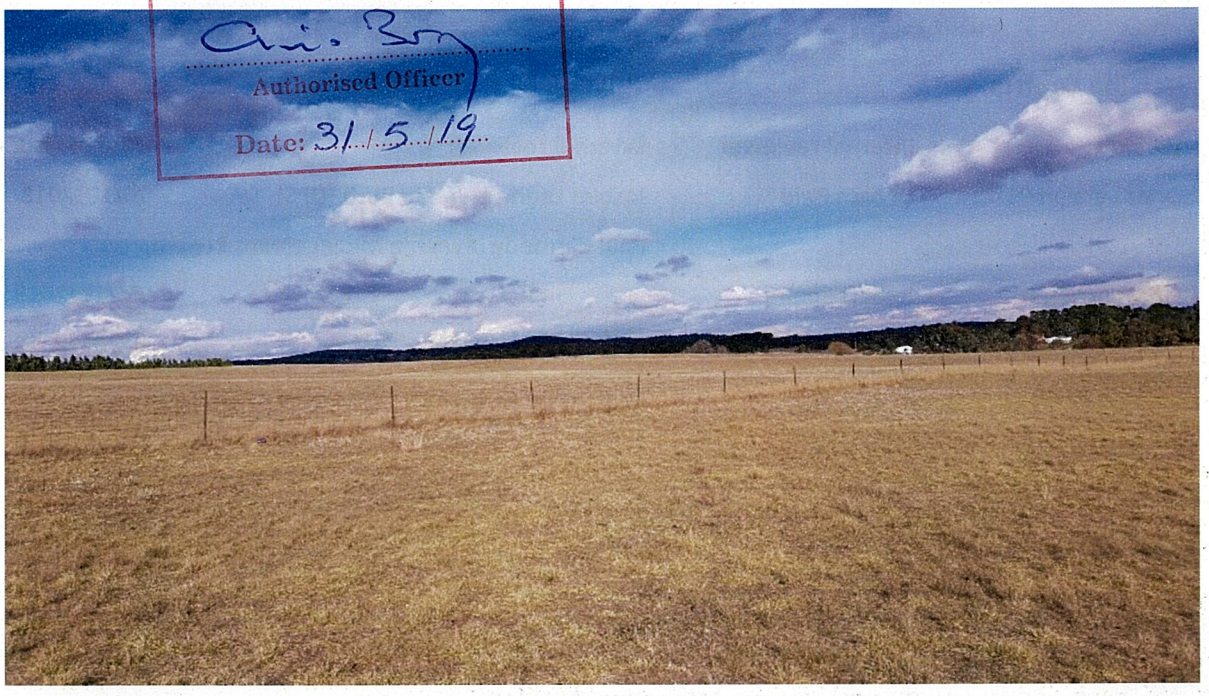
capital ecology



Fifty Lot Subdivision of 4056-4078 Gundaroo Road, Gundaroo, NSW

Biodiversity Development Assessment Report

Final – January 2019

Prepared for Kyeema Management Pty Ltd

Document Information

Report for: Kyeema Management Pty Ltd

Prepared by: Robert Speirs and Sam Reid

Capital Ecology project no.: 2812

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- Paul Carmody, Director, Kyeema Management Pty Ltd
- Joshua Laurie, Surveying Assistant, Diverse Project Solutions
- Jamie Bush, Project Surveyor, Diverse Project Solutions
- Rod Pietsch, Senior Threatened Species Officer, OEH Queanbeyan.

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Executive Summary

Kyeema Management Pty Ltd is progressing with the planning and approval process to subdivide 4056–4078 Gundaroo Road, Gundaroo, NSW (the 'proposed development' of the 'subject land'). Capital Ecology Pty Ltd (Capital Ecology) was commissioned by Kyeema Management Pty Ltd to complete the necessary biodiversity surveys and prepare this Biodiversity Development Assessment Report (BDAR) to identify and assess the significance of the impacts that the proposed development will have on the biodiversity values of the subject land.

Scope

Although general biodiversity values are identified and considered, the primary purpose of this BDAR is to present the results of Capital Ecology's application of the NSW Biodiversity Assessment Method (BAM) to assess the significance of the impacts of the proposed development on biota listed as threatened under the *NSW Biodiversity Conservation Act 2016* (BC Act). This BDAR also includes assessment of the potential impacts of the proposed development on Matters of National Environmental Significance (MNES) listed pursuant to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Survey overview

The following two ecological surveys were performed.

- A Golden Sun Moth larvae survey undertaken by Capital Ecology on 12 July 2018 and 21 August 2018.
- A biodiversity assessment undertaken by Capital Ecology between 24 and 28 September 2018.

Vegetation and potential flora/fauna habitat were surveyed and mapped in accordance with the BAM, and the Golden Sun Moth larvae surveyed following a protocol approved by the NSW Office of Environment and Heritage.

Native vegetation

The subject land supports two Plant Community Types (PCTs).

- PCT 351 – Brittle Gum – Broad-leaved Peppermint – Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion.
- PCT 896 – Kangaroo Grass – Wallaby Grass – Snow Grass moist tussock grassland in the Monaro and the Southern Tablelands regions of the South Eastern Highlands Bioregion and NSW South Western Slopes Bioregion.

The subject land has been utilised for agriculture for an extended period and the current vegetation is highly modified. The majority of the subject land is intensively grazed by sheep, and each of the open paddocks has been historically cultivated and sown to crops and/or pasture. Only two paddocks have retained a substantially native groundstorey (i.e. > 25% perennial native groundcover), with the remainder clearly dominated by exotic pasture grasses and forbs. Native trees and shrubs have been

planted around the dwellings and along road verges and fence lines. None of planted native species naturally occur in the relevant grassland PCT, yet they do meet the definition of native vegetation under the BC Act as they are native to NSW.

Threatened species

Field surveys confirmed that no threatened flora species occur on the subject land, and that the subject land does not contain any habitat currently occupied or of potential significance to any threatened fauna species. The three remnant Brittle Gums, which will be retained and protected, contain hollows which were occupied during the surveys by Common Starling and Crimson Rosella. Notably, these trees were not occupied by any threatened bird species, nor were any such species observed on the subject land during surveys.

No Golden Sun Moth larvae or pupae were recorded during the Golden Sun Moth larvae survey. As indicated by previous surveys for Golden Sun Moth larvae, the discovery rate of larvae in low density areas is 0.1 larvae per tussock or 0.75 larvae per person hour. Based on the number of tussocks sampled (384 tussocks) and person hours (24 hours), a minimum of 18 - 39 larvae should have been detected if present at low density within the potential habitat on the subject land. In light of the above, it is concluded that the subject land does not support the Golden Sun Moth.

Impacts

The proposed development will impact 29.75 ha of vegetation, 7.29 ha of which meets the BC Act definition of native vegetation. The remainder is highly modified exotic pasture. None of the remaining three remnant trees will be removed. The proposed development will not impact any threatened ecological community (TEC) or threatened species.

The proposed development will not result in any other direct impacts on native vegetation or habitat.

The subject land does not contain any vegetation with a vegetation integrity score that requires offsetting for impacts on a TEC or ecosystem credit species, nor does it support habitat of potential significance to any species credit species. Accordingly, biodiversity risk weighting is not of relevance to the subject land.

The subject land does not support any ecological community listed as a serious and irreversible impacts (SAII) entity, nor does it contain habitat of potential significance to any threatened flora or fauna species listed as a SAII entity. Accordingly, the proposed development will not result in a SAII on any BC Act listed entity.

The proposed development is unlikely to result in biodiversity impacts that are unforeseen or uncertain.

Commonwealth EPBC Act

The proposed development is unlikely to have a significant impact on a EPBC Act listed MNES given the subject land does not:

- support any EPBC Act listed ecological communities;
- support any EPBC Act listed flora species; or

- contain habitat of potential importance to EPBC Act listed threatened or migratory fauna species.

In light the above, EPBC Act referral is unwarranted and is not recommended.

Credit calculations

None of the vegetation zones of either of the PCTs in the proposed impact area (nor elsewhere on the subject land) have a vegetation integrity score sufficient for their clearance to result in generation of ecosystem credits. Accordingly, the proposed development does not generate an ecosystem credit obligation.

The subject land does not support habitat of potential significance to any species credit species. Accordingly, the proposed development does not generate a species credit obligation.

1 Introduction

Kyeema Management Pty Ltd is currently progressing with the planning and approval process to subdivide 4056–4078 Gundaroo Road, Lots 1 and 2 DP850916, Gundaroo, NSW (the 'proposed development'). Capital Ecology Pty Ltd (Capital Ecology) has been commissioned by Kyeema Management Pty Ltd to complete the necessary biodiversity surveys and prepare this Biodiversity Development Assessment Report (BDAR) to identify and assess the significance of the impacts that the proposed development will have on the biodiversity values of the subject land.

A development application (DA185092) was approved by Yass Council on 19 December 2018 for the subdivision and subsequent development for residential purposes of the south eastern portion of Lot 1 DP850916. Capital Ecology[1] prepared the BDAR which accompanied that development application. The subject land for that BDAR included not only the impact areas, but the entirety of Lots 1 and 2 DP850916, Gundaroo, NSW. Accordingly, the ecological surveys conducted during the development of that BDAR are used here to determine the impact of the proposed development as described in this report.

Although general biodiversity values are identified and considered, the primary purpose of this BDAR is to present the results of Capital Ecology's application of the NSW *Biodiversity Assessment Method* (BAM) (NSW Government 2017a[2]) to assess the significance of the impacts of the proposed development on biota listed as threatened under the NSW *Biodiversity Conservation Act 2016* (BC Act). This BDAR also includes assessment of the potential impacts of the proposed development on Matters of National Environmental Significance (MNES) listed pursuant to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

1.1 Subject Land

The 'subject land' for this BDAR is the property knows as "Kyeema" located at 4056–4078 Gundaroo Road, Gundaroo, NSW. The subject land encompasses a total area of 63 ha comprising Lots 1 and 2 DP850916. As shown in Figures 1 and 2, the subject land is bordered by Gundaroo Road to the west and the village of Gundaroo to the south. Mcleods Creek runs east to west through the southern portion of the subject land before draining into the Yass River approximately 400 m to the west.

Located in the Yass Valley Local Government Area (LGA), pursuant to the Yass Valley Local Environment Plan 2013 (Yass LEP), the subject land is comprised of the following zonings[3]:

- RU 1 – Primary Production
- R2 – Low Density Residential

[1] Capital Ecology (2018). *Subdivision of 4056-4078 Gundaroo Road, Gundaroo, NSW – Biodiversity Development Assessment Report*. Final – October 2018. Prepared for Kyeema Management Pty Ltd. Authors: R. Speirs & Sam Reid. Project no. 2812.
[2] NSW Government (2017a). *Biodiversity Assessment Method*. NSW Office of Environment and Heritage. Published LW 25 August 2017.
[3] Yass Valley Local Environment Plan (2013). Land Zoning Map - Sheet LZN_005E.

- E4 – Environmental Living
- E3 – Environmental Management
- E2 – Environmental Conservation

The elevation of the subject land ranges from 613 m Australian Height Datum (AHD) on the hill at the eastern boundary to 574 m AHD where Mcleods Creek runs from the subject land and under Gundaroo Road.

The built infrastructure on the subject land currently includes the Kyeema homestead and associated buildings together with a second smaller dwelling approx. 200 m to the southeast of the homestead. The subject land contains two farm dams, one being the large dam constructed on Mcleods Creek. Stock fences in a generally good condition divide the subject land into numerous paddocks.

1.2 Proposed Development

The proposed development involves the subdivision of the subject land and the subsequent development for residential purposes of portions of Lot 1 and 2 DP850916. As shown in the Plan of Subdivision (DPS 2019[4]), included herein as Figure 2, the proposed development will subdivide portions of the subject land to create 50 new lots. These lots range in size from 2,000 m^2 to 3,000 m^2 on land zoned 'R2 – Low Density Residential' with a minimum lot size[5] of 'V – 2,000 m^2'. Clearance of vegetation and other construction related impacts will occur for the creation and servicing of Lots.

The proposed development also includes the construction of a sewerage treatment plant and associated treated effluent irrigation areas in the north of Lot 1 DP850916 (Figure 2). As described in Decentralised Water Consulting (2018)[6]:

> *'the preferred servicing approach for the development is a Septic Tank Effluent Pump (STEP) / Septic Tank Effluent Gravity (STEG) effluent sewer conveying primary treated effluent to a central Sewage Treatment Plant (STP) consisting of an Advantex™ Recirculating Packed Bed Reactor, wet weather storage facility and reuse by irrigation of non-edible crop, pasture or woodlot.'*

With respect to biodiversity issues, the proposed sewerage treatment plant and deficit (i.e. 100% reuse) irrigation system have been designed to be consistent with planning and regulatory requirements and include a series of safeguards to eliminate the risk posed by surface runoff, groundwater contamination, and impacts on plant and animal health.

The proposed sewerage treatment plant and treated effluent irrigation areas are included within the proposed development impact area of this BDAR (Figure 3).

In addition, the area in the south eastern portion of Lot 1 DP850916 which has already been approved for development is included within the proposed development impact area of this BDAR (Figure 3).

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[4] Diverse Project Solutions (2019). *Plan of Subdivision – Lots 3, 11 to 13 DA185092, 4056-4078 Gundaroo Road, Gundaroo*.

[5] Yass Valley Local Environment Plan (2013). LEP Lot Size Map - Sheet LSZ_005E.

[6] Decentralised Water Consulting (2018). *Kyeema Subdivision (Stage 2): Sewage Management Plan.* Final Report, 18 December 2018.

Including this area ensures that all of the potential impacts within the subject land are appropriately considered.

Therefore, as shown in Figure 3, the proposed development impact area for this BDAR is 30.5 ha, comprised of the following.

- 15.39 ha for the proposed subdivision and creation of residential lots.
- 0.64 ha for the proposed sewerage treatment plant.
- 7.77 ha for the proposed treated effluent irrigation areas.
- 6.71 ha for areas already approved for residential development.

1.3 Commonwealth and State Assessment and Approval Processes

1.3.1 Commonwealth Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act is the key Commonwealth Government legislation for the protection and conservation of Australia's environment and biodiversity. The EPBC Act provides the legislative framework for the assessment and approval mechanism requiring that proposed 'actions' to be assessed in terms of their potential to impact upon 'Matters of National Environmental Significance' (MNES). MNES currently listed under the EPBC Act are:

- world heritage properties;
- national heritage places;
- wetlands of international importance (listed under the Ramsar Convention);
- threatened species and ecological communities;
- migratory species (protected under international agreements);
- Commonwealth marine areas;
- the Great Barrier Reef Marine Park;
- nuclear actions (including uranium mining); and
- a water resource, in relation to coal seam gas development and large coal mining development.

Where a potential impact on a MNES may occur as a result of a proposed action, the significance of that impact must be assessed. Guidelines for determining whether an impact is significant are provided by the Department of the Environment and Energy (Commonwealth of Australia 2013[7]). If it is determined that a proposed action will, or is likely to, have a significant impact on a MNES, the action must be referred to the Commonwealth Minister for the Environment. The Department will then consider the

[7] Commonwealth of Australia (2013). *Matters of National Environmental Significance - Significant Impact Guidelines 1.1. Environment Protection and Biodiversity Conservation Act 1999*. Commonwealth Department of the Environment.

referred action and the Minister (or his/her Delegate) will make a determination regarding whether the action requires approval under the EPBC Act and associated conditions and controls.

The following website provides further information regarding the EPBC Act referral and approval process: http://www.environment.gov.au/epbc/index.html

1.3.2 NSW Biodiversity Conservation Act 2016

The NSW *Biodiversity Conservation Act 2016* (BC Act) commenced on 25 August 2017, the purpose of which is "*to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development*" (BC Act Part 1, Section 1.3). The BC Act outlines the NSW framework for addressing impacts on biodiversity from development and clearing. Supported by the NSW *Biodiversity Conservation Regulation 2017* (BC Regulation), the BC Act establishes a framework to avoid, minimise and offset impacts on biodiversity from development through the Biodiversity Offsets Scheme (BOS).

1.3.2.1 NSW Biodiversity Offset Scheme

The BOS creates a transparent, consistent and scientifically based approach to biodiversity assessment and offsetting for all types of development that are likely to have a significant impact on biodiversity. The BOS aims to ensure a no-net-loss outcome for biodiversity by applying a framework which requires that impacts are first avoided and minimised, and where this cannot be fully achieved, residual impacts must be offset. The BOS also establishes Biodiversity Stewardship Agreements (BSAs), which are voluntary in-perpetuity agreements entered into by landholders, to secure and manage offset sites for biodiversity conservation. The two key elements of the BOS are as follows.

1. A developer, landholder etc. who undertakes an activity (i.e. development, clearing, other impact) which generates a credit obligation must retire the necessary credits to offset their activity.

2. A landholder who establishes a biodiversity stewardship site on their land generates credits which may be sold to developers or landholders who require those credits to offset their credit obligation.

Under the BC Act, the BOS is triggered for proposed development or clearing which:

- will occur on or otherwise impact land identified on the Biodiversity Values Map; and/or
- will exceed the native vegetation clearance threshold for the minimum lot size associated with the zoning of the subject land; and/or
- may significantly impact one or more BC Act listed entities (i.e. threatened species or ecological communities).

1.3.2.2 NSW Biodiversity Assessment Method

The NSW Biodiversity Assessment Method (BAM) is the assessment manual that outlines how an accredited person (i.e. a BAM Assessor) assesses impacts on biodiversity at development sites and biodiversity stewardship sites. The BAM is a scientific document that provides:

- a consistent (standard) method for the assessment of the biodiversity values of a proposed development site, major project site, or vegetation clearing site;
- guidance on how a proponent (i.e. developer, landholder) can avoid and/or minimise potential biodiversity impacts; and
- the number and class of biodiversity credits that need to be offset to achieve a standard of 'no net loss' of biodiversity values.

The BAM is supported by the online BAM Calculator, into which a BAM Assessor enters the data from desktop and field investigations to determine the number and class of biodiversity credits generated:

- as an obligation for development/clearance, this obligation must be addressed by the proponent to secure approval for the development/clearance; or
- by the establishment and management of a biodiversity stewardship site, these credits being a commodity that may be sold.

The BAM determines the following two types of credits on both development/clearance sites and stewardship sites.

- Ecosystem credits, these are credits generated for impacts on, or conservation of:
  - threatened ecological communities; and
  - threatened species habitat for species that can be reliably predicted to occur within a given plant community type (PCT) (referred to in the BAM as 'ecosystem credit species').
- Species credits, these are credits generated for impacts on, or conservation of, individuals and/or the habitat of threatened species which cannot be reliably predicted to occur in a given PCT (referred to in the BAM as species credit species).

The BAM Assessor documents the results of the biodiversity assessment in a Biodiversity Assessment Report (BAR), of which there are the following three types.

- Biodiversity Development Assessment Report (BDAR). A BDAR is developed to assess the likely biodiversity impacts of a development or vegetation clearing proposal.
- Biodiversity Certification Assessment Report (BCAR). A BCAR is developed to assess the likely biodiversity impacts of conferring biodiversity certification over a specific area of land.
- Biodiversity Stewardship Site Assessment Report (BSSAR). A BSSAR is developed to assess the likely biodiversity conservation gain of establishing a specific area of land as a biodiversity stewardship site under a formal Biodiversity Stewardship Agreement.

1.4 Biodiversity Development Assessment Report

As prescribed under Part 6, Division 3, Section 6.12 of the BC Act, a BDAR is –

"a report prepared by an accredited person in relation to proposed development or activity that would be authorised by a planning approval, or proposed clearing that would be authorised by a vegetation clearing approval, that:

(a) assesses in accordance with the biodiversity assessment method the biodiversity values of the land subject to the proposed development, activity or clearing, and

(b) assesses in accordance with that method the impact of proposed development, activity or clearing on the biodiversity values of that land, and

(c) sets out the measures that the proponent of the proposed development, activity or clearing proposes to take to avoid or minimise the impact of the proposed development, activity or clearing, and

(d) specifies in accordance with that method the number and class of biodiversity credits that are required to be retired to offset the residual impacts on biodiversity values of the actions to which the biodiversity offsets scheme applies."

A BDAR prepared applying the BAM by an accredited BAM Assessor must accompany any development application for which the BOS is triggered. As detailed previously, the BOS is triggered for a proposed development which:

- will occur on or otherwise impact land identified on the Biodiversity Values Map; and/or
- will exceed the native vegetation clearance threshold for the minimum lot size associated with the zoning of the subject land; and/or
- may significantly impact one or more BC Act listed entities (i.e. threatened species or ecological communities).

With regard to the above, the smallest of the minimum lot size designations for the subject land is 'V 2,000 m^2'. Therefore, in accordance with Part 7, Clause 7.2 of the BC Regulation, as the proposed development will involve the clearance of approx. 7.29 ha of BC Act 'native vegetation' (defined in Part 5A of the *Local Land Services Act 2013* as plant species indigenous to NSW) (refer Figure 3 and Figure 7), a BDAR is required to assess the impacts of the proposed development. Also, the segment of Mcleods Creek and the large dam which occur in the south of subject land are identified on the Biodiversity Value Map https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BVMap.

The BAM provides a standard method for assessing the impacts of a development/clearance proposal. This theme should carry over to the resulting BDAR such that it is as concise as possible whilst still addressing all of the relevant elements of the BAM in order to provide a complete assessment of the proposed development. The size of the BDAR should reflect the complexity of the subject land's biodiversity values and the scale and nature of the proposed development.

1.4.1 Objectives and Format

Developed to reflect the format of the BAM, this BDAR comprises the following two broad parts.

- Part 1 – Biodiversity Assessment (BAM Stage 1), includes assessment of the:

- landscape context;
- native vegetation, threatened ecological communities (TECs), vegetation integrity; and
- habitat suitability for threatened species.

- Part 1 – Impact Assessment (BAM Stage 2), details the:
  - proposed measures to avoid, minimise and mitigate biodiversity impacts;
  - residual impacts (direct and indirect) of the proposed development; and
  - offset requirements relevant to the proposed development.

1.4.2 Technical Resources and Qualifications

This BDAR has been prepared by the following technical personnel:

- Robert Speirs – Director / Principal Ecologist

  BAppSc (Ecology), DipPM, MEIANZ, CEnvP-E, Accredited BAM Assessor (No: BAAS17089)

  Robert was project manager for this assessment and completed or closely supervised all field surveys, data entry, GIS mapping, BAM credit calculations, and report preparation.

- Dr Sam Reid – Consultant Ecologist

  BSc (Hons), PhD, MEIANZ

  Sam undertook field surveys, data entry, GIS mapping, and report preparation.

All surveys for this assessment were undertaken in accordance with the following.

- Capital Ecology's (Robert Speirs – Principal Investigator) Animal Research Authority (ARA) granted under the NSW Animal Research Act 1985 by the NSW Department of Primary Industries Secretary's Animal Care and Ethics Committee (TRIM 15/2046).
- Capital Ecology's NSW Scientific Licence issued by the NSW Office of Environment and Heritage under s 132 C of the NSW National Parks and Wildlife Act 1974 (SL101623).

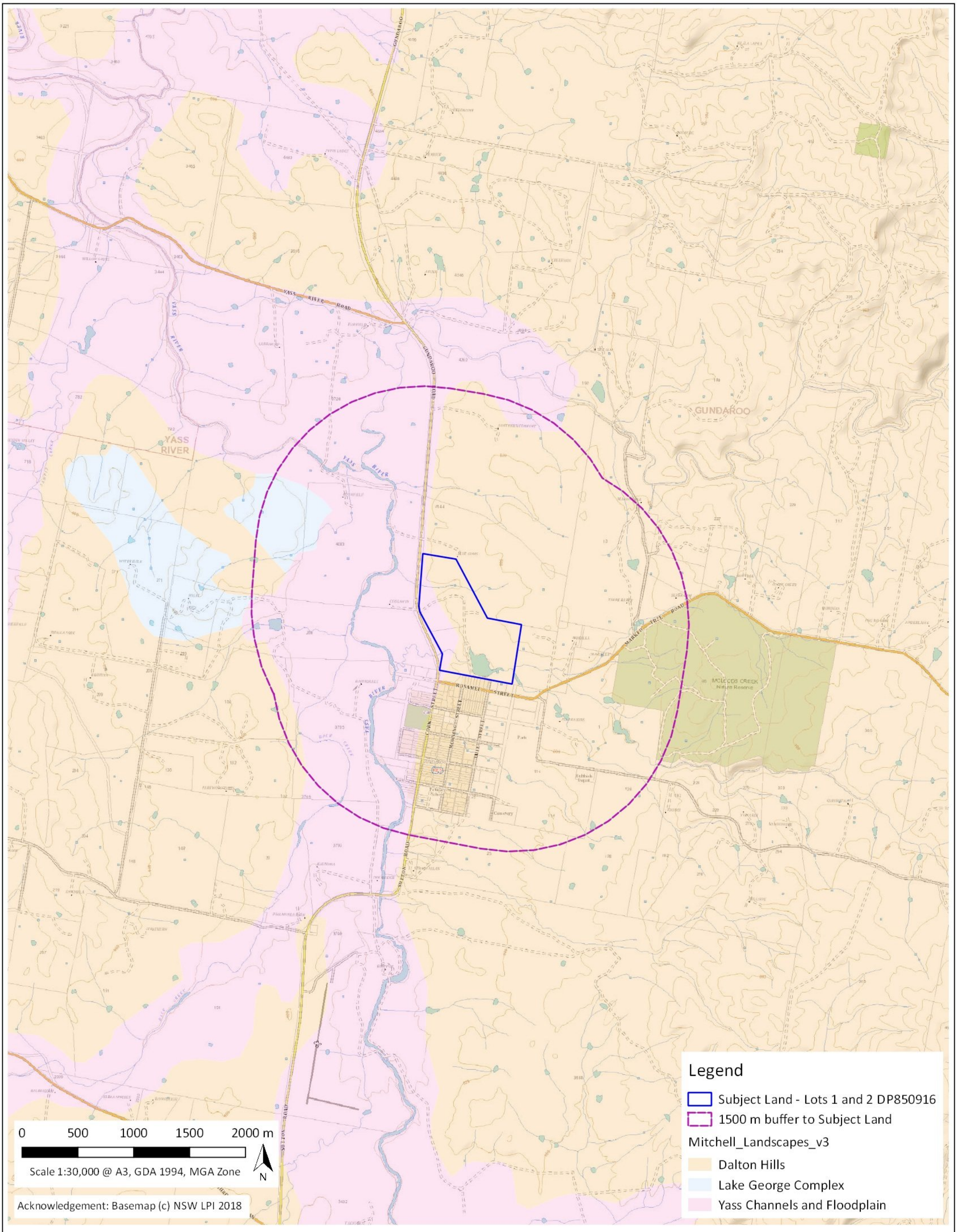

Figure 1. Locality Plan

Capital Ecology Project No: 2812
Drawn by: S. Reid
Date: 16 October 2018

Figure 2. Proposed Development

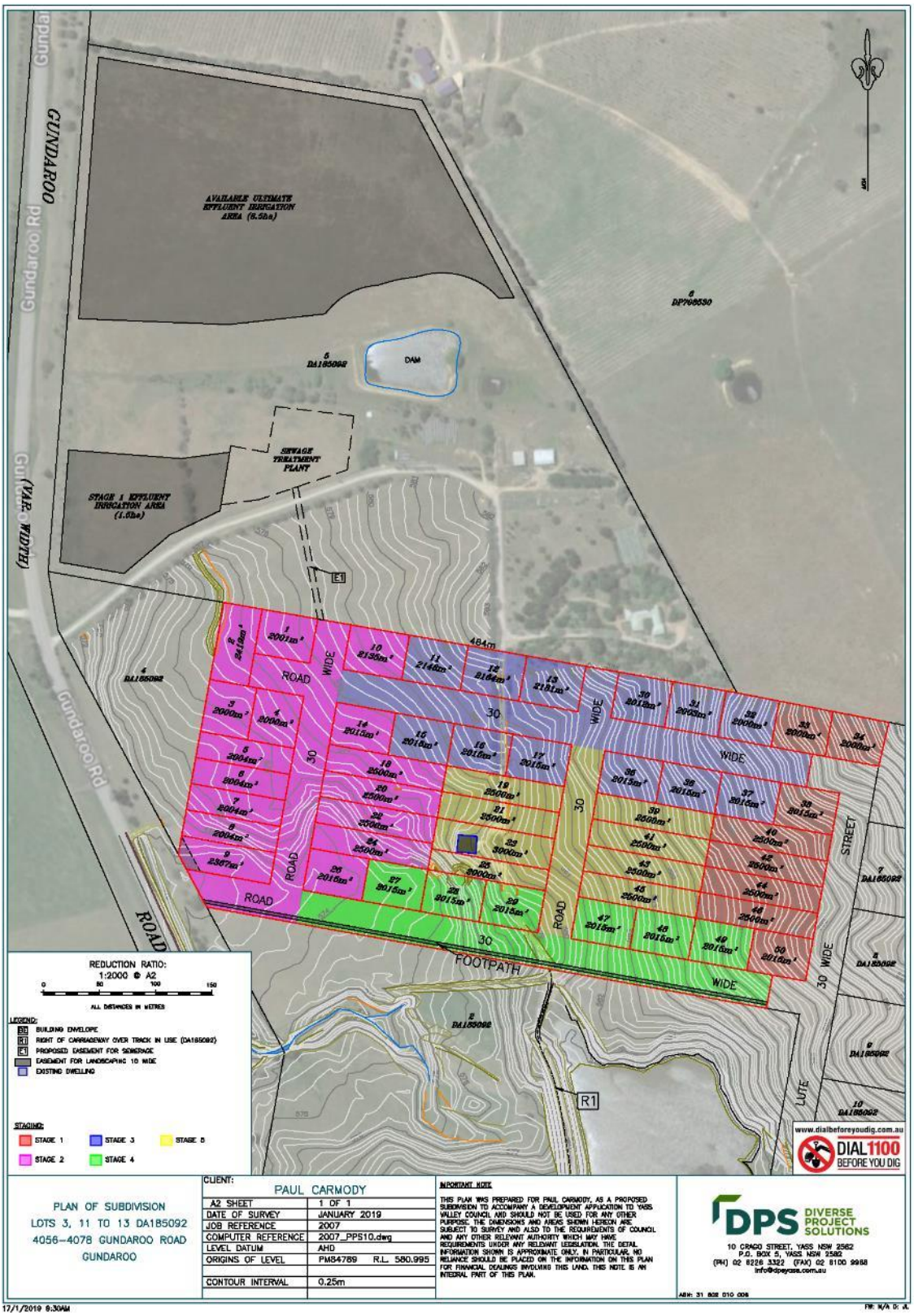

Figure 3. Proposed Development Impact Area

Capital Ecology Project No: 2812
Drawn by: S. Reid
Date: 18 January 2019

2 Part 1 – Biodiversity Assessment (BAM Stage 1)

Part 1 of this BDAR provides an assessment of the biodiversity values of the subject land as set out in Stage 2 of the BAM.

2.1 Landscape Context

As detailed in Chapter 4 of the BAM, a range of landscape features must be identified where they occur on the subject land or within the assessment area surrounding the subject land. These features may contain/support biodiversity values that are important for the site context of the subject land, or for informing the likely habitat suitability of the subject land. Table 1 outlines the landscape features and overall landscape context of relevance to the subject land.

Table 1. Landscape features

Landscape Feature	Description	Figure Reference
IBRA bioregion	The subject land is located in the **South Eastern Highlands** IBRA bioregion.	-
IBRA subregion	The subject land is located in the **Murrumbateman** IBRA subregion.	-
BioNet NSW landscapes (Mitchell landscapes)	As shown in Figure 1, the subject land contains the following Mitchell Landscapes: • **Yass Channels and Floodplain** (approx. 15% of the subject land, generally comprising the buffer to the Yass River floodplain); and • **Dalton Hills** (the balance, approx. 85% of the subject land). As per pg. 7 of OEH (2018), Dalton Hills has been used as the Mitchell Landscape for this BDAR as it covers the majority of the subject land and the entire impact area.	Figure 1
Rivers, streams and estuaries (Strahler[8] stream order)	Mcleods Creek, a 3rd order stream (defined based on the NSW LPI Hydrology Map and as per Appendix 3 of the BAM) that flows east to west through the southern portion of the subject land (refer Figure 4). Another small unnamed ephemeral drainage line (1st order stream) is mapped as running east to west through the northern portion of the subject land. Each of these streams flow to Yass River approximately 400 m to the east of the subject land. The unnamed stream has no aquatic habitat and is an unformed drainage line running across cultivated paddocks. This stream and the associated small farm dam are unlikely to be of substantial habitat value to aquatic fauna. The segment of Mcleods Creek within the subject land is highly modified and generally dominated by exotic fringing vegetation (Phalaris *Phalaris aquatica*, Willow *Salix* sp.), with one large clump of Common Reed *Phragmites australis* and numerous smaller patches of other native aquatic macrophytes. The large dam created on Mcleods	Figure 3 Figure 4

[8] Strahler, AN (1952). *Hypsometric (area-altitude) analysis of erosional topology*. Geological Society of America Bulletin 63 (11): 1117–1142.

Landscape Feature	Description	Figure Reference
	Creek provides a permanent water source and habitat feature likely to be of value to numerous waterbird species, as well as several common frogs, reptiles and fish.	
Wetlands (important wetlands)	The subject land does not contain any important wetlands as listed in the Directory of Important Wetlands in Australia (DIWA) or coastal wetlands protected under State Environmental Planning Policy No 14. Notes regarding the farm dams on the subject land are provided above.	-
Connectivity	The majority of the subject land would have historically been vegetated by natural grasslands, and only the hill crests would have once supported woody vegetation communities. The land use history of the subject land has generally replaced the previous native/natural groundstorey vegetation with exotic species (i.e. Phalaris, Cocksfoot *Dactylis glomerata*, Clovers *Trifolium* spp. and other pasture species). The three remnant Brittle Gum E*ucalyptus mannifera* are all that remains of the subject land's previous woody vegetation. All other woody vegetation (native and exotic) has been planted for amenity and to serve as windbreaks. The Willows and Poplars *Poplus* sp. along Mcleods Creek are likely self-sown. Whilst the extensive native tree and shrub plantings on the subject land are likely to be of some habitat value to numerous native bird species, they do not constitute or comprise part of a recognised biodiversity corridor[9] or other notable habitat connectivity feature.	Figure 5 Figure 6
Areas of geological significance and soil hazard	The subject land does not contain/support any karst, caves, crevices, cliffs or other areas/features of geological significance. There are no hazard soil features.	-
Areas of outstanding biodiversity value	The subject land does not support or occur near any declared area of outstanding biodiversity value (AOBV).	-
Percent native vegetation cover (buffer area)	A 1,500 m buffer was applied to the subject land resulting in an overall buffer area of 1,290 ha. This buffer area contains both woody PCTs (i.e. woodland, dry sclerophyll forest) and non-woody PCTs (i.e. natural grassland). Accordingly, the following two categories of native vegetation were defined to identify the total are of native vegetation in the buffer. 1. Woody vegetation – The areas which have a woody PCT and retain remnant woody vegetation or woody regrowth. 2. Non-woody vegetation – The areas which either: a. have a grassland PCT and retain at least a substantial proportionate cover (i.e. > 25%) of native groundstorey species; or b. have a woody PCT from which the woody vegetation has been cleared, yet at least a substantial proportionate cover	Figure 5

[9] Yass Valley Local Environment Plan (2013). *Natural Resources Biodiversity Map - Sheet NRB_005*.

Landscape Feature	Description	Figure Reference
	(i.e. > 25%) of native groundstorey species remains (often referred to as derived or secondary grassland). Native vegetation cover was first identified and mapped via interpretation of the available aerial imagery (NSW LPI). The presence of remnant canopy trees, cultivation patterns in paddocks, abnormally green and/or uniform groundstorey vegetation etc., were important factors considered during aerial interpretation. Field reconnaissance was then undertaken to ground truth and refine the mapping. This field reconnaissance involved driving the publicly accessible roads within the buffer area and making observations across paddocks etc. from the roadside. As shown in Figure 5, several paddocks in the buffer area have been cultivated in recent years and the Christmas Tree plantation to the north of the subject land has expanded. The mapping of native vegetation cover reflects these changes as observed on the ground. 1. Woody vegetation cover – 278 ha (22%) of the buffer area was determined to support native woody vegetation cover. 2. Non-woody vegetation cover – 263 ha (20%) of the buffer area was determined to support native non-woody vegetation cover. ↓ Total native vegetation cover – the total area of native vegetation cover in the buffer area is 541 ha (42%). This falls into the 30-70% cover class in the BAM Calculator.	

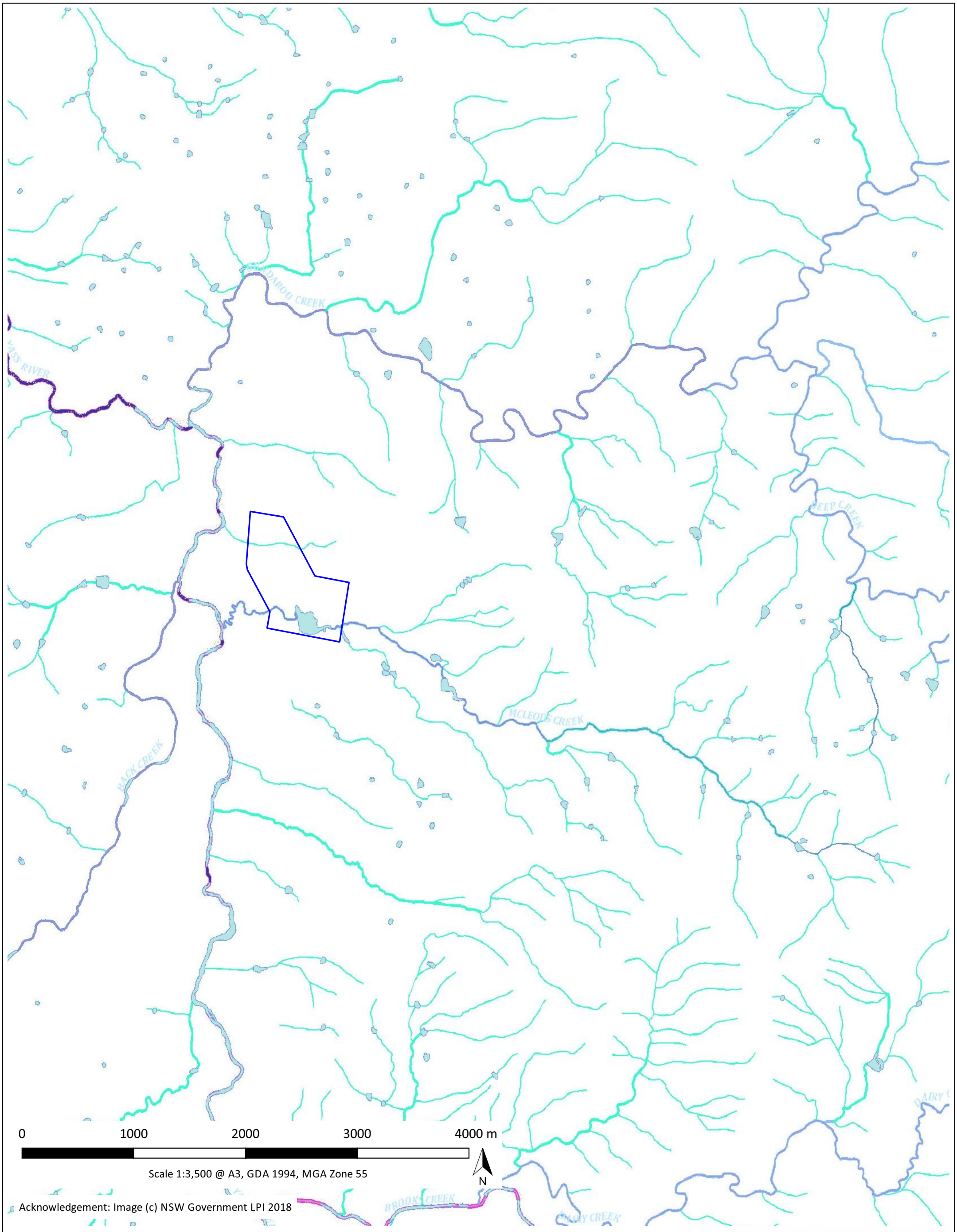

Figure 4. Hydrology

Legend

Subject Land - Lots 1 and 2 DP850916

capital ecology

Capital Ecology Project No: 2812
Drawn by: S. Reid
Date: 16 October 2018

0 250 500 750 1000 m

Scale 1:3,500 @ A3, GDA 1994, MGA Zone 55

N

Acknowledgement: Image (c) NSW Government LPI 2018

Figure 5. Site Map

Legend

- Subject Land - Lots 1 and 2 DP850916
- 1500 m buffer to Subject Land
- 1500 m Buffer - Woody Native Vegetation
- 1500 m Buffer - Non-woody Native Vegetation

Capital Ecology Project No: 2812
Drawn by: S. Reid
Date: 16 October 2018

capital ecology

2.2 Native Vegetation, Threatened Ecological Communities and Vegetation Integrity

2.2.1 Native vegetation extent

As per the BC Act, native vegetation is defined according to Part 5A of the *Local Land Services Act 2013* (LLS Act), which states:

> *"(1) For the purposes of this Part, native vegetation means any of the following types of plants native to New South Wales:*
>
> *(a) trees (including any sapling or shrub or any scrub),*
>
> *(b) understorey plants,*
>
> *(c) groundcover (being any type of herbaceous vegetation),*
>
> *(d) plants occurring in a wetland.*
>
> *(2) A plant is native to New South Wales if it was established in New South Wales before European settlement. The regulations may authorise conclusive presumptions to be made of the species of plants native to New South Wales by adopting any relevant classification in an official database of plants that is publicly accessible."*

As per this definition, planted vegetation which comprises plant species native to NSW, regardless of whether or not the species are indigenous to the specific region and/or PCT of the subject land, is classified as native vegetation.

The Commonwealth Government[10][11], ACT Government[12], and previous NSW Government[13] assessment guidelines for the temperate grassland and woodland PCTs of the NSW/ACT Southern Tablelands region each declare vegetation as native dominant if 50% or more of the perennial groundlayer is comprised of native species. However, no such threshold is defined by the BAM, and the Office of Environment and Heritage (OEH) have advised (Tobi Edmonds pers. comm., September 2018) that the criteria for use in determining native vs. exotic dominance must be more stringent than the previously applied 50/50 rule. It is understood that this is due to the potential for seasonal variation and/or assessor disparity to substantially alter the BAM mapping result. For example, a patch of vegetation that is classified as 55% native in one season may be classified as 45% native in another.

[10] Commonwealth of Australia (2006). *Policy Statement 3.5: White Box – Yellow Box – Blakely's Red Gum grassy woodlands and derived native grasslands*. Commonwealth Department of Environment and Heritage.
[11] Commonwealth of Australia (2016). Approved conservation advice for the Natural Temperate Grassland of the South Eastern Highlands (NTG–SEH) ecological community.
[12] ACT Government (2010). *Survey guidelines for determining lowland vegetation classification and condition in the ACT*. Environment and Sustainable Development Directorate – Conservation Planning and Research.
[13] NSW Government (2014). *BioBanking Assessment Methodology 2014*. NSW Government Office of Environment and Heritage.

With regard to the above, for the purposes of this BDAR (and the supporting BAM assessment):

1. 'Native vegetation' is defined as any plant, naturally occurring or planted, which is native to NSW.
2. Exotic vegetation is defined as any plant which is not native to NSW.
3. A polygon of vegetation is 'native vegetation' if:
    a. 25% or more of the perennial groundlayer comprises species native to NSW; and/or
    b. species native to NSW are present in one or more of the other strata.

2.2.2 Vegetation survey and mapping methods

The vegetation throughout the entirety of the subject land was surveyed and mapped in accordance with the BAM (survey dates: 12 July 2018, 24 September 2018, and 28 September 2018). The methodology involved the following.

- Mapping of the on-ground boundaries of the Plant Community Types (PCTs).
- Stratification of each PCT into vegetation zones reflecting the broad condition state of vegetation.
- The completion of a series of surveys to measure the composition, structure, and function attributes of the vegetation.

These steps are described in more detail below. The full BAM and supplementary resources are available online via the OEH website https://www.environment.nsw.gov.au/biodiversity/assessmentmethod.htm.

2.2.2.1 Plant Community Type (PCT) mapping

The on-ground boundaries of each of the Plant Community Types (PCTs) present within the subject land were mapped by marking boundaries directly onto high resolution orthorectified aerial photograph field maps. The PCTs and their characteristics are provided in the NSW Vegetation Information System (VIS) https://www.environment.nsw.gov.au/research/Vegetationinformationsystem.htm.

The PCTs were identified, and their boundaries defined, based on the:

- presence, species, growth form and density of remnant canopy trees and/or stags or stumps of these;
- presence and species of midstorey shrubs and trees;
- floristic composition of the groundstorey; and
- the landscape position and other geographical features (elevation, aspect, soils, apparent hydrology).

2.2.2.2 Vegetation zone definition and mapping

The mapped PCTs were further divided into vegetation zones based on the structure, floristic composition and overall condition ('condition state') of the vegetation. The vegetation zones were mapped in the field and then digitised using GIS, which provided accurate calculations of the total area of each vegetation zone within the subject land.

2.2.2.3 Survey Plots/Transects

A series of a BAM plots (i.e. vegetation assessment survey plot/transect sets) were completed to adequately sample each vegetation zone (as per the minimum required plot numbers specified in Table 4 of the BAM). As illustrated in Diagram 8 from NSW Government (2018[14]), each BAM Plot involved:

a. one 20 x 20 m (400 m^2) plot, used to assess the composition and structure attributes;

b. one 20 x 50 m plot (1,000 m^2) plot, used to assess the function attributes; and

c. five 1 m^2 sub-plots, used to assess average little cover (and other optional groundcover components) for the plot.

All BAM plot locations were selected randomly within the vegetation zone, by marking on a map and walking to the location.

The number of BAM plots completed within each vegetation zone was determined as per the minimum required plot numbers specified in Table 4 of the BAM. As shown in Figure 6, this involved a total of seven plots across the four vegetation zones containing BC Act 'native vegetation'.

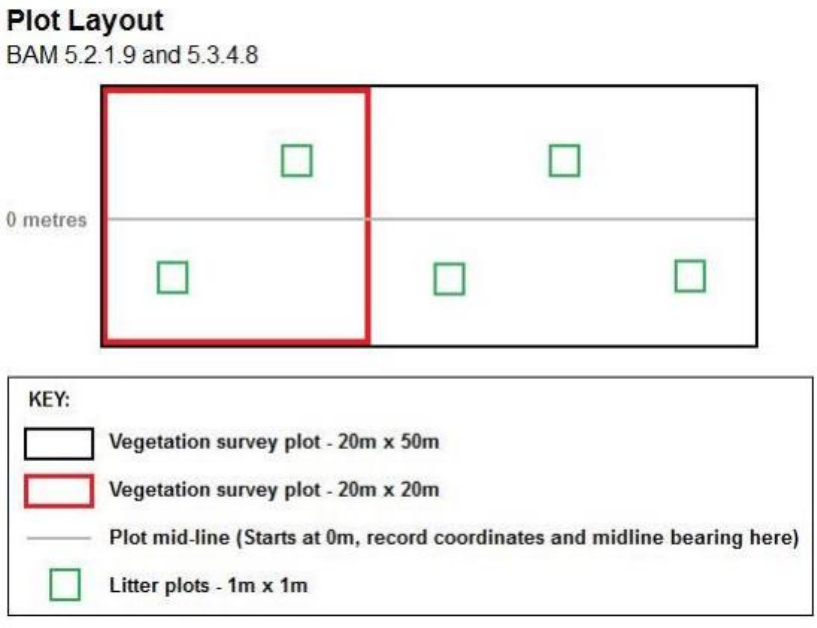

Figure 8 Plot layout to be used for site assessment

[14] NSW Government (2018). *Biodiversity Assessment Method Operational Manual – Stage 1*. State of New South Wales and Office of Environment and Heritage.

2.2.3 Vegetation survey and mapping results

2.2.3.1 Plant Community Type (PCT) mapping

Before European settlement the majority of the subject land would have been characterised by a naturally occurring grassland PCT, which would likely have merged with a dry sclerophyll forest PCT with increasing elevation (likely ecotone around the 595 m contour). However, the subject land has been utilised for agriculture for an extended period and the vegetation which occurs today is highly modified. The majority of the subject land is intensively grazed by sheep, and each of the open paddocks has been historically cultivated and sown to crops and/or pasture. Only two paddocks have retained a native dominant groundstorey (i.e. > 25% perennial native groundcover), with the remainder clearly dominated by exotic pasture grasses and forbs. Native trees and shrubs have been planted around the dwellings and along road verges and fence lines. None of planted native species naturally occur in the relevant grassland PCT, yet they do meet the definition of native vegetation under the BC Act as they are native to NSW (refer Section 2.2.1).

The two small patches of the dry sclerophyll forest PCT have been largely cleared and only three remnant trees remain (three old Brittle Gum *E. mannifera*, refer Figure 6). The midstorey and shrubstorey are entirely absent, and stock grazing has prevented regeneration of the remnant canopy eucalypts. The groundlayer across these patches consists of stock camps dominated by annual grasses and herbaceous weeds, and the only areas of BC Act native vegetation are those defined by the canopy of the three remnant trees.

The subject land supports two PCTs, as shown in Figure 6 and Table 2.

Table 2. PCTs recorded on the subject land.

PCT	PCT name	PCT description	Occurrence on subject land	TEC status Commonwealth / NSW	PCT % cleared
351	Brittle Gum – Broad-leaved Peppermint – Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion.	This community occurs on shallow, yellow to red podzolic clay to loam soils derived from sedimentary, metamorphic and igneous substrates on foot-slopes and hill-slopes. In its climax form this community would have been characterised by a canopy dominated by Brittle Gum, often with Red Stringybark, Broad-leaved Peppermint, Long-leaved Box, and occasionally Argyle Apple, with a sparse shrubstorey and sparse to moderately dense groundstorey supporting a moderate diversity of native forbs.	This PCT was mapped across the higher, hilled areas of the subject land.	Not listed	60%

PCT	PCT name	PCT description	Occurrence on subject land	TEC status Commonwealth / NSW	PCT % cleared
896	Kangaroo Grass – Wallaby Grass – Snow Grass moist tussock grassland in the Monaro and the Southern Tablelands regions of the South Eastern Highlands Bioregion and NSW South Western Slopes Bioregion.	This PCT is widespread on moist sites in the Southern Tablelands and NSW South Western Slopes, and in moist sites in the outer rim of the Monaro region, including the fringes of Monaro Tableland, and in the Southern Tablelands (Canberra, Yass, Crookwell, Goulburn, Braidwood and Bungendore districts). It occurs mainly on well-drained foot-slopes and mid-slopes on all lithologies.	This PCT was mapped across the of the lower-lying areas of the subject land, where cold air drainage and hydrology are likely to have led to a naturally treeless community dominated by native grasses and forbs.	Critically Endangered (Commonwealth) when occurring in a condition consistent with the listing criteria for *Natural Temperate Grassland of the Southern Tablelands of NSW and the Australian Capital Territory.* Not listed (NSW)	84%

2.2.3.2 Vegetation zones

As illustrated in Figure 6 and described in Section 2.2.3.1, PCT 351 contains two vegetation zones, each of which is characterised by a clearly exotic dominant groundstorey. The two vegetation zones are distinguished based on the presence (defined as 'Zone 1') or absence (defined as 'Zone 2') of an overstorey. PCT 896 contains five vegetation zones, which are characterised by a native dominant groundstorey (defined as 'Zone 1' and 'Zone 2'), or an exotic dominant groundstorey with either planted native trees and shrubs (defined as 'Zone 3'), exotic trees and riparian areas (defined as 'Zone 4'), or sown to exotic pasture (defined as 'Zone 5').

As shown in Tables 3 to 6, only the vegetation zones of each PCT which meet the definition of native vegetation as described in Section 2.2.1 were assessed to determine the vegetation integrity score (i.e. PCT 351 Zone 1, PCT 896 Zones 1-3). PCT 351 Zone 2 and PCT 896 Zone 5-6 are clearly dominated by exotic grasses and forbs (i.e. > 75% perennial exotic) and do not contain planted native trees and/or shrubs, and so as per Chapter 5 of the BAM they do not require assessment to determine a vegetation integrity score.

Table 3. PCT351 Zone 1 results summary.

	PCT 351 Zone 1
Description	Highly modified woodland. Observations of the PCT nearby suggest that Red Stringybark is likely to have once cooccurred with Brittle Gum, however only Brittle Gum remains. The midstorey and shrubstorey are absent, and the groundlayer is a clearly exotic stock camp dominated by Barley *Hordeum* sp. and Cock's Foot. Heavily grazed by sheep. The only remnant trees which remain on the subject land are three old Brittle Gum. All three occur in PCT 351 Zone 1 and are hollow-bearing.
Area	0.27 ha.
BAM plots assessed	1
Overstorey Species	Dominant = *E. mannifera.*
Overstorey Cover	Approx. 15%.
Overstorey Regeneration	No.
Perennial Groundlayer	0% native.
Significant Weeds	None.
EPBC Act and/or BC Act listed TEC	No.
BC Act Native Vegetation	Yes.

Table 4. PCT896 Zone 1 results summary.

	PCT 896 Zone 1
Description	Highly modified native pasture, with a low diversity native groundlayer dominated by Tall Speargrass *Austrostipa bigeniculata*. Contains no native forbs, and only disturbance tolerant native grasses remain. Moderate diversity of exotic grasses and forbs. Historically cultivated and now heavily grazed by sheep.
Area	6.78 ha.
BAM plots assessed	3
Overstorey Species	None.
Overstorey Cover	0%.
Overstorey Regeneration	None.
Perennial Groundlayer	53% - 81% native.
Significant Weeds	Serrated Tussock *Nassella trichotoma* (scattered tussocks, mostly sprayed) and Chilean Needle Grass *N. neesiana* (substantial patches, untreated).
EPBC Act and/or BC Act listed TEC	No.
BC Act Native Vegetation	Yes.

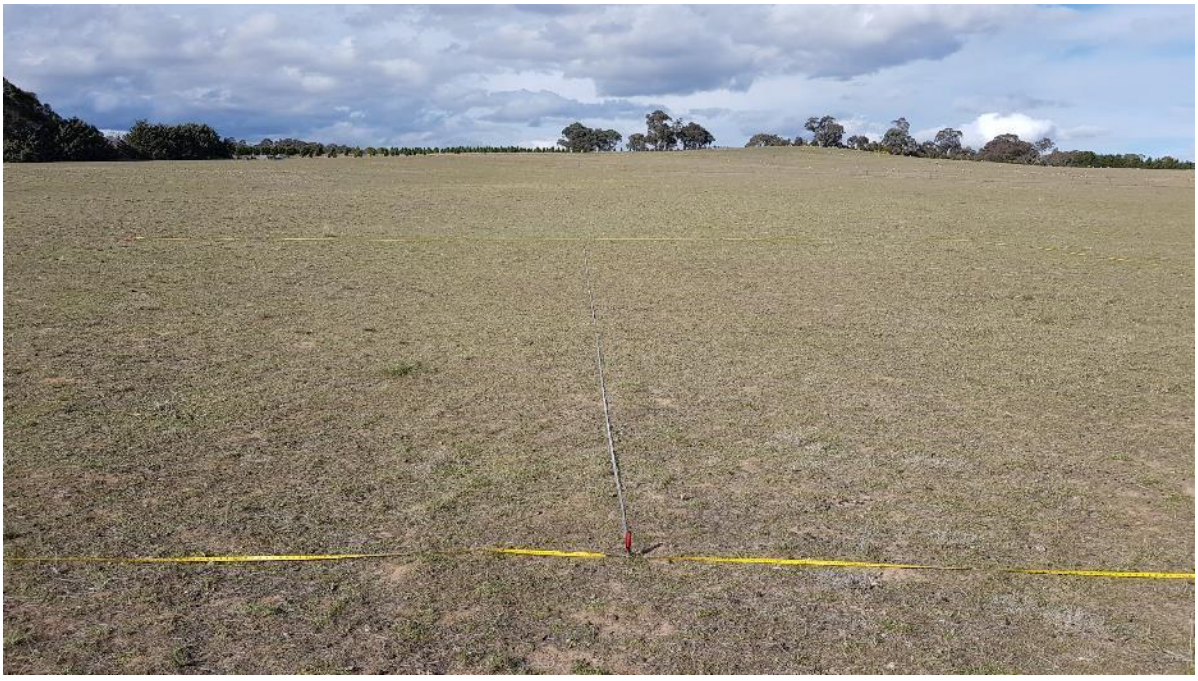

Table 5. PCT896 Zone 2 results summary.

	PCT 896 Zone 2
Description	Highly modified patch of vegetation boarding Mcleods Creek, with a low diversity native groundlayer dominated by Common Reed *Phragmites australis*.
Area	1.27 ha.
BAM plots assessed	1
Overstorey Species	None.
Overstorey Cover	0%.
Overstorey Regeneration	None.
Perennial Groundlayer	90% native.
Significant Weeds	None.
EPBC Act and/or BC Act listed TEC	No.
BC Act Native Vegetation	Yes.

Table 6. PCT896 Zone 3 results summary.

	PCT 896 Zone 3
Description	Largely restricted to road verges and fence lines. Highly modified exotic pasture, containing a diversity of planted native trees and shrubs. Low diversity exotic groundlayer dominated by exotic grasses such as Phalaris and Chilean Needle Grass. All planted trees are too young to be hollow-bearing.
Area	3.90 ha.
BAM plots assessed	2
Overstorey Species	Co-dominant = *A. dealbata*, *C. cunninghamiana, E. polyanthemous, E. mannifera.*
Overstorey Cover	Approx. 8% - 40%.
Overstorey Regeneration	None.
Perennial Groundlayer	0% - 7% native.
Significant Weeds	Chilean Needle Grass and African Lovegrass *Eragrostis curvula*.
EPBC Act and/or BC Act listed TEC	No
BC Act Native Vegetation	Yes

2.2.3.3 Patch size

As defined in the BAM, patch size is -

> *"an area of intact native vegetation that:*
>
> *a) occurs on the development site or biodiversity stewardship site, and*
>
> *b) includes native vegetation that has a gap of less than 100m from the next area of moderate to good condition native vegetation (or ≤30m for non-woody ecosystems).*
>
> *Patch size may extend onto adjoining land that is not part of the development site or biodiversity stewardship site."*

Where intact vegetation is defined as –

> *"vegetation where all tree, shrub, grass and/or forb structural growth form groups expected for a plant community type are present"*

With respect to the above, none of the native vegetation which occurs on the subject land (i.e. PCT 351 Zone 1 and PCT 869 Zone 1-3) meets the definition of intact vegetation as each of the identified vegetation zones lack some or all of the structural growth forms expected of their respective PCTs.

As such, including when vegetation from adjoining land is considered, the patch size for each identified vegetation zone of the subject land is zero (0).

2.2.3.4 Vegetation integrity scores

Table 7 presents the results of the BAM plot assessments and details the composition, structure, function, and resulting vegetation integrity score.

Table 7. Vegetation integrity scores.

	PCT 351 Zone 1	PCT 896 Zone 1	PCT 896 Zone 2	PCT 896 Zone 3
PCT	351	896	896	896
Zone (condition class)	1	1	2	3
Description	- Exotic groundstorey - Canopy - No regeneration	- Native groundstorey - Low diversity	- Native groundstorey of Common Reed	- Exotic groundstorey - Planted native trees and shrubs
Patch size	0	0	0	0
Area (ha)	0.27	6.78	1.27	3.90
BAM plots assessed	1	3	1	2
Composition condition score	1.6	7.2	1.0	13.2
Structure condition score	14.1	35.1	93.5	0
Function condition score	45.9	N/A - Grassland	N/A - Grassland	N/A - Grassland
Current vegetation integrity score	10.2	15.9	9.4	0.5

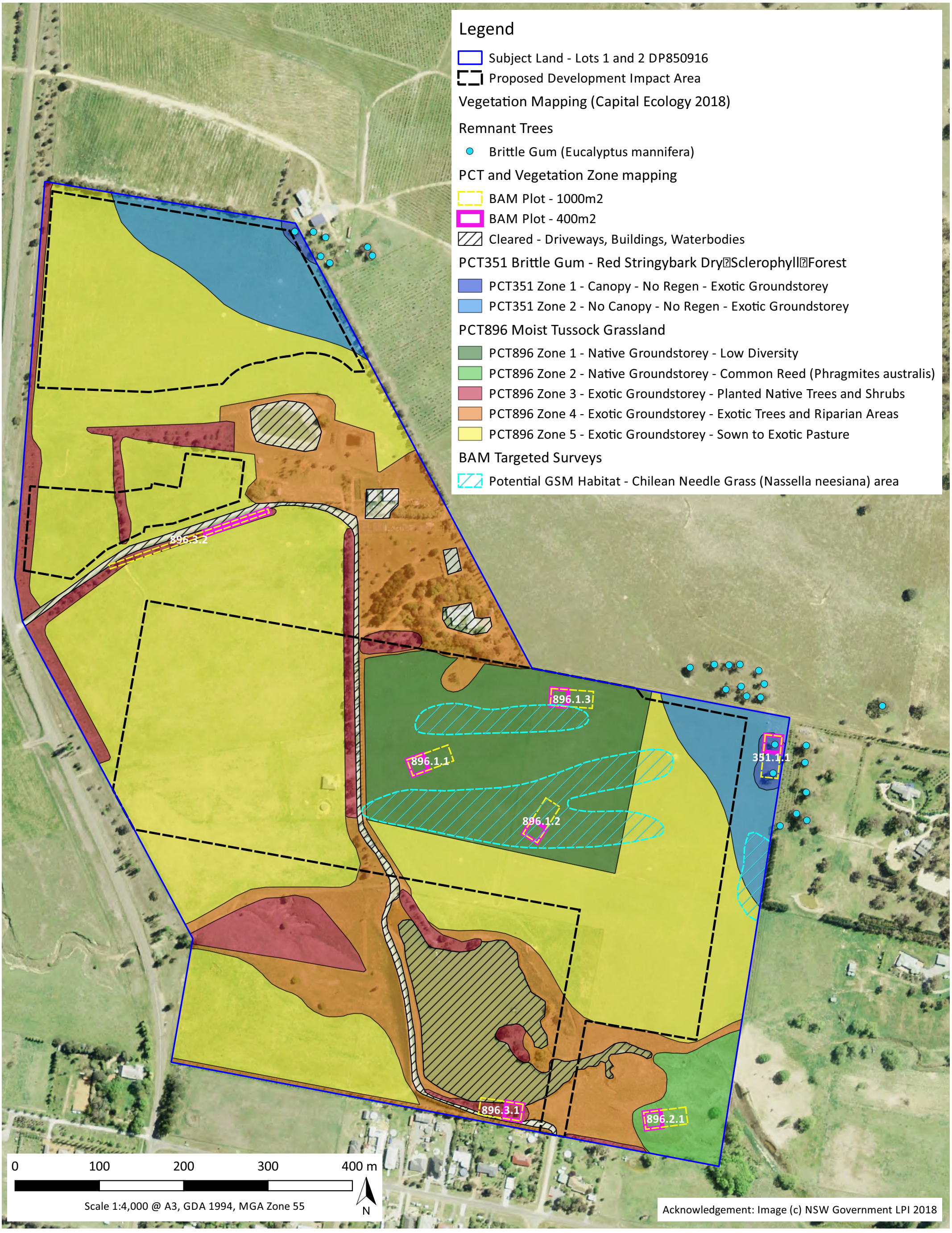

Figure 6. BAM Vegetation Mapping and Targeted Surveys

Capital Ecology Project No: 2812
Drawn by: S. Reid
Date: 18 January 2019

Figure 7. BC Act Native Vegetation

Legend

- Subject Land - Lots 1 and 2 DP850916
- Proposed Development Impact Area
- BC Act Native Vegetation

Capital Ecology Project No: 2812
Drawn by: S. Reid
Date: 18 January 2019

2.2.4 Threatened Ecological Communities

2.2.4.1 Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)

Two EPBC Act listed threatened communities have the potential to occur in the locality, both listed as critically endangered under the EPBC Act: 'Natural Temperate Grassland of the South Eastern Highlands' (Natural Temperate Grassland), and 'White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland' (Box-Gum Woodland). Based on the recorded vegetation types, plant species, landscape position, and the vegetation on adjoining and nearby properties, only Natural Temperate Grassland is considered to have the potential to occur on the subject land.

The *Approved conservation advice for the Natural Temperate Grassland of the South Eastern Highlands (NTG–SEH) ecological community* (Commonwealth of Australia 2016) provides the key diagnostic characteristics and condition thresholds for determining whether a patch is the listed community. A patch is the listed community if it meets either of the following scenarios.

Scenario A – The patch is characterised by at least 50% foliage cover of the ground of either Themeda triandra, Poa labillardierei, or Carex bichenoviana.

Scenario B – When the cover of the grassland is not evidently dominated by the species highlighted under Scenario A:

1. *The percentage cover of native vascular plants (including annual and perennial species) in the patch is greater than the percentage cover of perennial exotic species.*

   And

2. *When assessed during favourable sampling times (i.e. spring-summer), the patch has:*

   - *At least 8 non-grass native species*

     OR

   - *At least 2 indicator species*

     OR

   - *A floristic value score (FVS) of at least 5.*

While PCT 896 Zone 1 and Zone 2 are both native dominant (i.e. > 50% cover of native perennial species), they do not contain the specific species or sufficient diversity to meet the requirements of either Scenario A or Scenario B above. The remaining areas of PCT 896 are dominated by exotic grasses and forbs, and so also do not meet the criteria outlined in either Scenario A or Scenario B above.

Conclusion – The subject land does not support either of the EPBC Act listed ecological communities with the potential to occur in the locality.

2.2.4.2 Biodiversity Conservation Act 2016 (NSW)

Two BC Act listed ecological communities have the potential to occur in the site:

- 'White Box – Yellow Box – Blakely's Red Gum Woodland' (BC Act Box-Gum Woodland)'; and
- 'Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions'.

BC Act Box-Gum Woodland

This community, listed as endangered in NSW, is described below, together with an assessment of its presence and condition within the site.

The below description is extracted from the NSW *Final Determination for the TSC Act endangered listed ecological community White Box – Yellow Box – Blakely's Red Gum Woodland*) (NSW Scientific Committee 2002, gazetted 15 March 2002[15]).

> *White Box Yellow Box Blakely's Red Gum Woodland is found on relatively fertile soils on the tablelands and western slopes of NSW and generally occurs between the 400 and 800 mm isohyets extending from the western slopes, at an altitude of c. 170m to c. 1200 m, on the northern tablelands (Beadle 1981). The community occurs within the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands and NSW South Western Slopes Bioregions.*
>
> *White Box Yellow Box Blakely's Red Gum Woodland includes those woodlands where the characteristic tree species include one or more of the following species in varying proportions and combinations - Eucalyptus albens (White Box), Eucalyptus melliodora (Yellow Box) or Eucalyptus blakelyi (Blakely's Red Gum). Grass and herbaceous species generally characterise the ground layer. In some locations, the tree overstorey may be absent as a result of past clearing or thinning and at these locations only an understorey may be present. Shrubs are generally sparse or absent, though they may be locally common.*

Although the final determination does not provide specific listing criteria against which to assess a patch of vegetation, a useful key is provided in *Identification Guidelines for Endangered Ecological Communities – White Box Yellow Box Blakely's Red Gum Woodland (Box-Gum Woodland)* (NPWS 2002[16]), which draws its information from the final determination. As described in the final determination and the associated key, the definition for the BC Act Box-Gum Woodland TEC is extremely broad. In effect, any land for which the climax community is Box-Gum Woodland that has not been cultivated, become a stock camp, or otherwise been entirely modified, is likely to meet the minimum definition of the BC Act listed TEC.

Based on the recorded vegetation types, plant species, landscape position, and the vegetation on adjoining and nearby properties, the only woody PCT on the subject land is '*PCT 351 – Brittle Gum –*

[15] NSW Scientific Committee (2002). *Final Determination for the TSC Act endangered listed ecological community White Box – Yellow Box – Blakely's Red Gum Woodland*. Gazetted 15 March 2002.
[16] NSW Government (2002). *Identification Guidelines for Endangered Ecological Communities - White Box Yellow Box Blakely's Red Gum Woodland (Box-Gum Woodland)*. NSW National Parks and Wildlife Service.

Broad-leaved Peppermint – Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion'. Furthermore, the groundstorey across this PCT as it occurs on the subject land is highly modified and dominated by perennial exotic grasses and herbaceous weeds. As such, the subject land does not support vegetation which meets the criteria for this community under the BC Act.

BC Act Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland

This community, listed as endangered in NSW, is described below, together with an assessment of its presence and condition within the site.

The below description is extracted from the NSW *Final Determination for the TSC Act endangered listed ecological community Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions* (NSW Scientific Committee 2011, gazetted 10 June 2011[17]).

> *Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland typically forms an open-forest, woodland or open woodland that transitions into grassland at low tree cover. The canopy is dominated by Eucalyptus pauciflora (Snow Gum), E. rubida (Candlebark), E. stellulata (Back Sallee) and E. viminalis (Ribbon Gum), either as single species or in combinations. A shrub layer may be present and sub-shrubs are often a component of the ground stratum; characteristic species include Hymenanthera dentata and Melichrus urceolatus. The ground layer is dominated by grasses and other herbaceous species including Themeda australis, Poa spp., Austrostipa spp., Austrodanthonia spp., Leptorhynchos squamatus, Chrysocephalum apiculatum, and Asperula conferta. This community may also occur as secondary grassland where the dominant trees have been removed but the ground stratum remains.*
>
> *The ecological community mainly occurs on valley floors, margins of frost hollows, footslopes and undulating hills between approximately 600 and 1400 m in altitude. It occurs on a variety of substrates including granite, basalt, metasediments and Quaternary alluvium. The ecological community occurs as a part of a mosaic of native vegetation communities including swamps, bogs, wetlands, grasslands and sclerophyll forests.*

The final determination does not provide specific listing criteria against which to assess a patch of vegetation, however the presence of the key canopy eucalypts and a native dominated ground stratum are described as the key characteristics of the community. The final determination also states that the community may also occur as secondary grassland. In this regard, based on the final determination, a logical interpretation of the minimum criteria for a patch to constitute the listed community is that the patch must:

1. support a canopy which is dominated by the key eucalypt species and occurs in at least moderately intact condition; or

[17] NSW Scientific Committee (2011). *Final Determination for the TSC Act endangered listed ecological community Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions*. Gazetted 10 June 2011.

2. where the canopy has been cleared, the ground stratum remains in at least moderately intact condition (i.e. native dominated with moderate to high diversity).

Based on the recorded PCTs, plant species, landscape position, and the vegetation on adjoining and nearby properties, the only woody PCT on the subject land is '*PCT 351 – Brittle Gum – Broad-leaved Peppermint – Red Stringybark open forest in the north-western part (Yass to Orange) of the South Eastern Highlands Bioregion*'. Furthermore, the groundstorey across this PCT as if occurs on the subject land is highly modified and dominated by perennial exotic grasses and herbaceous weeds. As such, the subject land does not support vegetation which meets the criteria for this community under the BC Act.

Conclusion – The subject land does not support either of the BC Act listed ecological communities with the potential to occur in the locality.

2.2.5 High threat weeds

Table 8 lists the five high threat weeds which occur on the subject land. Only Chilean Needle Grass occurs at high density and is widespread. The remaining four high threat weeds occur at low densities as scattered individual plants/tussocks.

Table 8. High threat weeds.

Species Name	Common Name	Status
Trees		
Populus nigra	Black Popular	-
Shrubs		
Rosa rubiginosa	Briar Rose	-
Grass		
Eragrostis curvula	African Lovegrass	AP
Nassella neesiana	Chilean Needle Grass	WoNS, LM
Nassella trichotoma	Serrated Tussock	WoNS, C

Table key.

- WoNS - (Commonwealth) Weed of National Significance.
- Regional Priority Weed in the South East Local Land Services region under the *NSW Biosecurity Act 2015.*
  - P = Prevention.
  - E = Eradication.
  - C = Containment.
  - AP = Asset Protection.
  - LM = Species subject to Local Management programs.

2.3 Habitat Suitability for Threatened Species

2.3.1 Fauna habitat

The habitat features on the subject land were identified during the field surveys and assessed regarding their potential value to native fauna species, both threatened and common species. The fauna habitat features of the subject land are described in Table 9.

Table 9. Fauna habitat features.

Habitat Feature	Description	Relevant Native Fauna Species/Assemblages
Remnant eucalypts	Three remnant Brittle Gum were recorded on the subject land, each of which contains hollows.	These trees are likely to provide foraging resources for a variety of birds. Hollows are likely to provide a nesting resource for common birds, bats and marsupials.
Planted native vegetation	Road verges, fence lines, and around dwellings have been planted with native trees and shrubs. The planted species do not naturally occur in the recorded PCTs.	The planted native vegetation is likely to provide a foraging resource to a variety of native and exotic birds, including those recorded during field surveys (Appendix B). It is unlikely that the planted native trees and shrubs on the subject land would be of importance as nesting or roosting habitat for any threatened fauna species.
Native and exotic pasture	The subject land supports highly modified grassland and derived grassland, the majority of which is exotic dominant, has been pasture improved, and is heavily grazed by stock.	Grassy areas (the majority of the subject land) would provide grazing resources for common birds, reptiles and herbivores such as the Eastern Grey Kangaroos *Macropus giganteus* and Common Wombat *Vombatus ursinus.* Open areas provide hunting resources for raptors and other predatory birds.
Creeks, streams, dams	The subject land contains two farm dams, and Mcleods Creek passes through the south of the property. The dams are used to water stock and are therefore murky and support little fringing vegetation. The creek is highly disturbed, and the riparian vegetation is largely dominated by exotic species.	The dams and creek provide limited foraging and/or breeding resources for common native fauna, including waterfowl, frogs, and Eastern Long-necked Turtles *Chelodina longicollis*. Their general lack of native fringing vegetation, disturbed condition and distance from tree cover would prevent the dams from providing important habitat for any listed fauna species.

2.3.2 Threatened Biodiversity Data Collection

2.3.2.1 Definitions of conservation significance

The conservation significance of a species, population or community is determined by its current listing pursuant to Commonwealth and/or State legislation and associated policy, more specifically:

- National – Listed as threatened (critically endangered, endangered, vulnerable or conservation dependent) pursuant to the EPBC Act; and
- State (NSW) – Listed as threatened (endangered or vulnerable) pursuant to the BC Act.

Species listed as 'migratory' under the EPBC Act are also considered where relevant.

2.3.2.2 Database and literature review

Information regarding the suitability of the habitat on the subject land for threatened species was obtained from the Threatened Biodiversity Data Collection through the BAM Calculator. The species flagged by the BAM are detailed in Section 2.3.3 (ecosystem credit species) and Section 2.3.4 (species credit species).

In addition, a database search and literature review were completed to inform likelihood of occurrence assessments and provide useful background information for this assessment. This review included obtaining:

- a list of threatened species (flora and fauna), threatened populations and threatened ecological communities (TECs) listed pursuant to the EPBC Act with the potential to occur on the subject land obtained using the Department of the Environment's online EPBC Act Protected Matters Search Tool (PMST) on 17 January 2019; and
- ecological point data from the NSW Wildlife Atlas (BioNet), downloaded on 17 January 2019, providing a list of threatened species which have previously been recorded in the broad locality of the subject land (i.e. within 10 km) (refer Figure 8).

Literature referred to during the conduct of the surveys for this study and/or during the preparation of this BDAR is listed under References.

2.3.2.3 Likelihood of Occurrence Assessment

The Likelihood of Occurrence Assessment for threatened flora and fauna species is a categorisation used to determine the likelihood that the subject species occur on the subject land. The results of the Likelihood of Occurrence Assessment are based on the findings of desktop studies, field surveys, expert opinion, and consideration of the species' currently recognised distribution and preferred habitat.

Threatened species and populations included in the Likelihood of Occurrence Assessment include all of those identified during the database and literature review as potentially occurring in the locality (i.e. within ten kilometres of the subject land). Some BC Act listed threatened species have been included that have not been previously recorded in the locality yet are considered by Capital Ecology to have the potential to occur.

The likelihood of a species occurring on the subject land is categorised as either negligible, low, moderate or high. A species that has been identified on the subject land area during the surveys for this study or by other confirmed records is labelled as confirmed.

The completed Likelihood of Occurrence Assessment is provided as Appendix C. Species assigned a moderate or higher likelihood of occurrence are considered in more detail in Section 2.3.4 as species credit species under the BAM (or as additional species if they are not flagged as species credit species).

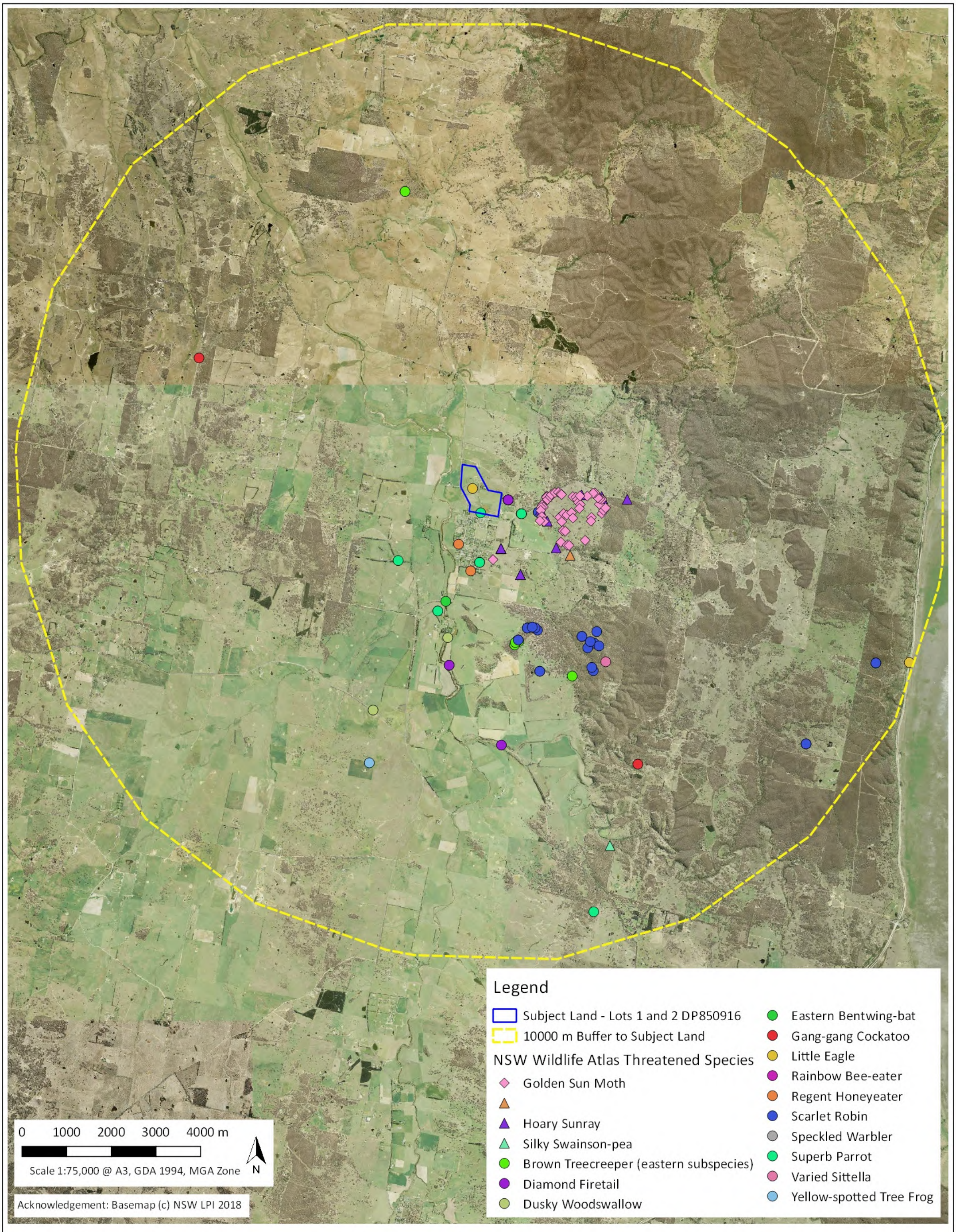

Figure 8. NSW Wildlife Atlas Threatened Species Search

Capital Ecology Project No: 2812
Drawn by: S. Reid
Date: 18 January 2019

2.3.3 Habitat suitability for ecosystem credit species

Threatened species classified as ecosystem credit species and identified by the BAM as potentially occurring on the subject land are listed in Table 10. The value of the habitat on the subject land for ecosystem credit species is determined based on the type and condition (i.e. vegetation integrity) of the vegetation present together with the landscape context (refer Section 2.1).

Table 10. Predicted ecosystem credit species identified by the BAM as potentially occurring on the subject land.

Species	NSW (BC Act) listing status	National (EPBC Act) listing status	Presence	Rationale for presence = no
Artamus cyanopterus cyanopterus Dusky Woodswallow	Vulnerable	-	Yes – assumed	-
Callocephalon fimbriatum Gang-gang Cockatoo (Foraging)	Vulnerable	-	Yes – assumed	-
Chthonicola sagittate Speckled Warbler	Vulnerable	-	Yes – assumed	-
Climacteris picumnus victoriae Brown Treecreeper (eastern subspecies)	Vulnerable	-	Yes – assumed	-
Daphoenositta chrysoptera Varied Sittella	Vulnerable	-	Yes – assumed	-
Dasyurus maculatus Spotted-tailed Quoll	Vulnerable	Endangered	No	There is no potential habitat on the subject land for the species.
Grantiella picta Painted Honeyeater	Vulnerable	Vulnerable	Yes – assumed	-
Hieraaetus morphnoides Little Eagle (Foraging)	Vulnerable	-	Yes – assumed	-
Melanodryas cucullata cucullata Hooded Robin (south-eastern form)	Vulnerable	-	Yes – assumed	-
Miniopterus schreibersii oceanensis Eastern Bentwing-bat (Foraging)	Vulnerable	-	Yes – assumed	-
Neophema pulchella Turquoise Parrot	Vulnerable	-	Yes – assumed	-
Ninox strenua	Vulnerable	-	Yes – assumed	-

Species	NSW (BC Act) listing status	National (EPBC Act) listing status	Presence	Rationale for presence = no
Powerful Owl (Foraging)				
Petroica boodang Scarlet Robin	Vulnerable	-	Yes – assumed Observed in PCT 896 Zone 1 during surveys.	-
Petroica phoenicea Flame Robin	Vulnerable	-	Yes – assumed	-
Phascolarctos cinereus Koala (Foraging)	Vulnerable	Vulnerable	No	The species is not known to occur in the Gundaroo locality, and no evidence of koala were detected (e.g. scats, scratch marks).
Stagonopleura guttata Diamond Firetail	Vulnerable	-	Yes – assumed	-

2.3.4 Habitat suitability for species credit species

2.3.4.1 Candidate species credit species

Threatened species classified as species credit species and identified by the BAM as potentially occurring on the subject land are listed in Table 11. The likelihood of these species occurring on the subject land and the potential value of the habitat present is determined based on the subject land's vegetation type and condition (i.e. vegetation integrity), the presence/absence of specific habitat features, species records (BioNet and ecological reports), and/or the results of targeted surveys.

Table 11. Candidate species credit species identified by the BAM as potentially occurring on the subject land.

Species	NSW (BC Act) listing status	National (EPBC Act) listing status	Presence	Rationale for presence = no
Aprasia parapulchella Pink-tailed Legless Lizard	Vulnerable	Vulnerable	No	There is no potential habitat (i.e. loose surface rock located in a native dominant groundstorey) for the species on the subject land.
Callocephalon fimbriatum Gang-gang Cockatoo (Breeding)	Vulnerable	-	No – surveyed	Surveys of the three remnant, hollow-bearing trees confirmed that the species is not nesting and/or breeding on the subject land.

Species	NSW (BC Act) listing status	National (EPBC Act) listing status	Presence	Rationale for presence = no
Delma impar Striped Legless Lizard	Vulnerable	Vulnerable	No	The species is not known to occur in the locality, with the nearest record over 20 km from the subject land (ref. BioNet).
Hieraaetus morphnoides Little Eagle (Breeding)	Vulnerable	-	No – surveyed	Surveys of potential nesting trees confirmed that the species is not nesting and/or breeding on the subject land.
Litoria aurea Green and Golden Bell Frog	Endangered	Vulnerable	No	The species is not known to occur in the locality, and the riparian areas and waterbodies on the subject land are unlikely to provide potential habitat.
Litoria booroolongensis Booroolong Frog	Endangered	Endangered	No	The species is not known to occur in the locality, and the riparian areas and waterbodies on the subject land are unlikely to provide potential habitat.
Miniopterus schreibersii oceanensis Eastern Bentwing-bat (Breeding)	Vulnerable	-	No	The subject land does not contain potential roosting and/or breeding habitat (caves, mines, water tunnels, etc.).
Myotis macropus Southern Myotis	Vulnerable	-	No	The subject land does not contain potential roosting and/or breeding habitat (caves, mines, hollow-bearing trees, etc. that are close a substantial water source).
Ninox strenua Powerful Owl (Breeding)	Vulnerable	-	No	The subject land contains only three remnant trees with large hollows. Surveys of these trees did not identify evidence of owl occupation (i.e. pellets, scats etc.) and it is unlikely that the Powerful Owl would choose to nest in these trees given the expanses of far more intact vegetation to the east of the subject land.

Species	NSW (BC Act) listing status	National (EPBC Act) listing status	Presence	Rationale for presence = no
Petaurus norfolcensis Squirrel Glider	Vulnerable	-	No	There is no potential habitat on the subject land for the species.
Phascolarctos cinereus Koala (Breeding)	Vulnerable	Vulnerable	No	The species is not known to occur in the Gundaroo locality, and no evidence of koala was detected (e.g. scats, scratch marks).
Thesium australe Austral Toadflax	Vulnerable	Vulnerable	No – surveyed	Surveys confirmed that the species does not occur on the subject land.

2.3.4.2 Threatened species surveys

Species credit species

As described in Table 11, surveys were completed to confirm the occurrence and/or habitat potential for the species credit species flagged by the BAM as having the potential to occur in the relevant PCTs of the subject land. Field surveys confirmed that none of the relevant flora species occur on the subject land, and that the subject land does not contain any habitat currently occupied or of potential significance to the relevant fauna species. The three remnant Brittle Gums, which will be retained during the proposed development, contained hollows which were occupied by Common Starling and Crimson Rosella. Importantly, no threatened bird species were observed nesting in these remnant trees despite observations occurring at the appropriate time of year, nor were any threatened bird species observed anywhere on the subject land during field surveys.

Golden Sun Moth

The Golden Sun Moth *Synemon plana* was not flagged by the BAM as a species credit species for the subject land, however officers from the OEH identified the potential for the species to occur on the subject land (refer Figure 6) during their site visit in May 2018. This potential occurrence was based on proximity of the subject land to the large patch of confirmed Golden Sun Moth habitat at Mcleods Creek Reserve (approx. 1 km to the east) and the presence of substantial patches of Chilean Needle Grass (a known food plant for the species). Surveys for this species were therefore required as the Golden Sun Moth is listed as critically endangered under the EPBC Act and endangered under the BC Act. Given the low likelihood of Golden Sun Moth occurring on the subject land based on habitat characteristics (i.e. historically cultivated native pasture), and the relatively low potential significance of the habitat should the species be present, the OEH confirmed that they would support a Golden Sun Moth larvae survey for the subject land. Accordingly, Capital Ecology developed a survey protocol (Appendix A), which was submitted to the OEH and endorsed (email from Rod Pietsch, Senior Threatened Species Officer, 6 August 2018).

On 12 July 2018, the subject land was inspected for areas containing a substantial proportion of Chilean Needle Grass. Three patches containing Chilean Needle Grass were mapped, totalling 31,418 m^2 (3.14 ha). All patches were associated with drainage lines running across historically cultivated paddocks. The

mapping was performed at a broad scale to ensure all areas of potential Golden Sun Moth habitat were recorded.

On 21 August 2018, three ecologists from Capital Ecology visited the subject land to survey for Golden Sun Moth larvae. In brief, a grid-based method was used to sample for larvae as this was deemed the most appropriate method to determine presence/absence across an area where larvae may be unevenly distributed (Appendix A). A mini excavator was used to remove approximately three grass tussocks per sample, to a depth of at least 15 cm. Each tussock was thoroughly broken up and inspected for larvae, and the soil and tussock then replaced into the ground.

In summary, 128 mini excavator samples were inspected, totalling approximately 384 individual Chilean Needle Grass tussocks. Three ecologists were involved in the survey over 8 hours, resulting in a total of 24-person hours.

No Golden Sun Moth larvae or pupae were recorded. As indicated by previous surveys for Golden Sun Moth larvae (Appendix A), the discovery rate of larvae in low density areas is 0.1 larvae per tussock or 0.75 larvae per person hour. Based on the number of tussocks sampled (384 tussocks) and person hours (24 hours), a minimum of 18 - 39 larvae should have been detected if present at low density within the potential habitat on the subject land.

In light of the above, it is concluded that the subject land does not support the Golden Sun Moth.

3 Part 2 – Impact Assessment (BAM Stage 2)

Part 2 of this BDAR provides an assessment of the impacts of the proposed development as set out in Stage 2 of the BAM.

3.1 Avoidance, Minimisation and Mitigation of Impacts on Biodiversity Values

In accordance with Chapter 8 of the BAM, a proponent is required to demonstrate that all reasonable and practicable measures have been employed to avoid, minimise and mitigate the impacts of a project on biodiversity values. This section outlines the measures that have been incorporated into the project design or will be implemented during construction and/or occupation of the proposed development.

3.1.1 Development location and design

As shown in Figure 6, the location and design of the proposed development has been developed in a manner that will impact only low diversity native pasture, exotic pasture or planted native and exotic trees and shrubs. The remnant trees will be retained and protected. The impacts to the E3 zoned land, which were addressed and approved in DA185092, are limited to those required to construct a road bridge over Mcleods Creek, the proposed alignment of which will avoid native vegetation or habitat of potential value to native fauna.

3.1.2 Construction

The key potential risk to the biodiversity values of the site during construction of the proposed development is the spread of high threat weeds within the subject land and/or the introduction of new weeds. The current landowner is proactive in monitoring and controlling high threat weeds on the subject land (i.e. spot-spraying Serrated Tussock etc.) and this management will continue during construction. In addition, the following weed management measures that will be implemented during construction.

- Appropriate vehicle hygiene will be maintained. Vehicles and machinery entering the subject land will be clean of weed seed or propagules.
- Only sterile materials such as hessian/jute or rice straw will be used for soil stabilisation or similar purposes.
- High threat weeds will be prevented from establishing on newly created road verges, landscaped areas, and other open space.

3.1.3 Occupation

The landowner will continue to implement the above described current weed controls throughout all areas of the subject land outside of the newly created residential lots. Weed control within the new lots will be the responsibility of the new owners.

Any future landscaping for the proposed development (subdivision and creation of lots) in areas of the subject land outside of the newly created lots will use only local native plant species. Where practicable within open space areas, all strata will be re-established (i.e. groundcover, midstorey shrubs, and

canopy trees) to create habitat complexity. This will discourage urban adapted species and encourage small woodland birds to visit the subject land.

3.2 Biodiversity Impacts of Proposed Development

3.2.1 Clearance and other direct impacts on native vegetation and habitat

As shown in Figure 6, the proposed development will impact:

- 0.02 ha of PCT 351 Zone 1 - Highly modified woodland (BC Act native vegetation)
- 2.27 ha of PCT 351 Zone 2 – Sown exotic pasture;
- 6.77 ha of PCT 896 Zone 1 – Highly modified native pasture (BC Act native vegetation);
- 0.51 ha of PCT 896 Zone 3 – Planted native trees/shrubs over exotic pasture (BC Act native vegetation);
- 0.85 ha of PCT 896 Zone 4 – Unmown exotic pasture along riparian fringe; and
- 19.34 ha of PCT 896 Zone 5 – Sown exotic pasture.

In total, the proposed development will impact 29.75 ha of vegetation, comprised of 7.29 ha of BC Act native vegetation and 22.46 ha of exotic vegetation.

The proposed development will not result in any other direct impacts on native vegetation or habitat.

3.2.2 Indirect impacts on native vegetation and habitat

The potential indirect impacts of the proposed development include:

- weed introduction and/or spread during construction; and
- sedimentation of receiving waterways (i.e. Mcleods Creek and then Yass River) from construction of roads, houses and other infrastructure.

As noted above, appropriate weed monitoring and control will occur to manage the potential impacts of high threat weeds. Similarly, it is assumed that appropriate site-based sediment and erosion controls will be implemented to prevent sedimentation of receiving waterways.

The proposed development includes the construction of a sewerage treatment plant and associated treated effluent irrigation areas in the north of Lot 1 DP850916 (Figure 2 and Figure 3). With respect to biodiversity issues, the proposed sewerage treatment plant and deficit (i.e. 100% reuse) irrigation system have been designed to be consistent with planning and regulatory requirements and include a series of safeguards to eliminate the risk posed by surface runoff, groundwater contamination, and impacts on plant and animal health (Decentralised Water Consulting 2018). As described in Decentralised Water Consulting (2018), these safeguards include, but are not limited to, the following.

- The low risk use of recycled water as the nutrient loading rates are expected to be low and the subject land and soil are well suited to irrigation of non-edible crops.

- A fully automated irrigation system with remote monitoring, control, and a weather station to avoid irrigation during inappropriate conditions (e.g. > 5mm rain).
- An irrigation system which eliminates the risk of surface runoff as the dripline is installed at least 200 mm below the finished ground level and pulse doses into the rootzone. Modelling indicates that soils will not experience saturation as a result of effluent irrigation.
- An irrigation system which is designed as a zero discharge deficit system (i.e. 100% reuse), consistent with the EPA Effluent Irrigation Guidelines (2004).
- Existing weather storage to enable zero wet weather overflows in a 100-year cycle. This will enable the scheme to operate without the need for controlled (precautionary) discharge to the environment.

With reference to Decentralised Water Consulting (2018), it is therefore unlikely that the proposed sewerage treatment plant and associated treated effluent irrigation areas will have indirect impacts on native vegetation and habitat.

The proposed development is unlikely to result in any other indirect impacts on native vegetation or habitat.

3.2.3 Biodiversity risk weighting

The biodiversity risk weighting (Section 6.6 of the BAM) is a tool used in the BOS to mitigate the risk in offsetting the loss of vegetation, threatened entities and/or their habitat. The biodiversity risk weighting does this by increasing the quantum of credits required at an impact site. The biodiversity risk weighting is derived from two components:

- sensitivity to loss – based on threat status under legislation or evidence-based information that suggests the entity is at an increased risk of loss; and
- sensitivity to potential gain – based on life history characteristics and ecological information for a species.

The subject land does not contain any vegetation with a vegetation integrity score that requires offsetting for impacts on a TEC or ecosystem credit species, nor does it support habitat of potential significance to any species credit species. Accordingly, biodiversity risk weighting is not of relevance to the subject land.

3.2.4 Prescribed biodiversity impacts

As described in Section 8.2 of the BAM, some types of projects may have impacts on biodiversity values in addition to, or instead of, impacts from clearing vegetation and/or loss of habitat. For many of these impacts the biodiversity values may be difficult to quantify, replace or offset, making avoiding and minimising impacts critical. Clause 6.1 of the BC Regulation identifies the following as impacts that are 'prescribed biodiversity impacts' that must be assessed using the BOS.

> *(a) impacts of development on the habitat of threatened species or ecological communities associated with:*

(i) karst, caves, crevices, cliffs and other geological features of significance;

(ii) rocks;

(iii) human made structures;

(iv) non-native vegetation;

(b) impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range;

(c) impacts of development on movement of threatened species that maintains their life cycle;

(d) impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities (including from subsidence or upsidence resulting from underground mining);

(e) impacts of wind turbine strikes on protected animals; and

(f) impacts of vehicle strikes on threatened species or on animals that are part of a TEC.

The subject land does not contain any of the above habitat features, nor does the proposed development have the potential to cause or contribute to any of the above listed prescribed biodiversity impacts.

3.2.5 Serious and irreversible impacts

The Guidance to assist a decisionmaker to determine a serious and irreversible impact (NSW Government 2017b[18]) provides a list of threatened species and ecological communities which are likely to be the subject of serious and irreversible impacts (SAII). The potential for a project to impact these SAII entities must be assessed in the BDAR.

The subject land does not support any ecological community listed as a SAII entity, nor does it contain habitat of potential significance to any threatened flora or fauna species listed as a SAII entity. Accordingly, the proposed development will not result in a SAII on any BC Act listed entity.

3.2.6 Adaptive management for uncertain impacts

The proposed development is unlikely to result in biodiversity impacts that are unforeseen or uncertain.

3.3 Requirements

3.3.1 Commonwealth EPBC Act – Referral

The proposed development is unlikely to have a significant impact on a EPBC Act listed MNES given the subject land does not:

[18] NSW Government (2017). *Guidance to assist a decision-maker to determine a serious and irreversible impact*. State of New South Wales and Office of Environment and Heritage

- support any EPBC Act listed ecological communities;
- support any EPBC Act listed flora species; or
- contain habitat of potential importance to EPBC Act listed threatened or migratory fauna species.

In light the above, EPBC Act referral is unwarranted and is not recommended.

3.3.2 NSW Biodiversity Conservation Act – Offset Requirements

The BAM Calculator is the tool for quantifying the offset requirements for a project, the output being expressed as ecosystem credits and species credits. The results of the BAM credit calculations completed for the proposed development are provide below.

3.3.2.1 Ecosystem credit requirements

The results of the BAM credit calculations completed for the proposed development are provided in Table 12. As shown in Table 12, none of the vegetation zones of either of the PCTs in the proposed impact area (nor elsewhere on the subject land) have a vegetation integrity score sufficient for their clearance to result in generation of ecosystem credits, as outlined in Section 10.3.1.1 of the BAM, these being:

- *(a) a vegetation integrity score of ≥15 where the PCT is representative of an endangered or critically endangered ecological community, or*
- *(b) a vegetation zone that has a vegetation integrity score of ≥17 where the PCT is associated with threatened species habitat (as represented by ecosystem credits), or is representative of a vulnerable ecological community, or*
- *(c) a vegetation zone that has a vegetation integrity score ≥20 where the PCT is not representative of a TEC or associated with threatened species habitat.*

Accordingly, the proposed development does not generate an ecosystem credit obligation.

Table 12. Ecosystem credit requirements.

PCT & Vegetation Zone	Vegetation Integrity Score	Proposed Clearance Area (ha)	Credits Required
PCT351 Zone 1	10.2	0.02	0
PCT351 Zone 2	N/A – Exotic	N/A – Exotic	N/A – Exotic
PCT896 Zone 1	15.9	6.77	0
PCT896 Zone 2	9.4	0	0
PCT896 Zone 3	0.5	0.51	0
PCT896 Zone 4	N/A – Exotic	N/A – Exotic	N/A – Exotic
PCT896 Zone 5	N/A – Exotic	N/A – Exotic	N/A – Exotic

3.3.2.2 Species credit requirements

As detailed herein, the subject land does not support habitat of potential significance to any species credit species. Accordingly, the proposed development does not generate a species credit obligation.

References

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Capital Ecology (2018). *Subdivision of 4056-4078 Gundaroo Road, Gundaroo, NSW – Biodiversity Development Assessment Report*. Final – October 2018. Prepared for Kyeema Management Pty Ltd. Authors: R. Speirs & Sam Reid. Project no. 2812.

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South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions. Gazetted 10 June 2011.

Strahler, AN (1952). *Hypsometric (area-altitude) analysis of erosional topology*. Geological Society of America Bulletin 63 (11): 1117–1142.

Yass Valley Local Environment Plan (2013).

- *Land Zoning Map - Sheet LZN_005E.*
- *LEP Lot Size Map - Sheet LSZ_005E.*
- *Natural Resources Biodiversity Map - Sheet NRB_005*.

Appendices

Appendix A. Golden Sun Moth Larvae Survey Protocol

This protocol is informed by unpublished studies and other documents relating to Golden Sun Moth *Synemon plana* larvae survey trials completed in the ACT and region (provided by the Office of Environment and Heritage [OEH] to Capital Ecology on 8 June 2018). The methodology and conclusions of these studies are summarised in Table A1.

Table A1. Summary of previous Golden Sun Moth larvae surveys

Study	Methodology	Results and Relevant Information
SMEC (2014) [19]	• 10 x 25m plots. • Each plot was divided into 5 x 5m cells. • Within each cell, 2 tussocks from feed species were excavated to a depth of approx. 15cm. This resulted in 20 samples (approx. 1m^2 of turf in total) per plot. • Each tussock was de-soiled, and the soil and tussock examined for larvae. • Larvae were returned to the hole and the tussock gently re-established in the hole with the spoil.	• Within a Chilean Needle Grass dominated plot, 11 larvae were found. This equals approx. 10 larvae per m^2. • Flying surveys nearby this plot recorded 'moderate' Golden Sun Moth densities. • Larvae in lower value habitat appear to occur in small 'islands', possibly relating to how females lay eggs. A radiating survey technique may be used to assess each of these islands.
SMEC (2015) [20]	• Transect based method. • Feed species tussocks were dug up at every meter along the transect using a mattock. • At least 15 tussocks were examined per transect. • The soil was examined by hand by breaking up clogs and checking the roots for larvae. • Golden Sun Moth larvae were photographed, and their location recorded with GPS. • Larvae were placed back into the ground and the tussock was returned with the soil, ensuring minimal harm to the tussock and larvae.	• A total of 118 tussocks were sampled from the five transects. The dominant grass was Chilean Needle Grass. • Transect 1 – 9 of 25 tussocks had larvae. • Transect 2 – 5 of 16 tussocks had larvae. • Transect 3 – 3 of 16 tussocks had larvae. • Transect 4 – 1 of 16 tussocks had larvae. • Transect 5 – 0 of 16 tussocks had larvae. • Most tussocks with larvae only had one larva per tussock. A smaller proportion had 2 to 4 larvae per tussock. • The density of larvae varied, with 'hot spots' separated by large gaps with no larvae. • Based on flying surveys, this site is known to have high Golden Sun Moth densities.

[19] SMEC (2014). *ESO and EPBC Referral scoping report for SALR.* Prepared by Will Allen, Principal Scientist, 24 October 2014.

[20] SMEC (2015). *Golden Sun Moth Larvae Sampling at potential bridge over Ginninderra Ck for possible Ginninderra Drive extension V2.* Prepared for Riverview. May 2015.

Study	Methodology	Results and Relevant Information
Crook (2015) [21]	• The below method was only proposed and never implemented. • 20 transects of 20 m, separated by 1 m. This is recognised as intensive sampling. • Every 1 m along the transect the nearest feed species tussock is sampled. • Tussocks are removed with a mattock. The soil is removed from the roots of the tussock, and the roots inspected for larvae. • Larvae are placed back into the ground and the tussock is re-planted. • Density can be estimated by sampling around tussocks where individuals are detected.	• Larvae can be easily identified compared to other invertebrates as Golden Sun Moth larvae do not have legs and are well segmented. • Small larvae (6 – 13 mm) are first year larvae. • Medium larvae (13 – 20 mm) are second year larvae. • Large larvae (> 20 mm) are third year larvae and are approaching pupation. • Pupation occurs in spring and adults emerge from October to January.
Allen *et al*. (unpublished) [22]	• Three different methods were developed. • Method 1 – use a mattock to uproot a tussock and sift through its roots by hand counting the larvae found. • Method 2 – use a backhoe to excavate from select areas stock piles of turf, then sift through the slabs by hand and record the number of larvae found. • Method 3– use a grader to rip the ground, then lift the broken tussocks and sift through the roots and salvage the larvae.	• Method 1 – this method found between 0.75 and 5.0 larvae per person hour. • Method 2 – this method found 6.4 larvae per person hour but was a destructive method. • Method 3 – this method found 10.0 larvae per person hour but was a destructive method.

The aim of the proposed survey is to confirm the presence/absence of Golden Sun Moth rather than to accurately determine density across the subject land. This therefore influences the methodology which should be employed. Based on the previous work summarised in Table A1, Golden Sun Moth larvae appear to occur in patches separated by large gaps with no larvae. An appropriate method to determine presence/absence should therefore sample evenly across an area rather than sampling smaller areas at a higher intensity. For the proposed survey, a grid-based method such as that used by SMEC (2014) would therefore be more appropriate than a transect-based methodology.

Proposed protocol for Golden Sun Moth *Synemon plana* larvae surveys

As Golden Sun Moth are known to occur in the locality, OEH staff have indicated that Chilean Needle Grass *Nassella neesiana* present within the subject land may provide habitat for the species (OEH

[21] Crook, N. (2015). *Developing soil survey methodology for larvae of the Golden Sun Moth (Synemon plana) in the Canberra Region*. Proposed Masters research project, 10 June 2015.
[22] Allen, W.B., Milner, M., Crook, N. and Jessop, R. (unpublished). *Translocation of Golden Sun Moth habitat: A trial undertaken during the construction of Majura Parkway, ACT.*

Correspondence DOC18/332735). Accordingly, Capital Ecology visited the subject land on 12 July 2018 and mapped those areas dominated by Chilean Needle Grass. As the mapping was performed during winter, patches of Chilean Needle Grass were easily distinguished and mapped from other grass species due to differences in colour. Mapped areas were subsequently inspected to confirm the presence and dominance of Chilean Needle Grass. The mapping was performed at a broad scale to ensure all areas of potential habitat were recorded.

The results of the mapping are presented in Figure 6. Two patches of Chilean Needle Grass, totalling 28,835m^2 (2.88 ha), were recorded on the subject land. Both patches are restricted to drainage lines.

Capital Ecology proposes the following protocol to survey for the Golden Sun Moth larvae in Chilean Needle Grass dominated areas of the subject land.

- A-grid based method will be used as this is the most appropriate method to determine presence/absence across an area where larvae may be unevenly distributed.
- Three ecologists will take part in the survey over 8 hours, resulting in 24 person hours in total.
- Each cell of the grid will be 10 x 10 m. Within each cell, 2 Chilean Needle Grass tussocks will be randomly selected for excavation.
- A mini excavator will be used to remove the tussock, ensuring a depth of at least 15 cm.
- The tussock will be placed over a large sieve, under which will be a container to collect any loose soil.
- The soil around the tussock will be broken up. The roots of the tussock will be inspected for larvae, as will any fallen soil.
- If any larvae are found, they will be photographed, measured and the location recorded with a handheld GPS unit. Larvae will be returned to the location of the removed tussock, and the associated tussock and soil carefully replaced.
- If a larva is found, the remaining area of connected habitat will be assumed to be confirmed habitat. This remaining area will not be sampled in order to reduce the disturbance associated with sampling.
- Surveys will then proceed to the next disconnected patch of potential habitat and be carried out as described above.
- As the potential habitat to be surveyed is 28,835m2, 288 (10 x 10 m) grids will be sampled and therefore 576 tussocks. With reference to the studies summarised in Table 1, the discovery rate of Golden Sun Moth larvae in low density areas is 0.1 larvae per tussock or 0.75 larvae per person hour. Based on the estimated number of tussocks to be sampled (576 tussocks) and person hours (24 hours), we estimate a minimum of 18 - 58 larvae to be detected if present at low densities within the potential habitat.

Appendix B. Fauna Species Recorded

Class	Common name	Scientific name	BC Act status
Amphibia	Common Eastern Froglet	*Crinia signifera*	Protected
Amphibia	Spotted Marsh Frog	*Limnodynastes tasmaniensis*	Protected
Aves	Yellow Thornbill	*Acanthiza nana*	Protected
Aves	Grey Teal	*Anas gracilis*	Protected
Aves	Pacific Black Duck	*Anas superciliosa*	Protected
Aves	Red Wattlebird	*Anthochaera carunculata*	Protected
Aves	Australasian Pipit	*Anthus novaeseelandiae*	Protected
Aves	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	Protected
Aves	Australian Raven	*Corvus coronoides*	Protected
Aves	Laughing Kookaburra	*Dacelo novaeguineae*	Protected
Aves	Galah	*Eolophus roseicapilla*	Protected
Aves	Eurasian Coot	*Fulica atra*	Protected
Aves	Australian Magpie	*Gymnorhina tibicen*	Protected
Aves	Welcome Swallow	*Hirundo neoxena*	Protected
Aves	Superb Fairy-wren	*Malurus cyaneus*	Protected
Aves	White-eared Honeyeater	*Nesoptilotis leucotis*	Protected
Aves	Crimson Rosella	*Platycercus elegans*	Protected
Aves	Eastern Rosella	*Platycercus eximius*	Protected
Aves	Willie Wagtail	*Rhipidura leucophrys*	Protected
Aves	Common Starling	*Sturnus vulgaris*	-
Aves	Australasian Grebe	*Tachybaptus novaehollandiae*	Protected
Aves	Masked Lapwing	*Vanellus miles*	Protected
Aves	Yellow-tailed Black Cockatoo	*Zanda funereus*	Protected
Mammalia	Rabbit	*Oryctolagus cuniculus*	-
Mammalia	Sheep	*Ovis aries*	-
Mammalia	Fox	*Vulpes vulpes*	-

Appendix C. Likelihood of Occurrence

Key for below table

EPBC Act:

CE - critically endangered

E - endangered

V - vulnerable

CD - conservation dependent

BC Act:

CE1 - critically endangered species (Schedule 1, Part 1)

E1 - endangered species (Schedule 1, Part 2)

E2 - endangered population (Schedule 1, Part 2, Division 4)

E4 - presumed extinct (Schedule 3, Part 1)

V1 - vulnerable species (Schedule 2, Part 3)

Note: The brief species distribution and habitat descriptions provided in the below table are sourced / appropriated from the threatened species online profiles, listing determinations and/or recovery plans prepared for the species by the Commonwealth Government and NSW Government. These resources and associated references are provided on the relevant government websites.

Species Name	EPBC Act Status	BC Act Status	Description (Distribution and Habitat)	Likelihood of Occurrence
Birds				
Anthochaera phrygia Regent Honeyeater	E	CE1	A semi-nomadic species occurring in temperate eucalypt woodlands and open forests. Most records are from box-ironbark eucalypt forest associations and wet lowland coastal forests. Key eucalypt species include Mugga Ironbark, Yellow Box, Blakely's Red Gum, White Box and Swamp Mahogany. Also utilises a number of other eucalypt species. Nectar and fruit from the mistletoes *Amyema miquelii*, *A. pendula*, and *A. cambagei* are also eaten during the breeding season. Regent Honeyeaters usually nest in horizontal branches or forks in tall mature eucalypts and sheoaks as well as within mistletoe haustoria (section of the root which connects with the host tree). An open cup-shaped nest is constructed by the female of bark, grass, twigs and wool.	Low It is possible that the species may visit the subject land to forage on the planted eucalypts. The subject land does not contain nesting resources or foraging resources of potential significance to the species.

Species Name	EPBC Act Status	BC Act Status	Description (Distribution and Habitat)	Likelihood of Occurrence
Artamus cyanopterus cyanopterus Dusky Woodswallow	-	V1	The Dusky Woodswallow has two separate populations. The eastern population is found from Atherton Tableland, Queensland south to Tasmania and west to Eyre Peninsula, South Australia. The other population is found in south-west Western Australia. The Dusky Woodswallow is found in open forests and woodlands and may be seen along roadsides and on golf courses. The south-eastern population migrates north in autumn.	Moderate It is possible that the species may visit the subject land to forage on the planted eucalypts. The subject land does not contain nesting resources or foraging resources of potential significance to the species.
Botaurus poiciloptilus Australasian Bittern	E	E1	Australasian Bitterns are widespread but uncommon over south-eastern Australia. In NSW they may be found over most of the state except for the far north-west. Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha* spp.) and spikerushes (*Eleocharis* spp.). Hides during the day amongst dense reeds or rushes and feed mainly at night on frogs, fish, yabbies, spiders, insects and snails.	Low There is no potential habitat of significance for this species on the subject land.
Calidris ferruginea Curlew Sandpiper	CE	E	The Curlew Sandpiper is distributed around most of the Australian coastline. Inland records are probably mainly of birds pausing for a few days during migration. The Curlew Sandpiper breeds in Siberia and migrates to Australia (as well as Africa and Asia) for the non-breeding period, arriving in Australia between August and November, and departing between March and mid-April. It generally occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts. It also occurs in non-tidal swamps, lakes and lagoons on the coast and sometimes inland.	Low There is no potential habitat of significance for this species on the subject land.
Callocephalon fimbriatum Gang-gang Cockatoo	-	V1	In summer the Gang-gang Cockatoo occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. Also occur in subalpine Snow Gum woodland and occasionally in temperate or regenerating forest. In winter, the species occurs at lower altitudes in drier, more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas. The Gang-gang Cockatoo usually breeds in tall forests in the Southern Tablelands region, however they have been observed on occasion to breed in Box-Gum Woodland and other similar lowland habitat around Canberra (R. Speirs pers. obs., M. Mulvaney pers. comm.).	Low It is possible that the species may visit the subject land to forage on the planted eucalypts. The subject land does not contain nesting resources or foraging resources of potential significance to the species.

Species Name	EPBC Act Status	BC Act Status	Description (Distribution and Habitat)	Likelihood of Occurrence
Calyptorhynchus lathami Glossy Black-cockatoo	-	V1	The Glossy Black-cockatoo has a patchy distribution, having once been widespread across most of the south-east of Australia. The species is now distributed throughout an area which extends from the coast near Eungella in eastern Queensland to Mallacoota in Victoria. Glossy black-cockatoos feed on casuarina seeds, however they occasionally consume seeds from eucalypts, angophoras, acacias and hakeas, as well as insect larvae. On the Southern Tablelands of the NSW and the ACT the species feeds almost exclusively on Drooping Sheoak *Allocasuarina verticillata*. Pairs mate for life and nest in the hollows of large, old living or dead eucalypt trees. Breeding occurs between March and August.	Low It is possible that the species may visit the subject land, however the subject land does not contain nesting resources or foraging resources of potential significance to the species.
Chthonicola sagittata Speckled Warbler	-	V1	The Speckled Warbler lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat includes scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area. The diet consists of seeds and insects, with most foraging taking place on the ground around tussocks and under bushes and trees. Pairs are sedentary and occupy a breeding territory of about ten hectares, with a slightly larger home-range when not breeding. The rounded, domed, roughly built nest of dry grass and strips of bark is located in a slight hollow in the ground or the base of a low dense plant.	Low It is possible that the species may visit the subject land to forage. The subject land does not contain nesting resources or foraging resources of potential significance to the species.
Climacteris picumnus victoriae Brown Treecreeper (eastern subspecies)	-	V1	In the region, Brown Treecreepers occur in dry woodlands and open forest below 1,000 metres. Brown Treecreepers also frequent paddocks and grasslands where there are sufficient logs, stumps and dead trees nearby. The species prefers relatively undisturbed woodland and dry open forest where the native understorey, especially grasses, has been preserved. The species usually prefers predominantly rough-barked trees such as Stringybarks and rough barked Boxes.	Low It is possible that the species may visit the subject land to forage. The subject land does not contain nesting resources or foraging resources of potential significance to the species.
Daphoenositta chrysoptera Varied Sittella	-	V1	The Varied Sittella occurs in a wide variety of woodland and forest habitats, particularly in lowland areas. The species prefers areas with a dominance of rough barked trees, notably Red Stringybark at relatively high density. The species is rarely recorded in sparsely treed areas.	Negligible There is no potential habitat for this species on the subject land.

Species Name	EPBC Act Status	BC Act Status	Description (Distribution and Habitat)	Likelihood of Occurrence
Grantiella picta Painted Honeyeater	-	V1	The Painted Honeyeater is found in Queensland and New South Wales west of the Great Dividing Range, through to northern Victoria. The species displays some migratory movement and is occasionally found in the Northern Territory and is a vagrant to South Australia and the ACT. The species frequents eucalypt forests and woodlands, particularly those that are infested heavily with mistletoes.	Low It is possible that the species may visit the subject land to feed on flowering eucalypts. The subject land does not contain foraging resources of potential significance to the species.
Hieraaetus morphnoides Little Eagle	-	V1	The Little Eagle is distributed throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment, and occupies habitats rich in prey within open eucalypt forest, woodland or open woodland. The species is sensitive to human disturbance.	Moderate The subject land is likely to be part of the large foraging range of a pair of Little Eagles, however no indications of breeding activity (i.e. large stick nests) were observed on the subject land or nearby during the survey.
Lathamus discolor Swift Parrot	E	E1	The Swift Parrot occurs in woodlands and forests of NSW from May to August, where it feeds on eucalypt nectar, pollen and associated insects. The Swift Parrot is dependent on flowering resources across a wide range of habitats in its wintering grounds in NSW. This species is migratory, breeding in Tasmania and also nomadic, moving about in response to changing food availability.	Low It is possible that the species may visit the subject land to feed on flowering eucalypts. The subject land does not contain foraging resources of potential significance to the species.
Melanodryas cucullata cucullata Hooded Robin (southeastern form)	-	V1	The Hooded Robin occupies drier eucalypt forest, woodland and scrub, grasses and low shrubs, as well as cleared paddocks with regrowth or stumps. The species uses stumps, posts or fallen timber from which to locate prey on the ground. The species is found in woodland, often with scattered Yellow Box and/or Blakely's Red Gum, with long grass and low shrubs, or fallen logs.	Low It is possible that the species may visit the subject land to forage. The subject land does not contain nesting resources or foraging resources of potential significance to the species.

Species Name	EPBC Act Status	BC Act Status	Description (Distribution and Habitat)	Likelihood of Occurrence
Petroica boodang Scarlet Robin	-	V1	The Scarlet Robin is found in south-eastern Australia (extreme south-east Queensland to Tasmania, western Victoria and south-east South Australia) and south-west Western Australia. In NSW it occupies open forests and woodlands from the coast to the inland slopes, breeding in drier eucalypt forests and temperate woodlands.	Moderate It is possible that the species may visit the subject land to forage. The subject land does not contain nesting resources or foraging resources of potential significance to the species.
Petroica phoenica Flame Robin	-	V1	The Flame Robin is found in south-eastern Australia, from the Queensland border to Tasmania, western Victoria and south-east South Australia. In NSW it breeds in upland moist eucalypt forests and woodlands, often on ridges and slopes, in areas of open understorey. The species migrates in winter to more open lowland habitats such as grassland with scattered trees and open woodland on the inland slopes and plains.	Low It is possible that the species may visit the subject land to forage. The subject land does not contain nesting resources or foraging resources of potential significance to the species.

Species Name	EPBC Act Status	BC Act Status	Description (Distribution and Habitat)	Likelihood of Occurrence
Polytelis swainsonii Superb Parrot	V	V1	Found mainly in open, tall riparian River Red Gum forest or woodland. Often found in farmland including grazing land with patches of remnant vegetation. Breeds in hollow branches of tall eucalypt trees within nine kilometres of feeding areas.	Moderate The species was not observed on the subject land or nearby during the field surveys, however it is possible that the species may visit the subject land to forage on the planted eucalypts. The hollows in the three remnant Brittle Gum trees are currently occupied by Rosellas and Starlings, and due to the peri-urban location and poor condition of the surrounding vegetation, these trees are likely to be provide suitable breeding habitat for such common species only. It is unlikely that Superb Parrots would breed in the remnant trees on the subject land. The subject land does not contain foraging resources of potential significance to the species.
Rostratula australis Australian Painted Snipe	V	E1	Usually found in shallow inland wetlands including farm dams, lakes, rice crops, swamps and waterlogged grassland. The species prefers freshwater wetlands, ephemeral or permanent, although it has been recorded in brackish waters.	Low There is no potential habitat of significance for this species on the subject land.
Stagonopleura guttata Diamond Firetail	-	V1	The Diamond Firetail is found in eastern Australia, from Eyre Peninsula, South Australia, to south-eastern Queensland. There has been a decline in density throughout the range, and many remaining populations may now be isolated. The species inhabits a wide range of eucalypt-dominated vegetation communities that have a grassy understorey, including woodland and mallee.	Low It is possible that the species may visit the subject land to forage. The subject land does not contain nesting resources or foraging resources of potential significance to the species.

Species Name	EPBC Act Status	BC Act Status	Description (Distribution and Habitat)	Likelihood of Occurrence
Fish and Crustacea				
Maccullochella peelii Murray Cod	V	-	The Murray Cod's natural distribution extends throughout the Murray-Darling basin ranging west of the divide from south east Queensland, through NSW into Victoria and South Australia. The species is found in the waterways of the Murray– Darling Basin in a wide range of warm water habitats that range from clear, rocky streams to slow flowing turbid rivers, billabongs and large deep holes. Murray Cod is entirely a freshwater species and will not tolerate high salinity levels.	Negligible There is no potential habitat on the subject land for the species.
Macquaria australasica Macquarie Perch	E	E1	Macquarie Perch are found in the Murray-Darling Basin (particularly upstream reaches) of the Lachlan, Murrumbidgee and Murray rivers, and parts of south-eastern coastal NSW, including the Hawkesbury and Shoalhaven catchments. Macquarie perch are found in both river and lake habitats, especially the upper reaches of rivers and their substantial tributaries.	Negligible There is no potential habitat on the subject land for the species.
Frogs				
Litoria aurea Green and Golden Bell Frog	V	E1	The Green and Golden Bell Frog occurs mainly along coastal lowland areas of eastern NSW and Victoria. The furthest inland record of the species is at a recently discovered population near Hoskinstown in the Southern Tablelands (referred to as the Molonglo population). The species was previously known from elsewhere in the Southern Tablelands but is now considered to have disappeared from the ACT and central slopes around Bathurst. In NSW, the species commonly occupies disturbed habitats, and breeds largely in ephemeral ponds. However, in Victoria, the Green and Golden Bell Frog occupies habitats with little human disturbance and commonly breeds in permanent ponds, as well as ephemeral ponds.	Negligible The species is not known to occur near the subject land, and the highly disturbed dams and creek are unlikely to provide potential habitat for the species.

Species Name	EPBC Act Status	BC Act Status	Description (Distribution and Habitat)	Likelihood of Occurrence
Litoria booroolongensis Booroolong Frog	E	-	The Booroolong Frog is restricted to tablelands and slopes in NSW and north-east Victoria at 200–1300 m above sea level. The species is predominantly found along the western-flowing streams and their headwaters of the Great Dividing Range, and a small number of eastern-flowing streams in the north end of its range. The Booroolong Frog occurs along permanent streams with some fringing vegetation cover such as ferns, sedges or grasses. Adults occur on or near cobble banks and other rock structures within stream margins, or near slow-flowing connected or isolated pools that contain suitable rock habitats. Streams range from small slow-flowing creeks to large rivers in dissected mountainous country, tablelands, foothills and lowland plains. Primary habitat requirements for the Booroolong Frog are extensive rock bank structures along permanent rivers. The species can occur in cleared grazing land and pasture.	Negligible The species is not known to occur near the subject land, and the highly disturbed dams and creek are unlikely to provide potential habitat for the species.
Litoria castanea Yellow-spotted Tree Frog	E	-	The Yellow-spotted Tree Frog previously had a disjunct distribution, being recorded on the New England Tablelands and on the Southern Tablelands from Lake George to Bombala. The species has only recently (2010) been rediscovered on the Southern Tablelands. Prior to this the species had not been recorded on the Southern Tablelands since the 1970s. Found in large permanent ponds, lakes and dams with an abundance of bulrushes and other emergent vegetation, it shelters during autumn and winter under fallen timber, rocks, other debris or thick vegetation.	Negligible The species is not known to occur near the subject land, and the highly disturbed dams and creek are unlikely to provide potential habitat for the species.
Litoria raniformis Growling Grass Frog	V	E1	In NSW, the species is known to exist only in isolated populations in the Coleambally Irrigation Area, the Lowbidgee floodplain and around Lake Victoria. Usually found in or around permanent or ephemeral swamps or billabongs with an abundance of bulrushes and other emergent vegetation along floodplains and river valleys. The species has also been found in irrigated rice crops. Outside the breeding season animals disperse away from water and take shelter beneath ground debris such as fallen timber and bark, rocks, grass clumps and in deep soil cracks. The species previously occurred on the Southern Tablelands at a number of sites within the Murrumbidgee River corridor, however it is now widely considered to have become extinct on the Southern Tablelands.	Negligible The species is not known to occur near the subject land, and the highly disturbed dams and creek are unlikely to provide potential habitat for the species.

Species Name	EPBC Act Status	BC Act Status	Description (Distribution and Habitat)	Likelihood of Occurrence
Insects				
Synemon plana Golden Sun Moth	CE	E1	The Golden Sun Moth's NSW populations are found in the area between Queanbeyan, Gunning, Young and Tumut. The species occurs in Natural Temperate Grasslands and Box-Gum Grassy Woodland in which the groundcover is dominated by Wallaby Grasses (*Rytidosperma* spp.). It is believed that the females lay up to 200 eggs at the base of the Wallaby Grass tussocks. After hatching, the larvae tunnel underground where they remain feeding on the roots of Wallaby Grass tussocks. The species is also known to feed on the introduced species (and Weed of National Significance), Chilean Needle Grass *Nassella neesiana*.	Negligible There is no potential habitat on the subject land for the species as confirmed by surveys for Golden Sun Moth larvae (Section 2.3.4.2).
Mammals				
Chalinolobus dwyeri Large-eared Pied Bat	V	V1	The Large-eared Pied Bat appears to exist in a number of small populations throughout its range. Very few maternity sites are known. The species requires a combination of sandstone cliff/escarpment to provide roosting habitat that is adjacent to higher fertility sites, particularly box gum woodlands or river/rainforest corridors which are used for foraging.	Negligible The species is highly unlikely to occur on the subject land.
Dasyurus maculatus maculatus Spot-tailed Quoll (SE mainland population)	E	V1	The Spot-tailed Quoll occurs along the east coast of Australia and the Great Dividing Range. The species uses a range of habitats including sclerophyll forests and woodlands, coastal heathlands and rainforests. Occasional sightings have been made in open country, grazing lands, rocky outcrops and other treeless areas. Habitat requirements include suitable den sites, including hollow logs, rock crevices and caves, an abundance of food and an area of intact vegetation in which to forage. Seventy per cent of the diet is medium-sized mammals, and also feeds on invertebrates, reptiles and birds. Individuals require large areas of relatively intact vegetation through which to forage. The home range of a female is between 180 and 1000ha, while males have larger home ranges of between 2000 and 5000ha. Breeding occurs from May to August.	Negligible There is no potential habitat on the subject land for the species.

Species Name	EPBC Act Status	BC Act Status	Description (Distribution and Habitat)	Likelihood of Occurrence
Miniopterus schreibersii oceanensis Eastern Bentwing Bat	-	V1	The Eastern Bentwing Bat is a subspecies of the Common Bentwing Bat, with a range thought to be from central Victoria to Cape York Peninsula, Queensland. It is a fast flyer, able to travel many kilometres in a night. Caves are the primary roosting habitat for this species however similar man-made structures are also used (culverts, eaves etc.). The species forages above the forest canopy.	Moderate The species may visit the subject land to forage, but there is no potential breeding habitat on the subject land for the species.
Petauroides Volans Greater Glider	V	-	The greater glider is restricted to eastern Australia, occurring from the Windsor Tableland in north Queensland through to central Victoria, with an elevational range from sea level to 1200 m above sea level. The greater glider is an arboreal nocturnal marsupial, largely restricted to eucalypt forests and woodlands. It is primarily folivorous, and is typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows. The greater glider favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred tree species	Negligible There is no potential habitat on the subject land for the species.
Petrogale penicillata Brush-tailed Rock-wallaby	V	E1	In NSW they occur from the Queensland border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit. They occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north. They browse on vegetation in and adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees.	Negligible There is no potential habitat for this species on the subject land.
Phascolarctos cinereus Koala (combined populations of Qld, NSW and the ACT)	V	V1	In NSW, the Koala mainly occurs on the central and north coasts with some populations in the western region. Koalas feed almost exclusively on eucalypt foliage, and their preferences vary regionally. They are solitary with varying home ranges. In high quality habitat home ranges may be 1-2 hectare and overlap, while in semi-arid country they are usually discrete and around 100 ha.	Negligible The species is not known to occur in the Gundaroo locality, and no evidence of koala was detected (e.g. scats, scratch marks).

Species Name	EPBC Act Status	BC Act Status	Description (Distribution and Habitat)	Likelihood of Occurrence
Pteropus poliocephalus Grey-headed Flying Fox	V	-	The Grey-headed Flying Fox occurs in the coastal belt from Rockhampton in central Queensland to Melbourne in Victoria. Whilst Brisbane, Newcastle, Sydney and Melbourne are occupied continuously, the species is widespread throughout their range during summer. In autumn the species occupies coastal lowlands and is uncommon inland. In winter the species congregates in coastal lowlands north of the Hunter Valley and is occasionally found on the south coast of NSW and on the northwest slopes (associated with flowering eucalypts of these areas). The Grey-headed Flying-fox requires foraging resources and roosting sites. It is a canopy-feeding frugivore and nectarivore, which utilises vegetation communities including rainforests, open forests, closed and open woodlands, Melaleuca swamps and Banksia woodlands. The Grey-headed Flying-fox roosts in aggregations of various sizes on exposed branches. Roost sites are typically located near water, such as lakes, rivers or the coast. The roost at Commonwealth Park in Canberra is the only known roost in the ACT region.	Low It is possible that the species may visit the subject land to forage. The subject land does not contain nesting resources or foraging resources of potential significance to the species.
Reptiles				
Aprasia parapulchella Pink-tailed Worm-lizard	V	V	The Pink-tailed Worm-lizard is a fossorial species which lives beneath surface rocks and occupies ant burrows. It feed on ants, particularly their eggs and larvae. Thought to lay eggs within the ant nests under rocks that it uses as a source of food and shelter and for thermoregulation. Key habitat features are a cover of native grasses, particularly Kangaroo Grass, sparse or no tree cover, little or no leaf litter, and scattered small rock with shallow embedment in the soil surface.	Negligible There is no potential habitat on the subject land for the species.

Species Name	EPBC Act Status	BC Act Status	Description (Distribution and Habitat)	Likelihood of Occurrence
Delma impar Striped Legless Lizard	V	V1	The Striped Legless Lizard is patchily distributed in grasslands of south-eastern NSW, the ACT, north-eastern, central and south-western Victoria, and south-eastern South Australia. Most areas where the species persists are thought to have had low to moderate levels of agricultural disturbance in the past and it has been suggested that ploughing in particular may be incompatible with the survival of the species. Until recently, the species was thought to inhabit only native grasslands dominated by species such as Tall Speargrass and Kangaroo Grass. In recent years, surveys have revealed the Striped Legless Lizard in many sites dominated by exotic grasses such as Phalaris, Serrated Tussock and Flatweed. They have also been found in several secondary grassland sites, generally within two kilometres of primary grassland.	Low The species is not known to occur in the locality, with the nearest record over 20 km from the subject land (ref. BioNet).
Plants				
Acacia bynoeana Bynoe's Wattle	V	E1	Bynoe's wattle is found in central eastern NSW, from the Hunter District (Morisset) south to the Southern Highlands and west to the Blue Mountains. The species is currently known from about 30 locations, with the size of the populations at most locations being very small (1-5 plants). The species occurs in heath or dry sclerophyll forest on sandy soils. It seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Associated overstorey species include Red Bloodwood, Scribbly Gum, Parramatta Red Gum, Saw Banksia and Narrow-leaved Apple.	Negligible There is no potential habitat on the subject land for the species
Caladenia tessellata Thick-lipped Spider-orchid	V	E1	Known from the Sydney area (old records), Wyong, Ulladulla and Braidwood in NSW. Populations in Kiama and Queanbeyan are presumed extinct. It was also recorded in the Huskisson area in the 1930s. The species occurs on the coast in Victoria from east of Melbourne to almost the NSW border. Generally found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil.	Negligible There is no potential habitat on the subject land for the species.

Species Name	EPBC Act Status	BC Act Status	Description (Distribution and Habitat)	Likelihood of Occurrence
Dodonaea procumbens Trailing Hop-bush	V	V	Trailing Hop-bush is found in the dry areas of the Monaro, between Michelago and Dalgety where it occurs mostly in Natural Temperate Grassland or Snow Gum *Eucalyptus pauciflora* Woodland. A single known population occurs at Lake Bathurst (the northern-most occurrence of the species) where it occurs adjacent to the lake bed in grassland dominated by Corkscrew Grass *Austrostipa scabra* and Curly Sedge *Carex bichenoviana*. The species grows on sandy-clay soils in open bare patches where there is little competition from other species. The species often occurs on roadside batters and does not persist in heavily grazed pastures.	Negligible There is no potential habitat on the subject land for the species.
Eucalyptus aggregata Black Gum	V	V1	Black Gum occurs on the central and southern tablelands of NSW, and in a small disjunct population in Victoria. In NSW, it occurs predominantly in the South Eastern Highlands Bioregion. The species is a small to medium-sized woodland tree which grows in grassy woodlands on alluvial soils in moist sites along creeks on broad, cold and poorly-drained flats and hollows. It commonly occurs with Candlebark *Eucalyptus rubida*, Ribbon Gum *E. viminalis*, and Snow Gum *E. pauciflora*, with a grassy understorey of River Tussock *Poa labillardieri*. Most populations are located on private land or road verges and travelling stock routes.	Negligible This species is not present on the subject land.
Eucalyptus macarthurii Camden Woollybutt / Paddys River Box	E	E1	The species is currently recorded from the Moss Vale District to Kanangra Boyd National Park. In the Southern Highlands it occurs mainly on private land, often as isolated individuals in, or on the edges, of paddocks. Isolated stands occur in the north west part of the range on the Boyd Plateau. The only known record in the conservation estate is within Kanangra Boyd National Park. The species occurs on grassy woodland on relatively fertile soils on broad cold flats.	Negligible This species is not present on the subject land.
Haloragis exalata subsp. Exalata Wingless Raspwort / Square Raspwort	V	V1	Square Raspwort occurs in 4 widely scattered localities in eastern NSW. It is disjunctly distributed in the Central Coast, South Coast and North Western Slopes botanical subdivisions of NSW. Square Raspwort appears to require protected and shaded damp situations in riparian habitats. Flowering specimens in NSW are recorded from November to January.	Negligible There is no potential habitat on the subject land for the species

Species Name	EPBC Act Status	BC Act Status	Description (Distribution and Habitat)	Likelihood of Occurrence
Kunzea cambagei	V	V1	*Kunzea cambagei* occurs in the western and southern parts of the Blue Mountains, NSW, with four main populations with 20–150 individuals. *Kunzea cambagei* occurs in wet heath and woodland on coarse sandy soil on sandstone and quartzite.	Negligible This species is not present on the subject land.
Lepidium hyssopifolium Basalt Peppercress	E	E	This species is known from a few populations in NSW, Victoria and Tasmania. The Basalt Pepper-cress is known to establish on open, bare ground with limited competition from other plants. It was previously recorded from Eucalypt woodland with a grassy ground cover, low open Casuarina woodland with a grassy ground cover and tussock grassland. Recently recorded localities have predominantly been in weed-infested areas of heavy modification, high degradation and high soil disturbance such as road and rail verges, on the fringes of developed agricultural land or within small reserves in agricultural land. Many populations are now generally found amongst exotic pasture grasses and beneath exotic trees.	Low The species is not known to occur near the subject land and was not recorded during the field survey.
Leucochrysum albicans var. *tricolor* Hoary Sunray	E	-	The Hoary Sunray occurs from Queensland to Victoria and in Tasmania. In the ACT the species can be seen in spring in abundance on the roadside along Fairbairn Avenue and into Mt Ainslie Nature Reserve, on the western slopes of Mt Majura and adjacent to the Federal Highway road easement. In NSW it is distributed on the inland slopes and plains including grasslands and woodlands on the Monaro and is quite a common species along in less modified areas. The species is usually found in ungrazed and lightly grazed areas, along roadsides in particular. It appears to be very sensitive to grazing but responds to disturbance as a coloniser and appears to tolerate mowing. Flowers spring to summer.	Negligible The species was not recorded during the survey and is unlikely to occur on the subject land due to the history of intense grazing and modification,
Pelargonium sp. Striatellum Omeo Stork's-bill	E	E1	An undescribed species of Pelargonium, Omeo Stork's Bill is a tufted perennial herb threatened by grazing, recreational activities, and exotic species. It is known to occur just above the high-water level of ephemeral lakes in NSW and Victoria.	Negligible There is no potential habitat for this species on the subject land.

Species Name	EPBC Act Status	BC Act Status	Description (Distribution and Habitat)	Likelihood of Occurrence
Pomaderris pallida Pale Pomaderris	V	V1	Pale Pomaderris has been recorded from near Kydra Trig, north-west of Nimmitabel, Tinderry Nature Reserve, and the Queanbeyan River. A record from Byadbo in Kosciuszko National Park has not been relocated. The main distribution is along the Murrumbidgee in the ACT. It was recorded recently in eastern Victoria. This species usually grows in shrub communities surrounded by Brittle Gum *Eucalyptus mannifera* and Red Stringybark *E. macrorhynca* or Black Cypress *Callitris endlicheri* woodland.	Negligible This species is not present on the subject land.
Prasophyllum petilum Tarengo Leek Orchid	E	E1	When first described in 1991, the Tarengo Leek Orchid was known only from the Hall Cemetery in the ACT. It has since been found at four sites in New South Wales: Captains Flat Cemetery, Ilford Cemetery, Steves Travelling Stock Route (TSR) at Delegate and the Tarengo TSR near Boorowa. The Tarengo Leek Orchid occurs on relatively fertile soils in grassy woodland or natural grassland. The three cemetery sites originally contained grassy woodland, dominated by Snow Gum *Eucalyptus pauciflora* and Black Gum *E. aggregata* at Captains Flat, and Blakely's Red Gum *E. blakelyi* and Yellow Box *E. melliodora* at Hall and Ilford. Both Tarengo TSR and Steves TSR are natural grasslands. The species is intolerant of grazing and this is considered to be the key reason it has been found only within cemeteries and TSRs, land from which grazing has been restricted.	Negligible There is no potential habitat on the subject land for the species.
Pultenaea pedunculata Matted Bush-pea	-	E1	In NSW, the species is represented by only three disjunct populations: in the Cumberland Plains in Sydney, the coast between Tathra and Bermagui, and the Windellama area south of Goulburn (where it is locally abundant). The Matted Bush-pea occurs in a range of habitats. NSW populations are generally among woodland vegetation, but plants have also been found on road batters and coastal cliffs. It is largely confined to loamy soils in dry gullies in populations in the Windellama area. The ability of stems to creep and root from the nodes has made this species a very good coloniser of bare ground in many parts of its range.	Negligible There is no potential habitat on the subject land for the species.

Species Name	EPBC Act Status	BC Act Status	Description (Distribution and Habitat)	Likelihood of Occurrence
Rutidosis Leptorrhynchoides Button Wrinklewort	E	E1	In the ACT and NSW, Button Wrinklewort occurs in box-gum woodland, secondary grassland derived from box-gum woodland or in natural temperate grassland. It prefers open spaces where it does not have to compete for light. It is known from several sites in the ACT, NSW and Victoria, where it is threatened by habitat loss, grazing and weed encroachment.	Negligible The species is quite conspicuous when present and it was not recorded during the survey.
Swainsona sericea Silky Swainson-pea	-	V1	Silky Swainson-pea is a low growing perennial, found from the Northern Tablelands to the Southern Tablelands and Monaro region as well as further inland on the slopes and plains. The species is found in Natural Temperate Grassland and Snow Gum Woodland on the Monaro, and in Box-Gum Woodland in the Southern Tablelands and South West Slopes.	Negligible There is no potential habitat on the subject land for the species

Appendix D. BAM plot transect scores

PCT code	Veg. Zone	Plot no.	Species richness						Cover (%)						
			Tree species	Shrub species	Grass species	Forb species	Fern species	Other species	Tree	Shrub	Grass	Forb	Fern	Other	High threat weed
351	1	1	1	0	0	0	0	0	15	0	0	0	0	0	0
896	1	1	0	0	3	0	0	0	0	0	39	0	0	0	3
		2	0	0	2	0	0	0	0	0	27	0	0	0	7
		3	0	0	2	0	0	0	0	0	35	0	0	0	1
896	2	1	0	0	1	0	0	0	0	0	90	0	0	0	0
896	3	1	4	7	0	0	0	0	8.5	15.5	0	0	0	0	32
		2	1	2	1	0	0	0	40	16	3	0	0	0	5

PCT code	Veg. Zone	Plot no.	Tree regeneration	Large trees (count)	Trees with hollows (count)	Litter cover (%)	Fallen logs (m)	Tree composition (count)						
								Stems < 5 cm	Stems 5-10 cm	Stems 10-20 cm	Stems 20-30 cm	Stems 30-50 cm	Stems 50-80 cm	Stems 80 + cm
351	1	1	0	2	2	12	65	-	-	-	-	-	-	2
896	1	1	0	0	0	22	0	-	-	-	-	-	-	-
		2	0	0	0	28	0	-	-	-	-	-	-	-
		3	0	0	0	12	0	-	-	-	-	-	-	-
896	2	1	0	0	0	0	0	-	-	-	-	-	-	-
896	3	1	0	0	0	39	0	17	33	8	1	-	-	-
		2	0	0	0		5	10	20	6	10	-	-	-