



**RIVERSTONE EAST PRECINCT (STAGE 3)
PACKAGE C – BIODIVERSITY AND RIPARIAN
CORRIDORS**

Biodiversity and Riparian Corridors Assessment Report

FINAL

September 2023

RIVERSTONE EAST PRECINCT (STAGE 3) PACKAGE C – BIODIVERSITY AND RIPARIAN CORRIDORS

Biodiversity and Riparian Corridors Assessment
Report

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Aurecon

Project Director: Rachel Musgrave
Project Manager: Maddy Young
Report No. 23182_R02
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Executive Summary

The Department of Planning and Environment (DPE, the Department), in collaboration with Blacktown City Council (Council), is progressing investigations into the potential rezoning of the remaining portion of the Riverstone East Precinct within the North West Growth Area (NWGA), nominally identified as Stage 3 (i.e. the Study Area).

The Study Area (shown on **Figure 1.1**) covers approximately 379 hectares (ha) (including Rouse Hill Regional Park) of which 244 ha has been 'biodiversity-certified' by order of the Minister for the Environment under Section 126G of the *Threatened Species Conservation Act 1995* (TSC Act), as outlined in the State Environmental Planning Policy (Precincts – Central River City) 2021 (formerly the SEPP (Sydney Region Growth Centre)). The remaining 135 ha of land within the Study Area is not biodiversity certified (refer to **Figure 1.2**). Impacts to vegetation within the non-certified areas are subject to assessment under Part 4 or Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and associated assessment under the *Biodiversity Conservation Act 2016* (BC Act), that replaced the TSC Act.

Umwelt has been engaged by Aurecon to provide biodiversity and riparian assessments for Stage 3 of the Riverstone East Precinct. The purpose of this assessment is to identify key ecological and riparian features and constraints within the Study Area as well as to provide recommendations with respect to terrestrial and aquatic ecosystem management. The assessment was undertaken with reference to the revised Riverstone East Stage 3: ILP Concept Map (shown in **Figure 1.3**).

The assessment was undertaken through a combination of desktop assessment and field surveys. During the site assessment all areas of the Study Area were not able to be accessed. Those properties that were accessed are shown on **Figure 1.4**.

The desktop assessment focused on the identification of threatened biota in the Study Area, and supplemented data for areas that access was not granted during the field surveys (results of the desktop assessment are shown on **Figure 3.1**). The desktop assessment collated data from existing sources including:

- Riverstone East Precinct – Biodiversity and Riparian Corridors Assessment (Eco Logical Australia 2015).
- NSW State Vegetation Type Map (SCTM) C1.1.M1 (DPE 2022a).
- Light detection and ranging data (LIDAR).
- Current satellite and historic aerial photographs.

Field surveys focused on identification of Plant Community Types (PCTs), Threatened Ecological Communities (TECs), validating Existing Native Vegetation (ENV) and Additional High Conservation Value Vegetation (AHCVV) and habitat for threatened biota in the Study Area (results shown on **Figure 4.1** and **Figure 4.2**). A riparian assessment was undertaken in sites with approved access, and from road verges and assessed from a distance from adjoining properties. LIDAR data was used to map the Top of Bank (ToB), given the extensive access limitations throughout the Study Area (results shown on **Figure 4.3** and **Figure 4.4**).

Vegetation and riparian corridor condition was in a moderate to degraded condition across the Study Area. The following four TECs have been recorded and identified through a combination of field surveys and desktop assessments:

- Cumberland Plain Woodland in the Sydney Basin Bioregion listed as a Critically Endangered Ecological Community (CEEC) under the BC Act and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- Shale Sandstone Transition Forest in the Sydney Basin Bioregion listed as a CEEC under the BC Act and EPBC Act.
- Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion listed as an Endangered Ecological Community (EEC) under the BC Act and CEEC under the EPBC Act.
- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin South East Corner Bioregions listed as an EEC under the BC Act and CEEC under the EPBC Act.

No threatened flora species were identified during the field surveys however, the surveys were not considered comprehensive given the land access limitations.

No threatened fauna species were identified during the field surveys however, the following three threatened bat species have previously been recorded in the Study Area (DPE 2023a):

- Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*)
- Grey-headed Flying-fox (*Pteropus poliocephalus*)
- Large Bent-winged Bat (*Miniopterus orianae oceanensis*).

Significant habitat features identified within the Study Area include hollow bearing trees, naturally occurring and planted native and exotic trees and the riparian areas associated with First Ponds Creek and Killarney Chain of Ponds which support a riparian vegetation community and would provide suitable habitat for nectivorous and insectivorous fauna, as well as small birds, migratory birds and some waders that inhabit riparian habitat types.

The following two main watercourses and their tributaries traverse the study area:

- First Ponds Creek, a 3rd order watercourse which occurs along the north-west boundary of the Study Area. The tributaries of First Ponds Creek comprise two unnamed first order watercourses which converge to form a second order stream, which then drains into First Ponds Creek.
- Killarney Chain of Ponds, which occurs in the south-eastern portion of the Study Area as a 2nd order watercourse fed by two unnamed first order watercourses (refer to **Figure 4.3**).

A Riparian and Vegetation management strategy is provided in **Section 6.0**.

Eco Logical (2015) validated 60.27 ha of ENV within the current boundary of the Stage 3 Riverstone East Precinct, of which 7.53 ha was located within non-certified areas and 52.74 ha within certified areas. Subsequent site inspections and desktop assessment have validated the presence of 55.86 ha of ENV within the Stage 3 Precinct boundary. The 55.86 ha is comprised of 48.97 ha in the certified lands and 6.89 ha in the non-certified lands. 5.53 ha of validated ENV within non-certified land is located within the proposed Rouse Hill Regional Park (RHRP) boundary.

Field inspections and aerial photograph interpretation revealed an additional 62.55 ha of AHCVV, of which 55.12 ha is in certified lands and 7.43 ha is in non-certified lands. The area of Validated ENV and AHCVV is shown on **Figure 4.2**.

It is considered that the draft ILP meets the conditions outlined in the Draft EPBC Act Strategic Assessment Report for the Sydney Growth Centres Program, May 2010. An assessment of consistency between the commitments of the ILP and the EPBC Strategic Assessment is provided in **Appendix A**.

It is considered that the draft ILP meets the conditions outlined in the North West Growth Centres Bio-certification Order. An assessment of consistency between the commitments of the ILP and the North West Growth Centres Bio-certification Order is provided in **Appendix B**.

The Study Area contains relatively large areas of good quality vegetation and ENV on certified lands. The PCTs in the Study Area are of high conservation value and are commensurate with four TECs listed under the BC Act and four TECs listed under the EPBC Act.

While the Biodiversity Certification and Strategic Assessment approvals that have been conferred on the Growth Centres enable the removal of vegetation within certified lands, it is recommended that good quality vegetation in certified land be retained. Further conservation and management recommendations are provided in **Section 7.0**.

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1.0 Introduction

1.1 Site Context

The Department of Planning and Environment (DPE, the Department), in collaboration with Blacktown City Council (Council), is progressing investigations into the potential rezoning of the remaining portion of the Riverstone East Precinct within the North West Growth Area (NWGA), nominally identified as Stage 3 (i.e. the Study Area).

The Study Area, located within Blacktown local government area (LGA), is bound by Windsor Road to the northeast, lands designated for Rouse Hill Regional Park in the east, including Burns Pet Food and AJ Bush and Sons sites, the developing lands within the Tallawong Station Precinct to the south, the developing lands within Riverstone East Stages 1 and 2 to the west, and First Ponds Creek in the northwest (refer to **Figure 1.1**).

The precinct, including Lots 1 and 2 DP 218794 Junction Road Riverstone (straddles Riverstone East Stages 1 and 2 and Stage 3) and sites owned by Burns Pet Food and A J Bush and Sons, is surrounded by North West Growth Area precincts in the Blacktown, Hills Shire and Hawkesbury local government areas.

The Study Area covers approximately 379 hectares (ha) (including Rouse Hill Regional Park) of which 244 ha has been 'biodiversity-certified' by order of the Minister for the Environment under section 126G of the *Threatened Species Conservation Act 1995* (TSC Act), as outlined in the State Environmental Planning Policy (Precincts – Central River City) 2021 (formerly the SEPP (Sydney Region Growth Centre)). The remaining 135 ha of land within the Study Area is not biodiversity certified (refer to **Figure 1.2**). Impacts to vegetation within the non-certified areas are subject to assessment under Part 4 or Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and associated assessment under the *Biodiversity Conservation Act 2016* (BC Act), that replaced the TSC Act.

The Study Area currently comprises small rural holdings that are made up primarily of low density/rural residential development and farming lands including poultry, market garden and cut flower production. There is also a meat rendering plant located within the precinct that is located to the west of the Rouse Hill Regional Park.

There are numerous watercourses within the precinct that serve primarily as tributaries to First Ponds Creek and to a lesser degree Killarney Chain of Ponds Creek (refer to **Figure 1.2**). The watercourses, while degraded, are in the main reasonably well defined although the majority have been heavily impacted by exotic species with little or no remaining native vegetation, or only small patches of well separated native vegetation remaining.

The term 'Study Area' is utilized throughout this report and refers to the land within Stage 3 of the Riverstone East Precinct boundary.

1.2 Background

The Planning Minister released the Riverstone East Precinct for planning in August 2013. This will be the final stage of planning for the Riverstone East Precinct, building on the planning undertaken for Stages 1 and 2, which were rezoned in 2016. Ecological (2015) undertook an assessment of the ecological, riparian and bushfire issues in order to inform Stages 1 and 2 the Riverstone East Precinct Planning Process.

Preliminary urban design and technical analysis was undertaken for the Stage 3 area in conjunction with Stages 1 and 2. A draft Indicative Layout Plan (ILP) Concept Map for Stage 3 was made available during the exhibition period for Stages 1 and 2. This body of work remains relevant to precinct planning for Stage 3, however was validated and updated to respond to changed site conditions and contemporary policy settings. The revised Riverstone East Stage 3: ILP Concept Map is shown in **Figure 1.3**. The Department has prepared a summary of the findings from the work undertaken previously for Stage 3 which has been considered as part of this assessment.

Umwelt has been engaged by Aurecon to provide biodiversity and riparian assessments for Stage 3 of the Riverstone East Precinct. Umwelt has undertaken a Gap Analysis as part of Stage 1 of this assessment (Umwelt 2023). The purpose of the Gap Analysis was to review the adequacy of existing studies, their methodology and assessment outcomes, and to identify any gaps in the analysis. The results of the Gap Analysis were used to identify additional assessments required for this assessment, including identification of sites for detailed surveys.

The results of the Gap Analysis were discussed in the Enquiry by Design (EbD) workshop hosted by the Department. The purpose of the EbD workshop was to allow numerous environmental specialists to provide recommendations to inform future development and refinement of the ILP.

1.3 Purpose of this Report

The purpose of this assessment is to identify key ecological and riparian features and constraints within the Study Area as well as to provide recommendations with respect to terrestrial and aquatic ecosystem management. Specific objectives of this project are to:

- Undertake a strategic biodiversity assessment including a flora and fauna study, analysis of ecological values particularly in regards to identifying areas of high, moderate and low ecological value.
- Ensure the statutory requirements for the protection, restoration and enhancement of threatened species, populations, ecological communities and their habitats will be met, and that precinct rezoning processes are consistent with the terms of the biodiversity certification granted to the Central River City SEPP and the Commonwealth Strategic Assessment.
- Provide recommendations for achieving innovative management frameworks for ecological and riparian issues which enable long term conservation and management while facilitating the safe urban development outcomes for the precinct.

1.4 Limitations

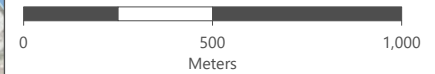
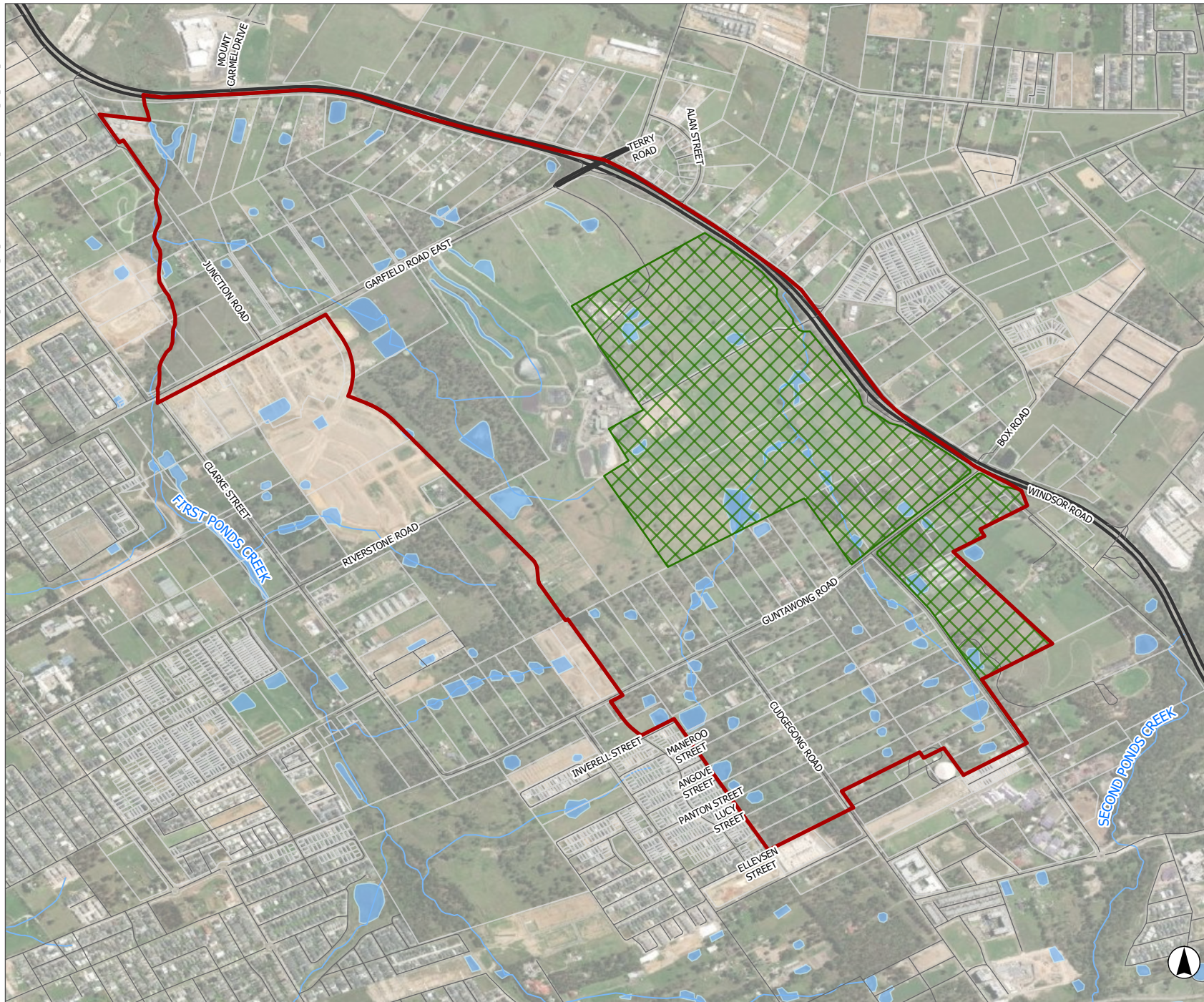
During the site assessment all areas of the Study Area were not able to be accessed. Those properties that were accessed are shown in **Figure 1.4**. A large portion of the Study Area is private property and very few properties have given permission for access. Additionally, several properties with landholders being public departments were not able to be accessed as fencing restricted access. Within these areas the existing desktop information along with any information able to be collected visually from nearby vantage points has been used to inform the ground truthing of vegetation community mapping and Existing Native Vegetation (ENV) in these areas. Not all these areas were able to be visually assessed.

FIGURE 1.1

Precinct Location

Legend

- Major Roads
- Minor Roads
- Watercourses
- Cadastre
- Study Area - Riverstone East Precinct Stage 3
- Rouse Hill Regional Park
- Watercourses Area



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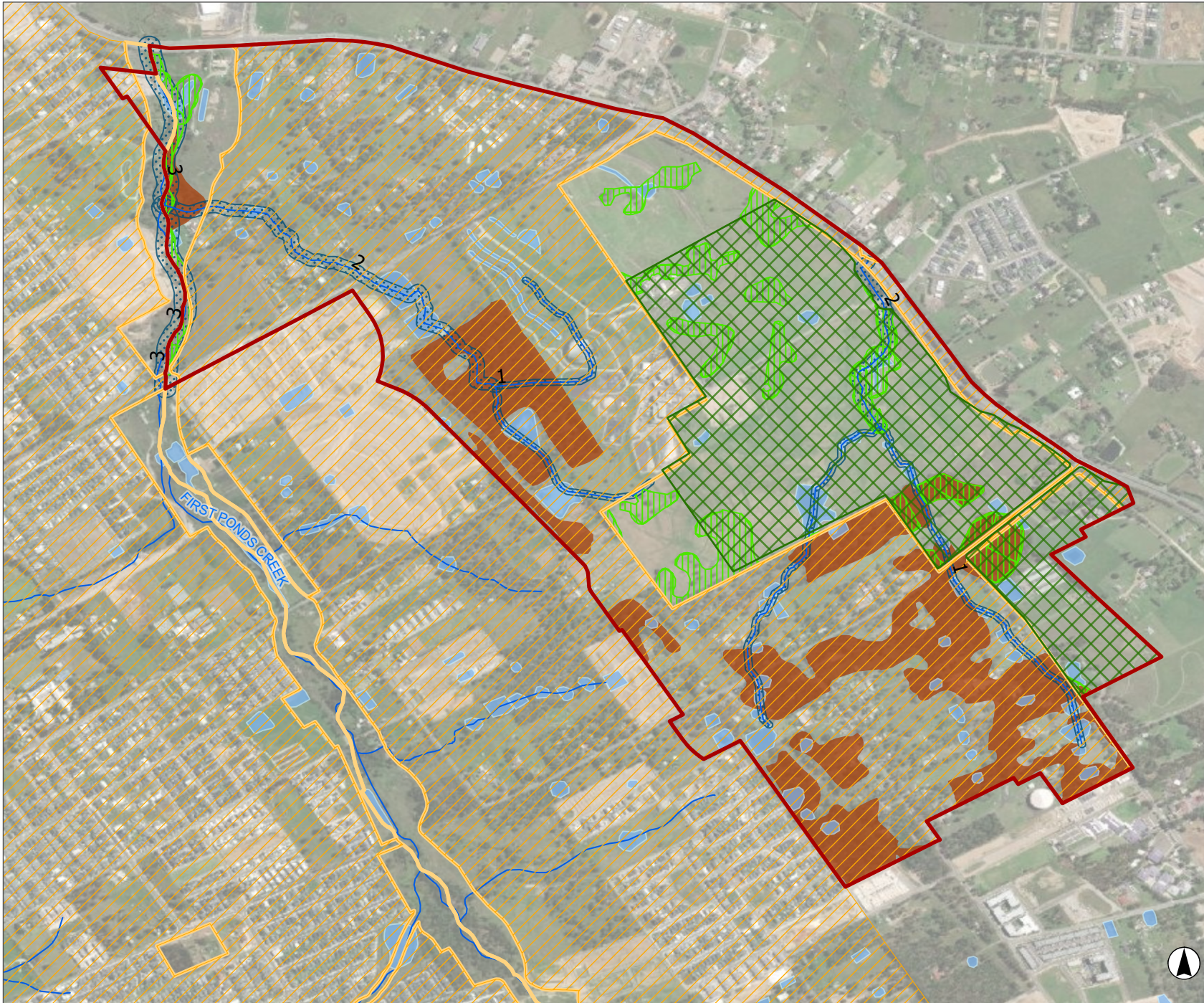
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FIGURE 1.2

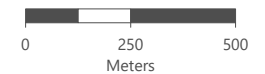
Certified and Non-certified Land and Conservation Plan Mapped Existing Native Vegetation

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Legend

- Study Area - Riverstone East Precinct Stage 3
- Rouse Hill Regional Park
- Vegetated Riparian Zone Buffer
- Existing Native Vegetation (Sydney Region Growth Centres)
- Biodiversity Values Map
- Watercourses Area
- Watercourses - Strahler Stream Order
- Growth Centre Land Certification**
- Existing Non-certified
- Existing Certified



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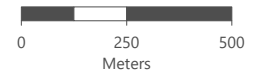


FIGURE 1.3

Draft ILP Concept Plan

Legend

- Study Area - Riverstone East Precinct Stage 3
- Design Lines
- Open Space - Rouse Hill Regional Park
- Open Space - Natural Green Infrastructure
- Open Space - Environmental Conservation
- Open Space - Natural Bushland
- Open Space - Active
- Open Space - Passive
- Open Space - Connectors and Corridors
- Open Space - Junction Road and Associated lands
- Open Space - Energy
- Riparian
- School
- Community
- Sporting Field
- Residential Blocks
- Major Road



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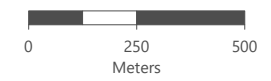
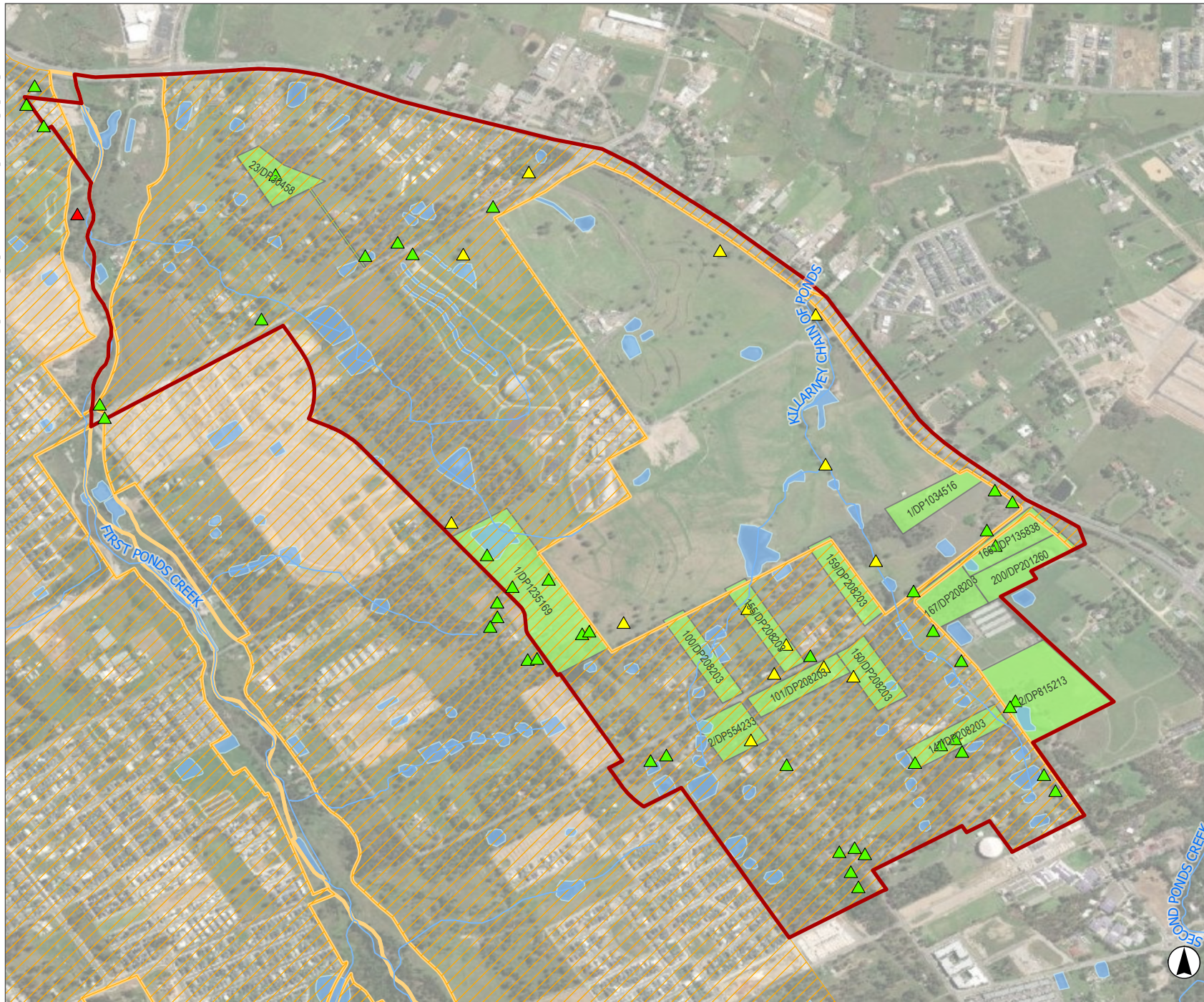
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FIGURE 1.4

Properties Accessed During Surveys

Legend

- Study Area - Riverstone East Precinct Stage 3
- Properties Accessed During Survey
- Watercourses Area
- Watercourses
- Growth Centre Land Certification**
- Existing Non-certified
- Existing Certified
- Locations of Umwelt's Site Assessment**
- ▲ Groundtruthed (up to 20m)
- ▲ Near Visual Assessment (20m to 100m)
- ▲ Remote Visual Assessment (100m +)



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2.0 Statutory Context

2.1 Commonwealth Legislative Context

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides the legal framework for the protection and management of nationally and internationally important flora, fauna, ecological communities, and heritage places, which are defined as Matters of National Environmental Significance (MNES). In addition to identifying and protecting MNES, the EPBC Act also incorporates measures for the protection of Commonwealth-owned land, assessing the actions of Commonwealth agencies, and the protection of marine species.

2.1.1 EPBC Act Strategic Assessment

Strategic assessments are landscape-scale assessments defined under the EPBC Act that help deliver conservation and planning outcomes on a much larger scale than project-by-project assessments. The Australian Government has signed a number of agreements with strategic assessment partners under section 146 of the EPBC Act, including an agreement with the NSW government for the Sydney Growth Centre Program strategic assessment, which regulates early development in Western Sydney, NSW.

Approval of the Sydney Growth Centre Program strategic assessment occurred on the 28 February 2012. The Commonwealth is satisfied that the conservation and development outcomes of the Growth Centres Precincts will satisfy their requirements for environmental protection under the EPBC Act.

If development proceeds in accordance with the Growth Centres requirements, including the Biodiversity Certification Order (discussed in **Section 5.4**), the *State Environmental Planning Policy (Precincts – Central River City) 2021* (formerly the Sydney Region Growth Centres SEPP), relevant Development Control Plans (DCPs), Growth Centres Development Code, then there is no requirement to assess the impact of development activities on MNES, and as such, no requirement for referral of activities to the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW).

An assessment of consistency between the commitments of the ILP and the EPBC Act Strategic Assessment is provided in **Appendix A**.

2.2 NSW Legislative Context

In December 2007, an order conferring biodiversity certification on the Sydney Region Growth Centres SEPP was made by the former Minister for the Environment under section 126G of the former TSC Act.

In July 2008, the Minister's certification was validated by the *Threatened Species Conservation Amendment (Special Provisions) Act 2008* which was subsequently incorporated into Part 7 of Schedule 7 of the TSC Act. The amendment gives the Minister for the Environment the power to suspend or revoke the certification if any of its conditions are not complied with. The conditions applying to the certification have remained unaltered since gazettal of the original order and require (among other things) the permanent protection of 2,000 hectares of high-quality vegetation within the Growth Centres.

On 25 August 2017, the BC Act came into force, replacing the TSC Act. However, section 35 of the Biodiversity Conservation (Savings and Transitional) Regulation 2017 notes that:

“Biodiversity certification that was conferred on land under Part 7AA of the *Threatened Species Conservation Act 1995* and that was in force on the repeal of that Act is taken to be biodiversity certification conferred on the land under Part 8 of the new Act”.

The effect of granting biodiversity certification (i.e. Bio-certification) is that any development or activity requiring consent (i.e. under Part 4 and 5 of the EP&A Act respectively) is automatically “development that is not likely to significantly affect threatened species”. The process of bio-certification removes the need to address threatened species considerations and the assessment of significance or seven-part tests (previously provided for under Section 5A of the EP&A Act, now Section 7.3 of the BC Act), including the preparation of species impact statements (SIS).

The replacement of the TSC Act with the BC Act does not impact assessment requirements for impacts to Bio-certified land in the Study Area, however the change in legislation would impact the assessment required for impacts to biodiversity on non-certified land in the Study Area.

2.2.1 Growth Centres SEPP Bio-Certification Order

As discussed above, the former Growth Centres SEPP has been Bio-certified by order of the Minister for the Environment under section 126G of the former TSC Act. The mechanism for achieving this is outlined in the (Draft) Growth Centres Conservation Plan (ELA 2007) and the conditions for biodiversity-certification are documented in the Ministers order for consent.

The (Draft) Growth Centres Conservation Plan 2007 assessed native vegetation across the entire Growth Centres area and identified areas of Existing Native Vegetation (ENV). **Figure 1.2** shows the area of mapped ENV for the Riverstone East Precinct as well as the delineation of Certified and Non-Certified land.

Table 2.1 outlines the conditions from the biodiversity certification order relevant to this assessment and where they are addressed in this report. An assessment of consistency between the commitments of the draft ILP and the North West Growth Centres Bio-certification Order is provided in **Appendix B**.

Table 2.1 Conditions from the Biodiversity Certification Order

Condition Number	Condition	Section of Report
Retention of existing native vegetation during precinct planning		
7	During the precinct planning process, the Growth Centres Commission (GCC) may determine to make areas of existing native vegetation within the non-certified areas available for development if the clearance of such vegetation is considered necessary for either the provision of essential infrastructure and/or to meet the required Development Parameters specified in the Growth Centres Development Code.	Section 5.0

Condition Number	Condition	Section of Report
8	<p>In making a determination under condition 7, the GCC must demonstrate by way of information provided during the public exhibition of the precinct plan (where that exhibition occurs after this order takes effect) that the clearing of any existing native vegetation in the non-certified areas will be offset by:</p> <ul style="list-style-type: none"> a. the protection of an equal or greater area of existing native vegetation elsewhere in the Growth Centres; and/or b. the revegetation and/or restoration of an area of land elsewhere in the Growth Centres, subject to satisfying the following, <ul style="list-style-type: none"> i. that the clearance of existing native vegetation in the non-certified areas will not affect the capacity to achieve overall improvement or maintenance of biodiversity values for threatened species, populations and ecological communities and their habitats, ii. the revegetated and/or restored areas will be protected, iii. the extent of revegetation and/or restoration compared to clearing of existing native vegetation must be undertaken at a ratio of at least 3:1 (to reflect the greater ecological risks relative to retaining existing native vegetation), iv. areas subject to revegetation and/or restoration must be of a suitable boundary configuration and design to support long-term management, v. revegetation and/or restoration of the proposed areas would not be undertaken under another scheme or regulatory requirement already in operation at the time that the clearing is approved (this includes but is not limited to any approvals, and associated conditions of such approvals, that may be required under the <i>Rivers and Foreshores Improvement Act 1948</i> and <i>Water Management Act 2000</i>), vi. revegetation and/or restoration will be undertaken by suitably qualified and experienced persons using indigenous plant stock, and vii. sufficient resources will be made available to undertake the revegetation and/or restoration and any necessary follow-up maintenance and monitoring for a minimum period of 5 years following the commencement of the revegetation and/or restoration. 	Section 5.0
10	<p>In the non-certified areas, proposals to clear existing native vegetation shall be subject to the relevant development controls in the SEPP and Sydney Regional Environmental Plan No. 31 – Regional Parklands, and the requirements of the <i>Environmental Planning and Assessment Act 1979</i>.</p>	Section 5.0
12	<p>Notwithstanding any other conditions of biodiversity certification, in the lands marked by a red hatching on the biodiversity certification maps existing native vegetation must not be cleared unless it is in accordance with a plan of management or unless such clearance has been agreed to by the DECC.</p>	Section 5.0
13	<p>If new information becomes available after the biodiversity certification order took effect that demonstrates that the vegetation within an area does not otherwise meet the definition of existing native vegetation, then for the purposes of conditions 7 to 8 and condition 11 to 12 only the area of confirmed existing native vegetation shall be considered.</p>	Section 3.2.2 and Section 4.1

Condition Number	Condition	Section of Report
18	<p><u>Green and Golden Bell Frog</u></p> <p>Potential population at Riverstone – as shown in black hatching on the biodiversity certification maps:</p> <p>Option 1</p> <ul style="list-style-type: none"> • survey to confirm the presence of the species • if the species is present, provide protection of the area of suitable habitat for the species to the satisfaction of the DECC/OEH. <p>Option 2</p> <ul style="list-style-type: none"> • If the species is present at Riverstone but cannot be adequately protected to the satisfaction of the DECC, then: <ol style="list-style-type: none"> a. undertake targeted survey to confirm the presence of the species elsewhere in the Growth Centres b. if the species is present elsewhere in the Growth Centres, provide for the protection of an area(s) of suitable habitat for the species to the satisfaction of the DECC/OEH. 	<p>Section 3.2.7 and Section 4.2</p>

2.2.1.1 Areas in Which Bio-Certification Does Not Apply

Bio-certification does not apply to several areas of land within the Study Area. These areas of non-certified lands within Stage 3 include:

- Flood prone land along First Ponds Creek between Garfield Road East and Windsor Road.
- Area presently zoned for the expansion of Rouse Hill Regional Park.
- Parcels of land north and west of the current zoned boundary of Stage 2 of the Rouse Hill Regional Park.

Bio-certification does not apply to these areas of non-certified land and any work within these areas would require an environmental impact assessment in accordance with the EP&A Act, BC Act and Biodiversity Offset Scheme (BOS) to support a development application.

Given that most of the non-certified land is largely cleared of native vegetation, with only small, fragmented patches of non-certified native vegetation, further Bio-certification of land within the precinct boundary is not recommended. It is recommended that areas of native vegetation (in particular patches of good condition TECs) in areas of Bio-certified land be avoided and retained for conservation.

2.2.2 Environmental Planning and Assessment Act 1979

The EP&A Act is the overarching planning legislation in NSW that provides for the creation of planning instruments that guide land use. The EP&A Act also provides for the protection of the environment, including the protection and conservation of native animals and plants. This includes threatened species, populations and ecological communities, and their habitats of biodiversity values as listed in the BC Act and FM Act.

In determining a development application, the consent authority is required to take into consideration the matters listed under Section 4.15 of the EP&A Act that are relevant to the application. Key considerations include:

- Any environmental planning instrument, including drafts.
- The likely impacts of the development.
- The suitability of the site for the development.
- Any submissions made in accordance with the EP&A Act or regulations.
- The public interest.

Any development proposed in areas which are not bio-certified would be subject to assessment under Part 4 or Part 5 of the EP&A Act and associated assessment under the BC Act, as outlined above.

2.2.3 Biosecurity Act 2015

The *Biosecurity Act 2015* replaced the *Noxious Weeds Act 1993* on 1 July 2017. The *Biosecurity Act* is a wide-ranging legislation that outlines the requirements of government, councils, private landholders, and public authorities in the management of biosecurity matters. Priority weeds are regulated under the *Biosecurity Act* with a general biosecurity duty to prevent, eliminate or minimize any biosecurity risk they may pose. Some priority weeds have additional management obligations which may apply generally, or under specific circumstances. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised as is reasonably practicable.

2.2.4 Water Management Act 2000

The *Water Management Act 2000* (WM Act) regulated developments that are deemed 'Controlled activities' which are activities carried out in, on or under waterfront land are defined by WM Act. The DPE administers the WM Act and is required to assess the impact of any proposed controlled activity to ensure that no more than minimal harm will be done to waterfront land as a consequence of carrying out the controlled activity.

Waterfront land includes the bed and bank of any river, lake or estuary and all land within 40 metres of the highest bank of the river, lake or estuary. This means that a controlled activity approval must be obtained from the Department of Primary Industries before commencing the controlled activity.

Identification and management of activities within waterfront land is addressed in **Section 3.3**, **Section 4.3** and **Section 6.0**.

2.2.5 Fisheries Management Act 1994

The objects of the *Fisheries Management Act 1994* (FM Act) are to conserve, develop and share fishery resources for the benefit of present and future generations, to conserve fish, key fish habitats, threatened species, populations and communities to promote ecologically sustainable development including conservation of biological diversity.

Part 7A, Division 1, Division 2 and Division 3 of the FM Act provides processes for identification of threatened species and critical habitats for threatened species, populations and ecological communities, to ensure that impact is properly assessed and conservation encouraged.

The FM Act aims to conserve key fish habitats however the FM Act does not define key fish habitat. NSW Department of Primary Industries (DPI) Fisheries have defined key fish habitat to include all marine and estuarine habitats up to highest astronomical tide level and most permanent and semipermanent freshwater habitats including rivers, creeks, lakes, lagoons, billabongs, weir pools and impoundments up to the top of the bank. DPI Fisheries policy excludes unmapped gullies, first and second order streams, man-made water storage structures and intermittent lagoons or wetlands filled from localised runoff and not otherwise hydrologically connected to other permanent habitats. Stream orders of the waterways in the Study Area are shown on **Figure 1.2**.

Assessment of key fish habitat and obstructions to fish passage will be considered in assessing ecological value.

3.0 Methods

3.1 Desktop Assessment

A review of documents and resources was undertaken to support the desktop assessment for the Project. The information obtained was used to assist in the assessment of potentially occurring threatened and migratory species, endangered populations (EP) and threatened ecological communities (TEC). The information obtained was used to assist in the assessment of potentially occurring ecosystem-credit and species-credit species. Relevant documents and resources included:

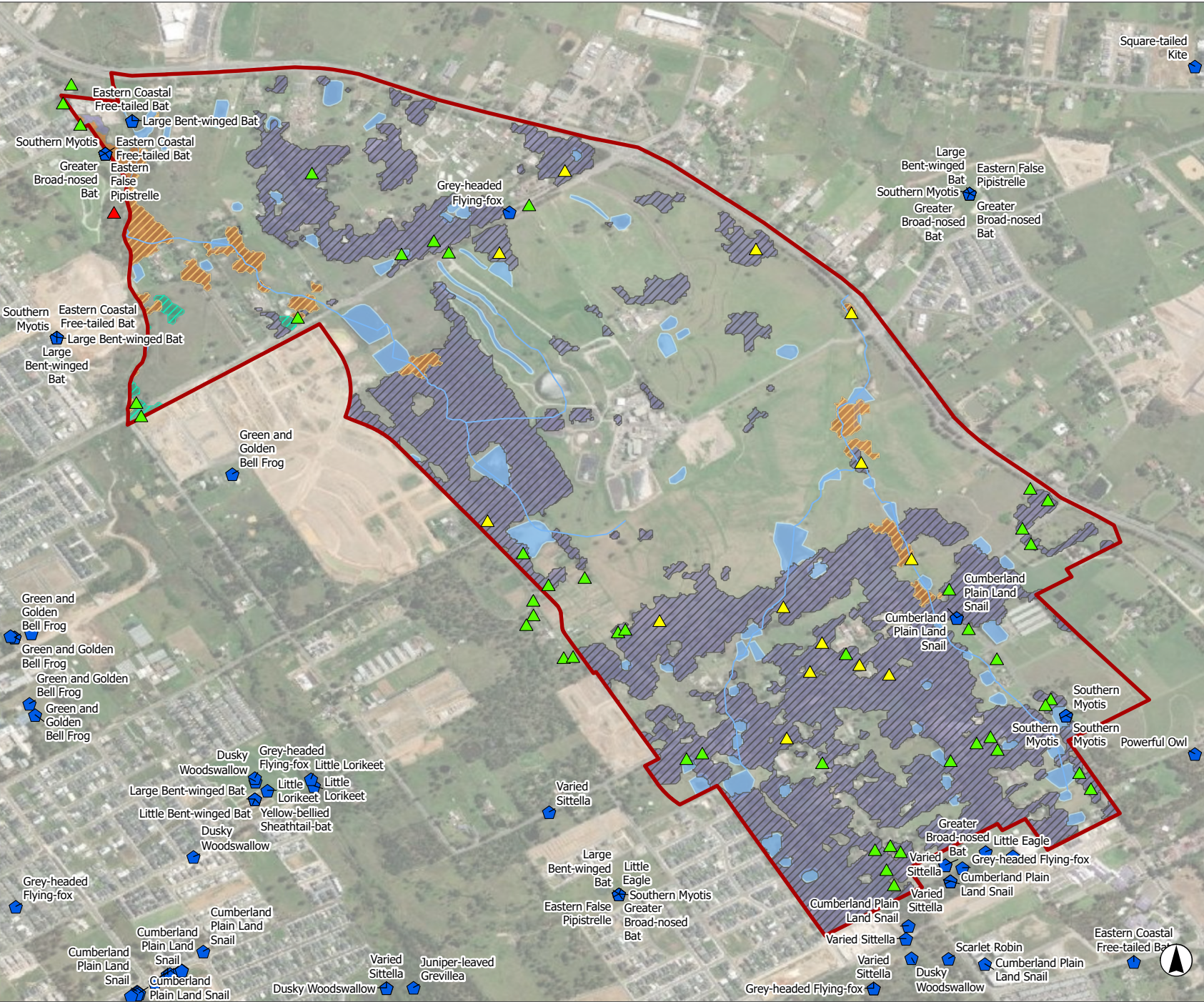
- DPE BioNet Atlas of NSW Wildlife database and mapping tool, searched for records of threatened species (state and federal listings) within an area 10 km x 10 km surrounding the Study Area (DPE 2023a).
- DCCEEW online protected matters search tool (PMST) (DCCEEW 2023) for known/predicted EPBC Act-listed species.
- Threatened Biodiversity Database Collection (TBDC) (DPE 2023b).
- Vegetation Information System (VIS) Classification Database (DPE 2023c).
- Biodiversity Assessment Method (BAM) Important Area mapping (DPE 2023d).
- NSW State Vegetation Type Map (SVTM) C1.1.M1 (DPE 2022a).
- The Native Vegetation of the Sydney Metropolitan Area – Version 3.1 VIS_ID 4489 (OEH 2016).
- Riverstone East Precinct – Biodiversity and Riparian Corridors Assessment (Eco Logical 2015).
- Riverstone Precinct Green and Golden Bell Frog Survey, Growth Centres Biocertification (Eco Logical 2009).
- NSW Government Historical Imagery.
- Light detection and ranging data (LIDAR).

Following collation of database records and species and community profiles, a likelihood of occurrence assessment was prepared with reference to the broad habitat contained within the Study Area. This was further refined following field surveys. The likelihood of threatened and migratory biota occurring in the Study Area was assessed based on the presence of records from the locality, species distribution and habitat preferences, the suitability of potential habitat present in the Study Area and the broader locality. The assessment of the likely occurrence of threatened species within the Study Area is provided in **Appendix C**. Threatened species and SVTM mapping is shown on **Figure 3.1**.

FIGURE 3.1

State Vegetation Mapping and Threatened Species Records

D:\UMWELT (AUSTRALIA) PTY LTD\3182 - 03 SRV02_PROJECTS\23182_RZ_RIV_BIODIVERSITY\RIP\ANALYSIS_VA\APR - 23182_RZ_RZ_FG031_L\VEGMAPPING_THREATENEDSPEC



Legend

- Study Area - Riverstone East Precinct Stage 3
- Watercourses
- Watercourses Area
- ◆ NSW Bionet Atlas Threatened Species Records

Locations of Umwelt's Site Assessment

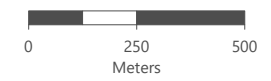
- ▲ Groundtruthed (up to 20m)
- ▲ Near Visual Assessment (20m to 100m)
- ▲ Remote Visual Assessment (100+)

Threatened Ecological Communities

- Cooks River/Castlereagh Ironbark Forest (listed as an EEC under the BC Act and a CEEC under the EPBC Act)
- Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (listed as a CEEC under the BC Act and EPBC Act)
- River-Flat Eucalypt Forest on Coastal Floodplains (listed as an EEC under the BC Act and CEEC under the EPBC Act)

State Vegetation Mapping

- PCT 3448: Castlereagh Ironbark Forest
- PCT 4025: Cumberland Red Gum Riverflat Forest
- PCT 3320: Cumberland Shale Plains Woodland



Scale 1:17,500 at A4
GDA2020

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3.2 Field Survey

Surveys of the Study Area was undertaken on 31 March, 5 and 6 July 2023. Surveys were undertaken by Senior Ecologist/ BAM Accredited Assessor, Maddy Young and Principal Ecologist/ BAM Accredited Assessor, Lachlan Laurie. Details of the survey method and effort are provided in **Table 3.1**.

Table 3.1 Survey Effort

Survey Date	Survey Method and Effort Overview
31 March 2023	<ul style="list-style-type: none"> • Vegetation Mapping. • Rapid vegetation assessment points. • Habitat assessments. • Diurnal bird surveys. • Searches for threatened flora. • Opportunistic observations.
5 July 2023	
6 July 2023	

3.2.1 Mapping Native Vegetation Extent

The native vegetation extent within the Study Area was mapped through a collation of data collected during field surveys, from existing mapping assessed during the desktop assessment and with aerial photograph interpretation using recent aerial imagery. Native vegetation and plant community type (PCT) mapping was undertaken using best-practice techniques to delineate vegetation communities across the Study Area. Vegetation mapping involved the following key steps:

- Review of aerial imagery to assess vegetation distribution patterns as dictated by change in canopy texture, tone, and colour, as well as topography.
- Review of the vegetation communities within broader scale regional based vegetation mapping (OEH 2016 and DPE 2022a) and existing vegetation mapping of the Riverstone East Precinct (Eco Logical 2015).
- Preparation of a draft PCT map based on interpretation of digital aerial imagery.
- Field-based ground truthing of the draft plant community type mapping where land access was granted.
- Confirmation of vegetation community floristic delineations based on rapid data assessment.

Vegetation communities were delineated through the identification of repeating patterns of plant species assemblages in each of the identified strata. Slight variations in species composition are typical across the extent of a community and are often associated with microhabitats or ecotones with other communities. Mapping is broad-scale and does not represent a detailed site-specific mapping of native vegetation cover in areas not ground truthed during these surveys.

3.2.2 Vegetation Assessment

The vegetation communities were compared to potential equivalent PCT as detailed in the BioNet Vegetation Classification Database (DPE 2023c). The dominant and characteristic species were entered into the online plant community identification tab and an initial list of PCTs was generated. The profiles for each of the possible PCTs were then interrogated and compared with data collected onsite. A justification for each PCT selected is presented in **Section 4.0**.

Rapid data assessments to record the flora species in the Study Area were conducted using random meanders as described by Cropper (1993). The rapid data assessments recorded the species present, the frequency of their occurrence (common, uncommon or rare) and their status as either threatened, native or non-native (to the Sydney Basin Bioregion).

The surveys also focused on ground truthing of the regional scale vegetation mapping to confirm and refine the extent of ENV as mapped under the certification, described in **Section 2.2.1**. This includes a comparison with the criteria for ENV prescribed in the bio-certification order and outlined below.

Under the Bio-certification Order, “ENV” means areas of indigenous trees (including mature and saplings) that:

- a. had 10 % or greater over-storey canopy cover present,
- b. were equal to or greater than 0.5 ha in area, and
- c. were identified as —vegetation on maps 4 and 5 of the (Draft) Growth Centres Conservation Plan, at the time the biodiversity certification order took effect, subject to condition 13.

The area of ENV shown on maps 4 and 5 of the (Draft) Growth Centres Conservation Plan is shown on **Figure 1.2**. Condition 13 of the biodiversity-certification details the ground truthing requirements for ENV; namely, if new information becomes available after the biodiversity certification order took effect that demonstrates that the vegetation within an area does not otherwise meet the definition of existing native vegetation, then for the purposes of conditions 7–8 and 11–12 only the area of validated ENV need be considered. In this regard, the field validation of vegetation across the site has updated the extent of ENV within the precinct.

Species listed under the *Biosecurity Act 2015* were recorded opportunistically during field surveys.

3.2.3 Threatened Ecological Community Delineation

Where applicable, vegetation communities identified in the Study Area were compared to Threatened Ecological Communities (TECs) listed under the EPBC Act and BC Act and an assessment of similarity with the NSW Scientific Committee Final Determinations and the Commonwealth Threatened Species Scientific Committee Listing and Conservation Advice. The following approach was used:

- meandering surveys to determine floristic composition and structure of each ecological community
- comparison with published species lists, including lists of ‘important species’ as identified on the listing advice provided by the NSW Scientific Committee and/or Commonwealth Threatened Species Scientific Committee
- comparison with habitat descriptions and distributions for listed TECs
- assessment using guidelines and recovery plans published by the Commonwealth Department DCCEEW and the NSW BCD.

3.2.4 Threatened Flora Searches

The habitat requirements for threatened flora predicted to occur by the desktop assessment were identified prior to the field surveys. Searches for threatened flora species were undertaken throughout the Study Area in areas of suitable habitat of all accessible land during the field surveys. Given the limitations with access throughout most of the Study Area, the threatened flora searches undertaken as part of these surveys are not considered comprehensive (**Figure 1.4**).

3.2.5 Fauna Surveys

Fauna surveys were undertaken to evaluate the suitability of the Study Area for a threatened and migratory species listed under the BC Act and EPBC Act. The assessment involved a combination of survey methods to identify the presence of fauna habitat within the Study Area, including general habitat assessment, diurnal bird surveys and active searches. Opportunistic and incidental observations of fauna species were recorded at all times during the field survey.

The habitat assessment included searches for any hollow bearing trees, logs, feed trees, density of understorey vegetation, leaf litter and rocky areas, as well as a general aquatic assessment and assessment of breeding habitat for cockatoos and large forest owls. Active searches were also undertaken in areas of suitable habitat for the Cumberland Plain Land Snail.

Seven 20-minute diurnal bird surveys were undertaken in the Study Area. Bird surveys were also performed opportunistically throughout the surveys.

3.2.6 Green and Golden Bell Frog Survey

Condition 18 of the bio-certification order is in relation to a potential Green and Golden Bell Frog population at Riverstone East. The area identified in condition 18 is located within the Riverstone East Stage 1 and 2 boundaries and is outside of the Study Area. Eco Logical (2009, 2015) undertook surveys of this area and confirmed the presence of the species and made a number of recommendations on how the species and its habitat should be adequately protected and enhanced (Eco Logical 2010). At that time, the Office of Environment and Heritage (OEH) was consulted and proposed habitat conservation measures were subsequently endorsed by the OEH (Eco Logical 2010). As a result of this work no further survey is required to satisfy Condition 18 in relation to the Riverstone East Precinct Stage 3 planning process.

3.2.7 Habitat Constraints Assessment

An assessment of the quality of terrestrial habitats present for native fauna was undertaken across the Study Area. Habitat quality was based on the level of breeding, nesting, feeding and roosting resources available. Indicative habitat criteria for targeted threatened species were identified prior to fieldwork based on information provided in DPE and DCCEEW threatened species profiles, field guides and the knowledge and experience of the field ecologists. This technique is important in assisting in the compilation of a comprehensive list of fauna that are predicted within the vicinity of the site, rather than relying solely on limited surveys that are subject to seasonal and access limitations and may only represent a snapshot of the species present.

The locations and quantitative descriptions of significant habitat features, such as habitat trees, were captured with a handheld global positioning system (GPS) unit and photographed where appropriate. For the purpose of this assessment, a 'habitat tree' is defined as a tree with one or more of the following characteristics: visible hollows; cracks, fissures or shedding bark that may provide roost sites; large concentrations of blossoms or fruit; visible nests or roosts or visible evidence of fauna occupation.

Habitat assessments included searches for and inspection of:

- Vegetation patch size, age, disturbance and structural diversity (important for many threatened birds and mammals).
- Quality of substrate for sheltering frogs, invertebrates and reptiles including rocks, logs, debris, peeling bark, leaf litter and native grassland.
- Presence of winter-flowering eucalypts and feed trees of the Koala (*Phascolarctos cinereus*).
- Hollow-bearing trees and logs that may provide refuge, nest and den sites for a range of threatened fauna species.
- Stags and other roost sites for raptors and owls.
- Wetlands, moist grassland and other foraging habitat for waterbirds (including migratory birds) and frogs.
- Mammal scats at the base of trees or along tracks and runways.
- Tracks in soft substrate.
- Nest/den sites within logs, tree bases or tree trunks.
- Guano or moth remains at the base of hollow-bearing trees (diagnostic of the presence of tree-roosting bats).
- Scratches on tree trunks (diagnostic of Koalas, gliders or goannas) and worn bark around tree hollows (diagnostic of active use of hollows).
- Owl pellets, whitewash or animal remains beneath trees (diagnostic of owl or raptor roosts).

3.3 Riparian and Aquatic Assessment

Rapid aquatic habitat assessments of riparian habitat in the Study Area were undertaken during the field surveys. The habitat value of riparian areas (i.e. habitat sensitivity and classification of waterways for fish passage) were characterised in accordance with NSW DPI (Fisheries) document *Policy and Guidelines for fish habitat conservation and management* (DPI 2013). The following characteristics were noted during the rapid aquatic assessment:

- Flow regime.
- Bed substrate (e.g. rocks, gravel, sand, mud).
- Instream habitat features (pools, riffles, snags, macrophytes).

- Existing infrastructure and barriers to fish movement (natural or artificial).
- Width and condition of riparian vegetation.
- Water quality based on visual observations.

3.3.1 Top of Bank Mapping and Conditions Assessment

The riparian categorisation and corridor mapping has been carried out in accordance with the Strahler stream order methodology as outlined in the *Controlled activities – Guidelines for riparian corridors on waterfront land* Fact Sheet (DPE 2022b). The assessment collated data from the topographic maps, field assessment data, aerial photograph interpretation and LIDAR.

Table 3.2 Recommended Riparian Corridor Widths

Watercourse type	VRZ width (each side of watercourse)	Total riparian corridor width
1 st order	10 metres	20 m + channel width
2 nd order	20 metres	40 m + channel width
3 rd order	30 metres	60 m + channel width
4 th order and greater (includes estuaries, wetlands and any parts of rivers influenced by tidal waters)	40 metres	80 m + channel width

A survey of the Top of Bank (ToB) for all accessible watercourses in the precinct was conducted by an ecologist on 5 and 6 July 2023. Where access was restricted, reaches were visually assessed from adjoining properties where access was available and/or from roadside verges. This approach was utilised for many of the reaches within the systems of the precinct where access was not available.

The ToB mapping completed in the field was verified by crosschecking with up-to-date, high resolution satellite imagery and LiDAR data. LiDAR data is a useful tool to map the ToB and to overcome limitations such as limited access to watercourses, limited visibility due to dense vegetation cover, or steep and eroded banks (Johansen *et al.* 2013).

The ToB mapping has been used as the basis for the initial riparian buffer delineation and riparian corridor boundary determination. The watercourses present in many parts of the study area are highly disturbed with some reaches having been channelised or diverted during previous urban development.

The assessment undertaken by Ecological (2015) was also referred to as part of the desktop assessment and to fill gaps where there was limited access to watercourses. The condition of each system was assessed for key characteristics related to hydrology, physical form, water quality, aquatic habitat and streamside vegetation. Each reach was given an overall condition rating of ‘Near intact condition’, ‘Good condition’, ‘Moderate condition’ and ‘Degraded condition’.

3.3.2 Waterway Class System under the FM Act

NSW DPI Fisheries apply a basic Class system to assign aquatic habitat values to waterway. **Table 3.3** outlines the characteristics of each waterway class.

Table 3.3 DPI Waterway Class Systems

Classification	Characteristics of Waterway Type	Minimum Recommended Crossing Type
CLASS 1 Major fish habitat	Major permanently or intermittently flowing waterway (e.g. river or major creek); habitat of a threatened fish species or 'critical habitat'.	Bridge, arch structure or tunnel
CLASS 2 Moderate fish habitat	Named permanent or intermittent stream, creek or waterway with clearly defined bed and banks with semi-permanent to permanent waters in pools or in connected wetland areas. Marine or freshwater aquatic vegetation is present. Known fish habitat and/or fish observed inhabiting the area.	Bridge, arch structure, culvert or ford.
CLASS 3 Minimal fish habitat	Named or unnamed waterway with intermittent flow and potential refuge, breeding or feeding areas for some aquatic fauna (e.g. fish, yabbies). Semi-permanent pools form within the waterway or adjacent wetlands after a rain event. Otherwise, any minor waterway that interconnects with wetlands or recognised aquatic habitats.	Culvert or ford.
CLASS 4 Unlikely fish habitat	Named or unnamed waterway with intermittent flow following rain events only, little or no defined drainage channel, little or no flow or free standing water or pools after rain events (e.g. dry gullies or shallow floodplain depressions with no permanent aquatic flora present).	Culvert, causeway or ford.

4.0 Existing Environment

4.1 Vegetation

4.1.1 Vegetation Communities

The vegetation within the study area comprises a combination of cleared pastureland and scattered remnant vegetation fragmented by large lot residential and industrial dwellings. Native vegetation in the Study Area is concentrated in the biodiversity certified land, with the non certified land (refer to **Table 4.1**) largely cleared of all canopy vegetation.

The dominant vegetation community in the Study Area is Cumberland Plain Woodland with smaller areas of Alluvial Woodland, Shale Sandstone Transition Forest and Castlereagh Ironbark Forest. The characteristics of these three native vegetation communities, their conservation significance and ecological condition are summarised in **Table 4.3** to **Table 4.6** and shown on **Figure 4.1**. It should be noted that the vegetation within large portions of the Study Area have not been ground truthed and data analysed during the desktop assessment (DPE 2022, Eco Logical 2015, OEH 2016) has been used to supplement the findings of the field surveys.

A total of 58 flora species were recorded in the Study Area during the field survey, including 23 native and 35 exotic species. The Poaceae family was the most diverse family recorded within the Study Area (11 species), followed by the Myrtaceae family (9 species) and the Asteraceae (7 species).

The surveys also focused on ground truthing of the regional scale vegetation mapping to confirm and refine the extent of ENV as mapped under the certification, described in **Section 2.2.1**. This includes determining areas of remnant vegetation that no longer meet the definition of ENV (refer to **Section 3.2.2**) as well as identifying areas of additional high conservation value vegetation (AHCVV).

Condition 13 of the biodiversity-certification details the ground truthing requirements for ENV; namely, if new information becomes available after the biodiversity certification order took effect that demonstrates that the vegetation within an area does not otherwise meet the definition of existing native vegetation, then for the purposes of conditions 7–8 and 11–12 only the area of validated ENV need be considered. Field validation and aerial photograph interpretation of the vegetation cover across the Study Area has updated the extent of ENV within the precinct.

This has resulted in a reduction of areas of AHCVV, that is, vegetation which meets criteria a) and b) for ENV (refer to **Section 3.2.2**) but was not mapped in the original conservation plan. The area of ENV identified in the certification order remains the same. The area of Certified and non-Certified land and the originally mapped ENV is shown on **Figure 1.2** with the updated areas shown on **Figure 4.2**.

55.86 ha of ENV is located within the Study Area. Of this 48.97 ha is within certified lands and 6.89 ha was within non-certified lands (refer to **Table 4.1**). RHRP will occupy 96.53 ha of land within the Study Area. 94.79 ha of RHRP is located on non-certified land and contains 5.53 ha of mapped ENV.

24.27 ha of land is mapped on the Biodiversity Values Map within Non-certified land in the Study Area.

FIGURE 4.1

Vegetation Map and Survey Effort

Legend

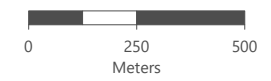
- Study Area - Riverstone East Precinct Stage 3
- Watercourses
- Watercourses Area
- Hollow-bearing Tree
- Habitat Dams
- Bird Survey Point
- Locations of Umwelt's Site Assessment**
- Groundtruthed (up to 20m)
- Near Visual Assessment (20m to 100m)
- Remote Visual Assessment (100+)

Threatened Ecological Communities

- Cooks River/Castlereagh Ironbark Forest (listed as an EEC under the BC Act and a CEEC under the EPBC Act)
- Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (listed as a CEEC under the BC Act and EPBC Act)
- Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (listed as a CEEC under the BC Act)
- River-Flat Eucalypt Forest on Coastal Floodplains (listed as an EEC under the BC Act and CEEC under the EPBC Act)
- Shale Sandstone Transition Forest of the Sydney Basin Bioregion (listed as a CEEC under the BC Act and EPBC Act)

Plant Community Types

- PCT 3448: Castlereagh Ironbark Forest
- PCT 4025: Cumberland Red Gum Riverflat Forest
- PCT 3320: Cumberland Shale Plains Woodland
- PCT 3321: Cumberland Shale-Sandstone Ironbark Forest



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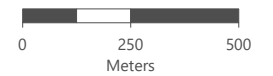
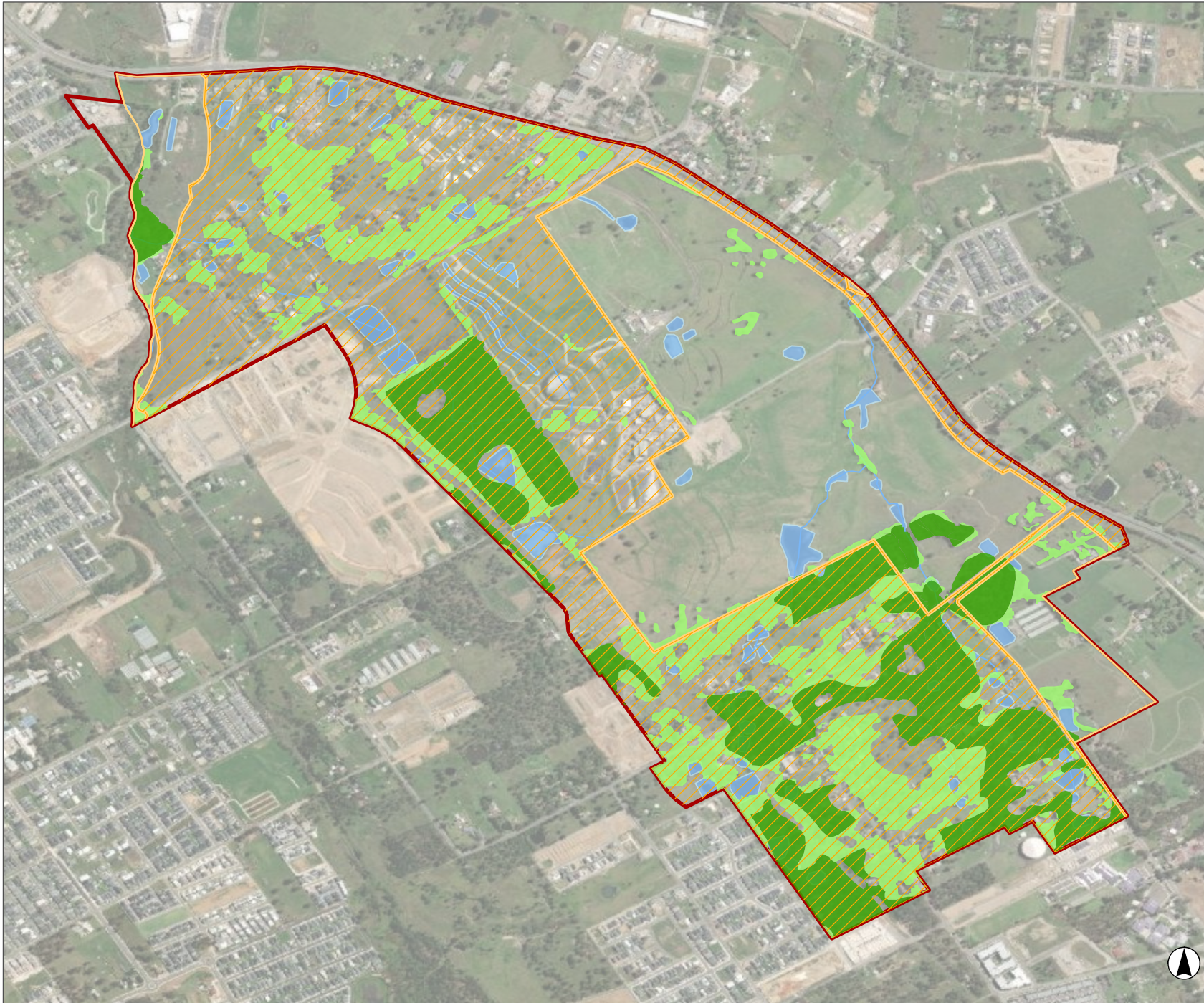
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FIGURE 4.2

Mapped and Validated ENV plus AHCVV within the Riverstone East Precinct

Legend

- Study Area - Riverstone East Precinct Stage 3
- Watercourses Area
- Watercourses
- Mapped and Validated**
- AHCVV
- ENV
- Growth Centre Land Certification**
- Existing Non-certified
- Existing Certified



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Table 4.1 Summary of the BC Act-Listed Native Vegetation in the Study Area

PCT ID	PCT Name	BC Act	Total Area (ha)	Area within Certified Land (ha)	Area within Non Certified Land (ha)
PCT 3220	Cumberland Shale Plains Woodland	Cumberland Plain Woodland in the Sydney Basin Bioregion (Critically Endangered Ecological Community (CEEC)).	104.28	94.69	9.58
PCT 3321	Cumberland Shale-Sandstone Ironbark Forest	Shale Sandstone Transition Forest in the Sydney Basin Bioregion (CEEC).	7.74	6.00	1.74
PCT 3448	Castlereagh Ironbark Forest	Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion (EEC). Shale Gravel Transition Forest in the Sydney Basin Bioregion (EEC).	0.88	0.66	0.22
PCT 4025	Cumberland Red Gum Riverflat Forest	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin South East Corner Bioregions (EEC).	7.27	3.18	4.09
Total			120.17	104.53	15.64

Table 4.2 Summary of the EPBC Act-Listed Native Vegetation in the Study Area


PCT ID	PCT Name	EPBC Act	Total Area (ha)	Area within Certified Land (ha)	Area within Non Certified Land (ha)
PCT 3220	Cumberland Shale Plains Woodland	Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (CEEC).	101.87	94.59	7.27
PCT 3321	Cumberland Shale-Sandstone Ironbark Forest	Shale Sandstone Transition Forest in the Sydney Basin Bioregion (CEEC).	7.74	6	1.74
PCT 3448	Castlereagh Ironbark Forest*	Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion (CEEC), Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (CEEC).	0.88	0.66	0.22
PCT 4025	Cumberland Red Gum Riverflat Forest	River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria (CEEC).	7.27	3.18	4.09
Total			117.76	104.43	13.32

Table 4.3 PCT 3320 Cumberland Shale Plains Woodland

Community Name	PCT 3320 Cumberland Shale Plains Woodland
Photo	
Vegetation Formation	Grassy Woodland
General Description	This vegetation community comprises patches of intact and degraded woodland across the Study Area. The patches are generally degraded with an understorey dominated by exotic grasses and forbs, however small patches of good condition vegetation occur within the Study Area.
Floristic Description	<p>The canopy consisted of Grey Box (<i>Eucalyptus moluccana</i>), Forest Red Gum (<i>Eucalyptus tereticornis</i>), Spotted Gum (<i>Corymbia maculata</i>) and Narrow-leaved Ironbark (<i>Eucalyptus crebra</i>), Thin-leaved Stringybark (<i>Eucalyptus eugenioides</i>) and Red Ironbark (<i>Eucalyptus fibrosa</i>).</p> <p>The midstorey is generally degraded or absent, however there were some patches with intact understoreys dominated by Native Blackthorn (<i>Bursaria spinosa</i>), Australian Indigo (<i>Indigofera australis</i>), <i>Acacia falcata</i> and Parramatta Wattle (<i>Acacia parramattensis</i>).</p> <p>Native groundcovers included Common Couch (<i>Cynodon dactylon</i>), Weeping Grass (<i>Microlaena stipoides</i>), <i>Oplismenus aemulus</i>, Slender Rat's Tail (<i>Sporobolus creber</i>), Grass Native Wandering Jew (<i>Commelina cyanea</i>), Kidney Weed (<i>Dichondra repens</i>), Variable Glycine (<i>Glycine tabacina</i>).</p> <p>Weed species including African Olive (<i>Olea europaea</i> subsp. <i>cuspidata</i>) and African Boxthorn (<i>Lycium ferocissimum</i>) are common along the roadside.</p> <p>The exotic ground covers included exotic grasses and forbs including Panic Veldtgrass (<i>Ehrharta erecta</i>), African Lovegrass (<i>Eragrostis curvula</i>), Paspalum (<i>Paspalum dilatatum</i>), Prairie Grass (<i>Bromus catharticus</i>), Rhodes Grass (<i>Chloris gayana</i>), Cobbler's Pegs (<i>Bidens pilosa</i>), Spear Thistle (<i>Cirsium vulgare</i>), Fireweed (<i>Senecio madagascariensis</i>), Common Sowthistle (<i>Sonchus oleraceus</i>) and Dandelion (<i>Taraxacum officinale</i>).</p>
BC Act Status	The patches of PCT 3320 comprises an occurrence Cumberland Plain Woodland in the Sydney Basin Bioregion which is listed as an CEEC under the BC Act.
EPBC Act Status	As the majority of PCT 3320 occurred within properties where access was not possible, detailed vegetation assessments were not undertaken at all patches of PCT 3320. It is not possible to confirm if all patches of PCT 3320 would meet the Condition Thresholds for Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community as listed under the EPBC Act.


Community Name	PCT 3320 Cumberland Shale Plains Woodland
	A conservative approach has been adopted for areas of TECs not ground truthed during the field surveys and the condition assumed to meet the EPBC Act criteria (DEWHA 2009), if they meet the patch size criteria of being greater than 0.5 ha.

Table 4.4 PCT 3321 Cumberland Shale – Sandstone Ironbark Forest

Community Name	PCT 3321 Cumberland Shale – Sandstone Ironbark Forest
	
Vegetation Formation	Grassy Woodland
General Description	This vegetation community is limited to fragmented patches in the south east of the study area. The patches are generally degraded with an understorey of mixed native and exotic grasses and forbs.
Floristic Description	<p>The canopy consisted of Narrow leaved ironbark (<i>Eucalyptus crebra</i>), Red ironbark (<i>Eucalyptus fibrosa</i>), White stringybark (<i>Eucalyptus globoidea</i>), Grey gum (<i>Eucalyptus punctata</i>) and Forest Red Gum (<i>Eucalyptus tereticornis</i>).</p> <p>The midstorey is generally absent, with infrequent occurrences of Native Blackthorn (<i>Bursaria spinosa</i>), Australian Indigo (<i>Indigofera australis</i>), <i>Hibbertia aspera</i>, and Parramatta Wattle (<i>Acacia parramattensis</i>).</p> <p>The ground cover was dominated by exotic grasses and forbs including Paspalum (<i>Paspalum dilatatum</i>), Cobbler's Pegs (<i>Bidens pilosa</i>), <i>Brassica spp.</i>, Common Chickweed (<i>Stellaria media</i>), Spear Thistle (<i>Cirsium vulgare</i>), Prairie Grass (<i>Bromus catharticus</i>), Rhodes Grass (<i>Chloris gayana</i>), Fireweed (<i>Senecio madagascariensis</i>), Common Sowthistle (<i>Sonchus oleraceus</i>) and Dandelion (<i>Taraxacum officinale</i>).</p>
BC Act Status	The patches of PCT 3321 comprises an occurrence Shale Sandstone Transition Forest in the Sydney Basin Bioregion which is listed as an CEEC under the BC Act.

Community Name	PCT 3321 Cumberland Shale – Sandstone Ironbark Forest
EPBC Act Status	As the majority of PCT 3321 occurred within properties where access was not possible, detailed vegetation assessments were not undertaken at all patches of PCT 3321. It is not possible to confirm if all patches of PCT 3321 would meet the Condition Thresholds for Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community as listed under the EPBC Act. A conservative approach has been adopted for areas of TECs not ground truthed during the field surveys and the condition assumed to meet the EPBC Act criteria (DoE 2014), if they meet the patch size criteria of being greater than 0.5 ha.

Table 4.5 PCT 4025 Cumberland Red Gum Riverflat Forest

Community Name	PCT 4025 Cumberland Red Gum Riverflat Forest
	
Vegetation Formation	Forest Wetlands
General Description	This vegetation community occurs along watercourses and drainage lines throughout the study area. The community is generally fragmented by powerline easements, small scale agriculture and residential dwellings. The condition is generally moderate to poor with a moderately disturbed understorey.
Floristic Description	<p>The canopy consisted of Cabbage Gum (<i>Eucalyptus amplifolia</i>), Forest Red Gum (<i>Eucalyptus tereticornis</i>) with a subcanopy of Swamp Oak (<i>Casuarina glauca</i>) and Prickly-leaved Tea Tree (<i>Melaleuca styphelioides</i>).</p> <p>The midstorey comprises a sparse occurrence of Native Blackthorn (<i>Bursaria spinosa</i>), Australian Indigo (<i>Indigofera australis</i>) and Parramatta Wattle (<i>Acacia parramattensis</i>), with infestations of African Olive (<i>Olea europaea</i> subsp. <i>cuspidata</i>), African Boxthorn (<i>Lycium ferocissimum</i>), Wild Tobacco Bush (<i>Solanum mauritianum</i>) and Madeira Winter Cherry (<i>Solanum pseudocapsicum</i>).</p>

Community Name	PCT 4025 Cumberland Red Gum Riverflat Forest
	<p>The ground cover was dominated by exotic grasses and forbs including Prairie Grass (<i>Bromus catharticus</i>), Rhodes Grass (<i>Chloris gayana</i>), Panic Veldtgrass (<i>Ehrharta erecta</i>), African Lovegrass (<i>Eragrostis curvula</i>), Paspalum (<i>Paspalum dilatatum</i>), Cobbler's Pegs (<i>Bidens pilosa</i>), Spear Thistle (<i>Cirsium vulgare</i>), Fireweed (<i>Senecio madagascariensis</i>), Common Sowthistle (<i>Sonchus oleraceus</i>), Dandelion (<i>Taraxacum officinale</i>), <i>Brassica</i> spp., Umbrella Sedge (<i>Cyperus eragrostis</i>), White Clover (<i>Trifolium repens</i>), Paddy's Lucerne (<i>Sida rhombifolia</i>) and purple top (<i>Verbena bonariensis</i>).</p>
BC Act Status	<p>The patch of PCT 4025 comprises an occurrence River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions which is listed as an EEC under the BC Act.</p>
EPBC Act Status	<p>The patches of PCT 4025 comprises of River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria which is listed as a CEEC under the EPBC Act.</p> <p>The patch meets the minimum condition class and threshold for the ecological community outlined in the Approved Conservation Advice (DAWE 2020) as outlined below:</p> <ul style="list-style-type: none"> • Patch Size threshold – the patch is greater than 0.5 ha and is contiguous with other native riparian vegetation in the Study Area and broader locality. • Biotic thresholds – The patch is in moderate condition with some native understorey. Non-native species comprise less than 80% of total understorey vegetation cover and transformer species comprise less than 50% of total understorey vegetation cover. <p>Note that not all patches have been ground truthed, a conservative approach has been adopted for areas of TECs not ground truthed during the field surveys and the condition assumed to meet the EPBC Act criteria (DAWE 2020).</p>

Table 4.6 Exotic Grassland

Community Name	Exotic Grassland	
Photo		

Community Name	Exotic Grassland
Vegetation Formation	Cleared/exotic grassland.
General Description	This vegetation community comprises mostly exotic grass and forb species with the occasional occurrence of native shrubs or groundcovers. The majority of the non-certified land comprises exotic grassland with little conservation value.
Floristic Description	The ground cover was dominated by exotic grasses and forbs including Panic Veldtgrass (<i>Ehrharta erecta</i>), Rhodes Grass (<i>Chloris gayana</i>), African Lovegrass (<i>Eragrostis curvula</i>), Paspalum (<i>Paspalum dilatatum</i>), Prairie Grass (<i>Bromus catharticus</i>), Rhodes Grass (<i>Chloris gayana</i>), Cobbler's Pegs (<i>Bidens pilosa</i>), Spear Thistle (<i>Cirsium vulgare</i>), Fireweed (<i>Senecio madagascariensis</i>), Common Sowthistle (<i>Sonchus oleraceus</i>) and Dandelion (<i>Taraxacum officinale</i>).
BC Act Status	Not listed as a TEC under the BC Act.
EPBC Act Status	Not listed as a TEC under the EPBC Act.

4.1.2 Groundwater Dependent Ecosystems

Groundwater Dependent Ecosystems (GDEs) in the Study Area comprises Alluvial Woodland vegetation type which are commensurate with River-flat eucalypt forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions. Patches of this vegetation type were validated during field survey undertaken as part of the biodiversity assessment for the Precinct. The riparian vegetation may utilise groundwater fed base flows associated with shallower aquifers linked to First Ponds Creek and Killarney Chain of Ponds.

4.1.3 Threatened Flora

No threatened flora species listed under the BC Act or EPBC Act were identified during the field surveys undertaken by Umwelt in 2023 or Eco Logical (Eco Logical 2015) within the Riverstone East Precinct. One threatened flora species has previously been recorded within the precinct, being Juniper-leaved Grevillea, (*Grevillea juniperina* subsp. *juniperina*). Ground truthing during Umwelt's and Eco Logical's field investigations did not record the species, however given the access restriction associated with the project, the survey was not considered comprehensive.

A NSW BioNet Wildlife Atlas search undertaken for the Gap Analysis identified records for 24 threatened flora species within a 10 kilometre (km) radius of the study area (**Appendix C**). Four threatened have been recorded within 10 km of the Study Area that had previously not been considered for the project.

One endangered population, *Marsdenia viridiflora* R. Br. subsp. *viridiflora* population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas, is recorded within 10 km of the Study Area.

Sixteen threatened flora species are considered to have a moderate or higher likelihood of occurrence. These species are detailed in **Appendix D**. This is based on Umwelt’s assessment of these species and known potential habitat in the Study Area. All these species are listed under the BC Act and ten listed under the EPBC Act. This is a precautionary assessment based on the large area of the Study Area with mapped native vegetation that has not been accessed or previously surveyed.

4.1.4 Priority Weed Species

Priority weeds for the Blacktown City Council LGA that were recorded in the Study Area are shown in **Table 4.7**.

Table 4.7 Priority weed species recorded in the Study Area

Common name	Scientific name	Biosecurity duty in Greater Sydney
African boxthorn	<i>Lycium ferocissimum</i>	Prohibition on certain dealings. Must not be imported into the state, sold, bartered, exchanged or offered for sale.
African olive	<i>Olea europaea subsp. cuspidata</i>	Regional Recommended Measure. An exclusion zone is established for all lands in the Blue Mountains City Council local government area and lands to the west of the Nepean River in the City of Penrith local government area. The rest of the region is classified as the core infestation area.
Blackberry	<i>Rubus fruticosus sp. Agg.</i>	Prohibition on certain dealings. Must not be imported into the state, sold, bartered, exchanged or offered for sale.
Fireweed	<i>Senecio madagascariensis</i>	Prohibition on certain dealings. Must not be imported into the state, sold, bartered, exchanged or offered for sale.
Prickly Pear	<i>Opuntia stricta</i>	Prohibition on certain dealings. Must not be imported into the state, sold, bartered, exchanged or offered for sale.

4.2 Fauna


4.2.1 Fauna Habitats



Surveys focused on identifying habitat features and assessing condition of these features within and surrounding the Study Area. The results of this assessment can be found in **Table 4.7**. Significant habitat features identified within the Study Area include the riparian areas associated with First Ponds Creek and Killarney Chain of Ponds which supports a riparian vegetation community and would provide suitable habitat for nectivorous and insectivorous fauna, as well as small birds, migratory birds and some waders that inhabit riparian habitat types.

Other habitat features of the Study Area include naturally occurring and planted native and exotic trees, shrubs and groundcovers as well as exotic grasses and exotic weed species. Six hollow bearing trees were recorded in the Study Area, which may provide nesting and roosting habitat for hollow dependant fauna.

As large portions of the Study Area were not surveyed due to access limitations it is likely that the actual number of hollow bearing trees is much larger. Detailed mapping of hollow bearing trees prior to construction and retention of trees is recommended. No large fallen logs or rocky areas were observed in the Study Area.

Table 4.8 Habitat Features in the Study Area

Habitat Feature	Present on the Study Area (Y/N)	Notes
Burrows	N	None observed.
Caves	N	Not applicable.
Claypans	N	Not applicable.
Cliffs	N	Not applicable.
Dunes	N	Not applicable.
Epiphytes	N	None observed.
Escarpments	N	Not applicable.
Fallen/standing dead timber including logs	Y	<p>Stags were observed in the non certified and certified land, this vegetation may provide suitable roosting habitat for birds of prey.</p> 
Hollow bearing trees	Y	<p>Six hollow bearing trees were recorded in the Study Area. The hollow bearing trees are all in biodiversity certified land in the patches of native vegetation.</p> <p>Tree hollows represent a critical resource for many fauna species, providing shelter and nesting-sites. Hollows are a limiting resource for fauna in many habitats, and that security of threatened hollow-dependent fauna is contingent on increasing their availability (DPE 2023f).</p> <p>Key threatening process strategy for Loss of hollow-bearing trees (DPE 2023f) identifies a need to retain hollow bearing trees, particularly in urban landscapes where the resources are already limited.</p>

Habitat Feature	Present on the Study Area (Y/N)	Notes
		
Intertidal zones	N	Not applicable.
Rocky areas	N	Not applicable.
Semi-permanent/ ephemeral wet areas	Y	The creek beds of First Ponds Creek and Killarney Chain of Ponds. More detail in Section 4.3 .
Swamps	N	None observed.
Termite mounds	N	None observed.
Waterbodies	Y	<p>Numerous dams and chains of ponds occur within the Study Area. More detail in Section 4.3.1.</p> <p>A large dam on the southern boundary of the Lot 10 DP 1076228 (north of Lot 155 DP208209) in the non certified land had suitable wetland and migratory bird habitat.</p> 

Habitat Feature	Present on the Study Area (Y/N)	Notes
		
		

4.2.2 Threatened Fauna

The field surveys undertaken in the Study Area identified 33 fauna species, 32 of which were bird species and one frog species. No threatened or migratory fauna species listed under the BC Act or EPBC Act were observed in the Study Area. One marine species listed under the EPBC Act, the Black-winged Stilt (*Himantopus himantopus*) was recorded in a dam on the southern boundary of the Lot 10 DP 1076228 (north of Lot 155 DP208209) in the non certified land.

The NSW BioNet Wildlife Atlas searches identified records for 41 terrestrial threatened fauna species within a 10 km radius of the Study Area. Three threatened fauna species have been recorded (DPE 2023a) in the Study Area by others: Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*); Grey-headed Flying-fox (*Pteropus poliocephalus*); and Large Bent-winged Bat (*Miniopterus orianae oceanensis*). Six threatened fauna species have been recorded within 10 km of the Study Area that had previously not been considered for the project. The desktop assessment and site assessment identified areas of native vegetation, hollow bearing trees, leaf litter, woody debris, water bodies and exotic species as providing potential habitat for threatened fauna species within the Study Area.

It is considered that there is a moderate or higher likelihood of occurrence for 20 threatened fauna species to occur in the Study Area (**Appendix C**). This is based on the presence of habitat utilised by the species and past records within the Study Area and the locality. All these species are listed under the BC Act and four are listed under the EPBC Act. This is a precautionary assessment based on the large area of the Study Area with mapped native vegetation that has not been accessed or previously surveyed. Species of particular interest are less mobile species including the Green and Golden Bell Frog (*Litoria aurea*) and Cumberland Plain Land Snail (*Meridolum corneovirens*) that have historical records in the Study Area or within contiguous habitat to the Study Area (**Figure 3.1**).

4.3 Riparian and Aquatic Habitat

The following two main watercourses and their tributaries traverse the study area:

- First Ponds Creek, a 3rd order watercourse which occurs along the north-west boundary of the Study Area. The tributaries of First Ponds Creek comprise two unnamed first order watercourses which converge to form a second order stream, which then drains into First Ponds Creek.
- Killarney Chain of Ponds, which occurs in the south-eastern portion of the Study Area as a 2nd order watercourse fed by two unnamed first order watercourses (refer to **Figure 4.3**).

Field surveys were limited to properties with approved access, which limited the extent of aquatic assessment undertaken. The overall condition of the ground truthed watercourses was degraded and considered to be severely modified. The riparian vegetation was generally in poor condition with a high degree of exotic vegetation.

None of the watercourses in the Study Area have been mapped as key fish habitat by NSW DPI Fisheries. In keeping with the definition for key fish habitat the third order section of First Ponds Creek along the boundary of the Study Area may be defined as key fish habitat. No freshwater threatened fish species as listed under the FM Act are predicted to occur in either of the watercourses in the Study Area or locality.

Table 4.9 outlines the NSW DPI Fisheries class rating and characteristics of each waterway in the Study Area.

Table 4.9 DPI classification of watercourses in the Study Area

Watercourse	Strahler	DPI Waterway Class
First Ponds Creek	3	CLASS 3 Minimal fish habitat Named or unnamed waterway with intermittent flow and potential refuge, breeding or feeding areas for some aquatic fauna (e.g. fish, yabbies). Semi-permanent pools form within the waterway or adjacent wetlands after a rain event. Otherwise, any minor waterway that interconnects with wetlands or recognised aquatic habitats.
Killarney Chain of Ponds and Unnamed tributary (2 nd order) of First ponds Creek	2	CLASS 3 Minimal fish habitat Named or unnamed waterway with intermittent flow and potential refuge, breeding or feeding areas for some aquatic fauna (e.g. fish, yabbies). Semi-permanent pools form within the waterway or adjacent wetlands after a rain event. Otherwise, any minor waterway that interconnects with wetlands or recognised aquatic habitats.

Watercourse	Strahler	DPI Waterway Class
Two Unnamed tributaries (1 st order) of First ponds creek and Killarney Chain of Ponds	1	CLASS 4 Unlikely fish habitat Named or unnamed waterway with intermittent flow following rain events only, little or no defined drainage channel, little or no flow or free standing water or pools after rain events (e.g. dry gullies or shallow floodplain depressions with no permanent aquatic flora present).

First Ponds Creek was identified in Eco Logical (2015) as having good recovery potential. This watercourse was not surveyed during the recent field surveys, however the results of the desktop assessment indicate that First Ponds Creek is the highest priority riparian area for conservation, with the system retaining approximately 50% of the native vegetation cover.

The remaining watercourses in the Study Area occur in degraded forms in urbanised and agricultural areas with disturbed sub-catchment, impacted heavily by past broad scale native vegetation removal and establishment of exotic species and modified drainage regimes.

The Department recommends a Vegetated Riparian Zone (VRZ) width based on watercourse order as classified under the Strahler System as provided in **Table 3.2**. The width of the VRZ should be measured from the top of the highest bank on both sides of the watercourse. A detailed survey of top of bank would be required to accurately map the required VRZ for each watercourse. An estimate of the VRZ has been shown on **Figure 4.4** based on the recommended VRZ widths outlined in (DPE 2022b) and **Table 4.10**. LiDAR has been used to identify Top of Bank and show channel width which forms part of the VRZ (refer to **Figure 4.4**). For works proposed within riparian land, a controlled activity approval must be obtained from the department before commencing work to meet the requirements of the *Water Management Act 2000*.

Table 4.10 Strahler Stream order and VRZ width

Watercourse	Strahler Stream Order	VRZ width (on each side of watercourse)	Total VRZ + channel width (shown on Figure 4.1)
First Ponds Creek	3	30 m	60 m + channel width
Unnamed tributary (2 nd order)	2	20 m	40 m + channel width
Unnamed tributary (1 st order)	1	10 m	20 m + channel width
Killarney Chain of Ponds	2	20 m	40 m + channel width
Unnamed tributary (1 st order)	1	10 m	20 m + channel width

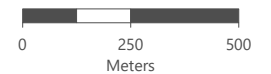
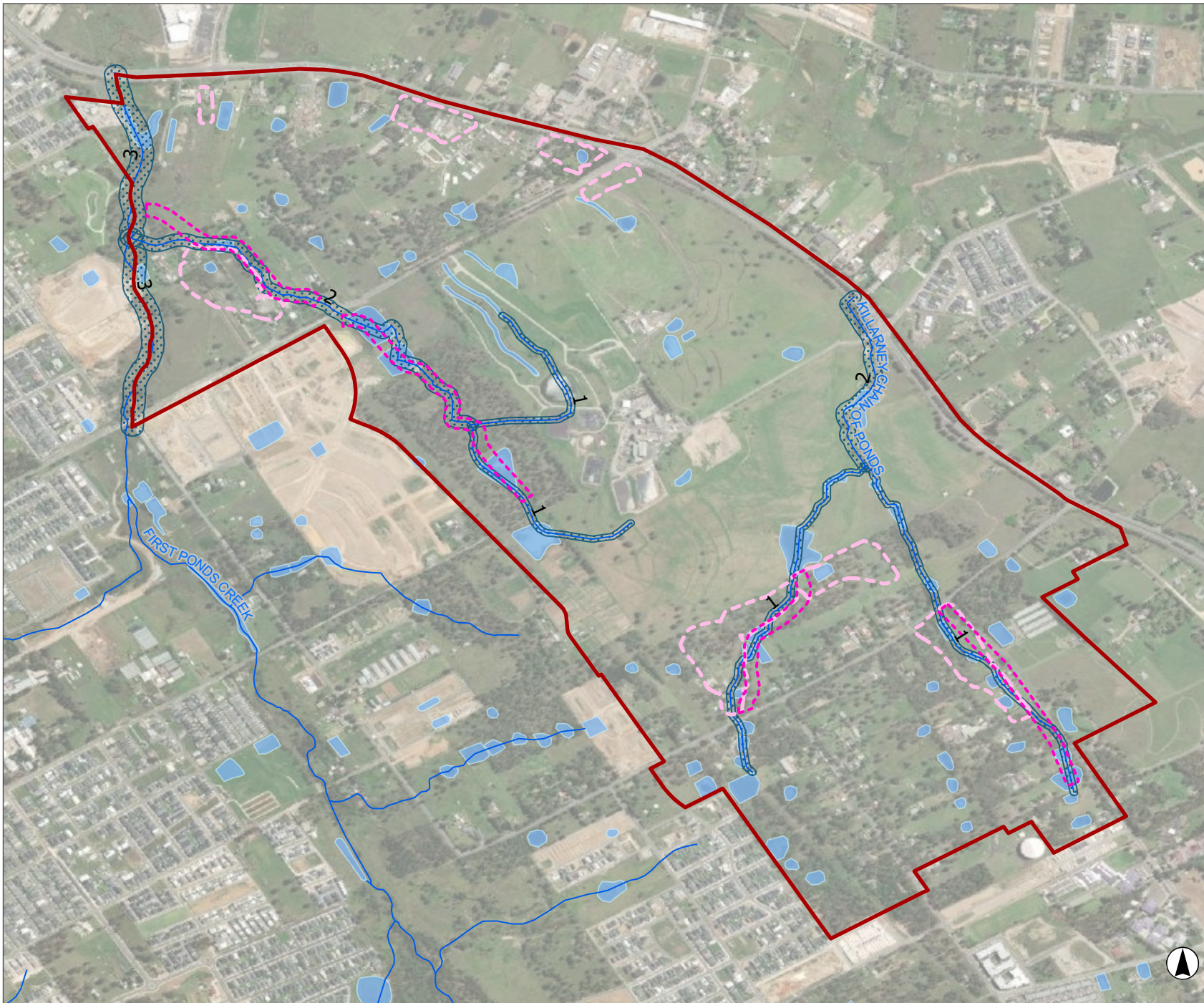
A Flooding and Water Cycle Management Report (Rhelm 2023) includes detailed mapping of the estimated 100-year flood area for Riverstone East. The flood prone land is correlated to the riparian areas within the Study Area and provides an opportunity for retention and revegetation of native vegetation communities across the Study Area.

FIGURE 4.3

**Riverstone East Precinct
Drainage Lines Map and
Strahler Stream Ordering
System**

Legend

- Study Area - Riverstone East Precinct Stage 3
- Proposed riparian corridors (Rhelm 2023)
- Proposed Stormwater Basins (Rhelm 2023)
- Estimated Vegetated Riparian Zone Buffer
- Watercourses Area
- Watercourses - Strahler Stream Order



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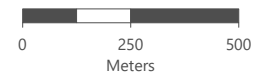
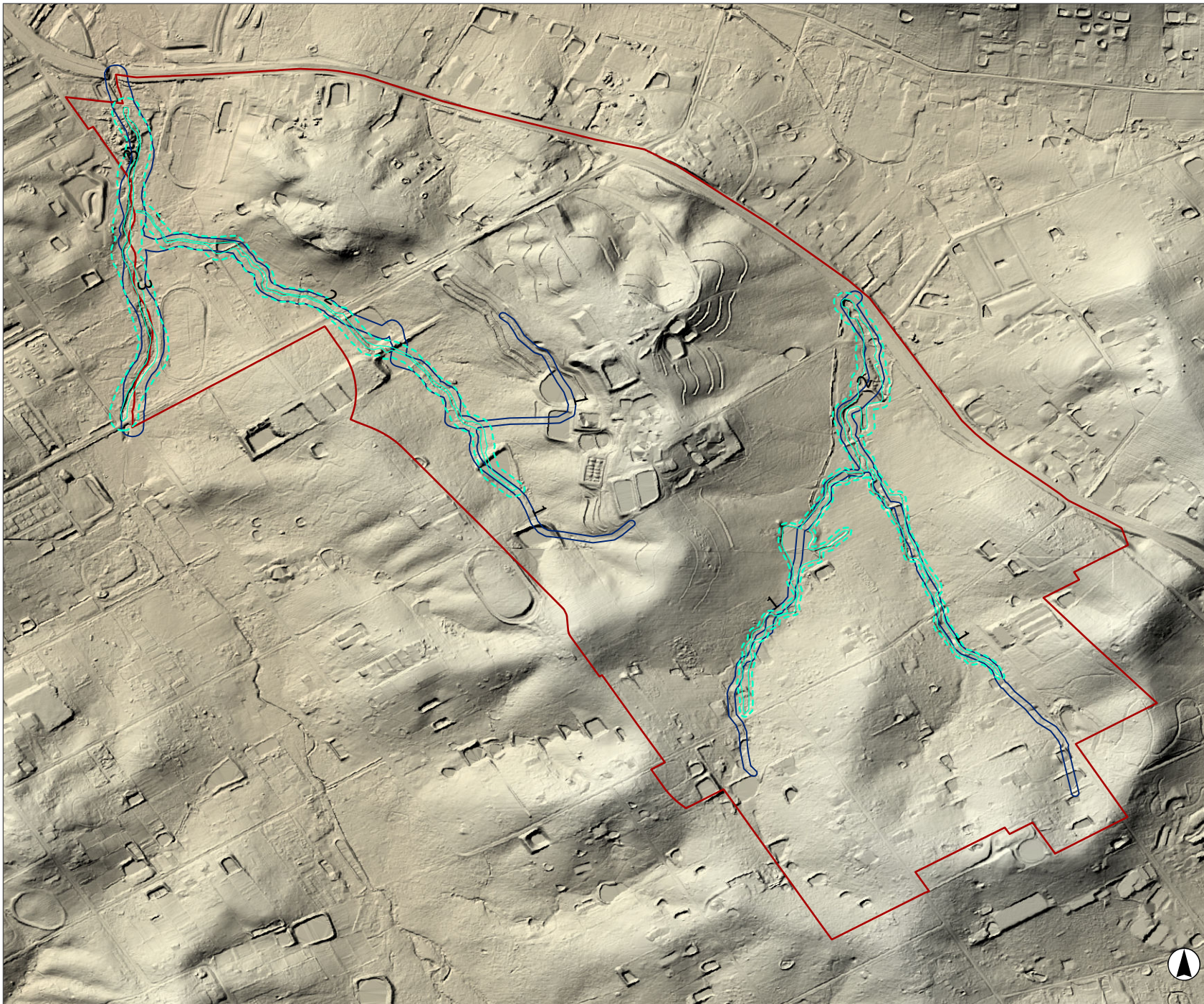
FIGURE 4.4

LiDAR Data and Identification of Top of Bank

Legend

-  Study Area - Riverstone East Precinct Stage 3
-  Top of Bank
-  Riparian Zone Buffer from Top of Bank
-  Estimated Vegetated Riparian Zone Buffer

Digital Elevation Model



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D:\UMWELT (AUSTRALIA) PTY LTD\03182 - 03_SAVOZ_PROJECT\3182_032 - BIODIVERSITY\PM\NANASSESS_VA_APPX - 23182_R02_FIG004_LIDAR_TOPORIPRIANBUFFERIDENTIFICATION

4.3.1 Chain of Ponds

A series of ponds and dams (a *chain of ponds*) are located along the riparian areas in the Study Area (**Figure 4.3**). During times of high water flow the watercourse provide connectivity between each pond, with each pond overflowing into the next downstream pond. Chains of ponds can play an important role in supporting biodiversity and ecosystem health, especially in areas where wetland habitats have been lost or degraded due to human activities such as agriculture, urbanization, and industrial development (Hardwick *et al.* 2017).

Chain of ponds provide habitat for a variety of aquatic and semi-aquatic species, including fish, amphibians, insects, and birds. Each pond often has unique conditions and inhabitants, and often create a diverse range of aquatic habitats (Bunting *et al.* 2002).

In addition to supporting aquatic life, chains of ponds also contribute to the health of surrounding ecosystems by providing water storage and filtration services. The ponds can help to slow the flow of water during times of heavy rainfall, reducing the risk of downstream flooding and erosion. They can also help to filter out pollutants and sediment from the water, improving water quality and reducing the impact of runoff on downstream ecosystems (Mould and Fryris 2017).

4.4 Connectivity

Ecological connectivity is important for maintaining biodiversity and ecosystem functioning. Landscape connectivity allows for genetic exchange between populations, which can increase genetic diversity and allows populations to adapt to changing environmental conditions. It also allows for the movement of species in response to changing habitats or climate conditions, preventing local extinctions and maintaining species ranges (Crooks and Sanjayan 2006).

The surrounding precincts of Box Hill and Riverstone East Stage 1 and 2 are largely cleared of native vegetation, with limited connectivity across the landscape. The Study Area contains large areas of moderately intact vegetation. It is important that the precinct plan is designed to retain connectivity through the landscape, through the strategic retention of native vegetation. Opportunities are present to retain and revegetate native vegetation along riparian zones that flow across precinct boundaries.

Vegetation within land that is not suitable for urban development (e.g. areas mapped within the existing 1% Annual Exceedance Probability (AEP) flood extents and riparian corridors (Mott MacDonald 2015)) could provide an opportunity to restore a corridor of native vegetation that could facilitate movement of flora and fauna and maintain ecological function. This corridor would provide connectivity with areas identified for environmental conservation in the adjoining Box Hill Precinct Master Plan, as well as Riverstone Bushland, Rouse Hill Regional Park and the vegetation riparian areas of Seconds Pond Creek.

4.5 Key Threatening Processes

Table 4.11 identifies the key threatening processes, as listed under the BC Act, that will be exacerbated by the removal of the vegetation in biodiversity certified land.

Table 4.11 Key Threatening Processes

Key Threatening Process	Impact on threatened species	Mitigation measure
Loss of hollow bearing trees	<p>Loss of critical resource for many fauna species, providing shelter and nesting-sites.</p> <p>Their loss from the landscape can have severe impacts on the viability of dependent populations.</p> <p>In NSW, terrestrial vertebrate species that are reliant on tree hollows for shelter and nests include at least 46 mammals, 81 birds, 31 reptiles and 16 frogs. Of these, more than 40 species are listed as threatened on the Schedules of the BC Act (DPE 2023f).</p>	<p>Avoid impacts to hollow bearing trees through detailed design and sustainable development.</p> <p>A recommendation that hollow bearing trees are to be protection is outlined in Section 7.0.</p>
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands	<p>Survival of ecological communities relies on the maintenance of ecological processes, species life cycles and their interactions. Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands may disrupt these processes.</p>	<p>Avoid impacts to ecological function of watercourses and restore function to the Killarney Chain of Ponds.</p>
Clearing of native vegetation	<ul style="list-style-type: none"> • Destruction of habitat causing a loss of biological diversity, and may result in total extinction of species or loss of local genotypes. • The fragmentation of populations resulting in limited gene flow between small isolated populations, reduced potential to adapt to environmental change and loss or severe modification of the interactions between species. • Riparian zone degradation, such as bank erosion leading to sedimentation that affects aquatic communities. • Disturbed habitat which may permit the establishment and spread of exotic species which may displace native species. • Loss of leaf litter, removing habitat for a wide variety of vertebrates and invertebrates. 	<p>Avoiding impacts to the existing native vegetation in biodiversity certified land within the Study Area.</p>

5.0 Biodiversity Conservation Assessment

5.1 Validated Existing Native Vegetation Area Calculations

The (Draft) Growth Centres Conservation Plan (2007) mapped areas of ENV as per the results of the NSW National Parks and Wildlife Service (NPWS) Cumberland Plain Vegetation Mapping Project (2002). The original mapping showed the presence of three endangered ecological communities within the precinct, Cumberland Plain Woodland, Alluvial Woodland and Shale Sandstone Transition Forest.

Eco Logical (2015) validated 60.27 ha of ENV within the current boundary of the Stage 3 Riverstone East Precinct, of which 7.53 ha was located within non-certified areas and 52.74 ha within certified areas (refer to **Table 5.1**). Subsequent site inspections and desktop assessment have validated the presence of 55.86 ha of ENV within the Stage 3 Precinct boundary. The 55.86 ha is comprised of 48.97 ha in the certified lands and 6.89 ha in the non-certified lands (refer to **Table 5.1**). The reduction in area of mapped ENV was a result of aerial photograph interpretation as observations from field surveys. Areas cleared since 2015 that no longer met the definition of ENV were excluded from the areas of validated ENV. Changes to mapped ENV (Eco Logical 2015) are located under the powerline easements and along Worcester Road and Cudgegong Road.

In addition to the originally mapped and now validated ENV, additional areas of vegetation were found on-site that are classified as AHCVV that is vegetation that was not mapped in the Conservation Plan but meets the specified ecological criteria (for ENV) of:

- a) having 10% or greater over-storey canopy cover present
- b) patch size equal to or greater than 0.5 ha.

Field inspections and aerial photograph interpretation revealed an additional 62.55 ha of AHCVV, of which 55.12 ha is in certified lands and 7.42 ha is in non-certified lands (refer to **Table 5.1**). The area of Validated ENV and AHCVV is shown on **Figure 4.2**.

Table 5.1 Area of ENV and AHCVV in the Study Area

Riverstone East Precinct – Stage 3	Total Area (ha)	Area within Certified Land (ha)	Area within Non Certified Land (ha)
ENV (Eco Logical 2015)	60.27	52.74	7.53
Validated 2023			
Castlereagh Ironbark Forest	0	0	0
Cumberland Red Gum Riverflat Forest	2.70	0.17	2.53
Cumberland Shale Plains Woodland	46.35	43.46	2.89
Cumberland Shale-Sandstone Ironbark Forest	6.81	5.34	1.47
Validated ENV (field and desktop)	55.86	48.97	6.89
Castlereagh Ironbark Forest	0.88	0.66	0.22
Cumberland Red Gum Riverflat Forest	4.58	3.01	1.56
Cumberland Shale Plains Woodland	56.25	50.84	5.41

Riverstone East Precinct – Stage 3	Total Area (ha)	Area within Certified Land (ha)	Area within Non Certified Land (ha)
Cumberland Shale-Sandstone Ironbark Forest	0.84	0.61	0.23
AHCVV	62.55	55.12	7.42
Total validated ENV and AHCVV	118.41	104.09	14.31

5.2 Conservation Significance and Opportunities

The vegetation in the Study Area is of high conservation value and the rezoning of the precinct represents an opportunity to retain and improve biodiversity values in an urban environment. The vegetation is commensurate with four CEECs listed under the EPBC Act, two CEECs listed under the BC Act and two EECs listed under the BC Act.

Key opportunities for biodiversity across the Study Area include:

- Retaining and improving larger areas of habitat associated with low-lying areas or national park estate.
- Restoration of floodplain function through native vegetation community restoration.
- Restoration of ecological and environmental function of the Killarney Chain of Ponds and its tributaries.
- Retaining, connecting and enhancing biodiversity corridors, both along drainage corridors as well as high or hilly areas. These corridors will connect biodiversity values in the locality and facilitate movement of flora and fauna and maintain ecological function in the broader landscape.
- Retaining and enhancing representative areas across a range of nuanced habitat types and floristic and soil landscape variation.
- Maximising retention of ENV and AHCVV within non-certified lands.
- Maximise retention of ENV and AHCVV within certified lands, including planning for the location of conservation reserves, public open space, visual buffers and other passive land uses in these areas to avoid and retain areas of native vegetation.
- Retention of habitat trees, including hollow bearing trees, and other native vegetation onsite through strategic location of sympathetic land use zones (such as open space, education, drainage etc.) and site-specific planning controls in the DCP to help provide contiguous biodiversity corridors.
- Protection and restoration of any identified threatened species or their habitats.

Opportunities for retention of vegetation was explored during the EbD. Existing vegetation will be retained in the following land uses on the ILP Concept Map (**Figure 5.1**) and outlined in **Table 5.2** below:

- Natural Bushland.
- Open Space (passive).
- Open Space (Environmental Conservation).

- Open Space (Junction Road and Associated Lands).
- Natural Green Infrastructure.
- Rouse Hill Regional Park.
- Connectors and Corridors.

The areas of retained vegetation in the non certified and certified lands are summarised in **Table 5.2**.

Table 5.2 Areas of Retained Vegetation in the Study Area

Vegetation Type	Non Certified Land (ha)	Certified Land (ha)	Total (ha)
ENV			
Castlereagh Ironbark Forest	0	0	0
Cumberland Red Gum Riverflat Forest	2.47	0.05	2.51
Cumberland Shale Plains Woodland	2.67	13.11	15.79
Cumberland Shale-Sandstone Ironbark Forest	1.43	0.69	2.12
Total ENV	6.57	13.85	20.42
AHCVV			
Castlereagh Ironbark Forest	0.10	0.36	0.46
Cumberland Red Gum Riverflat Forest	1.42	0.66	2.08
Cumberland Shale Plains Woodland	4.74	8.81	13.55
Cumberland Shale-Sandstone Ironbark Forest	0.23	0.08	0.31
Total AHCVV	6.49	9.91	16.4

A comparison of the areas of extant TECs from the Cumberland Plain Recovery Plan (CPRP) (DECCW 2011) is shown in **Table 5.3**.

Table 5.3 Comparison of the areas of extant TECs from the Cumberland Plain Recovery Plan

TEC	Area of BC listed TEC in CPRP (ha)	Area of EPBC listed TEC in CPRP (ha)	Estimate area retained in the Study Area (ha)	Estimated Area to be cleared in the Study Area (ha)	% of extant BC listed TEC to be impacted
Cumberland Shale Plains Woodland	10,612	10,726	30.14	74.14	0.7%
Cumberland Shale-Sandstone Ironbark Forest	9642	9642	2.43	5.31	0.06%
Castlereagh Ironbark Forest	609	-	0.46	0.42	0.07%
Cumberland Red Gum Riverflat Forest	5313	-	4.95	2.32	0.04%

**A comparison with EPBC Act listed communities was not undertaken as the majority of the Study Area was not ground truthed. A conservative approach was undertaken and the condition of the vegetation was assumed to meet the EPBC Act listed condition threshold.*

5.3 Compliance with the EPBC Act Strategic Assessment

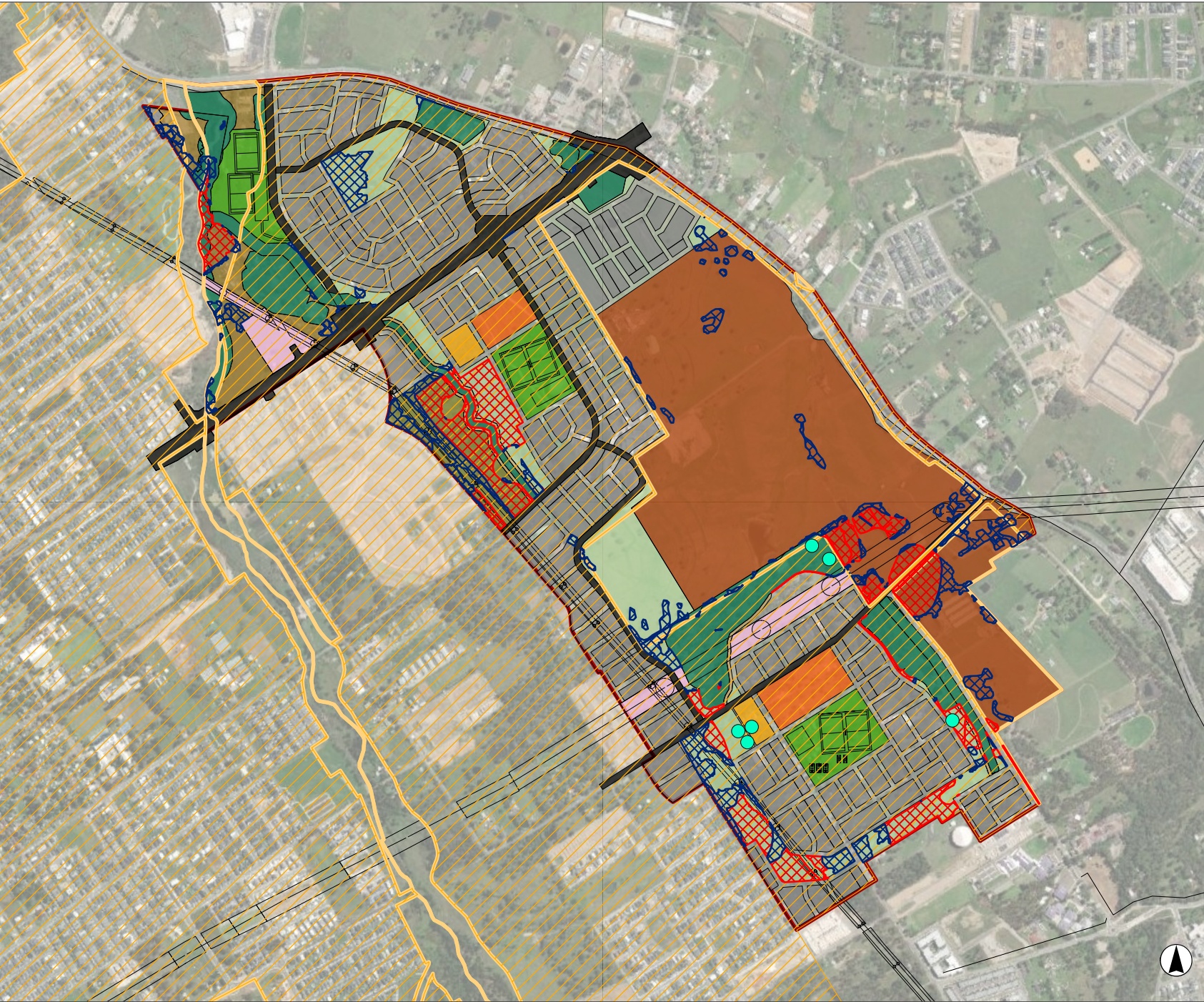
It is considered that the draft ILP meets the conditions outlined in the Draft EPBC Act Strategic Assessment Report for the Sydney Growth Centres Program, May 2010. An assessment of consistency between the commitments of the ILP and the EPBC Strategic Assessment is provided in **Appendix A**.

5.4 Compliance with the Bio-certification Order

It is considered that the draft ILP meets the conditions outlined in the North West Growth Centres Bio-certification Order. An assessment of consistency between the commitments of the ILP and the North West Growth Centres Bio-certification Order is provided in **Appendix B**.

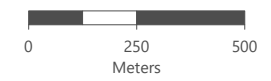
FIGURE 5.1
Retained ENV and AHCVV

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Legend

- Hollow-bearing Trees
- Study Area - Riverstone East Precinct Stage 3
- Retained ENV
- Retained AHCVV
- Growth Centre Land Certification**
- Existing Non-certified
- Existing Certified
- Draft ILP Concept Plan**
- Design Lines
- Open Space - Rouse Hill Regional Park
- Open Space - Natural Green Infrastructure
- Open Space - Environmental Conservation
- Open Space - Natural Bushland
- Open Space - Active
- Open Space - Passive
- Open Space - Connectors and Corridors
- Open Space - Junction Road and Associated lands
- Open Space - Energy
- Riparian
- School
- Community
- Sporting Field
- Residential Blocks
- Major Road



Scale 1:17,500 at A4
GDA2020 MGA Zone 56

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6.0 Riparian Vegetation Management Strategy

This section has been prepared to draw upon the outcomes of the desk and field-based assessments in conjunction with known conservation strategies to formulate a strategy for the effective management of riparian corridors and vegetation within the Study Area. The strategy details the requirements for managing vegetation to be retained and areas of rehabilitation in keeping with the Guidelines for Vegetation Management Plans on Waterfront Land and Blacktown City Council guidelines to assist in preparing Vegetation Management Plans. The strategy does not provide detailed mitigation and management measures, but instead provides broad guidance with regard to future urban development within the precinct.

The location of water sensitive urban design features has been identified as a potential issue as these features often encroach on riparian setbacks and impact areas identified as retained vegetation. It was suggested by Blacktown City Council that an extra 10 m buffer be added to the minimum riparian setback requirements to allow for the potential encroached by drainage basins, detention basins and stormwater connections. Opportunities for such works will need to be considered in terms of the availability of suitable land, the location of remnant vegetation and modelled flow regimes as the future development footprint is refined within the ILP. Land ownership will be an important consideration in this regard, especially for those watercourses that are located immediately adjacent to existing residential development and where the opportunities to install water sensitive urban design features will be more limited.

The dams in the precinct provide important habitat features for fauna in the Study Area, they also provide aquatic ecological function in the form of 'chain of ponds'. Future stormwater/hydrology modelling within the precinct should consider the role of these dams within the intended urban landscape (as defined by the ILP) to ensure both that natural flow and habitat regimes are enhanced above their current levels as a minimum. Should the dams be removed, dewatering should take place in accordance with detailed dewatering plans to manage and minimise impacts on the existing aquatic flora and fauna. Should this occur, it is recommended that any dewatering of the dam be staged so that any aquatic fauna utilising it have the opportunity to seek other habitat. Examples of compensatory habitat could include appropriately designed wet basins containing similar habitat features to the dams which are removed.

Where possible, drainage and detention structures should be owned and managed by Blacktown City Council. These areas can then be revegetated and managed as a naturalised feature. It is assumed that in accordance with the WM Act a vegetation management plan will be required and prepared to the satisfaction of the NSW Office of Water and Blacktown City Council for future development applications which impact on these areas. Where public ownership cannot be achieved, consideration of suitable zoning and planning controls should be made in order to facilitate appropriate riparian land management outcomes.

It is recommended that consistent with the Central River City SEPP a Riparian Protection Area Map be included within the amended SEPP and linked to the WM Act in a way that defines waterfront land within the precinct as being limited to the extent of the Riparian Lands identified. It is noted that confirmation of stream locations and ToB may be a condition for areas of identified Riparian Lands where access was not possible for this project.

6.1 Riparian Corridor Management under the WM Act

Controlled activities carried out in, on or under waterfront land are regulated by the WM Act. The overarching objective of the controlled activities provisions of the WM Act is to establish and preserve the integrity of riparian corridors. DPE has produced guidelines that include urban design principles and recommendations in relation to certain activities on waterfront land, these guidelines are outlined below (DPE 2022b).

- Identify whether or not there is a watercourse present and determine its order in accordance with the Strahler System (identified in **Section 3.3** and **Figure 4.3**).
- If a watercourse is present define the Riparian Corridor (RC) /Vegetated riparian zone (VRZ) on a map in accordance with Table 1 of the guidelines (**Table 3.2** and **Figure 4.3**).
- Maintain or rehabilitate a RC/VRZ with fully structured native vegetation in accordance with Table 1 of the guidelines.
- Minimise disturbance and harm to the recommended RC/VRZ.
- Minimise the number of creek crossings and provide perimeter road separating development from the RC/VRZ. When crossings are unavoidable, refer to the department's Guidelines for watercourse crossings and NSW Department of Primary Industries Policy and Guidelines for Fish Friendly Waterway Crossings.
- Locate services and infrastructure outside of the RC/VRZ. Within the RC/VRZ provide multiple service easements and/or utilise road crossings where possible.
- Treat stormwater run-off before discharging into the RC/VRZ.

DPE, however, does allow for a range of works and activities on waterfront land and in riparian corridors to better meet the needs of the community. The riparian corridor matrix outlined in DPE (2022b) enables applicants to identify certain works and activities that can occur on waterfront land and in riparian corridors. **Table 6.1** identified what works are permissible under the WM Act for the watercourses in the Study Area. The following terms are used in **Table 6.1**:

- **Riparian corridor (RC) off-setting for non-RC uses:** non-riparian uses, such as Asset Protection Zones are allowed within the outer 50% of the VRZ, so long as offsets are provided in accordance with the averaging rule as seen in Figure 3 of the guidelines (DPE 2022b).
- **Cycleways and paths:** cycleways or paths no wider than four metres total disturbance footprint can be built in the outer 50% of the VRZ.
- **Detention basins:** detention basins can be built in the outer 50% of the VRZ or online where indicated. Refer to the department's Guidelines for outlet structures and Guidelines for in-stream works. Online basins must:
 - be dry and vegetated
 - be for temporary flood detention only with no permanent water holding
 - have an equivalent VRZ for the corresponding watercourse order
 - not be used for water quality treatment purposes.

- **Stormwater outlet structures and essential services:** stormwater outlets or essential services are allowed in the RC. Works for essential services on a fourth order or greater stream are to be undertaken by directional drilling or tied to existing crossings. Refer to the DPE's Guidelines for outlet structures and Guidelines for in-stream works.
- **Stream realignment:** indicates that a watercourse may be realigned. Refer to the DPE's Guidelines for in-stream works.
- **Road crossings:** indicates permitted road crossing methods. Refer to the DPI's Guidelines for watercourse crossings and NSW Department of Primary Industries Policy and Guidelines for Fish Friendly Waterway Crossings.

Table 6.1 Riparian Corridor Matrix for Watercourses in the Study Area

Watercourse	Strahler Stream Order	VRZ width (on each side of watercourse)	RC offsetting for non- RC uses	Cycleways and paths	Detention Basins		Stormwater outlet structures and essential services	Stream realignment	Road Crossings		
					Only within 50% outer VRZ	Online			Any	Culvert	Bridge
First Ponds Creek	3	30 m	X	X	X		X			X	X
Unnamed tributary (2 nd order)	2	20 m	X	X	X	X	X				
Unnamed tributary (1 st order)	1	10 m	X	X	X	X	X	X	X		
Killarney Chain of Ponds	2	20 m	X	X	X	X	X				
Unnamed tributary (1 st order)	1	10 m	X	X	X	X	X	X	X		

7.0 Conservation and Management Recommendations for Inclusion in the ILP

The Study Area contains relatively large areas of good quality vegetation and ENV on certified lands. The plant community types in the Study Area are of high conservation value and are commensurate with:

- Cumberland Plain Woodland in the Sydney Basin Bioregion which is listed as a CEEC under the BC Act and EPBC Act.
- Shale Sandstone Transition Forest in the Sydney Basin Bioregion which is listed as a CEEC under the BC Act and EPBC Act.
- Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion which is listed as an EEC under the BC Act and CEEC under the EPBC Act.
- River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria which is listed as an EEC under the BC Act and CEEC under the EPBC Act.

While the Biodiversity Certification and Strategic Assessment approvals that have been conferred on the Growth Centres enable the removal of vegetation within certified lands, it is recommended that good quality vegetation in certified land be retained.

The following recommendations and opportunities should be implemented to maintain and improve biodiversity values across the Study Area:

- Minimising clearing of ENV and AHCVV within certified lands, including planning for the location of conservation reserves, public open space, visual buffers and other passive land uses in these areas to avoid impacts and retain areas of native vegetation.
- Minimising clearing of ENV and AHCVV within non-certified lands.
- Land uses surrounding detention basins, riparian corridors and parks will need to be carefully managed in order to appropriately manage the ecological integrity of the precinct.
- It is recommended that water quality and flood detention devices are located in existing areas of low ecological constraint on certified lands, to minimise loss of existing habitat across the site. An extra 10 m buffer be added to the minimum riparian setback requirements to allow for the potential encroached by drainage basins, detention basins and stormwater connections is recommended.
- It is recommended that the flood prone land correlated to the riparian areas within the Study Area are retained and revegetated with native vegetation communities.
- Retain, connect and enhance biodiversity corridors, both along drainage corridors as well as high or hilly areas. These corridors will connect biodiversity values in the locality and facilitate movement of flora and fauna and maintain ecological function in the broader landscape.
- It is recommended that mapping of hollow bearing trees in areas that were not ground truthed as part of this assessment be undertaken prior to construction.

- Retention of habitat trees, including hollow bearing trees, and other native vegetation onsite through strategic location of sympathetic land use zones (such as open space, education, drainage etc.) and site-specific planning controls in the DCP to help provide contiguous biodiversity corridors as recommended by DPE in the key threatening process strategy (DPE 2023f). Restoration of floodplain function through native vegetation community restoration.
- Restoration of ecological and environmental function of the Killarney Chain of Ponds.
- Retaining and enhancing representative areas across a range of nuanced habitat types and floristic and soil landscape variation.
- Protection and restoration of any identified threatened species or their habitats.
- Liaise with Western Sydney Parklands and Rouse Hill Reserve for relocation of fauna and habitat removed during clearing on bio-certified land during development.

Opportunities to maximise ecological values across the Study Area will also be available through the rehabilitation and revegetation of detention basins and the potential for retention of remnant vegetation in areas zoned for public or private open space, drainage and education infrastructure, and possibly environmental conservation and environmental living. Use of local provenance species for revegetation and weed management will be important in these areas to ensure ecosystem functionality is maximised and downstream impacts are minimised. Vegetation management plans for these areas will need to be prepared to the satisfaction of DPE and Environment and Heritage Group.

While fragmented landownership may constrain the development of suitable riparian corridors in some parts of the precinct, proposed detention basins should result in sections of land along the riparian corridors with detention basins being revegetated and rehabilitated and held in public ownership. These areas could provide potential habitat for fauna and strengthen habitat connectivity. Special consideration will need to be afforded First Ponds Creek to reduce any potential indirect impacts the population Green and Golden Bell Frog from potential changes to hydrological function.

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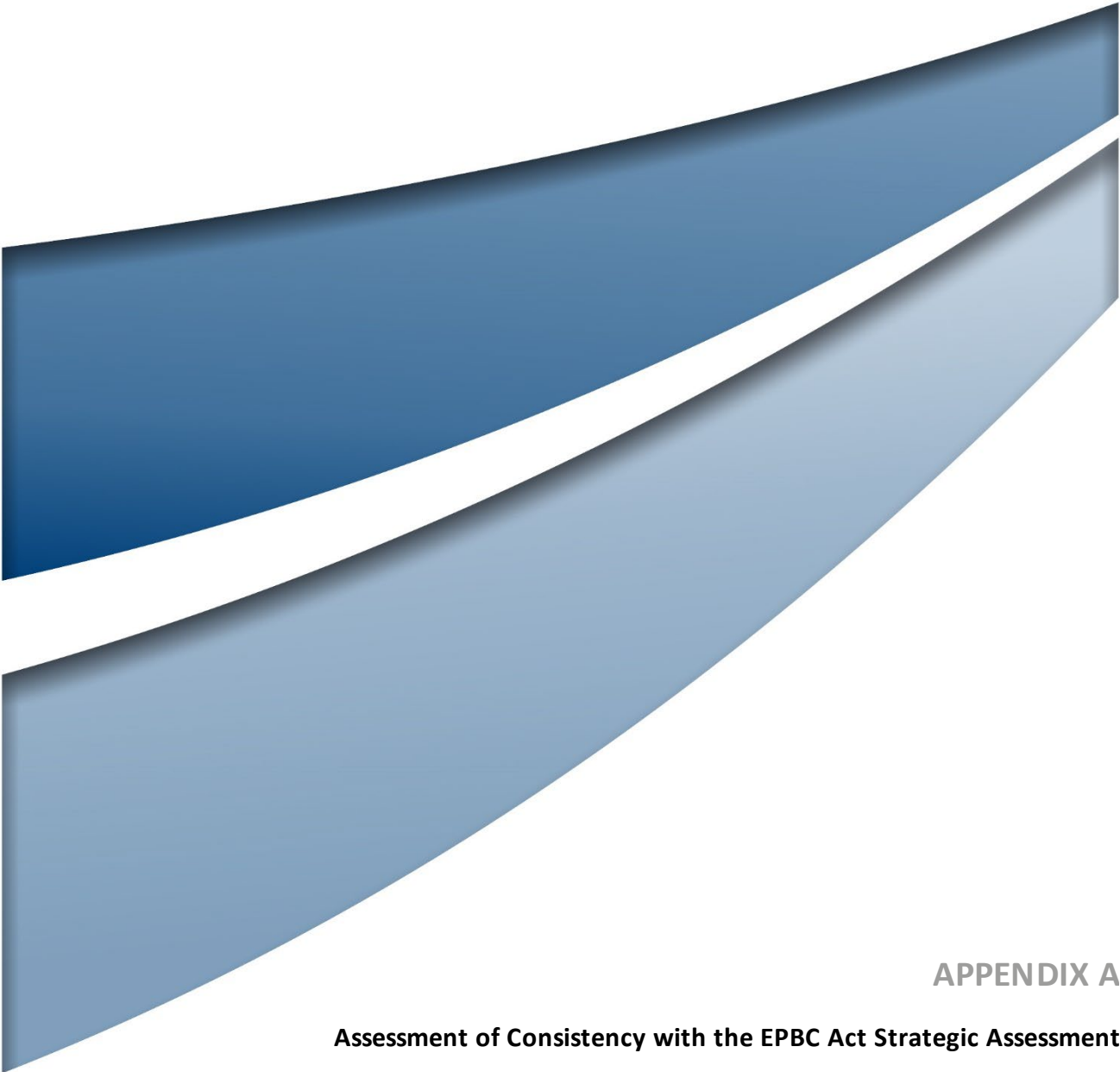
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APPENDIX A

Assessment of Consistency with the EPBC Act Strategic Assessment

Assessment of consistency between the relevant requirements of the Strategic Assessment and the proposed ILP and zoning for Riverstone East Precinct Stage 3 is presented below.

Assessment of consistency between the commitments of the EPBC Strategic Assessment and the Riverstone East Precinct Stage 3

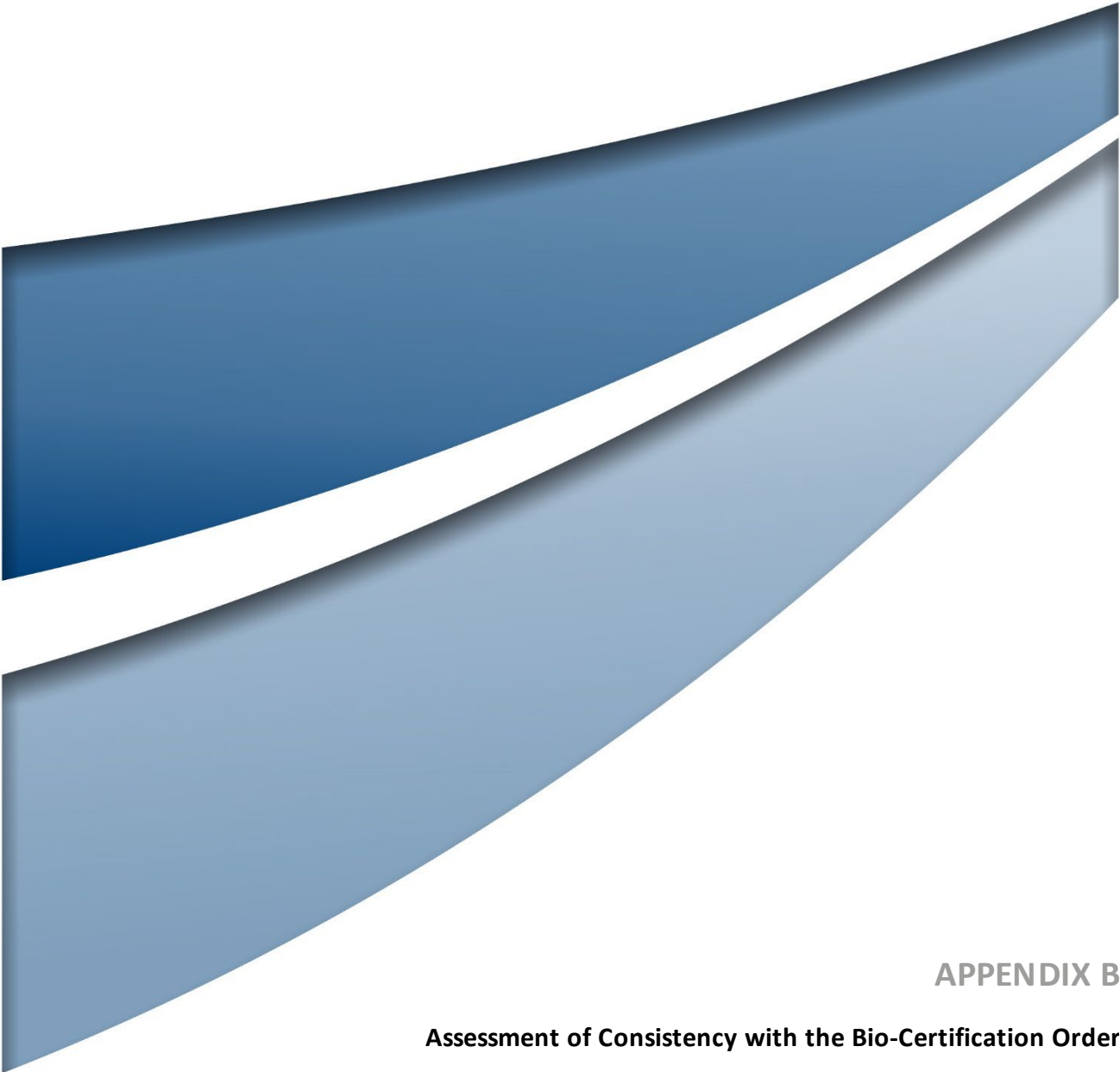
Commitment ID	Commitment	Current status within Riverstone East Precinct – Stage 3	Consistent with Commitment?	Stage 3 Justification
Review of Zoning				
3	N/A			
Threatened Ecological Communities				
4	<p>Retention and protection of a minimum of 998 ha of CPW within the Growth Centres, including a minimum of 363 ha of HMV CPW</p> <p>i) Retention and protection of CPW in the following areas of the Growth Centres:</p> <p>a) 138 ha within Flood Prone Land to be protected through the vegetation clearing controls under the Central River City SEPP or through zoning and/or development controls following completion of precinct planning.</p> <p>b) 424 ha within Environment Conservation and Public Recreation – Regional zoning to be protected through:</p> <ul style="list-style-type: none"> RBM 12 which states that clearing of these areas is not permitted unless it is in accordance with a Plan of Management endorsed by DECCW. The zoning and vegetation clearing controls under the Central River City SEPP. The Growth Centres Conservation Fund which provides funding to acquire the land. 	<p>Riverstone East Precinct – Stage 3 contains 104.28 ha of Cumberland Plain Woodland (CPW). 46.35 ha of this is within Validated ENV and 56.25 ha of this is AHCVV.</p> <p>The target for protection is based on areas of CPW mapped in the Strategic Assessment as ENV which lies within non-certified lands. Of this 43.47 ha, 2.89 ha is within non-certified land, therefore, to maintain parity with the Strategic Assessment 2.89 ha is to be protected.</p> <p>None of the CPW to be protected is mapped on Flood Prone Land on the DCP map.</p> <p>There is no CPW on Environment Conservation or Public Recreation under the Original SEPP Zoning.</p>	Yes	<p>Stage 3 contains 43.46 ha of CPW. Within Stage 3 (Figure 4.1).</p> <p>A total of 29.34 ha of CPW will be retained within Riverstone East Stage 3. Of the 29.34 ha, 15.79 ha is ENV, with 2.67 of ENV on non-certified land and 13.11 ha on biodiversity certified land (Table 5.2).</p> <p>13.55 ha of the total 29.34 ha comprises AHCVV with 4.74 ha on non-certified land and 8.81 ha on biodiversity certified land (Figure 4.2).</p> <p>This contributes 4.69 ha of ENV CPW in flood prone land to the minimum of 138 ha of CPW within Flood Prone Lands required for protection within the Growth Centres.</p>

Commitment ID	Commitment	Current status within Riverstone East Precinct – Stage 3	Consistent with Commitment?	Stage 3 Justification
	<p>c) 280 ha to be protected within existing reserved areas including the Westlink M7 Motorway Offsets area, the Kemps Creek Nature Reserve, and the Western Sydney Parklands.</p> <p>d) 79 ha to be protected within protected zones within Edmondson Park.</p> <p>e) 77 ha to be retained within non-certified and transitional lands. These areas will be retained subject to the confirmation of the presence of the community through survey at the precinct planning stage.</p> <p>ii) If for any reason the above targets cannot be achieved then the NSW Government will ensure that 998 ha of CPW is protected within the Growth Centres through the measures contained in either RBM 8a or 8b.</p>	<p>There is no High Management Viability (HMV) CPW within the precinct. Accordingly, the precinct CPW does not count towards the 363 ha of HMW CPW to be protected within the Growth Centres.</p>		<p>The principal protection mechanism is the SEPP which prohibits clearing of ENV in areas of non certified land.</p> <p>The retained vegetation in certified land has been identified as Natural Bushland, Open Space (passive), Open Space (Environmental Conservation), Open Space (Junction Road and Associated Lands), Natural Green Infrastructure, Rouse Hill Regional Park and Connectors and Corridors on the draft ILP.</p>
5. CPW within Marsden Park Precinct	N/A			
Shale Sandstone Transition Forest (SSTF)				
8	<p>Retention and protection of a minimum of 58 ha of SSTF within the Growth Centres.</p> <p>i) Retention and protection of SSTF in the following areas of the North West Growth Centre:</p> <p>a) 5.5 ha within Flood Prone Land to be protected through the vegetation clearing controls under the Central River City SEPP.</p> <p>b) 5.5 ha within Public Recreation – Regional zoning to be protected through:</p>	<p>7.74 ha of SSTF has been identified in Stage 3. Of the 7.74 ha of SSTF, 1.74 ha is within non-certified lands.</p>	Yes	<p>0.23 ha of SSTF is within flood prone land.</p> <p>A total of 2.43 ha of SSTF will be retained within Riverstone East Stage 3. Of the 2.43 ha, 2.12 ha is ENV, with 1.43 of ENV on non-certified land and 0.69 ha on biodiversity certified land. 0.31 ha of the total 2.43 ha comprises AHCVV with</p>

Commitment ID	Commitment	Current status within Riverstone East Precinct – Stage 3	Consistent with Commitment?	Stage 3 Justification
	<ul style="list-style-type: none"> RBM 12 which states that clearing of these areas is not permitted unless it is in accordance with a Plan of Management endorsed by DECCW the zoning and vegetation clearing controls under the Central River City SEPP the Growth Centres Conservation Fund which provides funding to acquire the land. <p>c) 0.5 ha within the Westlink M7 Motorway Offsets area to be protected through maintenance of the existing conservation area (purchased by the RTA for transfer to DECCW as part of the Westlink M7 Motorway offsets).</p> <p>d) 46.5 ha within the E3 Environmental Management zone in North Kellyville to be protected under the existing native vegetation and native vegetation retention controls under the North Kellyville Precinct Plan.</p>			0.23 ha on non-certified land and 0.08 ha on biodiversity certified land (refer to Figure 4.1 and Figure 4.2).
Additional conservation actions within the Growth Centres – plants				
Conditions 11, 12, 14, 15, 17, 18, 19, 20, 22, 23, 24, 25, 27, 30	N/A			
Additional conservation actions within the Growth Centres – animals				
During or before the preparation of the relevant precinct plan(s) under the Growth Centres Development Code relating to the area referred to in the table below, the following actions must be undertaken:	This Precinct has the potential for the Swift Parrot, Large-eared Pied Bat and Grey-headed Flying Fox to occur	Yes	Within Stage 3, A total of 6.26 ha of ENV is to be retained in stage 3 to meet the target of	

Commitment ID	Commitment		Current status within Riverstone East Precinct – Stage 3	Consistent with Commitment?	Stage 3 Justification
32	Species Swift Parrot	Required action Protection of potential habitat for the Swift Parrot within the Growth Centres. a) Protection of 2,000 ha native vegetation within the Growth Centres through: <ul style="list-style-type: none"> • Relevant Biodiversity Measure (RBM) 6 which requires a minimum of 2,000 ha of existing native vegetation to be retained • the relevant development controls under the Central River City SEPP that relate to the retention of native vegetation. 	on site. The Precinct has the potential for the Green and Golden Bell Frog to occur on site. The draft Conservation Plan identifies 7.53 ha of ENV in non-certified lands to be retained within the Stage 3 area to maintain parity with the 2000 ha requirement. Protection of ENV will protect existing potential habitat for the Green and Golden Bell Frog, Swift Parrot, Large-eared Pied Bat and Grey-headed Flying Fox.		14.56 ha over the entire Riverstone East Precinct to be retained under the draft Conservation Plan and count towards the 2000 ha target. A further 13.85 ha of ENV will be protected in the certified land within Stage 3, in land zoned as Environmental Conservation.
34 and 35	Green and Golden Bell Frog	Potential population at Riverstone – as shown in red hatching on the Biodiversity Certification maps: <ul style="list-style-type: none"> • Incorporation of habitat protection and enhancement features (as per the agreed concept design) in the Riverstone Precinct Development Control Plan for the trunk drainage land. • Inclusion of provisions in the Riverstone Precinct Plan and Development Control Plan to require the design and assessment of development on subject lands to be consistent with any recovery plan for the species and the Best Practice Guidelines for Green and Golden Bell Frog habitat (DECC 2008b). 	An area which is covered by RBM 18 to protect the Green and Golden Bell Frog, lies outside of the Stage 3 Riverstone precinct, as such RBM 18 is not applicable to this assessment.		

Commitment ID	Commitment	Current status within Riverstone East Precinct – Stage 3	Consistent with Commitment?	Stage 3 Justification
	Retention of major drainage lines and associated vegetation throughout the Growth Centres through Growth Centres SEPP development controls for major creeks and flood prone areas.			
36	Large-eared Pied Bat Retention of potential roosting habitat and immediately adjacent potential foraging habitat along Cattai Creek in North Kellyville through development controls associated with the E3 Environmental Management and E4 Environmental Living zones.			
36	Grey-headed Flying Fox Protection of potential habitat for the Grey-headed Flying Fox within the Growth Centres. b) Protection of 2,000 ha native vegetation within the Growth Centres through: <ul style="list-style-type: none"> • RBM 6 which requires a minimum of 2,000 ha of existing native vegetation to be retained • the relevant development controls under the Central River City SEPP that relate to the retention of native vegetation. 			
Note: On completion of the above actions the Minister may decide that it is appropriate to amend the boundaries of the area subject to biodiversity certification, in accordance with condition 3.				



APPENDIX B

Assessment of Consistency with the Bio-Certification Order

Assessment of consistency between the relevant requirements of the Sydney Region Growth Centres Bio-certification Order and the proposed ILP and zoning for Riverstone East Precinct Stage 3 is presented below.

Assessment of consistency between the commitments of the Bio-certification Order and the Riverstone East Precinct – Stage 3

Commitment ID	Relevant Biodiversity Measure (RBM)	Current status within Riverstone East Precinct – Stage 3	Consistent with Commitment?	Stage 3 Justification
General				
4	Copies of all final reports, maps, reviews, plans and monitoring data referred to in the conditions of biodiversity certification must be held by the GCC and made publicly available, either on request and/or by a mechanism that is broadly publicly accessible. This does not apply to material that is commercially sensitive or contains sensitive information regarding the location of threatened species, populations or ecological communities or their habitat.	All information required by the RBMs for the Riverstone East Precinct was publicly exhibited from 26 November 2008 to 6 February 2009. Since exhibition, the assessment of consistency (this report) has been updated where necessary and will (along with relevant supporting technical studies and maps) be publicly available following gazettal of the Precinct Plan.	Yes	This information will be publicly available following gazettal.
Native vegetation to be retained within the Growth Centres				
6	A minimum of 2000 hectares of existing native vegetation must be retained and protected within the Growth Centres, either within the certified areas and/or the non-certified areas, subject to conditions 7 to 13 below.	The draft Conservation Plan identifies 14.56 ha of ENV in Riverstone to be retained or otherwise offset within the Precinct to maintain parity with the broader 2000 ha requirement. 4.3 hectares of ENV was to be retained for Stage 1 to meet the requirements of the draft Conservation Plan. A total of 6.6 hectares of validated ENV was to be protected and retained using SP2 and RE1 zones, and inclusion on the Native Vegetation Protection Map,, which	Yes	A total of 14.56 ha of ENV in non certified land is to be protected under the Riverstone East Precinct Plan over Stages 1, 2 and 3. The principal protection mechanism is clause 6.5 of the Precinct Plan, which prohibits clearing of ENV as shown on the Native Vegetation Protection Areas Map.

Commitment ID	Relevant Biodiversity Measure (RBM)	Current status within Riverstone East Precinct – Stage 3	Consistent with Commitment?	Stage 3 Justification
		<p>exceeds the area to be retained by 2.3 hectares.</p> <p>0.2 hectares of non-certified ENV was cleared to allow for the upgrade of a road crossing over First Ponds Creek, at Oak Street / Gordon Street. This was to be offset by the retention of 3.7 hectares of field validated certified ENV within the SP2 and RE1 zones.</p> <p>Within Stage 2, 3.2 hectares of ENV was required to be retained to meet the requirements of the draft Conservation Plan. A total of 1.7 hectares of validated ENV was be protected and retained using SP2 and RE1 zones, and inclusion on the Native Vegetation Protection Map. This represents a shortfall of the ENV target, however, will be offset by the additional ENV to be protected within Stage 1.</p>		<p>Stage 1 retained 6.6 ha of ENV and Stage 2 retained a total of 1.7.</p> <p>A total of 6.26 ha is to be retained in Stage 3 to meet the target of 14.56 ha.</p>
Retention of existing native vegetation during precinct planning				
7	<p>During the precinct planning process, the GCC may determine to make areas of existing native vegetation within the non-certified areas available for development if the clearance of such vegetation is considered necessary for either the provision of essential infrastructure and/or to meet the required Development Parameters specified in the Growth Centres Development Code.</p>	<p>A small area of ENV in non-certified land will be impacted by the proposed works outlined in the ILP.</p>	No	<p>A total of 6.89 ha of ENV was identified in non-certified land.</p> <p>6.57 will be retained and 0.32 ha will be impacted</p>

Commitment ID	Relevant Biodiversity Measure (RBM)	Current status within Riverstone East Precinct – Stage 3	Consistent with Commitment?	Stage 3 Justification
8	<p>In making a determination under condition 7, the GCC must demonstrate by way of information provided during the public exhibition of the precinct plan (where that exhibition occurs after this order takes effect) that the clearing of any existing native vegetation in the non-certified areas will be offset by:</p> <ul style="list-style-type: none"> • (a) the protection of an equal or greater area of existing native vegetation elsewhere in the Growth Centres; and/or • (b) the revegetation and/or restoration of an area of land elsewhere in the Growth Centres, subject to satisfying the following, <ul style="list-style-type: none"> • (i) that the clearance of existing native vegetation in the noncertified areas will not affect the capacity to achieve overall improvement or maintenance of biodiversity values for threatened species, populations and ecological communities and their habitats, • (ii) the revegetated and/or restored areas will be protected, • (iii) the extent of revegetation and/or restoration compared to clearing of existing native vegetation must be undertaken at a ratio of at least 3:1 (to reflect the greater ecological risks relative to retaining existing native vegetation), • (iv) areas subject to revegetation and/or restoration must be of a suitable boundary configuration and design to support long term management, 			<p>by the proposed works outlined in the ILP.</p> <p>An additional 13.85 ha of ENV in biodiversity certified land will be retained to offset this.</p>

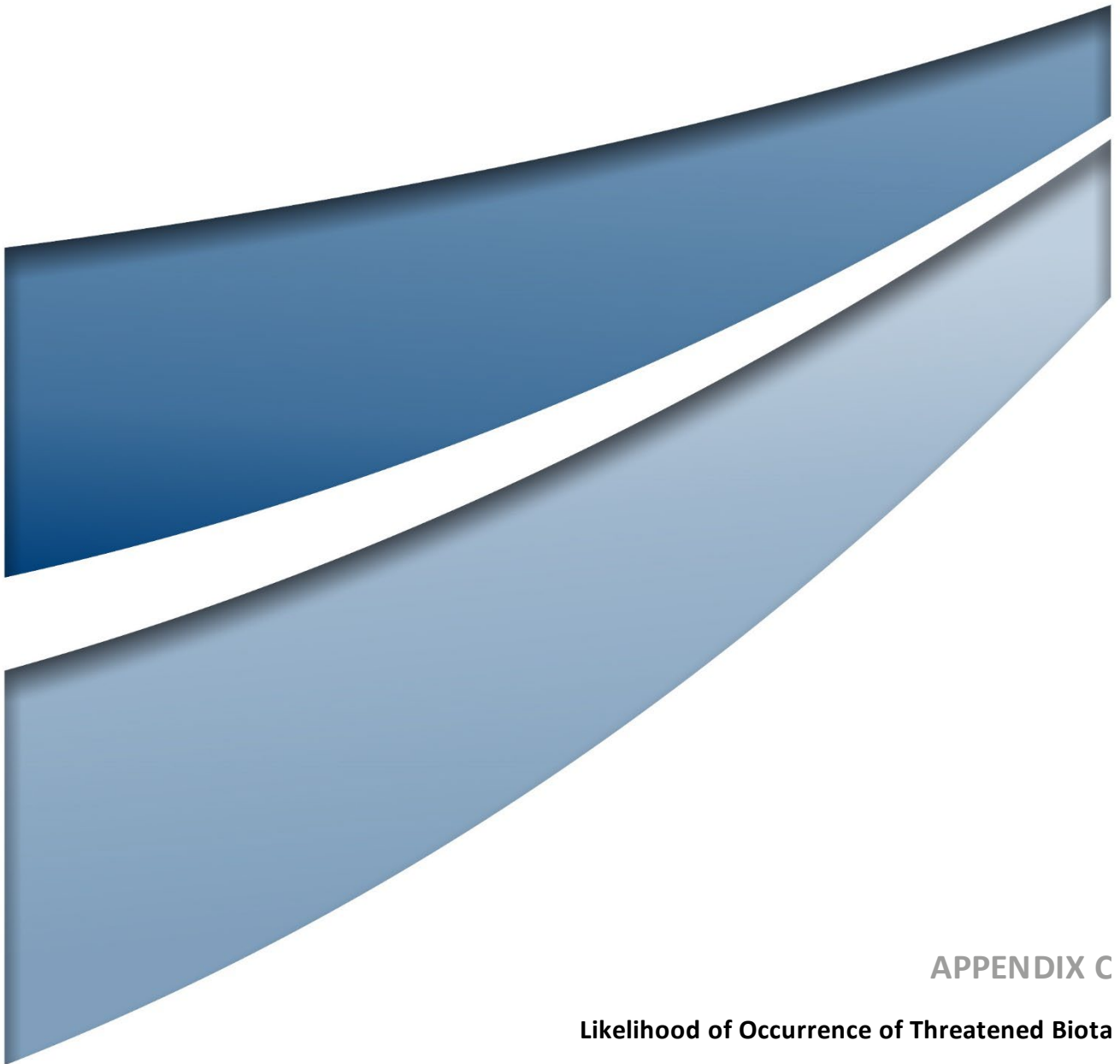
Commitment ID	Relevant Biodiversity Measure (RBM)	Current status within Riverstone East Precinct – Stage 3	Consistent with Commitment?	Stage 3 Justification
	<ul style="list-style-type: none"> (v) revegetation and/or restoration of the proposed areas would not be undertaken under another scheme or regulatory requirement already in operation at the time that the clearing is approved (this includes but is not limited to any approvals, and associated conditions of such approvals, that may be required under the Rivers and Foreshores Improvement Act 1948 and Water Management Act 2000), (vi) revegetation and/or restoration will be undertaken by suitably qualified and experienced persons using indigenous plant stock, and (vii) sufficient resources will be made available to undertake the revegetation and/or restoration and any necessary follow-up maintenance and monitoring for a minimum period of 5 years following the commencement of the revegetation and/or restoration. 			
9	N/A			
Retention of existing native vegetation shown in areas marked with red hatching				
12	Notwithstanding any other conditions of biodiversity certification, in the lands marked by a red hatching on the biodiversity certification maps existing native vegetation must not be cleared unless it is in accordance with a plan of management or unless such clearance has been agreed to by the DECC.	Two areas of land subject to this condition are located in the Riverstone East Precinct – Stage 3. Boundary amendments are proposed to align with cadastral boundaries and to facilitate more efficient urban development on adjoining lands.	Yes	A total of 6.89 ha of ENV was identified in non-certified land (Table 5.1). 6.57 will be retained (Table 5.2) and 0.32 ha will be impacted by the proposed works outlined in the ILP.

Commitment ID	Relevant Biodiversity Measure (RBM)	Current status within Riverstone East Precinct – Stage 3	Consistent with Commitment?	Stage 3 Justification
				An additional 13.85 ha of ENV in biodiversity certified land will be retained to offset this. These impacts will need to be discussed with DPE.
Ground truthing of existing native vegetation				
13	If new information becomes available after the biodiversity certification order took effect that demonstrates that the vegetation within an area does not otherwise meet the definition of existing native vegetation, then for the purposes of conditions 7 to 8 and condition 11 to 12 only the area of confirmed existing native vegetation shall be considered.	The mapping of ENV in the Riverstone East Precinct generally corresponds with the findings of additional investigations done for precinct planning. Some minor amendments have been made to account for areas cleared since 2015.	Yes	Minor amendments have been made to the ENV mapping to account for clearing of vegetation since 2015. Eco Logical (2015) mapped 60.27 ha of ENV in the Stage 3 precinct boundary, with 7.53 ha in non certified land (Table 5.1). Our revised mapping identified 55.86 ha of verified ENV in the Stage 3 precinct boundary, with 6.89 ha of ENV in non certified land (Table 5.1). The mapping resulted in a reduction of 4.42 ha of ENV within certified land.

Commitment ID	Relevant Biodiversity Measure (RBM)	Current status within Riverstone East Precinct – Stage 3	Consistent with Commitment?	Stage 3 Justification
Additional conservation actions within the Growth Centres – native vegetation				
Conditions 14, 15 and 16	N/A			
Additional conservation actions within the Growth Centres – plants				
17	N/A			
Additional conservation actions within the Growth Centres – animals				
18	During or before the preparation of the relevant precinct plan(s) under the Growth Centres Development Code relating to the area referred to in the table below, the following actions must be undertaken:	Since exhibition, additional targeted surveys have been undertaken on land to which this condition applies to determine the presence of the Green and Golden Bell Frog. The survey identified the species within the subject lands and identified areas of habitat for protection, in accordance with Option 1.	Yes	The area of black hatching shown on the biodiversity certification maps is located outside of the Stage 3 precinct boundary. As such, this condition is not applicable to this assessment.
Species Green and Golden Bell Frog	Required action Potential population at Riverstone – as shown in black hatching on the biodiversity certification maps: Option 1 <ul style="list-style-type: none"> • survey to confirm the presence of the species • if the species is present, provide protection of the area of suitable habitat for the species to the satisfaction of the DECC. Option 2 <ul style="list-style-type: none"> • if the species is present at Riverstone but cannot be adequately protected to the satisfaction of the DECC, then: <ul style="list-style-type: none"> • a) undertake targeted survey to confirm the presence of the species elsewhere in the Growth Centres • b) if the species is present elsewhere in the Growth Centres, provide for the protection of an area(s) of suitable habitat for the species to the satisfaction of the DECC. 			

Commitment ID	Relevant Biodiversity Measure (RBM)	Current status within Riverstone East Precinct – Stage 3	Consistent with Commitment?	Stage 3 Justification
	<p>Note: On completion of the above actions the Minister may decide that it is appropriate to amend the boundaries of the area subject to biodiversity certification, in accordance with condition 3.</p>			
Additional conservation actions within the Growth Centres – development sites				
19	<p>Within twelve months of the biodiversity certification order taking effect, the GCC (in consultation with the DECC) must put in place procedures so that all future precinct plans (excluding any plans that were publicly exhibited before the biodiversity certification order took effect), where practicable, provide for the appropriate re-use of:</p> <ul style="list-style-type: none"> • (a) native plants (including but not limited to seed collection) and the re-location of native animals from development sites, prior to development commencing • (b) top soil from development sites that contain known or potential native seed bank. <p>For the purposes of condition 19a and 19b appropriate uses may include, but are not limited to, application in revegetation or restoration works and landscaping in the Growth Centres.</p>	<p>Relevant provisions will be included in the Blacktown Growth Centre Precincts Development Control Plan.</p>	Yes	<p>Relevant provisions will be included in the Blacktown Growth Centre Precincts DCP.</p>
Future precinct plans				
35	<p>During the preparation of future precinct plans (excluding any precinct plans already publicly exhibited before this order took effect) the GCC must undertake and make publicly available an assessment of the consistency of the proposed precinct plan with the conditions of biodiversity certification. This may occur during or before any public exhibition of future draft precinct plans.</p>	<p>An assessment of consistency will be prepared and publicly exhibited with the full precinct planning package.</p>	Yes	<p>This assessment updates the assessment that was publicly exhibited and addresses all RBMs applicable to the planning for the Riverstone East Precinct.</p>

Commitment ID	Relevant Biodiversity Measure (RBM)	Current status within Riverstone East Precinct – Stage 3	Consistent with Commitment?	Stage 3 Justification
Future threatened species listings or discoveries				
36	<p>Where a preliminary determination is made under the Act to list a species, population or ecological community, and that species, population or ecological community may or is known to occur within the Growth Centres, then the Department of Planning must (as soon as practicable) provide advice to the DECC on whether:</p> <ul style="list-style-type: none"> • (a) the species, population or ecological community is known or likely to be present in the Growth Centres • (b) it was considered during the preparation of the draft Growth Centres Conservation Plan by the GCC • (c) whether the SEPP, and related measures, provides adequate protection for the species, population or ecological community. 	<p>A Gap Analysis (Umwelt 2023) was undertaken as part of the precinct plan package. The Gap Analysis included a likelihood of occurrence assessment for threatened biota predicted or known to occur in the locality. This assessment included all new species listed after the previous assessment undertaken in 2015 (Eco Logical 2015). No threatened biota listed after this date are considered likely to occur in precinct.</p>	Yes	<p>All new species listed under the BC Act and EPBC Act have been considered as part of this assessment and during the Gap Analysis assessment. It is considered unlikely that any new species listed under the BC Act or EPBC Act are likely to occur in the Stage 3 precinct area.</p>
37	N/A			



APPENDIX C

Likelihood of Occurrence of Threatened Biota

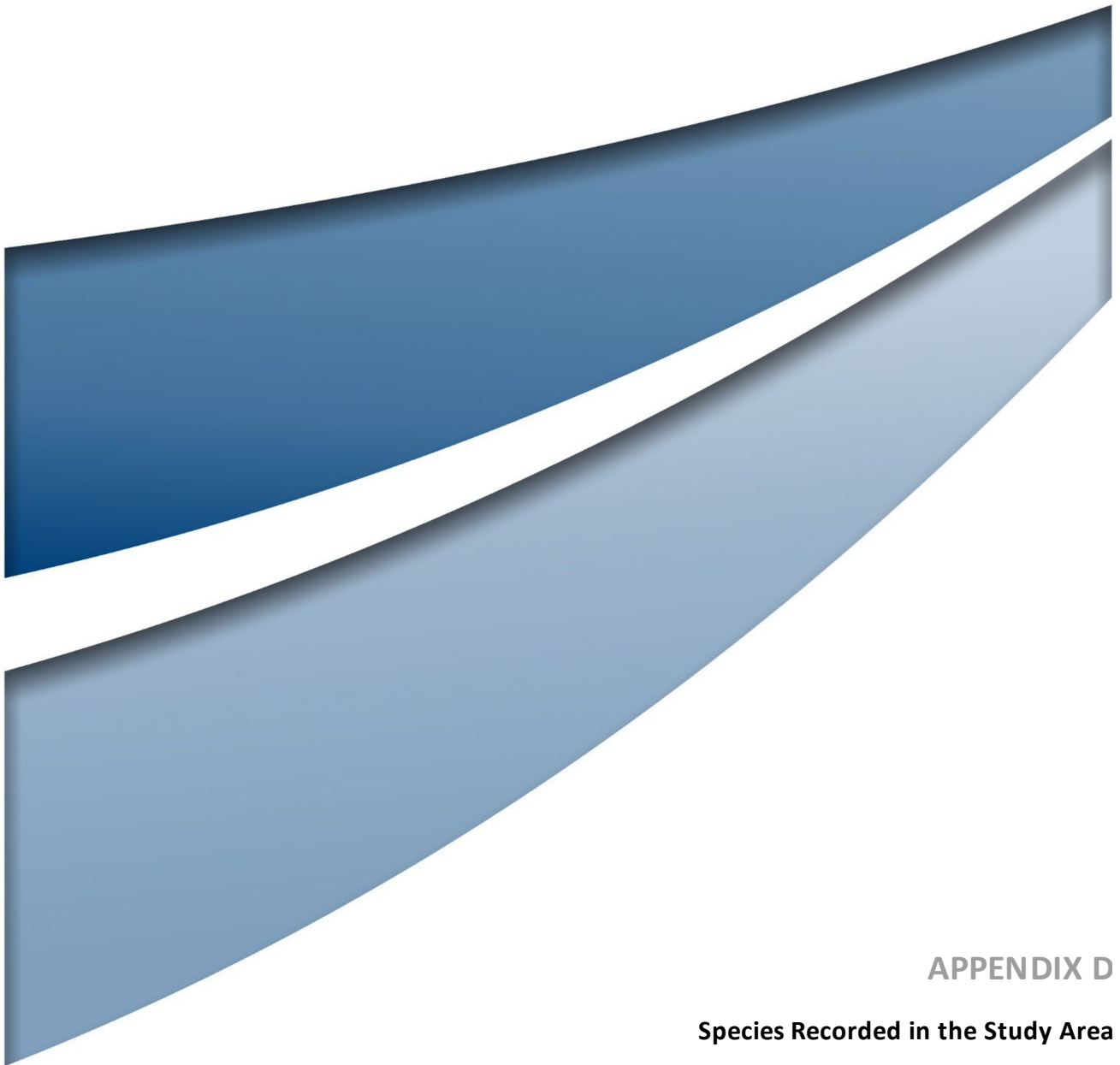
Threatened Flora and Fauna Likelihood of Occurrence within the Study Area

Species	BC Act listing	EPBC Act listing	Likelihood of occurrence (Eco Logical 2015)	Current likelihood of occurrence in the Study Area	Current likelihood of occurrence in the Rouse Hill Regional Park
Flora					
<i>Acacia bynoeana</i>	E	V	No	Low	Low
<i>Acacia pubescens</i>	V	V	No	Moderate	Moderate
<i>Callistemon linearifolius</i>	V	-	Not included in assessment	Low	Low
<i>Darwinia biflora</i>	V	V	No	Low	Low
<i>Dillwynia tenuifolia</i>	V	-	Unlikely	High	High
<i>Epacris purpurascens</i> var. <i>purpurascens</i>	V	-	No	Moderate	Moderate
<i>Eucalyptus sp. Cattai</i>	CE	CE	No	Unlikely	Unlikely
<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	V	-	Unlikely	High	High
<i>Hibbertia puberula</i>	E	-	Not included in assessment	Moderate	Moderate
<i>Hibbertia sp. Bankstown</i>	CE	CE	Not included in assessment	Low	Low
<i>Hibbertia superans</i>	E	-	No	Moderate	Moderate
<i>Lasiopetalum joyceae</i>	V	V	No	Moderate	Moderate
<i>Marsdenia viridiflora</i> subsp. <i>Viridiflora</i> (endangered population)	E	-	Unlikely	Moderate	Moderate
<i>Melaleuca deanei</i>	V	V	No	Moderate	Moderate
<i>Micromyrtus minutiflora</i>	E	V	Unlikely	Moderate	Moderate
<i>Persoonia hirsuta</i>	E	E	Unlikely	Moderate	Moderate
<i>Persoonia nutans</i>	E	E	Unlikely	Moderate	Moderate
<i>Pimelea curviflora</i> var. <i>curviflora</i>	V	V	No	Moderate	Moderate
<i>Pimelea spicata</i>	E	E	Unlikely	Moderate	Moderate
<i>Pomaderris brunnea</i>	E	V	Not included in assessment	Moderate	Moderate
<i>Pterostylis saxicola</i>	E	E	No	Unlikely	Unlikely
<i>Pultenaea parviflora</i>	E	V	Unlikely	Moderate	Moderate
<i>Syzygium paniculatum</i>	E	V	No	Low	Low
<i>Tetratheca glandulosa</i>	V	-	No	Low	Low

Species	BC Act listing	EPBC Act listing	Likelihood of occurrence (Eco Logical 2015)	Current likelihood of occurrence in the Study Area	Current likelihood of occurrence in the Rouse Hill Regional Park
Fauna					
Barking Owl <i>Ninox connivens</i>	V	-	Unlikely	Low	Low
Black-chinned Honeyeater (eastern subspecies) <i>Melithreptus gularis gularis</i>	V	-	Unlikely	Low	Low
Black Falcon <i>Falco subniger</i>	V	-	No	Low	Low
Blue-billed Duck <i>Oxyura australis</i>	V	-	Unlikely	Unlikely	Unlikely
Brown Treecreeper (eastern subspecies) <i>Climacteris picumnus victoriae</i>	V	-	No	Low	Low
Cumberland Plain Land Snail <i>Meridolum corneovirens</i>	E	-	Potential	High	High
Curlew Sandpiper <i>Calidris ferruginea</i>	E	CE	Not included in assessment	Low	Low
Dural Land Snail <i>Pommerhelix duralensis</i>	E	E	Not included in assessment	Low	Low
Dusky Woodswallow <i>Artamus cyanopterus cyanopterus</i>	V	-	Not included in assessment	High	High
Eastern Cave Bat <i>Vespadelus troughtoni</i>	V	-	Not included in assessment	Low	Low
Eastern Coastal Free-tailed Bat <i>Micronomus norfolkensis</i>	V	-	Potential	Previously recorded in the Study Area by others	High
Eastern False Pipistrelle <i>Artamus cyanopterus cyanopterus</i>	V	-	Unlikely	Moderate	Moderate
Eastern Osprey <i>Pandion cristatus</i>	V	-	Not included in assessment	Low	Low
Flame Robin <i>Petroica phoenicea</i>	V	-	Unlikely	Low	Low

Species	BC Act listing	EPBC Act listing	Likelihood of occurrence (Eco Logical 2015)	Current likelihood of occurrence in the Study Area	Current likelihood of occurrence in the Rouse Hill Regional Park
Freckled Duck <i>Stictonetta naevosa</i>	V	-	Unlikely	Low	Low
Gang-gang Cockatoo <i>Callocephalon fimbriatum</i>	V	E	Not included in assessment	Low	Low
Giant Burrowing Frog <i>Heleioporus australiacus</i>	V	V	No	Unlikely	Unlikely
Glossy Black-Cockatoo <i>Calyptorhynchus lathami</i>	V	V	Unlikely	Low	Low
Greater Broad-nosed Bat <i>Scoteanax rueppellii</i>	V	-	Potential	Moderate	Moderate
Green and Golden Bell Frog <i>Litoria aurea</i>	E	V	Likely	High	High
Grey-headed Flying-fox <i>Pteropus poliocephalus</i>	V	V	Potential Recorded	Previously recorded in the Study Area by others	Previously recorded by others
Koala <i>Phascolarctos cinereus</i>	E	E	No	Low	Low
Large-eared Pied Bat <i>Chalinolobus dwyeri</i>	V	V	Potential	Moderate	Moderate
Large Bent-winged Bat <i>Miniopterus orianae oceanensis</i>	V	-	Potential	Previously recorded in the Study Area by others	High
Little Bent-winged Bat <i>Miniopterus australis</i>	V	-	Potential	Moderate	Moderate
Little Eagle <i>Hieraaetus morphnoides</i>	V	-	Potential	Moderate	Moderate
Little Lorikeet <i>Glossopsitta pusilla</i>	V	-	Potential	Moderate	Moderate
Masked Owl <i>Tyto novaehollandiae</i>	V	-	Unlikely	Unlikely	Unlikely
Powerful Owl <i>Ninox strenua</i>	V	-	Potential	Moderate	Previously recorded by others
Red-crowned Toadlet <i>Pseudophryne australis</i>	V	-	No	Unlikely	Unlikely

Species	BC Act listing	EPBC Act listing	Likelihood of occurrence (Eco Logical 2015)	Current likelihood of occurrence in the Study Area	Current likelihood of occurrence in the Rouse Hill Regional Park
Southern Myotis <i>Myotis macropus</i>	V	-	Potential	High	Previously recorded by others
Speckled Warbler <i>Chthonicola sagittata</i>	V	-	Unlikely	Low	Low
Spotted-tailed Quoll <i>Dasyurus maculatus</i>	E	E	No	Unlikely	Unlikely
Spotted Harrier <i>Circus assimilis</i>	V	-	No	Low	Low
Square-tailed Kite <i>Lophoictinia isura</i>	V	-	Potential	Moderate	Moderate
Swift Parrot <i>Lathamus discolor</i>	E	CE	Potential	Moderate	Previously recorded
Turquoise Parrot <i>Neophema pulchella</i>	V	-	No	Moderate	Moderate
Varied Sittella <i>Daphoenositta chrysoptera</i>	V	-	Potential	Moderate	Moderate
White-bellied Sea-Eagle <i>Haliaeetus leucogaster</i>	V	-	Unlikely	Moderate	Moderate
Yellow-bellied Glider <i>Petaurus australis</i>	V	V	No	Unlikely	Unlikely
<i>Saccolaimus flaviventris</i>	V	-	Potential	Moderate	Previously recorded by others



APPENDIX D

Species Recorded in the Study Area

Fauna Species recorded in the Study Area

Class	Family	Exotic	Scientific Name	Common Name	NSW Status
Aves	Psittacidae	-	<i>Alisterus scapularis</i>	Australian King-Parrot	P
Aves	Meliphagidae	-	<i>Anthochaera carunculata</i>	Red Wattlebird	P
Aves	Ardeidae	-	<i>Ardea intermedia</i>	Intermediate egret	P
Aves	Accipitridae	-	<i>Aviceda subcristata</i>	Pacific baza	P
Aves	Cacatuidae	-	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo	P
Aves	Cacatuidae	-	<i>Cacatua sanguinea</i>	Little corella	P
Aves	Cacatuidae	-	<i>Calyptorhynchus funereus</i>	Yellow-tailed black-cockatoo	P
Aves	Anatidae	-	<i>Chenonetta jubata</i>	Australian wood duck	P
Aves	Campephagidae	-	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	P
Aves	Corvidae	-	<i>Corvus coronoides</i>	Australian Raven	P
Aves	Artamidae	-	<i>Cracticus tibicen</i>	Australian magpie	P
Aves	Artamidae	-	<i>Cracticus torquatus</i>	Grey butcherbird	P
Amphibia	Myobatrachidae	-	<i>Crinia signifera</i>	Common eastern froglet	P
Aves	Alcedinidae	-	<i>Dacelo novaeguineae</i>	Laughing Kookaburra	P
Aves	Ardeidae	-	<i>Egretta novaehollandiae</i>	White-faced heron	P
Aves	Cacatuidae	-	<i>Eolophus roseicapillus</i>	Galah	P
Aves	Rallidae	-	<i>Fulica atra</i>	Eurasian coot	P
Aves	Columbidae	-	<i>Geopelia striata</i>	Peaceful dove	P
Aves	Monarchidae	-	<i>Grallina cyanoleuca</i>	Magpie-lark	P
Aves	Recurvirostridae	-	<i>Himantopus himantopus</i>	Black-winged stilt	P
Aves	Meliphagidae	-	<i>Manorina melanocephala</i>	Noisy Miner	P
Aves	Meliphagidae	-	<i>Manorina melanophrys</i>	Bell miner	P
Aves	Columbidae	-	<i>Ocyphaps lophotes</i>	Crested pigeon	P
Aves	Psittacidae	-	<i>Platycercus eximius</i>	Eastern Rosella	P
Aves	Psittacidae	-	<i>Psephotus haematonotus</i>	Red-rumped Parrot	P
Aves	Ptilonorhynchidae	-	<i>Ptilonorhynchus violaceus</i>	Satin bowerbird	P
Aves	Rhipiduridae	-	<i>Rhipidura leucophrys</i>	Willie wagtail	P
Aves	Artamidae	-	<i>Strepera graculina</i>	Pied Currawong	P
Aves	Sturnidae	Ex	<i>Sturnus tristis</i>	Common Myna	
Aves	Threskiornithidae	-	<i>Threskiornis molucca</i>	Australian White Ibis	P
Aves	Psittacidae	-	<i>Trichoglossus haematodus</i>	Rainbow lorikeet	P
Aves	Charadriidae	-	<i>Vanellus miles</i>	Masked lapwing	P

Flora species recorded in the Study Area

Family	Scientific Name	Common Name	Growth form or exotic
Agavaceae	<i>Agave spp.</i>	-	E
Apiaceae	<i>Hydrocotyle laxiflora</i>	Stinking Pennywort	Forb (FG)
Apocynaceae	<i>Araujia sericifera</i>	Moth Vine	E
Arecaceae	<i>Phoenix canariensis</i>	Canary Island Date Palm	E
Asteraceae	<i>Bidens pilosa</i>	Cobbler's Pegs	E
Asteraceae	<i>Cirsium vulgare</i>	Spear Thistle	E
Asteraceae	<i>Cirsium vulgare</i>	Spear Thistle	E
Asteraceae	<i>Senecio madagascariensis</i>	Fireweed	E
Asteraceae	<i>Soliva sessilis</i>	Bindyi	E
Asteraceae	<i>Sonchus oleraceus</i>	Common Sowthistle	E
Asteraceae	<i>Taraxacum officinale</i>	Dandelion	E
Brassicaceae	<i>Brassica spp.</i>	Brassica	E
Caryophyllaceae	<i>Stellaria media</i>	Common Chickweed	E
Casuarinaceae	<i>Casuarina glauca</i>	Swamp Oak	Tree (TG)
Commelinaceae	<i>Commelina cyanea</i>	Native Wandering Jew	Forb (FG)
Convolvulaceae	<i>Dichondra repens</i>	Kidney Weed	Forb (FG)
Cyperaceae	<i>Cyperus eragrostis</i>	Umbrella Sedge	E
Fabaceae (Faboideae)	<i>Glycine tabacina</i>	Variable Glycine	Other (OG)
Fabaceae (Faboideae)	<i>Trifolium repens</i>	White Clover	E
Fabaceae (Faboideae)	<i>Trifolium repens</i>	White Clover	E
Fabaceae (Faboideae)	<i>Vicia spp.</i>	Vetch	E
Fabaceae (Mimosoideae)	<i>Acacia falcata</i>	-	Shrub (SG)
Fabaceae (Mimosoideae)	<i>Acacia parramattensis</i>	Parramatta Wattle	Tree (TG)
Lobeliaceae	<i>Pratia purpurascens</i>	Whiteroot	Forb (FG)
Malvaceae	<i>Sida rhombifolia</i>	Paddy's Lucerne	E
Moraceae	<i>Ficus rubiginosa</i>	Port Jackson Fig	Tree (TG)
Myrtaceae	<i>Angophora floribunda</i>	Rough-barked Apple	Tree (TG)
Myrtaceae	<i>Corymbia citriodora</i>	Lemon-scented Gum	E
Myrtaceae	<i>Corymbia maculata</i>	Spotted Gum	Tree (TG)
Myrtaceae	<i>Eucalyptus crebra</i>	Narrow-leaved Ironbark	Tree (TG)
Myrtaceae	<i>Eucalyptus eugenioides</i>	Thin-leaved Stringybark	Tree (TG)
Myrtaceae	<i>Eucalyptus fibrosa</i>	Red Ironbark	Tree (TG)
Myrtaceae	<i>Eucalyptus moluccana</i>	Grey Box	Tree (TG)
Myrtaceae	<i>Eucalyptus tereticornis</i>	Forest Red Gum	Tree (TG)

Family	Scientific Name	Common Name	Growth form or exotic
Myrtaceae	<i>Syncarpia glomulifera</i>	Turpentine	Tree (TG)
Oleaceae	<i>Olea europaea subsp. Cuspidata</i>	African Olive	E
Oxalidaceae	<i>Oxalis perennans</i>	-	Forb (FG)
Phytolaccaceae	<i>Phytolacca octandra</i>	Inkweed	E
Pinaceae	<i>Pinus radiata</i>	Radiata Pine	E
Pittosporaceae	<i>Bursaria spinosa</i>	Native Blackthorn	Shrub (SG)
Plantaginaceae	<i>Plantago lanceolata</i>	Lamb's Tongues	E
Poaceae	<i>Bromus catharticus</i>	Praire Grass	E
Poaceae	<i>Chloris gayana</i>	Rhodes Grass	E
Poaceae	<i>Cynodon dactylon</i>	Common Couch	Grass & grasslike (GG)
Poaceae	<i>Ehrharta erecta</i>	Panic Veldtgrass	E
Poaceae	<i>Eragrostis curvula</i>	African Lovegrass	E
Poaceae	<i>Microlaena stipoides</i>	Weeping Grass	Grass & grasslike (GG)
Poaceae	<i>Opismenus aemulus</i>	-	Grass & grasslike (GG)
Poaceae	<i>Paspalum dilatatum</i>	Paspalum	E
Poaceae	<i>Phyllostachys aurea</i>	Fishpole Bamboo	E
Poaceae	<i>Setaria parviflora</i>	-	E
Poaceae	<i>Sporobolus creber</i>	Slender Rat's Tail Grass	Grass & grasslike (GG)
Solanaceae	<i>Lycium ferocissimum</i>	African Boxthorn	E
Solanaceae	<i>Solanum mauritianum</i>	Wild Tobacco Bush	E
Solanaceae	<i>Solanum pseudocapsicum</i>	Madeira Winter Cherry	E
Solanaceae	<i>Solanum sisymbriifolium</i>	-	E
Urticaceae	<i>Urtica dioica</i>	Giant Nettle	E
Verbenaceae	<i>Verbena bonariensis</i>	Purpletop	E

E=Exotic.

