scattered trees comprised of Eucalypts (*E. moluccana*, *E. tereticornis, E. crebra*), *Melaleuca decora*, *Angophora subvelutina*, of predominantly one age class. These trees comprised one stratum, an overstorey/canopy. There was no mid-storey or understorey shrub layer/juvenile trees species present. As such, the understory lacked any structural complexity. These aforementioned features indicated that the investigation area had previously been subjected to regular clearing, slashing and mowing of the understory consistent with bushfire hazard reduction requirements of Campbelltown City Council.

4.9.2 Loss of Hollow-bearing Trees

The site supported predominantly Eucalypts of one age class that supported a relatively high occurrence of tree hollows across most of the investigation area. It is likely though, that there has been a loss of hollow bearing trees, with few mature (i.e. hundred year old trees and/or senescent) trees present across the investigation area.

4.9.3 Invasion of Native Plant Communities by Exotic Perennial Grasses:

It was evident that past and current management practices such as clearing, mowing and slashing of the understorey have contributed to the majority of the understory supporting exotic perennial grasses.

4.9.4 Removal of Dead Wood and Dead Trees

The investigation area had only a minor occurrence of dead wood and dead trees present, which consistent with the management of the understory, indicated that the site had previously been subjected to the removal of dead wood and dead trees. Dead wood and dead trees occurred as three separate piles stacked up across the investigation area.

4.10 Invasive Species

A number of Invasive Species were documented in the EPBC Act Protected Matters Report as likely to occur and/or have suitable habitat within the study area. These species were:

- Cane Toad *Bufo marinus*
- Cat *Felis catus*
- European Rabbit *Oryctolagus cuniculus*
- Red Fox *Vulpes vulpes*
- Alligator Weed *Alternanthera philoxeroides*
- Bridal Creeper *Asparagus asparagoides*

- Cabomba *Cabomba caroliniana*
- Bitou Bush *Chrysanthemoides monilifera*
- Broom *Genista sp. X Genista monspessulana*
- Lantana *Lantana camara*
- African Boxthorn *Lycium ferocissimum*
- Chilean Needle Grass *Nassella neesiana*
- Serrated Tussock *Nassella trichotoma*
- Radiata Pine *Pinus radiata*
- Blackberry *Rubus fruticosus aggregate*
- Pussy Willow *Salix spp.*
- Salvinia *Salvinia molesta*
- Gorse *Ulex europaeus*

Of these aforementioned species, evidence of one species, the European Rabbit *Oryctolagus cuniculus* was observed within the investigation area during field surveys.

5 CONCLUSION

This Eco logical Assessment has assessed the ecological attributes of the Glenfield Waste Site, Glenfield NSW. The Eco logical Assessment 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 this or any previous survey;
- All of the abiotic characteristics of the investigation area revealed that the site should support some Cumberland Plain Woodland. These include the soil landscape, altitude, topographic position and geographic location;
- In relation to Cumberland Plain Woodland, biotic characteristics of the investigation area revealed that the site supported Grey Box and some areas of native understorey consistent with Cumberland Plain Woodland;
- The investigation area was assessed as having suitable habitat for a total of 16 threatened and migratory fauna species. Except for the bat species referred to in section 4.6 none of the 16 threatened and migratory fauna species were identified at the time of the site inspection. Of these, there were ten bird species (eight passerines/perching birds and two shorebirds) and six mammal species (bats);
- No threatened frog, threatened waterbird, 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 man-made dam which provided an area of open, deep water for common waterbird species;
- The investigation area had been regularly mown, slashed and managed such that there was a paucity of leaf litter and fallen timber across the site;
- The investigation area supported a relatively high number of hollow bearing trees across most of the investigation area;
- The investigation area had been regularly mown, slashed and managed such that a predominantly cleared understorey occurred across the investigation area. This was likely to provide some foraging habitat for only common bird species such as the Common Myna, Magpie Lark, Eastern Rosella, Common Starling etc; and
- The investigation area was bound 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.

It is recommended that any development that will result in the loss of habitat for threatened species shall take into account the existing biodiversity values and apply the following conservation principles:

1. Avoidance: measures taken to avoid creating impacts from the outset, such as careful spatial or temporal placement of elements of infrastructure, in order to completely avoid impacts on certain components of biodiversity.

Example of Site Response:

- Limited development on sensitive areas such as the land adjoining the Georges River identified as riparian land.

2. Minimisation: measures taken to reduce the duration, intensity and / or extent of impacts (including direct, indirect and cumulative impacts, as appropriate) that cannot be completely avoided, as far as is practically feasible.

Example of Site Response:

- Carry out a ground survey of the Cumberland Plain Woodland, other tiers of vegetation on site and report on the vegetation conditions.

3. Rehabilitation/restoration: measures taken to rehabilitate degraded ecosystems or restore cleared ecosystems following exposure to impacts that cannot be completely avoided and/ or minimised.

Example of Site Response:

- Possible rehabilitation/restoration of sensitive areas on the site such as the land adjoining the Georges River identified as riparian land.
- If required appropriate artificial nest boxes are placed on site to replace the Hollow Bearing Trees that are removed as part of any development.

4. Offset: measures taken to compensate for any residual significant, adverse impacts that cannot be avoided, minimised and / or rehabilitated or restored, in order to achieve no net loss or a net gain of biodiversity. Offsets can take the form of positive management interventions such as restoration of degraded habitat, arrested degradation or averted risk, protecting areas where there is imminent or projected loss of biodiversity.

Example of Site Response:

- The recommended methodology for calculation of compensatory measures is embodied in the Bio-Banking procedures and would be applied to the relevant ecological communities affected by any development on the site. The current Bio-Banking procedures are currently under review which could introduce a new methodology that will replace the existing methodology. Because the rezoning will not cause any adverse impacts it is considered prudent to assess any future impact at the development application stage and to apply the contemporary Bio-Banking methodology to the development.
- Recent offset approvals in the area include the OEH and DOP&I in 2011 agreeing to ARTC's offset restoration proposal for enhancement planting at Leacock Regional Park as compensation for the removal of EEC's outside the park's boundary.

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Appendix 1

Raw Data from the BioNet Atlas of NSW Wildlife website

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°). Copyright the State of NSW through the Office of Environment and Heritage.
Search criteria : Public Report of all Valid Records of Threatened (listed on TSC Act 1995) Animals and Plants in selected area
[North: -33.9 West: 150.85 East: 150.95 South: -34.01] returned a total of 341 records of 45 species. Report generated on 12/04/2012 12:11 PM

Kingdom	Class	Family	Scientific Name	Common Name	Legal Status	Records
Fauna	Amphibia	Myobatrachidae	*Pseudophryne australis*	Red-crowned Toadlet	V	1
Fauna	Amphibia	Hylidae	*Litoria aurea*	Green and Golden Bell Frog	E	5
Fauna	Aves	Accipitridae	^^*Lophoictinia isura*	Square-tailed Kite	V	1
Fauna	Aves	Accipitridae	*Circus assimilis*	Spotted Harrier	V	1
Fauna	Aves	Accipitridae	*Hieraaetus morphnoides*	Little Eagle	V	9
Fauna	Aves	Burhinidae	*Burhinus grallarius*	Bush Stone-curlew	E	1
Fauna	Aves	Cacatuidae	^^*Callocephalon fimbriatum*	Gang-gang Cockatoo	V	1
Fauna	Aves	Psittacidae	^^*Lathamus discolor*	Swift Parrot	E	6
Fauna	Aves	Psittacidae	*Glossopsitta pusilla*	Little Lorikeet	V	7

Kingdom	Class	Family	Scientific Name	Common Name	Legal Status	Records
Fauna	Aves	Strigidae	^^*Ninox connivens*	Barking Owl	V	1
Fauna	Aves	Strigidae	^^*Ninox strenua*	Powerful Owl	V	2
Fauna	Aves	Acanthizidae	*Chthonicola sagittata*	Speckled Warbler	V	1
Fauna	Aves	Meliphagidae	*Anthochaera phrygia*	Regent Honeyeater	E	2
Fauna	Aves	Meliphagidae	*Epthianura albifrons*	White-fronted Chat	V	1
Fauna	Aves	Meliphagidae	*Epthianura albifrons*	White-fronted Chat *Epthianura albifrons* (Jardine & Selby, 1828) in the Sydney Metropolitan Catchment	E	1
Fauna	Aves	Meliphagidae	*Melithreptus gularis gularis*	Black-chinned Honeyeater (eastern subspecies)	V	1
Fauna	Aves	Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella	V	9
Fauna	Aves	Petroicidae	*Petroica boodang*	Scarlet Robin	V	2
Fauna	Aves	Petroicidae	*Petroica phoenicea*	Flame Robin	V	1
Fauna	Mammalia	Dasyuridae	*Dasyurus maculatus*	Spotted-tailed Quoll	V	1
Fauna	Mammalia	Phascolarctidae	*Phascolarctos cinereus*	Koala	V	9
Fauna	Mammalia	Petauridae	*Petaurus norfolcensis*	Squirrel Glider	V	1

Kingdom	Class	Family	Scientific Name	Common Name	Legal Status	Records
Fauna	Mammalia	Pteropodidae	*Pteropus poliocephalus*	Grey-headed Flying-fox	V	40
Fauna	Mammalia	Emballonuridae	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat	V	1
Fauna	Mammalia	Molossidae	*Mormopterus norfolkensis*	Eastern Freetail-bat	V	10
Fauna	Mammalia	Vespertilionidae	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	V	1
Fauna	Mammalia	Vespertilionidae	*Miniopterus schreibersii oceanensis*	Eastern Bentwing-bat	V	5
Fauna	Mammalia	Vespertilionidae	*Myotis macropus*	Southern Myotis	V	4
Fauna	Mammalia	Vespertilionidae	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V	7
Fauna	Gastropoda	Camaenidae	*Meridolum corneovirens*	Cumberland Plain Land Snail	E	106
Flora	Flora	Apocynaceae	*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	E	2
Flora	Flora	Ericaceae	*Leucopogon exolasius*	Woronora Beard-heath	V	1
Flora	Flora	Fabaceae (Faboideae)	*Pultenaea pedunculata*	Matted Bush-pea	E	12
Flora	Flora	Fabaceae (Mimosoideae)	*Acacia pubescens*	Downy Wattle	V	28
Flora	Flora	Gyrostemonaceae	^^*Gyrostemon thesioides*		E	31

Kingdom	Class	Family	Scientific Name	Common Name	Legal Status	Records
Flora	Flora	Myrtaceae	^^*Callistemon linearifolius*	Netted Bottle Brush	V	1
Flora	Flora	Myrtaceae	*Eucalyptus nicholii*	Narrow-leaved Black Peppermint	V	1
Flora	Flora	Myrtaceae	*Melaleuca deanei*	Deane's Paperbark	V	1
Flora	Flora	Orchidaceae	^*Diuris aequalis*	Buttercup Doubletail	E	1
Flora	Flora	Orchidaceae	^*Pterostylis nigricans*	Dark Greenhood	V	1
Flora	Flora	Orchidaceae	^*Pterostylis saxicola*	Sydney Plains Greenhood	E	2
Flora	Flora	Proteaceae	*Grevillea parviflora subsp. parviflora*	Small-flower Grevillea	V	2
Flora	Flora	Proteaceae	*Persoonia hirsuta*	Hairy Geebung	E	1
Flora	Flora	Proteaceae	*Persoonia nutans*	Nodding Geebung	E	12
Flora	Flora	Thymelaeaceae	*Pimelea spicata*	Spiked Rice-flower	E	7

Key:
TSC Act – Threatened Species Conservation Act 1995 EPBC Act – Environment Protection and Biodiversity Conservation Act 1999
V = Vulnerable E = Endangered CE = Critically Endangered M = Migratory

Appendix 2

Raw Data EPBC Act Protected Matters Search Tool Results

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 about the EPBC Act including significance guidelines, forms and application process details can be found at http://www.environment.gov.au/epbc/assessmentsapprovals/index.html

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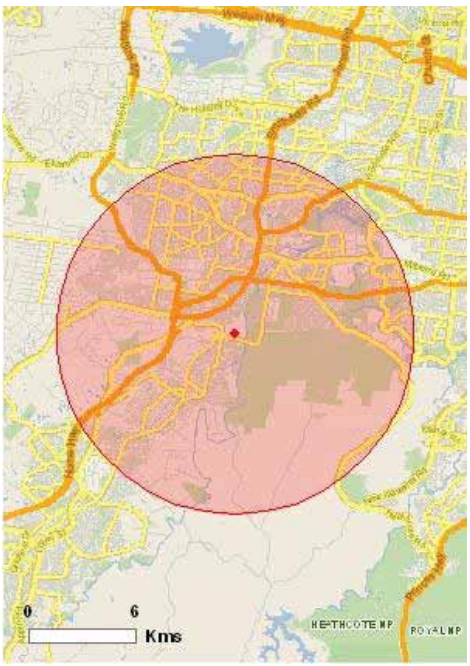

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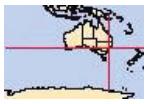

Summary

Matters of National Environment 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 - see http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Threatened Ecological Communities:	3
Threatened Species:	38
Migratory Species:	15

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. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage/index.html

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. Information on EPBC Act permit requirements and application forms can be found at http://www.environment.gov.

Commonwealth Lands:	17
Commonwealth Heritage Places:	6
Listed Marine Species:	12
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves:	None

Extra Information

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

Place on the RNE:	27
State and Territory Reserves:	2
Regional Forest Agreements:	None
Invasive Species:	18
Nationally Important Wetlands:	2

Details

Matters of National Environmental Significance

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

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
Turpentine-Ironbark Forest in the Sydney Basin Bioregion	Critically Endangered	occur within area Community likely to occur within area

Threatened Species [Resource Information]

Name	Status	Type of Presence
BIRDS		
Anthochaera phrygia Regent Honeyeater [82338]	Endangered	Species or species habitat likely 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
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Vulnerable	Species or species habitat likely to occur within area
Sternula nereis nereis Fairy Tern (Australian) [82950]	Vulnerable	Species or species habitat may occur within area
FISH		
Macquaria australasica Macquarie Perch [66632]	Endangered	Species or species habitat may occur within 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	Endangered	Species or species

Name	Status	Type of Presence
(southeastern mainland population) [75184]		habitat may occur within area
Isoodon obesulus obesulus		
Southern Brown Bandicoot [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
Potorous tridactylus tridactylus		
Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat may occur within area
Pseudomys novaehollandiae		
New Holland Mouse [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
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 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
Grevillea parviflora subsp. parviflora		
Small-flower Grevillea [64910]	Vulnerable	Species or species habitat likely to occur within area
Hibbertia sp. Bankstown (R.T.Miller & C.P.Gibson s.n. 18/10/06)		
[81969]	Critically Endangered	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
Persoonia nutans		
[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		
[20834]	Endangered	Species or species habitat known to occur within area
Pomaderris brunnea		
Rufous Pomaderris [16845]	Vulnerable	Species or species habitat likely to occur

Name	Status	Type of Presence
		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
Thelymitra sp. Kangaloon (D.L.Jones 18108)		
Kangaloon Sun-orchid [81971]	Critically Endangered	Species or species habitat may occur within area
REPTILES		
Hoplocephalus bungaroides		
Broad-headed Snake [1182]	Vulnerable	Species or species habitat likely to occur within area

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 may occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Migratory Marine Species		
Lamna nasus		
Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus		
White-throated Needletail [682]		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]		Breeding may occur within area
Myiagra cyanoleuca		
Satin Flycatcher [612]		Breeding likely to occur within area
Rhipidura rufifrons		
Rufous Fantail [592]		Breeding may occur within area
Xanthomyza phrygia		
Regent Honeyeater [430]	Endangered*	Species or species habitat likely to occur within area
Migratory Wetlands Species		

Name	Threatened	Type of Presence
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Rostratula benghalensis s. lat.		
Painted Snipe [889]	Vulnerable*	Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Lands [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
Ingleburn Army Camp	NSW	Listed place
Old Army / Internment Camp Group Holsworthy	NSW	Listed place
Prefabricated Cottages Ingleburn Village	NSW	Listed place
Bankstown Airport Air Traffic Control Tower	NSW	Nominated 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 may occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		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 likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat may occur within area
Lathamus discolor Swift Parrot [744]	Endangered	Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Breeding may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Breeding likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Breeding may occur within area
Rostratula benghalensis s. lat. Painted Snipe [889]	Vulnerable*	Species or species habitat likely 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

Name	State	Status
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
The Homestead	NSW	Registered
Varro Ville	NSW	Registered

State and Territory Reserves [Resource Information]

Name	State
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,

Name	Status	Type of Presence
Frogs		
Bufo marinus		
Cane Toad [1772]		Species or species habitat likely to occur within area
Mammals		
Felis catus		
Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Oryctolagus cuniculus		
Rabbit, European Rabbit [128]		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
Asparagus asparagoides		
Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		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
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 may occur within area
Nassella neesiana		
Chilean Needle grass [67699]		Species or species

Name	Status	Type of Presence
		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
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtiji 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
Ulex europaeus Gorse, Furze [7693]		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

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

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.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-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
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

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

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Appendix 3

Threatened Flora Assessment

Species	TSC Act	EPBC Act	Comments
Acacia pubescens Downy Wattle	E	V	Recorded within study area; Suitable habitat within investigation area.
Asterolasia elegans	E	E	Predicted to occur within study area; No suitable habitat within investigation area
Caladenia tessellata Thick-lipped Spider-orchid	E	V	Predicted to occur within study area; No suitable habitat within investigation area
Callistemon linearifolius Netted Bottlebrush	V	-	Recorded within study area; No suitable habitat within investigation area
Cryptostylis hunteriana Leafless Tongue-orchid	V	V	Predicted to occur within study area; No suitable habitat within investigation area
Cynanchum elegans White-flowered Wax Plant	E	E	Predicted to occur within study area; No suitable habitat within investigation area
Diuris aequalis Buttercup Doubletail	E	V	Recorded within study area; No suitable habitat within investigation area
Eucalyptus nicholii Narrow-leaved Black Peppermint	V	V	Recorded within study area; No suitable habitat within investigation area
Grevillea parviflora subsp. Parviflora Small-flower Grevillea	V	V	Recorded within study area; No suitable habitat within investigation area
Gyrostemon thesioides	E	-	Recorded within study area; No suitable habitat within investigation area
Hibbertia sp. Bankstown (R.T. Miller & C.P. Gibson s.n. 18/10/06)	CE	CE	Predicted to occur within study area; No suitable habitat within investigation area
Leucopogon exolasius Woronora Beard-heath	V	V	Recorded within study area; No suitable habitat within investigation area
Melaleuca biconvexa Biconvex Paperbark	V	V	Predicted to occur within study area; No suitable habitat within investigation area
Melaleuca deanei Deane's Paperbark	V	V	Recorded within study area; No suitable habitat within investigation area

Species	TSC Act	EPBC Act	Comments
Persoonia hirsuta Hairy Geebung	E	E	Recorded within study area; No suitable habitat within investigation area
Persoonia nutans Nodding Geebung	E	E	Recorded within study area; No suitable habitat within investigation area
Pimelea curviflora var. curviflora	V	V	Predicted to occur within study area; No suitable habitat within investigation area
Pimelea spicata Spiked Rice-flower	E	E	Recorded within study area; Suitable habitat within investigation area
Pomaderris brunnea	V	V	Predicted to occur within study area; No suitable habitat within investigation area
Pultenaea parviflora	E	V	Predicted to occur within study area; No suitable habitat within investigation area
Pultenaea pedunculata Matted Bush-pea	E	-	Recorded within study area; Suitable habitat within investigation area
Pterostylis gibbosa	E	E	Recorded within study area; No suitable habitat within investigation area
Pterostylsis nigricans Dark Greenhood	V	-	Recorded within study area; No suitable habitat within investigation area
Pterostylsis saxicola Sydney Plains Greenhood	E	E	Recorded within study area; No suitable habitat within investigation area
Thelymitra sp. Kangaloon (D.L. Jones 18108)	CE	CE	Predicted to occur within study area.

Key:

TSC Act – Threatened Species Conservation Act 1995 EPBC Act – Environment Protection and Biodiversity Conservation Act 1999

V = Vulnerable E = Endangered CE = Critically Endangered M = Migratory

Appendix 4

Endangered Flora Populations and Ecological Communities Assessment

Name	TSC Act	EPBC Act	Type	Comments
Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (EPBC); Cumberland Plain Woodland in the Sydney Basin Bioregion (TSC Act)	CE	CE	Community	Community likely to occur within study area; Suitable habitat within investigation area
Shale/Sandstone Transition Forest	-	E	Community	Community likely to occur within study area; Suitable habitat within investigation area
Marsdenia viridiflora subsp. *Viridiflora* Marsdenia population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith LGA's	E	-	Population	Population recorded within study area; Suitable habitat within investigation area

Key:

TSC Act – Threatened Species Conservation Act 1995 EPBC Act – Environment Protection and Biodiversity Conservation Act 1999

V = Vulnerable E = Endangered CE = Critically Endangered M = Migratory

Appendix 5

Threatened Fauna Assessment

Type/Species	TSC Act	EPBC Act	FM Act	Assessment Comments
Frogs				
Giant Burrowing Frog *Heleioporus australiacus*	V	V	-	Predicted to occur within study area; No habitat on investigation area
Green and Golden Bell Frog *Litoria aurea*	E	V	-	Recorded within study area; No habitat on investigation area
Growling Grass Frog *Litoria raniformis*	V	V	-	Predicted to occur within study area; No habitat on investigation area
Littlejohn's Tree Frog *Litoria littlejohni*	V	V	-	Predicted to occur within study area; No habitat on investigation area
Stuttering Frog Mixophyes balbus	E	V	-	Predicted to occur within study area; No habitat on investigation area
Red-crowned Toadlet *Psueudophryne australis*	V	-	-	Recorded within study area; No habitat on investigation area
Birds				
Passerines				
Barking Owl *Ninox connivens*	V	-	-	Predicted to occur within study area; No habitat on investigation area
Black-chinned Honeyeater *Melithreptus gularis gularis*	V	-	-	Recorded within study area; No habitat on investigation area
Black-faced Monarch *Monarcha melanopsis*	-	M	-	Predicted to occur within study area; No habitat on investigation area
Eastern Bristlebird *Dasyornis brachypterus*	E	E	-	Predicted to occur within study area; No habitat on investigation area
Flame Robin Petroica phoenicea	V	-	-	Recorded within study area; No habitat on investigation area
Fork-tailed Swift *Apus pacificus*	-	M		Predicted to occur within study area; Some foraging habitat on investigation area
Gang-gang Cockatoo *Callocephalon fimbriatum*	V	-	-	Recorded within study area; No habitat on investigation area
Little Eagle *Hieraaetus morphnoides*	V	-	-	Recorded within study area; No habitat on investigation area
Little Lorikeet *Glossopsitta pusilla*	V	-	-	Recorded within study area; Some habitat on investigation area
Powerful Owl *Ninox strenua*	V	-	-	Recorded within study area; No habitat on investigation area
Rainbow Bee-eater *Merops ornatus*	-	M	-	Predicted to occur within study area; Some habitat on investigation area
Regent Honeyeater *Anthochaera phrygia*	E	E	-	Predicted to occur within study area; Some foraging habitat on investigation area

Type/Species	TSC Act	EPBC Act	FM Act	Assessment Comments
Rufous Fantail *Rhipidura rufifrons*	-	M	-	Predicted to occur within study area; No habitat on investigation area
Satin Flycatcher *Myiagra cyanoleuca*	-	M	-	Predicted to occur within study area; No habitat on investigation area
Scarlet Robin *Petroica boodang*	V	-	-	Recorded within study area; No habitat on investigation area
Speckled Warbler *Chthonicola sagittata*	V		-	Predicted to occur within study area; No habitat on investigation area
Spotted Harrier *Circus assimilis*	V	-	-	Recorded within study area; No habitat on investigation area
Square-tailed Kite *Lophoictinia isura*	V	-	-	Recorded within study area; No habitat on investigation area
Swift Parrot *Lathamus discolour*	E	E	-	Recorded within study area; Some foraging habitat on investigation area
Varied Sittella *Daphoenositta chrysoptera*	V	-	-	Recorded within study area; Some foraging habitat on investigation area
White-bellied Sea-Eagle *Haliaeetus leucogaster*	-	M	-	Predicted to occur within study area; Some foraging habitat on investigation area
White-fronted Chat *Epthianura albifrons*	V	-	-	Recorded within study area; No habitat on investigation area
White-throated Needletail *Hirundapus caudacutus*	-	M	-	Predicted to occur within study area; Some foraging habitat on investigation area
Shorebirds				
Australian Painted Snipe *Rostratula benghalensis*	E	V, M	-	Predicted to occur within study area; No habitat on investigation area
Cattle Egret *Ardea ibis*	-	M	-	Breeding likely to occur within study area; Some foraging habitat on investigation
Great Egret *Ardea alba*	-	M	-	Breeding likely to occur within study area; Some foraging habitat on investigation area
Latham's Snipe *Gallinago hardwickii*	-	M	-	Roosting known to occur within study area; No habitat on investigation area
Waterbirds				
Australasian Bittern *Botaurus poiciloptilus*	E	E	-	Recorded within study area; No habitat on investigation area
Bush Stone-curlew *Burhinus grallarius*	E	-	-	Recorded within study area; No habitat on investigation area
Mammals				
Brush-tailed Rock-wallaby *Petrogale penicillata*	E	V	-	Predicted to occur within study area; No habitat on investigation area

Type/Species	TSC Act	EPBC Act	FM Act	Assessment Comments
Eastern Bentwing-bat *Miniopterus schreibersii oceanensis*	V	-	-	Recorded within study area; Some habitat on investigation area
Eastern False Pipistrelle *Falsistrellus Tasmaniensis*	V	-	-	Recorded within study area; No habitat on investigation area
Eastern Freetail-bat *Mormopterus norfolkensis*	V	-	-	Recorded within study area; Some habitat on investigation area
Greater Broad-nosed Bat *Scoteanax rueppellii*	V	-	-	Recorded within study area; Some habitat on investigation area
Grey-headed Flying-fox *Pteropus poliocephalus*	V	V	-	Recorded within study area; Some foraging habitat on investigation area
Koala Phascolarctus cinereus	V	-	-	Recorded within study area; No habitat on investigation area
Large-eared Pied Bat Chalinolobus dwyeri	-	V	-	Recorded within study area; No habitat on investigation area
Little Bentwing-bat Miniopterus australis	V	-	-	Recorded within study area; No habitat on investigation area
Long-nosed Potoroo Potorous tridactylus tridactylus	V	V	-	Predicted to occur within study area; No habitat on investigation area
New Holland Mouse Pseudomys				
Southern Brown Bandicoot Isoodon obesulus				
Southern Myotis Myotis macropus	V	-	-	Recorded within study area; Some habitat on investigation area
Spotted-tailed Quoll Dasyurus maculatus	V	E	-	Recorded within study area; No habitat on investigation area
Squirrel Glider Petaurus norfolcensis	V	-	-	Recorded within study area; No habitat on investigation area
Yellow-tailed Sheathtail-bat Saccolaimus				
Gastropods				
Cumberland Plain Land Snail *Meridolum corneovirens*	E	-	-	Recorded within study area; No habitat on investigation area
Fish				
Australian Grayling *Prototroctes maraena*	-	V	-	Recorded within study area; No habitat on investigation area
Macquarie Perch *Macquaria australasica*	-	E	E	Recorded within study area; No habitat on investigation area

Key:

TSC Act – Threatened Species Conservation Act 1995 EPBC Act – Environment Protection and Biodiversity Conservation Act 1999 FM Act – Fisheries Management Act 1994 V = Vulnerable E = Endangered CE = Critically Endangered M = Migratory

Appendix 6

Flora Recorded During Field Surveys

Family	Scientific Name	Common Name	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Dams	Soak	RM
Acanthaceae	*Brunoniella australis*	Blue Trumpet	2	1									
Adiantaceae	*Cheilanthes sieberi* subsp.*sieberi*	Poison Rock Fern	1										
Amaranthaceae	*Alternanthera*	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	

Family	Scientific Name	Common Name	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Dams	Soak	RM
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*	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*	River Oak											X
Casuarinaceae	*Casuarina glauca*	Swamp Oak											X
Crassulaceae	*Bryophyllum delagoense*	Mother-of-millions									X		
Chenopodiaceae	*Einadia hastata*	Berry Saltbush	1										
Chenopodiaceae	*Einadia polygonoides*	-					4b			3			
Chenopodiaceae	*Einadia trigonos* subsp.	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			
Cyperaceae	*Carex inversa PD9,PD28,PD29*	-						2	2				
Cyperaceae	*Cyperus gracilis*	-	2							2			

Family	Scientific Name	Common Name	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Dams	Soak	RM
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 parviflorusPD28*	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 decurrensPD29*	Black Wattle									X		
Myrtaceae	*Angophora subvelutina U9,U10PD29*	-							4b				
Myrtaceae	*Eucalyptus crebra U9,PD10,PD28,PD29*	Narrow-leaved Ironbark				4b							

Family	Scientific Name	Common Name	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Dams	Soak	RM
Myrtaceae	*Eucalyptus moluccana PD9,PD10,PD28,PD2*	Grey Box	5	4b	5	4b	4b	4b		5	X	X	
Myrtaceae	*Eucalyptus tereticornis PD9,PD10,PD28,PD2 9*	Forest Red Gum				4b		4b	4b		X		
Myrtaceae	*Melaleuca decoraPD29*	-	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,PD2 9*	-	2	2			1						
Oxalidaceae	*Oxalis sp.*									1			
Pittosporaceae	*Bursaria spinosa var. spinosa PD9,PD10,PD28,PD2 9*	Blackthorn		2	1		1			1			
Plantaginaceae	*Plantago lanceolata*	Ribwort	3	3	3	2	3	3	6	3			
Plantaginaceae	*Plantago varia*	-	2	1									
Poaceae	*Austrodanthonia fulvaPD29*	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

Family	Scientific Name	Common Name	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Dams	Soak	RM
Poaceae	*Chloris ventricosa PD9,PD10,PD28,PD29*	Tall Chloris	3	2	2	2	2			2			
Poaceae	*Echinopogon ovatus C9PD28,PD29*	Forest Hedgehog Grass						1					
Poaceae	*Ehrharta erecta*	Panic Veldtgrass			4b			3	3	3			
Poaceae	*Entolasia marginata*	Bordered Panic	2							2			
Poaceae	*Eragrostis leptostachyaPD10,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 confertaPD28,PD29*	Common Woodruff							4a				
Solanaceae	*Lycium ferocissimum*	African Boxthorn							1	1			
Solanaceae	*Physalis peruviana*	Cape Gooseberry	1					1					
Solanaceae	*Solanum campanulatum*	-	2		1					2			

Family	Scientific Name	Common Name	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Dams	Soak	RM
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 7

Fauna Recorded During Field Surveys

Type/Species	Location/Habitat
Frogs	
Common Eastern Froglet *Crinia signifera*	Siltation Dam, wet soak/drainage area
Whistling Tree Frog *Litoria verreauxii verreauxii*	Siltation Dam, wet soak/drainage area
Birds	
Australian Magpie *Gymnorhina tibicen*	Throughout investigation area
Australian Raven *Corvus coronoides*	Throughout investigation area
Australian White Ibis *Threskiornis molucca*	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
Grey Butcherbird *Cracticus torquatus*	Throughout investigation area
Laughing Kookaburra *Dacelo novaeguineae*	Throughout investigation area
Little Corella *Cacatua sanguinea*	Flying over investigation area
Magpie Lark *Grallina cyanoleuca*	Throughout investigation area
Noisy Miner *Manorina melanocephala*	Throughout investigation area
Purple Swamphen *Porphyrio porphyrio*	Siltation Dam
Red-whiskered Bulbul *Pycnonotus jocosus*	Throughout investigation area
Spotted Pardalote *Pardalotus punctatus*	Throughout investigation area
Sulphur-crested Cockatoo *Cacatua galerita*	Throughout investigation area
White-faced Heron *Egretta novaehollandiae*	Siltation Dam; flying over site
Yellow-faced Honeyeater *Lichenostomus*	Throughout investigation area, in trees
Mammals	
Common Ringtail Possum *Pseudocheirus*	In tree, within investigation area

Appendix 8

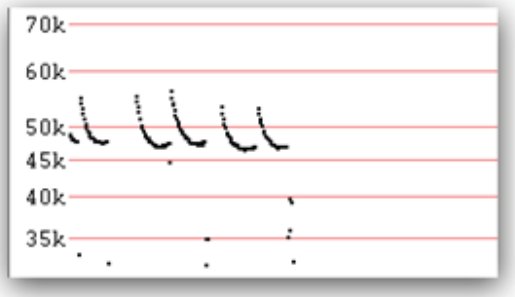
Microchiropteran Bat Data (Anabat)

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)	Possible *Vespadelus regulus* or possible *Miniopterus schreibersii oceanensis*.
			Miniopterus schreibersii oceanensis (44 – 47.)5	
2	20/06/12	45 - 45.5	*Vespadelus regulus* (43.5-46)	Probable *Miniopterus schreibersii oceanensis*. See comment 1
			Miniopterus schreibersii oceanensis (44 – 47.5)	
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

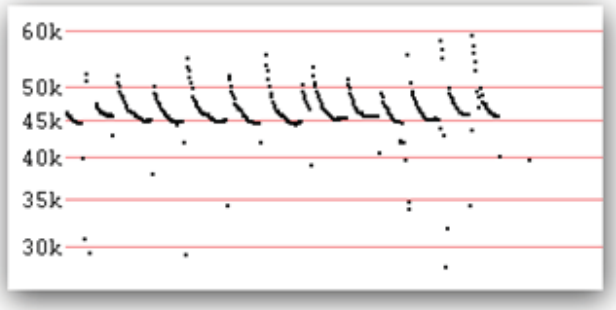
Comments

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.

Call 1.



Call 2.



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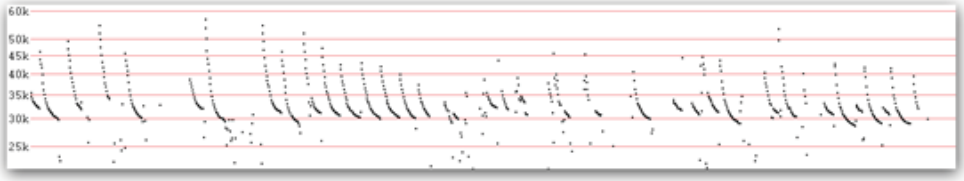

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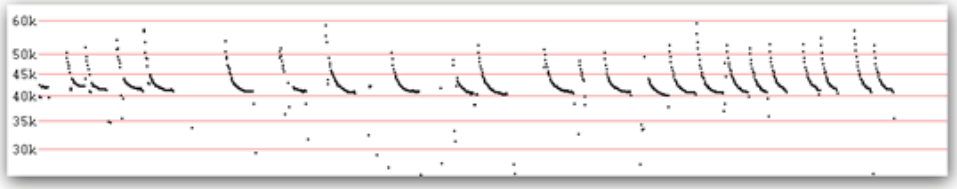

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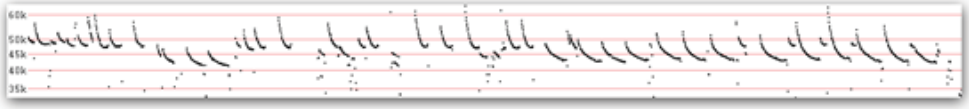

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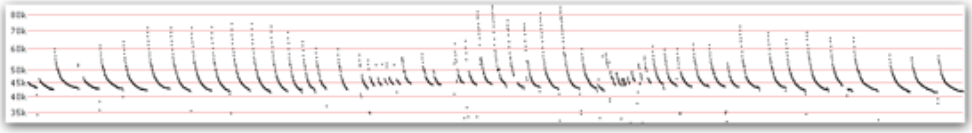

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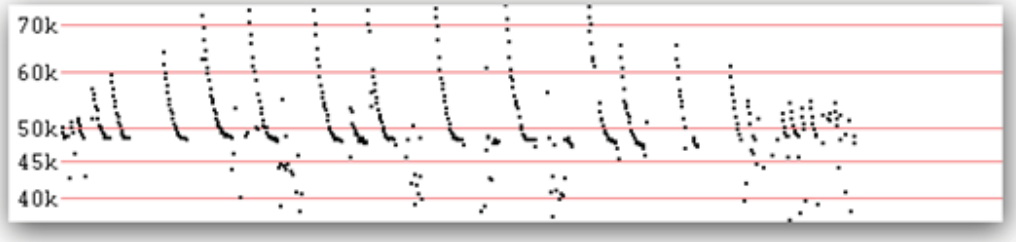

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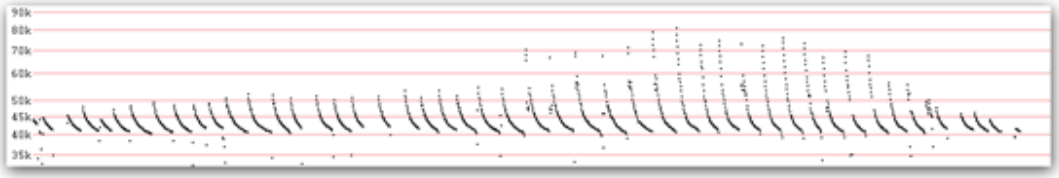

Appendix 9

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
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
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 10

Site Photos

Man-made dam in the northern section of the investigation area.

Mowed grassland and Eucalypt woodland within the investigation area.

Mowed grassland and scattered Eucalypt trees within the eastern section of the investigation area

Mowed grassland and Eucalypt woodland in the central section of the investigation area.

Appendix 18

Bush Fire Prone Land Map

An extract from the Campbelltown LGA – Bush Fire Prone Land Map

Bush Fire Prone Land

- Vegetation Category 1
- Vegetation Category 2
- Vegetation Buffer
- Campbelltown LGA

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