CALDERWOOD URBAN DEVELOPMENT PROJECT

Flora and fauna assessment under Part 3A of the *Environmental Planning and Assessment Act, 1979* Final Report

Report prepared for
Delfin Lend Lease

4 March 2010

Calderwood Urban Development Project

Flora and Fauna Assessment – FINAL

PREPARED FOR	**Delfin Lend Lease**
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Executive Summary

This flora and fauna assessment has been prepared by Eco Logical Australia for the Calderwood Urban Development Project. The Calderwood Urban Development Project is a master planned community development by Delfin Lend Lease. This assessment will accompany a Concept Plan Application under Part 3A of the *Environmental Planning & Assessment Act 1979* (EP&A Act) and a proposal for State significant site listing under Schedule 3 of *State Environmental Planning Policy Major Development 2005* (SEPP Major Development). The Calderwood Urban Development Project site is located within the Calderwood Valley in the Illawarra Region. The Calderwood study area has been subject to long term rural land uses and currently includes dairy farming, grazing, horse studs, a cemetery, church and private residences.

The methodology in this report is based on the Guidelines for Threatened Species Assessment (DEC & DPI, 2005) and included a literature review of previous work, database search for threatened species, populations and ecological communities, assessment of statutory requirements, field validation of existing vegetation, threatened species and habitat condition, an assessment of conservation significance, recommendations for and a full impact assessment of the proposed Concept Plan. Impact assessment also included full tests of significance for all matters of National Environmental Significance (NES) that were considered to be impacted by the proposal.

Five native vegetation communities were found on site, four of which are listed as endangered ecological communities under the *Threatened Species Conservation Act 1995* (TSC Act). No threatened flora or fauna species were found to occur on site, however four threatened flora species were considered to be likely or have the potential to occur on site all of which are also listed as endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act). Twenty two fauna species were also considered likely or as having the potential to occur on site, seven of which are listed on the EPBC Act.

The site also includes a section of Marshall Mount Creek and part of Macquarie Rivulet. Both streams have highly disturbed, regenerating native riparian vegetation (Riparian River Oak Forest) and provide habitat for aquatic and riparian species. The streams were assessed to determine habitat value and condition. It was found that stream condition is better overall in Macquarie Rivulet (moderate/good) than in Marshall Mount Creek, and that removal of cattle and implementation of water sensitive urban design as part of the proposed Calderwood development should improve the quality of flows to Lake Illawarra. These major riparian corridors that have a significant drainage function are proposed to be zoned SP2.

Review of the concept plan indicated that the core ecological values of the site are to be retained. These core ecological values include Johnston's Spur, Marshall Mount Creek and Macquarie Rivulet as well as smaller pockets of better quality remnant native vegetation. With the retention of these key areas of remnant native vegetation there will be minimal impact to threatened ecological communities, threatened species and their habitat and regional corridors linking the escarpment to the coast are maintained and enhanced. Additional protection of on-site biodiversity and specifically remnant native vegetation of high conservation significance is to be provided through the proposed zoning of these areas as E3 and E2, inclusion in an Environmentally Significant Lands Layer (ESL) and additional survey requirements for selected species in certain areas within the Statement of Commitments.

Impact assessments found that the impact to threatened species and ecological communities on site is not considered to be significant with impacts being restricted mostly to poor quality habitat and given the large amount of habitat protection to be provided on site. It is considered that for the Calderwood Urban Development Project that the majority of impacts are being avoided, therefore

minimal mitigation measures and no offsetting is considered to be required. Longer term the broader regional connectivity of the area will be enhanced through the identification of regional corridors along Marshall Mount Creek and Macquarie Rivulet linking Lake Illawarra to the escarpment. A series of secondary corridors are proposed to provide a link between the regional corridors and Jonhston's Spur.

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Abbreviations

ABBREVIATION	DESCRIPTION
CSA	Conservation significance assessment
DLL	Delfin Lend Lease
DoP	Department of Planning
EP&A Act	*NSW Environmental Planning and Assessment Act 1979*
GGC	Growth Centres Commission
LGA	Local government area
IRS	Illawarra Regional Strategy
SEPP	State Environmental Planning Policy
WDRA	West Dapto Release Area

1 Introduction

This flora and fauna assessment has been prepared by Eco Logical Australia for the Calderwood Urban Development Project. The Calderwood Urban Development Project is a master planned community development by Delfin Lend Lease. This assessment will accompany a Concept Plan Application under Part 3A of the *Environmental Planning & Assessment Act 1979* (EP&A Act), a proposal for State significant site listing under Schedule 3 of *State Environmental Planning Policy Major Development 2005* (SEPP Major Development) and subsequent development stages.

1.1 THE PROPOSAL

The Calderwood Urban Development Project is a master planned community development by Delfin Lend Lease (DLL).

The Calderwood Urban Development Project proposes a mix of residential, employment, retail, education, conservation and open space uses. The development proposes approximately 4,800 dwellings and approximately 50 hectares of retail, education, community and mixed use / employment land. The overall development will accommodate approximately 12,400 people and will deliver an estimated $2.9 billion in development expenditure and create approximately 8,000 full time equivalent jobs by 2031.

The Calderwood Urban Development Project site is located within the Calderwood Valley in the Illawarra Region. It is approximately 706 hectares in area with approximately 600 hectares of land in the Shellharbour LGA and the balance located within the Wollongong LGA.

The Calderwood Valley is bounded to the north by Marshall Mount Creek (which forms the boundary between the Shellharbour and Wollongong LGAs), to the east by the Macquarie Rivulet, to the south by Johnston's Spur and to the west by the Illawarra Escarpment. Beyond Johnston's Spur to the south is the adjoining Macquarie Rivulet Valley within the suburb of North Macquarie. The Calderwood Urban Development Project land extends south from the Calderwood Valley to the Illawarra Highway. Refer to Location Plan at **Figure 1**.

The Calderwood Valley has long been recognised as a location for future urban development, firstly in the Illawarra Urban and Metropolitan Development Programmes and more recently in the Illawarra Regional Strategy (IRS).

The IRS nominates Calderwood as an alternate release area if demand for additional housing supply arises because of growth beyond projections of the Strategy, or if regional lot supply is lower than expected.

In 2008, the former Growth Centres Commission reviewed the proposed West Dapto Release Area (WDRA) draft planning documents. The GCC concluded that forecast housing land supply in the IRS cannot be delivered as expected due to implementation difficulties with the WDRA, and the significantly lower than anticipated supply of housing land to market in the Illawarra Region is now been recognised as a reality.

The GCC Review of the WDRA also recognised that there is merit in the early release of Calderwood in terms of creating a higher dwelling production rate and meeting State government policy to release as much land to the market as quickly as possible. Given the demonstrated shortfall in land supply in the Illawarra Region and the WDRA implementation difficulties highlighted in the GCC Report, the release of Calderwood for urban development now conforms to its strategic role under the IRS as a source of

supply triggered by on-going delays in regional lot supply. The Calderwood Urban Development Project can deliver about 12% of the IRS' new dwelling target.

Changes in outlook arising from global, national and regional factors influencing investment and delivery certainty, housing supply and affordability and employment and economic development also add to the case for immediate commencement of the Calderwood Project.

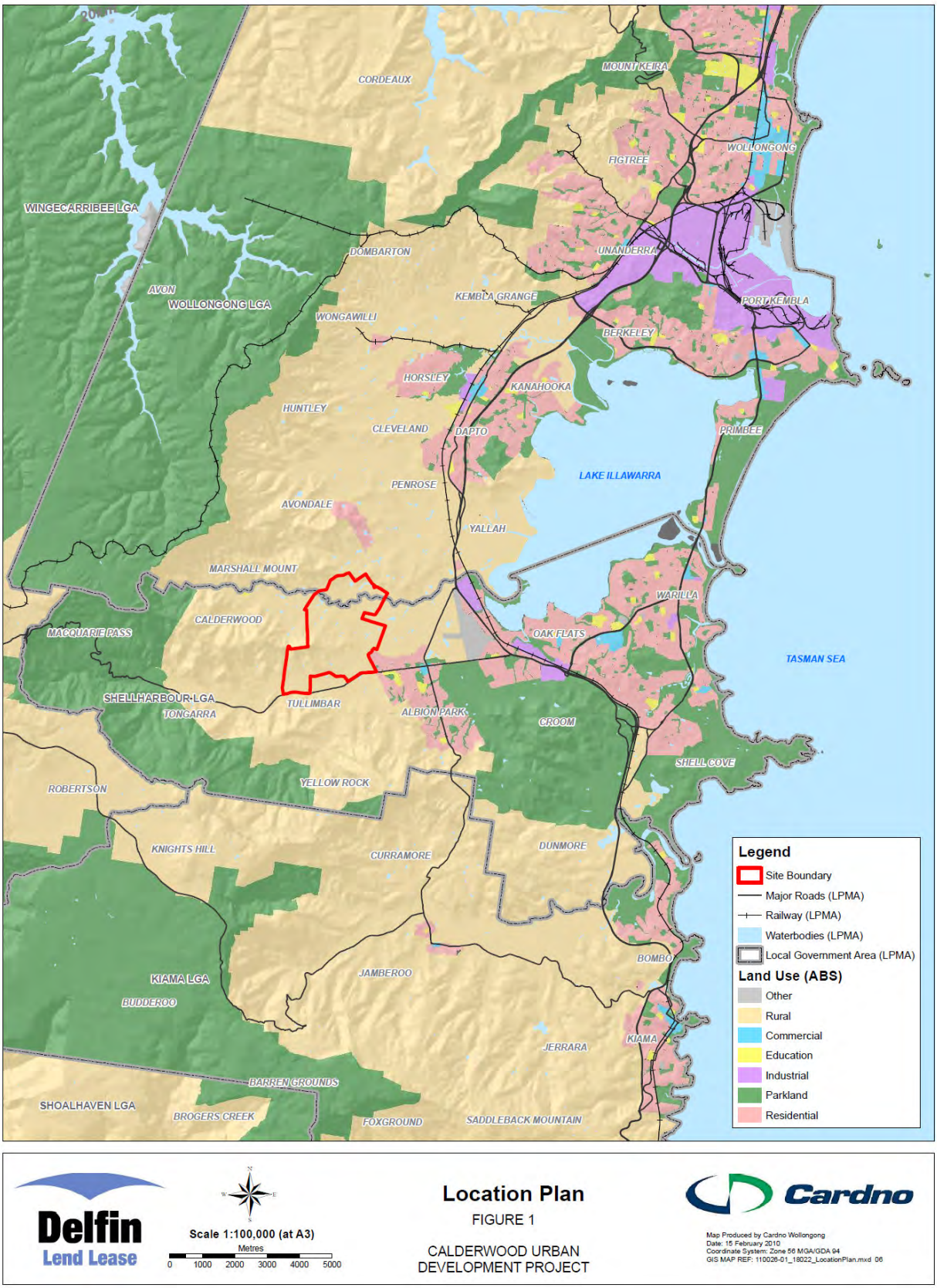


Figure 1: Calderwood study area

1.2 CONCEPT PLAN

Delfin has developed a Concept Plan for the site (**Figure 2**), which delineates broadly the proposed land zones which will be put forward in the Part 3A application to DoP in February / March 2010. This report has included an impact assessment based on the final concept and draft zoning plan (Figure 3).

The concept plan provides a broad structure plan for the Calderwood Urban Development Project, and incorporates on site ecological values (including remnant vegetation, riparian and aquatic habitat) into a network of green corridors which will see a combination of conservation, recreation and water sensitive urban design being developed as detailed design continues over the coming decade.

The concept plan will be further supported by the SEPP rezoning plan for the site and an Environmentally Sensitive Lands Layer (ESL) which will give specific protection through additional heads of consideration for DA's within sensitive areas of Johnston's Spur, riparian corridors and other areas across the site (refer to JBA report for full detail).

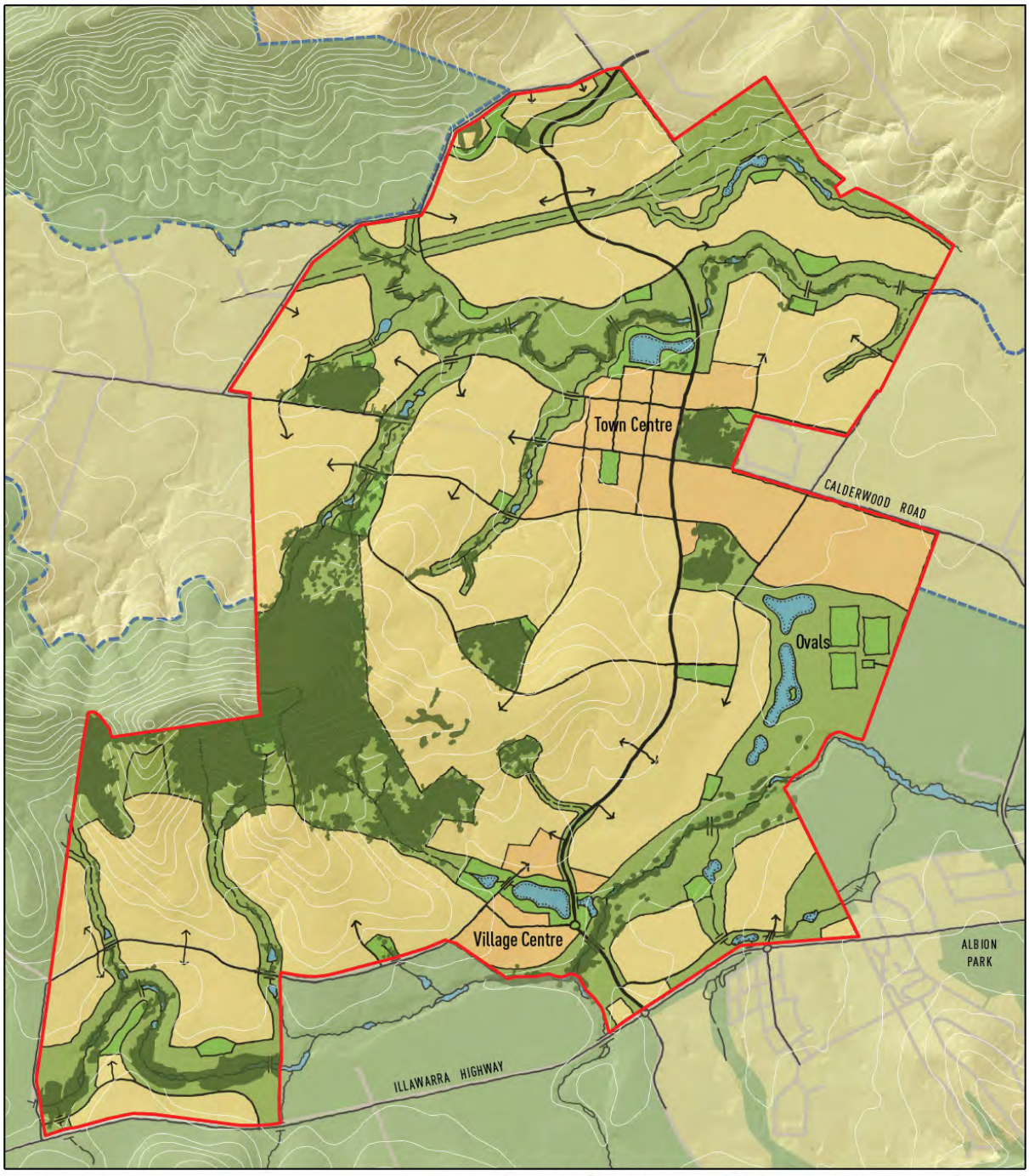


Figure 2: Final Concept Plan

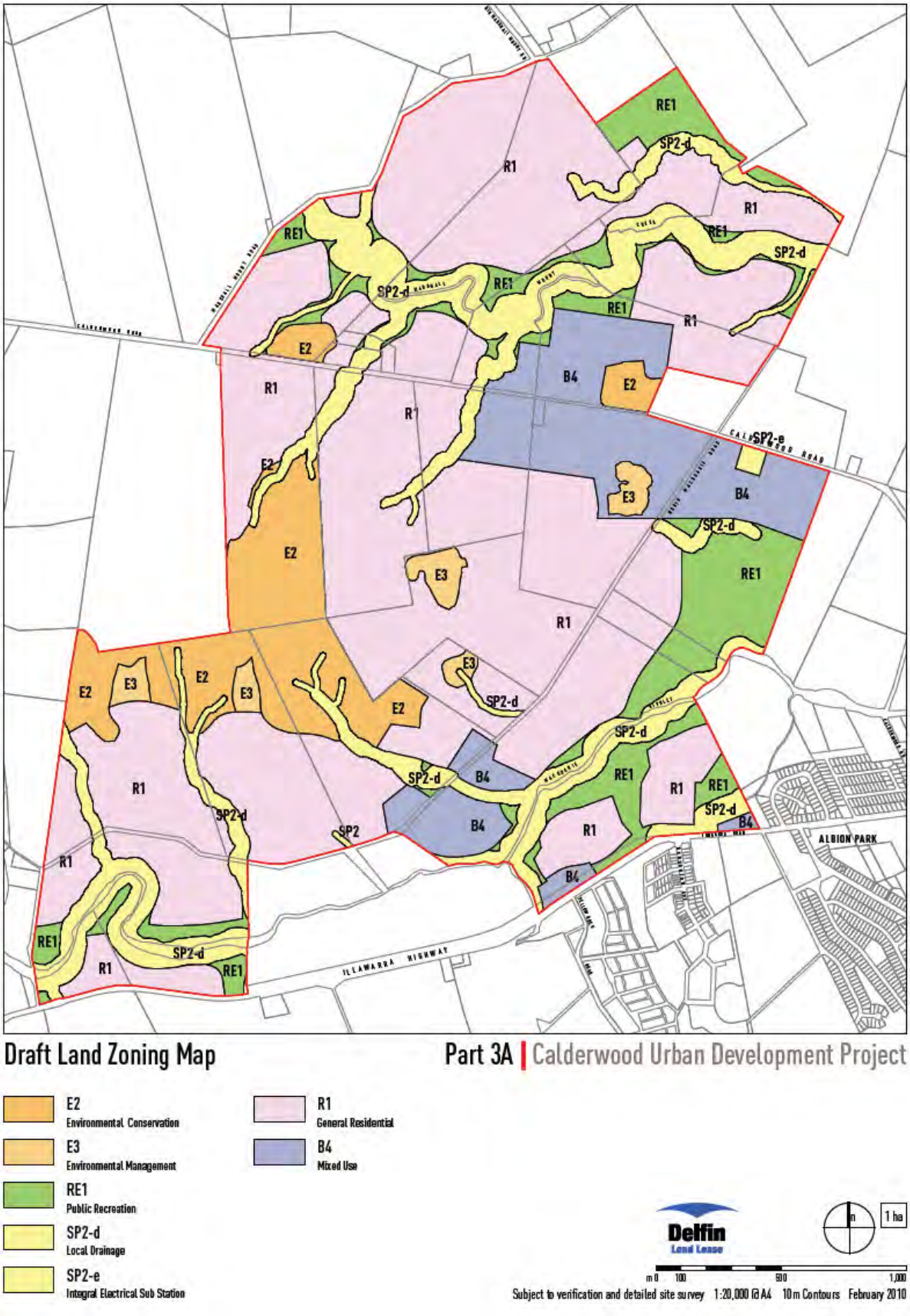


Figure 3: Draft Zoning Plan

1.3 PLANNING PROCESS

Changes in outlook arising from global, national and regional factors influencing investment and delivery certainty, housing supply and affordability and employment and economic development also add to the case for immediate commencement of the Calderwood Project.

In April 2008 the Minister for Planning issued terms of reference for the preparation of a Justification Report to address the implications of initiating the rezoning of Calderwood for urban development including associated staging, timing and infrastructure considerations.

In February 2009 the Minister for Planning considered a Preliminary Assessment Report for the Calderwood Urban Development Project that provided justification for the planning, assessment and delivery of the project to occur under Part 3A of the EP&A Act, having regard to the demonstrated contribution that the project will have to achieving State and regional planning objectives.

Subsequently, on the 16 April 2009, pursuant to Clause 6 of SEPP Major Development, the Minister for Planning formed the opinion that the Calderwood Urban Development Project constitutes a Major Project to be assessed and determined under Part 3A of the EP&A Act, and also authorised the submission of a Concept Plan for the site. In doing so, the Minister also formed the opinion that a State significant site (SSS) study be undertaken to determine whether to list the site as a State Significant site in Schedule 3 of SEPP Major Development.

The Part 3A process under the EP&A Act allows for the Calderwood Urban Development Project to be planned, assessed and delivered in an holistic manner, with a uniform set of planning provisions and determination by a single consent authority. Given the scale of the proposal, the Concept Plan and SSS listing provide the opportunity to identify and resolve key issues such as land use and urban form, development staging, infrastructure delivery and environmental management in an integrated and timely manner.

1.4 REPORT REQUIREMENTS & OBJECTIVES

This report has been prepared to fulfil the Environmental Assessment Requirements issued by the Director General for the inclusion of the Calderwood site as a State Significant Site under SEPP Major Development, and for a Concept Plan approval for the development. Specifically, this report addresses the following requirements:

- *Consideration of all relevant State Environmental Planning Policies, planning instruments (including relevant Council LEP and DCP instruments) and relevant legislation and policies including the Illawarra Regional Strategy.*
- *Address the impact of the development on existing native flora and fauna and their habitats, including identified threatened species (e.g. Illawarra Lowland Grassy Woodland, and Lespedeza juncea and Chonzema parviflora species), having regard to the Threatened Species Assessment Guidelines and recommend offset measures to avoid or mitigate impacts on threatened species and their habitat.*
- *Evaluate the ecological values of Johnston's Spur and Yallah-Calderwood Regional Habitat Corridor on this site for development (including any road upgrades).*
- *Identify the ecological attributes of the lands proposed for dedication and how the environmental land offsets scheme will mitigate the impacts of the development.*
- *Discuss the development of ecological corridors to link flora and fauna corridors both on and adjoining the site.*

Objectives of this study are to:

- Undertake a strategic biodiversity assessment including a flora and fauna study, an analysis of ecological values and identification and high-quality mapping of areas of high, moderate and low ecological value
- Identify innovative management frameworks for ecological and biodiversity issues which enable long term conservation and management, while facilitating the development outcomes
- Ensure the statutory requirements for the protection, restoration and enhancement of threatened species, populations, ecological communities and their habitats are met

In accordance with the Director General's Requirements this report has been prepared following consultation with the following agencies:

- DECCW consultation meeting on 20th October 2009 (minutes are available in Appendix F).

1.5 METHODOLOGY OVERVIEW

This report demonstrates the objectives are achieved through a methodology based on the *Guidelines for Threatened Species Assessment (DEC & DPI, 2005).* An overview of the methodology is provided below; full details can be found in **Appendix A**.

- Literature review of previous work
- Database search for threatened species, populations and ecological communities
- Assessment of statutory requirements such as *Threatened Species Conservation Act*, *Environment Protection and Biodiversity Conservation Act*, *Water Management Act*, *Fisheries Management Act*
- Detailed field validation of existing vegetation, threatened species and habitat condition mapping and assessments
- Analysis and identification of ecological constraints
- Strategic conservation planning across the site
- Recommendations for the Concept Plan
- Impact assessment of the Concept Plan

1.6 STUDY AREA ENVIRONMENTAL CHARACTER

The Calderwood study area has been subject to long term rural land uses and currently includes dairy farming, grazing, horse studs, a cemetery, church and private residences.

Johnston's Spur consists of large patches of remnant native vegetation and weedy regrowth and extends into the middle portion of the site. The spur has been identified as an area of high conservation value by DECCW, Wollongong Council and Shellharbour Council.

The land ranges from gently sloping (0-5 degrees) in the east of the study area, with an elevation of about 15 m, to undulating and steep (>14 degrees) towards the west and south of the site. Higher points rise steeply to about 190 m at Mount Johnston in the south west of the site.

Marshall Mount Creek flows in an easterly direction through the northern portion of the study area, eventually linking into the Macquarie Rivulet to the east of the site. The whole of the site is contained within the drainage catchment of the Macquarie Rivulet.

The study area is underlain by Quaternary sediments on the floodplains which include shale based soils in the lower lying areas generally south of Marshall Mount Creek, through sedimentary strata of the Berry Formation on the footslopes, to an outcrop of volcanics of Cambewarra latites at the highest point

of the study area around Mount Johnston. There is also an area underlain by Budgong sandstone at the northern boundary of the study area towards Marshall Mount.

2 Results

This section outlines the results of the literature review, database searches and field assessment.

2.1 VEGETATION COMMUNITIES

Figure 4 shows the distribution of vegetation community types and conditions across the Calderwood study area. Eleven vegetation community types have been identified through the field investigation and review of NPWS (2002a) vegetation mapping. The native vegetation communities are:

- Coastal Grassy Red Gum Forest
- Lowland Dry-Subtropical Rainforest
- Lowland Woollybutt-Melaleuca Forest
- Moist Box-Red Gum Foothills Forest
- Riparian River Oak Forest

Detailed descriptions of the native vegetation communities are provided in **Appendix B.**

2.1.1 Conservation status

Of the five native vegetation communities identified, four are sub-sets of Endangered Ecological Communities (EEC) listed on the schedule of the NSW *Threatened Species Conservation Act 1995* (TSC Act), as indicated in **Table 1.**

Table 1: Endangered ecological communities (by sub community)

EEC LISTED ON SCHEDULE 1 OF TSC ACT	CORRESPONDING SUB COMMUNITY ON SITE*
Illawarra sub tropical rainforest in the Sydney Basin	Lowland Dry-Subtropical Rainforest
Illawarra lowlands grassy woodland in the Sydney Basin	Lowland Woollybutt-Melaleuca Forest
	Coastal Grassy Red Gum Forest
River-Flat Eucalypt Forest on Coastal Floodplain	Riparian River Oak Forest

*Shown in **Figure 4**

None of the communities found in the study site, or immediately adjacent to the study site, are matters of National Environmental Significance (NES) as described in the schedules of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

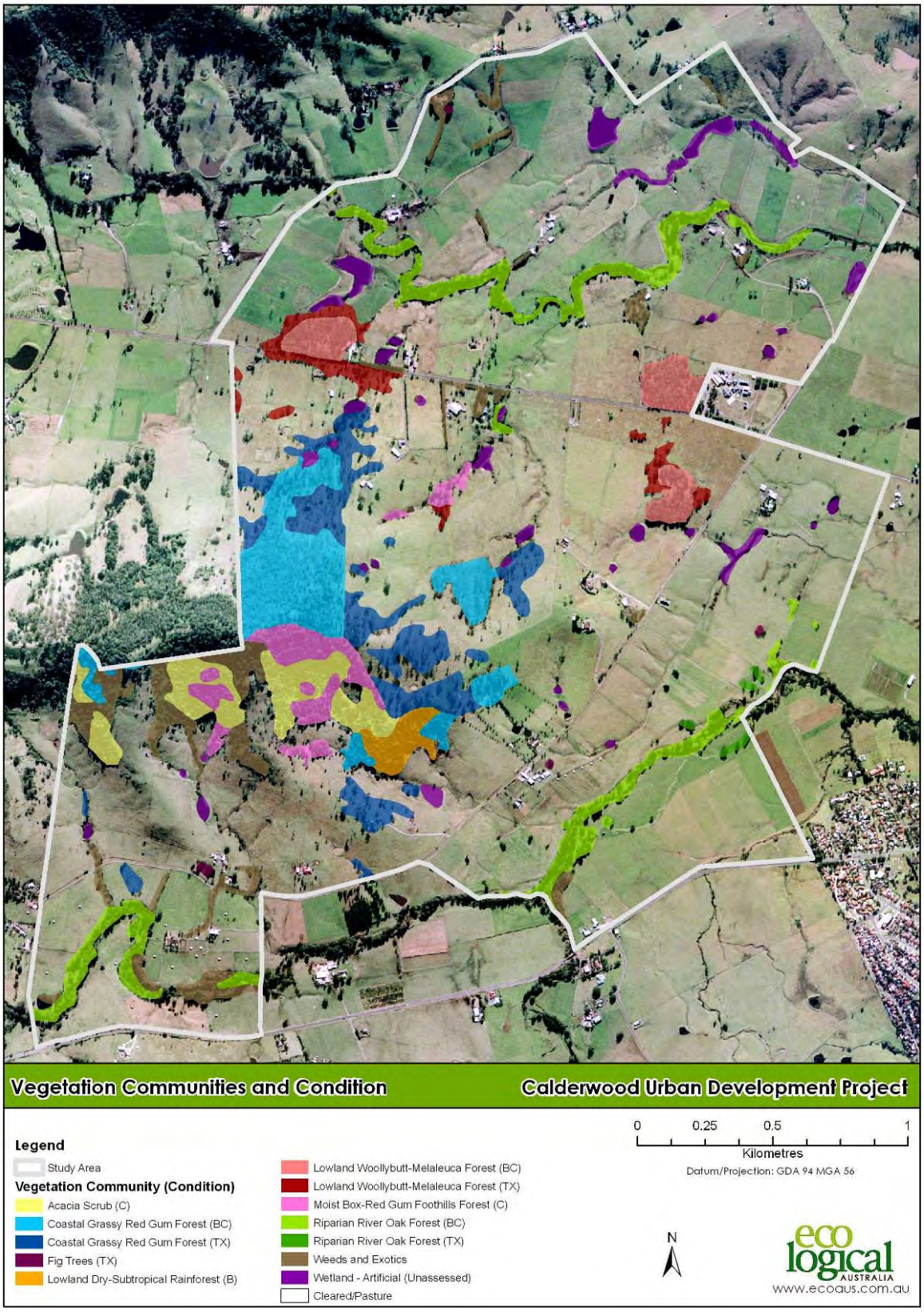


Figure 4: Vegetation communities and condition

2.1.2 Condition

Remnant vegetation community condition codes used in **Figure 4** and **Table 2** were developed by NPWS as part of the native vegetation mapping project (NPWS 2002a). These provided the basis for the condition assessment of the study area, as described in **Appendix A**.

Over 75% of the study area has been heavily modified by clearing for grazing, particularly on the lower slopes and foothills within the site.

The largest patch of native vegetation is located on Johnston's Spur. It comprises Coastal Grassy Red Gum Forest (an EEC), Moist Box-Red Gum Foothills Forest and Lowland Dry-Subtropical Rainforest (an EEC). The core area of the Coastal Grassy Red Gum Forest is in moderate condition, with the outer margins comprising scattered trees.

Acacia scrub regrowth (13.44 ha) and weeds and exotics (approximately 21 ha) add to the area of vegetation cover on the southern side of Johnston's Spur.

Riparian vegetation along Marshall Mount Creek and Macquarie Rivulet comprises approximately 26.75 ha of Riparian River Oak Forest (an EEC). This is mostly contiguous, highly disturbed and regenerating with varying levels of weed invasion. Riparian vegetation helps to protect water quality and reduces the potential for erosion. (Additional information about riparian features and values is given in **Section 3.3**. and in the geomorphology reports by Cardno Forbes Rigby).

There are three pockets of Lowland Woollybutt-Melaleuca Forest (an EEC). The core of these areas is moderately disturbed (about 10 ha collectively). The margins comprise scattered trees (about 7 ha collectively).

All stands of remnant native vegetation contain established mature trees, with areas classed as condition 'B', exhibiting a more complete range of age classes. Tree hollows were common throughout most areas of remnant native vegetation on the site.

There are several areas of paddock trees across the site, that are mapped with the condition code 'TX'. Typically these areas have a very sparse native canopy and an understorey of exotic pasture. Based on the canopy species present these areas have been assigned to the most closely related ecological community. However due to the long term disturbance history of the site, it is highly unlikely that these areas would regenerate to the corresponding community and significant artificial enhancement would be required to reinstate 'natural' shrub and ground layers.

Table 2: Vegetation communities on the study site, by conservation significance and condition

VEGETATION TYPE	CONSERVATION VALUE	VEGETATION CONDITION (ha)*				TOTAL (ha)	% OF SITE
Native vegetation		**Moderate disturbance (B)**	**High disturbance, regenerating (C)**	**Scattered trees, thinned canopy (TX)**	**No relevant condition code**		
Coastal Grassy Red Gum Forest	**EEC**	22.82	3.62	25.12		51.56	7.16%
Lowland Dry-Subtropical Rainforest	**EEC**	3.73				3.73	0.52%
Lowland Woollybutt-Melaleuca Forest	**EEC**	10.06	0.01	7.10		17.17	2.38%
Moist Box-Red Gum Foothills Forest			10.68			10.68	1.48%
Riparian River Oak Forest	**EEC**	3.00	22.87	0.88		26.75	3.71%
Acacia Scrub			13.44			13.44	1.87%
Native Vegetation Sub Total		**39.61**	**50.62**	**33.10**		**123.33**	17.13%
Exotic veg & cleared land							
Artificial Wetlands					11.60	11.60	1.61%
Fig Trees				0.48		0.48	0.07%
Weeds and Exotics					20.67	20.67	2.87%
Cleared/Pasture					563.98	563.98	78.32%
Exotic Vegetation Sub Total						596.73	82.87%
TOTAL SITE		**39.61**	**50.62**	**33.58**	**596.25**	**720.06**	

*Refer to **Appendix A** for definitions of condition

2.2 THREATENED SPECIES AND POPULATIONS

No threatened species or populations were observed on site during fieldwork.

2.2.1 Flora

Threatened flora species and populations that have been recorded within a 10 km radius of the site are shown in **Appendix C** based on records from the NSW Wildlife Atlas database and the EPBC Act search tool. The likelihood of these species occurring at Calderwood was considered by cross-checking the habitat preferences for each species against the known habitats at Calderwood.

Table 3 identifies four flora species that were found to be likely or have the potential to occur within the study site.

Table 3: Flora likely or with potential to occur at Calderwood

SCIENTIFIC NAME	COMMON NAME	NSW LEGAL STATUS	EPBC LEGAL STATUS	LIKELIHOOD OF OCCURRENCE
Cynanchum elegans	White-flowered Wax Plant	E1	E	Likely
Daphnandra sp. Illawarra *(Daphnandra johnsonii)*	Illawarra Socketwood	E1	E	Likely
Pterostylis gibbosa	Illawarra Greenhood Orchid	E1	E	Potential
Zieria granulata	Hill Zieria	E1	E	Potential

Legal Status
*TSC Act: **E1** - Endangered; **E2** – Endangered population; **V** – Vulnerable*
*EPBC Act: Matters of National Environmental Significance – **E** – Endangered; **V** – Vulnerable*

2.2.2 Fauna

A similar process was undertaken for fauna species to determine the likelihood of occurrence at Calderwood. From the full list of species given in **Appendix C,** 22 species were found to be likely to occur or have potential to occur on site. These are listed in **Table 4**. Eight of these species are listed under the EPBC Act.

Table 4: Fauna likely or with potential to occur at Calderwood

SCIENTIFIC NAME	COMMON NAME	NSW LEGAL STATUS	EPBC LEGAL STATUS	LIKELIHOOD OF OCCURRENCE
Birds				
Apus pacificus	Fork-tailed Swift		M	Potential
Ardea ibis	Cattle Egret		M	Likely
Botaurus poiciloptilus	Australasian Bittern	V		Potential
Callocephalon fimbriatum	Gang-gang Cockatoo	V		Potential
Calyptorhynchus lathami	Glossy Black-Cockatoo	V		Potential
Ixobrychus flavicollis	Black Bittern	V		Likely
Lathamus discolor	Swift Parrot	E1	E	Likely
Lophoictinia isura	Square-tailed Kite	V		Potential
Merops ornatus	Rainbow Bee-eater		M	Likely
Neophema pulchella	Turquoise Parrot	V		Likely
Ninox strenua	Powerful Owl	V		Potential
Pachycephala olivacea	Olive Whistler	V		Likely
Petroica rodinogaster	Pink Robin	V		Potential
Rostratula australis	Australian Painted Snipe		V	Likely
Rostratula benghalensis s. lat.	Painted Snipe		M	Likely
Stictonetta naevosa	Freckled Duck	V		Likely
Mammals				
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Likely
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V		Potential
Miniopterus schreibersii oceanensi	Eastern Bent-wing Bat	V		Likely
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Likely
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V		Potential
Scoteanax rueppellii	Greater Broad-nosed Bat	V		Potential

Legal Status
*TSC Act: **E** - Endangered; **V** – Vulnerable*
*EPBC Act: Matters of National Environmental Significance **E-** Endangered, **V**- Vulnerable, **M -** Migratory*

2.3 RIPARIAN AND AQUATIC VALUES

The study area includes a section of Marshall Mount Creek and part of the northern bank of Macquarie Rivulet. Both streams have highly disturbed, regenerating native riparian vegetation (Riparian River Oak Forest) and provide habitat for aquatic and riparian species.

The streams were assessed to determine habitat value and condition. Results are summarised in **Table 5** and **Table 6.** The minor streams on site were not assessed because of their limited value as aquatic habitat.

Figure 5 illustrates the overall stream condition of surveyed sections of Marshall Mount Creek and Macquarie Rivulet. Condition deteriorates from moderate to poor moving downstream in Marshall Mount Creek. Stream condition is better overall in Macquarie Rivulet (moderate/good) than in Marshall Mount Creek.

As discussed in **Tables 5** and **6**, current agricultural practices have degraded water quality in the study area. Removal of cattle and implementation of water sensitive urban design as part of the proposed Calderwood development should improve the quality of flows to Lake Illawarra and the value of aquatic habitat within and downstream of the site (for full detail refer to Cardno Forbes Rigby Geomorphology Assessment). The lake is an important ecological and recreational feature in the region and some of the fringing wetlands whilst unlikely to be influenced by flows from this site, are protected under SEPP14.

No aquatic or marine species listed under the *Fisheries Management Act, 1994* are known or likely to occur on the site. **Table 5** provides an analysis of onsite aquatic habitat values that are largely degraded through erosion, cattle grazing and unfettered access to riparian areas and the construction of a number of impediments to the movement of aquatic species (dams, causeways etc). The development can facilitate improvement of aquatic habitat through the removal of grazing pressures, establishment of native vegetation, improvements to water quality and the removal of in-stream structures. Re-introduction of woody debris to channels would provide additional aquatic habitat, however such an approach would need to be undertaken in a manner that does not result in unwanted changes to flood dynamics.

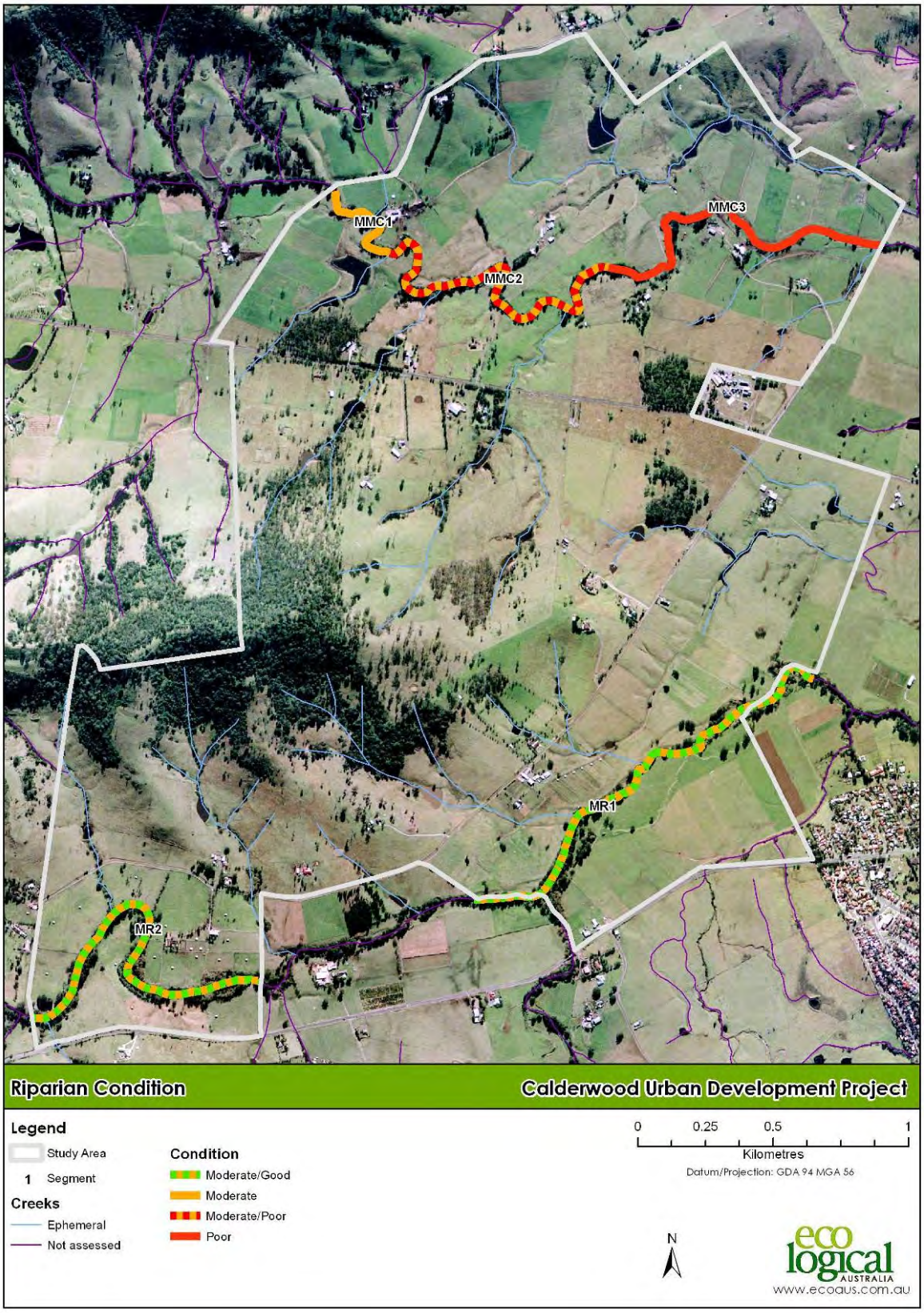


Figure 5: Riparian condition

Table 5: Results of stream assessment – Marshall Mount Creek

Marshall Mount Creek									
Section	**Bed & Bank**	**Water Quality**	**Instream Habitat**	**Connectivity**	**Hydrology**	**Streamside Vegetation**	**Vegetation Recovery Potential**	**Overall Stream Condition**	**Overall Stream Recovery Potential**
MMC 1	*Moderate/Good* Generally stable with limited areas of localised erosion. Bank profile appears to be largely unmodified though may be slightly steeper along outsides due to past erosion and vegetation loss. Benches present along insides, with riffles connecting wider runs and pools.	*Moderate/Poor* Moderate to high cover of filamentous algae, with unrestricted cattle access	*Moderate/Poor* Occasional woody debris but limited. Occasional instream macrophytes (predominantly introduced). Much of bed covered with algae and organic material. Limited larger rocks in riffles and pool edges.	*Moderate/Good* Limited barriers upstream with occasional small scale stream crossings.	*Good* Some small and medium sized dams upstream	*Poor* Thin and patchy strip of *Casuarina cunninghamiana* and ocassional *Erythrina sykesii* as canopy to 40 m. Midstorey and understorey vegetation confined to localised areas of previous tree recruitment. Groundcover dominated by exotic grasses with low litter and native diversity.	*Moderate*	*Moderate*	*Good*
MMC 2	*Moderate/Poor* Moderate to locally severe erosion along banks. Water crossing from packed earth. Frequent cattle tracks along banks.	*Moderate/Poor* Moderate to high cover of filamentous algae, with unrestricted cattle access. Areas of high turbidity.	*Moderate/Poor* Occasional woody debris but limited. Occasional instream macrophytes (predominantly introduced). Much of bed covered with algae and organic material. Limited larger rocks in riffles and pool edges. Small *Azolla sp* patches.	*Moderate/Poor* Disruption of local connectivity through earthen and concrete causeway stream crossings, limits upstream movement of fish during low and moderate flows. Erosion likely to have contributed to chain of ponds type river style.	*Good* Some small and medium sized dams upstream	*Poor* Thin and patchy strip of *Casuarina cunninghamiana* and ocassional *Erythrina sykesii* as canopy to 40 m. Management and removal of trees for powerline easment. Large areas of heavy weed invasion including *Lantana camara, Rubus fruticosus, Ageratina riparia, Solanum mauritianum, Delairea oderata* threatening future establishment of canopy species. However greater native species richness in understorey and midstorey.	*Moderate/ Poor*	*Moderate/ Poor*	*Moderate*
MMC 3	*Poor* Large scale localised erosion and moderate erosion, bank slumping and tracks throughout. Unrestricted cattle access through most of section.	*Poor* High nutrient load due to cattle access and nearby runoff from areas with concentrated manure. Erosion contributing to high turbidity. Growth of blue-green algae prevalent in east.	*Poor* Occasional woody debris. Instream macrophytes rare (predominantly introduced). Much of bed covered with algae and organic material. Limited larger rocks in riffles and pool edges.	*Moderate/Poor* Disruption of local connectivity through earthen and concrete causeway stream crossings, limits upstream movement of fish during low and moderate flows. Erosion likely to have contributed to chain of ponds type river style	*Good* Some small and medium sized dams upstream	*Poor* Thin and patchy strip of *Casuarina cunninghamiana* and ocassional *Erythrina sykesii* as canopy to 25 m. Localised areas of heavy weed invasion.	*Moderate/ Poor*	*Poor*	*Moderate/ Poor*

Table 6: Results of stream assessment – Maquarie Rivulet

Macquarie Rivulet									
Section	**Bed & Bank**	**Water Quality**	**Instream Habitat**	**Connectivity**	**Hydrology**	**Streamside Vegetation**	**Vegetation Recovery Potential**	**Overall Stream Condition**	**Overall Stream Recovery Potential**
MR 1	*Good* Main stream channel experiencing only minor localised erosion for most of this section. Cattle access prevented from main stream channel.	*Good* Appears to be of good quality. Low turbidity and buffering vegetation present. High nutrient indicators in anabranches.	*Moderate/Good* Vegetated and sandy bars present and fringing macrophytes occasional. Instream wood occasional along with outcropping rock. Bed sediments range from sand to pebbles and large stones with riffle sections also present.	*Good* No local barriers to connectivity.	*Moderate/Good* Occasional small and medium farm dams and historical diversions to flow along minor tributaries upstream.	*Moderate/Poor* Well established large *Casuarina cunninghamiana* to 40 m forming canopy and riparian width up to approx 50 m. Good recruitment of canopy species. However, understorey and ground cover dominated by exotics, with aggressive weed invasions in patches including *Erythrina sykesii, Lantana camara, Tradescantia fluminensis, Ageratina riparia, Solanum mauritianum, Cardiospermum grandiflorum, Delairea oderata, Ehrharta erecta, Ricinus communis*. Some native understorey and ground cover components.	*Moderate/ Poor*	*Moderate/ Good*	*Moderate*
MR 2	*Moderate/Good* Generally stable with limited areas of localised erosion. Cattle access prevented from main stream channel. Bed consists of sandy alluvial sediments and rock.	*Good* Water is clear and flowing freely with some minor algal growth in places.	*Moderate/Good* Abundant woody debris in stream. Bed sediments range from sand to pebbles and large stones with riffle sections also present.	*Good* No significant barriers to connectivity, one localised rocky bar/crossing at the Fischl property (photo185 231) however this does not impede flow.	*Moderate/Good* Occasional small and medium farm dams and historical diversions to flow along minor tributaries upstream.	*Moderate/Poor* Large mature *Casuarina cunninghamiana* along the reach, including stags and hollows extending out to widths of up to 50m from the bank. Understory and groundcover vegetation a is predominately weed infested, with patches of aggressive weed invasions extending down into the sandy bars of shallow beds exposed at low flow (photo 143-240). Most common weeds include *Lantana camara, Erythrina sykesii* and *Tradescantia fluminensis.*	*Moderate*	*Moderate/ Good*	*Moderate*

3 Strategic conservation planning

This section outlines the results of strategic conservation planning and the implications for development of the concept plan. The methodology for the conservation significance assessment (CSA) and constraints analysis is described in **Appendix A.**

Strategic conservation planning for the Calderwood Urban Development Project aims to:

- Connect with regional biodiversity corridors such as the Yallah-Calderwood faunal linkage corridor
- Establish a comprehensive, hierarchical network of biodiversity corridors based on the results of the conservation significance assessment
- Define land use zoning and protective mechanisms for the corridors
- Maintain, protect and improve the majority of existing native vegetation and fauna habitat
- Integrate passive recreation and water sensitive urban design features in suitable areas of the corridor

3.1 CONSERVATION SIGNIFICANCE ASSESSMENT (CSA)

Figure 6 shows the outcome of this assessment and **Table 7** shows the breakdown of each CSA category by native vegetation type. Of the 146.03ha of vegetation on the study site, 85.05 ha has been classified as Primary vegetation in the CSA. This equates to 11.81% of the total study site.

The good condition Primary, Support for Primary and other native vegetation categories form the basis of the Environmentally Significant Lands (ESL) overlay (further discussed in later chapters).

Table 7: Vegetation community by CSA classification

	CSA Classification				
Vegetation Community (Ha)	Primary	Support for Primary	Enhancement	Other Native Vegetation	Grand Total
Coastal Grassy Red Gum Forest	43.65		7.19	0.72	**51.56**
Lowland Dry-Subtropical Rainforest	3.73				**3.73**
Lowland Woollybutt-Melaleuca Forest	16.17	0.01	0.98		**17.17**
Moist Box-Red Gum Foothills Forest	2.28	8.40			**10.68**
Riparian River Oak Forest	5.77	19.71		1.27	**26.75**
Acacia Scrub	13.44				**13.44**
Artificial Wetlands			7.77	0.57	**8.34**
Fig Trees			0.09		**0.09**
Weeds and Exotics			14.27		**14.27**
Grand Total	**85.05**	**28.12**	**30.31**	**2.56**	**146.03**
% of all vegetation (excluding cleared/pasture)	58.24	19.26	20.76	1.75	
% of total Site	**11.81**	**3.91**	**4.21**	**0.35**	**20.28**

3.2 RECOMMENDATIONS

Table 8 below provides a series of recommendations that have been considered by Delfin during the preparation of the concept plan and identification of land use zones across the site. This table should be read with reference to **Figure 7**. The preferred management and recommended zones were derived from consideration of greenspace management options in **Appendix E.**

The strategic focus is on the conservation and enhancement of ecological corridors and areas of high conservation significance. The identification of regional and secondary corridors reflects the relative importance of the habitat corridors and the nature of the species likely to move between valley floor, midslope and ridgeline ecosystems.

Such an approach whilst reflecting current climatic and ecosystem conditions also provides for species movement in response to different climatic conditions brought on by climate change. This provides for the movement of species between habitat types and across ecotones and access to significant areas of refugia, particularly the extensive bushland areas of the escarpment and Woronora Plateau.

Table 8: Recommendations

TYPE	DESCRIPTION (Refer to **Figure 7** for locations)	OBJECTIVES	PREFERRED MANAGEMENT OPTION & RECOMMENDED REZONING*
Johnston's Spur conservation area	The most significant area of native vegetation habitat within the study area is on Mount Johnston and its associated spurs. This is part of the Yallah-Calderwood Regional Corridor and warrants conservation and active rehabilitation (e.g. weed removal) to maintain and improve its ecological values. Threatened species habitat and a number of vegetation communities exist in this area, including EECs - Lowland Dry-Subtropical Rainforest and Coastal Grassy Red Gum Forest.	Primary – biodiversity conservation Secondary – passive recreation (e.g. walking trails, bike paths, seating) Tertiary – small scale development in low impact locations	Public ownership (Council) LEP zone E2 – environmental conservation OR E3 – environmental management in isolated areas which are cleared.
Primary corridors	Vegetation along Marshall Mount Creek and Macquarie Rivulet needs to be maintained and improved because as it provides important habitat for riparian and aquatic ecosystems and contributes significantly to faunal habitat connectivity between the escarpment and the coast.	Primary - Biodiversity conservation and connectivity Secondary – passive recreation (e.g. walking trails, bike paths, seating) Tertiary – active recreation in low impact locations (e.g. playing fields)	Public Ownership (Council) LEP zone E2 – environmental conservation or, SP2 - infrastructure in areas required for WSUD, drainage and open space. With ESL Layer to protect existing vegetation
Secondary corridors	Some tributaries of the main creeks have been identified as part of the ecological corridor network. Although these areas currently have limited ecological value, they would contribute to the north south connectivity of terrestrial remnant vegetation in primary conservation areas and corridors and provide a series of links for mobile fauna species like to move between valley and ridge environments.	Primary - Terrestrial habitat connectivity Secondary – Water sensitive urban design, drainage and passive recreation	Public Ownership (Council) LEP zone E3 – environmental management or, SP2 - infrastructure in areas required for WSUD, drainage and open space. With ESL Layer to protect existing vegetation
Reserves	There are four areas of remnant vegetation that are recommended for reserves. These are primary CSA areas comprising Lowland Woollybutt-Melaleuca Forest and Coastal Grassy Red Gum Forest (both EECs).	Two reserves have biodiversity conservation as the primary objective with passive recreation to be incorporated in a sensitive manner Two of the reserves have passive recreation as the primary objective reflecting the lower habitat quality (refer to Figure 7)	Public Ownership (Council) LEP zone E2 – environmental conservation for the biodiversity reserves and, LEP zone E3 – environmental management for passive recreation reserves
Mature Remnant Trees	There are a number of remnant native trees which are recommended for retention.	Retain as part of the urban environment subject to detailed assessment	Tree preservation order or similar. Detailed assessment included in the Statement of Commitments with habitat trees retained within an urban environment

*Refer to **Appendix E** for more information about management options

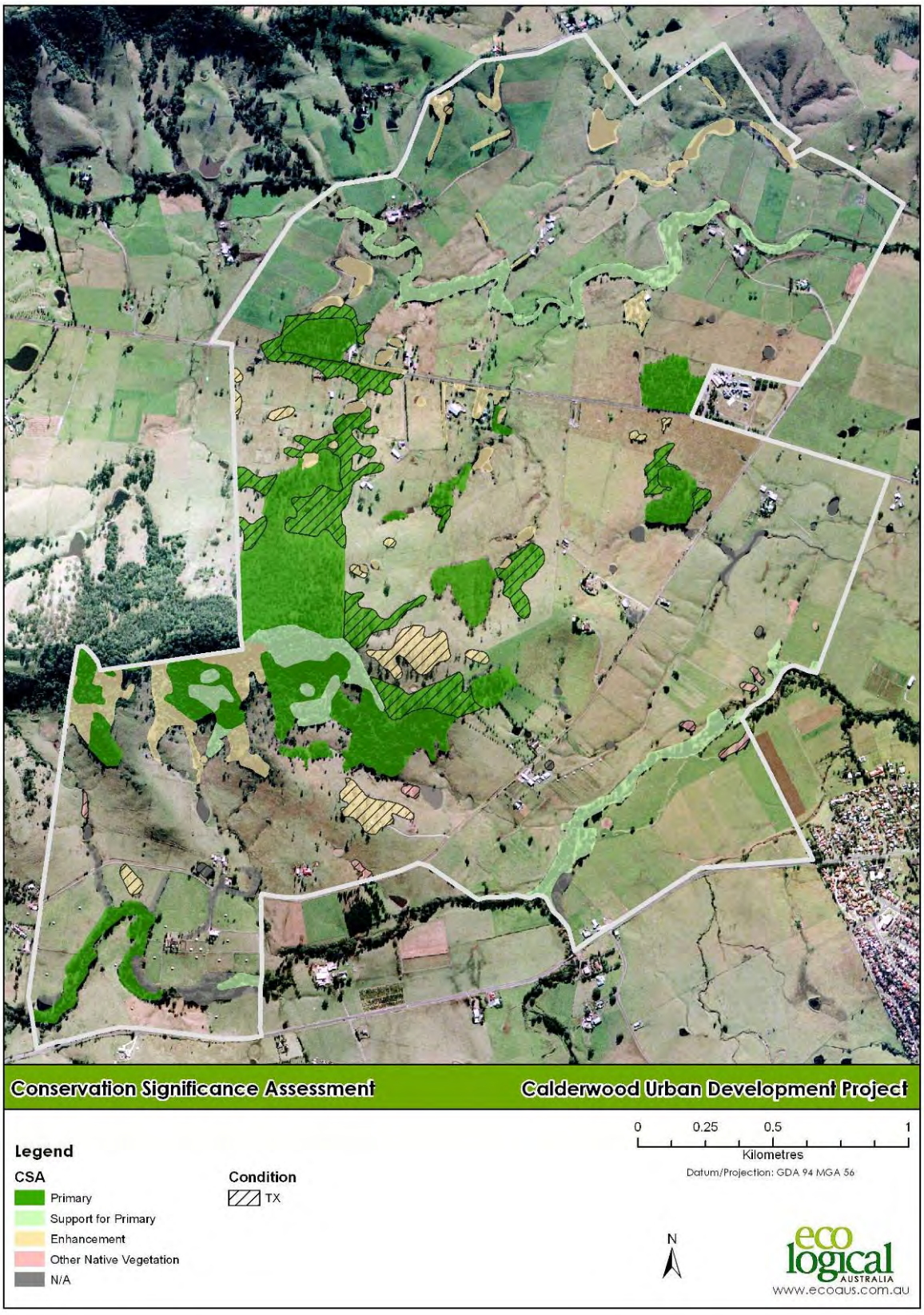


Figure 6: Conservation significance assessment

Figure 7: Recommended conservation areas

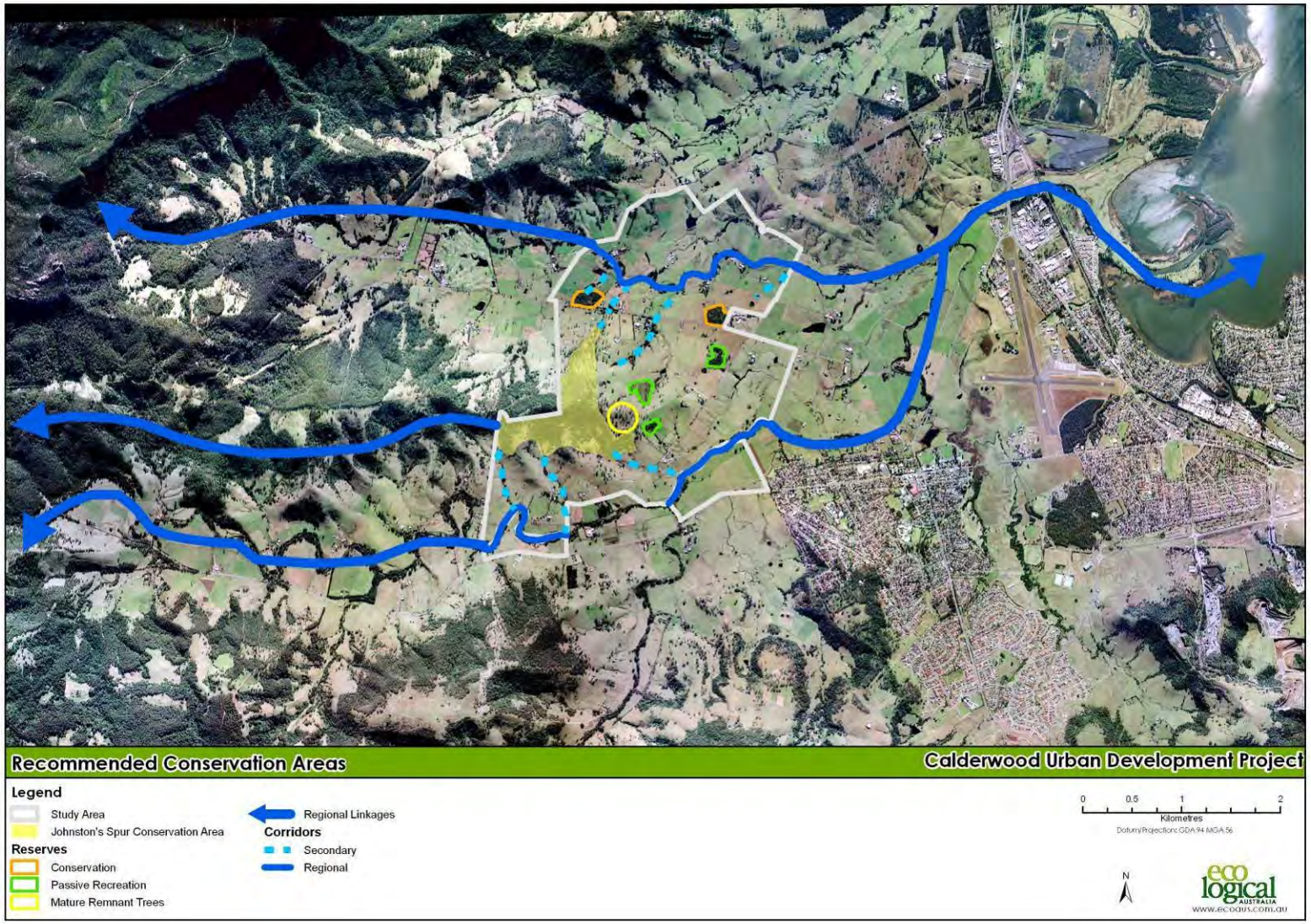


Figure 8: Regional Connectivity

4 Mitigation and impact assessment

4.1 MEASURES TO AVOID, MITIGATE AND OFFSET IMPACTS

Delfin have set an objective of improving the ecological value of the site through retaining areas of high conservation value and identifying a corridor network that reflects regional and local requirements. The proposed concept plan and land use zones achieve this and avoid significant impacts to ecological communities or threatened species.

Concept Plan

Review of the concept plan (**Figure 2**) indicates that the core ecological values of the site are to be retained. These core ecological values include Johnston's Spur, Marshall Mount Creek and Macquarie Rivulet as well as smaller pockets of good quality remnant native vegetation. With the retention of these key areas of remnant native vegetation there will not be a significant impact to threatened ecological communities, threatened species or their habitat.

The concept plan has incorporated significant terrestrial habitat connectivity both within the site (north south) and most importantly with offsite areas to the east and west, ensuring that the regional corridors linking the escarpment to the coast are maintained and improved.

The concept plan is strategic in nature, therefore ongoing protection of the native flora and fauna will be provided by the following measures;

Zoning and ESL

Specifically Delfin propose to protect the majority of habitat on site via zoning (Figure 3) and an Environmentally Significant Lands (ESL) layer which will serve as an additional consent requirement for any works proposed therein. These protective mechanisms will also be supported by the proposed future public ownership of E2 and SP2 zones.

E2, Environmental Conservation zones have been placed over Johnston's Spur and the highest value remnants stands. This zone is intended to protect land that has high conservation value. A number of land uses considered to be inappropriate for this zone have been mandated as prohibited uses. Passive recreation will be permissible in these areas and will principally involve walking paths and picnic tables in already open areas. Prior to construction of any such facilities, detailed seasonal field survey will be undertaken in these areas to locate potential threatened plants. These survey requirements will be identified in the legally binding Statement of Commitments.

E3, Environmental Management zones have been placed over native vegetation which have been found to be of lesser conservation value, or cleared areas within Johnston's 's Spur to protect the E3 areas from edge effects. The mandatory zone objectives focus on protecting, managing and restoring areas with special ecological, scientific, cultural or aesthetic values and to provide for a limited range of development that does not have an adverse effect on these values.

The native vegetation within the riparian corridors will be zoned SP2 Infrastructure (local drainage etc). This zone allows a number of uses that could impact on ecological values. Thus Environmentally Significant Lands (ESL) layer will provide an additional layer of protection to the vegetation within this zone.

The ESL layer has been developed in consultation with Delfin to ensure that native vegetation of high conservation significance is protected. The ESL layer comprises of all vegetation in good condition which is of Primary, Support for Primary and Other Native Vegetation significance as found by the conservation significance assessment (refer to section 3.1). The ESL layer is shown in Figure 9. The ESL Layer takes account of small areas of floodplain regrading works; these areas have been considered in the loss calculations of the impact assessment.

The ESL will be officially contained within the SEPP and identifies areas of ecological significance across the site and incorporates a special provision in the SEPP that establishes heads of consideration to be taken into account prior to determination of Development Approvals (DAs). The specific protection provisions proposed are contained in Appendix H: Environmentally Significant Lands Provisions.

Further protection is also afforded to this zone through the mandatory acquisition requirements of the SP2 zone. Ultimately, this land will be owner by the relevant local council.

Ownership

The proposed ongoing ownership plan for the site is to handover all E2, SP2 and RE1 (Public Recreation) to council. Delfin will rehabilitate these areas to a suitable condition prior to handover, details of which will be part of the Statement of Commitments.

Open Space Management

The open space management plan for the site incorporates passive uses for sensitive areas of the E2 zones, adjacent E3 zones and parks and reserves. Passive uses have been located to avoid impact to existing native vegetation communities wherever possible, and where potential threatened plant habitat may be impacted the Statement of Commitments requires detailed, seasonal field survey prior to works being undertaken. Figure 10 shows the proposed Landscape and Open Space Masterplan (full detail can be found in the Environmental Partnerships NSW Landscape and Open Space Masterplan report). As discussed above, open space areas will be owned and managed by local council.

Statement of Commitments

The statement of commitments will set out requirements for future assessments and approvals, as well as secure certain outcomes for the site (such as the need to assess and incorporate specific remnant trees into urban design – see Figure 7). It will be derived from the findings and conclusions of the technical assessments and will incorporate specific recommendations of the reports. It will be used to set up requirements for further analysis and investigation at subsequent stages of development.

Section 5 of this report outlines recommended environmental protection measures for inclusion in the statement of commitments. This will further ensure that the identified impacts to the biodiversity of the site are minimised throughout subsequent stages of development.

Summary

The design of the concept plan retains the core biodiversity areas within the site and incorporates both east-west and north-south habitat connectivity. In conjunction with the concept plan, the additional measures proposed through the zoning, ESL provisions, public ownership of environmental and open space zonings and requirements of the Statement of Commitments will ensure that significant impacts are avoided and the ecological values of the site are improved or maintained into the future.

In this context, the loss of a limited amount of poorer quality vegetation much of which is isolated paddock trees, is considered acceptable and does not warrant amelioration or offset measures.

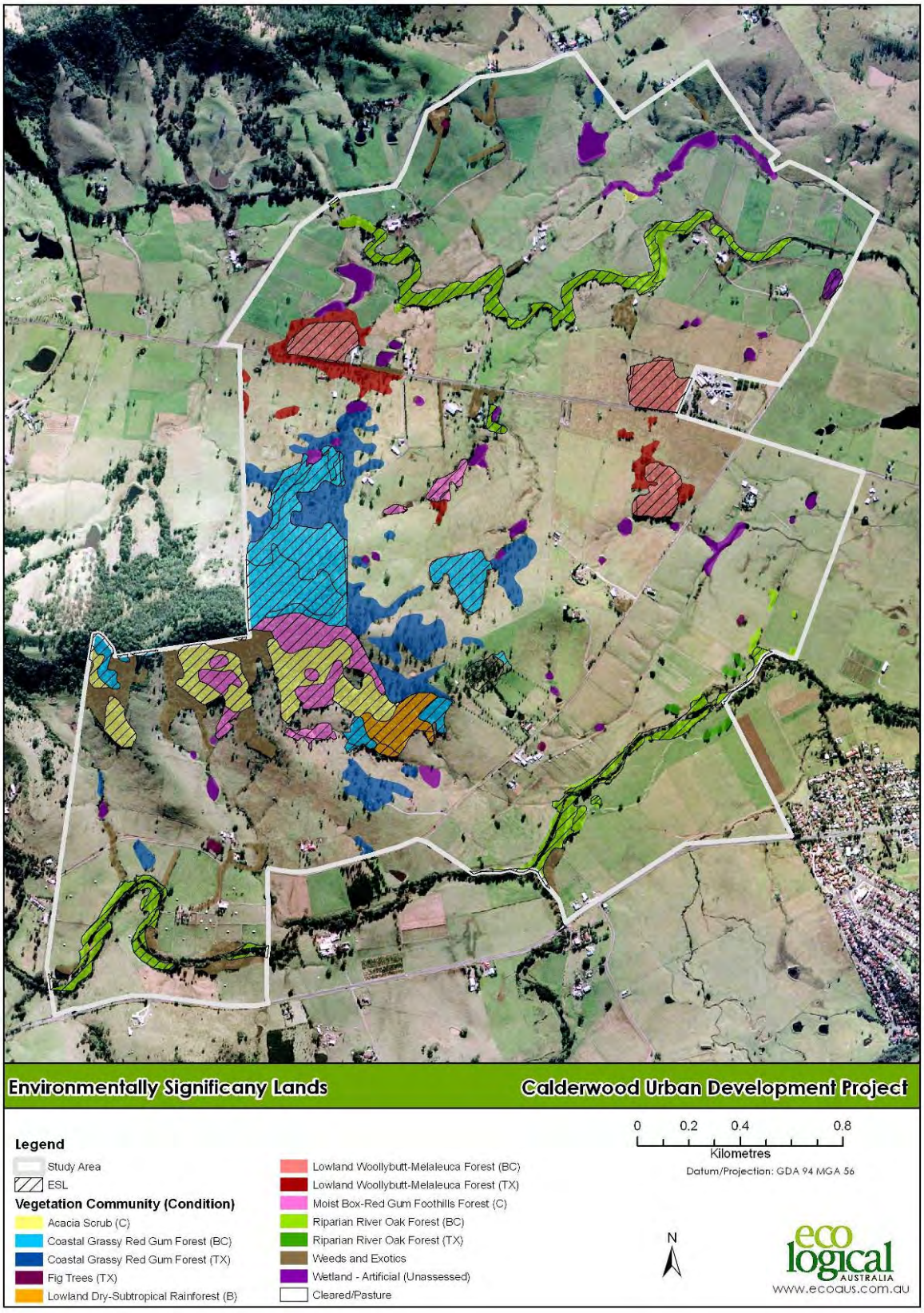
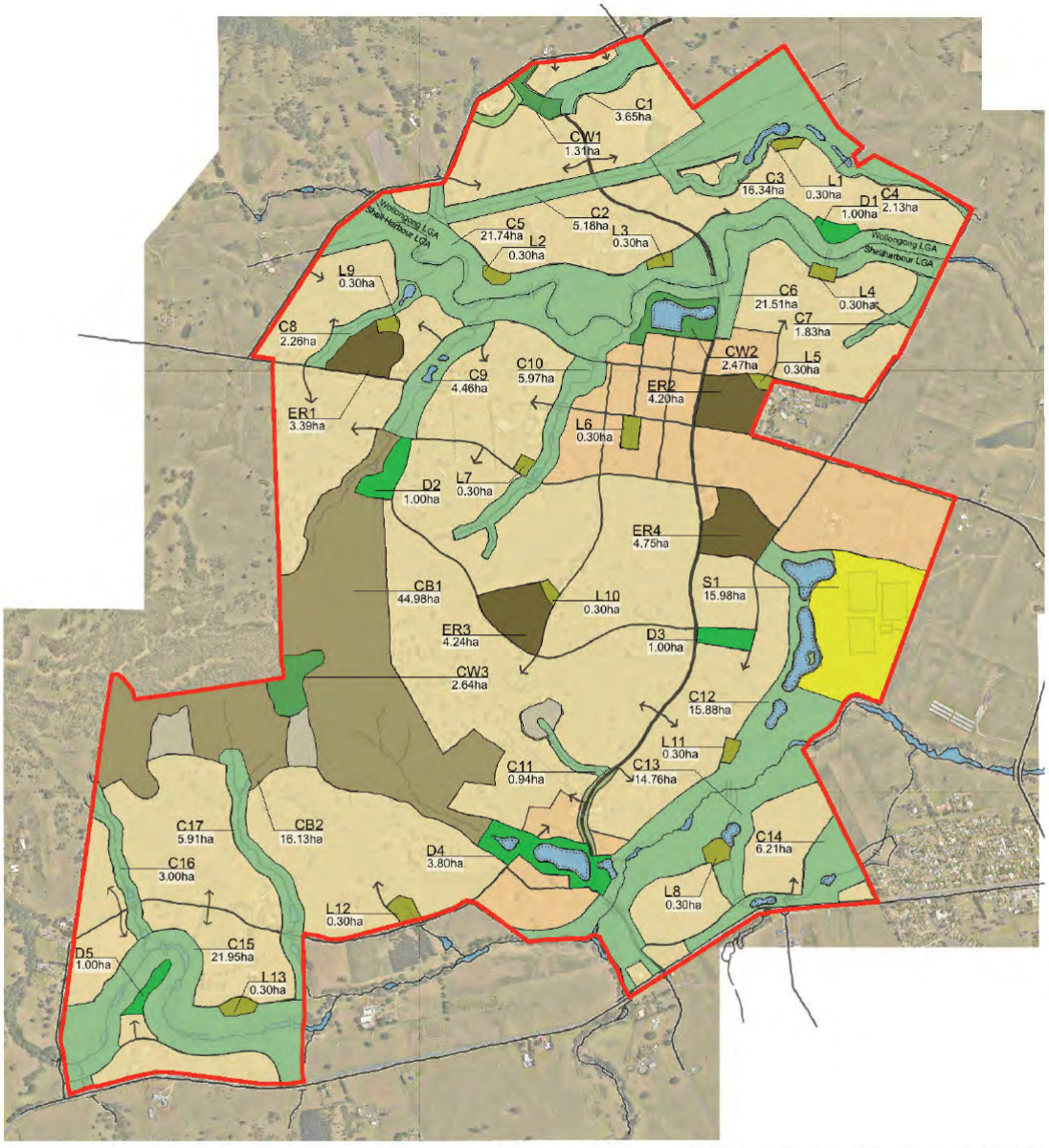


Figure 9: Environmentally Significant Lands

Landscape and Open Space Masterplan



Disclaimer: Final locations of sites subject to detailed design

Proposed Open Space - Whole Development
02.03.2010

Key	Code	Type	Paramaters	Base Requirement eg. Shellharbour (12,400 total pop'n)	Provision
	L1	Local Parks	0.3ha min 400m radius	4.09ha	3.90ha
	D1	District Parks	1.0ha min 800m radius	6.20ha	7.80ha
	CW1	Citywide Parks	1.0ha min	3.72ha	6.42ha
	S1	Sporting Grounds (Active Recreation)		21.08ha	15.98ha
		Paths in open space corridors (Active Rec - refer access plan)			4.43ha
			Total	35.09ha	38.53ha
	C1	Open Space Corridor		n/a	153.72ha
	ER1	Environmental Reserves		n/a	16.58ha
	CB1	Citywide Bushland		n/a	61.11ha
			Total		231.41ha

Figure 10: Proposed Open Space (Source: Environmental Partnership NSW - Landscape and Open Space Masterplan)

4.2 IMPACT ASSESSMENT

This impact assessment includes quantification of impacts on threatened species and their habitat through calculations of vegetation disturbance/loss based on the proposed zoning for the site. The ESL Layer takes account of small areas of clearing required for floodplain regrading works; these areas have been considered in the loss calculations of the impact assessment.

4.2.1 Calculation of vegetation loss

Table 9 identifies the level of retention of CSA classes across the site. Some 96.4% of Good Condition vegetation will be retained across all CSA classes reflecting the emphasis of this project on protecting areas of high habitat values.

Table 10 contains detailed calculations of vegetation loss and retention for the native vegetation communities currently existing within the site. Overall, approximately 71.39% (88.04ha) of all native vegetation will be retained on site as part of the proposed rezoning. At least 87.0% of the good condition vegetation within each community type is to be retained.

The highest losses will occur from the Lowland Woollybutt-Melaleuca Forest and Coastal Grassy Red Gum Forest communities (sub-communities of the EEC Illawarra lowlands grassy woodland in Sydney Basin), will experience a total loss of 7.52 (43.77%) and 22.65 (43.93%) hectares respectively. The vast majority of the loss of each community type is restricted to paddock trees that do not possess a native understorey. The highest value paddock trees will be assessed and integrated into urban design as part of the State of Commitments (see Figure 7).

The remainder of the communities will experience minimal overall loss as part of the proposed rezoning. Lowland Dry-Subtropical Rainforest will see a loss of approximately 0.14ha (3.73%) of poor condition vegetation and Riparian River Oak Forest will see a loss of approximately 3.36ha (12.99% of which only 0.88ha is currently in good condition. Moist Box-Red Gum Foothills Forest will experience a loss of only 0.73ha (6.87%) with the vast majority of the community being retained in conservation reserves (93.13%).

Table 9: Retention of CSA Classes

	Good Condition (Ha Retained*)	Good Condition (% Retained*)	Poor Condition (Ha Retained*)	Poor Condition (% Retained*)
Primary	59.6	96.5%	3.3	14.0%
Support for Primary	25.1	89.3%	-	-
Enhancement	-	-	7.4**	47.2%
Other Native Vegetation	0.1	25.0%	0.0	0.0%
Total	**84.8**	**96.4%**	**10.6**	**26.2%**

* All ESL within E2, E3, SP2 and RE1+ all other vegetation within E2 and E3.
** Weeds and exotics on Johnston's Spur

Table 10: Vegetation Retention and Loss Calculations

Native Vegetation Community and Condition	Status	Retention* (Ha)	Retention * (% of total vegetation type)	Loss** (Ha)	Loss** (% of total vegetation type)
Illawarra sub tropical rainforest in Sydney Basin	*EEC TSC Act*				
Lowland Dry-Subtropical Rainforest - ABC		3.59	96.27	0.14	3.73
Lowland Dry-Subtropical Rainforest - Tx		0.00		0.00	
Total		3.59	96.27	0.14	3.73
Illawarra lowlands grassy woodland in Sydney Basin	*EEC TSC Act*				
Lowland Woollybutt-Melaleuca Forest - ABC		9.65	95.88	0.42	4.12
Lowland Woollybutt-Melaleuca Forest - Tx		0.00	0.01	7.10	99.99
Total		9.65	56.23	7.52	43.77
Coastal Grassy Red Gum Forest - ABC		25.65	97.00	0.79	3.00
Coastal Grassy Red Gum Forest - Tx		3.26	12.98	21.86	87.02
Total		28.91	56.07	22.65	43.93
River-Flat Eucalypt Forest on Coastal Floodplains	*EEC TSC Act*				
Riparian River Oak Forest - ABC		22.51	87.01	3.36	12.99
Riparian River Oak Forest - Tx		0.00	0.00	0.88	100.00
Total		22.51	84.15	4.24	15.85
Moist Box-Red Gum Foothills Forest - ABC	*N/A*	9.94	93.13	0.73	6.87
Total		9.94	93.13	0.73	6.87
Acacia Scrub	*N/A*	13.43	99.87	0.02	0.13
Total		13.43	99.87	0.02	0.13
Grand Total		88.04	71.39	35.29	28.61

* All ESL within E2, E3, SP2 and RE1+ all other vegetation within E2 and E3

** Non ESL vegetation in SP2 and RE1 and all vegetation within R1, B4

4.2.2 Threatened species assessments

The *Draft Guidelines for Threatened Species Assessment* (DEC & DPI 2005) have been utilised to evaluate state significant ecological impacts in accordance with the DoP Director-Generals requirements (refer to Appendix E: TSC Act Threatened Species Assessments for full assessments).

For the threatened fauna species assessed as being likely or having the potential to occur on or use habitat within the site, it was found that the loss of habitat present in and around the project site, will be minimal. Along with several areas of preferred habitat located in the surrounding areas, the impact is considered likely to be low or negligible and acceptable.

For the threatened flora species assessed as having the potential to occur on site it was found that for most species the impact on habitat is considered to be low or negligible and acceptable. One species is considered to require additional detailed surveys in an appropriate season to determine if the species is present, prior to development due to their cryptic nature combined with proposed clearing of their habitat on site. These species and their respective habitats are found in Table 11 below.

Table 11: Threatened flora further survey requirements

SCIENTIFIC NAME	NSW LEGAL STATUS	EPBC LEGAL STATUS	LIKELIHOOD OF OCCURRENCE	HABITAT	FURTHER SURVEY REQUIREMENT
Cynanchum elegans White-flowered Wax Plant	E1	E	Likely	Rainforest gullies, and edge of dry rainforest areas.	**None** Not found during surveys and potential habitat is being retained.
Daphnandra sp. Illawarra *(Daphnandra johnsonii)* Illawarra Socketwood	E1	E	Likely	Rainforest areas and moist eucalypt forests on rocky hillsides.	**None** Not found during surveys and potential habitat is being retained.
Pimelea spicata Spiked Rice-flower	E1	E	Potential	Open Woodland and disturbed grassland e.g. road verges.	**None** No individuals found during surveys and suitable habitat is being retained.
Pterostylis gibbosa Illawarra Greenhood	E1	E	Potential	Moist Box-Red Gum Foothills Forest and Coastal Grassy Red Gum Forest Woollybutt-Melaleuca.	**Survey** Not found during survey, however further survey within the Lowland Woollybutt-Melaleuca Forest patches north of Calderwood Road is highly recommended prior to works as required under the Statement of Committments.
Zieria granulata Hill Zieria	E1	E	Potential	Dry ridgetops and volcanic soils and moist slopes.	None Not found during survey and potential habitat is retained within the proposed conservation areas.

No matters of National Environmental Significance (NES) have been identified as known on site; however NES matters which have been assessed as potential or likely to occur on site are found in Table 12 below.

The matters in Table 12 have been addressed in accordance with the DEWH impact assessment requirements and it is considered that all potential impacts are unlikely to be significant. The EPBC Act tests of significance for these species are included in Appendix F and are further considered in a formal referral to DEWH.

Table 12: EPBC matters of significance

SCIENTIFIC NAME	COMMON NAME	EPBC LEGAL STATUS	LIKELIHOOD OF OCCURRENCE
Caladenia tessellata	Thick-lipped Spider-orchid	Vulnerable	Potential Habitat
Cynanchum elegans	White-flowered Wax Plant	Endangered	Likely habitat
Daphnandra sp. Illawarra (Daphnandra johnsonii)	Illawarra Socketwood	Endangered	Likely Habitat
Pimelea spicata	Spiked Rice-flower	Endangered	Potential Habitat
Pterostylis gibbosa	Illawarra Greenhood	Endangered	Potential Habitat
Zieria granulata	Hill Zieria	Endangered	Potential Habitat
Apus pacificus	Fork-tailed Swift	Migratory	Potential foraging Habitat
Ardea ibis	Cattle Egret	Migratory	Likely foraging habitat
Lathamus discolor	Swift Parrot	Endangered	Likely foraging habitat
Merops ornatus	Rainbow Bee-eater	Migratory	Likely foraging habitat
Rostratula australis	Australian Painted Snipe	Vulnerable	Likely foraging habitat
Rostratula benghalensis s. lat.	Painted Snipe	Migratory	Likely foraging habitat
Chalinolobus dwyeri	Large-eared Pied Bat	Vulnerable	Likely foraging habitat
Pteropus poliocephalus	Grey-headed Flying-fox	Vulnerable	Likely foraging habitat

4.3 CONCLUSION

The design of the concept plan retains the core biodiversity areas within the site and incorporates both east west and north south habitat connectivity. In conjunction with the concept plan, the additional measures proposed through the zoning provisions, ESL controls, and public ownership of environmental and open space zonings the majority of impacts to threatened species and ecological communities have been avoided.

The proposal will have some minor impact on biodiversity through the removal of predominantly poor quality vegetation on the site. The impact of the vegetation removal however has been restricted in the most part to isolated and poor quality patches of vegetation communities which are of lower conservation significance.

Total vegetation loss on site is approximately 35 Ha, of which 30Ha is poor quality vegetation, generally associated with sparse paddock trees with no native understorey. Of this 30Ha, the best quality remnant trees will be incorporated into urban design via the Statement of Commitments.

In contrast, 88.04 Ha of native vegetation will be retained and a further 7.4Ha of weeds and exotics have been identified for enhancement. In addition to the vegetation being retained, there is a further 75Ha of cleared land that will be included within the E2, E3 and SP2 zones, which overtime will contribute to improving the connectivity of the site. A further 61Ha of cleared land is also included with the RE1 zone, much of which provide an additional contribution to biodiversity conservation on the site over the long term.

The proposed level and type of habitat loss is considered to be of a minor adverse impact to most threatened species and ecological communities which have the potential to occur on site.

There remains some uncertainty of the location of a small number of cryptic threatened flora species. Further survey for these species in relevant habitat has been recommended for inclusion in the Statement of Commitments in order to ensure that these sensitive species will not be adversely impacted during future development. Currently their habitat is located in E2 zones that are proposed to have limited passive recreation uses that must be located in areas that do not contain threatened plants.

The statement of commitments will also contain additional mitigation measures to further reduce the minor impact to biodiversity to be caused by the proposal and will ensure any uncertainty at this strategic planning phase of the work is dealt with as site development progresses (refer to section 5.1 for further detail).

5 Summary of issues and DGR consistency table

The following table summarises how the key statutory and policy issues relevant to biodiversity are addressed in this report.

Table 13: Key issues

ISSUE	RESPONSE
Commonwealth legislation	
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	Approval from the Commonwealth Environment Minister is required under the EPBC Act if the proposed development will have or is likely to have a significant impact on a 'matters of national environmental significance'. Matters of national environmental significance include threatened species, ecological communities and migratory species, including JAMBA and CAMBA bird species, or heritage items or places, which are listed under the Act. There are four flora species and eight fauna species that are matters of national environmental significance likely to occur or with potential to occur on or near the study site, as summarised in **Section 2.2**. It is considered likely that these matters of NES will suffer some adverse impact due to habitat loss however these impacts are not likely to be considered significant. A full EPBC Act referral will be submitted to the Commonwealth Department of Environment, Water and Heritage (DEWH). This report includes full tests of significance for each matter of NES that is likely or has the potential to occur on site and are supplementary material for the full referral assessment.
NSW legislation	
Environmental Planning and Assessment Act 1979 (EP&A Act)	The proposed development is being considered under Part 3A of the EP&A Act. Part 3A switches off a number of authorisations for an approved project. These include: • a permit under section 201, 205 or 219 of the *Fisheries Management Act 1994*, • an authorisation referred to in section 12 of the *Native Vegetation Act 2003* (or

ISSUE	RESPONSE
	under any Act to be repealed by that Act) to clear native vegetation or State protected land, • a permit under Part 3A of the *Rivers and Foreshores Improvement Act 1948*, • a water use approval under section 89, a water management work approval under section 90 or an activity approval under section 91 of the *Water Management Act 2000*. To obtain approval under Part 3A of the EP&A Act, the proponent is required to address issues nominated by the Department of Planning Director-General. These issues, and a summary of responses, are given below.
Director-General's Requirements (DGRs) relevant to biodiversity:	
○ Address the impact of the development on existing native flora and fauna and their habitats, including identified threatened species (e.g. Illawarra Lowland Grassy Woodland, and *Lespedeza juncea* and *Chonzema parviflora* species), having regard to the Threatened Species Assessment Guidelines and recommend offset measures to avoid or mitigate impacts on threatened species and their habitat.	This report has been prepared in accordance with the Part 3A Threatened Species Assessment Guidelines. Threatened species and communities within the study area are described and potential impacts are assessed. A conservation significance assessment process was used to identify areas of high ecological value. Primary and support for primary habitat areas shown in **Figure 5** are generally considered to be unsuitable for general residential development, as recognised in the concept plan. The concept plan also nominates much of the Primary Support for Primary and Other Native Vegetation areas for environmental protection through the ESL overlay. This report recommends future land use zoning and management objectives for areas of ecological value. Quantification of areas to be conserved has been conducted in section 4 and it was found that through zoning, the ESL layer controls, and ongoing public authority ownership options the majority of impacts to existing native flora and fauna have been avoided. The adverse impact that will occur is minimal and considered acceptable.
○ Evaluate the ecological values of Johnston's Spur and Yallah-Calderwood Regional Habitat Corridor on this site for development (including any road upgrades).	**Figure 5** shows the results of the conservation significance assessment and vegetation in 'TX' condition (i.e. scattered trees). Vegetation on the northern side of Johnston's Spur is ranked Primary, whereas much of the vegetation on the southern side is a mixture of Primary, Support for Primary and Enhancement. **Figure 5** also shows the ecological value of other vegetation in the study area based on the conservation significance assessment. No development or road upgrades are proposed in Johnston's Spur E2 zones and the Yallah-Calderwood Regional Habitat Corridor will be supplemented through the proposed corridor networks to be created and protected within the site.
○ Identify the ecological attributes of the lands proposed for dedication and how the environmental land offsets scheme will mitigate the impacts of the development.	The concept plan allows for conservation of most of the existing native vegetation. There will be some minor losses of poor quality native vegetation across the site (including EEC's).

ISSUE	RESPONSE
	Impact assessment and quantification of areas to be conserved including vegetation communities and their conditions has been included in section 4. Due to the high level of retention it is not considered necessary to identify further offsets.
o Discuss the development of ecological corridors to link flora and fauna corridors both on and adjoining the site.	Providing an ecological corridor network was a key objective of this project. Two main regional corridors via Marshall Mount Creek and Macquarie Rivulet provide connectivity between Lake Illawarra and the Escarpment. Johnston's spur is an area of habitat in its own right and provides a ridgeline corridor. A series of secondary corridors are proposed to run between the valley floor and the ridgeline of Johnston's spur, reflecting the nature of species that will move between valley, midslope and ridge environments and the relative hierarchy of the corridor network.
o A consideration of the following with any variations to be justified: a) all relevant State Environmental Planning Policies, b) all applicable planning instruments, including relevant Council LEP and DCP instruments, and c) relevant legislation and policies, including the *Illawarra Regional Strategy*.	Refer below for consideration of relevant planning instruments and policies
State Environmental Planning Policy 44 – Koala Habitat	SEPP 44 applies to the study area. However, the lack of suitable vegetation means that a SEPP 44 assessment is not required.
State Environmental Planning Policy 14 – Coastal Wetlands	SEPP 14 wetlands are located downstream of the study area, associated with Lake Illawarra. Water quality from Calderwood is currently degraded by agricultural activities. Removal of agricultural practices, plus the application of water sensitive urban design and rehabilitation of riparian corridors as part of the Calderwood Urban Development Project are expected to have a beneficial impact on the downstream SEPP 14 wetlands.
Shellharbour Local Environmental Plan and Wollongong Local Environmental Plan	Land use zoning is examined in detail in the planning report by JBA Planning. The majority of the site is zoned Rural, with some areas of native vegetation (e.g. Johnston's Spur) zoned Environmental Protection. It is proposed that the areas currently zoned Environmental Protection would be primarily rezoned E2 Environmental Conservation or E3 Environmental Management in accordance with the new LEP template, thus maintaining similar objectives regarding environmental protection. Further discussion of zoning can be found in section 4.
Native Vegetation Strategy for the Yallah - Marshall Mount Environmental Corridor (DECC 2007) and Fauna of the Illawarra Escarpment, Coastal Plain and Plateau (DEC 2004)	The Strategies nominate biodiversity corridors within the Illawarra region. The report identifies the Yallah – Calderwood Fauna Linkage corridor which includes parts of the Calderwood site (north of and including Johnston's Spur). The Marshall Mount Creek corridor and Johnston's Spur is incorporated in the concept plan for Calderwood as

ISSUE	RESPONSE
	discussed in section 4.
Threatened Species Conservation Act 1995 (TSC Act)	Under Part 3A of the EP&A Act, tests of significance (also called 7 part tests) are not required to assess potential impacts on threatened species and communities. However, potential impacts to these species and communities still need to be considered to address the DGRs. . The schedules of the TSC Act list species, populations and communities as endangered, threatened or vulnerable. **Section 2.2** and **Appendix C** identify which of these species and communities may inhabit the study area. **Appendix E**: TSC Act Threatened Species Assessmentsincludes an impact assessment for TSC Act listed species in accordance with the DECC Part 3A assessment guidelines. Further consideration of potential impacts is given in **Section 4**. A full assessment of impact in accordance with the NPWS Part 3A assessment guidelines has been undertaken to quantify the level of impact. It was concluded that the impact is minor with the majority of impacts being avoided.
Fisheries Management Act 1994	Similar to the TSC Act, Part 3A of the EP&A Act removes requirements to formally consider potential impacts to aquatic species and habitats. However, the DGRs still require assessment to be done. Results of the aquatic habitat assessment are presented in Section 2.3. No threatened aquatic species are likely to be found in the study area.

5.1 RECOMMENDATIONS FOR THE STATEMENT OF COMMITMENTS

The following are recommended for inclusion in the Statement of Commitments

- VMPs to be prepared for all works with ESL land and riparian corridors in accordance with the latest DECCW guidelines.
- Detailed seasonal survey for threatened flora required prior to any works commencing within potential habitat during appropriate seasons in accordance with Table 11: Threatened flora further survey requirements.
- Remnant habitat trees are to be individually assessed prior to detailed design in the area identified in Figure 7. High value trees are to be retained and incorporated into urban design.

References

Atlas of NSW Wildlife (Atlas) (2004) A database of flora and fauna sitings maintained by the NSW Department of Environment and Conservation. February 2004.

Department of Environment and Conservation (NSW) 2005. *Guidelines for Threatened Species Assessment (Draft).* DEC and DPI.

Department of Environmental and Climate Change 2007. *Native Vegetation Strategy for the Yallah - Marshall Mount Environmental Corridor*. (Draft)

DLWC (2003) *Riparian Corridor Management Study,* Department of Land and Water Conservation, Wollongong NSW.

Commissioner (2002) *Commission of Inquiry: Preferred land uses, planning outcomes and management options for certain lands at Sandon Point, Thirroul, Wollongong Local Government Area* Office of Commissioners of Inquiry for Environment and Planning, Sydney.

Commissioner Simpson (1999) *Commission of Inquiry into the Long Term Planning and Management of The Illawarra Escarpment- Report to the Hon. Dr Andrew Refshauge Deputy Premier, Minister for Urban Affairs and Planning Minister for Aboriginal Affairs and Minister for Housing,* Office of Commissioners of Inquiry for Environment and Planning, Sydney.

Department of the Environment and Heritage (DEH) (2004). *EPBC Act Protected Matters Search Tool.* [online]. Available: http://www.deh.gov.au/erin/ert/epbc/ index.html (March 4, 2004).

NPWS (2003) *Bioregional Assessment Study Part III, Conservation Assessment of Wollongong Local Government Area*, NPWS, Hurstville NSW.

NPWS (2002a) *Bioregional Assessment Part I - Native Vegetation of the Illawarra Escarpment and Coastal Plain NPWS*, Hurstville NSW.

NPWS (2002b) *Bioregional Assessment Part II - Fauna of the Illawarra Escarpment Coastal Plain and Plateau*, NPWS, Hurstville NSW

NSW Fisheries (1999) *Policy and Guidelines – Aquatic habitat management and fish conservation* (ed A.K Smith and DA Pollard) NSW Fisheries, Port Stephens.

Wollongong City Council (2004) *Draft Illawarra Escarpment Strategic Management Plan* Vol 1 and 2, Wollongong City Council, Wollongong.

Appendix A: Detailed methodology

The detailed methodology has been implemented in accordance with DEC's (2005) *Guidelines for Threatened Species Assessment* (herein referred to as the guidelines) which identifies important factors and/or heads of consideration that must be considered by proponents and consultants when assessing potential impacts on threatened species, populations, or ecological communities, or their habitat for development applications under Part 3A of the EPA Act. We have added steps for strategic conservation planning and analysis of ecological constraints

STEP 1 – PRELIMINARY ASSESSMENT

A desktop literature review was undertaken by ELA to determine the location and extent of previous surveys, identify the representative spectrum of flora and fauna within the study area, and identify the presence of any threatened species, populations and ecological communities listed under the TSC Act and the Commonwealth EPBC Act that could potentially occur within the study area. To this end, the following documentation and mapping was reviewed:

- Search of Atlas of NSW Wildlife (10km distance out from the study area boundary conducted 9/10/2009)
- Commonwealth protected matters search tool (15km radius from coordinates -34.56, 150.73 conducted 8/10/2009)
- Collation of available GIS information
    - NPWS validated vegetation mapping (2004)
    - Threatened Species Atlas records (9th October 2009)
    - EPBC Protected Matters records (9th October 2009)
    - SEPP 14 Wetland locations
    - Aerial Photos
    - DIPNR and updated modelled drainage networks
- Preparation of species likelihood of occurrence tables based on information obtained from above searches (refer to Appendix C for results)
- One day field reconnaissance to assess the local environment and identify target areas for field survey
- Preparation of field survey plan to ensure a representative sample of all habitats and targeted sampling of habitats that are likely to contain threatened species

STEP 2 – FIELD SURVEY AND ASSESSMENT

A seven person day field survey was undertaken across the site. A map showing survey effort is provided on the following page.

DATE	ECOLOGISTS	CONDITIONS
21st October, 2009	Liz Norris	Temperature (^{0}C): 7-34

DATE	ECOLOGISTS	CONDITIONS
	Simon Tweed Steven House	Rainfall (mm): 0
22nd October, 2009	Liz Norris Simon Tweed	Temperature (^{0}C): 16-20 Rainfall (mm): 0
23rd October, 2009	Liz Norris Simon Tweed	Temperature (^{0}C): 17-23 Rainfall (mm): 0

Source http://www.bom.gov.au/climate accessed 26/11/2009

The random meander methodology was used to:

- Undertake targeted threatened flora searches
- Validate vegetation community and condition mapping (each polygon on site was visited)
- Opportunistically record flora and fauna species encountered
- Undertake a habitat assessment for threatened flora and fauna that have the potential to occur on the site
- Identify the recovery potential of vegetation
- Assess aquatic habitat
- Identify management issues

Following field survey, any voucher specimens were identified by field survey staff and data was entered into ELA's MS Access database.

Vegetation condition was determined in accordance with the following rules:

Vegetation Condition Code Definitions

CONDITION CODE	CONDITION DESCRIPTION	INDICATES THE FOLLOWING PATTERNS*
A**	Low Disturbance	No visible signs of disturbance from air. Polygon may have some established tracks dissecting. Evidence of weeds may not be visible or only identified during field investigation, generally at low intensity. Gaps in canopy are more likely to be natural dynamic between rainforest/eucalypt structures.
B	Moderate Disturbance	A polygon may exhibit >75% integrity in forest canopy structure but contains features such as single or multiple canopy gaps where weed infestations have developed from light penetration. The polygon may also be marked by several poorly developed trails dissecting path or evidence of human disturbance such as clearing or understorey patchiness
C	High Disturbance, Regenerating vegetation	Includes areas of regenerating vegetation Common around areas of previous mining and clearing. Dense weed infestations dominate the understorey or canopy. Structure of vegetation is limited to canopy and dense weed understorey. In some areas canopy may include exotic species amongst natives. Canopy gaps are clearly apparent, and evidence of soil disturbance may be apparent, as may be evidence of previous mining activities or clearing.
TX	Scattered trees (thinned canopy)	A regular feature of native vegetation cover in disturbed environments is the presence of scattered trees above an open or absent understorey in a mosaic of cleared and remnant vegetation. A code "Tx" was applied where Crown Canopy Projected Density (CCPD) of tree cover fell below ten percent. A minimum mapping area of 0.5 hectares was used.
EX	Excluded from assessment process	Excluded map units are: Cleared, Modified Lands, Water, Weeds and Exotics

*Source: NPWS (2003)
** No condition A vegetation was recorded at Calderwood

Aquatic habitat condition was assessed by considering:

- *Hydrology; presence of artificial barriers, comparison to natural hydrological regime.*
- *Streamside Vegetation; width, condition, latitudinal connectivity, recruitment of native canopy species.*
- *Physical Form; bank stability instream, woody debris, fish passage.*
- *Water Quality; observed turbidity and algal growth, potential land management problems.*

The level of assessment conducted was chosen to assist with future management of watercourse and riparian environments within the study area by highlighting current values, threats and limits to potential improvements along the watercourse.

Field surveys were conducted along the length of the main watercourses within the study area wherever access was permitted. Ephemeral streams were not surveyed because of their lack of aquatic habitat value. Differences in condition, as observed through the key indicators, and channel width were used to separate the watercourse into separate reaches. A final condition class was assigned to each reach of the watercourse.

Habitat was investigated for threatened species with the potential to occur within the area listed under the *Fisheries Management Act 1994.* No fish survey was undertaken.

For the overall condition classes the following categories were applied;

Good – Hydrological regime similar to natural state, high diversity of habitat features provided through large wood and/or rocks with no desnagging apparent, no evidence of erosion or stream bank degradation, riparian vegetation consists of native species and characteristics are similar to benchmarks for that community.

Moderate – Hydrological regime modified from natural state, medium density of large wood and/or rocks with little desnagging apparent, some evidence of localised erosion or stream bank degradation but overall the bank is in a stable condition, riparian vegetation is dominated by native species but has moderate biodiversity values due to deviation from benchmark characteristics.

Poor - Almost all aspects of hydrological regime highly modified from natural state, almost no large instream wood or rocks providing in-stream habitat, widespread and severe erosion or stream bank degradation, riparian vegetation (if present) dominated by weeds.

STEP 3 –STRATEGIC CONSERVATION PLANNING

This step recognises that identification of values, evaluating impacts and avoiding, mitigating and offsetting impacts is an iterative process that works in conjunction with urban design and statutory planning outcomes. It effectively amalgamates steps 3 to 5 of the guidelines and recognises that conservation planning needs to be undertaken in conjunction with other planning disciplines in order to achieve integrated outcomes.

The intention of this step is to prepare a relative ranking of biodiversity values on the site to inform urban design, and reduce the potential for unwanted impacts. The Conservation Significance Assessment (CSA) is an iterative process that amalgamates the following parameters into a relative ranking of habitat from very low to high:

- Significance of vegetation communities (legal status)
- The structural condition of vegetation remnants
- Type and severity of disturbance and associated recovery potential

- Connectivity between remnants on and off site

Conservation Significance Assessment

The NPWS CSA decision rules used in the Wollongong CSA (NSW NPWS 2003) could not be directly applied to the site because they were developed to account for state and regional not local significance and they rely on modelled fauna habitat not actual data regarding the presence of fauna species.

For this reason a modified set of decision rules is used in this CSA. These decision rules are outlined in Table 14 and use only those criteria which relate to vegetation community and condition.

Conservation significance criteria were determined for each conservation value, and combined into a single conservation assessment map. The results are essentially a ranking of the remaining vegetation into one of a number of categories:

- *Primary*: areas of highest conservation value, where species or communities are at imminent risk of extinction, or areas within the region that make the greatest contribution to explicit conservation goals.
- *Support for Primary;* areas providing a range of support values to Primary habitat. Support for Primary is generally more disturbed. Where it is adjacent to Primary, it increases the size of Primary and provides a buffer between developed areas and the higher conservation values found in Primary habitat.
- *Enhancement*; areas that are heavily disturbed and thinned, consisting of scattered canopy trees, often with land uses such as grazing or cultivation beneath the canopy. Within regional corridors, "Enhancement" areas also include weeds and cleared areas. Enhancement areas can have strategic values, particularly for the provision of linkages and vegetation consolidation. Enhancement areas present lower levels of constraint to development than Primary or Support for Primary.
- *Other Native Vegetation*; any native vegetation that is not classified by the conservation assessment as Primary, Support for Primary or Enhancement is classified as "other native vegetation". These areas comprise opportunistic native species (such as Acacia longifolia) or introduced native species.
- *Excluded*; the following map units were excluded from the conservation significance process: Cleared, Modified Lands, Water, Weeds and Exotics. These units can only be classified as Primary, Support for Primary or Enhancement where they occur in conservation corridors (note that as Calderwood is part of the Yallah-Calderwood Corridor these units were included).

The decision rules applied to each of these conservation values are outlined in the table below.

Table 14: CSA decision matrix for Calderwood Urban Development Project assessment

VALUE LEVEL	CONSERVATION VALUE	CONDITION CODES	PATCH SIZE	CONNECTIVITY	SIGNIFICANCE CATEGORY	GIS DATA CODE
National and State Protected Values – Legislative Requirements	Endangered Ecological Communities	AB, N/A	> 0.5 ha	-	Primary	C1
		C	> 0.5 ha	Adjacent to Primary	Primary	C2
				Isolated	Support for Primary	C3
		TX	> 0.5 ha	Adjacent to Primary	Primary	C4
				Isolated	Enhancement	C5
Bio-regionally Significant Values – Policy Objectives	Rare Vegetation Communities (< 1,000 ha extant)	AB, N/A	> 2ha	-	Primary	C6
		C	> 2ha	-	Support for Primary	C7
		TX	> 2ha	-	Enhancement	C8
	Poorly Conserved	AB, N/A	> 2ha	-	Primary	C9

VALUE LEVEL	CONSERVATION VALUE	CONDITION CODES	PATCH SIZE	CONNECTIVITY	SIGNIFICANCE CATEGORY	GIS DATA CODE
	Vegetation Communities (<30% reserved)	C	> 2ha	-	Support for Primary	C10
		TX	> 2ha	-	Enhancement	C11
	Regional Corridors and Connectivity	AB or C	-	Within Corridors	Primary	C12
		TX, N/A, Cleared, Weeds, Artificial wetlands	-	Within Corridors	Enhancement	C13
All other native vegetation falling outside the categories above		AB	-	Adjacent to Primary	Support for Primary	C14
			-	Isolated	Other Native Vegetation	C15
		C, TX, NA	-	Adjacent to Primary, Adjacent to Support	Enhancement	C16
			-	Isolated	Other Native Vegetation	C17
Other - weeds, artificial wetlands, exotics, Fig trees		-	-	Not in corridors	N/A	-

Recovery Potential

The recovery potential of a site is determined using information collected in the field, and then applying this information to a recovery potential matrix. The recovery potential of a site is defined as *'...the anticipated capacity of (an) area to recover to a state representative of its condition prior to the most recent disturbance event'* (Ian Perkins Consultancy Services and Aquila Ecological Surveys 2002). The table on the following page outlines the decision rules used in this step, which results in a ranking of *high*, *moderate*, *low* or *very low* recovery potential for each vegetation remnant.

Table 15: Recovery Potential Matrix

CURRENT CONDITION AND LAND USE	PAST LAND USE AND DISTURBANCE	SOIL CONDITION	VEGETATION	RECOVERY POTENTIAL	RECOVERY CODE
Cleared (no woodland canopy)	Recently cleared (<2 years)	Unmodified or largely natural. Uncultivated.	Native dominated	High	C1
			Exotic dominated	Moderate	C2
		Modified. Heavily cultivated and/or pasture improved. Imported material.	Either	Low	C3
	Historically cleared (>2 years) and consistently managed as cleared.	Unmodified or largely natural. Uncultivated.	Native dominated	Moderate	C4
			Exotic dominated	Low	C5
		Modified. Heavily cultivated and/or pasture improved. Imported material.	Either	Very Low	C6
Wooded/Native Canopy present or regenerating	No recent clearing of understorey	Unmodified or largely natural. Uncultivated.	Native understorey relatively intact or in advanced state of regeneration. Native dominated.	High	W1
			Native understorey significantly structurally modified, absent or largely absent. Includes areas dominated by African Olive / lantana.	Moderate	W2
			Exotic dominated	Low	W2.1
		Moderately modified by long term grazing or mowing.	Native dominated	Low	W2.2
		Modified. Heavily cultivated and/or pasture improved. Imported material.	Native understorey significantly structurally modified, absent or largely absent. Includes areas dominated by African Olive / lantana.	Very Low	W3
			Native understorey present. Heavily weed invaded.	Low	W4
	Understorey patchily intact	Disturbed	Native dominated	Moderate	W4.1
			Exotic dominated	Low	W4.2
	Recent clearing of understorey and or native understorey significantly structurally modified due to existing land use (eg. Mowing, grazing)	Unmodified or largely natural. Uncultivated.	Native dominated. If no vegetation present, assume native dominated.	High	W5
			Exotic dominated	Moderate	W6
		Modified. Heavily cultivated and/or pasture improved. Imported material.	Native dominated	Low	W7
			Exotic dominated	Very Low	W8

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The following Steps 5-7 are taken from the guidelines and results will be included in the final report.

STEP 5 – EVALUATION OF IMPACTS

This step involves identifying not only the magnitude and extent of impacts, but also the significance of the impacts as related to the conservation importance of the habitat, individuals and populations likely to be affected. Impacts will be more significant if:

- areas of high conservation value are affected;
- individual animals and/or plants and/or subpopulations that are likely to be affected by the proposal play an important role in maintaining the long-term viability of the species, population or ecological community;
- habitat features that are likely to be affected by the proposal play an important role in maintaining the long-term viability of the species, population or ecological community;
- the duration of impacts are long-term;
- the impacts are permanent and irreversible.

STEP 6 - AVOID, MITIGATE AND THEN OFFSET

This step requires the description and justification of measures to mitigate any adverse effects. Consideration is to be given to measures to avoid or minimise the impacts. The measures must be practical, must be implemented and there needs to be a reasonable level of confidence in their effectiveness. Acknowledged authorities with particular species or conservation practices should be consulted to determine if the measures proposed constitute appropriate management.

Where measures to avoid and mitigate are not possible, then offset strategies need to be considered. These may include offsite or local area proposals that contribute to the long term conservation of the threatened species.

Offset strategies are a last resort and should only be considered where the impacts cannot be avoided or mitigated. Considerable research indicates that relocation of flora or fauna is not successful in the medium or longer term.

The extent to which measures avoid, mitigate or offset impacts upon threatened species must reflect the conservation value of the feature including its formal status as a critically endangered, endangered or vulnerable species, population or ecological community.

STEP 7 - KEY THRESHOLDS

The development application needs to contain a justification of the preferred option based on:

- whether or not the proposal, including actions to avoid or mitigate impacts or compensate to prevent unavoidable impacts will maintain or improve biodiversity values.
- whether or not the proposal is likely to reduce the long-term viability of a local population of the species, population or ecological community.
- whether or not the proposal is likely to accelerate the extinction of the species, population or ecological community or place it at risk of extinction.
- whether or not the proposal will adversely affect critical habitat.

Appendix B: Vegetation communities

The following general descriptions and reservation status of vegetation communities are from NPWS (2002a) *Bioregional Assessment Part I - Native Vegetation of the Illawarra Escarpment and Coastal Plain NPWS*, Hurstville NSW.

LOWLAND DRY-SUBTROPICAL RAINFOREST

Description: Lowland Dry-Subtropical Rainforest is a closed forest characterised by a low and dense canopy of species such as *Cassine australis* var*. australis, Alectryon subcinereus, Planchonella australis, Ficus rubiginosa, Geijera salicifolia* var. *latifolia, Alphitonia excelsa, Dendrocnide excelsa* and *Melia azedarach*. A layer of small trees such as *Streblus brunonianus* and *Notelaea venosa* is abundant and common to most sites. Unlike other rainforest in the district, it is rarely tall and may sometimes form low thick scrubs. A diversity of vines drape from the canopy above a sparse, rocky understorey. These include *Maclura cochinchinensis, Parsonsia straminea* and *Celastrus australis*. Ground cover includes a low abundance of ferns that include *Pellaea falcata, Doodia aspera* and *Asplenium flabellifolium*. Occasional emergent *Eucalyptus tereticornis* are present.

Conservation status: Lowland Dry-Subtropical Rainforest forms a component of Illawarra Subtropical Rainforest, an Endangered Ecological Community listed under the Threatened Species Act (1995).

Reservation status:

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	51.09	11.1	51 (2.5)
Water Catchment	0	0	
State Forest	0	0	
Wollongong City Council Reserves	14.55	3.2	
Reserved Subtotal	65.64	14.3	
Other	395.48	85.8	
Total	461.12	100	2079

Condition at Calderwood:
One patch of this community exists in the centre of the study area within Johnston's Spur in the western edge of the site. The patch remains in good condition and was found to have high recovery potential despite the presence of some weed infestation.

Photos:

MOIST BOX-RED GUM FOOTHILLS FOREST

Description: Moist Box-Red Gum Foothills Forest is dominated by *Eucalyptus quadrangulata* with *E. tereticornis* and/or *E. salignaXbotryoides* as infrequent associate species. A low mesic shrub layer is always present. Typical shrub and small tree species are closely affiliated to the Lowland Dry-Subtropical Rainforest assemblages that occur as part of the complex of vegetation on the escarpment foothills. Hardy and/or pioneer rainforest species such *as Croton verreauxii, Cassine australis* var. *australis, Backhousia myrtifolia, Streblus* brunonianus and *Pittosporum* spp. frequently occur. Ground cover is usually a sparse cover of ferns such as *Doodia aspera* and *Pellaea falcata*.

Conservation status: nil

Reservation status:

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	22.64	3.7	23 (2)
Water Catchment	0	0	
State Forest	0	0	
Wollongong City Council Reserves	30.41	4.9	
Reserved Subtotal	53.05	8.6	
Other	567.03	91.5	
Total	620.08	100	1022

Condition at Calderwood:
This community remains in good condition on site with remant patches mainly existing within Johnston's Spur, with a few smaller patches located along an ephemeral watercourse in the centre of the site. Weed infestations were present, however this community is considered to have high recovery potential.

Photos:

COASTAL GRASSY RED GUM FOREST

Description: Coastal Grassy Red Gum Forest describes a complex of vegetation occupying the undulating landscapes of the coastal plain and escarpment foothills. *Eucalyptus tereticornis* is the dominant component of the canopy, occurring in combination with *E. eugenioides, Angophora floribunda* and *E. bosistoana*. The ground cover features a dense cover of grasses and herbs including *Dichondra repen, Desmodium varians, Microlaena stipoides* var. *stipoides*, *Oplismenus imbecillis, Commelina cyanea, Pratia purpurascens, Poa labillardieri* var. *labillardieri, Entolasia marginata, Themeda australis, Eragrostis leptostachya* and *Echinopogon ovatus*. This dense ground cover is a consistent feature across a number of floristic variations within this community.

Conservation status: Listed as an Endangered Ecological Community under the Threatened Species Act (1995) as part of Illawarra Lowlands Grassy Woodland

Reservation status:

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioegion (ha/%)
National Park Estate	0.36	0.0	0.4 (0.03)
Water Catchment	0	0	
State Forest	0	0	
Wollongong City Council Reserves	33.68	4.2	
Reserved Subtotal	34.04	4.2	
Other	763.40	95.7	
Total	797.44	100	>1255

Condition at Calderwood:
This community is the most common on site, its distribution is restricted to the western areas of the site predominantly within Johnston's Spur. The forest remains in a combination of large patches of good condition remnants with smaller patches of poor condition remnant located at the margins and in smaller fragments towards the southern end of the site.

Photos:

LOWLAND WOOLLYBUTT-*MELALEUCA* FOREST

Description: Lowland Woollybutt-*Melaleuca* Forest is characterised by the presence of *Eucalyptus longifolia, E. globoidea/E. eugenioides,* a dense subcanopy of *Melaleuca decora* and a grassy understorey. *Eucalyptus tereticornis* occurs only occasionally. Patchy occurrences of *Eucalyptus pilularis* in the canopy represent a minor variation within the Map Unit. This community occurs on flat low-lying Shoalhaven Group sediments at elevations between 10 and 35 metres above sea level. Slope rarely exceeds two degrees. Remnant trees of *Eucalyptus longifolia, E. tereticornis* and *Melaleuca decora* remain primarily on Permian rather than Quaternary geologies.

Conservation status: Listed as an Endangered Ecological Community under the Threatened Species Act (1995) as part of Illawarra Lowlands Grassy Woodland

Reservation status:

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	0	0	0 (0)
Water Catchment	0	0	
State Forest	0	0	
Wollongong City Council Reserves	21.21	4.5	
Reserved Subtotal	21.21	4.5	
Other	452.98	95.5	
Total	474.19	100	>490

Condition at Calderwood:
This forest remains in predominantly good condition as moderately sized patches (approximately 5 Ha) across the middle of the site, with the margins of these remnants considered to be in poor condition. The remnant patches of this community are considered to have high recovery potential.

Photos:

RIPARIAN RIVER OAK FOREST

Description: Riparian River Oak Forest features narrow ribbons of tall *Casuarina cunninghamiana* subsp. *cunninghamiana* along Macquarie Rivulet and Marshall Mount Creek in the Calderwood Valley. Remnants remain as discontinuous patches along the banks of these streams. Other tree species include *Eucalyptus tereticornis* and *E. salignaXbotryoides*.

The remnants of this community are heavily degraded by past clearing and ongoing grazing activities. Weeds dominate the understorey, particularly *Lantana camara* and Privet (*Ligustrum* spp.) and exotic trees such as Camphor laurel (*Cinnamomum camphora*) and Coral tree (*Erythrina X sykesii*).

Conservation status: Listed as an Endangered Ecological Community under the Threatened Species Act (1995) as part of River Flat Eucalypt Forest of Coastal Floodplains

Reservation status:

Tenure	Study Area (ha)	Proportion of Total (%)	Sydney Basin Bioregion (ha/%)
National Park Estate	0.80	0.8	1 (0.2)
Water Catchment	0	0	
State Forest	0	0	
Wollongong City Council Reserves	0.20	0.2	
Reserved Subtotal	1.0	1.0	
Other	103.62	99.0	
Total	104.62	1.0	441

Condition at Calderwood:
Riparian River Oak Forest is located along the major riparian corridors within the site, Macquarie Rivulet and Marshall Mount Creek. The condition of this community is moderate to good, and recovery potential is moderate to high. The remnants often contain significant weed invasion, as is common within riparian areas throughout the Illawarra.

Photos:

DISTURBED LANDSCAPES

Acacia Scrubs

A number of *Acacia* species (*A. mearnsii, A. maidenii, A. binervata, A. melanoxylon*) recolonise cleared or heavily disturbed native vegetation. These Acacias often form dense scrubs on a wide variety of regenerating habitats and environments. *Acacia mearnsii* scrubs are distinctive on the footslopes of the escarpment, where tall moist forests and rainforests are likely to have once existed. In disturbed rainforest, *Acacia melanoxylon* may form a tall dense canopy. On the plateau on shale soils, *Acacia binervata* occasionally forms a tall closed shrub to small tree layer in areas formerly burnt, cleared or underscrubbed. Acacia Scrubs regularly occur in combination with weeds such as *Lantana camara*. However, they also occur in combination with native species such as *Syncarpia glomulifera* subsp. *glomulifera* and species common to remnant rainforest and wet sclerophyll forest.

Acacia scrub occurs within Johnston's Spur within the Calderwood site, contributing to the connectivity of the remnant native vegetation communities.

Weeds and Exotics

Infestation by weeds and other exotic species is common on the Illawarra Escarpment and Coastal Plain. Lantana (*Lantana camara*) is the most conspicuous of these species, often forming scrambling impenetrable scrubs. These areas are prominent on former grazing and mining sites on escarpment benches and gullies. Weeds and exotics have been mapped as a feature where they dominate and as a disturbance descriptor where they occur in combination with native vegetation communities. Remnant vegetation along riparian strips are often a combination of Willow Trees (*Salix* spp.), Coral Trees (*Erythrina X sykesii*) and isolated native species.

Cleared Land

Removal of native vegetation cover for agricultural, uses is widespread across the site.

Appendix C: Flora & Fauna Lists

Likelihood of occurrence

The table below identifies the threatened species and populations returned by the NSW DECCW Wildlife Atlas database and EPBC online Protected Matters database searches (based on a 10km radius from the study area) together with an assessment of the likelihood of occurrence for each species. Each species' likely occurrence was determined by records in the area, habitat availability and knowledge of the species' ecology.

Five terms for the likelihood of occurrence of species are used in this report. The terms for likelihood of occurrence are defined below:

- "yes" = the species was or has been observed on the site.
- "likely" = a medium to high probability that a species uses the site.
- "potential" = suitable habitat for a species occurs on the site, but there is insufficient information to categorise the species as likely to occur, or unlikely to occur.
- "unlikely" = a very low to low probability that a species uses the site.
- "no" = habitat on site and in the vicinity is unsuitable for the species.

Records were extracted from the Atlas of NSW Wildlife and from the Commonwealth Department of Environment, Heritage and the Arts EPBC Act Protected Matters Search Tool on the 8th October 2009.

Fauna

Scientific Name	Common Name	NSW Legal Status	EPBC Legal Status	Habitat/Resources*	Likelihood of Occurrence
Birds					
Actitis hypoleucos	Common Sandpiper		M	Intertidal mudflats and sandflats	No
Apus pacificus	Fork-tailed Swift		M		Potential
Ardea alba	Great Egret		M		Unlikely
Ardea ibis	Cattle Egret		M		Likely
Arenaria interpres	Ruddy Turnstone		M	Intertidal mudflats and sandflats	No
Botaurus poiciloptilus	Australasian Bittern	V		Permanent freshwater wetlands with dense vegetation	Potential
Calidris acuminata	Sharp-tailed Sandpiper		M	Intertidal mudflats and sandflats	No
Calidris alba	Sanderling		M	Open coastal areas	No
Calidris canutus	Red Knot		M	Intertidal mudflats and sandflats	No
Calidris ferruginea	Curlew Sandpiper		M		No
Calidris ruficollis	Red-necked Stint		M		No
Calidris tenuirostris	Great Knot		M	Sheltered coastal areas with large mudflats and sandflats	No
Callocephalon fimbriatum	Gang-gang Cockatoo	V		Eucalypt or sclerophyll forests and woodlands	Potential
Calyptorhynchus lathami	Glossy Black-Cockatoo	V		Woodland with *Casuarina*	Potential
Charadrius bicinctus	Double-banded Plover		M		No

Scientific Name	Common Name	NSW Legal Status	EPBC Legal Status	Habitat/Resources*	Likelihood of Occurrence
Charadrius leschenaultia	Greater Sand Plover		M	Intertidal sandflats and mudflats	No
Charadrius mongolus	Lesser Sand Plover		M	Sheltered coastal areas	No
Dasyornis brachypterus	Eastern Bristlebird	E1	E	Dense heaths and coastal woodlands	Unlikely
Diomedea antipodensis	Antipodean Albatross		V, M	Coastal waters	No
Diomeda exulans	Wandering Albatross	E1		Coastal waters	No
Diomedea gibsoni	Gibson's Albatross		V, M	Coastal waters	No
Gallinago hardwickii	Latham's Snipe		M	Wet grassland, marshes, brakes along freshwater streams	Unlikely
Glareola maldivarum	Oriental Pratincole		M		No
Haematopus longirostris	Pied Oystercatcher	V		Estuaries, beaches, coastal paddocks	Unlikely
Haliaeetus leucogaster	White-bellied Sea-Eagle		M	Open water for foraging, woodland/forests for roosting	Unlikely
Heteroscelus brevipes	Grey-tailed Tattler		M	Intertidal mudflats and sandflats	No
Hirundapus caudacutus	White-throated Needletail		M	Aerial, Forests for roosting	Unlikely
Irediparra gallinacea	Comb-crested Jacana	V		Permanent wetalnds with floating vegetation cover	Unlikely
Ixobrychus flavicollis	Black Bittern	V		Freshwater & estuarine wetlands with Casuarina	Likely
Lathamus discolor	Swift Parrot	E1	E	Woodland	Likely
Limicola falcinellus	Broad-billed Sandpiper		M	Sheltered coastal areas	No
Limosa limosa	Black-tailed Godwit		M	Sheletered coastal areas	No

Scientific Name	Common Name	NSW Legal Status	EPBC Legal Status	Habitat/Resources*	Likelihood of Occurrence
Lophoictinia isura	Square-tailed Kite	V		Timbered areas including dry woodlands and open forests	Potential
Macronectes giganteus	Southern Giant-Petrel		E, M	Coastal Waters	No
Macronectes halli	Northern Giant-Petrel		V, M	Coastal waters	No
Merops ornatus	Rainbow Bee-eater		M		Likely
Monarcha melanopsis	Black-faced Monarch		M	Rainforest & gully forest (wet forest)	Unlikely
Myiagra cyanoleuca	Satin Flycatcher		M	Wet gully forest	Unlikely
Neophema chrysogaster	Orange-bellied Parrot		CE, M	Sheltered coastal areas	Unlikely
Neophema pulchella	Turquoise Parrot	V		Open forest	Likely
Ninox connivens	Barking Owl	V		Euclaypt and swamp woodlands and open forests	Unlikely
Ninox strenua	Powerful Owl	V		Various forest habitats, feeds on small - medium mammals	Potential
Numenius madagascariensis	Eastern Curlew		M	Intertidal mudflats and sandflats	No
Numenius minutus	Little Curlew		M		No
Numenius phaeopus	Whimbrel		M	Intertidal mudflats and sandflats	No
Pachycephala olivacea	Olive Whistler	V		Forests and woodlands	Likely
Pandion haliaetus	Osprey	V		Coastal waters	No
Petroica rodinogaster	Pink Robin	V		Rainforest and tall, open eucalypt forest	Potential
Pezoporus wallicus wallicus	Eastern Ground Parrot	V		Low heaths and sedgelands	Unlikely

Scientific Name	Common Name	NSW Legal Status	EPBC Legal Status	Habitat/Resources*	Likelihood of Occurrence
Pluvialis fulva	Pacific Golden Plover		M	Intertidal mudflats and sandflats	No
Pluvialis squatarola	Grey Plover		M	Intertidal mudflats and sandflats	No
Pterodroma neglecta neglecta	Kermadec Petrel (western)		V	Coastal waters	No
Rhipidura rufifrons	Rufous Fantail		M	Rainforest & wet forest	Unlikely
Rostratula australis	Australian Painted Snipe		V	Swamps	Likely
Rostratula benghalensis s. lat.	Painted Snipe		M	Swamps	Likely
Sterna albifrons	Little Tern	E1	M	Sheltered, coastal areas	No
Stictonetta naevosa	Freckled Duck	V		Swamps, open lakes & floodwaters	Likely
Thalassarche bulleri	Buller's Albatross		V, M	Coastal waters	No
Thalassarche cauta	Shy Albatross		V, M	Coastal waters	No
Thalassarche impavida	Campbell Albatross		V, M	Coastal waters	No
Thalassarche salvini	Salvin's Albatross		V, M	Coastal waters	No
Thalassarche steadi	White-capped Albatross		V, M	Coastal waters	No
Tringa glareola	Wood Sandpiper		M		No
Tringa nebularia	Common Greenshank		M	Intertidal mudflats and sandflats	No
Tringa stagnatilis	Marsh Sandpiper		M	Intertidal mudflats and sandflats	No
Tyto novaehollandiae	Masked Owl	V		Wide range of woodland habitats	Unlikely

Scientific Name	Common Name	NSW Legal Status	EPBC Legal Status	Habitat/Resources*	Likelihood of Occurrence
Tyto tenebricosa	Sooty Owl	V		Tall wet forests, feeds on small mammals	Unlikely
Xanthomyza phrygia	Regent Honeyeater	E1	E, M	Woodland	Unlikely
Xenus cinereus	Terek Sandpiper		M	Coastal mudflats, lagoons, creeks and estuaries	No
Fish					
Macquaria australasica	Macquarie Perch		E	Inland and coastal rivers and streams	Unlikely
Prototroctes maraena	Australian Grayling		V	Clear, flowing waters in coastal rivers	Unlikely
Frogs					
Heleioporus australiacus	Giant Burrowing Frog	V	V	Sandy ridgetops	Unlikely
Litoria aurea	Green and Golden Bell Frog		V	Marshes, dams and stream sides	Unlikely
Litoria littlejohni	Littlejohn's Tree Frog		V	Creeks	Unlikely
Mixophyes balbus	Stuttering Frog		V	Rainforest, wet leaf litter	Unlikely
Pseudophryne australis	Red-crowned Toadlet	V		Swamp, sedgeland, woodland	Unlikely
Mammals					
Cercartetus nanus	Eastern Pygmy-possum	V		Woodland with nectar resources	Unlikely
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Woodland, roosts in sandstone caves	Likely
Dasyurus maculates (s. lat.)	Spot-tailed Quoll	V	E	Woodland, hollows	Unlikely
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V		Moist habitats with trees taller than 20m	Potential

Scientific Name	Common Name	NSW Legal Status	EPBC Legal Status	Habitat/Resources*	Likelihood of Occurrence
Isoodon obesulus obesulus	Southern Brown Bandicoot (eastern)	E1	E	Scrubby habitat, low ground cover	Unlikely
Miniopterus schreibersii oceanensi	Eastern Bent-wing Bat	V		Roosts in caves, forages for insects	Likely
Petaurus norfolcensis	Squirrel Glider	V		Woodland, flowering eucalypts, tree hollows	Unlikely
Petrogale penicillata	Brush-tailed Rock-wallaby		V	Rock outcrops	Unlikely
Phascolarctos cinereus	Koala	V		Woodland	Unlikely
Potorous tridactylus	Long-nosed Potoroo	V	V	Heath, woodland, forests with thick ground cover	Unlikely
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Camps in gullies. Forages for eucalypt blossom, and fruit of native and planted trees.	Likely
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V		Most habitats, with and without trees	Potential
Scoteanax rueppellii	Greater Broad-nosed Bat	V		Utilises most habitats but mostly found in tall wet forest	Potential
Reptiles					
Chelonia mydas	Green Turtle		V, M	Marine waters	No
Dermochelys coriacea	Leathery Turtle		E, M	Inshore and offshore marine waters	No
Hoplocephalus bungaroides	Broad-headed Snake		V	Sandstone rock outcrops	Unlikely

Flora

Scientific Name	Common Name	NSW Legal Status	EPBC Legal Status	Habitat/Resources*	Likelihood of Occurrence
Boronia deanei	Deane's Boronia	V	V	Wet heaths	Unlikely
Caladenia tessellata	Thick-lipped Spider-orchid	E1	V	Grassy woodland on clay loam or sandy soils	Unlikely
Chorizema parviflorum		E2		Heath country on sandstone	Unlikely
Cryptostylis hunteriana	Leafless Tongue-orchid		V	Coastal areas on sandstone	Unlikely
Cynanchum elegans	White-flowered Wax Plant	E1	E	Rainforest, gully scrub and scree slopes	Likely
Daphnandra sp. Illawarra *(Daphnandra johnsonii)*	Illawarra Socketwood	E1	E	Subtropical rainforest, gullies	Likely
Grevillea parviflora		V	V	Heath or shrubby woodland	Unlikely
Grevillea rivularis	Carrington Falls Grevillea	E1	E	Moist creekside on sandstone	Unlikely
Irenepharsus trypherus	Delicate Cress	E1	E	Gullies on the coast and escarpment	Unlikely
Lespedeza juncea subsp. *sericea*		E2		Grassland or woodland	Unlikely
Melaleuca biconvexa	Bioconvex Paperbark	V			No
Persoonia glaucescens	Mittagong Geebung	E1			No
Pimelea spicata	Spiked Rice-flower	E1	E	Amongst grasses in open forest, clay soils	Unlikely
Pomaderris walshii		E4A			No
Pterostylis gibbosa	Illawarra Greenhood	E1	E	Grassy understoreys on clay soils	Potential
Pterostylis pulchella	Pretty Greenhood		V	Escarpments and on moist, sheltered ridges	Unlikely

Scientific Name	Common Name	NSW Legal Status	EPBC Legal Status	Habitat/Resources*	Likelihood of Occurrence
Pultenaea aristata			V	Heath and woodland on sandstone	Unlikely
Solanum celatum		E1		Rainforest clearings, wet sclerophyll forest dominated by Eucalypts	Unlikely
Thelymitra sp. Kangaloon	Kangaloon Sun-orchid		CE		No
Thesium australe	Austral Toadflax	V	V	Grassland or woodland	Unlikely
Zieria granulata	Hill Zieria	E1	E	Dry rocky ridges in sclerophyll forest to rainforest margins, principally on volcanic soils	Potential

Appendix D: Recorded species

Flora and fauna species observed during fieldwork in October 2009 are tabulated below.

Flora species observed

FAMILY	SCIENTIFIC NAME	COMMON NAME
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower
Adaiantaceae	*Adiantum aethiopicum*	Maiden Hair Fern
	Adiantum formosum	Black Stem
	Cheilanthes sieberi subsp. *sieberi*	Rock Fern
	Pellaea falcata	Sickle Fern
Alismataceae	*Alisma plantago-aquatica*	Water Plantain
Amaranthaceae	*Alternanthera denticulata*	
	Nyssanthes duffusa	Barbwire Weed
Aphanopetalaceae	*Aphanopetalum resinosum*	Gum Vine
Apiaceae	*Cyclospermum leptophyllum* *	Slender Celery
	Foeniculum vulgare *	Fennel
	Hydrocotyle bonariensis *	
	Hydrocotyle tripartita	Pennywort
Apocynaceae	*Araujia sericifera* *	Moth Vine
	Conium maculosum *	Hemlock
	Gomphocarpus fruiticosus *	Narrow-leaved Cotton Bush
	Marsdenia flavescens	Hairy Milk Vine
	Marsdenia rostrata	Milk Vine
	Parsonsia straminea	Common Silkpod
	Tylophora barbata	Bearded Tylophora
Araceae	*Gymnostachys anceps*	Settler's Twine
Asteraceae	*Ageratina adenophora* *	Crofton Weed
	Ageratina riparia *	Mist Flower
	Aster subulatus *	Wild Aster
	Bidens pilosa *	Cobblers Pegs
	Cassinia aculeata	Dolly bush
	Cassinia sp.	
	Cirsium vulgare *	Spear Thistle
	Conyza sp. *	Fleabane
	Cotula australis	
	Cotula coronopifolia	
	Delairea odorata *	Cape Ivy
	Euchiton sp.	
	Facelis retusa *	
	Gamochaeta americana *	Cudweed

FAMILY	SCIENTIFIC NAME	COMMON NAME
	Hypochaeris radicata *	Catsear
	Senecio linearifolius	
	Senecio madagascariensis *	Fireweed
	*Sigesbeckia orientalis*subsp. *orientalis*	Indian Weed
	Sonchus asper *	Prickly Sowthistle
	Sonchus oleraceus *	Common Sowthistle
	Tagetes minuta *	Stinking Roger
	Taraxacum officinalis *	Dandelion
Aspelniaceae	*Asplenium flabellifolium*	Necklace Fern
Azollaceae	*Azolla filiculoides*	
Bassellaceae	*Anredera cordifolia*	Madiera Vine
Bignoniaceae	*Pandorea pandorana* subsp. *pandorana*	Wonga Vine
	Tecoma capensis *	Cape Honeysuckle
Blechnaceae	*Blechnum cartilagineum*	Gristle Fern
	Doodia aspera	Prickly Rasp Fern
Boraginaceae	*Echium plantagineum* *	Paterson's Curse
Callitrichaceae	*Callitriche stagnallis* *	Common Starwort
Campanulaceae	*Wahlenbergia gracilis*	
Caryophyllaceae	*Cerastium glomeratum* *	Mouse-ear Chickweed
	Paronychia brasiliana *	Chilean Whitlow Wort
	Polycarpon tetraphyllum *	Four-leaved Allseed
	Stellaria flaccida	
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak
	Casuarina cunninghamiana	River Oak
	Casuarina glauca	Swamp Oak
Celastraceae	*Elaeodendron australe* var. *australe*	
Chenopodiaceae	*Chenopodium album* *	Fat Hen
	Einadia hastata	
	Einadia trigonos	Fishweed
Clusiaceae	*Hypericum gramineum*	
Commelinaceae	*Commelina cyanea*	Native Wandering Jew
	Tradescantia fluminensis *	Wandering Jew
Convolvulaceae	*Dichondra repens*	Kidney Weed
Crassulaceae	*Crassula sieberiana*	Australian Stonecrop
Cyatheaceae	*Cyathea australis*	Rough Tree Fern
Cyperaceae	*Carex appressa*	
	Carex sp.	
	Cyperus eragrostis *	Umbrella Sedge
	Cyperus exaltatus	
	Cyperus sequiflorus	
	Eleocharis sphacelata	
	Isolepis inundata	Club Rush
	Isoplepis prolifera *	
	Isolepis sp.	
Davalliaceae	*Arthropteris tennella*	
Dicksoniaceae	*Calchlaena dubia*	Soft Bracken
Dilleniaceae	*Hibbertia dentata*	Twining Guinea Flower

FAMILY	SCIENTIFIC NAME	COMMON NAME
	Hibbertia scandens	Climbing Guinea Flower
Ebenaceae	*Diospyros pentamera*	Myrtle Ebony
Euphorbiaceae	*Baloghia inophylla*	Brush Bloodwood
	Capsella bursa-pastoris *	
	Croton verreauxii	Green Native Cascarilla
	Euphorbia peplus *	Petty Spurge
	Ricinus communis *	Caster Oil Plant
Fabaceae - Faboideae	*Daviesia ulicifolia* subsp. *ulicifolia*	Gorse Bitter Pea
	Desmodium rhytidophyllum	
	Desmodium varians	
	Erythrina sykesii *	Coral Tree
	Glycine clandestina	Twining Glycine
	Glycine tabacina	Variable Glycine
	Lotus angustissimus *	
	Trifolium repens *	White Clover
	Vicia sativa subsp. *angustifolia*	
Fabaceae - Mimosoideae	*Acacia binervata*	Two-veined Hickory
	Acacia maidenii	Maiden's wattle
	Acacia mearnsii	Black Wattle
	Acacia melanoxylon	Blackwood
	Pararchidendron pruinosum var. pruinosum	Snow Wood
Flacourtiaceae	*Scolopia braunii*	Flintwood
Fumariaceae	*Fumaria muralis* subsp. *muralis* *	Wall Fumitory
Geraniaceae	*Geranium* sp.	
Goodeniaceae	*Goodenia hederacea*	
Haloragaceae	*Myriophyllum* sp.	
Juncaceae	*Juncus continuus*	
	Juncus usitatus	
	Juncus sp.	
Juncaginaceae	*Triglochin procera*	Water Ribbons
Lamiaceae	*Mentha x piperita* notomorph *citrata*	Mint
	Plectranthus parviflorus	
Lobeliaceae	*Pratia purpurascens*	White Root
Lomandraceae	*Lomandra filiformis* subsp. *filiformis*	Wattle Mat-rush
	Lomandra longifolia	Spiked Mat-rush
Luzuriagaceae	*Eustephus latifolius*	Wombat Berry
	Geitonoplesium cymosum	Scrambling Lily
Lythraceae	*Lythrum hyssopifolia*	Hyssop Loosestrife
	Lythrum salicaria	Purple Loosestrife
Malvaceae	*Hibiscus heterophyllus* subsp. *heterophyllus*	Native Rosella
	Lagunaria patersonia #	Norfolk Island Hibiscus
	Malva parviflora *	
	Modiola caroliniana *	Red-flowered Mallow
	Sida rhombifolia *	Pady's Lucerne
Meliaceae	*Melia azederach*	White Cedar
	Toona ciliata	Red Cedar
Menispermaceae	*Sarcopetalum harveyanum*	Pearl Vine

FAMILY	SCIENTIFIC NAME	COMMON NAME
Monimiaceae	*Hedycarya angustifolia*	Native Mulberry
Moraceae	*Ficus superba*	Deciduous Fig
	Ficus rubiginosa	Port Jackson Fig
	Maclura cochinchinensis	Cockspur Thorn
	Streblus brunonianus	Whalebone Tree
Myrsinaceae	*Anagallis arvensis* *	Scarlet Pimpernel
	Myrsine variabile	
Myrtaceae	*Acmena smithii*	Lilly Pilly
	Angophora floribunda	Rough-barked Apple
	Eucalyptus bosistoana	Coast Grey Box
	Eucalyptus eugenioides	
	Eucalyptus longifolia	Woolybutt
	Eucalyptus microcorys #	Tallowwood
	Eucalyptus quadrangulata	White-topped Box
	Eucalyptus saligna X botryoides hybrid	
	Eucalyptus tereticornis	Forest Red Gum
	Melaleuca decora	
	Melaleuca styphelioides	Prickly-leaved Tea Tree
Oleaceae	*Ligustrum sinsense* *	Small-leaved Privet
	Notelaea venosa	Veined Mock-olive
Onagraceae	*Ludwigia peploides* subsp. *montevidensis*	Water Primrose
Oxalidaceae	*Oxalis perennans*	
Passifloraceae	*Passiflora subpeltata* *	White Passionflower
Phytolaccaceae	*Phytolacca octandra* *	Inkweed
Pinaceae	*Pinus radiata* *	Radiata Pine
Pittosporaceae	*Pittosporum multiflorum*	Orange Thorn
	Pittosporum undulatum	Sweet Pittosporum
Plantaginaceae	*Plantago debilis*	
	Plantago lanceolata *	Lambs Tongue
Poaceae	*Anthoxanthum odoratum* *	
	Aristida ramosa	Three-awn Grass
	Austrostipa ramosissima	
	Axonopus fissifolius *	Carpet Grass
	Bothriochloa macra.	Red Leg Grass
	Briza minor *	
	Briza subaristata *	
	Bromus catharticus *	
	Bromus sp. *	
	Chloris sp.	
	Cynodon dactylon	Couch
	Echinopogon caespitosus	Hedgehog Grass
	Ehrharta erecta *	Panic Veldt Grass
	Eleusine indica *	Crowsfoot Grass
	Eragrostis sp.	
	Holcus lanatus *	Yorshire Fog
	Hordeum leporinum *	
	Imperata cylindrica	Blady Grass

FAMILY	SCIENTIFIC NAME	COMMON NAME
	Lachnagrostis filiformis	
	Lolium perenne *	Perrenial Rye
	Microlaena stipoides	Weeping Grass
	Oplismenis aemulus	Basket Grass
	Paspalum dilatatum *	Paspalum
	Paspalum distichum	Water Couch
	Pennisetum clandestinum *	Kikuyu
	Poa annua *	Winter Grass
	Poa sp.	
	Polypogon monspeliensis *	Annual Beardgrass
	Setaria gracilis *	Slender Pidgeon Grass
	Sporobolis africanus *	Parramatta Grass
	Vulpia sp.*	
Podocarpaceae	*Podocarpus elatus*	Plum Pine
Polygonaceae	*Acetosa sagittata* *	Turkey Rhubarb
	Persicaria decipiens	Slender Knotweed
	Persicaria hydropiper	Water Pepper
	Persicaria orientalis	Princes Feathers
	Rumex conglomeratus *	Clustered Dock
	Rumex brownii	
Potamogentonaceae	*Potamogeton ochreatus*	Blunt Pondweed
Proteaceae	*Stenocarpus salignus*	Scrub Beefwood
Ranunculaceae	*Ranunculus inundatus*	River Buttercup
	Ranunculus repens *	Creeping Buttercup
Rhamnaceae	*Alphitonia excelsa*	Red Ash
Rosaceae	*Rubus fruiticosus* agg. spp.*	Blackberry
	Rubus parvifolius	Native Raspberry
Rubiaceae	*Morinda jasminoides*	Sweet Morinda
Rutaceae	*Calodendrum capensis* #	Cape Chestnut
	Citrus limon Hybrid #	Lemon Tree
	Melicope micrococca	Hairy-leaved Doughwood
Salicaceae	*Salix* sp. *	Willow
Sapindaceae	*Cardiospermum grandiflorum* *	Balloon Vine
	Diploglottis cuninghamii	Native Tamarind
Sapotaceae	*Planchonella australis*	Black Apple
Scrophulariaceae	*Verbascum thapsus* subsp. *thapsus* *	Aarons Rod
	Verbascum virgatum *	Twiggy Mullien
Smilacaceae	*Smilax australis*	Lawyer Vine
Solanaceae	*Lycium ferocissimum* *	African Boxthorn
	Solanum linnaeanum *	Apple of Sodom
	Solanum mauritianum *	Tabacco Bush
	Solanum nigrum *	
	Solanum pseudocapsicum *	Madiera Winter
	Solanum pungetium	Eastern Nightshade
Sterculiaceae	*Brachychiton acerifolius*	Illawarra Flame Tree
	Commersonia frazeri	Brush Kurrajong
Typhaceae	*Typha orientalis*	Broadleaved Cumbungi
Urticaceae	*Dendrocnide excelsa*	Giant Stinging Tree

FAMILY	SCIENTIFIC NAME	COMMON NAME
	Urtica incisa	Stinging Nettle
	Urtica urens *	
Verbenaceae	*Clerodendrum tomentosum*	
	Lantana camara *	Lantana
	Verbena bonariensis *	Purple Top
	Verbena rigida *	
Violaceae	*Melicytus dentatus*	Tree Violet
	Viola betonicifolia	
Vitaceae	*Cissus antarctica*	Water Vine

* exotic weed species
\# planted native and exotic species

Red font declared noxious weeds within the Southern Councils Group

Fauna species observed

CLASS	COMMON NAME	SCIENTIFIC NAME
Ave	Australasian Grebe	*Tachybaptus novaehollandiae*
Ave	Australian King-Parrot	*Alisterus scapularis*
Ave	Australian Magpie	*Gymnorhina tibicen*
Ave	Australian Raven	*Corvus coronoides*
Ave	Australian Wood Duck	*Chenonetta jubata*
Ave	Bar-shouldered Dove	*Geopelia humeralis*
Ave	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*
Ave	Black-faced Monarch	*Monarcha melanopsis*
Ave	Black-fronted Dotteral	*Elseyornis melanops*
Ave	Brown Falcon	*Falco berigora*
Ave	Brown Thornbill	*Acanthiza pusilla*
Ave	Channel-billed Cuckoo	*Scythrops novaehollandiae*
Ave	Chestnut Teal	*Anas castanea*
Amp	Common Eastern Froglet	*Crinia signifera*
Ave	Common Starling	*Sturnus vulgaris*
Mam	Common Wombat	Vombatus ursinus
Ave	Crested Pigeon	*Ocyphaps lophotes*
Ave	Crimson Rosella	*Platycercus elegans*
Ave	Dollarbird	*Eurystomus orientalis*
Amp	Eastern Dwarf Tree Frog	*Litoria fallax*
Ave	Eastern Rosella	*Platycercus adscitus eximius*
Ave	Eastern Spinebill	*Acanthorhynchus tenuirostris*
Rep	Eastern Water Dragon	*Physignathus lesueurii*
Ave	Eastern Whipbird	*Psophodes olivaceus*
Ave	Eastern Yellow Robin	*Eopsaltria australis*
Mam	Fox	*Vulpes vulpes*

CLASS	COMMON NAME	SCIENTIFIC NAME
Ave	Galah	*Eolophus roseicapillus*
Ave	Golden Whistler	*Pachycephala pectoralis*
Ave	Great Egret	*Ardea alba*
Ave	Grey Butcherbird	*Cracticus torquatus*
Ave	Grey Fantail	*Rhipidura albiscapa*
Ave	Grey Shrike-thrush	*Colluricincla harmonica*
Ave	Hard-head Duck	*Aythya australis*
Ave	Jacky Lashtail	*Amphibolurus muricatus*
Amp	Keferstein's Tree Frog	*Litoria dentata*
Ave	Laughing Kookaburra	*Dacelo novaeguineae*
Ave	Lewin's Honeyeater	*Meliphaga lewinii*
Ave	Little Black Cormorant	*Phalacrocorax sulcirostris*
Ave	Little Pied Cormorant	*Phalacrocorax melanoleucos*
Ave	Long-billed Corella	*Cacatua tenuirostris*
Ave	Magpie-lark	*Grallina cyanoleuca*
Ave	Masked Lapwing	*Vanellus miles*
Ave	Noisy Miner	*Manorina melanocephala*
Ave	Pacific Black Duck	*Anas superciliosa*
Amp	Peron's Tree Frog	*Litoria peronii*
Ave	Pied Butcherbird	*Cracticus nigrogularis*
Ave	Purple Swamphen	*Porphyrio porphyrio*
Rep	Red-bellied Black Snake	*Pseudechis porphyriacus*
Ave	Red-browed Finch	*Neochmia temporalis*
Ave	Red-whiskered Bulbul	*Pycnonotus jocosus*
Ave	Rufous Whistler	*Pachycephala rufiventris*
Ave	Satin Bowerbird	*Ptilonorhynchus violaceus*
Ave	Silvereye	*Zosterops lateralis*
Ave	Sparrow	*Passer domesticus*
Ave	Spotted Pardalote	*Pardalotus punctatus*
Amp	Striped Marsh Frog	*Limnodynastes peronii*
Ave	Superb Fairy-wren	*Malurus cyaneus*
Mam	Swamp Wallaby	*Wallabia bicolor*
Ave	Topknot Pigeon	*Lopholaimus antarcticus*
Rep	unidentified grass skink	*Lampropholis sp.*
Ave	unidentified Stilt	
Ave	Welcome Swallow	*Hirundo neoxena*
Ave	White-faced Heron	*Egretta novaehollandiae*
Ave	White-throated Gerygone	*Gerygone olivacea*
Ave	Willie Wagtail	*Rhipidura leucophrys*
Ave	Yellow Thornbill	*Acanthiza nana*

Appendix E: TSC Act Threatened Species Assessments

The following assessments of adverse impacts is applied to species, populations and ecological communities listed on Schedules 1, 1A and 2 of the TSC Act and Schedules 4, 4A and 5 of the Fisheries Management Act. The assessment sets out factors (identified in DEC Guidelines for Threatened Species Assessments for Part 3A projects), which when considered, allow proponents to undertake a qualitative analysis of the likely adverse impacts of an action.

The following assessments of adverse impacts is applied to species, populations and ecological communities listed on Schedules 1, 1A and 2 of the TSC Act and Schedules 4, 4A and 5 of the Fisheries Management Act. The assessment sets out factors (identified in DEC Guidelines for Threatened Species Assessments for Part 3A projects), which when considered, allow proponents to undertake a qualitative analysis of the likely adverse impacts of an action.

The threatened species that are the subject of tests for this proposal include:

- *Cyncanchum elegans* (White-flowered Wax Plant) – likely habitat;
- *Daphnandra sp. Illawarra (Daphnandra johnsonii)* (Illawarra Socketwood) – likely habitat;
- *Pterostylis gibbosa* (Illawarra Greenhood) – potential habitat;
- *Zieria granulata* (Hill Zieria) – potential habitat;
- Lowland Dry-Subtropical Rainforest (Illawarra sub tropical rainforest in the Sydney Basin) – known to occur within the study area;
- Lowland Wollybutt-Melaleuca Forest (Illawarra lowlands grassy woodland in the Sydney Basin) – known to occur within the study area;
- Coastal Grassy Red Gum Forest (Illawarra lowlands grassy woodland in the Sydney Basin) – known to occur within the study area;
- Riparian River Oak Forest (River Flat Eucalypt Forest on Coastal Floodplain) – known to occur within the study area;
- *Botaurus poiciloptilus* (Australasian Bittern) - potential habitat;
- *Callocephalon fimbriatum* (Gang-gang Cockatoo) - potential habitat;
- *Calyptorhynchus lathami* (Glossy Black-Cockatoo) - potential habitat;
- *Ixobrychus flavicollis* (Black Bittern) - likely habitat;
- *Lathamus discolour* (Swift Parrot) – likely habitat;

- *Lophoictinia isura* (Square-tailed Kite) – potential habitat;
- *Neophema pulchella (*Turquoise Parrot) – likely habitat;
- *Ninox strenua* (Powerful Owl) – potential habitat;
- *Pachycephala olivacea* (Olive Whistler) – likely habitat;
- *Petroica rodinogaster* (Pink Robin) – potential habitat;
- *Stictonetta naevosa* (Freckled Duck) – likely habitat;
- *Chalinolobus dwyeri* (Large-eared Pied Bat) – likely habitat;
- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle) – potential habitat;
- *Miniopterus schreibersii oceanensi* (Eastern Bent-wing Bat) – likely habitat;
- *Pteropus poliocephalus*(Grey-headed Flying-fox) – likely habitat;
- *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat) – potential habitat;
- *Scoteanax rueppellii* (Greater Broad-nosed Bat) – potential habitat;

Threatened species, population or community.	*NSW legal status*	*How is the proposal likely to affect the lifecycle of a threatened species and/or population?*	*How is the proposal likely to affect the habitat of a threatened species population or ecological community?*	*Does the proposal affect any threatened species or populations that are at the limit of its known distribution?*	*How is the proposal likely to affect current disturbance regimes?*	*How is the proposal likely to affect habitat connectivity?*	*How is the proposal likely to affect critical habitat?*
White-flowered Wax Plant (*Cynanchum elegans)*	E1	The proposal is unlikely to affect the life cycle of this species as a majority of its habitat will be avoided. No individuals were found during targeted field investigations and given the level of disturbance of potential habitat and proposed mitigation measures the proposal is not likely to significantly affect the lifecycle of the White-flowered Wax Plant.	A majority of the potential habitat on site for White-flowered Wax Plant will be reserved in the proposed retention of remnant Lowland Dry-Subtropical Rainforest, Lowland Wollybutt-*Melaleuca* Forest and good condition Coastal Grassy Red Gum Forest as part of the rezoning of the Calderwood Urban Development Project. The proposed reservation of Johnston's Spur results in protection of downstream waterflow to a majority the good condition potential habitat for *Cynanchum elegans*. No individuals were found during field investigations and given the level of disturbance of potential habitat and proposed mitigation measures the proposal is not likely to significantly affect the habitat of *Cynanchum elegans.*	The site is not at the limit of the known distribution of the White Flowered Wax Plant. It is limited to the east coast of NSW occurring from Brunswick Heads in the North to Gerroa in the South.	The proposal is unlikely to negatively affect any current disturbance regimes of fire and flooding. Mitigation measures proposed will contain current and additional flooding flows anticipated post development of the site.	The proposed rezoning plan will incorporate terrestrial connectivity both within the site and to larger habitat corridors to the east and west of the site. The proposal will see some removal of remnant vegetation within the site, mitigated by considerable retention of large areas of contiguous remnant vegetation and wildlife corridors (Johnston's Spur, Marshall Mount Creek and Macquarie Rivulet riparian corridors).	There is no critical habitat known to occur on the site. .

Threatened species, population or community.	*NSW legal status*	*How is the proposal likely to affect the lifecycle of a threatened species and/or population?*	*How is the proposal likely to affect the habitat of a threatened species population or ecological community?*	*Does the proposal affect any threatened species or populations that are at the limit of its known distribution?*	*How is the proposal likely to affect current disturbance regimes?*	*How is the proposal likely to affect habitat connectivity?*	*How is the proposal likely to affect critical habitat?*
Illawarra Socketwood *(Daphnandra sp. Illawarra (Daphnandra johnsonii)*)	E1	The proposal is unlikely to affect the life cycle of this species as a majority of its habitat will be avoided. 0.87ha of potential habitat for the Illawarra Socketwood is proposed to be removed. The proposal may cause minor disruption to seedbanks, and recruitment of the Illawarra Socketwood. However, no individuals were found during targeted field investigations and given the level of disturbance of potential habitat and proposed mitigation measures the proposal is not likely to significantly affect the lifecycle of the Illawarra Socketwood.	A majority of the potential habitat on site for Illawarra Socketwood will be reserved in the proposed retention of Lowland Dry-Subtropical Rainforest and the Moist Box-Red Gum Foothills Forest as part of the rezoning of the Calderwood Urban Development Project. No individuals were found during field investigations and given the level of disturbance of potential habitat and proposed mitigation measures the proposal is not likely to significantly affect the habitat.	The site is not at the limit of the known distribution of the Illawarra Socketwood. *Daphnandra sp. Illawarra (Daphnandra johnsonii)* been recorded at 41 sites within the Illawarra region, to which it is endemic. It is known to occur from Scarborough in the north to Toolijooa in the south.	The proposal is unlikely to negatively affect any current disturbance regimes of fire and flooding. Mitigation measures proposed will contain current and additional flooding flows anticipated post development of the site.	The proposed rezoning plan will incorporate terrestrial connectivity both within the site and to larger habitat corridors to the east and west of the site. The proposal will see some removal of remnant vegetation within the site, mitigated by considerable retention of large areas of contiguous remnant vegetation and wildlife corridors (Johnston's Spur, Marshall Mount Creek and Macquarie Rivulet riparian corridors).	There is no critical habitat known to occur on the site.

Threatened species, population or community.	*NSW legal status*	*How is the proposal likely to affect the lifecycle of a threatened species and/or population?*	*How is the proposal likely to affect the habitat of a threatened species population or ecological community?*	*Does the proposal affect any threatened species or populations that are at the limit of its known distribution?*	*How is the proposal likely to affect current disturbance regimes?*	*How is the proposal likely to affect habitat connectivity?*	*How is the proposal likely to affect critical habitat?*
Illawarra Greenhood (*Pterostylis gibbosa)*	E1	No individuals were found during field investigations and given the level of disturbance of potential habitat and proposed mitigation measures the proposal is not likely to significantly affect the lifecycle of the Illawarra Greenhood. However, further survey is recommended in potential habitat at an appropriate time, considering time of year and weather conditions, prior to any works commencing in areas of potential habitat.	A majority of the potential habitat (Lowland Woollybutt-*Melaleuca* Forest) on site for *Pterostylis gibbosa* will be reserved in the proposed rezoning of the Calderwood Urban Development Project. No individuals were found during field investigations and given the level of disturbance of potential habitat and proposed mitigation measures the proposal is not likely to significantly affect the habitat. However further survey is recommended in potential habitat prior to any works commencing in areas of potential habitat.	The site is not at the known limit of the distribution of the Illawarra Greenhood. It is known from a small number of populations in the hunter region, the Illawarra region and the Shoalhaven region.	The proposal is unlikely to negatively affect any current disturbance regimes of fire and flooding. Mitigation measures proposed will contain current and additional flooding flows anticipated post development of the site.	The proposed rezoning plan will incorporate terrestrial connectivity both within the site and to larger habitat corridors to the east and west of the site. The proposal will see some removal of remnant vegetation within the site, mitigated by considerable retention of large areas of contiguous remnant vegetation and wildlife corridors (Johnston's Spur, Marshall Mount Creek and Macquarie Rivulet riparian corridors).	There is no critical habitat known to occur on the site.

Threatened species, population or community.	*NSW legal status*	*How is the proposal likely to affect the lifecycle of a threatened species and/or population?*	*How is the proposal likely to affect the habitat of a threatened species population or ecological community?*	*Does the proposal affect any threatened species or populations that are at the limit of its known distribution?*	*How is the proposal likely to affect current disturbance regimes?*	*How is the proposal likely to affect habitat connectivity?*	*How is the proposal likely to affect critical habitat?*
Hill Zieria (*Zieria granulata)*	E1	The proposal is unlikely to affect the life cycle of this species as a majority of its habitat will be avoided. The proposal may cause minor disruption to seedbanks, and recruitment of the Hill Zieria, however no individuals were found during targeted field investigations and given the level of disturbance of potential habitat and proposed mitigation measures the proposal is not likely to significantly affect the lifecycle of the Hill Zieria.	A majority of the potential habitat (Lowland Dry-subtropical Rainforest, Caostal Grassy Red Gum Forest and lowland Woollybutt-*Melaleuca* Forest) in good condition on site for *Hill Zieria* will be reserved in the proposed rezoning of the Calderwood Urban Development Project. No individuals were found during field investigations and given the level of disturbance of potential habitat and proposed mitigation measures the proposal is not likely to significantly affect the habitat.	The subject site is at the northern end of the known distribution of *Zieria granulata.* It occurs in the coastal lowlands and escarpment slopes between Oak Flats and Toolijooa and has been recorded from 26 populations within its range of 22km.	The proposal is unlikely to negatively affect any current disturbance regimes of fire and flooding. Mitigation measures proposed will contain current and additional flooding flows anticipated post development of the site.	The proposed rezoning plan will incorporate terrestrial connectivity both within the site and to larger habitat corridors to the east and west of the site. The proposal will see some removal of remnant vegetation within the site, mitigated by considerable retention of large areas of contiguous remnant vegetation and wildlife corridors (Johnston's Spur, Marshall Mount Creek and Macquarie Rivulet riparian corridors).	There is no critical habitat known to occur on the site.

Threatened species, population or community.	*NSW legal status*	*How is the proposal likely to affect the lifecycle of a threatened species and/or population?*	*How is the proposal likely to affect the habitat of a threatened species population or ecological community?*	*Does the proposal affect any threatened species or populations that are at the limit of its known distribution?*	*How is the proposal likely to affect current disturbance regimes?*	*How is the proposal likely to affect habitat connectivity?*	*How is the proposal likely to affect critical habitat?*
Illawarra Subtropical Rainforest in the Sydney Basin (Lowland Dry-Subtropical Rainforest)	EEC	Not a threatened species and/or population.	A majority of the Illawarra Subtropical Rainforest (96.27%) that occurs on site will be reserved in the proposed rezoning of the Calderwood Urban Development Project. Vegetation upslope of the Illawarra Subtropical Rainforest will be reserved and as such the proposal is unlikely to impact the hydrology of the EEC. Given the small amount of removal of Illawarra Subtropical Rainforest (0.14ha) the proposal is not likely to significantly affect the EEC.	The site is not at the limit of known distribution of this EEC. Illawarra Subtropical Rainforest mostly occurs between Albion Park and Gerringong with outlying occurrences at Berkley Hills and to the Shoalhaven river in the south.	The proposal is unlikely to negatively affect any current disturbance regimes of fire and flooding. Mitigation measures proposed will contain current and additional flooding flows anticipated post development of the site.	The proposed rezoning plan will incorporate terrestrial connectivity both within the site and to larger habitat corridors to the east and west of the site. The proposal will see some removal of remnant vegetation within the site, mitigated by considerable retention of large areas of contiguous remnant vegetation and wildlife corridors (Johnston's Spur, Marshall Mount Creek and Macquarie Rivulet riparian corridors).	There is no critical habitat known to occur on the site.

Threatened species, population or community.	*NSW legal status*	*How is the proposal likely to affect the lifecycle of a threatened species and/or population?*	*How is the proposal likely to affect the habitat of a threatened species population or ecological community?*	*Does the proposal affect any threatened species or populations that are at the limit of its known distribution?*	*How is the proposal likely to affect current disturbance regimes?*	*How is the proposal likely to affect habitat connectivity?*	*How is the proposal likely to affect critical habitat?*
Illawarra Lowlands Grassy Woodland in the Sydney Basin (Lowland Wollybutt-Melaleuca Forest and Coastal Grassy Red Gum Forest)	EEC	Not a threatened species and/or population.	The proposal will result in a loss of 30.17 ha of Illawarra Lowlands Grassy Woodland. This represents 44.2% of the community found on site, however, only 1.21ha is considered in good condition, the remaining 29ha is isolated paddock trees. 35.3 ha, or 97% of good condition Illawarra Lowlands Grassy Woodlands will be reserved through the proposed rezoning of the Calderwood Urban Development Project. The reserved vegetation will be protected for the long term through zoning and an ESL layer. Given the level of disturbance of the Illawarra Lowlands Grassy Woodlands the loss is not likely to significantly affect the EEC.	The site is not at the limit of known distribution of this EEC. Illawarra Lowlands Grassy Woodland occurs in the Wollongong, Shellharbour and Kiama local government areas.	The proposal is unlikely to negatively affect any current disturbance regimes of fire and flooding. Mitigation measures proposed will contain current and additional flooding flows anticipated post development of the site.	The proposed rezoning plan will incorporate terrestrial connectivity both within the site and to larger habitat corridors to the east and west of the site. The proposal will see some removal of remnant vegetation within the site, mitigated by considerable retention of large areas of contiguous remnant vegetation and wildlife corridors (Johnston's Spur, Marshall Mount Creek and Macquarie Rivulet riparian corridors).	There is no critical habitat known to occur on the site.

Threatened species, population or community.	*NSW legal status*	*How is the proposal likely to affect the lifecycle of a threatened species and/or population?*	*How is the proposal likely to affect the habitat of a threatened species population or ecological community?*	*Does the proposal affect any threatened species or populations that are at the limit of its known distribution?*	*How is the proposal likely to affect current disturbance regimes?*	*How is the proposal likely to affect habitat connectivity?*	*How is the proposal likely to affect critical habitat?*
River-Flat Eucalypt Forest on Coastal Floodplain (Riparian River Oak Forest)	EEC	Not a threatened species and/or population.	The proposal will result in a loss of 0.72 ha of River-Flat Eucalypt Forest on Coastal Floodplain. This represents 3.99% of this community found on site. 25.68 ha of River-Flat Eucalypt Forest on Coastal Floodplain will be reserved through the proposed rezoning of the Calderwood Urban Development Project. On Site Detention, Water Sensitive Urban Design and rehabilitation of the riparian areas is likely to improve water quality and is unlikely to result in changes to hydrology that will impact the EEC. Given the small amount of removal, the level of disturbance of the River-Flat Eucalypt Forest on Coastal Floodplain the loss is not likely to significantly affect the EEC.	The site is not at the limit of known distribution of this EEC. River-Flat Eucalypt Forest on Coastal Floodplain occurs from Port Stephens LGA in the north to Bega LGA in the South.	The proposal is unlikely to negatively affect any current disturbance regimes of fire and flooding. Mitigation measures proposed will contain current and additional flooding flows anticipated post development of the site.	The proposed rezoning plan will incorporate terrestrial connectivity both within the site and to larger habitat corridors to the east and west of the site. The proposal will see some removal of remnant vegetation within the site, mitigated by considerable retention of large areas of contiguous remnant vegetation and wildlife corridors (Johnston's Spur, Marshall Mount Creek and Macquarie Rivulet riparian corridors).	There is no critical habitat known to occur on the site.

Threatened species, population or community.	*NSW legal status*	*How is the proposal likely to affect the lifecycle of a threatened species and/or population?*	*How is the proposal likely to affect the habitat of a threatened species population or ecological community?*	*Does the proposal affect any threatened species or populations that are at the limit of its known distribution?*	*How is the proposal likely to affect current disturbance regimes?*	*How is the proposal likely to affect habitat connectivity?*	*How is the proposal likely to affect critical habitat?*
Australasian Bittern (*Botaurus poiciloptilus)*	V	The proposal is unlikely to affect the life cycle of the Australasian Bittern. Vegetation removal is unlikely to result in significant impacts to resources (feeding, breeding, roosting).	A majority of the potential habitat (Riparian River Oak Forest) on site will be retained and rehabilitated. It is unlikely that the proposal will impact on the inhabitancy of this species within the site. Artificial wetlands will be established as part of the proposal and riparian areas will be rehabilitated, which may provide improved habitat for the Australasian Bittern. On Site Detention, Water Sensitive Urban Design and rehabilitation of the riparian areas is likely to improve water quality. No individuals were found during field investigations and given the level of disturbance of potential habitat and proposed mitigation measures the proposal is not likely to significantly affect the habitat.	The site is not at the limit of known distribution of the Australasian Bittern. It is widespread throughout NSW but uncommon in the south east of the state.	The proposal is unlikely to negatively affect any current disturbance regimes of fire and flooding. Mitigation measures proposed will contain current and additional flooding flows anticipated post development of the site.	The proposal will result in removal of remnant vegetation within the site, mitigated by considerable retention of large areas of contiguous remnant vegetation and wildlife corridors (Johnston's Spur, Marshall Mount Creek and Macquarie Rivulet riparian corridors) and the establishment of some artificial wetlands.	There is no critical habitat known to occur on the site.

Threatened species, population or community.	*NSW legal status*	*How is the proposal likely to affect the lifecycle of a threatened species and/or population?*	*How is the proposal likely to affect the habitat of a threatened species population or ecological community?*	*Does the proposal affect any threatened species or populations that are at the limit of its known distribution?*	*How is the proposal likely to affect current disturbance regimes?*	*How is the proposal likely to affect habitat connectivity?*	*How is the proposal likely to affect critical habitat?*
Gang-gang Cockatoo (*Callocephalon fimbriatum)*	V	The proposal is unlikely to affect the life cycle of the Gang–gang Cockatoo. Hollow bearing trees on site provide potential habitat for the Gang-gang Cockatoo. Whilst the proposal will result in removal of a number of hollow bearing trees many will be protected in the reservation of remnant vegetation. An area of scattered remnant Coastal Grassy Red Gum Forest requires further survey prior to any works commencing on site. The proposed vegetation removal is unlikely to result in significant impacts to resources (feeding, breeding, roosting) as it is a highly mobile species.	A majority of the potential habitat on site for Gang-gang Cockatoo (Lowland Dry-subtropical Rainforest, Moist Box-Red Gum Foothills Forest, Coastal Grassy Red Gum Forest and Lowland Woollybutt-Melaleuca Forest) will be reserved in the proposed retention of remnant vegetation as part of the rezoning of the Calderwood Urban Development Project. No individuals were found during field investigations and given the level of disturbance of potential habitat, the proximity to nearby areas of suitable habitat and proposed mitigation measures the proposal is not likely to significantly affect the habitat of the Gang-gang Cockatoo.	The site is not at the known limit of distribution of the Gang-gang Cockatoo. It is known to occur from Victoria in the south to Coffs Harbour in the north and west to Mudgee.	The proposal is unlikely to negatively affect any current disturbance regimes of fire and flooding. Mitigation measures proposed will contain current and additional flooding flows anticipated post development of the site.	The proposed rezoning plan will incorporate terrestrial connectivity both within the site and to larger habitat corridors to the east and west of the site. The proposal will see some removal of remnant vegetation within the site, mitigated by considerable retention of large areas of contiguous remnant vegetation and wildlife corridors (Johnston's Spur, Marshall Mount Creek and Macquarie Rivulet riparian corridors).	There is no critical habitat known to occur on the site.

Threatened species, population or community.	*NSW legal status*	*How is the proposal likely to affect the lifecycle of a threatened species and/or population?*	*How is the proposal likely to affect the habitat of a threatened species population or ecological community?*	*Does the proposal affect any threatened species or populations that are at the limit of its known distribution?*	*How is the proposal likely to affect current disturbance regimes?*	*How is the proposal likely to affect habitat connectivity?*	*How is the proposal likely to affect critical habitat?*
Glossy Black-cockatoo (*Calyptorhynchus lathami)*	V	The proposal is unlikely to affect the life cycle of the Glossy Black-cockatoo. Hollow bearing trees on site provide potential habitat for the Glossy Black-cockatoo. Whilst the proposal will result in removal of a number of hollow bearing trees many will be protected in the reservation of remnant vegetation. An area of scattered remnant Coastal Grassy Red Gum Forest requires further survey prior to any works commencing on site. The proposed vegetation removal is unlikely to result in significant impacts to resources (feeding, breeding, roosting).	A majority of the potential habitat on site for Glossy Black-cockatoo (Coastal Grassy Red Gum Forest, Lowland Woollybutt-Melaleuca Forest and Riparian River Oak Forest) will be reserved in the proposed retention of remnant vegetation as part of the rezoning of the Calderwood Urban Development Project. No individuals were found during field investigations and given the level of disturbance of potential habitat, the proximity to nearby areas of suitable habitat and proposed mitigation measures the proposal is not likely to significantly affect the habitat of the Glossy Black-cockatoo.	The site is not at the limit of the known distribution of the Glossy Black-cockatoo. It is known to occur from Queensland in the north to Victoria in the South.	The proposal is unlikely to negatively affect any current disturbance regimes of fire and flooding. Mitigation measures proposed will contain current and additional flooding flows anticipated post development of the site.	The proposed rezoning plan will incorporate terrestrial connectivity both within the site and to larger habitat corridors to the east and west of the site. The proposal will see some removal of remnant vegetation within the site, mitigated by considerable retention of large areas of contiguous remnant vegetation and wildlife corridors (Johnston's Spur, Marshall Mount Creek and Macquarie Rivulet riparian corridors).	There is no critical habitat known to occur on the site.

Threatened species, population or community.	*NSW legal status*	*How is the proposal likely to affect the lifecycle of a threatened species and/or population?*	*How is the proposal likely to affect the habitat of a threatened species population or ecological community?*	*Does the proposal affect any threatened species or populations that are at the limit of its known distribution?*	*How is the proposal likely to affect current disturbance regimes?*	*How is the proposal likely to affect habitat connectivity?*	*How is the proposal likely to affect critical habitat?*
Black Bittern (*Ixobrychus flavicollis*)	V	The proposal is unlikely to affect the life cycle of the Black Bittern. Vegetation removal is unlikely to result in significant impacts to resources (feeding, breeding, roosting).	A majority of the potential habitat (Riparian River Oak Forest) on site will be retained and rehabilitated. It is unlikely that the proposal will impact on the inhabitancy of this species within the site. Artificial wetlands will be established as part of the proposal and riparian areas will be rehabilitated, which may provide improved habitat for the Black Bittern. On Site Detention, Water Sensitive Urban Design and rehabilitation of the riparian areas is likely to improve water quality. No individuals were found during field investigations and given the level of disturbance of potential habitat and proposed mitigation measures the proposal is not likely to significantly affect the habitat.	The site is not at the limit of the known distribution of the Black Bittern which occurs throughout NSW.	The proposal is unlikely to negatively affect any current disturbance regimes of fire and flooding. Mitigation measures proposed will contain current and additional flooding flows anticipated post development of the site.	The proposal will see some removal of remnant vegetation within the site, mitigated by considerable retention of large areas of contiguous remnant vegetation and wildlife corridors (Johnston's Spur, Marshall Mount Creek and Macquarie Rivulet riparian corridors) and the establishment of some artificial wetlands.	There is no critical habitat known to occur on the site.

Threatened species, population or community.	*NSW legal status*	*How is the proposal likely to affect the lifecycle of a threatened species and/or population?*	*How is the proposal likely to affect the habitat of a threatened species population or ecological community?*	*Does the proposal affect any threatened species or populations that are at the limit of its known distribution?*	*How is the proposal likely to affect current disturbance regimes?*	*How is the proposal likely to affect habitat connectivity?*	*How is the proposal likely to affect critical habitat?*
Swift Parrot (*Lathamus discolour)*	E1	The proposal is unlikely to affect the life cycle of the Swift Parrot. The Swift Parrot breeds in Tasmania and feed on flowering eucalypts. Vegetation removal is unlikely to result in significant impacts to resources (feeding, breeding, roosting) as it is a highly mobile species.	A majority of the potential habitat on site for Swift Parrot (Coastal Grassy Red Gum Forest and Lowland Woollybutt-*Melaleuca* Forest) will be reserved in the proposed retention of remnant vegetation as part of the rezoning of the Calderwood Urban Development Project. No individuals were found during field investigations and given the level of disturbance of potential habitat, the proximity to nearby areas of suitable habitat and proposed mitigation measures the proposal is not likely to significantly affect the habitat of the Swift Parrott.	The site is not at the known limit of distribution for the Swift Parrot. It is known to breed in Tasmania during Spring and Summer moving north for autumn and winter, occurring from Victoria to south east Queensland.	The proposal is unlikely to negatively affect any current disturbance regimes of fire and flooding. Mitigation measures proposed will contain current and additional flooding flows anticipated post development of the site.	The proposed rezoning plan will incorporate terrestrial connectivity both within the site and to larger habitat corridors to the east and west of the site. The proposal will see some removal of remnant vegetation within the site, mitigated by considerable retention of large areas of contiguous remnant vegetation and wildlife corridors (Johnston's Spur, Marshall Mount Creek and Macquarie Rivulet riparian corridors).	There is no critical habitat known to occur on the site.

Threatened species, population or community.	*NSW legal status*	*How is the proposal likely to affect the lifecycle of a threatened species and/or population?*	*How is the proposal likely to affect the habitat of a threatened species population or ecological community?*	*Does the proposal affect any threatened species or populations that are at the limit of its known distribution?*	*How is the proposal likely to affect current disturbance regimes?*	*How is the proposal likely to affect habitat connectivity?*	*How is the proposal likely to affect critical habitat?*
Square-tailed Kite (*Lophoictinia isura*)	V	The proposal is unlikely to affect the life cycle of the Square-tailed Kite A majority of potential roosting vegetation (along waterways) will be retained. Vegetation removal is unlikely to result in significant impacts to resources (feeding, breeding, roosting) as it is a highly mobile species.	A majority of the potential habitat on site for Square-tailed Kite (Riparian River Oak Forest, Coastal Grassy Red Gum Forest and Lowland Woollybutt-Melaleuca Forest) will be reserved in the proposed retention of remnant vegetation as part of the rezoning of the Calderwood Urban Development Project. No individuals were found during field investigations and given the level of disturbance of potential habitat, the proximity to nearby areas of suitable habitat and proposed mitigation measures the proposal is not likely to significantly affect the habitat of the Square-tailed Kite.	The site is not at the limit of the known distribution of the Square-tailed Kite. It occurs in coastal and sub coastal areas throughout Queensland, NSW and Victoria.	The proposal is unlikely to negatively affect any current disturbance regimes of fire and flooding. Mitigation measures proposed will contain current and additional flooding flows anticipated post development of the site.	The proposed rezoning plan will incorporate terrestrial connectivity both within the site and to larger habitat corridors to the east and west of the site. The proposal will see some removal of remnant vegetation within the site, mitigated by considerable retention of large areas of contiguous remnant vegetation and wildlife corridors (Johnston's Spur, Marshall Mount Creek and Macquarie Rivulet riparian corridors).	There is no critical habitat known to occur on the site.

Threatened species, population or community.	*NSW legal status*	*How is the proposal likely to affect the lifecycle of a threatened species and/or population?*	*How is the proposal likely to affect the habitat of a threatened species population or ecological community?*	*Does the proposal affect any threatened species or populations that are at the limit of its known distribution?*	*How is the proposal likely to affect current disturbance regimes?*	*How is the proposal likely to affect habitat connectivity?*	*How is the proposal likely to affect critical habitat?*
Turquoise Parrot (*Neophema pulchella*)	V	The proposal is unlikely to affect the life cycle of the Turquoise Parrot. Hollow bearing trees on site provide potential habitat for the Turquoise Parrot. Whilst the proposal will result in removal of a number of hollow bearing trees many will be protected in the reservation of remnant vegetation. An area of scattered remnant Coastal Grassy Red Gum Forest requires further survey prior to any works commencing on site. The proposed vegetation removal is unlikely to result in significant impacts to resources (feeding, breeding, roosting).	A majority of the potential habitat on site for Turquoise Parrot (Riparian River Oak Forest and Coastal Grassy Red Gum Forest) will be reserved in the proposed retention of remnant vegetation as part of the rezoning of the Calderwood Urban Development Project. No individuals were found during field investigations and given the level of disturbance of potential habitat, the proximity to nearby areas of suitable habitat and proposed mitigation measures the proposal is not likely to significantly affect the habitat of the Turquoise Parrot.	The site is not at the limit of the known distribution of the Turquoise Parrot. It is known to occur from southern Queensland to northern Victoria.	The proposal is unlikely to negatively affect any current disturbance regimes of fire and flooding. Mitigation measures proposed will contain current and additional flooding flows anticipated post development of the site.	The proposed rezoning plan will incorporate terrestrial connectivity both within the site and to larger habitat corridors to the east and west of the site. The proposal will see some removal of remnant vegetation within the site, mitigated by considerable retention of large areas of contiguous remnant vegetation and wildlife corridors (Johnston's Spur, Marshall Mount Creek and Macquarie Rivulet riparian corridors).	There is no critical habitat known to occur on the site.

Threatened species, population or community.	*NSW legal status*	*How is the proposal likely to affect the lifecycle of a threatened species and/or population?*	*How is the proposal likely to affect the habitat of a threatened species population or ecological community?*	*Does the proposal affect any threatened species or populations that are at the limit of its known distribution?*	*How is the proposal likely to affect current disturbance regimes?*	*How is the proposal likely to affect habitat connectivity?*	*How is the proposal likely to affect critical habitat?*
Powerful Owl (*Ninox strenua*)	V	The proposal is unlikely to affect the life cycle of the Powerful Owl. Hollow bearing trees on site provide potential habitat for the Powerful Owl. Whilst the proposal will result in removal of a number of hollow bearing trees many will be protected in the reservation of remnant vegetation. An area of scattered remnant Coastal Grassy Red Gum Forest requires further survey prior to any works commencing on site. The proposed vegetation removal is unlikely to result in significant impacts to resources (feeding, breeding, roosting).	A majority of the potential habitat on site for Powerful Owl (Lowland Dry-subtropical Rainforest, Moist Box-Red Gum Foothills Forest, Coastal Grassy Red Gum Forest and Lowland Woollybutt-*Melaleuca* Forest) will be reserved in the proposed retention of remnant vegetation as part of the rezoning of the Calderwood Urban Development Project. No individuals were found during field investigations and given the level of disturbance of potential habitat, the proximity to nearby areas of suitable habitat and proposed mitigation measures the proposal is not likely to significantly affect the habitat of the Powerful Owl.	The site is not at the limit of the known distribution of the Powerful Owl. It is known to occur from Mackay in the north to south west Victoria.	The proposal is unlikely to negatively affect any current disturbance regimes of fire and flooding. Mitigation measures proposed will contain current and additional flooding flows anticipated post development of the site.	The proposed rezoning plan will incorporate terrestrial connectivity both within the site and to larger habitat corridors to the east and west of the site. The proposal will see some removal of remnant vegetation within the site, mitigated by considerable retention of large areas of contiguous remnant vegetation and wildlife corridors (Johnston's Spur, Marshall Mount Creek and Macquarie Rivulet riparian corridors).	There is no critical habitat known to occur on the site.

Threatened species, population or community.	*NSW legal status*	*How is the proposal likely to affect the lifecycle of a threatened species and/or population?*	*How is the proposal likely to affect the habitat of a threatened species population or ecological community?*	*Does the proposal affect any threatened species or populations that are at the limit of its known distribution?*	*How is the proposal likely to affect current disturbance regimes?*	*How is the proposal likely to affect habitat connectivity?*	*How is the proposal likely to affect critical habitat?*
Olive Whistler (*Pachycephala olivacea)*	V	The proposal is unlikely to affect the life cycle of the Olive Whistler. Vegetation removal is unlikely to result in significant impacts to resources (feeding, breeding, roosting).	A majority of the potential habitat on site for Olive Whistler (Lowland Dry-subtropical Rainforest, Moist Box-Red Gum Foothills Forest, Coastal Grassy Red Gum Forest, Lowland Woollybutt-*Melaleuca* Forest and Riparian River Oak Forest) will be reserved in the proposed retention of remnant vegetation as part of the rezoning of the Calderwood Urban Development Project. No individuals were found during field investigations and given the level of disturbance of potential habitat, the proximity to nearby areas of suitable habitat and proposed mitigation measures the proposal is not likely to significantly affect the habitat of the Olive Whistler.	The site is not at the limit of the known distribution for the Olive Whistler. It occurs in disjunct populations throughout NSW, in the north around Barrington Tops, from the Illawarra to Victoria and inland around the Snowy Mountains and Brindabella Range.	The proposal is unlikely to negatively affect any current disturbance regimes of fire and flooding. Mitigation measures proposed will contain current and additional flooding flows anticipated post development of the site.	The proposed rezoning plan will incorporate terrestrial connectivity both within the site and to larger habitat corridors to the east and west of the site. The proposal will see some removal of remnant vegetation within the site, mitigated by considerable retention of large areas of contiguous remnant vegetation and wildlife corridors (Johnston's Spur, Marshall Mount Creek and Macquarie Rivulet riparian corridors).	There is no critical habitat known to occur on the site.

Threatened species, population or community.	*NSW legal status*	*How is the proposal likely to affect the lifecycle of a threatened species and/or population?*	*How is the proposal likely to affect the habitat of a threatened species population or ecological community?*	*Does the proposal affect any threatened species or populations that are at the limit of its known distribution?*	*How is the proposal likely to affect current disturbance regimes?*	*How is the proposal likely to affect habitat connectivity?*	*How is the proposal likely to affect critical habitat?*
Pink Robin (*Petroica rodinogaster*)	V	The proposal is unlikely to affect the life cycle of the Pink Robin. Vegetation removal is unlikely to result in significant impacts to resources (feeding, breeding, roosting).	A majority of the potential habitat on site for Pink Robin (Lowland Dry-subtropical Rainforest, Moist Box-Red Gum Foothills Forest, Coastal Grassy Red Gum Forest, Lowland Woollybutt-*Melaleuca* Forest and Riparian River Oak Forest) will be reserved in the proposed retention of remnant vegetation as part of the rezoning of the Calderwood Urban Development Project. No individuals were found during field investigations and given the level of disturbance of potential habitat, the proximity to nearby areas of suitable habitat and proposed mitigation measures the proposal is not likely to significantly affect the habitat of the Pink Robin.	The site is not at the limit of the known distribution for the Pink Robin. It occurs from Tasmania in the south to the central coast of NSW in the north.	The proposal is unlikely to negatively affect any current disturbance regimes of fire and flooding. Mitigation measures proposed will contain current and additional flooding flows anticipated post development of the site.	The proposed rezoning plan will incorporate terrestrial connectivity both within the site and to larger habitat corridors to the east and west of the site. The proposal will see some removal of remnant vegetation within the site, mitigated by considerable retention of large areas of contiguous remnant vegetation and wildlife corridors (Johnston's Spur, Marshall Mount Creek and Macquarie Rivulet riparian corridors).	There is no critical habitat known to occur on the site.

Threatened species, population or community.	*NSW legal status*	*How is the proposal likely to affect the lifecycle of a threatened species and/or population?*	*How is the proposal likely to affect the habitat of a threatened species population or ecological community?*	*Does the proposal affect any threatened species or populations that are at the limit of its known distribution?*	*How is the proposal likely to affect current disturbance regimes?*	*How is the proposal likely to affect habitat connectivity?*	*How is the proposal likely to affect critical habitat?*
Freckled Duck (*Stictonetta naevosa*)	V	The proposal is unlikely to affect the life cycle of the Freckled Duck. Vegetation removal is unlikely to result in significant impacts to resources (feeding, breeding, roosting).	Riparian River Oak Forest and artificial wetlands on site provide potential habitat for the Freckled Duck. A majority of the Riparian River Oak Forest on site will be retained and rehabilitated. Artificial wetlands onsite will be removed or modified and rehabilitated with additional wetlands being created. It is unlikely that the proposal will impact on the inhabitancy of this species within the site. On Site Detention, Water Sensitive Urban Design and rehabilitation of the riparian areas is likely to improve water quality. No individuals were found during field investigations and given the level of disturbance of potential habitat and proposed mitigation measures the proposal is not likely to significantly affect the habitat.	The site is not at the limit of the known distribution of the Freckled Duck. It primarily occurs in south eastern and south western Australia however in times of drought will disperse to coastal NSW and Victoria	The proposal is unlikely to negatively affect any current disturbance regimes of fire and flooding. Mitigation measures proposed will contain current and additional flooding flows anticipated post development of the site.	The proposal will see some removal of remnant vegetation within the site, mitigated by considerable retention of large areas of contiguous remnant vegetation and wildlife corridors (Johnston's Spur, Marshall Mount Creek and Macquarie Rivulet riparian corridors) and the establishment of some artificial wetlands.	There is no critical habitat known to occur on the site.

Threatened species, population or community.	*NSW legal status*	*How is the proposal likely to affect the lifecycle of a threatened species and/or population?*	*How is the proposal likely to affect the habitat of a threatened species population or ecological community?*	*Does the proposal affect any threatened species or populations that are at the limit of its known distribution?*	*How is the proposal likely to affect current disturbance regimes?*	*How is the proposal likely to affect habitat connectivity?*	*How is the proposal likely to affect critical habitat?*
Large-eared Pied Bat (*Chalinolobus dwyeri*)	V	The proposal is unlikely to affect the life cycle of the Large-eared Pied Bat. The cliff areas on Johnston's Spur provide potential roosting habitat on site for the Large-eared Pied Bat. This area is proposed to be reserved. Whilst the proposal will result in the removal of multiple hollow bearing trees, these are known to only provide temporary roosting habitat for the species. Vegetation removal is unlikely to result in significant impacts to resources (feeding, breeding, roosting).	A majority of the potential habitat on site for Large-eared Pied Bat (Lowland Dry-subtropical Rainforest, Moist Box-Red Gum Foothills Forest, Coastal Grassy Red Gum Forest, Lowland Woollybutt-*Melaleuca* Forest and Riparian River Oak Forest) will be reserved in the proposed retention of remnant vegetation as part of the rezoning of the Calderwood Urban Development Project. The proposal will result in the loss of some potential foraging habitat. However, no individuals were found during field investigations and given the level of disturbance of potential habitat, the proximity to nearby areas of suitable habitat and proposed mitigation measures the proposal is not likely to significantly affect the habitat of the Large-eared Pied Bat.	The site is near the southern limit of known distribution of the Large-eared Pied Bat. Mainly found from Rockhampton in the north to Bungonia in the south in areas with extensive cliffs, the Large-eared Pied Bat has been detected in the Wollongong LGA in the Royal NP, near Tallawarra power station and possibly in the Calderwood Valley.	The proposal is unlikely to negatively affect any current disturbance regimes of fire and flooding. Mitigation measures proposed will contain current and additional flooding flows anticipated post development of the site.	The proposed rezoning plan will incorporate terrestrial connectivity both within the site and to larger habitat corridors to the east and west of the site. The proposal will see some removal of remnant vegetation within the site, mitigated by considerable retention of large areas of contiguous remnant vegetation and wildlife corridors (Johnston's Spur, Marshall Mount Creek and Macquarie Rivulet riparian corridors).	There is no critical habitat known to occur on the site.

Threatened species, population or community.	*NSW legal status*	*How is the proposal likely to affect the lifecycle of a threatened species and/or population?*	*How is the proposal likely to affect the habitat of a threatened species population or ecological community?*	*Does the proposal affect any threatened species or populations that are at the limit of its known distribution?*	*How is the proposal likely to affect current disturbance regimes?*	*How is the proposal likely to affect habitat connectivity?*	*How is the proposal likely to affect critical habitat?*
Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)	V	The proposal is unlikely to affect the life cycle of the Eastern False Pipistrelle. Hollow bearing eucalypts on site provide potential habitat for the Eastern False Pipistrelle. Whilst the proposal will result in removal of a number of hollow bearing trees many will be protected in the reservation of remnant vegetation. An area of scattered remnant Coastal Grassy Red Gum Forest requires further survey prior to any works commencing on site. Some foraging habitat will be lost, however, vegetation removal is unlikely to result in significant impacts to resources (feeding, breeding, roosting).	A majority of the potential habitat on site for Eastern False Pipistrelle (Lowland Dry-subtropical Rainforest, Moist Box-Red Gum Foothills Forest, Coastal Grassy Red Gum Forest, Lowland Woollybutt-Melaleuca Forest and Riparian River Oak Forest) will be reserved in the proposed retention of remnant vegetation as part of the rezoning of the Calderwood Urban Development Project. The proposal will result in the loss of some potential foraging habitat. However, no individuals were found during field investigations and given the level of disturbance of potential habitat, the proximity to nearby areas of suitable habitat and proposed mitigation measures the proposal is not likely to significantly affect the habitat of the Eastern False Pipistrelle.	The site is not at the limit of known distribution of the Eastern False Pipistrelle. It occurs from southern Queensland to Victoria.	The proposal is unlikely to negatively affect any current disturbance regimes of fire and flooding. Mitigation measures proposed will contain current and additional flooding flows anticipated post development of the site.	The proposed rezoning plan will incorporate terrestrial connectivity both within the site and to larger habitat corridors to the east and west of the site. The proposal will see some removal of remnant vegetation within the site, mitigated by considerable retention of large areas of contiguous remnant vegetation and wildlife corridors (Johnston's Spur, Marshall Mount Creek and Macquarie Rivulet riparian corridors).	There is no critical habitat known to occur on the site.

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Eastern Bent-wing Bat (*Miniopterus schreibersii oceanesi*)	V	The proposal is unlikely to affect the life cycle of the Eastern Bent-wing Bat. The cliff areas on Johnston's Spur provide potential roosting habitat on site for the Eastern Bent-wing Bat. This area is proposed to be reserved. Occasionally the Eastern Bent-wing Bat will use hollows for roosting. Some foraging habitat will be lost, however, vegetation removal is unlikely to result in significant impacts to resources (feeding, breeding, roosting).	A majority of the potential roosting and foraging habitat on site for Eastern Bent-wing Bat (Lowland Dry-subtropical Rainforest, Moist Box-Red Gum Foothills Forest, Coastal Grassy Red Gum Forest, Lowland Woollybutt-Melaleuca Forest and Riparian River Oak Forest) will be reserved in the proposed retention of remnant vegetation as part of the rezoning of the Calderwood Urban Development Project. The proposal will result in the loss of some potential foraging habitat. However, no individuals were found during field investigations and given the level of disturbance of potential habitat, the proximity to nearby areas of suitable habitat and proposed mitigation measures the proposal is not likely to significantly affect the habitat of the Eastern Bent-wing Bat.	The site is not at the limit of the known distribution of the Eastern Bent-wing Bat. It is known to occur along the east coast of Australia.	The proposal is unlikely to negatively affect any current disturbance regimes of fire and flooding. Mitigation measures proposed will contain current and additional flooding flows anticipated post development of the site.	The proposed rezoning plan will incorporate terrestrial connectivity both within the site and to larger habitat corridors to the east and west of the site. The proposal will see some removal of remnant vegetation within the site, mitigated by considerable retention of large areas of contiguous remnant vegetation and wildlife corridors (Johnston's Spur, Marshall Mount Creek and Macquarie Rivulet riparian corridors).	There is no critical habitat known to occur on the site.

Threatened species, population or community.	*NSW legal status*	*How is the proposal likely to affect the lifecycle of a threatened species and/or population?*	*How is the proposal likely to affect the habitat of a threatened species population or ecological community?*	*Does the proposal affect any threatened species or populations that are at the limit of its known distribution?*	*How is the proposal likely to affect current disturbance regimes?*	*How is the proposal likely to affect habitat connectivity?*	*How is the proposal likely to affect critical habitat?*
Grey-headed Flying-fox (*pteropus poliochephalus*)	V	The proposal is unlikely to affect the life cycle of the Grey-headed Flying-fox. Potential roosting habitat on site for the Grey-headed Flying-fox exists on Johnston's Spur which is proposed to be reserved. The proposal would not remove or disturb any known campsite or colony and would not create a barrier to movements between campsites and foraging areas for this highly and wide-ranging species. Some foraging habitat will be lost, however, vegetation removal is unlikely to result in significant impacts to resources (feeding, breeding, roosting).	A majority of the potential habitat on site for Grey-headed Flying-fox (Lowland Dry-subtropical Rainforest, Moist Box-Red Gum Foothills Forest, Coastal Grassy Red Gum Forest, Lowland Woollybutt-Melaleuca Forest and Riparian River Oak Forest) will be reserved in the proposed retention of remnant vegetation as part of the rezoning of the Calderwood Urban Development Project. The proposal will result in the loss of some potential foraging habitat. However, no individuals were found during field investigations and given the level of disturbance of potential habitat, the proximity to nearby areas of suitable habitat and proposed mitigation measures the proposal is not likely to significantly affect the habitat of the Grey-headed Flying-fox.	The site is not at the limit of the known distribution of the Grey-headed Flying-fox. It is known to occur from Bundaberg in the north to Melbourne in the south.	The proposal is unlikely to negatively affect any current disturbance regimes of fire and flooding. Mitigation measures proposed will contain current and additional flooding flows anticipated post development of the site.	The proposed rezoning plan will incorporate terrestrial connectivity both within the site and to larger habitat corridors to the east and west of the site. The proposal will see some removal of remnant vegetation within the site, mitigated by considerable retention of large areas of contiguous remnant vegetation and wildlife corridors (Johnston's Spur, Marshall Mount Creek and Macquarie Rivulet riparian corridors).	There is no critical habitat known to occur on the site.

Threatened species, population or community.	*NSW legal status*	*How is the proposal likely to affect the lifecycle of a threatened species and/or population?*	*How is the proposal likely to affect the habitat of a threatened species population or ecological community?*	*Does the proposal affect any threatened species or populations that are at the limit of its known distribution?*	*How is the proposal likely to affect current disturbance regimes?*	*How is the proposal likely to affect habitat connectivity?*	*How is the proposal likely to affect critical habitat?*
Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)	V	The proposal is unlikely to affect the life cycle of the Yellow-bellied Sheathtail-bat. Hollow bearing trees on site provide potential habitat for the Yellow-bellied Sheathtail-bat. Whilst the proposal will result in removal of a number of hollow bearing trees many will be protected in the reservation of remnant vegetation. An area of scattered remnant Coastal Grassy Red Gum Forest requires further survey prior to any works commencing on site. Some foraging habitat will be lost, however, vegetation removal is unlikely to result in significant impacts to resources (feeding, breeding, roosting).	A majority of the potential habitat on site for Yellow-bellied Sheathtail-bat (Lowland Dry-subtropical Rainforest, Moist Box-Red Gum Foothills Forest, Coastal Grassy Red Gum Forest, Lowland Woollybutt-*Melaleuca* Forest and Riparian River Oak Forest) will be reserved in the proposed retention of remnant vegetation as part of the rezoning of the Calderwood Urban Development Project. The proposal will result in the loss of some potential foraging habitat. However, no individuals were found during field investigations and given the level of disturbance of potential habitat, the proximity to nearby areas of suitable habitat and proposed mitigation measures the proposal is not likely to significantly affect the habitat of the Yellow-bellied Sheathtail-bat.	The site is not at the limit of the known distribution of the Yellow-bellied Sheathtail-bat. It is a wide ranging species found across northern and eastern Australia.	The proposal is unlikely to negatively affect any current disturbance regimes of fire and flooding. Mitigation measures proposed will contain current and additional flooding flows anticipated post development of the site.	The proposed rezoning plan will incorporate terrestrial connectivity both within the site and to larger habitat corridors to the east and west of the site. The proposal will see some removal of remnant vegetation within the site, mitigated by considerable retention of large areas of contiguous remnant vegetation and wildlife corridors (Johnston's Spur, Marshall Mount Creek and Macquarie Rivulet riparian corridors).	There is no critical habitat known to occur on the site.

Threatened species, population or community.	*NSW legal status*	*How is the proposal likely to affect the lifecycle of a threatened species and/or population?*	*How is the proposal likely to affect the habitat of a threatened species population or ecological community?*	*Does the proposal affect any threatened species or populations that are at the limit of its known distribution?*	*How is the proposal likely to affect current disturbance regimes?*	*How is the proposal likely to affect habitat connectivity?*	*How is the proposal likely to affect critical habitat?*
Greater Broad-nosed Bat (*Scoteanax rueppellii*)	V	The proposal is unlikely to affect the life cycle of the Greater Broad-nosed Bat. Hollow bearing trees on site provide potential habitat for the Greater Broad-nosed Bat. Whilst the proposal will result in removal of a number of hollow bearing trees many will be protected in the reservation of remnant vegetation. An area of scattered remnant Coastal Grassy Red Gum Forest requires further survey prior to any works commencing on site. Some foraging habitat will be lost, however, vegetation removal is unlikely to result in significant impacts to resources (feeding, breeding, roosting).	A majority of the potential habitat on site for Greater Broad-nosed Bat (Lowland Dry-subtropical Rainforest, Moist Box-Red Gum Foothills Forest, Coastal Grassy Red Gum Forest, Lowland Woollybutt-*Melaleuca* Forest and Riparian River Oak Forest) will be reserved in the proposed retention of remnant vegetation as part of the rezoning of the Calderwood Urban Development Project. The proposal will result in the loss of some potential foraging habitat. However, no individuals were found during field investigations and given the level of disturbance of potential habitat, the proximity to nearby areas of suitable habitat and proposed mitigation measures the proposal is not likely to significantly affect the habitat of the Greater Broad-nosed Bat.	The site is not at the limit of the known distribution of the Greater Broad-nosed Bat. It is a wide ranging species found across eastern Australia, known to occur from the Atherton tableland in Queensland to southern NSW.	The proposal is unlikely to negatively affect any current disturbance regimes of fire and flooding. Mitigation measures proposed will contain current and additional flooding flows anticipated post development of the site.	The proposed rezoning plan will incorporate terrestrial connectivity both within the site and to larger habitat corridors to the east and west of the site. The proposal will see some removal of remnant vegetation within the site, mitigated by considerable retention of large areas of contiguous remnant vegetation and wildlife corridors (Johnston's Spur, Marshall Mount Creek and Macquarie Rivulet riparian corridors).	There is no critical habitat known to occur on the site.

Appendix F: EPBC Act Matters of National Environmental Significance Assessments

The EPBC Act Administrative Guidelines on Significance set out 'Significant Impact Criteria' that are to be used to assist in determining whether a proposed action is likely to have a significant impact on matters of national environmental significance. Matters listed under the EPBC Act as being of national environmental significance include:

- Listed threatened species and ecological communities
- Listed migratory species
- Wetlands of International Importance
- The Commonwealth marine environment
- World heritage properties
- National heritage places
- Nuclear actions

Specific 'Significant Impact Criteria' are provided for each matter of national environmental significance except for threatened species and ecological communities in which case separate criteria are provided for species listed as endangered and vulnerable under the EPBC Act.

MATTERS TO BE ADDRESSED	**Impact (Commonwealth Legislation)**
(a) any environmental impact on a World Heritage Property;	**No.** No World Heritage Properties occur within, or in proximity to the study area. Referral of the project to the Federal Environment Minister under the EPBC Act is therefore not considered necessary.
(b) any environmental impact on Wetlands of International Importance;	No
(c) any environmental impact on Commonwealth Listed Threatened Species and Ecological Communities;	**Yes.** The following eight listed species have the potential to be impacted by the proposed rezoning; • Swift Parrot (*Lathamus discolor)* – Endangered • Australian Painted Snipe (*Rostratula australis*) - Vulnerable • Large-eared Pied Bat (*Chalinolobus dwyeri*) – Vulnerable • Grey-headed Flying-fox (*Pteropus poliocephalus)* – Vulnerable • White-flowered Wax Plant (*Cynanchum elegans)* - Endangered • *Daphnandra johnsonii* - Endangered • Illawarra Greenhood, Pouched Greenhood (*Pterostylis gibbosa)* - Endangered • Hill Zieria, Illawarra Zieria (*Zieria granulate*) - Endangered **<u>Swift Parrot (*Lathamus discolor)*</u>** Swift parrots are winter migrants to the south-eastern Australia mainland from Tasmania, where they feed on winter flowering eucalypts, such as forest red gum (*Eucalyptus tereticornis*) (DECC 2009b). The Swift Parrot is a highly mobile species able to utilise a variety of nectar sources over large areas (DECC 2009b). Potential habitat for the swift parrot to pass through or forage exists within the areas of Coastal Grassy Red Gum Forest and Moist Box-Red Gum Foothills Forest on site. ***a. lead to a long-term decrease in the size of a population of a species, or*** The study area provides potential foraging habitat for the swift parrot, winter flowering eucalypts, such as forest red gum (*Eucalyptus tereticornis*). Potential habitat offering similar foraging habitat is common within adjacent areas including Johnston's Spur and the Illawarra Escarpment. There will be some loss of these vegetation communities as a result of the proposed development. However, long-term decrease in the population of Swift Parrot is considered unlikely for the following reasons: • the majority (38 ha) of these vegetation communities will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer, including 95% of these vegetation communities in good condition;

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- the Swift Parrot was not recorded on site during field surveys and the area is not recognised as an important area for the species;
- the Swift Parrot is a highly mobile species able to utilise a variety of nectar sources over large areas, making them less sensitive to fragmentation.

b. reduce the area of occupancy of a population, or

The proposed rezoning may impact upon the area of potential foraging habitat for the swift parrot within the study area, but it is unlikely to significantly affect the overall area of occupancy of the species within the locality for the following reasons;

- the majority (38 ha) of these vegetation communities will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer, including 95% of these vegetation communities in good condition;
- the Swift Parrot was not recorded on site during field surveys and the area is not recognised as an important area for the species;
- the Swift Parrot is a highly mobile species able to utilise a variety of nectar sources over large areas, making them less sensitive to fragmentation.

c. fragment an existing population into two or more populations, or

The proposed rezoning will not fragment an existing population of the Swift Parrot into two or more populations. There have been no previous recordings of a Swift Parrot population within the site, and the habitat present being potentially used only as foraging habitat. Furthermore the proposed works will incorporate significant terrestrial habitat connectivity both within the site and linking to the Illawarra Escarpment to the west and Lake Illawarra and the coast to the east.

d. adversely affect habitat critical to the survival of a species, or

This species commonly inhabits south-eastern Australian forest and woodland in winter, foraging upon winter flowering eucalypt species.

The study area provides moderate habitat potential for the Swift Parrot. The clearing of the potential habitat within the study area will be minor and will not adversely affect habitat critical to the survival of the species in the locality, and will not significantly affect the overall survival of the species.

e. disrupt the breeding cycle of a population, or

The study area does not provide potential habitat for breeding, and therefore the proposed action will not disrupt the breeding cycle of a population.

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

The proposed is unlikely to cause an overall decline in the species for the

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following reasons;

- the majority (38 ha) of these vegetation communities will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer, including 95% of these vegetation communities in good condition;
- the Swift Parrot was not recorded on site during field surveys and the area is not recognised as an important area for the species;
- the Swift Parrot is a highly mobile species able to utilise a variety of nectar sources over large areas, making them less sensitive to fragmentation.

g. result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*, or

The proposed rezoning is unlikely to result in invasive species that are harmful to the swift parrot becoming established in the remaining habitat in the locality.

h. interfere with the recovery of the species.

The proposed rezoning will be unlikely to interfere substantially with the overall recovery of the species for the following reasons;

- the majority (38 ha) of these vegetation communities will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer, including 95% of these vegetation communities in good condition;
- the Swift Parrot was not recorded on site during field surveys and the area is not recognised as an important area for the species;
- the Swift Parrot is a highly mobile species able to utilise a variety of nectar sources over large areas, making them less sensitive to fragmentation.

AUSTRALIAN PAINTED SNIPE (*Rostratula australis*)

The Australian Painted Snipe has been recorded in wetlands in all states in Australia. This species primarily occurs along the east coast from north Queensland (excluding Cape York) to the Eyre Peninsula in South Australia, including the majority of Victoria and NSW.

The Australian Painted Snipe is usually found close to the fringes of reed beds along shorelines of marshes, swamps, ponds, streams and mud flats where it probes for food in the shallows and mud. A number of artificial wetlands across the site provide fragmented patches of potential swampland habitat for the species.

a. lead to a long-term decrease in the size of a population of a species, or

A number of artificial wetlands across the site provide fragmented patches of potential swampland habitat for the species. These areas are likely to be adversely impacted by the proposed development. However, no individuals of this species have been recorded within the proposed development site. The Australian Painted Snipe is a broad ranging and non-aggregating species that

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	is often recorded in low densities. The Calderwood site is not likely to support an important population of this species. Therefore, the proposal is not likely to lead to a long-term decrease in the size and population of this species. ***b. reduce the area of occupancy of a population, or*** A number of artificial wetlands across the site provide fragmented patches of potential swampland habitat for the species. These areas are likely to be adversely impacted by the proposed development. However, no individuals of this species have been recorded within the proposed development site. The Australian Painted Snipe is a broad ranging and non-aggregating species that is often recorded in low densities. The Calderwood site is not likely to support an important population of this species. Therefore, the proposal is not likely to reduce the areas of occupancy of a population of this species. ***c. fragment an existing population into two or more populations, or*** A number of artificial wetlands across the site provide fragmented patches of potential swampland habitat for the species. These areas are likely to be adversely impacted by the proposed development. However, no individuals of this species have been recorded within the proposed development site. The Australian Painted Snipe is a broad ranging and non-aggregating species that is often recorded in low densities. The Calderwood site is not likely to support an important population of this species. Therefore, the proposal is not likely to fragment an existing population into two or more populations. ***d. adversely affect habitat critical to the survival of a species, or*** A number of artificial wetlands across the site provide fragmented patches of potential swampland habitat for the species. These areas are likely to be adversely impacted by the proposed development. However, no individuals of this species have been recorded within the proposed development site. The Australian Painted Snipe is a broad ranging and non-aggregating species that is often recorded in low densities. The Calderwood site is not likely to support an important population of this species. Therefore, the proposal is not likely to adversely affect habitat critical to the survival of this species. ***e. disrupt the breeding cycle of a population, or*** A number of artificial wetlands across the site provide fragmented patches of potential swampland habitat for the species. These areas are likely to be adversely impacted by the proposed development. However, no individuals of this species have been recorded within the proposed development site. The Australian Painted Snipe is a broad ranging and non-aggregating species that is often recorded in low densities. The Calderwood site is not likely to support an important population of this species. Therefore, the proposal is not likely to disrupt the breeding cycle of a population of this species. ***f. modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or*** A number of artificial wetlands across the site provide fragmented patches of potential swampland habitat for the species. These areas are likely to be adversely impacted by the proposed development. However, no individuals of this species have been recorded within the proposed development site. The Australian Painted Snipe is a broad ranging and non-aggregating species that

MATTERS TO BE ADDRESSED	**Impact (Commonwealth Legislation)**

is often recorded in low densities. The Calderwood site is not likely to support an important population of this species. Therefore, the proposal is not likely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

g. result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*, or

The proposal is not likely to result in an invasive species becoming established in the Australian Painted Snipe potential habitat on site. Retained habitat on site will be subject to initial invasive weed removal works and ongoing vegetation management.

h. interfere with the recovery of the species.

A number of artificial wetlands across the site provide fragmented patches of potential swampland habitat for the species. These areas are likely to be adversely impacted by the proposed development. However, no individuals of this species have been recorded within the proposed development site. The Australian Painted Snipe is a broad ranging and non-aggregating species that is often recorded in low densities. The Calderwood site is not likely to support an important population of this species. Therefore, the proposal is not likely to interfere with the recovery of the species.

LARGE-EARED PIED BAT *(Chalinolobus dwyeri)*

The current distribution of the Large-eared Pied Bat is poorly known. Records exist from Shoalwater Bay, north of Rockhampton, Queensland, through to the vicinity of Ulladulla, NSW. It is generally rare with a very patchy distribution in NSW (DEC 2005e).

Little is known about the habitat and roosting requirements of the Large-eared Pied Bat, but natural roosts may depend heavily on sandstone outcrops (DEWHA 2009f). The species is thought to roost in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Hirundo ariel*). These bats frequent low to mid-elevation dry open forest and woodland close to the above features and are also found in well-timbered areas containing gullies (DEC 2005e).

a. lead to a long-term decrease in the size of a population of a species, or

There have been no records of the Large-eared Pied Bat on site. However, the development footprint is primarily confined to grassland areas, while the majority of vegetation with canopy cover will be retained and protected on site. It is considered that management and protection of the conservation land at Calderwood will provide suitable resources for the Large-eared Pied Bat, and as such will not be likely to lead to a long-term decrease in the size of a population of this species.

b. reduce the area of occupancy of a population, or

There have been no records of the Large-eared Pied Bat on site. However, the development footprint is primarily confined to grassland areas, while the majority of vegetation with canopy cover will be retained and protected on site. It is considered that management and protection of the conservation land at

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	Calderwood will provide suitable resources for the Large-eared Pied Bat, and as such the proposed rezoning is not likely to lead to a reduction in the area of occupancy of a population of this species. ***c. fragment an existing population into two or more populations, or*** There have been no records of the Large-eared Pied Bat on site. However, the development footprint is primarily confined to grassland areas, while the majority of vegetation with canopy cover will be retained and protected on site within corridors which link regionally to the Illawarra escarpment to the east. It is therefore considered that the proposal will not fragment an existing population into two or more populations. ***d. adversely affect habitat critical to the survival of a species, or*** There have been no records of the Large-eared Pied Bat on site. However, the development footprint is primarily confined to grassland areas, while the majority of vegetation with canopy cover will be retained and protected on site. Therefore it is considered unlikely that the proposal will significantly adversely affect habitat critical to the survival of this species. ***e. disrupt the breeding cycle of a population, or*** There have been no records of the Large-eared Pied Bat on site. However, the development footprint is primarily confined to grassland areas, while the majority of vegetation with canopy cover will be retained and protected on site. It is considered that management and protection of the conservation land at Calderwood will provide suitable resources for the Large-eared Pied Bat, and as such the proposed rezoning is not likely to disrupt the breeding cycle of a population of this species. ***f. modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or*** The development footprint is primarily confined to grassland areas, while the majority of vegetation with canopy cover will be retained and protected on site. It is considered that management and protection of the conservation land at Calderwood will provide suitable habitat for the Large-eared Pied Bat, and as such the proposed rezoning is not likely to modify, destroy, remove or decrease the availability or quality of habitat to the extent that the species is likely to decline. ***g. result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*, or*** The proposal is not likely to result in an invasive species becoming established in the Australian Painted Snipe potential habitat on site. Retained habitat on site will be subject to initial invasive weed removal works and ongoing vegetation management. ***h. interfere with the recovery of the species.*** There is potential for this species to occur in the study area given its habitat characteristics. However, the development footprint is primarily confined to grassland areas, while the majority of vegetation with canopy cover will be

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retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer. It is considered that management and protection of the conservation land at Calderwood will be sufficient to ensure that interference with the recovery of this species is unlikely.

GREY-HEADED FLYING-FOX *(Pteropus poliocephalus)*

The Grey-headed Flying Fox is known to occur along the eastern coast of Australia from Bundaberg in Queensland to Melbourne in Victoria (DEC 2005f). Due to the high mobility of the species, there are no separate or distinct populations of this species as individuals move between camps and throughout its geographic distribution (DEWHA 2009g).

The species inhabits a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated areas (Churchill 1998, Eby 1998). The species feeds on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia. Urban gardens and fruit crops also provide foraging habitat for the Grey-headed Flying Fox. The species roosts in aggregations of various sizes on exposed branches of trees which are often located in gullies, typically close to water, in vegetation with a dense canopy (Churchill 1998). Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, or in vegetation with a dense canopy.

a. lead to a long-term decrease in the size of a population of a species, or

There have been no records of the Grey-headed Flying-fox on site. There is potential for this species to occur in the study area given some of its habitat characteristics. However, the majority of vegetation with canopy cover will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer. It is considered that management and protection of the conservation land at Calderwood will provide improved habitat resources for the bat, and as such will not lead to a long-term decrease in the size of a population of this species.

b. reduce the area of occupancy of a population, or

There have been no records of the Grey-headed Flying-fox on site. There is potential for this species to occur in the study area given some of its habitat characteristics. However, the majority of vegetation with canopy cover will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer. It is considered that management and protection of the conservation land at Calderwood will provide improved habitat resources for the bat, and as such will not reduce the area of occupancy of a population of this species now or into the future.

c. fragment an existing population into two or more populations, or

There have been no records of the Grey-Headed Flying-fox populations on site. However, the development footprint is primarily confined to grassland areas, while the majority of vegetation with canopy cover will be retained and protected on site within corridors which link regionally to the Illawarra escarpment to the east. It is therefore considered that the proposal will not fragment an existing population into two or more populations.

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d. adversely affect habitat critical to the survival of a species, or

There have been no records of the Grey-headed Flying-fox on site. There is potential for this species to occur in the study area given some of its habitat characteristics. However, the majority of vegetation with canopy cover will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer. It is considered that management and protection of the conservation land at Calderwood will provide improved habitat resources for the bat, and as such will not adversely affect habitat critical to the survival of this species now or into the future.

e. disrupt the breeding cycle of a population, or

There have been no records of the Grey-Headed Flying-fox populations on site. However, the development footprint is primarily confined to grassland areas, while the majority of vegetation with canopy cover will be retained and protected on site within corridors which link regionally to the Illawarra escarpment to the east. It is therefore considered that the proposal will not disrupt the breeding cycle of a population of this species.

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

There have been no records of the Grey-headed Flying-fox on site. There is potential for this species to occur in the study area given some of its habitat characteristics. However, the majority of vegetation with canopy cover will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer. It is considered that management and protection of the conservation land at Calderwood will provide improved habitat resources for the bat, and as such will not modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

g. result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*, or

The proposal is not likely to result in an invasive species becoming established in the Australian Painted Snipe potential habitat on site. Retained habitat on site will be subject to initial invasive weed removal works and ongoing vegetation management.

h. interfere with the recovery of the species.

There have been no records of the Grey-Headed Flying-fox populations on site. However, the development footprint is primarily confined to grassland areas, while the majority of vegetation with canopy cover will be retained and protected on site within corridors which link regionally to the Illawarra escarpment to the east. It is therefore considered that the proposal will not interfere with the recovery of this species.

WHITE FLOWERED WAX PLANT (*Cynanchum elegans*)

The white-flowered wax plant is currently known from 86 locations within New South Wales, where it is most commonly found within the Kempsey Region.

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Other locations include the Cumberland Plain, the Forster area, Manning Valley, Hunter Valley, Yabbra State Forest, Brunswick Heads, Gerroa, Merriwa and northeast of Tenterfield (DEWHA 2009j). The species has also been recorded in the Illawarra Escarpment State Recreation Area (SRA) and Berkeley Islands Nature Reserve (NR) in the Illawarra area.

The white-flowered wax plant occurs on the edges of dry rainforest vegetation, littoral rainforest; Coastal Tea-tree *Leptospermum laevigatum* – Coastal Banksia *Banksia integrifolia* subsp. integrifolia coastal scrub; Forest Red Gum *Eucalyptus tereticornis* aligned open forest and woodland; Spotted Gum *Eucalyptus maculata* aligned open forest and woodland; and Bracelet Honeymyrtle *Melaleuca armillaris* scrub to open scrub (DEC 2005i).

a. lead to a long-term decrease in the size of a population of a species, or

The White flowered Wax Plant has not been recorded on site; however there is potential habitat for the species amongst areas of Lowland Dry-Subtropical Rainforest and Moist Box-Red Gum Foothills Forest on site. There will be some loss of these vegetation communities as a result of the proposed development. However, the impacts are not considered to lead to a long term decrease in the size of a population of the White flowered Wax Plant for the following reasons:

- specific searches for this species were carried out within areas of suitable habitat on site and the species was not recorded; and
- the vast majority (93%) of areas that may provide potential habitat for the species (that is, areas of Lowland Dry-Subtropical Rainforest and Moist Box-Red Gum Foothills Forest) will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer.

b. reduce the area of occupancy of a population, or

The White flowered Wax Plant has not been recorded on site; however there is potential habitat for the species amongst areas of Lowland Dry-Subtropical Rainforest and Moist Box-Red Gum Foothills Forest on site. There will be some loss of these vegetation communities as a result of the proposed development. However, a reduction to the area of occupancy of a population of the White flowered Wax Plant is considered unlikely for the following reasons:

- specific searches for this species were carried out within areas of suitable habitat on site and the species was not recorded; and
- the vast majority (93%) of areas that may provide potential habitat for the species (that is, areas of Lowland Dry-Subtropical Rainforest and Moist Box-Red Gum Foothills Forest) will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer.

c. fragment an existing population into two or more populations, or

The White flowered Wax Plant has not been recorded on site; however there is potential habitat for the species amongst areas of Lowland Dry-Subtropical Rainforest and Moist Box-Red Gum Foothills Forest on site. There will be some loss of these vegetation communities as a result of the proposed

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development. However, it is considered unlikely that the proposal will fragment an existing population of the White Flowered Wax Plant into two or more populations for the following reasons:

- specific searches for this species were carried out within areas of suitable habitat on site and the species was not recorded; and
- the vast majority (93%) of areas that may provide potential habitat for the species (that is, areas of Lowland Dry-Subtropical Rainforest and Moist Box-Red Gum Foothills Forest) will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer.

d. adversely affect habitat critical to the survival of a species, or

The White flowered Wax Plant has not been recorded on site; however there is potential habitat for the species amongst areas of Lowland Dry-Subtropical Rainforest and Moist Box-Red Gum Foothills Forest on site. There will be some loss of these vegetation communities as a result of the proposed development. However, adverse affects on habitat critical to the survival of the White flowered Wax Plant is considered unlikely for the following reasons:

- specific searches for this species were carried out within areas of suitable habitat on site and the species was not recorded; and
- the vast majority (93%) of areas that may provide potential habitat for the species (that is, areas of Lowland Dry-Subtropical Rainforest and Moist Box-Red Gum Foothills Forest) will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer.

e. disrupt the breeding cycle of a population, or

The White flowered Wax Plant has not been recorded on site; however there is potential habitat for the species amongst areas of Lowland Dry-Subtropical Rainforest and Moist Box-Red Gum Foothills Forest on site. There will be some loss of these vegetation communities as a result of the proposed development. However, disruption to the breeding cycle of a population of the White flowered Wax Plant is considered unlikely for the following reasons:

- specific searches for this species were carried out within areas of suitable habitat on site and the species was not recorded; and
- the vast majority (93%) of areas that may provide potential habitat for the species (that is, areas of Lowland Dry-Subtropical Rainforest and Moist Box-Red Gum Foothills Forest) will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer.

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

There is potential habitat for the species amongst areas of Lowland Dry-Subtropical Rainforest and Moist Box-Red Gum Foothills Forest on site. There will be some loss of these vegetation communities as a result of the proposed development. However, it is considered unlikely that the level of habitat disturbance proposed on site will be to an extent that would see a decline in the White Flowered Wax Plant for the following reasons:

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- specific searches for this species were carried out within areas of suitable habitat on site and the species was not recorded; and
- the vast majority (93%) of areas that may provide potential habitat for the species (that is, areas of Lowland Dry-Subtropical Rainforest and Moist Box-Red Gum Foothills Forest) will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer.

g. result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*, or

The proposal is not likely to result in an invasive species becoming established in the potential habitat on site for this species. Retained habitat on site will be subject to initial invasive weed removal works and ongoing vegetation management.

h. interfere with the recovery of the species.

There is potential habitat for the species amongst areas of Lowland Dry-Subtropical Rainforest and Moist Box-Red Gum Foothills Forest on site. There will be some loss of these vegetation communities as a result of the proposed development. However, it is considered unlikely that the level of habitat disturbance proposed on site will interfere with the recovery of the White Flowered Wax Plant for the following reasons:

- specific searches for this species were carried out within areas of suitable habitat on site and the species was not recorded; and
- the vast majority (93%) of areas that may provide potential habitat for the species (that is, areas of Lowland Dry-Subtropical Rainforest and Moist Box-Red Gum Foothills Forest) will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer.

Daphnandra johnsonii

The distribution of *Daphnandra johnsonii* (also known as the Ilawarra Socketwood), is restricted to the Illawarra region of NSW. The species has previously been recorded at 41 sites within the local government areas of Shoalhaven, Kiama, Shellharbour and Wollongong.

The species occupies the rainforest understorey and is commonly found in soils consisting of loams and clay loams derived from volcanic or fertile sedimentary rocks. Associated vegetation types include subtropical, moist subtropical, dry subtropical, and mixed subtropical - warm temperate rainforest types. It has also occasionally been found in moist Eucalypt forest in association with *Eucalyptus tereticornis* (Forest Red Gum), *E. pilularis* (Blackbutt), *E. quadrangulata* (White Box) and *Casuarina cunninghamiana* (River She-Oak).

a. lead to a long-term decrease in the size of a population of a species, or

D. johnsonii has not been recorded on site. However, there is potential for the species to occur within areas of Lowland Dry-Subtropical Rainforest and Moist

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	Box-Red Gum Foothills Forest which have been recorded within the Calderwood site. Long term decrease in the size of the population of *D. johnsonii* is considered unlikely as a result of the proposed development as the vast majority (93%) of areas that may provide potential habitat for the species will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer. ***b. reduce the area of occupancy of a population, or*** *D. johnsonii* has not been recorded on site. However, there is potential for the species to occur within areas of Lowland Dry-Subtropical Rainforest and Moist Box-Red Gum Foothills Forest which have been recorded within the Calderwood site. A significant reduction in the area of occupancy of a population of *D. johnsonii* are considered unlikely as a result of the proposed development as the vast majority (93%) of areas that may provide potential habitat for the species will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer. ***c. fragment an existing population into two or more populations, or*** *D. johnsonii* has not been recorded on site. However, there is potential for the species to occur within areas of Lowland Dry-Subtropical Rainforest and Moist Box-Red Gum Foothills Forest which have been recorded within the Calderwood site. Fragmentation of an existing population of *D. johnsonii* into two or more populations is considered unlikely as a result of the proposed development as the vast majority (93%) of areas that may provide potential habitat for the species will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer. ***d. adversely affect habitat critical to the survival of a species, or*** *D. johnsonii* has not been recorded on site. However, there is potential for the species to occur within areas of Lowland Dry-Subtropical Rainforest and Moist Box-Red Gum Foothills Forest which have been recorded within the Calderwood site. Adverse effects to habitat critical to the survival of *D. johnsonii* are considered unlikely as a result of the proposed development as the vast majority (93%) of areas that may provide potential habitat for the species will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer. ***e. disrupt the breeding cycle of a population, or*** *D. johnsonii* has not been recorded on site. However, there is potential for the species to occur within areas of Lowland Dry-Subtropical Rainforest and Moist Box-Red Gum Foothills Forest which have been recorded within the Calderwood site. Disruption to the breeding cycle of a population of *D. johnsonii* is considered

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unlikely as a result of the proposed development as the vast majority (93%) of areas that may provide potential habitat for the species will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer.

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

D. johnsonii has not been recorded on site. However, there is potential for the species to occur within areas of Lowland Dry-Subtropical Rainforest and Moist Box-Red Gum Foothills Forest which have been recorded within the Calderwood site.

Modification, destruction, removal or isolation or decline in the availability or quality of habitat to the extent that *D. johnsonii* is likely to decline is considered unlikely as a result of the proposed development as the vast majority (93%) of areas that may provide potential habitat for the species will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer.

g. result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*, or

The proposal is not likely to result in an invasive species becoming established in the potential habitat on site for this species. Retained habitat on site will be subject to initial invasive weed removal works and ongoing vegetation management.

h. interfere with the recovery of the species.

D. johnsonii has not been recorded on site. However, there is potential for the species to occur within areas of Lowland Dry-Subtropical Rainforest and Moist Box-Red Gum Foothills Forest which have been recorded within the Calderwood site.

Interference wit the recovery of *D. johnsonii* is considered unlikely as a result of the proposed development as the vast majority (93%) of areas that may provide potential habitat for the species will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer.

ILLAWARRA GREENHOOD, POUCHED GREENNHOOD *(Pterostylis gibbosa)*

The Illawarra Greenhood is known only from a small number of populations in the Hunter region (Milbrodale), the Illawarra region (Albion Park and Yallah) and the Shoalhaven region (near Nowra). In the Illawarra region, the species grows in woodland dominated by Forest Red Gum *Eucalyptus tereticornis*, Wollybutt *E. longifolia* and White Feather Honey-myrtle *Melaleuca decora*.

a. lead to a long-term decrease in the size of a population of a species, or

No individuals of this species have been recorded within the proposed development site. Potential habitat occurs within areas of Lowland Woollybutt-

MATTERS TO BE ADDRESSED	**Impact (Commonwealth Legislation)**
	Melaleuca Forest. If the species were to occur on site, long term decrease in the size of a population is considered unlikely as the majority (more than 9 ha) of this vegetation community will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer, including 96% of the community in good condition. Due to the long term degradation that has occurred in poorer quality vegetation it is highly unlikely that this species would be present in areas identified as TX. This species is cryptic in nature and has therefore been included in the statement of commitments as requiring further seasonal survey prior to any further development in or in proximity to potential habitat. ***b. reduce the area of occupancy of a population, or*** No individuals of this species have been recorded within the proposed development site. Potential habitat occurs within areas of Lowland Woollybutt-Melaleuca Forest. If the species were to occur on site, a reduction in the area of occupancy of a population is considered unlikely as the majority (more than 9 ha) of this vegetation community will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer, including 96% of the community in good condition. ***c. fragment an existing population into two or more populations, or*** No individuals of this species have been recorded within the proposed development site. Potential habitat occurs within areas of Lowland Woollybutt-Melaleuca Forest. If the species were to occur on site, fragmentation of an existing population into two or more populations is considered unlikely as the majority (more than 9 ha) of this vegetation community will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer, including 96% of the community in good condition. ***d. adversely affect habitat critical to the survival of a species, or*** No individuals of this species have been recorded within the proposed development site. Potential habitat occurs within areas of Lowland Woollybutt-Melaleuca Forest. If the species were to occur on site, adverse effects to habitat critical to the survival of the species is considered unlikely as the majority (more than 9 ha) of this vegetation community will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer, including 96% of the community in good condition. ***e. disrupt the breeding cycle of a population, or*** No individuals of this species have been recorded within the proposed development site. Potential habitat occurs within areas of Lowland Woollybutt-Melaleuca Forest. If the species were to occur on site, disruption of the breeding cycle of a

MATTERS TO BE ADDRESSED	**Impact (Commonwealth Legislation)**

population is considered unlikely as the majority (more than 9 ha) of this vegetation community will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer, including 96% of the community in good condition.

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

No individuals of this species have been recorded within the proposed development site. Potential habitat occurs within areas of Lowland Woollybutt-Melaleuca Forest.

If the species were to occur on site, modification, destruction, removal or isolation or decline in the availability or quality of habitat to the extent that the species is likely to decline is considered unlikely as the majority (more than 9 ha) of this vegetation community will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer, including 96% of the community in good condition.

g. result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*, or

The proposal is not likely to result in an invasive species becoming established in the potential habitat on site for this species. Retained habitat on site will be subject to initial invasive weed removal works and ongoing vegetation management.

h. interfere with the recovery of the species.

No individuals of this species have been recorded within the proposed development site. Potential habitat occurs within areas of Lowland Woollybutt-Melaleuca Forest.

If the species were to occur on site, interference with the recovery of the species is considered unlikely as the majority (more than 9 ha) of this vegetation community will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer, including 96% of the community in good condition.

HILL ZIERIA, ILLAWARRA ZIERIA (*Zieria granulata*)

The Hill Zieria is distributed around Kiama and Shellharbour within the Illawarra Region. Populations are highly fragmented and occur across 97 sites. The most recent estimates of the total population size of *Z. granulata* are at least 8000 mature individuals which occur within 26 populations. Populations are defined as groups of individuals more than 1 km apart and sites are discrete groups of plants separated by 200 m or more. The most significant and largest populations are at Dunmore Hills (4213 plants), Toolijooa (2365 plants) and West Kiama (1496 plants). There are only 10 sites which are known to support more than 300 individuals.

The species is typically found in habitat which includes dry ridge tops and rocky outcrops on shallow volcanic soils. Hill Zieria is less frequently found on the moist slopes of the Illawarra escarpment and in low-lying areas on

MATTERS TO BE ADDRESSED	**Impact (Commonwealth Legislation)**
	Quaternary sediments. Populations are found in the following vegetation community types: Bracelet Honey-myrtle *Melaleuca armillaris* scrub and Forest Red Gum *Eucalyptus tereticornis* woodland and rainforest margins. It has also been recorded from a number of other vegetation types. ***a. lead to a long-term decrease in the size of a population of a species, or*** No individuals of the species have been recorded within the development site, however potential habitat occurs within the Moist Box-Red Gum Foothills Forest vegetation community which occurs across some areas of the Calderwood site. If the species were to occur on site, long term decrease in the size of a population of this species is considered unlikely as the vast majority (93%) of this vegetation community will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer. ***b. reduce the area of occupancy of a population, or*** No individuals of the species have been recorded within the development site, however potential habitat occurs within the Moist Box-Red Gum Foothills Forest vegetation community which occurs across some areas of the Calderwood site. If the species were to occur on site, a significant reduction in the area of occupancy of a population of this species is considered unlikely as the vast majority (93%) of this vegetation community will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer. ***c. fragment an existing population into two or more populations, or*** No individuals of the species have been recorded within the development site, however potential habitat occurs within the Moist Box-Red Gum Foothills Forest vegetation community which occurs across some areas of the Calderwood site. If the species were to occur on site, fragmentation of an existing population into two or more populations of this species is considered unlikely as the vast majority (93%) of this vegetation community will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer. ***d. adversely affect habitat critical to the survival of a species, or*** No individuals of the species have been recorded within the development site, however potential habitat occurs within the Moist Box-Red Gum Foothills Forest vegetation community which occurs across some areas of the Calderwood site. If the species were to occur on site, significant adverse affects the habitat critical to the survival of this species is considered unlikely as the vast majority (93%) of this vegetation community will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer.

MATTERS TO BE ADDRESSED	**Impact (Commonwealth Legislation)**
	e. disrupt the breeding cycle of a population, or No individuals of the species have been recorded within the development site, however potential habitat occurs within the Moist Box-Red Gum Foothills Forest vegetation community which occurs across some areas of the Calderwood site. If the species were to occur on site, significant disruption to the breeding cycle of a population of this species is considered unlikely as the vast majority (93%) of this vegetation community will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer. ***f. modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or*** No individuals of the species have been recorded within the development site, however potential habitat occurs within the Moist Box-Red Gum Foothills Forest vegetation community which occurs across some areas of the Calderwood site. If the species were to occur on site, significant modification, destruction, removal or isolation or decline in the availability or quality of habitat to the extent that the species is likely to decline is considered unlikely as the vast majority (93%) of this vegetation community will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer. ***g. result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*, or*** The proposal is not likely to result in an invasive species becoming established in the potential habitat on site for this species. Retained habitat on site will be subject to initial invasive weed removal works and ongoing vegetation management. ***h. interfere with the recovery of the species.*** No individuals of the species have been recorded within the development site, however potential habitat occurs within the Moist Box-Red Gum Foothills Forest vegetation community which occurs across some areas of the Calderwood site. If the species were to occur on site, significant interference with the recovery of this species is considered unlikely as the vast majority (93%) of this vegetation community will be retained and protected on site through proposed zoning and the conservation provisions enabled through the ESL layer.
(c) any environmental impact on Commonwealth Listed Migratory Species;	**Yes** Yes, however impact will be minor and not result in significant impacts to these species.

MATTERS TO BE ADDRESSED	**Impact (Commonwealth Legislation)**

Four Commonwealth listed migratory species are considered to potentially occur within the study area, including:

- Rainbow Bee-eater (*Merops ornatus*)
- Cattle Egret (*Ardea ibis)*
- Australian Painted Snipe *(Rostratula benghalensis s. lat.)*
- Fork-tailed Swift *(Apus pacificus)*

RAINBOW BEE-EATER (*Merops ornatus*)

The Rainbow Bee-eater has a wide distribution throughout Australia, occurring in most areas except Tasmania and the arid inland regions of the continent (DEWHA 2009p). Seasonal movement patterns of the species are not yet well understood. It is thought that the southern breeding populations migrate north during winter, while the northern breeding populations are present throughout the year and may only migrate within a short range throughout their northern distribution (DEWHA 2009p).

Habitat for the Rainbow Bee-eater occurs in open country, chiefly at suitable breeding places in areas of sandy or loamy soil such as: sand-ridges; riverbanks; road-cuttings; sand-pits; and, occasionally coastal cliffs. The nest is located in a chamber at the end of a burrow, up to 1.6 m long, tunnelled in flat or sloping ground, sandy back or cutting. Nesting areas are thought to be re-used each breeding season, although new nests are excavated in these areas (DEWHA 2009p).

a. Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species.

There are no records of this species within the study area. No important nesting sites have been recorded on site, although individuals may transit through the area for opportunistic foraging. Given the absence of important habitat for the species within the proposed development area, it is considered unlikely that substantial modification, destruction or isolation of an area of important habitat for this migratory species will occur as a result of development.

b. Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.

There are no records of this species within the study area. No important nesting sites have been recorded on site, although individuals may transit through the area for opportunistic foraging. Given the absence of important habitat for the species within the proposed development area, it is considered unlikely that the development will result in an invasive species that is harmful to the species becoming established in any areas of important habitat.

c. Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

There are no records of this species within the study area. No important

MATTERS TO BE ADDRESSED	**Impact (Commonwealth Legislation)**

nesting sites have been recorded on site, although individuals may transit through the area for opportunistic foraging. Given the absence of important habitat for the species within the proposed development area, it is considered unlikely that serious disruption to the lifecycle of an ecologically significant proportion of a population of this migratory species will occur as a result of the proposed development.

CATTLE EGRET (*Ardea ibis*)

The Cattle Egret is a highly mobile, wide ranging migratory species. It has been recorded throughout most of Australia (DEWHA 2009m).

Cattle Egrets forage on pasture, marsh, grassy road verges, rain puddles and croplands, but not usually in the open water of streams or lakes and are known to avoid marine environments (McKilligan, 2005). Some individuals stay close to the natal heronry from one nesting season to the next, but the majority leave the district in autumn and return the next spring. Cattle Egrets are likely to spend the winter dispersed along the coastal plain and only a small number have been recorded west of the Great Dividing Range (McKilligan, 2005).

a. Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species.

There were no records of this species within the site during surveys. The development area is not known to support any important habitat for the species, and therefore an ecologically significant proportion of the population has not been observed within the area. Given the wide range of habitat available for the species, substantial modification, destruction or isolation of an area of important habitat for this migratory species is considered to be unlikely.

b. Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.

There were no records of this species within the site during surveys. The development area is not known to support any important habitat for the species, and therefore an ecologically significant proportion of the population has not been observed within the area. Given the wide range of habitat available for the species, it is considered unlikely that the development will result in an invasive species that is harmful to the species becoming established in any areas of important habitat.

c. Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

There were no records of this species within the site during surveys. The development area is not known to support any important habitat for the species, and therefore an ecologically significant proportion of the population has not been observed within the area. Given the wide range of habitat available for the species, it is considered unlikely that serious disruption to the lifecycle of an ecologically significant proportion of a population of this migratory species will occur as a result of the proposed development.

MATTERS TO BE ADDRESSED	**Impact (Commonwealth Legislation)**

AUSTRALIAN PAINTED SNIPE (*Rostratula australis*)

See assessment under threatened species.

FORK-TAILED SWIFT (*Apus pacificus*)

The Fork-tailed Swift is a wide-ranging migratory species found throughout most of Australia. The species has been recorded as occasionally travelling with Needletails (e.g.. Hirundapus caudacutus). Given its wide distribution, it is found in a variety of habitats with a possible tendency to more arid areas but also over coasts and urban areas (Simpson & Day 1999).

Little information regarding the ecology of the species is available.

a. Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species.

The Fork-tailed Swift has not been recorded on site, although the species may occasionally transit through the study area. No habitat critical to the survival of this migratory species is known to occur within the Calderwood site, nor is this area known to support any part of the life-cycle of an ecologically significant proportion of their population. As such, it is unlikely that the Fork-tailed Swift will suffer any substantial modification, destruction of isolation of an area of important habitat through the proposed development.

b. Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.

The Fork-tailed Swift has not been recorded on site, although the species may occasionally transit through the study area. No habitat critical to the survival of this migratory species is known to occur within the Calderwood site, nor is this area known to support any part of the life-cycle of an ecologically significant proportion of their population. As such, it is unlikely that the proposed development will result in an invasive species that is harmful to the Fork-tailed Swift becoming established in an area of important habitat.

c. Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

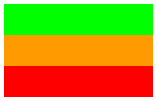
The Fork-tailed Swift has not been recorded on site, although the species may occasionally transit through the study area. No habitat critical to the survival of this migratory species is known to occur within the Calderwood site, nor is this area known to support any part of the life-cycle of an ecologically significant proportion of their population. As such, it is unlikely that the proposed development will seriously disrupt the lifecycle of an ecologically significant proportion of the population of the Fork-tailed Swift.

(d) does any part of the Proposal involve a	No. The project does not include a Nuclear Action.

MATTERS TO BE ADDRESSED	**Impact (Commonwealth Legislation)**
Nuclear Action;	
(e) any environmental impact on a Commonwealth Marine Area;	No. There are no Commonwealth Marine Areas within the study area.
In addition, any direct or indirect effect on Commonwealth land.	No. The project does not directly or indirectly affect Commonwealth land.

Appendix G: Greenspace management options

On the following page is a table outlining the different ownership options and how they meet the above objectives. To assist with interpreting this table the options have been colour coded based on the following qualitative categories:



Good Outcome
Moderate Outcome
Poor Outcome

A detailed management framework can be developed following consideration of these options and discussion with relevant agencies.

	Government Objectives			Developer Objectives						
Model	**Protection Mechanism**	**Funding Mechanism**	**Management Mechanism**	**Access**	**Aesthetics**	**Bush fire**	**Costs**	**Heritage**	**Future Use**	**General**
State Agency e.g. Regional Park	Highest Available	Planning Agreement (costly and lengthy)	Government employees	Open to general public	Low priority	Likely to be well managed	High	Secondary consideration	Developers have no say	Not likely to be a viable option given small area available for conservation. Also is likely to be an expensive management option given government overheads.
Council Reserve	High level of protection	Sn94 or Planning Agreement	Council Staff	Open to general public	Low priority	May be a management issue that Council is not willing to accept	High	Secondary consideration	Developers have no say	Council reserves generally have an emphasis on recreational use and supply of management funding is often an issue. There is the potential to obtain in-kind funds from CMAs and other government sources. Will provide a high level of public access.
Statutory Trust or not for profit group (Eg Nature Conservation Trust or Bush Heritage Fund)	Moderate level of protection however some instruments can be removed through rezoning	Developer contributions to a site specific trust	Contracted to private sector or onsite custodian	Determined by management plan	Low priority	Determined by management plan	Moderate	Secondary consideration	Developers / owners may have a seat on trust board	The existing trusts tend to concentrate on large rural parcels of land and have established revolving land funds rather than holding land long-term. A site specific trust could be established for the site utilising the covenant tool of the NCT. This tool may however be overturned through a rezoning and control of the site could be lost.
Community Scheme	Moderate level of protection	Community levy	Usually outsourced to private sector	Available to members of the community scheme	High priority	High priority and can be interlinked with private allotment management	Moderate	High consideration	Developers / owners can be written into the community by-laws	A strong tool for fostering community involvement in a site however given impost of community levy and perceptions of community scheme it may not be an ideal sales point. Community levy provides an excellent mechanism for ensuring ongoing funding, an upfront contribution to a 'sinking fund' by the developer can significantly reduce ongoing levy amounts.
Torrens Title (with covenants)	Low level of protection	Sinking fund or leverage of commercial uses	Determined by landholder	Determined by landholder, but could use right of ways to provide access	Initially a high priority whilst developer is involved, may taper off over time	A function of the vigilance of the landholder	Low – Moderate (not many administrative overheads).	Determined by landholder	Determined by landholder	This option provides the highest level of flexibility for the landholder but the lowest level of security. Council are also likely to require a 'policing' role which they would likely consider as an unwanted administrative burden. DECCW likely to object unless a strong covenant is imposed and a dedicated management and funding source is identified.
Torrens Title (biobanking site)	Highest level of protection on private land	Sinking fund contributed to by developer and administered by DECC	Likely to be outsourced to private contractor	As determined by landholder	As determined by landholder and permissible within biobanking agreement	Can be made a high priority	Low – moderate. Some additional upfront costs in establishing biobank but low ongoing overheads	As determined by landholder	Determined by landholder but must be consistent with biobanking agreement	The inclusion of a biobanking agreement maintains much of the flexibility of Torrens title but establishes a strong framework for ongoing management of the site. Importantly, it also established a dedicated in perpetuity funding mechanism with annual payments made from a sinking fund contributed to by the developer upfront and administered by DECCW.

Appendix H: Environmentally Significant Lands Provisions

The following is a suggested clause for the ESP Layer, the final clause will be determined through consultation between Deflin and the Department of Planning.

ENVIRONMENTALLY SIGNIFICANT LAND (ESL)

ESL is to be shown on an appropriate map within the SEPP.

OBJECTIVES

- identify environmentally significant land, and
- to maintain biodiversity, and
- to retain and enhance the natural functions of riparian corridors, and
- to provide for controlled pedestrian and bicycle access to,, and sensitively integrated fire trails on, such land, and
- to protect items of Aboriginal heritage significance.

CONTROLS

Before granting consent, the consent authority must be satisfied that the development:

- would substantially retain existing native vegetation, and
- would not adversely affect to a significant extent:
    - the ecological value of the existing vegetation, or
    - native fauna

Before granting consent, the consent authority must consider whether;

- the locality has high biological diversity
- the locality contains:
    - a disjunct population of native species or a species that is neat the limit of its geographical range, or
    - riparian vegetation, or
    - vegetation associated with wetlands, and
- the land has connective importance as, or as part of , a corridor of native vegetation forming a connection that allows for the potential passage of species of flora or fauna between two or more areas of native vegetation, and
- the vegetation is adequately represented on land in the general locality, and
- the land is important as a site along a migratory route for wildlife, and
- the land functions as an important drought refuge for wildlife, and

- clearing of the land would be likely to contribute significantly to:
  - soil erosion, or
  - salinisation of soil or water, or
  - acidification of soil, or
  - landslip, or
  - deterioration in the quality of surface or ground water, or
  - increased flooding, or
- there is any need to conserve all or some of the native vegetation because:
  - of its unusually good condition or its significance as a sample of its type, or
  - the development will increase the perimeter of the native vegetation, and so the ratio of the boundary to the area of the native vegetation, making it more vulnerable to negative impacts, or
  - there is an archaeological site that has Aboriginal heritage significance on the land.

Appendix I: DECCW Meeting Minutes

Calderwood Urban Development Project
Summary Record of Agency Consultations

Date	**20.10.09**		
Project team member / firm	**Bill Mitchell/Rob Bennett DLL, Evan Raper Austral, Steven House Ecological, Anthony Barthelmess Cardno, Lesley Bull JBA**		
Organisation	**DECCW/DOP**		
Name of contact	**DoP:** **Mike File, Simon Bennett, Michelle Cramsie** **DECCW:** **Lou Ewins, Marnie Stewart, Liz Peterson, Fran Scully, John Bucinskas, Janne Gross**		
Position in organisation			
Contact details			
Form of Consultation	**Face to face X**	**Phone call**	**Email**
Issues discussed / outcomes	Austral outlined the planned approach to Aboriginal archaeological and cultural heritage consultation and assessment as per methodological points from agenda notes relating to Aboriginal heritage. DECCW advised that as a part 3A process the usual Section 87 and 90 consents as normally required under the NP&W Act would not be required. DECCW enquired as to how the data and recommendations from the Aboriginal heritage study would be incorporated by DLL. DLL advised that such data would be included in the design of the final concept plan. The Austral rep in particular highlighted the planned approach to consulting with the Aboriginal community in the Illawarra and Shellharbour area. Austral rep suggested that consultation methodology be approved in principle by DECCW. DECCW wished to point out that DoP are the consent authority in this case and main point of contact should be Kylie Siridis in relation to Aboriginal heritage in addition to any consultation with DECCW. DoP in the process of producing their own guidelines to dealing with Aboriginal heritage matters under Part 3A projects. DECCW stressed that the consultation process was a means to highlight Aboriginal cultural information. Aboriginal stakeholder consent/review should not be sort for matters pertaining to the archaeological method. Austral stressed that the consultation process was about providing an opportunity to consult in order to ascertain what cultural knowledge, if any, was known for the project area.		

	DECCW advised that consultation was not about providing employment to the Aboriginal stakeholders who register their interest. Austral concurred however stated that involvement of community is a positive way of affirming good will though technically not required. DECCW requested further information as to Austral's approach in terms of a predictive model for Aboriginal site location. Specifics relating to local and regional archaeological context, topographical, hydrological and geomorphological data, past land disturbance and historic land use patterns. This reply was sufficient to answer DECCW's query.
Actions arising	Minutes to be circulated

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