



Mt Gilead Residential Development

EPBC Preliminary Documentation Report (EPBC 2015/7599)

Prepared for:
Lendlease Communities (Mt Gilead) Pty Ltd

11 December 2017



DOCUMENT TRACKING

Item	Detail
Project Name	Mt Gilead-EPBC Preliminary Documentation Assessment Report
Project Number	16SUT 4677
Project Manager	Brendan Dowd 02 4201 2202 Suite 204, Level 2, 62 Moore Street, Austinmer NSW 2515
Prepared by	Jack Talbert, Karen Spicer and Deanne Hickey
Reviewed by	Robert Humphries and Brendan Dowd
Approved by	Brendan Dowd
Status	Draft for Exhibition
Version Number	V7
Last saved on	11 December 2017
Cover photo	Mt Gilead from a hill in the north west of the study area looking to the south east. Photo by ELA April 2015

This report should be cited as 'ELA 2017 *Mt Gilead EPBC Preliminary Documentation Assessment Report* prepared for Lendlease Communities (Mt Gilead) Pty Ltd.

ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd with support from Mt Gilead Pty Ltd.

Disclaimer

This document may only be used for the purpose for which it was commissioned and in accordance with the contract between Eco Logical Australia Pty Ltd and Lendlease Communities (Mt Gilead) Pty Ltd. The scope of services was defined in consultation with Lendlease Communities (Mt Gilead) Pty Ltd, by time and budgetary constraints imposed by the client, and the availability of reports and other data on the subject area. Changes to available information, legislation and schedules are made on an ongoing basis and readers should obtain up to date information.

Eco Logical Australia Pty Ltd accepts no liability or responsibility whatsoever for or in respect of any use of or reliance upon this report and its supporting material by any third party. Information provided is not intended to be a substitute for site specific assessment or legal advice in relation to any matter. Unauthorised use of this report in any form is prohibited.

Template 10/05/13

Contents

Executive Summary	ix
1 Scope of this Report	12
2 Introduction	15
2.1 Proponent	15
2.2 Site description	15
2.3 Variation to the action	16
2.4 Proposed action	21
2.5 Development footprint	22
2.6 Social and Economic Considerations	23
3 Legislation and Assessment	32
3.1 Environmental impact assessments under Commonwealth, state or territory legislation	32
3.2 Public consultation (including with Indigenous stakeholders)	33
4 Identification of Matters of National Environmental Significance	34
4.1 DotEE Requirements	34
4.2 Protected Matters Search Tool	34
4.3 Field survey and methodology	35
4.4 Threatened Flora	43
4.5 Fauna	47
4.6 Vegetation Communities	47
4.6.1 Justification for EPBC Act listed vegetation within the study area	48
4.6.2 SSTF at Mt Gilead	50
4.6.3 CPW at Mt Gilead	51
5 Threatened Ecological Communities	57
5.1 Mt Gilead TECs	57
5.1.1 Location and physical environment	57
5.1.2 Geology and Soils	57
5.1.3 Vegetation biogeographical discussion	57
5.2 Shale Sandstone Transition Forest	59
5.2.1 Ecological community description	59
5.2.2 Condition of SSTF within study area	60
5.2.3 Impacts to SSTF	61
5.3 Cumberland Plain Woodlands and Shale-Gravel Transition Forest	63

5.3.1	Ecological community description	63
5.3.2	Condition of CPW within study area	64
5.3.3	Impact to CPW.....	64
6	Threatened Fauna.....	67
6.1	Swift Parrot (<i>Lathamus discolor</i>)	67
6.2	Grey-headed Flying-fox (<i>Pteropus poliocephalus</i>)	71
6.3	Large-eared Pied Bat (<i>Chalinobolus dwyeri</i>).....	73
6.4	Koala (<i>Phascolarctos cinereus</i>).....	75
7	Proposed Safeguards and Mitigation Measures	79
7.1	Avoidance and minimisation.....	79
7.2	Management of potential indirect impacts	79
7.3	Buffer zones.....	80
7.4	Flooding, stormwater and water quality.....	81
7.5	Vegetation and habitat clearance	83
7.6	Construction Environmental Management Plan	83
7.7	Parties responsible for implementation	85
8	Offset Strategy.....	86
8.1	On-site Offsets.....	87
8.1.1	Offset site management agreements	87
8.1.2	EPBC listed associations with the On-site Conservation Areas.....	90
8.1.3	EPBC Act Offset Requirements.....	90
8.1.4	Management of the On-site Offsets	102
8.1.5	Time to achieve conservation gain	102
8.1.6	Level of certainty of conservation gain	103
8.1.7	Funding.....	103
8.2	Off-site Offset.....	104
8.2.1	Off-site Offsets summary	104
8.2.2	Diversity and structure of SSTF.....	108
8.2.3	Vegetation condition	108
8.2.4	Regional Significance	110
8.2.5	Time to achieve conservation gain	116
8.2.6	Tenure	116
8.2.7	Management of the offset area.....	116
8.2.8	Management of grazing for conservation	116
8.2.9	Management of fire for conservation	116
8.2.10	Management of human disturbance	117
8.2.11	Retention and regrowth and remnant native vegetation	117
8.2.12	Weed control.....	117

8.2.13	Replanting or supplementary planting where natural regeneration will not be sufficient	117
8.2.14	Retention of dead timber	118
8.2.15	Erosion control.....	118
8.2.16	Retention of rocks.....	118
8.2.17	Nutrients	118
9	Monitoring and reporting.....	119
9.1	Monitoring	119
9.2	Measurability and performance measures	119
9.3	Annual report	120
10	Biodiversity Outcome Summary and Conclusion	121
	References	123
	Appendix A: Mt Gilead Biodiversity Certification Assessment Report and Biocertification Strategy	126
	Appendix B: Protected Matters Search Tool Results	127
	Appendix C: Species list from Plot data and EPBC Act condition assessment.....	143
	Appendix D: Macarthur Onslow BioBank Assessment.....	144
	Appendix E: Macarthur Onslow Credit Report.....	145
	Appendix F: Noorumba BioBank Assessment.....	146
	Appendix G: Noorumba Credit Report.....	147
	Appendix H: Stormwater Management and Flooding Assessment	148
	Appendix I: Conceptual Landscape Plans.....	149
	Appendix J: Fernhill Central West BioBank BioBanking Assessment.....	150

List of figures

Figure 1: Mt Gilead locality	18
Figure 2: The Mt Gilead study area and surrounding land.....	19
Figure 3: The proposed land zoning map (Source: CCC 2015).....	20
Figure 4: Proposed development layout plan zones and proposed conservation areas	25
Figure 5: North-eastern portion zoom - proposed development layout plan, asset protection zones and proposed conservation area features	26
Figure 6: North-western portion zoom - proposed development layout plan, asset protection zones and proposed conservation area features	27
Figure 7: Central northern portion zoom - proposed development layout plan and proposed conservation area features	28
Figure 8: Central southern portion zoom - proposed development layout plan and proposed conservation area features	29
Figure 9: Western portion zoom 1 - proposed development layout plan, asset protection zones and proposed conservation area features.....	30
Figure 10: Western portion zoom 2 - proposed development layout plan, asset protection zones and proposed conservation area features.....	31
Figure 11: Survey effort within the study area and surrounding land.....	40
Figure 12: Survey effort for fauna species.	41
Figure 13: Vegetation communities mapped within the study area	49
Figure 14: Flowchart to determine whether the condition thresholds for CPW under the EPBC Act are met (DEWHA 2010).....	52
Figure 15: Quadrats and patches of “like” vegetation within the study area based on EPBC Act advice and condition criteria.	56
Figure 16: Existing and potential conservation areas and SSTF and CPW within the study area and surrounding lands	58
Figure 17: EPBC vegetation outcome	66
Figure 18: Potential habitat for EPBC Act listed threatened fauna species to be impacted or protected within the study area	70
Figure 19: Koala habitat and records and potential movement corridors	78
Figure 20: Indicative design of the detention basins from nearby examples at Rouse Hill.....	82
Figure 21: Onsite offset areas	89

Figure 22: Fernhill Central West BioBank in relation to Mount Gilead..... 105

Figure 23: Fernhill Central West BioBank Site 106

Figure 24: Validated vegetation and proposed area of offset 107

Figure 25: Zoning surrounding Fernhill Central West 111

List of tables

Table 1: Additional Information requested by DotEE	13
Table 2: Field survey completed by ELA within the study area	36
Table 3: Field survey conducted by ELA outside of the study area in surrounding lands.	38
Table 4: ELA survey times (green) and recommended timing of targeted flora and fauna survey for each potential threatened species (OEH 2014)	42
Table 5: Condition Thresholds for patches that meet description for the SSTF ecological community...51	
Table 6: EPBC categories and thresholds for Cumberland Plain Woodland / Shale-Gravel Transition Forest	53
Table 7: Justification of EPBC Act listed vegetation within the study area.	54
Table 8: Impacts to SSTF.....	61
Table 9: Significant Impact Assessment for the Swift Parrot	68
Table 10: Significant Impact Assessment for Grey-headed Flying -fox	72
Table 11: Significant Impact Assessment for Large-eared Pied Bat.....	74
Table 12: Koala habitat assessment tool	75
Table 13: Conservation areas within Mt Gilead	88
Table 14: Species associations with the Onsite Conservation Areas	90
Table 15: Current quality of SSTF to be impacted	91
Table 16: Current and future qualities of Category A SSTF offset.....	92
Table 17: Current and future qualities of Category D SSTF offset	92
Table 18: Applicable attributes to the EPBC Act environmental offsets policy for SSTF Category A	93
Table 19: Applicable attributes to the EPBC Act environmental offsets policy for SSTF Category D	98
Table 20: Timing of the conservation gains within the Onsite Conservation Area.....	102
Table 21: Offset liabilities, availabilities, surplus and deficits.....	104
Table 22: Current and future qualities of SSTF offsite offset	109
Table 23: Applicable attributes to the EPBC Act environmental offsets policy for SSTF Category D ...	112
Table 24: Performance criteria	119

Abbreviations

Abbreviation	Description
APZ	Asset Protection Zone
BBAM	BioBanking Assessment Methodology
BCAM	Biodiversity Certification Assessment Methodology
CCC	Campbelltown City Council
CEEC	Critically Endangered Ecological Community
CEMP	Construction Environmental Management Plan
CLEP	Campbelltown Local Environment Plan 2011
CPW	Cumberland Plain Woodland
DGR	Director General Requirements
DNG	Derived Native Grassland
DotEE	Department of the Environment
DPE	NSW Department of Planning and Environment
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EP&A Act	NSW <i>Environmental Planning and Assessment</i> 1979
EPBC Act	<i>Environment Protection and Biodiversity Conservation</i> Act 1999
FMP	Fauna Management Plan
HBT	Hollow Bearing Tree
LEP	Local Environment Plan
LGA	Local Government Area
MNES	Matters of National Environmental Significance
OEH	NSW Office of Environment and Heritage
PMST	Protection Matters Search Tool
PoM	Plan of Management
RFEF	River-flat Eucalypt Forest
RMS	NS Roads and Maritime Services
SEPP	NSW State Environmental Planning Policy
SSTF	Shale Sandstone Transition Forest
TEC	Threatened Ecological Community
TSC Act	NSW <i>Threatened Species Conservation</i> Act 1995

Executive Summary

Purpose and Scope of this Report

In October 2015, the proposed Mt Gilead residential development was referred to the Australian Government Department of the Environment and Energy (DotEE) for consideration under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

On 8 January 2016, the DotEE decided that the proposed action is a ‘*controlled action*’ and that it will be assessed by preliminary documentation. This document is the EPBC Act Preliminary Documentation Assessment Report for the proposed development and has been provided to the DotEE to enable further assessment and approval under the EPBC Act (EPBC Ref: 2015/7599).

A second referral (EPBC Ref: 2016/7830) for residential development on Mt Gilead was submitted by Lendlease Communities (Mt Gilead) Pty Ltd in November 2016. Following discussion with the DoTEE, it was agreed that the two referrals were part of a single larger development.

Project Proponent

The designated proponent for the Mt Gilead residential development was originally Mt Gilead Pty Ltd, however, as time has passed the new proponent is now Lendlease Communities (Mt Gilead) Pty Ltd. This change was approved by DotEE on the 29 May 2017.

Site Context

Mt Gilead is located off Appin Road, approximately 7 km south of the Campbelltown city centre within the Campbelltown Local Government Area (LGA). The proposed development is located on Lot 3 DP 1218887 (formerly part of Lot 2 DP 807555, Lot 59 DP 752042, and part of Lot 1 DP 807555), part Lot 2 DP 807555 and Lot 61. DP 752042.

Matters of National Environmental Significance

There are Matters of National Environmental Significance (MNES) protected under the EPBC Act that require further assessment/clarification in relation to potential impacts from the development. These include the critically endangered ecological communities Shale Sandstone Transition Forest of the Sydney Basin Bioregion (SSTF) and Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest of the Sydney Basin Bioregion (CPW), as well as records and potential habitat for ten (10) listed flora species and four (4) listed fauna species, including Koala.

Description of the Proposed Action

The proposed action, herein referred to as ‘Mt Gilead’, consists of a residential development with an indicative yield of approximately 1,700 lots, associated infrastructure, biodiversity offset areas (managed for conservation), community recreation areas and undeveloped areas to be left in their existing state (rural grazing land).

The proposed development is to follow from the rezoning of land on site to predominantly R2 Low Density Residential, SP2 Special Infrastructure (proposed future widening of Appin Road), along with areas for public recreation and open space zoned RE1 Recreation and RU2 Rural Landscape. The planning proposal was placed on exhibition by CCC between 28 April and 30 June 2015 and was rezoned in September 2017. Preliminary subdivision plans are expected to be submitted in 2018. Subject to all

approval being in place, construction is proposed to commence in two stages starting with Stage 1 in 2018/19 and subject to demand for lots, be completed by 2022/23.

In parallel with the rezoning of Mt Gilead, is an application for ‘Biodiversity Certification’ of the land proposed for residential development, which is being submitted to the NSW Office of Environment and Heritage (OEH) for consideration and is expected to be exhibited in late 2017 (ELA 2017). Two BioBank site applications have also been submitted to OEH for registration with this application and will be managed as in perpetuity biodiversity offsets for conservation. These sites will be referred to in the document as “Offset Sites”.

Details of the proposed action include:

- The total area of the site is 208.9 ha. Of this area, the action will impact on 165.2 ha of land, of which 35.3 ha is remnant native vegetation, and 173.6 ha is cleared grazing land. A total of 43.7 ha will not be impacted (i.e. the part of the property that will remain in its existing use as rural land or managed as Local Government dedicated open space and offset areas).
- Impacted areas will include a residential development with an indicative yield of up to 1,700 lots and associated infrastructure including roads, stormwater detention basins, water, sewer and electrical supply infrastructure.
- It is intended that development of the site will occur over an indicative/approximate five year period in stages and deliver a range of lot sizes consistent with the natural features of the site, to enhance and expand housing supply close to the Campbelltown-Macarthur Major Centre.
- Non-impacted areas will be protected and managed as offset sites (22.36 ha), while other parts will be landscaped and used for recreation or left in their existing condition as rural land (21.4 ha).

Mitigation, Enhancement and Conservation of MNES

The site has a long history of grazing and cropping including cleared paddocks and pasture improvement. Native vegetation is mostly present on the site as individual scattered paddock trees with a grazed understorey and as small copses of trees along drainage lines.

- Three vegetation communities occur at Mt Gilead: Cumberland Plain Woodland (CPW), Shale Sandstone Transition Forest (SSTF), and River-Flat Eucalypt Forest (RFEF). The vegetation communities are highly modified through a long history of grazing, pasture improvement and weed invasion, however some patches of SSTF were in better condition.
- CPW and SSTF are listed as critically endangered ecological communities (CEECs) under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and *Commonwealth Environment Protection and Biodiversity Conservation Act* (EPBC Act) 1999, whilst River-Flat Eucalypt Forest (RFEF) is listed as an endangered ecological community (EEC) under the TSC Act only.
- The total area of EPBC Act listed CPW within the study area is 5.21 ha and the proposed development will potentially impact up to 0.5 ha of this vegetation. These impacts include minor edge impacts along patches in the north of the study area (water pumping station) and includes an individual tree located on the edge of a proposed detention basin that will be retained if possible; small areas of derived native grassland that will be removed as part of the proposed Appin Road widening and a fire trail that will impact grassland but avoid tree removal.
- The remaining non-impacted EPBC Act listed CPW will be protected in:
 - the Noorumba-Mt Gilead BioBank Site (4.63 ha) or
- The total areas of EPBC Act listed SSTF within the site is 15.79 ha, of which 5.48 ha will be impacted by the proposed development. Most of this impact is located within the proposed road widening of Appin Road and internal road construction within the development, or associated with the consolidation of the fringing vegetation of the two central Council Reserves.
- The non-impacted EPBC Act listed SSTF will be managed and protected in:

- a proposed Council Reserve conservation area to be managed by Campbelltown City Council (2.07 ha) which is part of a larger (3.46 ha) protected area.
- the Macarthur Onslow-Mt Gilead BioBank site to be managed under a BioBanking Agreement which includes 8.15 ha of SSTF, with a further 3.28 ha to be restored to EPBC Act SSTF
- proposed open space areas (0.3 ha). This will not be subject to any conservation actions, however, 0.04 ha will be restored via landscape plantings in the open space/recreation areas to the north of former Lot 61 DP 752042, and will link existing scattered paddock trees
- 20.21 ha of vegetation within 'offset sites' covering 22.36 ha of land will be protected and managed for conservation in perpetuity under Biobanking Agreements or as gazetted Conservation Areas under the Local Government Act which will conserve and improve:
 - 4.63 ha of EPBC Act listed CPW
 - 1.64 ha of land to be restored and revegetated to CPW
 - 10.22 ha of SSTF to be protected in a BioBank or Council Reserve
 - 3.28 ha of land to be restored and revegetated to EPBC Act condition SSTF.
 - 0.44 ha of RFEF (not listed under the EPBC Act)
- 6.5 ha of SSTF has been secured at an offsite area known as Fernhill Central West BioBank
- The management of these offset areas will improve the condition of the vegetation, so that existing degraded areas of SSTF and CPW will meet the EPBC Act condition criteria in the future.

Conservation Outcomes

Conservation of 20.21 ha of vegetation and derived native grasslands within offset areas to be fenced, access restricted, revegetated and restored and maintained to EPBC Act condition criteria for CPW and SSTF. These areas will be managed in perpetuity under two Biobanking Agreements and a gazetted Local Government Act Conservation Area. All conservation outcomes will be further protected under a legally binding Biocertification Agreement, registered on title, between the NSW Minister for the Environment, Campbelltown City Council and the land owners.

Conservation and management of an additional 6.5 ha of SSTF at an offsite offset area that will be managed in perpetuity within a Biobank known as Fernhill Central West.

Social and economic factors

The Campbelltown LGA has a forecast population increase projection of 64,000 between 2011 and 2031. An additional 24,846 homes will be required in the Campbelltown area by 2031 to meet this population growth (Department of Planning and Environment 2014). The Mt Gilead development will deliver approximately 1,700 lots with a range of lot sizes consistent with the natural features of the site. This will enhance and expand housing supply close to the Campbelltown-Macarthur Major Centre.

1 Scope of this Report

In October 2015, the proposed Mt Gilead residential development (the proposed action) was referred to the then Australian Government Department of the Environment (DotE) for consideration under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). On 8 January 2015, the DotEE determined that the proposed action would be a controlled action requiring further assessment and approval under the EPBC Act (EPBC Ref: 2015/7599).

The level of assessment under the EPBC Act for the project was set at 'Preliminary Documentation'. The DotEE requested further information from the proponent on the 12 February 2016 in order to inform the assessment process.

From the information provided in the referral, the DotEE considered that the following ecological communities listed under the EPBC Act (protected matters) were likely to be significantly impacted by the proposed action:

- Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (CPW) of the Sydney Basin Bioregion (Critically Endangered Community)
- Shale Sandstone Transition Forest (SSTF) of the Sydney Basin Bioregion (Critically Endangered Community)

From the information provided in the referral, the DotEE also considered that the following threatened species listed under the EPBC Act (protected matters) were likely to be significantly impacted by the proposed action:

- Bynoe's Wattle (*Acacia bynoeana*) - Vulnerable
- Yellow Gnat-orchid (*Genoplesium baueri*) - Endangered
- Small-flower Grevillea (*Grevillea parviflora* subsp. *parviflora*) - Vulnerable
- Woronora Beard-heath (*Leucopogon exolasius*) - Vulnerable
- Deane's Melaleuca (*Melaleuca deanei*) - Vulnerable
- Bargo Geebung (*Persoonia bargoensis*) - Vulnerable
- Hairy Persoonia (*Persoonia hirsuta*) - Endangered
- Spiked Rice-flower (*Pimelea spicata*) - Endangered
- Rufous Pomaderris (*Pomaderris brunnea*) - Vulnerable
- Sydney Plains Greenhood (*Pterostylis saxicola*) – Endangered
- Swift Parrot (*Lathamus discolor*) - Endangered
- Large-eared Pied Bat (*Chalinolobus dwyeri*) - Vulnerable
- Grey-headed Flying-fox (*Pteropus poliocephalus*) - Vulnerable
- Koala (*Phascolarctos cinereus*) - Vulnerable).

Additional information requested by the DotEE that has been addressed in this report is included in **Table 1**.

The purpose of this Preliminary Documentation Assessment Report is to address this further information requested by the DotEE. This document will also replicate the information contained in the referral document and other relevant background studies, to provide all the relevant information in one report.

The project will require assessment and approval under the EPBC Act before it can proceed.

Table 1: Additional Information requested by DotEE

FORMATION REQUESTED BY DOTE	ADDRESSED IN SECTION OF THIS REPORT:
1) Direct impacts upon Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (CPW) and Shale-Gravel Transition Forest (SSTF) critically endangered ecological communities (CEEC's).	
a) Confirm the actual quantum of EPBC Act CPW and SSTF present on the proposed development site and that proposed to be cleared.	5
b) Provide a map that illustrates the distribution of both CPW and SSTF.	Figure 13
c) Provide further justification on how it has been determined that vegetation on the site meets / or does not meet the EPBC Act definition with reference to the EPBC guideline and advice	4.6.1
d) Quantify any direct impacts on CPW and SSTF from Asset Protection Zones (APZ) and detail the ongoing maintenance of APZs including consideration of statutory APZ buffer requirements on distances from building and infrastructure assets and other necessary management actions that may include slashing of remnant EC's understorey and/or trimming/clearing.	2.5, 5.2.3, 5.3.2, 7.2
2) Indirect impacts upon CPW and SSTF	
a) Provide clarification on the location and extent of indirect impacts upon CPW and SSTF CEEC's including areas proposed to be retained in the future bio-banking sites:	7.2
i) Fragmentation and habitat connectivity impacts	5.2.3 – SSTF 5.3.3 - CPW 6 – Fauna
ii) Edge effects such as garden waste dumping and run-off from residential areas resulting in the spread of weeds and degradation of the CEEC's; and	7.2
iii) Residents use of these BioBanking-retained sites for recreation	7.2
3) Other species potentially impacted by the proposed action (as listed above)	
a) Clarify adequacy of the surveys conducted against EPBC Act survey guidelines and conservation advices for the flora species listed above and the actual quantum of direct and indirect impacts upon these species;	4.4
b) In relation to the four fauna species listed above, confirm the amount of important habitat or habitat critical to the survival (based on relevant Recovery Plans and/or Conservation Advices and guidelines) that is likely to be impacted by the proposed action.	6

c)	In relation to the Koala, the EPBC Act koala referral guidelines summary and koala habitat assessment tool should be reviewed and used to a 'habitat quality' score	6.4
4)	Proposed mitigation and management measures	
a)	Provide greater description of changes to the action to avoid impacts and feasible mitigation measures that are intended to minimise relevant impacts including:	7
i)	How impacts to areas of SSTF, CPW and threatened species habitat are being avoided as part of the proposed action	7.1
ii)	Detail how a 30m vegetated buffer zone adjacent to SSTF and CPW (as recommended on the listing advice for SSTF) will be implemented as part of mitigating impacts to this community from development actions including spatial information identifying the buffer zone	7.3
iii)	Details of proposed mitigation and management measures including Construction Environmental Management Plan (CEMP) Vegetation Management Plan (VMP) and Fauna Management Plans (FMP) for the EPBC Act matters.	7
iv)	A statement on the cost effectiveness of the measures proposed and how these will be funded.	8.1
5)	Proposed offset measures	
a)	Provide an analysis of how the proposed offset package meets the requirements of the EPBC Act Offsets Policy; or details of how the offset meets an endorsed state offsets policy.	8
b)	Include a statement on the cost effectiveness of the measures proposed and how these will be funded	8.1
6)	Outcomes based conditions	
a)	If an Outcomes-based condition/approval is sought information on the outcomes must be provided, being specific, measurable and achievable using robust baseline data.	N/A
7)	Economic and social matters	
a)	The PD must provide information on relevant economic and social impacts of the action including:	2.4 2.6 Executive Summary

2 Introduction

2.1 Proponent

The designated proponent for Mt Gilead for the purposes of referral, assessment and approval under the EPBC Act is Lendlease Communities (Mt Gilead) Pty. Limited (Lendlease).

The contacts for the Commonwealth assessment of the proposed action are:

Mr Mark Anderson

Senior Development Manager

Lendlease Communities (Mt Gilead) Pty. Limited

Level 2, 88 Phillip Street

Parramatta NSW 2150

The designated proponent for the Mt Gilead residential development was originally Mt Gilead Pty Ltd, however, as time has passed the new proponent is now Lendlease Communities (Mt Gilead) Pty Ltd. This change was approved by DotEE on the 29 May 2017.

2.2 Site description

The site is located at Appin Road Gilead, in the southwest of the Sydney metropolitan area, approximately 7 km south of the Campbelltown city centre (**Figure 1**). The site covers an area of approximately 208.9 hectares (ha), and forms part of the long-established Mt Gilead rural property (the remainder of the Mt Gilead rural property lies to the west of the study area). More broadly, the surrounding lands include low density residential suburbs of Campbelltown (Rosemeadow) to the north, the Hume Highway and Nepean River to the west, Appin Road, Dharawal National Park and the Georges River to the east, and rural residential land to the south.

Figure 2 shows that the study area and immediate surrounds along with the Lot/DP that comprise the site. The study area is bounded by Appin Road to the east, Noorumba Reserve to the north, the Sydney Water Supply Canal (the Upper Canal) and rural land associated with the Mt Gilead homestead and farm to the west, and the Beulah Biobank site to the south. Access to the site is currently via a driveway entry off Appin road. Proposed biobank sites surrounding the study area, proposed offsite sites within the study area and the proposed CCC reserve indicate proposed conservation land.

The study area has been subject to numerous previous studies including the, Rezoning Ecological Assessment (ELA 2014), Mt Gilead Planning Proposal (CCC 2015), Macarthur Onslow –Mt Gilead Biobank Assessment (ELA 2015b), Noorumba – Mt Gilead Biobank Assessment (ELA 2015c), the Noorumba Reserve BioBank Assessment (ELA 2017b) and the Biodiversity Certification and Assessment Report and Biocertification Strategy (ELA 2017a). It is proposed that an up to 1,700 lots will be developed across the site.

The study area is currently zoned as No 1 (Non-Urban) under the *City of Campbelltown Interim Development Order No. 15 (IDO 15)*. The proposed rezoning of the study area is shown in **Figure 3**. The study area will be rezoned to R2 Low Density Residential, RE1 Public Recreation, RU2 Rural Landscape, B1 Neighbourhood Centre and SP2 Classified Road along Appin Road (to account for proposed future road widening of Appin Road).

The site has been used for intensive agricultural purposes since the mid-19th century and thus contains predominantly cleared paddocks with improved pastures. Pockets of remnant native vegetation are located along drainage lines and steeper slopes. The land is currently used for cattle grazing and cropping.

Topographically, the land is gently undulating throughout. Several drainage lines traverse the site draining towards the Nepean River. A number of farm dams have been constructed to capture surface water flows. The majority of the watercourses are considered to be substantially to slightly modified and erosion was noted in many of the watercourses. Aquatic habitat was limited, and where present was marginal. Fringing vegetation where present provided suitable habitat for common amphibians, birds and fish. The overall rating of the riparian and aquatic condition varied from degraded to moderate.

Three native vegetation communities have been recorded within the study area: Cumberland Plain Woodland (CPW), Shale Sandstone Transition Forest (SSTF), and River-Flat Eucalypt Forest (RFEF). The vegetation communities are highly modified through a long history of grazing, pasture improvement and weed invasion, and erosion was present in places, although some patches of SSTF are in better condition. Both CPW and SSTF are present within the study area in a condition that meets the EPBC Act listed critically endangered ecological communities (CEEC) listing advice.

No EPBC listed threatened flora species have been recorded despite extensive flora surveys by ELA of the study area and broader locality in 2006, 2014 and 2015 (a and b), 2017 (a and b). The closest record of an EPBC Act listed threatened flora species is *Pomaderris brunnea* (Rufous Pomaderris) which was recorded 200m to the west of the study area (ELA 2015e).

A total of 83 fauna species, comprising 58 birds, 14 microbats, five other mammals, three frogs, one reptile, and two fish have been recorded in the study area. No EPBC Act listed threatened flora species have been recorded on the site despite extensive searches. The only EPBC Act listed fauna species detected onsite was one Large-eared Pied Bat. One Grey-headed Flying-fox was recorded flying over the site. The study area provides foraging habitat for Koala, Grey-headed Flying-fox, Large-eared Pied Bat and Swift Parrot. One EPBC Act listed migratory species, the Cattle Egret, has been recorded on the site.

2.3 Variation to the action

On 21 June 2017 Lend Lease wrote to DotEE to vary the proposed action. The variation to the proposed action will result in the following:

- inclusion of the adjacent Lot 61 Dp 752045 into the project boundary
- an increase in site area by 33.7 ha, to a new total of 208.9 ha
- an increase in indicative yield of 400 lots, to a new total of up to 1,700 lots, and the addition of further associated internal roads and two open space and council reserves

No changes were proposed to the development layout within the original 175.2 ha project area. All changes relate to the addition of the adjacent 33.7 ha development and the interface between the two areas.

The reasons for the proposed variation are as follows:

On 30 November 2016, Lend Lease Communities (Mount Gilead) Pty Ltd referred the development on the adjacent area (Lot 61 Dp 752042) for assessment (EPBC 2016/7830). However, Lend Lease Communities (Mount Gilead) Pty Ltd now propose that the action of EPBC 2016/7830 is more easily understood and assessed as part of the this project (2015/7599). Combining the two areas results in a

holistic proposal which is not reliant on any adjacent development and will provide for an assessment of the impacts of the total development on EPBC act protected matters.

Furthermore, both projects were previously under management by separate developers, with the developer of the larger land parcel (EPBC 2015/7599) being significantly more progressed with their development design. It therefore made sense to refer EPBC 2015/7599 first and as a separate project. However, as time has passed, the developers of both land packages have aligned, with both land parcels now being managed by Lendlease Communities (Mount Gilead) Pty Ltd. Furthermore, detailed design of both projects now have the two development areas sharing roads and other residential infrastructure. In this sense, it can be acknowledged that aligning both projects under the one assessment would make sense and would allow all elements to be assessed holistically through one approval.



Figure 1: Mt Gilead locality

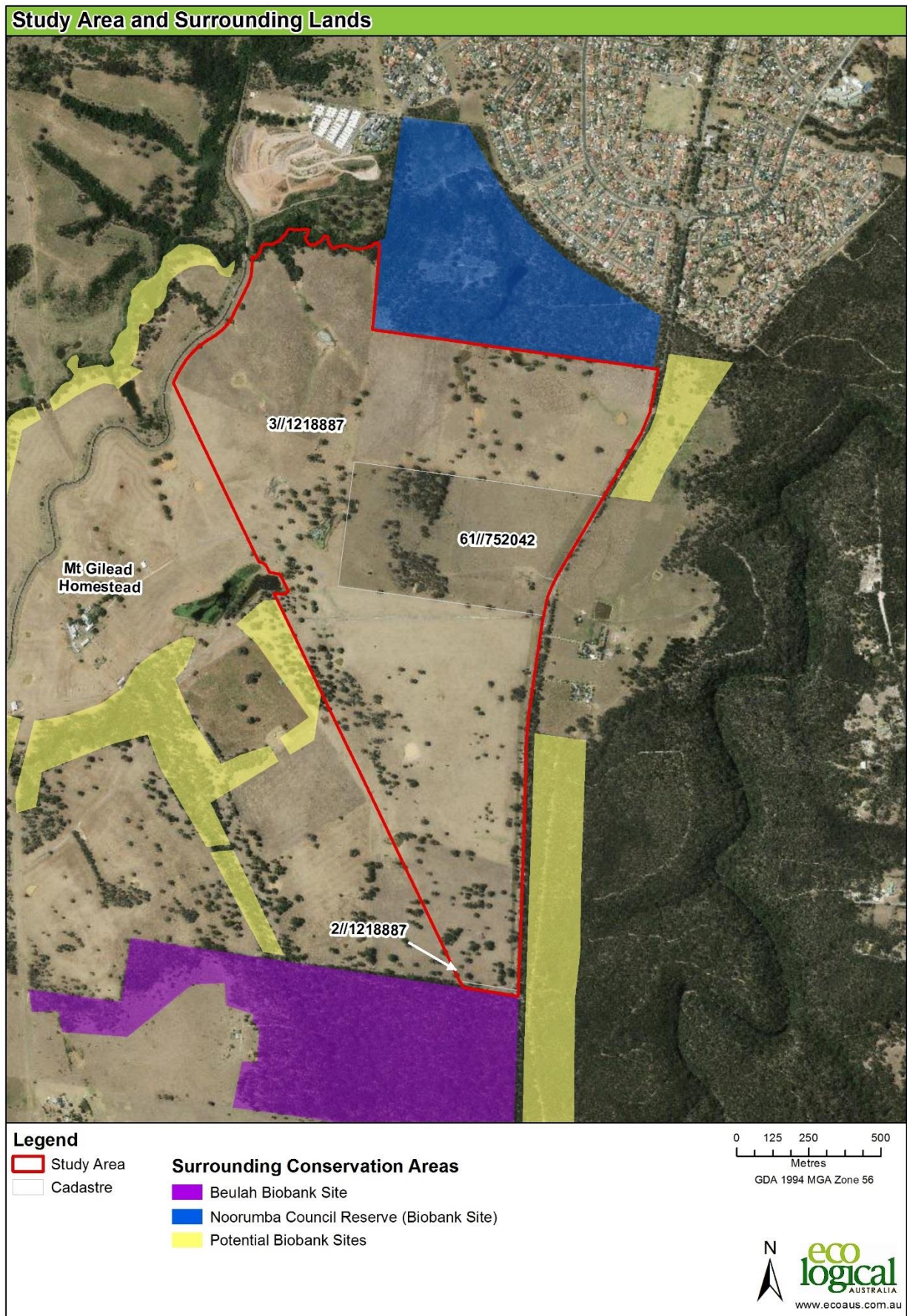


Figure 2: The Mt Gilead study area and surrounding land.

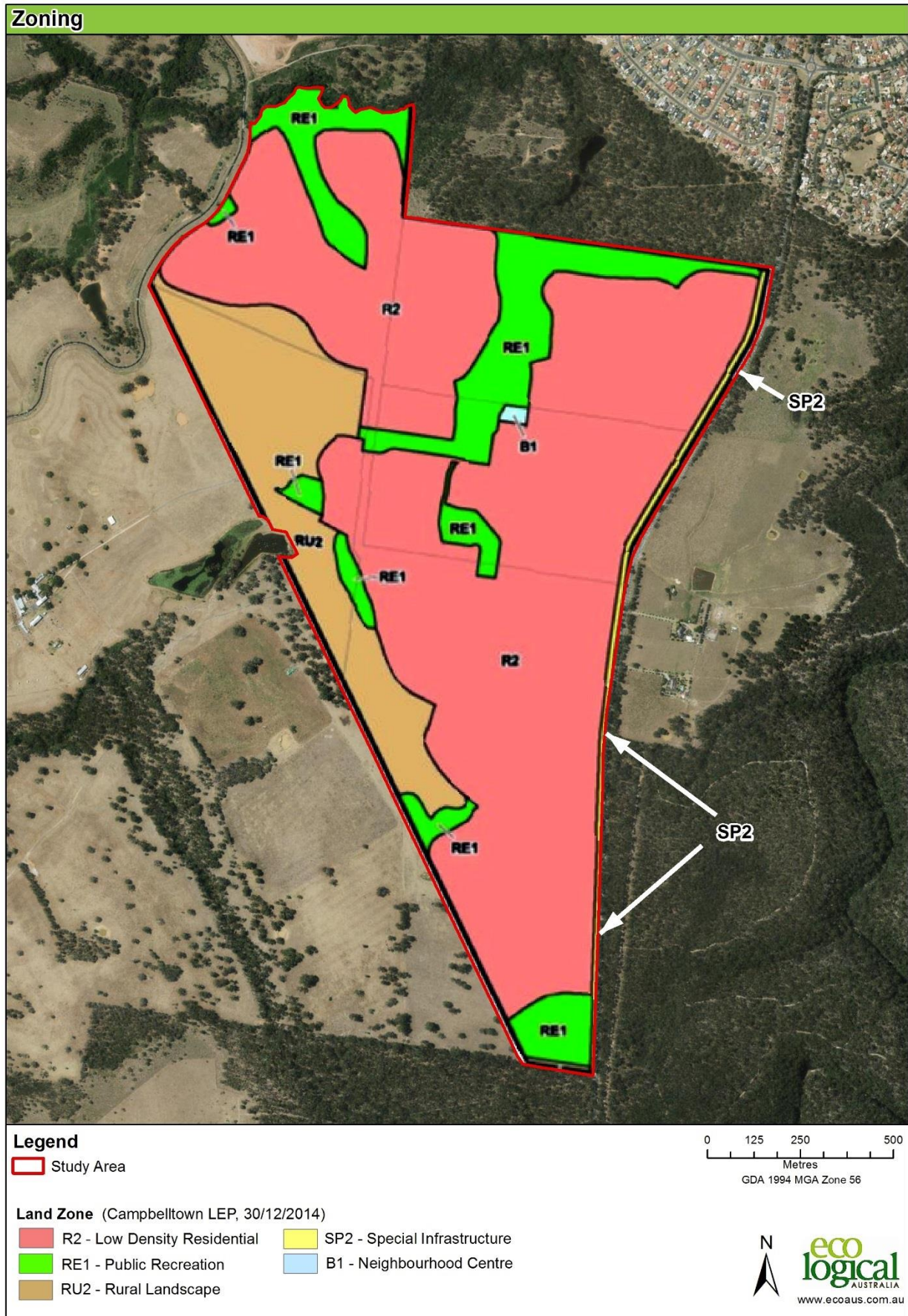


Figure 3: The proposed land zoning map (Source: CCC 2015)

2.4 Proposed action

This preliminary documentation assessment report has been based on an assessment of the total impacts (direct and indirect, including buffer areas) of the proposed action to clear the site and construct the proposed structures.

Mt Gilead Pty Ltd is proposing a residential development with an indicative yield of up to 1,700 lots in two stages as shown in **Figure 4**. It is intended that development of the site will deliver a broad range of lot sizes consistent with the natural features of the site, environmental conservation areas, and a suitable street and community layout.

The key concepts of the development will be to:

- incorporate and maximise the existing landscape and topographical characteristics of the site
- retain existing native vegetation which is in good condition, and protect and enhance biodiversity and sensitive habitats
- enhance the existing riparian corridors
- protect visually prominent features such as ridgelines
- enhance visual links to distant views, heritage features and open space
- encourage passive surveillance and increase safety
- facilitate sustainable transport access
- maximise solar access for future lots and sustainable design outcomes
- provide a walkable neighbourhood

The objectives of the development are to:

- permit low density residential development as well as public active and passive open space and associated community amenities and facilities
- provide an opportunity for a small area of retail development
- protect the environmental significance of the Beulah biobanking site
- protect environmentally sensitive land and provide a secondary ecological corridor linking Noorumba Reserve with the Beulah biobanking site and the Nepean River corridor
- reserve land on Appin road for acquisition by Roads and Maritime Services for future road infrastructure
- increase the supply of housing within the Campbelltown LGA with the addition of 1,700 new dwellings

The development will be predominantly urban and consist of residential constructions and associated infrastructure. More specifically, the proposed action will involve:

- the delivery of new housing in proximity to existing residential urban land with access to public transport
- water and sewer infrastructure
- a community centre and small kiosk/store

Detailed information on the planning proposal can be found in the final planning proposal prepared by CCC (CCC 2015):

<http://www.campbelltown.nsw.gov.au/Assets/13037/1/MtGileadPlanningProposalJanuary2015.pdf>

The planning proposal was placed on exhibition by CCC between 28 April and 30 June 2015 and was rezoned in September 2017. Preliminary subdivision plans are expected to be submitted in 2018. Subject to all approval being in place, construction is proposed to commence in two stages starting with Stage 1 in 2018/19 and subject to demand for lots, be completed by 2022/23.

2.5 Development footprint

The proposed development footprint as shown in **Figure 4** through **Figure 10** is the result of a series of design reiterations that occurred based on ecological information gained from multiple ecological surveys conducted by Eco Logical Australia (2014, 2015 a and b) and 2017 (a and b) with the goal of reducing impacts to areas of higher environmental values.

The Mt Gilead study area includes approximately 208.9 ha. The proposed action will impact on 165.2 ha or 79.1% of the study area. Of the land to be impacted, only 35.3 ha is remnant native vegetation (16.9%), and 173.6 ha (83.1%) is cleared. A total of 43.7 ha will not be impacted by the proposed action and will include areas to be protected and managed as offset sites (22.36 ha), while other parts will be retained in their existing condition as open space or rural landscapes (21.4 ha).

Details of the development include:

- General residential: The Campbelltown LGA has a forecast population projection of 64,000 between 2011 and 2031. An additional 24,846 homes will be required in the Campbelltown area by 2031 to meet this population growth (Department of Planning and Environment 2014). The Mt Gilead development will deliver approximately 1,700 lots with a range of lot sizes consistent with the natural features of the site. This will enhance and expand housing supply close to the Campbelltown-Macarthur Major Centre.
- Recreation and active open space areas: will be provided including an oval and recreation areas to be landscaped consistent with the native vegetation. These areas will be classified as Community Land under the Local Government Act and will have a Plan of Management prepared and adopted under the Act. Under this management, these areas will have a positive contribution to the environmental outcome of the project through management as native vegetated areas. Where possible, trees will be retained in these areas, and enhanced by landscape plantings of species consistent with the existing environment, resulting in structured restoration and regeneration of these areas.
- Open space – passive: natural areas maintained in their existing rural character as open space, retaining ecological value but not for use as a formal conservation area/offset. These areas will include management under the Local Government Act, and will include fencing, assisted regeneration, and surrounding paths/cycleways to discourage access into the vegetated areas by controlling and formalising movement patterns.
- Services: The development will be serviced by the required infrastructure, including water, sewer and electricity for the proposed development. Infrastructure relating to traffic, stormwater, sewerage, telecommunications and electricity will, where possible, be located onsite. Subsequent rehabilitation works will be carried out in accordance with a site specific management plan
- Detention basins: the development has been designed with detention basins/swales that will capture and treat run-off water. The water will be initially captured by a network of curb and guttering along all roads. The detention basins and swales will treat and control run-off water to ensure post development impacts of water quality and flows when released into natural creeks are no greater than those pre-development. The detention basins will include appropriate plantings around the banks that will retain and enhance habitat for birds and frogs, foraging/nesting resources for bats, birds and arboreal mammals, whilst also acting as a buffer between the urban development and protected areas of vegetation.
- Roads, access ways, and parking: The street network within the site is to be consistent with Campbelltown City Councils Engineering Design Specification and street network principles including the establishment of a permeable network that is based on a modified grid system, and encourages walking and cycling and reduced travel distances.

- Asset Protection Zones (APZs): The development will be carried out in a way to ensure prevention of loss of life and property due to bushfires. The lot layout shown in **Figure 5** through to **Figure 10** shows that perimeter roads are located along most bushland and landscaped interfaces. **Figure 5** through to **Figure 10** also shows the location of APZ's which have been calculated in accordance with Planning for Bushfire Protection (ELA 2015b, RFS 2006). The impact calculations have considered APZs to be "complete clearing" and are thus an over estimate of the impacts, as APZ's are able to maintain a degree of tree, shrub and ground cover. Further, none of the required APZs extend into proposed offset areas and are fully absorbed within predominantly cleared open spaces, perimeter roads and building development setbacks within each lot.
- On-site Offset sites: Five areas are proposed as offset sites to offset the impacts of the proposed action on EPBC Act listed MNES. All offset sites include perimeter fencing to allow the movement of fauna (including koala) but prevent the entry of people, unauthorised vehicles or cattle. The sites will be managed in perpetuity predominantly as registered Biobank Sites under two Biobanking Agreements, as well as in offset areas managed by Campbelltown City Council under the Local Government Act (LG Act) subject to a plan of management similar to that required for the Biobanks. The applications to register these sites have been submitted to the NSW OEH and are expected to be registered in 2018. All conservation outcomes will be further protected under a legally binding Biocertification Agreement (Appendix A), registered on title, between the NSW Minister for the Environment, Campbelltown City Council and the land owners.
- Off-site Offset site: Impacts on MNES that are unable to be accounted for from within the site will be offset through securing offsite offsets from a Biobank known as Fernhill Central West and will be managed and funded in perpetuity with an existing Biobank Agreement.
- Riparian lands: Three riparian corridors have been mapped within the study area. Each will be retained and protected within areas proposed as open space or in offset areas.

2.6 Social and Economic Considerations

The study area has been identified for some time on the former Metropolitan Development Program (MDP) as future greenfield release land and was identified in the *Draft Metropolitan Strategy for Sydney to 2031* as part of the South West subregion that is expected to provide capacity for at least an additional 10,000 jobs until 2031 and a predicted demand for 141,000 new dwellings (DPE 2013).

The Mt Gilead study area was identified in the *Metropolitan Plan for Sydney 2036* as a key location to provide housing for the predicted growth of Campbelltown – Macarthur as a Major Centre (DPE 2013). The Plan anticipates the South West Sydney region will need to provide an additional 155,000 dwellings and 141,000 new jobs by 2036, with the Campbelltown – Macarthur Strategic Centre contributing 11,000 of these jobs. The following are the key issues in relation to the supply of housing and jobs of relevance to the proposed action:

- The Campbelltown LGA currently has a much higher proportion of public housing, and much lower private rental housing than the Sydney average
- unemployment in the LGA is above Sydney's average (8.5% in comparison to 6.1% for Sydney as a whole in 2001) with high unemployment rates particularly concentrated in public housing suburbs
- Campbelltown has a much lower proportion of people in the white collar occupational categories (managers, administrators, professions) and higher proportion in the less skilled categories

Most recently, the study area at Mt Gilead has been identified as a priority precinct in the Greater Macarthur Land Release Investigation report (DPE 2015). The land within the study area has been identified as developable land. For further details, please see the full document:

<http://www.planning.nsw.gov.au/~media/ABA7AB6177DF4D638F0529A906A9BB52.ashx>

A limitation in housing choice has been identified as a limiting factor to the attractiveness of the Campbelltown area as a place to live for professional and business people. The proposed development and average lot size at Mt Gilead will strategically address this issue, so contributing to the required growth of Campbelltown – Macarthur as a Major Centre.

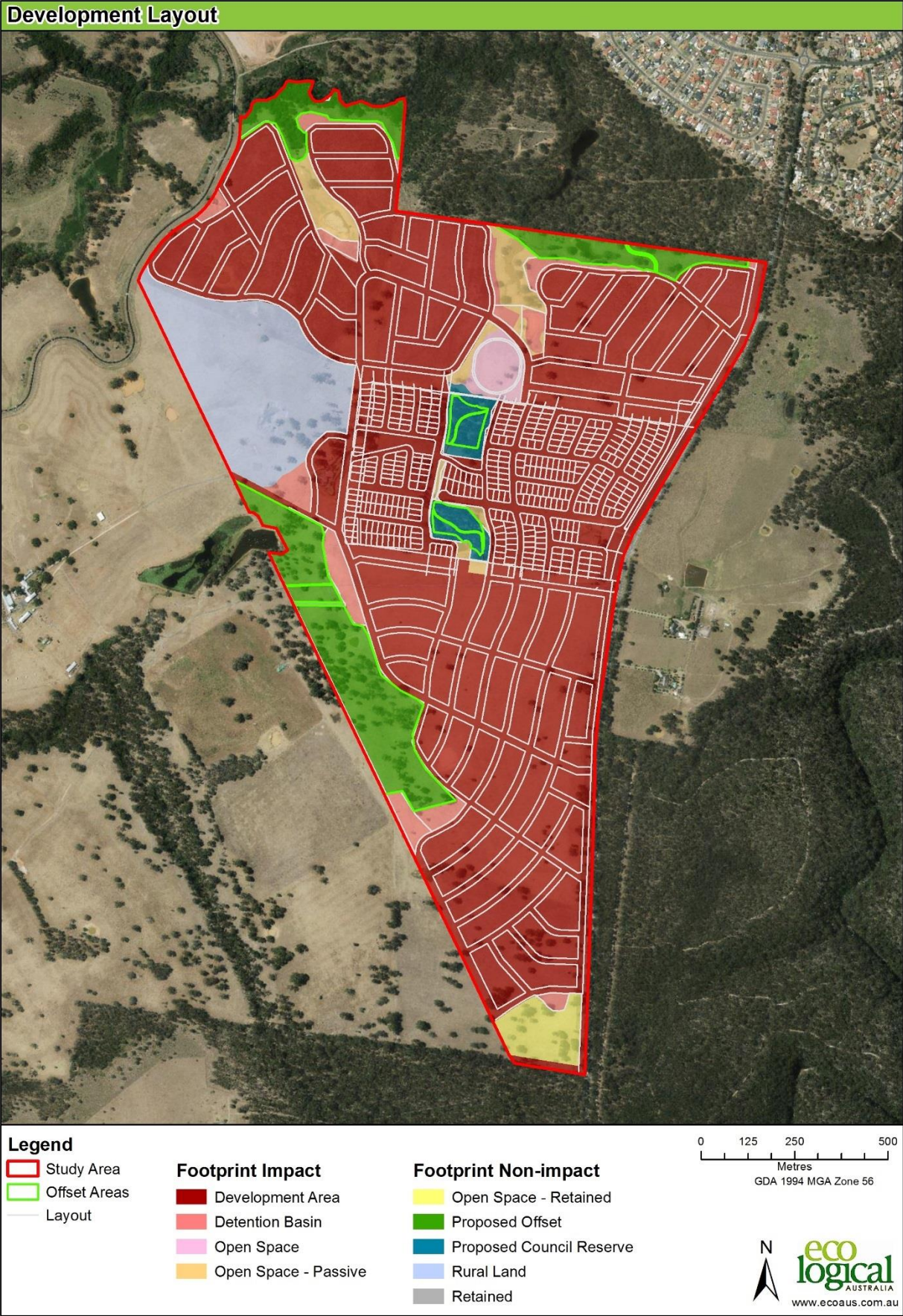


Figure 4: Proposed development layout plan zones and proposed conservation areas

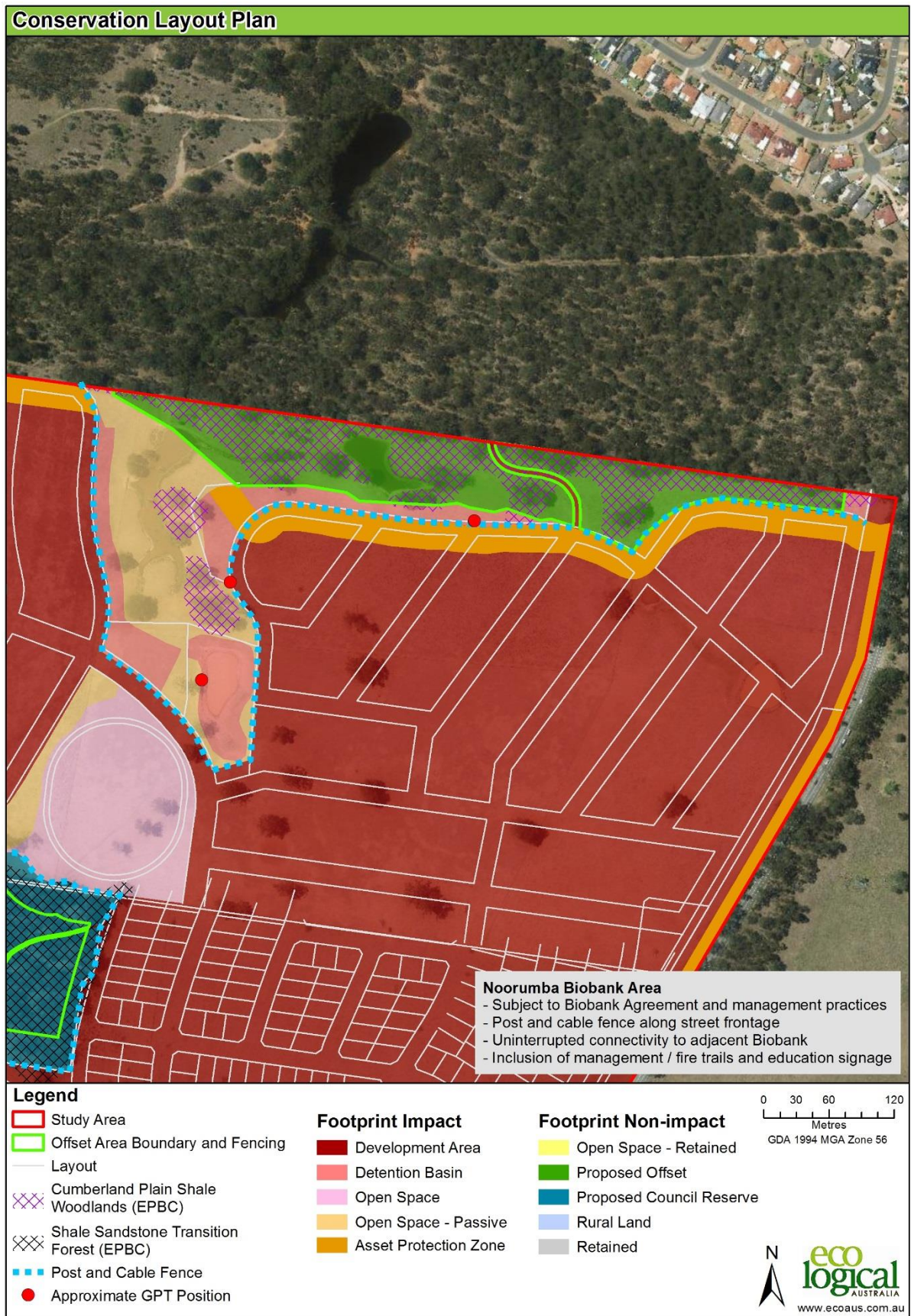


Figure 5: North-eastern portion zoom - proposed development layout plan, asset protection zones and proposed conservation area features

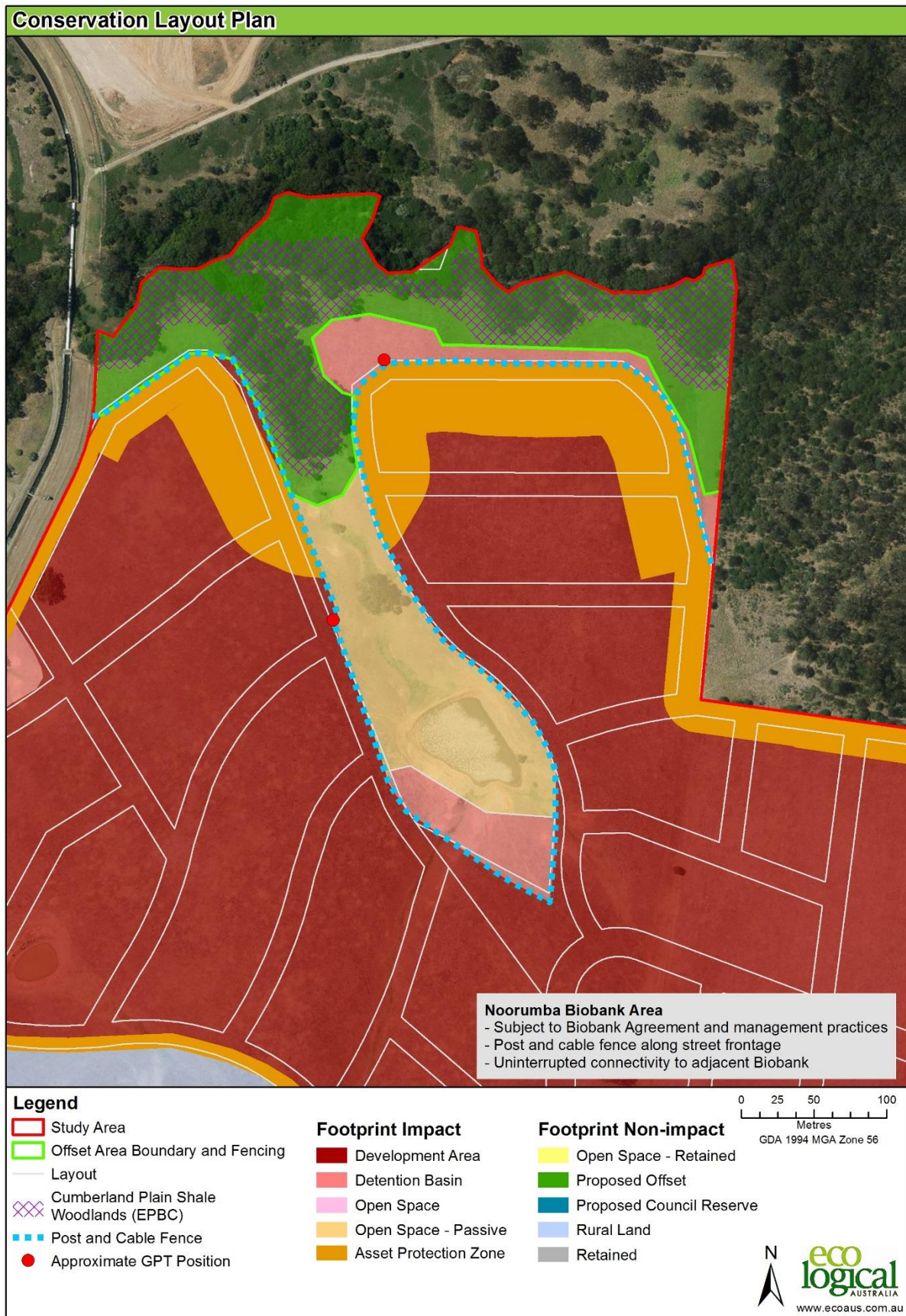


Figure 6: North-western portion zoom - proposed development layout plan, asset protection zones and proposed conservation area features

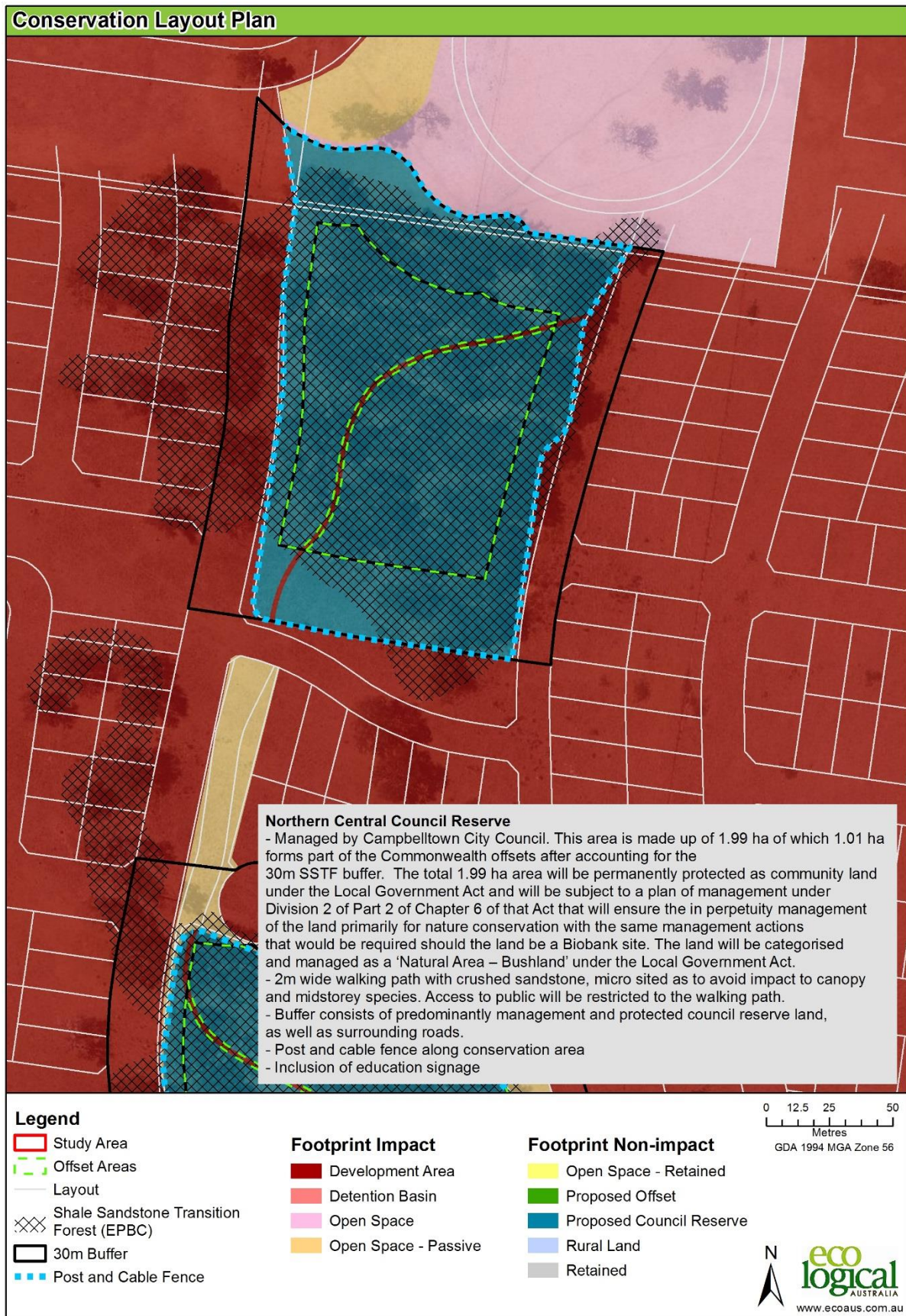


Figure 7: Central northern portion zoom - proposed development layout plan and proposed conservation area features

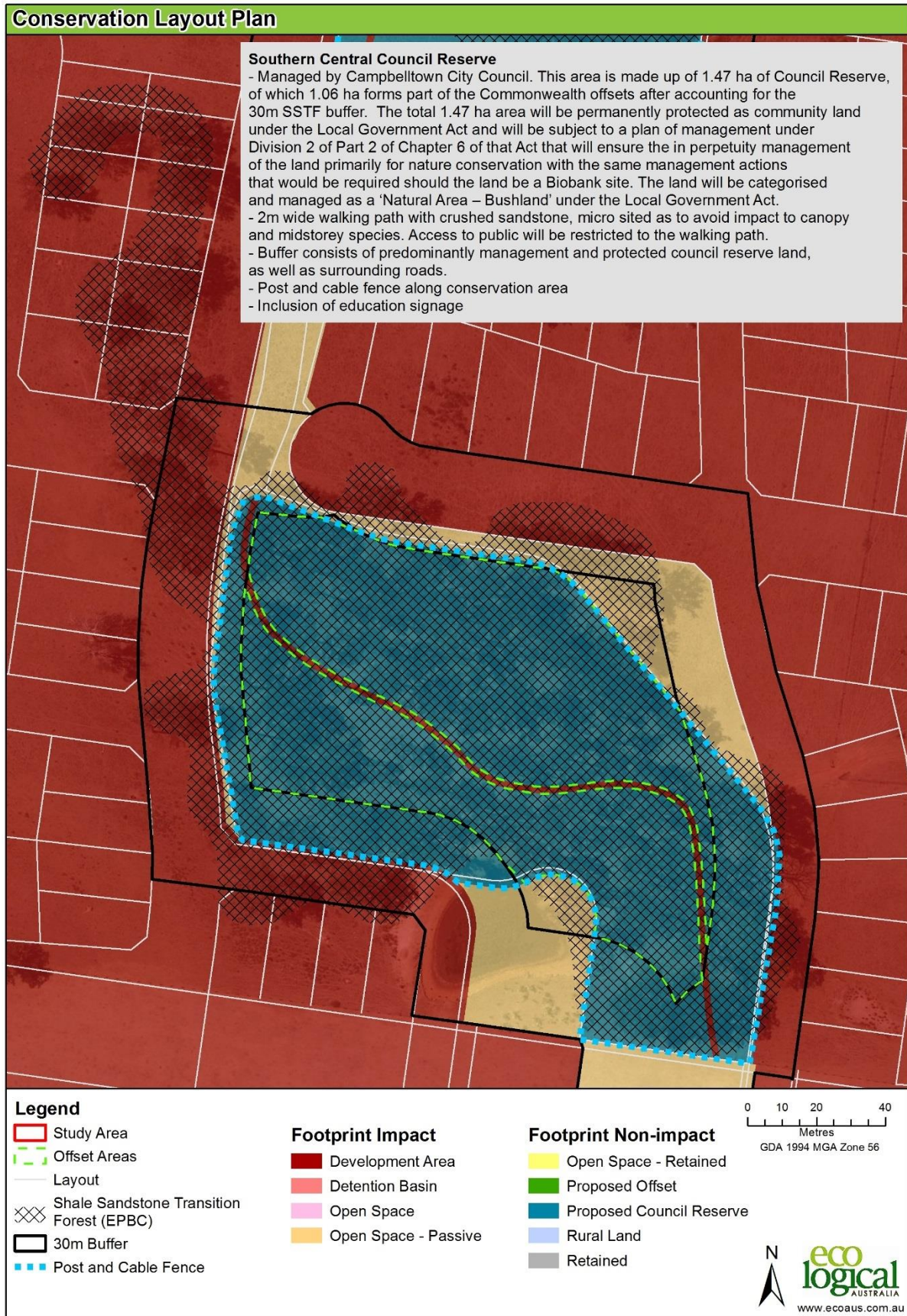


Figure 8: Central southern portion zoom - proposed development layout plan and proposed conservation area features

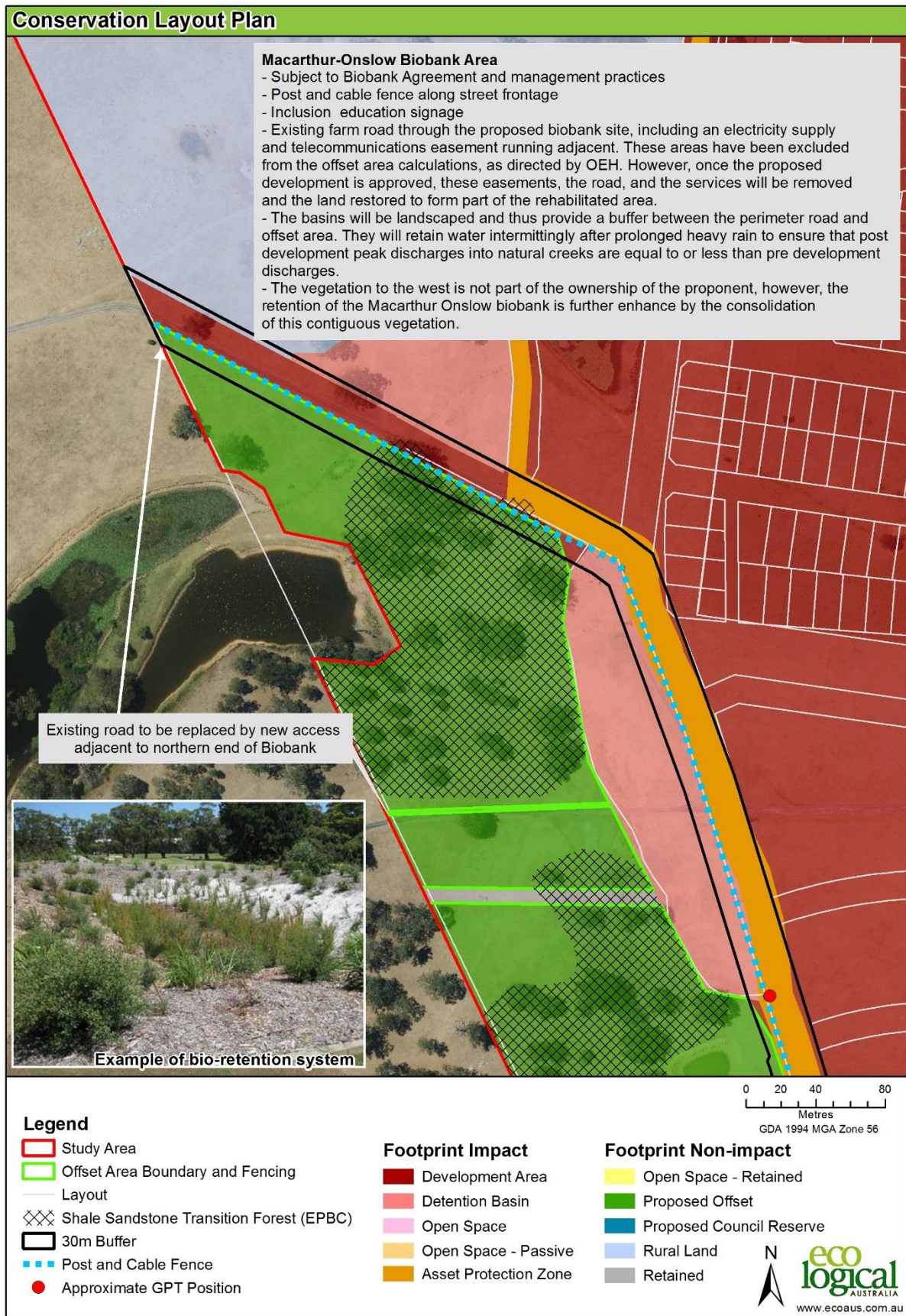


Figure 9: Western portion zoom 1 - proposed development layout plan, asset protection zones and proposed conservation area features

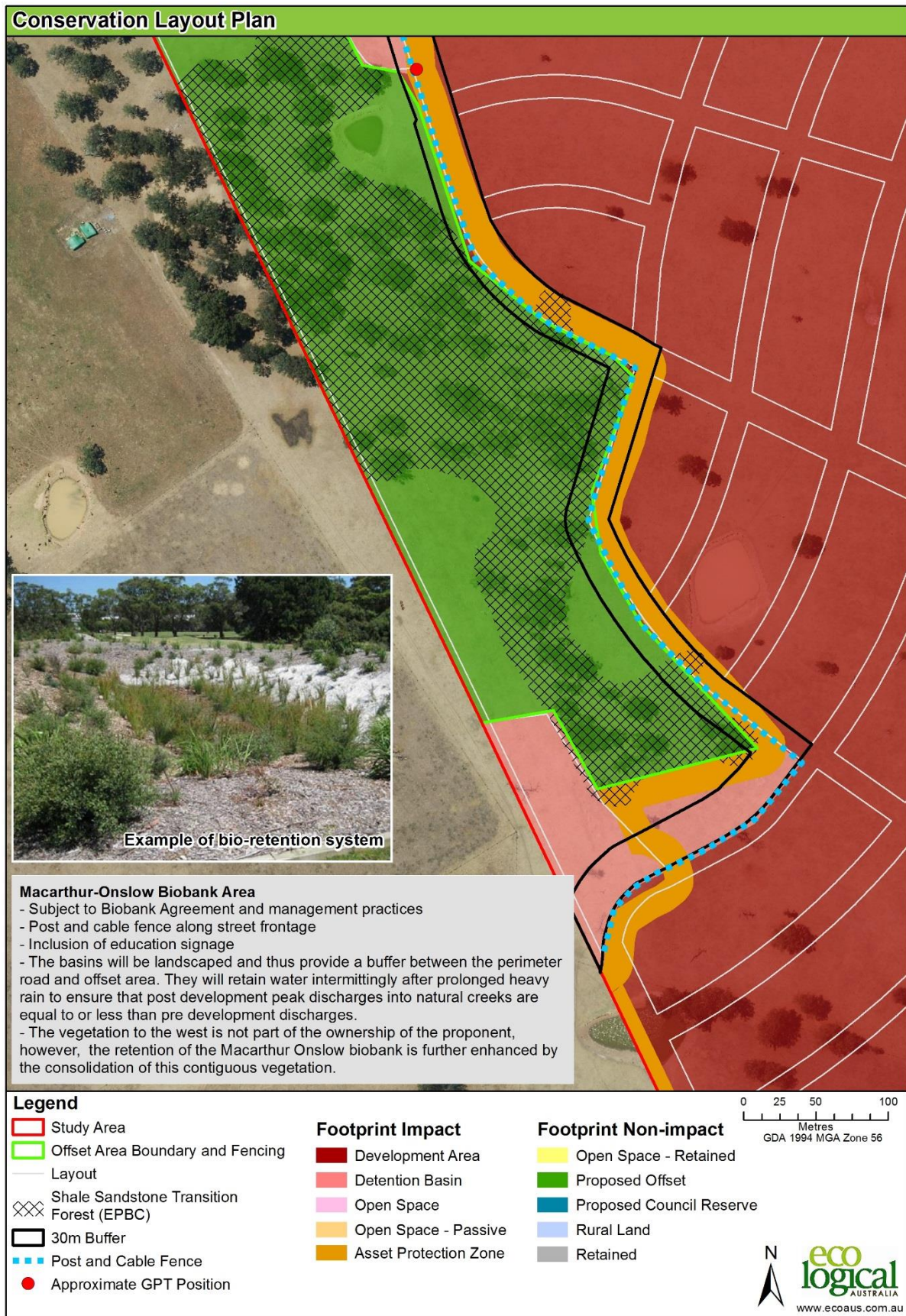


Figure 10: Western portion zoom 2 - proposed development layout plan, asset protection zones and proposed conservation area features

3 Legislation and Assessment

3.1 Environmental impact assessments under Commonwealth, state or territory legislation

The proposed action seeking approval includes subdivision, early site establishment works and subsequent residential development. This referral has been written to consider the overall (total) impact on the site's environmental values for all stages of work and is based on the preferred indicative layout plan for the study area (**Figure 4**). The proposed development will be staged over an indicative five year timeframe (subject to demand for housing lots).

A referral under the EPBC Act regarding the proposed Mt Gilead development was lodged with DotEE in October 2015. On 8 January 2016 the project was determined to be a Controlled Action that will be assessed by Preliminary Documentation. The proposed action was then varied to include a larger boundary, as approved May 2017. This report forms the Preliminary Documentation required by the DotEE for further assessment of the proposed action.

A preliminary Flora and Fauna Assessment was completed by ELA (2014) for the subject site as part of the rezoning investigation of this land to determine the extent of ecological values and any impacts to MNES. The planning proposal was undertaken to rezone the study site to a combination of residential, rural and recreational land use. The offset sites will be protected by in-perpetuity Biobank Agreements registered on title (applications submitted to NSW OEH in 2015 and expected to be registered in late 2017) or through the Local Government Act with land vested for perpetual conservation. The planning proposal was placed on public exhibition between 28 April and 30 June 2015 by CCC, and was rezoned in September 2017. Preliminary subdivision plans are expected to be submitted in 2018. Subject to all approval being in place, construction is proposed to commence in two stages starting with Stage 1 in 2018/19 and subject to demand for lots, be completed by 2022/23.

A detailed Biodiversity Certification Assessment of the study area was undertaken between 2015 and 2017 following the Biodiversity Certification Assessment Methodology (BCAM) (Appendix A). The biocertification assessment has been reviewed by CCC and the NSW Office of Environment and Heritage (OEH). The BCAM assesses the impact of the proposal on ecological matters and proposed conservation measures. This assessment is measured using the number of credits 'required' for impacts to existing vegetation, and the number of credits 'generated' by the protection and conservation management of offset areas. Biodiversity certification can only be conferred by the Minister where an "improve or maintain" biodiversity outcome is met. The proposed rezoning plan presents a plan that exceeds an "improve or maintain" outcome under the BCAM. The biocertification application will be publicly exhibited in 2017.

Additionally, it is noted that an agreement (Strategic Assessment) between the Commonwealth Minister for the Environment and the NSW Roads and Maritime Services (RMS) has been made whereby the majority of actions which encompass road and traffic management works assessed and determined by RMS under Part 5 of the NSW EP&A Act are endorsed under "the Program" (*Program Report – Environmental assessment and decision making by NSW Roads and Maritime Services Assessment under Part 10 of the Commonwealth EPBC Act, May 2015*). The endorsement of "the Program" removes the need for referral (and assessment/approval) under the EPBC Act for such works.

Proposed road widening and a portion of the subsequent clearance activities of the vegetation within the verges of Appin Road, could accordingly be endorsed under this Strategic Assessment agreement. However, components of the work are also required as part of the proposed action and accordingly in lieu

of RMS conducting assessments under Part 5 of the EP&A Act (at this time), it is deemed more appropriate to gain approval through the EPBC Act approval pathway to ensure project deliveries are met. As such, potential impacts associated with clearance within the study area for proposed road widening have been considered within this assessment.

3.2 Public consultation (including with Indigenous stakeholders)

The planning proposal to rezone the subject land at Mt Gilead has undergone extensive community and stakeholder consultation since 2010, including with indigenous groups, the Department of Planning and Environment (DPE) and the OEH. Consultation with indigenous groups was noted in the planning proposal and formed part of a study by Navin Officer who prepared an Archaeological Assessment and Aboriginal Consultation Report for the planning proposal (Navin Officer and Tropman & Tropman Architects 2014).

The planning proposal was placed on public exhibition between 28 April and 30 June 2015 by Campbelltown City Council. Further, consistent with section 126N of the *Threatened Species Conservation Act 1995* (TSC Act), the application for Biodiversity Certification will also be placed on public exhibition in 2017 and a report prepared responding to any submissions received.

4 Identification of Matters of National Environmental Significance

4.1 DotEE Requirements

Under the EPBC Act, actions that have, or are likely to have, a significant impact on a matter of national environmental significance (MNES) requires approval from the Australian Government Minister of the Environment (the Minister). An assessment of MNES relevant to the proposed action was conducted prior to the referral of the proposed action using:

- Literature review, including a search of DotEE's Protected Matters Search Tool (PMST); and
- Biodiversity and ecological surveys of the study area conducted between 2013 and 2016 as outlined below in **Table 2**.

From the information provided in the referral, DotEE considered that the following communities and species listed under the EPBC Act (MNES) are likely to be significantly impacted by the proposed action:

- Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (CPW) of the Sydney Basin Bioregion (Critically Endangered Community)
- Shale Sandstone Transition Forest of the Sydney Basin Bioregion (SSTF) of the Sydney Basin Bioregion (Critically Endangered Community)
- Threatened flora
 - Bynoe's Wattle (*Acacia bynoeana*; Vulnerable)
 - Yellow Gnat Orchid (*Genoplesium baueri*; Endangered)
 - Small-flower Grevillea (*Grevillea parviflora* subsp. *parviflora*)
 - Woronora Beard-heath (*Leucopogon exolasius*)
 - Deane's Melaleuca (*Melaleuca deanei*; Vulnerable)
 - Bargo Geebung (*Persoonia bargoensis*; Vulnerable)
 - Hairy Persoonia (*Persoonia hirsuta*; Endangered)
 - Spiked Rice-flower (*Pimelea spicata*)
 - Rufous Pomaderris (*Pomaderris brunnea*)
 - Sydney Plains Greenhood (*Pterostylis saxicola*; Endangered)

Threatened fauna and migratory species

- Swift Parrot (*Lathamus discolor*; Endangered)
- Large-eared Pied Bat (*Chalinolobus dwyeri*; Vulnerable)
- Grey-headed Flying-fox (*Pteropus poliocephalus*; Vulnerable)
- Koala (*Phascolarctos cinereus*; Vulnerable)

4.2 Protected Matters Search Tool

A search of the EPBC Act Protected Matters Search Tool (PMST) was undertaken on 28th August 2017 and returned five (5) listed Threatened Ecological Communities, thirty-eight (38) listed Threatened Species and 11 Migratory Birds as potentially occurring within 5 km of the proposed action. These are listed in Appendix B along with the likelihood of occurrence based on targeted field surveys and habitat present on the site. There is no marine habitat on site, so marine species have been excluded from these lists.

The following species that were identified for further assessment by the DotEE are not considered to have potential habitat within the study area based on their habitat requirements as detailed in Appendix B and were not recorded during extensive, targeted survey. It is highly unlikely that they occur within the study area and have not been identified during extensive survey, no further assessment is required.

These species include:

- Bynoe's Wattle (*Acacia bynoeana*) – Vulnerable
 - Grows in heath and dry sclerophyll forest on sand and sandy clay, often with ironstone gravels and is usually very infertile and well-drained.
- Yellow Gnat-orchid (*Genoplesium baueri*) – Endangered
 - Usually grows in heathland to shrubby woodland on sands or sandy loams or open forest, shrubby forest and heathy forest on well-drained sandy and gravelly soils.
- Woronora Beard-heath (*Leucopogon exolasius*) – Vulnerable
 - It is restricted to Woronora and Grose Rivers, Stokes Creek, Georges River, Holsworthy Military Reserve and in both Heathcote and Royal National Park. It inhabits woodland on sandstone and sandy alluvium, preferring rocky hillsides along creek banks on low nutrient soils.
- Deane's Melaleuca (*Melaleuca deanei*) – Vulnerable
 - Generally found on heath on sandstone substrates and often found in Coastal Sandstone Ridgetop Woodland.
- Hairy Persoonia (*Persoonia hirsuta*) – Endangered
 - Requires sandy soils in dry sclerophyll open forest, woodland and heath on sandstone.

4.3 Field survey and methodology

Table 2 outlines the ecological field survey and effort that has been completed by ELA within the study area in 2006, 2014, 2015a and b and 2017 (a and b) along with the major results for each survey. These surveys have generally been undertaken in higher quality vegetation / habitat compared to the study area. Despite this, no EPBC listed threatened flora or fauna species were detected during this survey, apart from *Pomaderris brunnea* which was recorded within a proposed future biobanking site to the west of the study area in tributaries of Menangle Creek.

The location of the flora survey effort both within the study area and on surrounding land is shown in **Figure 11** as traverses recorded with a GPS between 2013 and 2016. **Figure 7** does not show the location of survey effort from the 2006 survey as GPS were not available. A total of 36 biometric plots were completed across the study area involving gathering field data from 20 x 50 m plots.

The location of fauna survey effort is shown in **Figure 12**. However, this figure does not include opportunistic records of fauna species that has been made during traverses of the study area.

Table 2: Field survey completed by ELA within the study area

Survey	Effort	Results
<ul style="list-style-type: none"> - ELA (2014) Ecological Assessment for Rezoning 	<ul style="list-style-type: none"> - Five-day survey on 25th and 26th March, 4th April, 27th June, and 20th September 2013. - Vegetation communities and their condition were validated through random meander to demarcate vegetation zones (a combination of vegetation communities and their conditions). - 18 plots surveying vegetation zones (Appendix C), flora species and habitat features (i.e. biometric plots in accordance with NSW survey methods), were undertaken in eight vegetation zones, which included 'cleared' areas. - Searches for threatened flora species were undertaken via random meander in suitable habitat and were all undertaken during appropriate survey times identified by the OEH impact assessment databases. - Birds were surveyed over 20-30 minute intervals at four sites over four mornings, depending on whether one or two observers were present. - Microbat surveys were undertaken using two ultrasonic Anabat detectors at three sites (one Anabat at two sites and one Anabat at one site) targeting areas where bats are likely to be present over two consecutive nights over a period of 12 hours between 1800 hours and 0600 hours. - Habitat features for fauna across the study area, such as hollow-bearing trees, rocks and rocky outcrops, water bodies and Koala feed/forage resources were opportunistically recorded. As some features were assessed to be unsuitable for the threatened frog target species <i>Heleioporus australiacus</i> (Giant Burrowing Frog) and <i>Litoria aurea</i> (Green and Golden Bell Frog), targeted survey for these were not undertaken. 	<ul style="list-style-type: none"> - Three vegetation communities were recorded: River-Flat Eucalypt Forest, Cumberland Plain Woodland, and Shale Sandstone Transition Forest. - No threatened flora species were recorded. - Seven threatened species (six bats and one bird) were recorded: Eastern Bentwing Bat, East-coast Freetail Bat, Eastern False Pipistrelle, Yellow-bellied Sheath-tail Bat, Southern Myotis, Greater Broad-nosed Bat, and Little Lorikeet. - One migratory species was recorded: Cattle Egret. - There was potential for Koala to be present, but a low likelihood for Cumberland Plain Land Snail to be present. - The overall rating of the riparian and aquatic condition varied from degraded to moderate.

Survey	Effort	Results
	<ul style="list-style-type: none"> - Koala was surveyed opportunistically within potential habitat over all five survey days. - Riparian and aquatic habitat assessments included mapping the top of bank using a differential GPS, classifying the condition and recovery potential of stream reaches, categorising each stream using the Strahler method, and identifying heavily degraded streams or areas of overland flow that do not meet the definition of 'river' and are suitable for removal. Assessments were undertaken over one and a half days. 	
<ul style="list-style-type: none"> - ELA (2015a) Biobanking Agreement Credit Assessment Report: Macarthur-Onslow Mt Gilead Biobank Site. (Appendix D) 	<ul style="list-style-type: none"> - 6 plots surveying vegetation zones, flora species and habitat features (i.e. biometric plots in accordance with NSW survey methods) were undertaken in 3 vegetation zones within proposed Offset Site 1. - Habitat assessment for threatened species - Expert report for Koala habitat including mapping of habitat 	<ul style="list-style-type: none"> - One threatened ecological community recorded – Shale Sandstone Transition Forest - No threatened flora or fauna species recorded
<ul style="list-style-type: none"> - ELA 2015b. Biobanking Agreement Credit Assessment Report: Noorumba-Mt Gilead Biobank Site. (Appendix F) 	<ul style="list-style-type: none"> - 6 plots surveying vegetation zones, flora species and habitat features (i.e. biometric plots in accordance with NSW survey methods) were undertaken in 4 vegetation zones within proposed Offset Site 2. - Habitat assessment for threatened species - Expert report for Koala habitat including mapping of habitat 	<ul style="list-style-type: none"> - Three threatened ecological communities were recorded: River-Flat Eucalypt Forest, Cumberland Plain Woodland, and Shale Sandstone Transition Forest. - No threatened flora or fauna species recorded.

Survey	Effort	Results
<ul style="list-style-type: none"> - ELA (2017b Biodiversity Certification and Assessment Report (Appendix A)) 	<ul style="list-style-type: none"> - Two-day survey on 9th and 10th April 2015 to further refine vegetation mapping and delineate EPBC Act listed vegetation in accordance with EPBC Act approved conservation advice criteria - Vegetation communities and their condition as determined by ELA (2014) were validated through random meander to demarcate vegetation zones (a combination of vegetation communities and their conditions). - 13 plots surveying vegetation zones, flora species and habitat features (i.e. biometric plots in accordance with NSW survey methods) were undertaken in five vegetation zones. 	<ul style="list-style-type: none"> - Three vegetation communities were recorded: River-Flat Eucalypt Forest, Cumberland Plain Woodland, and Shale Sandstone Transition Forest. - No threatened flora or fauna species were recorded. - Koala not recorded but assumed to be present based on suitable browse species.

Table 3: Field survey conducted by ELA outside of the study area in surrounding lands.

Survey	Effort	Results
<ul style="list-style-type: none"> - ELA (2006) Mt Gilead Flora and Fauna Assessment: Stage 2 	<ul style="list-style-type: none"> - 56 person hours over the 16th and 28th of February and the 1st and 6th of March, 2006. - identification and validation of vegetation communities and condition and mapping of recovery potential, - identifying flora species, - an assessment of fauna habitat attributes, including hollows in canopy trees, fallen logs, rocks and foraging resources for threatened fauna species known to occur in the area. - an assessment of koala feed trees, and any indication of koalas being on site - assessment of riparian health 	<ul style="list-style-type: none"> - Four vegetation communities were confirmed: Alluvial Woodland, Riparian Forest, Cumberland Plain Woodland, and Shale Sandstone Transition Forest. - One threatened flora species, <i>Eucalyptus benthamii</i>, was potentially recorded on the bank of the Nepean River. - No threatened fauna species were recorded, but key habitat features were present which could support a range of common and threatened fauna species. - Potential Koala habitat as defined by the State Environmental Planning Policy No 44 – Koala Habitat Protection (SEPP 44) was recorded

Survey	Effort	Results
- Feb / Oct 2015 Mt Gilead Flora Assessment	- 119 person hours - Vegetation plots (biometric), vegetation validation and targeted survey for threatened plants from the study area west to the Nepean River.	- Found <i>Pomaderris brunnea</i> (approximately 200) within proposed biobanking site to the west.
- Feb / March 2016 Mt Gilead Flora Assessment	- Bloom/Samaha Lands – 6 person days = 50 hrs	- Cumberland Plain Land Snail (<i>Meriodolum corneovirens</i>) detected and mapped. - CPW, SSTF and Western Sydney Dry Rain Forest mapped. - <i>Marsdenia viridiflora</i> endangered population located and mapped
April 2016 Mt Gilead Flora Assessment	- Sugarloaf lands – 16 hours	- mapped CPW, Moist Shale Woodland, Western Sydney Dry Rain Forest - No Cumberland Plain Land Snail (<i>Meriodolum corneovirens</i>) - No rare or threatened plants recorded
March 2016 Mt Gilead Flora Assessment	- 8 person hours - targeted flora surveys for <i>Pimelea spicata</i> and <i>Pomaderris brunnea</i>	- No threatened species recorded - No new records for <i>Pomaderris brunnea</i>
Jan / Feb 2016 Biobanking Assessment for Noorumba Reserve	- 60 person hours as part of a biobanking assessment at Noorumba Reserve.	- Cumberland Plain Land Snail (<i>Meriodolum corneovirens</i>) detected and mapped. - CPW and SSTF mapped and sampled. - No rare or threatened plant recorded

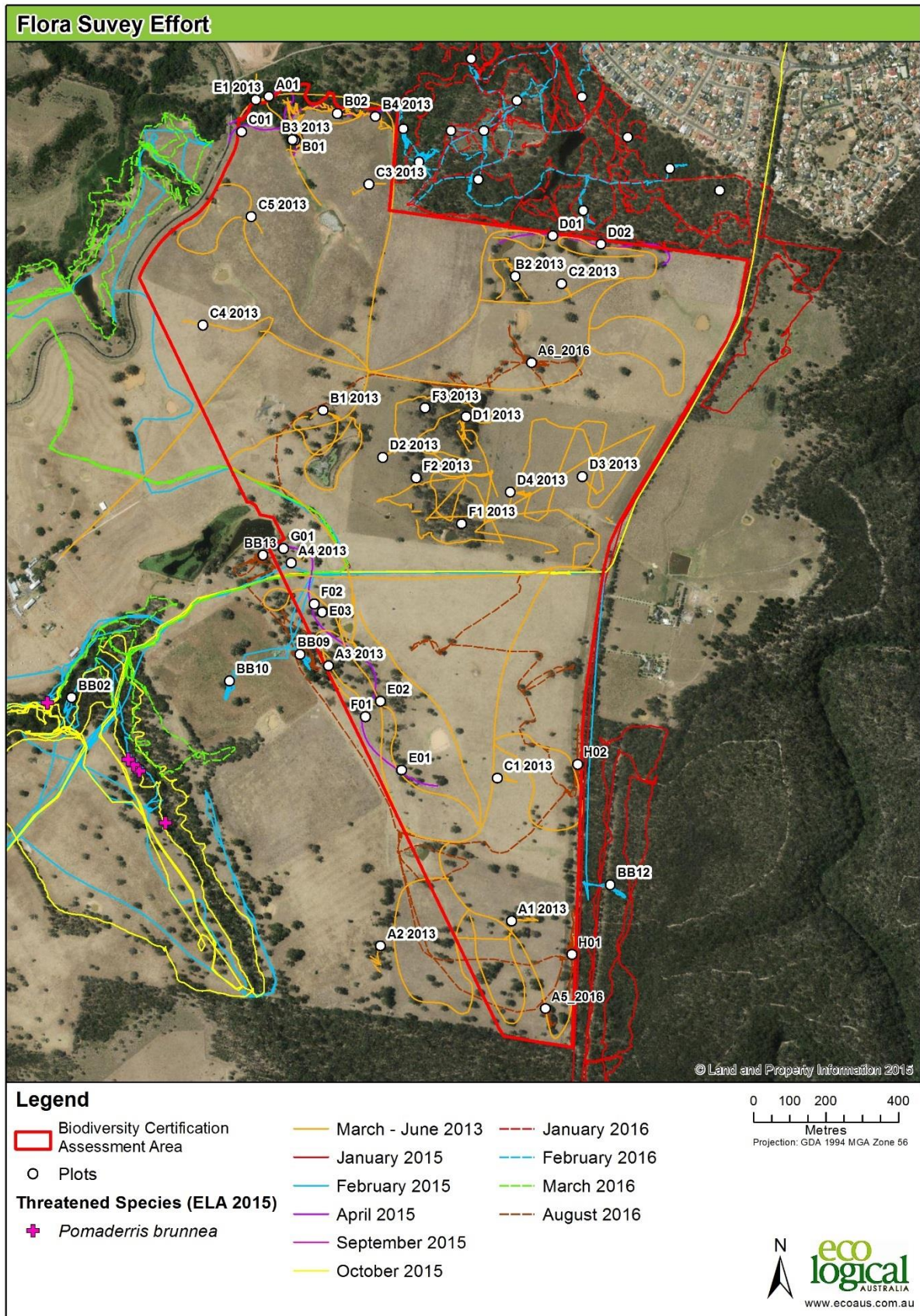


Figure 11: Survey effort within the study area and surrounding land

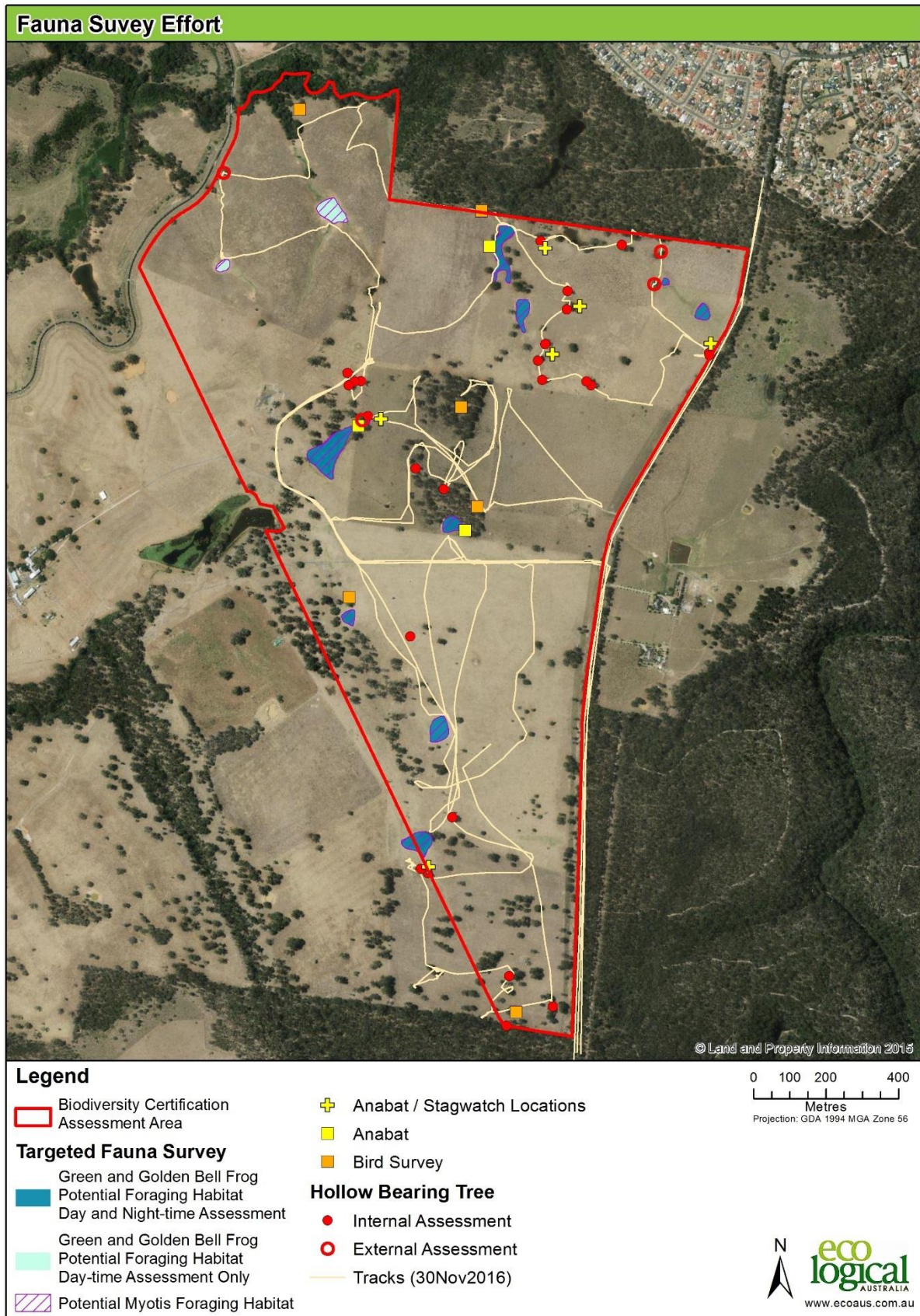


Figure 12: Survey effort for fauna species.

Table 2, Table 3, Figure 11 and Figure 12 demonstrate that extensive time and effort has been spent conducting field survey within the study area and surrounding lands. Survey has focussed on defining the extent and condition of the vegetation communities in accordance with EPBC Act approved conservation advice condition criteria and targeted surveys for threatened flora and fauna that have the potential to occur in the study area. The recommended seasonality of survey for each potential species as outlined in the NSW BioNet data bases is shown in **Table 4**. The survey times were consistent with the recommended timing for threatened species with potential to occur within the study area. Note that there was no survey time recommended for Swift Parrot. However, this species is a winter migrant from Tasmania, so will only be recorded in the winter months.

Table 4: ELA survey times (green) and recommended timing of targeted flora and fauna survey for each potential threatened species (OEH 2014)

Scientific name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Acacia bynoeana</i>	Yes	Yes	Yes						Yes	Yes	Yes	Yes
<i>Leucopogon exolasius</i>								Yes	Yes	Yes		
<i>Melaleuca deanei</i>	Yes								Yes	Yes	Yes	Yes
<i>Genoplesium baueri</i>		Yes	Yes									
<i>Persoonia bargoensis</i>	Yes	Yes	Yes	Yes	Yes							Yes
<i>Persoonia hirsuta</i>	Yes										Yes	Yes
<i>Pimelea spicata</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Pomaderris brunnea</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Pterostylis saxicola</i>									Yes	Yes	Yes	
<i>Phascolarctos cinereus</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Pteropus poliocephalus</i>	Yes	Yes	Yes	Yes	Yes				Yes	Yes	Yes	Yes

Scientific name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<i>Chalinobolus dwyeri</i>	Yes	Yes	Yes	Yes					Yes	Yes	Yes	Yes

4.4 Threatened Flora

The following species were considered to have potential habitat within the study area and targeted flora surveys were conducted:

- Small-flower Grevillea (*Grevillea parviflora* subsp. *parviflora*)
- Bargo Geebung (*Persoonia bargoensis*)
- Spiked Rice-flower (*Pimelea spicata*)
- Rufous Pomaderris (*Pomaderris brunnea*)
- Sydney Plains Greenhood (*Pterostylis saxicola*)

A description of each species is listed below, along with the survey guidelines and how these were met by the ELA survey effort.

Small-flower Grevillea (*Grevillea parviflora* subsp. *parviflora*)

Small-flower Grevillea is a spindly shrub that can vary from a low spreading to erect shape, growing up to 1.5-2 m high. It suckers readily from rhizomes, although individuals sometimes have single stems. The flowers are spider-like and clustered in groups of 6-12. They are small and white or pinkish, with rusty-brown hairs that can become red with age.

The species is sporadically distributed throughout the Sydney Basin and in the Hunter, and is also known from Putty to Wyong and Lake Macquarie on the Central Coast. Its habitat requirements consist of shrubby woodland to open forest on sandy or light clay soils usually over thin shales. Flowering has been recorded between July to December as well as April to May.

EPBC guidelines suggest that Small-flower Grevillea is best surveyed during the main flowering period between July and December when it is easier to identify by its flowers. It is also reported to flower in April and May. Surveys should target flat to gently sloping land within areas with both a shale and sandstone influence. At higher altitudes the location of Shale/Sandstone Transition forest can be an indicator for the species.

ELA conducted surveys in the March, April and June 2013 within the study area and September and October 2015, off site to the west of the study area (**Figure 11**). These surveys included the flowering period for this species in a variety of vegetation conditions, but the species was not detected.

The closest record of this species is approximately 2 km east of the study area, where numerous records of the species occurs east of the Georges River. It is highly unlikely that the species would occur within the study area, which is highly degraded through extensive grazing, pasture improvement and cropping. No impacts to this species are expected to result from the proposed action and no further assessment is required.

Bargo Geebung (*Persoonia bargoensis*)

The Bargo Geebung is an erect, bushy shrub growing to 0.6-2.5 m in height. It has slender branches with a light covering of hairs on the new growth. The small, thin leaves have a lighter green lower surface. Its yellow tubular flowers appear mainly in summer and are produced in the angles where leaves join the stem of new growth. Its fruits are pear-shaped, green, pendulous and grow to 12 mm long.

The Bargo Geebung is restricted to a small area south-west of Sydney on the western edge of the Woronora Plateau and the northern edge of the Southern Highlands. Its habitat requirements consist of woodland or dry sclerophyll forest on sandstone and on heavier, well drained, loamy, gravelly soils of the Wianamatta Shale and Hawkesbury Sandstone. The flowering period for the species is November into December.

EPBC guidelines suggest that the Bargo Geebung is best surveyed during flowering in summer and autumn, as it can be very difficult to detect when not in flower or during the later stages of fruiting. The species tends to occur along fire trails or the margins of disturbed areas.

ELA conducted surveys in the flowering period of January and February 2016 to the north of the study area in Noorumba Reserve, but did not detect the species. Extensive surveys were undertaken in June 2013 to March 2013 within areas of potential habitat within the study area. Further, less extensive surveys were undertaken in February 2015. These survey times covered the flowering period of summer and autumn, but did not detect the species. The closest record of this species is 6 km to the south, on the eastern side of Appin Road.

It was determined that the species is highly unlikely to occur within the study area and there will be no impacts to this species as a result of the proposed action. No further assessment of this species is required.

Spiked Rice-flower (*Pimelea spicata*)

The Spiked Rice-flower is a slender, low growing shrub with glabrous stems and narrow elliptical leaves 5 – 20 mm long and approximately 2 mm wide. The flowers are in racemes starting out compact but elongate as they age. The flowers are white and often tinged with pink, 7 – 10 mm long with sparsely haired sepals. The fruit is green and approximately 2.5 mm long. It can grow up to 50 cm in height but rarely exceeds 30 cm in height. Stems are prostrate and brittle.

The invasion of Spiked Rice-flower habitat by mat-forming grasses such as Kikuyu (*Pennisetum clandestinum*) can result in variation of the species. In response to shading, the stems can become elongated to over 2 m in length, climbing to the upper canopy resulting in foliage being restricted to emergent sections of the stem.

Adult plants flower and fruit prolifically throughout the year with peaks in spring and autumn. After disturbances, established plants can resprout from a substantial, carrot like taproot, however this diminishes the ability of the species to recover from further disturbance events.

The distribution of the Spiked Rice-flower is scattered, occurring in two disjunct areas; the Cumberland Plain area of western Sydney and the Illawarra region near Wollongong, NSW. The western Sydney population extends from Camden in the south to Maraylya in the north and from Horsley Park in the east to Bankstown in the west.

Populations occur on undulating to hilly country in remnant bushland on Wianamatta shales. Habitats include open woodlands and grasslands of Grey Box (*Eucalyptus moluccana*), Narrow-leaved Ironbark (*E. crebra*), Forest Redgum (*E. tereticornis*), Blackthorn (*Bursaria spinosa*), and Kangaroo Grass (*Themeda triandra*).

In the Illawarra region, the species is associated with coastal headlands and hill tops from Mt Warrigal to Gerroa. Populations occur on well-structured clay soils on coastal headlands in *Themeda triandra* grassland with low native shrubs such as *Westringia fruticosa*, *Banksia integrifolia* and *Acacia sophorae*.

In total the species occupies an area of less than 17 ha. As of 2000 it was known to occur at 42 sites, with the total number of mature individuals approximately 4300. Population sizes vary from site to site with most populations supporting a low number of plants.

Pimelea spicata is cryptic and difficult to detect, particularly when not in flower, so surveys should not be relied upon unless undertaken whilst the species is flowering. *Pimelea spicata* flowers sporadically throughout the year, with flowering likely to depend upon climatic conditions, particularly rainfall. For example, the flowering period has been noted as May - January; March – April; and abundant flowering was recorded was also been recorded in winter and spring (June-September) of 2003 after the break of a drought. Given that *P. spicata* flowers opportunistically and peak flowering time may vary from year to year, survey of other known nearby sites supporting *P. spicata* should be used as an indicator of flowering time (NSW NPWS 2004).

Surveys should not necessarily be restricted to the species' known distribution. In particular, suitable habitat in western Sydney and along coastal Illawarra, outside of the species current known distribution. Given that the species is small and cryptic, when surveying potential habitat, *P. spicata* needs to be the subject of a specific targeted survey. The targeted survey should be undertaken using the random meander method, favouring suitable habitat areas (ie. open areas), and survey effort should be at least one hour per hectare of suitable habitat. Surveys should aim to determine species presence and, when presence is confirmed, an estimate of population size and area should be obtained (NSW NPWS 2004).

The closest record of *P. spicata* is approximately 3 km to the north of the study area (Bionet 2016). The majority of the impacts resulting from the proposed action occur within highly degraded grazing land that is not considered to be potential habitat for *P. spicata*. Extensive targeted surveys for this species within the study area and surrounding lands have been timed to include the species sporadic flowering in a variety of vegetation conditions. These surveys did not detect the species. Based on these factors, it was determined that the species is highly unlikely to occur within the study area and there will be no impacts to this species as a result of the proposed action. No further assessment of *P. spicata* is required.

Rufous Pomaderris (*Pomaderris brunnea*)

Rufous Pomaderris is a shrub growing 1 – 4 m high with yellowish/cream flowers. The species occurs in the Sydney region of the Central Coast NSW, east of Tamworth on the Northern tablelands NSW and in the east Gippsland region of Victoria, normally in small populations. Rufous Pomaderris flowers from September to October, taking a minimum of 4 – 6 years to produce seed.

The species grows in open forest and is often associated with *Eucalyptus amplifolia*, *Angophora floribunda*, *Acacia parramattensis*, *Bursaria spinosa* and *Kunzea ambigua*. In the Sydney area it is typically found near the coast and grows in woodland and semi-cleared scrub, on clay and alluvial soils of floodplains and creek lines.

The species is known from the Colo River, Nepean River floodplain at Menangle, in creek lines at Wirumbirra Sanctuary (Bargo) and on the Hawkesbury River. It is possible the distribution may extend into the southern section of Yengo National Park along major creek lines and floodplains.

Recently, other populations have been found in Tuggolo State Forest in the Northern region of NSW. The forest type supporting this population also occurs in Nowendoc, Riamukka and Enfield State Forests but

populations are not known to occur in these areas. There is a conserved population of unknown size in Wollemi National Park.

No specific EPBC Act guidelines are provided for this species, most likely because the species is easily recognisable outside of the flowering of September to October. ELA surveys conducted in February and October 2015 readily detected Rufous Pomaderris approximately 400 m west of the study area along a drainage line as shown in **Figure 11**. Approximately 200 individuals were recorded within habitat considered to be of higher quality than that contained within the study area. As shown in **Figure 2**, the location of these records occurs on land proposed to be future biobank sites. The species has also been previously recorded from the Beulah biobank site to the south of the study area, but was not recorded within Noorumba biobank site to the north.

Despite extensive targeted searches within the study area, the species was not detected. Considering that the species is easily detectable in better condition vegetation adjacent to the study area, it is likely that potential habitat within the study area is no longer present due to a long history of grazing and pasture improvement that has degraded potential habitat for this species. The species is highly unlikely to be impacted by the proposed action given the poor condition of vegetation within the proposed impact areas of the study area. No further assessment of Rufous Pomaderris is required.

Sydney Plains Greenhood (*Pterostylis saxicola*)

The Sydney Plains Greenhood is a tuberous, terrestrial herb, with scape to 25 cm tall. It has reddish brown and green translucent flowers on a slender stem to 35 cm tall. It has concave, curved lateral sepals and a fairly broad labellum with setae to 0.7 mm long on basal lobe with 5-9 pairs of marginal setae. The plants have 5-8 rosette leaves, and 2-4 closely-sheathing stem leaves.

Sydney Plains Greenhood is restricted to western Sydney between Freemans Reach in the north and Picton in the South. The required habitat for the species consists of small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines, adjacent to sclerophyll forest or woodland on shale/sandstone transition soils or shale soils.

All species of *Pterostylis* are deciduous and die back to fleshy rounded underground tuberoids. The time of emergence and withering has not been recorded for this species, however flowering occurs from October to December and may vary due to climatic conditions. The above ground parts of the plant wither and die following seed dispersal and the plant persists as a tuberoid until the next year. They typically occur as scattered individuals or in small groups.

The closest record *Pterostylis saxicola* is approximately 2.5 km north of the study area within a residential area in Campbelltown.

The Draft survey guidelines for Australia's threatened orchids (DotEE 2013a) states that the peak detectability for this species is during the peak flowering time of October to December. **Table 4** demonstrates that ELA surveys were undertaken during the recommended times (OEH 2014) of September and October. The September survey included the higher quality patches of vegetation within the study area and the October survey included areas of better condition vegetation to the west of the study area. Despite this, the species was not detected.

The study area is heavily pasture improved with clay soils and a grassy understorey which does not provide met the optimal habitat requirements of this species. Potential habitat for this species occurs west of the study area along the edge of the Nepean River where the soils are more sandstone influenced.

Based on the above assessment and the species not being recorded during extensive survey efforts, it was concluded that *Pterostylis saxicola* is highly unlikely to occur within the study area and no further assessment is required.

4.5 Fauna

Fauna survey has been completed for the following species are detailed in Section 4.3 and **Figure 12**.

- Swift Parrot (*Lathamus discolor*; Endangered)
- Large-eared Pied Bat (*Chalinolobus dwyeri*; Vulnerable)
- Grey-headed Flying-fox (*Pteropus poliocephalus*; Vulnerable)
- Koala (*Phascolarctos cinereus*; Vulnerable)

Of the above species, only the Large-eared Pied Bat was detected on-site. The Grey-headed Flying Fox was recorded flying over the site. However, all species listed above are considered to have foraging habitat present within the study area and may use the site on occasion. Impacts to potential habitat resulting from the proposed action are detailed below in Section 6.

4.6 Vegetation Communities

Survey effort is detailed in Section 4.3. In summary, field surveys were conducted by ELA in September 2013 to validate the presence, and extent of vegetation occurring within the study area (ELA 2014). This vegetation mapping was refined via additional assessment for the two proposed Biobank sites within the study area (ELA 2015a and b), for the biodiversity certification assessment of the site (ELA 2017b) and this EPBC Act assessment following restoration works between October 2016 and April 2017 in the Macarthur-Onslow Biobanks site (ELA 2017c).

In total some 36 full floristic 20 x 20m plots were completed within the study area and a further 20 in the immediately adjacent lands (**Figure 11**). Appendix C provides a full species list for these plots.

The biometric plots conducted followed the BioBanking Assessment Methodology (OEH 2014). The BioBanking Assessment Methodology (BBAM) is a transparent, consistent and scientifically-based set of rules to assess biodiversity values. The BBAM is summarised as follows:

- preliminary mapping of the extent of vegetation within the site using digital photography and available vegetation, survey and historic data
- identify and map the plant community type (ecological community) through a quantitative analysis of survey data – i.e. field validate/refine the preliminary mapping
- stratify the site into vegetation zones including areas of low, moderate/good condition
- conduct further survey and plots in each vegetation zone for each ecological community
- measure various attributes within the plots, including percent foliage cover, native plant species richness, number of trees with hollows, total length of fallen logs
- plots of 0.04 ha (20m x 20m) for species richness
- plots and transects are stratified randomly within a vegetation zone, accounting for the level of variation in broad condition of the vegetation zone
- a minimum number of plots must occur in line with BBAM, for example, a vegetation zone of 0-4 ha must have 1 plot per 2 ha, or 1 plot if vegetation condition is low

The survey technique used at the site (based on the BBAM) is consistent with DotEE survey requirements, which recommends the following sampling protocol:

- developing a simple map of the vegetation, landscape qualities and management history of the site
- thorough and representative samples for vegetation cover and species richness
- a number of plots which provide a good representation of the species present across a whole vegetation patch
- recommended plots of 0.04 ha (quadrats of 20m x 20m)

The data collected within the study area meets these requirements.

From these surveys, the following critically endangered ecological communities (CEEC) listed under the EPBC Act (MNES) exist within the study area and are considered by DotEE as 'likely' to be significantly impacted by the proposed action:

- Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (CPW, Critically Endangered Ecological Community (CEEC))
- Shale Sandstone Transition Forest of the Sydney Basin Bioregion (SSTF; CEEC)

The extent of vegetation, and that which meets the condition thresholds specified by the EPBC Act conservation listing advice within the study area is shown in **Figure 13**.

4.6.1 Justification for EPBC Act listed vegetation within the study area

Further information was requested from the DotEE to justify why some patches of vegetation are considered to be EPBC Act listed CPW and SSTF and other patches are not. The condition criteria for each community as listed in **Table 5** for SSTF and **Table 6** and **Figure 14** for CPW. The conservation listing advice for each community was reviewed (TSSC 2008, 2014a). The policy statement for CPW was also reviewed (DEWHA 2010). Using the data collected during the vegetation mapping, the justification for defining which patches of vegetation meet or do not meet the condition criteria for each community is shown in **Table 7** and **Figure 15**.

The following sections provide a justification for how CPW and SSTF meets the condition criteria under the EPBC Act.

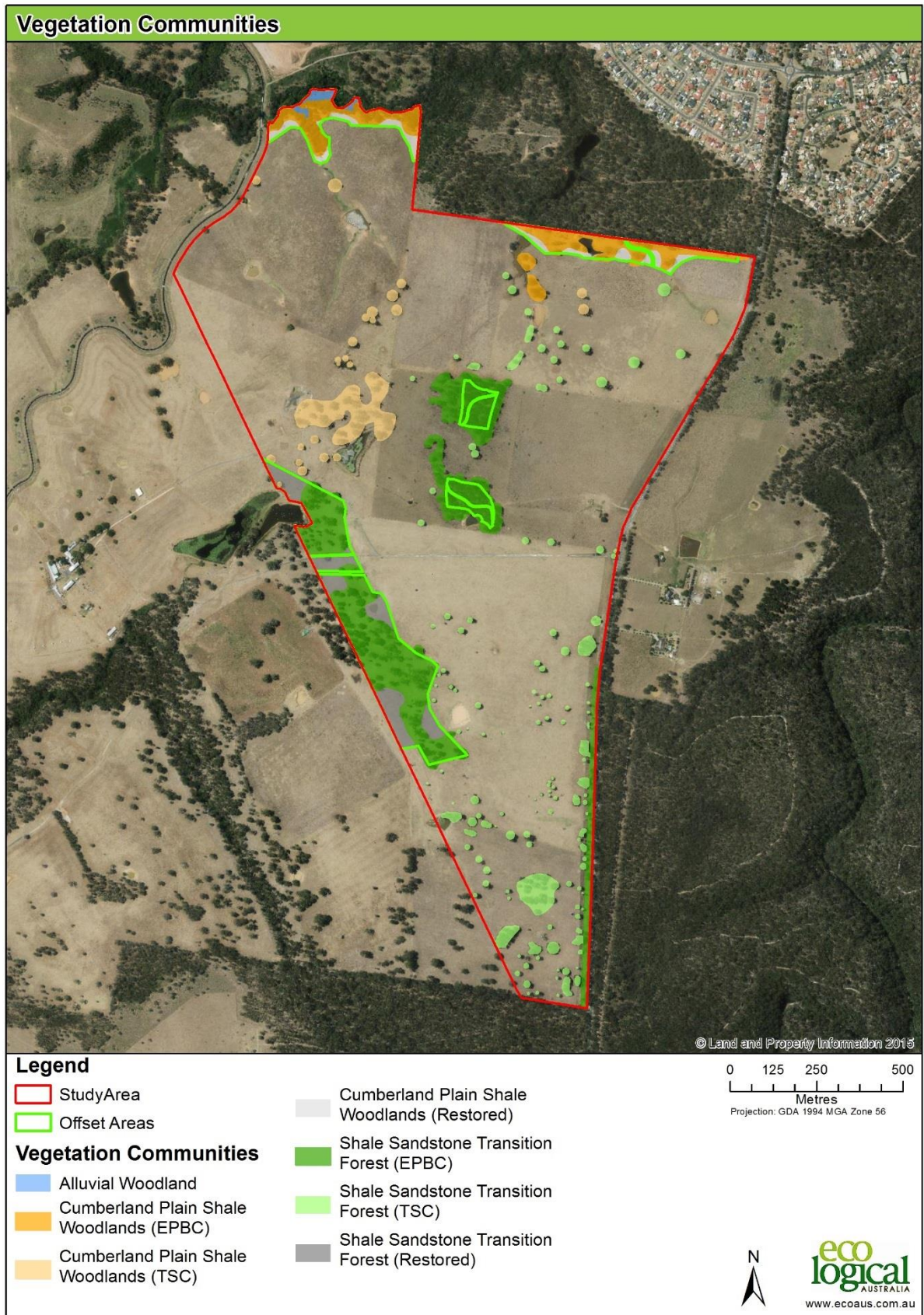


Figure 13: Vegetation communities mapped within the study area

4.6.2 SSTF at Mt Gilead

ELA (2014, 2015 a and b and 2017b) found that SSTF, as recognised by the EPBC Act, was present within the site only in the east (Patch 9, Condition A) and the centre (Patch 7, Condition D) of the site. However, following the cessation of grazing in late 2016 and a targeted weed control program as part of the preliminary management of Patches 3 and 4 as a Biobank site, the native ground cover in these areas was also assessed as meeting EPBC Act condition thresholds with Patch 3 meeting Condition A and Patch 4 meeting Condition B. Thus the total area of EPBC Act condition SSTF in the study area was 15.79 ha (**Figure 13** and **Figure 15**). Refer to **Figure 15** for patch locations and Appendix C for species list and groundcover calculations within plots.

Where present along the western boundary of the site, SSTF mostly had a mature over-storey of *E. tereticornis*, *E. creber*, *E. punctata* and *E. moluccana* and a ground cover of perennial native grasses comprising over 30% of the ground cover thus meeting the EPBC Act condition threshold of Category A for SSTF (Appendix C).

Also along the western boundary of the site, a small area (Patch 4) of SSTF had an over-storey dominated by *Eucalyptus tereticornis* and *E. creber*, the shrub layer was largely absent, however, the under-storey was comprised of a mixture of native and introduced grasses, sedges, herbs and scramblers comprising greater than 50% of the ground cover thus meeting the EPBC Act condition threshold of Category B for SSTF (Appendix C).

Near the centre of the site (Patch 7), the canopy was dominated by ironbark species, and a native mid-storey was present. The under-storey was native dominated with a low incidence of weeds with native ground cover exceeding 50% (SSTF Category D) (Appendix C). The SSTF within the centre of the site was recorded in a good condition due to having been fenced off and protected from grazing by the current land owner. The vegetation here was not contiguous with other vegetation surrounding the site.

Along the eastern boundary of the site (Patch 9), SSTF had a native dominated ground layer and was also less subject to disturbance from grazing due to the presence of a fence. The native ground cover of perennial native grasses comprising over 30% but less than 50% of the ground cover thus meeting the EPBC Act condition threshold of Category A for SSTF (Appendix C).

Remaining areas in the south and north of the site were composed of scattered trees, lacking a mid-storey layer, over an exotic ground cover (Patch 5 and 6). These areas did not meet the minimum condition thresholds for EPBC Act SSTF.

With reference to **Table 5**, only patches 3, 4, 7 and 9 were considered to meet the condition criteria due to SSTF in these areas either:

- Patch 3 and Patch 9 meeting the minimum patch size criteria (>0.5 ha), having a perennial native understorey cover greater than 30%, and being contiguous with native vegetation greater than 1 ha in size (Category A; moderate condition class), or
- Patch 4 meeting the minimum patch size criteria (>0.5 ha) having a perennial native understorey cover greater than 50% (Category B; moderate condition class).
- Patch 7 meeting the minimum patch size criteria (>2 ha), and having >50% of the perennial understorey vegetation cover made up of native species (Category D; high condition class)

The total area of these patches and thus the amount of EPBC Act listed SSTF within the study area is 15.79 ha. Specifically, the site contained 8.69 ha of SSTF Condition A, 1.87 ha of SSTF Condition B, and 5.24 ha of SSTF Condition D.

Table 5: Condition Thresholds for patches that meet description for the SSTF ecological community

Category and rationale	Thresholds
A. Moderate condition class Represented by medium to large-size patch as part of a larger native vegetation remnant and/or with mature trees	Patch size >0.5ha And >30% of the perennial understorey vegetation cover is made up of native species And The patch is contiguous with a native vegetation remnant (any native vegetation where cover in each layer present is dominated by native species) >1ha in area And/Or The patch has at least one tree with hollows or at least one large locally indigenous tree (>80cm dbh). Where patches are >1ha, a density of at least one mature tree/tree with hollows per hectare is required.
B. Moderate condition class Represented by medium to large size patch with high quality native understorey	Patch size >0.5ha And >50% of the perennial understorey vegetation cover is made up of native species
C. High condition class Represented by medium to large size patch with very high quality native understorey	Patch size >0.5ha And >70% of the perennial understorey vegetation cover is made up of native species
D. High condition class Represented by large size patch with high quality native understorey	Patch size >2ha And >50% of the perennial understorey vegetation cover is made up of native species

Perennial understorey vegetation cover includes vascular plant species of the ground and shrub layers with a lifecycle of more than two growing seasons. Measurements of perennial understorey vegetation cover exclude annuals, cryptogams, leaf litter or exposed soil.

Contiguous means the patch of the ecological community is continuous with, or in close proximity (within 100 m), of another patch of vegetation that is dominated by native species in each vegetation layer present.

4.6.3 CPW at Mt Gilead

A long history of grazing, pasture improvement and weed invasion has fragmented and modified vegetation of this community. Survey by ELA (2015 a and b and 2017 b) found that the CPW along the northern boundary of the site, in the west (Patch 1) and east (Patch 8), formed part of the EPBC Act listed community, while the remaining patch conformed to the TSC Act listing criteria only. This was due to Patch 8 meeting the minimum patch size and having a perennial native understorey cover greater than 50% (Category A condition threshold); and Patch 1 having a perennial native understorey cover greater than 30% (Category B condition threshold) (Appendix C). In contrast the remaining TSC Act CPW across the study area (Patch 2) had a perennial native ground cover being less than 30%. The total area of EPBC Act listed CPW within the study area is 5.20 ha (2.91 ha Condition A and 2.30 ha Condition B).

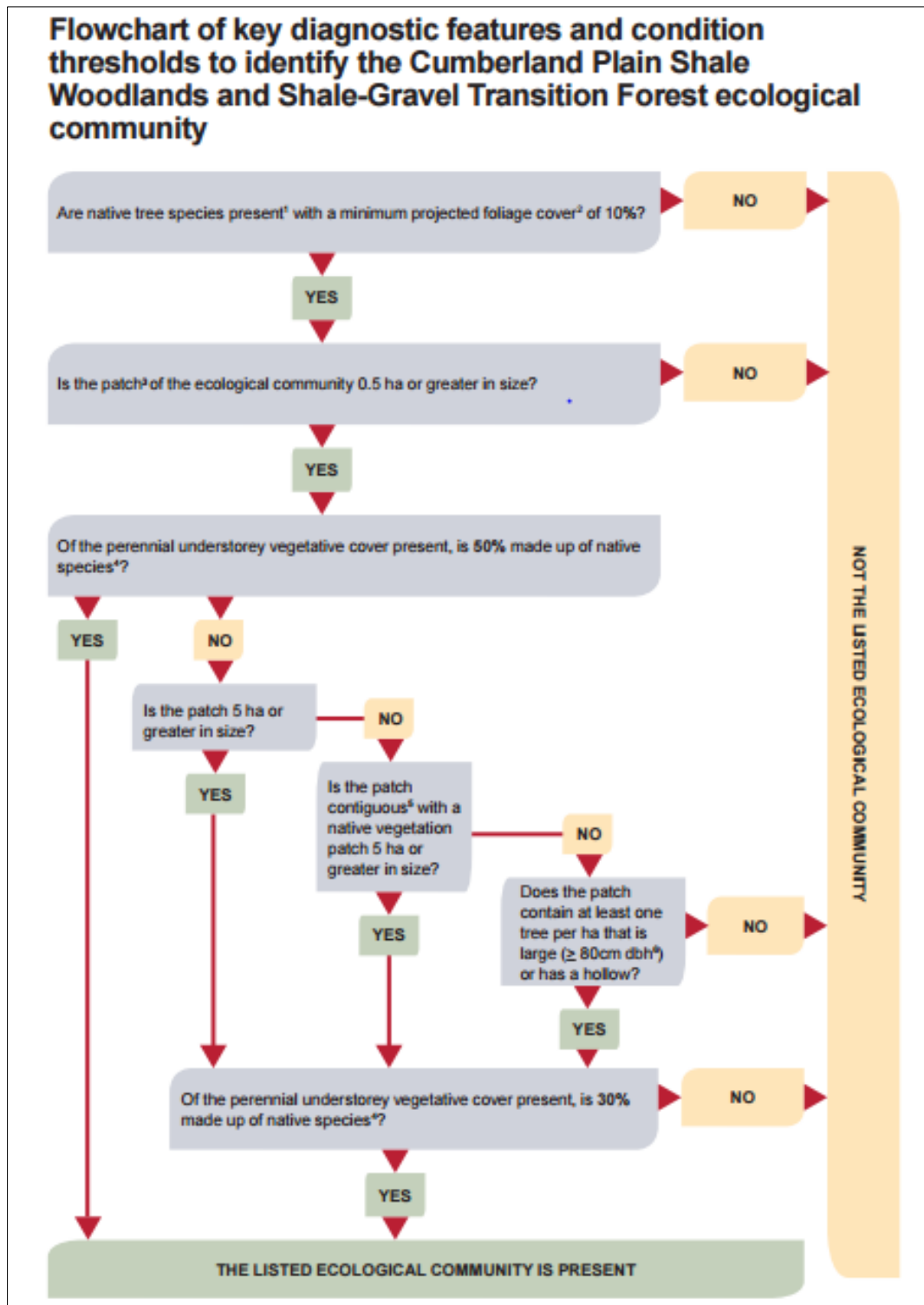


Figure 14: Flowchart to determine whether the condition thresholds for CPW under the EPBC Act are met (DEWHA 2010).

Table 6: EPBC categories and thresholds for Cumberland Plain Woodland / Shale-Gravel Transition Forest

Category and Rationale	Thresholds
A. Core thresholds that apply under most circumstances: patches with an understorey dominated by natives and a minimum size that is functional and consistent with the minimum mapping unit size applied in NSW.	Minimum patch ¹ size is ≥ 0.5 ha; AND $\geq 50\%$ of the perennial understorey vegetation cover ² is made up of native species.
OR	
B. Larger patches which are inherently valuable due to their rarity.	The patch size is ≥ 5 ha; AND $\geq 30\%$ of the perennial understorey vegetation cover is made up of native species.
OR	
C. Patches with connectivity to other large native vegetation remnants in the landscape.	The patch size is ≥ 0.5 ha; AND $\geq 30\%$ of the perennial understorey vegetation cover is made up of native species; AND The patch is contiguous ³ with a native vegetation remnant (any native vegetation where cover in each layer present is dominated by native species) that is ≥ 5 ha in area.
OR	
D. Patches that have large mature trees or trees with hollows (habitat) that are very scarce on the Cumberland Plain.	The patch size is ≥ 0.5 ha in size; AND $\geq 30\%$ of the perennial understorey vegetation cover is made up of native species; AND The patch has at least one tree with hollows per hectare or at least one large tree (≥ 80 cm dbh) per hectare from the upper tree layer species outlined in the Description and Appendix A.

¹ A *patch* is defined as a discrete and continuous area that comprises the ecological community, outlined in the Description. Patches should be assessed at a scale of 0.04 ha or equivalent (e.g. 20m x 20m plot). The number of plots (or quadrats or survey transects) per patch must take into consideration the size, shape and condition across the site. Permanent man-made structures, such as roads and buildings, are typically excluded from a patch but a patch may include small-scale disturbances, such as tracks or breaks or other small-scale variations in native vegetation that do not significantly alter the overall functionality of the ecological community, for instance the easy movement of wildlife or dispersal of spores, seeds and other plant propagules.

² Perennial understorey vegetation cover includes vascular plant species of the ground and shrub layers (as outlined in the Description and Appendix A) with a life-cycle of more than two growing seasons (Australian Biological Resources Study, 2007). Measurements of perennial understorey vegetation cover exclude annuals, cryptogams, leaf litter or exposed soil (although these are included in a patch of the ecological community when they do not alter functionality as per footnote 3 and the Description and Condition Thresholds are met).

³ Contiguous means the woodland patch is continuous with, or in close proximity (within 100 m), of another patch of vegetation that is dominated by native species in each vegetation layer present.

Source: TSSC (2008) Advice to the Minister for the Environment, Heritage and the Arts from the Threatened Species Scientific Committee (the Committee) on an Amendment to the List of Threatened Ecological Communities under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

Table 7: Justification of EPBC Act listed vegetation within the study area.

Patch number as shown in Figure 15.	EPBC Act condition criteria met?	Relevant characteristics and condition class	Patch Size (ha)	Quadrats in patch
1	Yes CPW Condition Category B	CPW considered part of the same patch as within 100 m of each other, the same condition and not separated by a road or canal. > 5 ha and the native understorey cover is $\geq 30\%$ and is contiguous with other native vegetation	2.30	B01 B02 B03 2013 B04 2013
2	No	CPW considered part of the same patch as within 100 m of each other and not separated by a road or canal and the same condition. > 0.5 ha but because the native understorey cover is not $\geq 30\%$ it fails the threshold for condition A, B, C and D.	5.73	B1 2013
3	Yes, SSTF Condition Category A	SSTF considered part of the same patch as within 100 m of each other and not separated by a road or canal and the same condition. > 30% of the perennial understorey vegetation cover is made up of native species	7.11	A3 A4 E01 E02 E03 F01 F02
4	Yes, SSTF Condition Category B	A small patch of SSTF with >70% native cover which meets the minimum patch size of > 0.5 ha due to vegetation connection	1.87	G01 BB13
5	No	SSTF paddock trees part of the same patch as within 100m of each other, but fails thresholds for condition A, B, C and D as native understorey cover is not > 30%.	37.84	A1 2013 A2 2013 A5 2016 C1 2013
6	No	SSTF paddock trees part of the same patch as within 100m of each other, but fails thresholds for condition A, B, C and D as native understorey cover is not > 30%.	4.73	A6

Patch number as shown in Figure 15.	EPBC Act condition criteria met?	Relevant characteristics and condition class	Patch Size (ha)	Quadrats in patch
7	Yes – Condition Category D	Central patch of SSTF, recorded in a good condition. > 2 ha and perennial native understorey cover is > 70%.	5.24	D1 2013 F1 2013 F2 2013 F3 2013
8	Yes – CPW Condition Category A.	CPW. Part of same patch as within 100m and same condition. > 0.5 ha and perennial native understorey cover is > 50%. Contiguous with Noorumba Reserve, so condition A. Doesn't meet size criteria for condition B. No hollows observed so not condition D.	2.91	B02 D01 D02
9	Yes – SSTF Condition Category A.	SSTF. >0.5 ha and perennial native understorey cover is >30%.	1.58	H01 H02

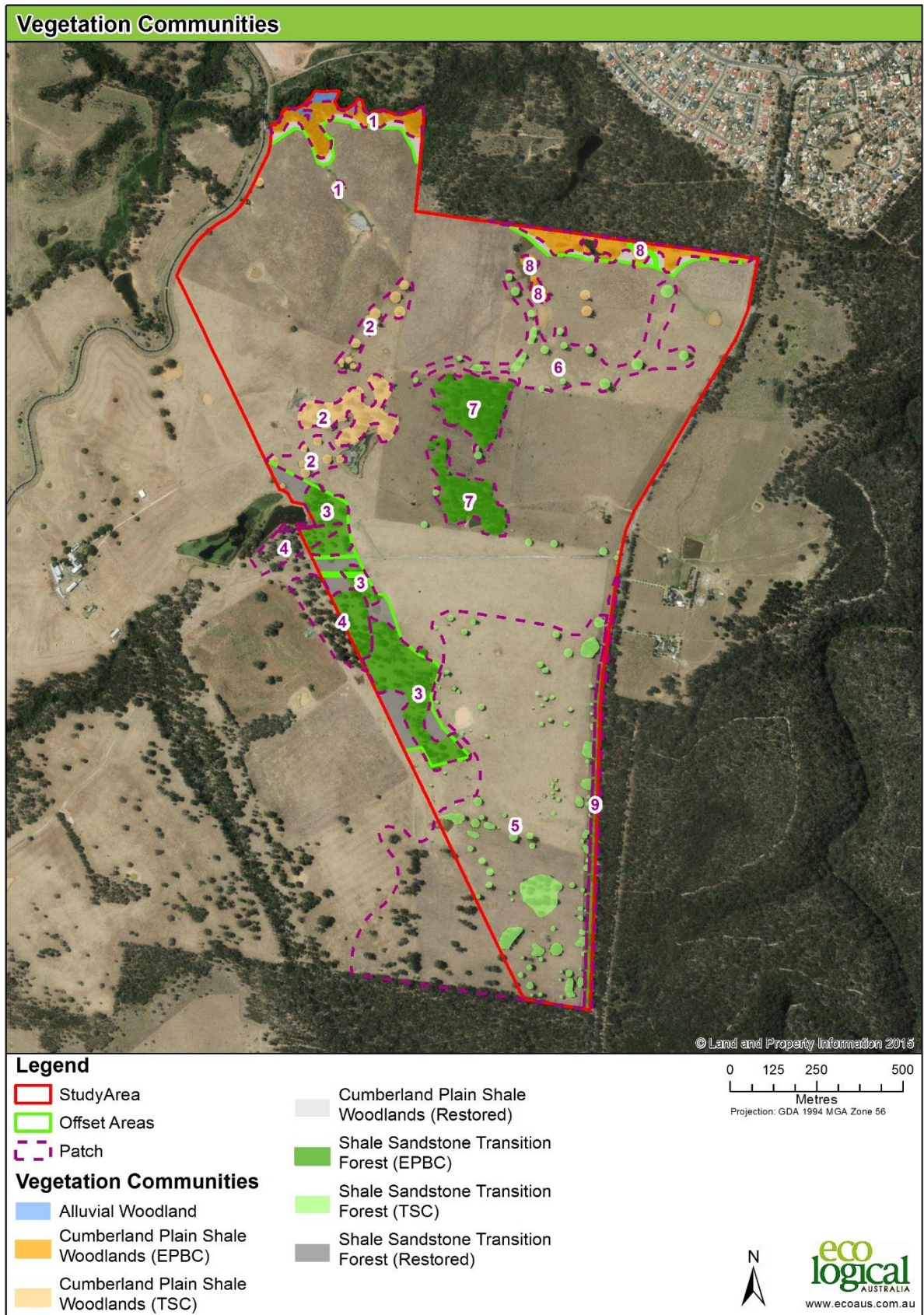


Figure 15: Quadrats and patches of “like” vegetation within the study area based on EPBC Act advice and condition criteria.

5 Threatened Ecological Communities

5.1 Mt Gilead TECs

Figure 15 shows the amount of EPBC Act listed vegetation present within the study area, which was determined through field survey and consideration of the condition thresholds for CPW and SSTF in the EPBC Act approved conservation advice. Impacts to each community as a result of the proposed action are discussed below throughout **Section 5**.

5.1.1 Location and physical environment

The site is located within the Sydney Basin Bioregion towards the eastern edge of the Cumberland sub-region close to the boundary of the Sydney Cataract subregion. The study area occurs within the Mitchell landscape of the Cumberland plain with the Upper Nepean Gorges landscape entering a small section of the western boundary of the study area. The Woronora Plateau occurs to the east.

At this broad scale, the site is within the geographic envelope that supports SSTF and CPW. The sites topography ranges from 116 m ASL in the northwest corner to 200 m ASL in the southeast corner, which is also within the elevation limits for these two communities.

5.1.2 Geology and Soils

The study area is underlain by the Triassic Ashfield Shale of the Wianamatta Group deposited over the Hawkesbury Sandstone. In general there are only limited bedrock outcrops across this area, with shale underlying the northern portion of the site and sandstone in the southern portion of the site.

The site occurs on the Blacktown Soil Landscapes (Hazelton and Tille 1990), which occurs on gently undulating rises over Wianamatta Group shales. The ground slopes are usually less than 5% and the vegetation typically comprises cleared and partly cleared eucalypt, woodlands and tall open forests. The soils range from shallow to moderately deep (less than 1m thick) and are hard setting, mottled textured clay soils. The soils are typically moderately reactive with a highly plastic subsoil, have a low soil fertility and poor soil drainage (Hazelton and Tille 1990)

A review of the available Acid Sulphate Soil Risk Map and an assessment of the topography and lithology of the site also confirmed there is a very low risk or potential acid sulphate soils.

5.1.3 Vegetation biogeographical discussion

The vegetation patterns on the site reflect soil lithology, topography and historical landuse. Due to the relatively small size of the site, climate is relatively homogenous and does not influence the vegetation patterns across the site.

Two main geologies and associated lithology's are present on the site. The Blacktown Soil landscape is mapped across the study area and is comprised of clay soils overlaying Hawkesbury Sandstone (Hazelton and Tille 1990). The depth of the Hawkesbury Sandstone is a significant factor in determining the distribution of the two Critically Endangered Ecological Communities observed on the site, CPW and SSTF.

The approved listing advice for one of the key MNES, SSTF (TSSC 2014a), states:

Shale Sandstone Transition Forest is found on soils that are primarily derived from shale substrates and thus tend to have a clay texture, but also have some influence from weathered sandstone substrates. This most commonly occurs where the Wianamatta Group shale underlying the Cumberland Plain grades into sandstone, mainly from the Hawkesbury Group, which dominates the surrounding elevated plateaux.

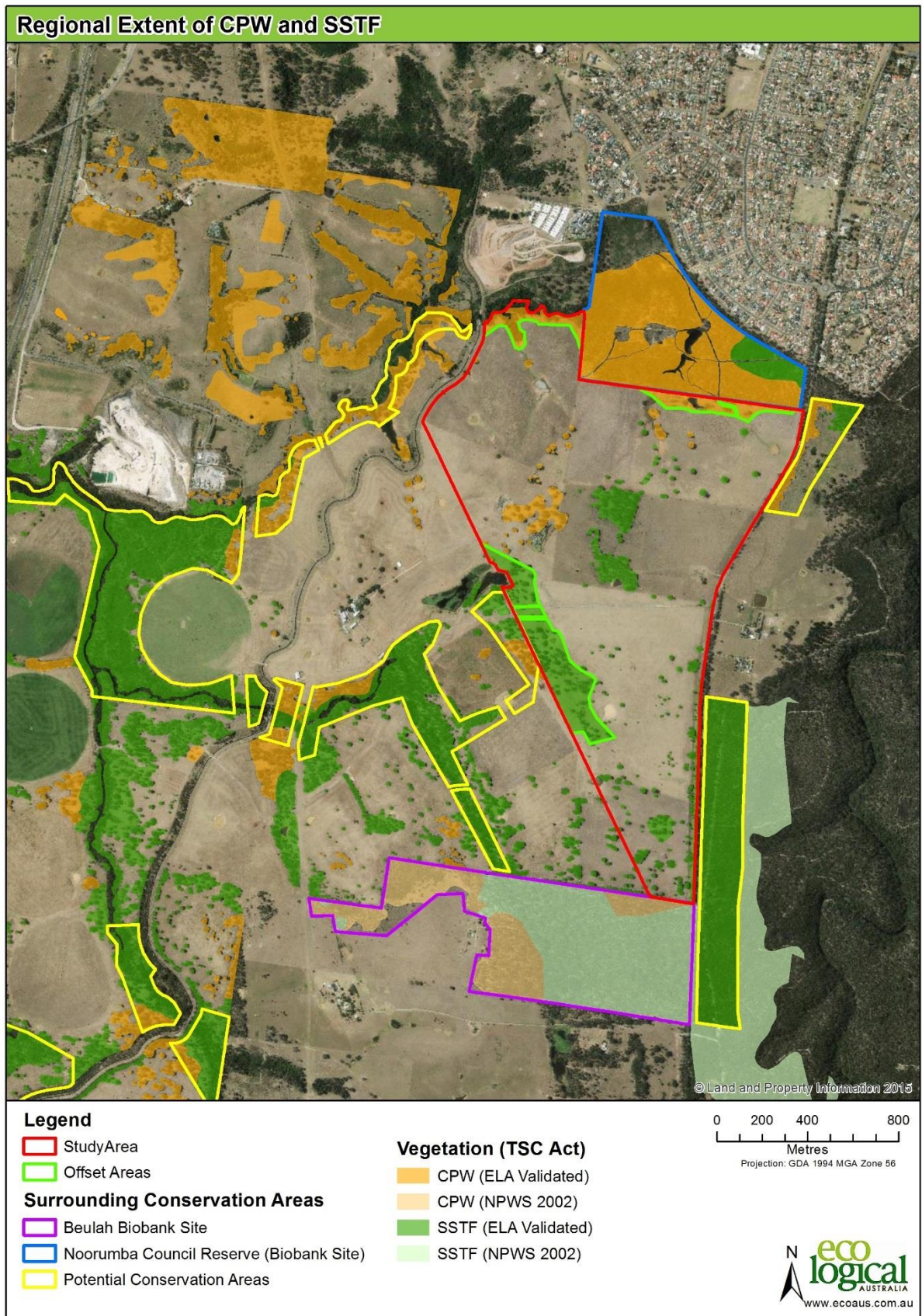


Figure 16: Existing and potential conservation areas and SSTF and CPW within the study area and surrounding lands

5.2 Shale Sandstone Transition Forest

5.2.1 Ecological community description

SSTF is a critically endangered ecological community (CEEC) that occurs within the Sydney Basin in New South Wales. Its location is defined primarily by the geological substrate, where the shale based geology of the Cumberland Plain is influenced by underlying sandstone near the surface – as aforementioned.

The ecological community is found to the west of Sydney, on the edges of the Cumberland Plain (particularly the southern edge), as well as on the sandstone-dominated Hornsby, Woronora, and Lower Blue Mountains Plateaux that adjoin the plain. As the name implies, this ecological community occurs between other ecological communities found respectively on shale or sandstone substrates.

While the transitional nature of the ecological community means that its character is not simply described, some of its constituent plant species are considered to be strongly indicative. The presence of considerable numbers of these species, together with the context provided by landscape, substrate and adjacent ecological communities assist in a positive identification of Shale Sandstone Transition Forest.

The dominant species vary with factors such as the position in the landscape and extent of sandstone substrate influence but the canopy is typically composed of trees of approximately 20 m including the species *Eucalyptus punctata* (grey gum), *E. crebra* (narrow-leaved ironbark) and *E. fibrosa* (broad-leaved ironbark). Other Eucalypt species likely to be present include *E. tereticornis* (forest red gum) - especially in areas with low sandstone influence. There is sometimes a mid-canopy, often dominated by short eucalypts as well as *Allocasuarina littoralis* (black she-oak), with other species found particularly in areas of high sandstone influence including *Syncarpia glomulifera* (turpentine) and *Acacia decurrens* (black wattle). The understorey layers can be either shrubby or grassy. The shrub layer is dominated by *Bursaria spinosa* (sweet bursaria) in areas with low sandstone influence, with other common species including *Kunzea ambigua* (tick bush) and *Persoonia linearis* (narrow-leaved geebung). The ground layer is diverse and dominated by native grasses and herbs.

SSTF generally occurs in areas receiving between 800mm and 1100mm mean annual rainfall. Typically it occurs at elevations less than 200 m Above Sea Level (ASL), although it may occur up to 350 m ASL in parts of the Lower Blue Mountains and western Woronora Plateau that are associated with the rainshadow extending south-west of the Cumberland Plain. It also may occur at approximately 600 m ASL at its southern limit in the Southern Highlands.

The key diagnostic characteristics describing the Shale Sandstone Transition Forest are:

- Limited to the Sydney Basin Bioregion
- Occurs at the transition between shales and sandstones of the Wianamatta and Hawkesbury Groups, including the Mittagong Formation
- Occurs as forest or woodland, and may have a primarily shrubby or primarily grassy understorey, or be a mixture
- Canopy is a mix of species typically including two or more of the following: *Eucalyptus punctata* (grey gum), *E. crebra* (narrow-leaved ironbark), *E. fibrosa* subsp. *fibrosa* (broad-leaved ironbark), *E. tereticornis* subsp. *tereticornis* (forest red gum), *E. resinifera* subsp. *resinifera* (red mahogany), *E. eugenoides* (or *E. globoidea* depending on local species present and degree of sandstone influence) and *Angophora bakeri* (narrow-leaved apple)
- Where present the mid layer of the understorey varies in structure and floristics
 - Where present, the small tree layer is likely to be dominated by *Eucalypt* species and *Allocasuarina littoralis* (black she-oak)

- Where shrubs are present, the mid layer is likely to be dominated by *Bursaria spinosa* (blackthorn) in areas with low sandstone influence, with other common species including *Leucopogon juniperinus*, *Kunzea ambigua* (tick bush), *Persoonia linearis* (narrow-leaved geebung), *Ozothamnus diosmifolius* (rice flower, sago bush, white dogwood) and *Hibbertia aspera* (rough guinea flower)
- Where present, the ground layer of the understorey is typically diverse and dominated by grasses and herbs including: *Aristida vagans* (three-awned spear grass), *Austrostipa pubescens* (spear grass), *Cheilanthes sieberi* subsp. *sieberi* (poison rock fern), *Dichondra repens* (kidney weed), *Echinopogon ovatus* (forest hedgehog grass), *Entolasia marginata* (bordered panic), *Entolasia stricta* (wiry panic), *Lepidosperma laterale* (saw sedge), *Lomandra multiflora*, *Microlaena stipoides* var. *stipoides* (weeping grass), *Oxalis perennans* (wood-sorrel), *Pimelea linifolia* subsp. *linifolia*, *Pomax umbellata*, *Phyllanthus hirtellus*, *Pratia purpurascens* (white root), *Solanum prinophyllum* (forest nightshade) and *Themeda triandra* syn. *T. australis* (kangaroo grass). The ground layer may also contain small shrubs, including *Hibbertia aspera* (rough guinea flower).

5.2.2 Condition of SSTF within study area

This vegetation community is the most common native vegetation community within the study area. *Corymbia maculata* (Spotted Gum) is the dominant species at the southern end of the study site. Ironbark species, *Eucalyptus crebra* (Narrow-leaved Ironbark) and *E. fibrosa* (Red Ironbark) are more frequent in the northern patches of this community (Patches 6 and 7).

The community is generally represented by patches with sparse canopies or occur as scattered trees over a predominantly exotic understory (Patches 5 and 6). However, there are small patches which have been fenced out from grazing and/or are not as heavily grazed or cropped where the native grass *Microlaena stipoides* dominates, along with the occasional herbs/twiner, such as *Glycine clandestina* and *Dichondra repens* (Kidney Weed) (Patches 3, 4, 7 and 9). Exotic species form a dominant ground cover through most of these low quality patches. Species include *Tagetes minuta* (Stinking Roger) and *Senecio madagascariensis* (Fireweed); the latter is listed as a Weed of National Significance. Two other weed species located in this vegetation community have been listed as noxious in the LGA *Xanthium spinosum* and *Rubus fruticosus* agg. (Blackberry).

Vegetation has been disturbed through clearing, prolonged grazing, fertilizer application and weed establishment. Areas where grazing pressures have been lower and/or have not be subject to pasture improvement or cropping represented the better quality patches of SSTF (patch 9) (**Plates 1 and 2**).

Using the Biobanking Assessment Methodology site value calculations derived from floristic and structural data from 0.1 ha plots, the site value scores for SSTF in the study area generally ranged from 20-30/100, with outliers of 19/100 and 63/100.



Plate 1: Examples of higher quality (Patch 7) and low quality (Patch 6) SSTF within the study area

5.2.3 Impacts to SSTF

The Significant Impact Guidelines were reviewed to assist in the impact assessment of the 5.48 ha of EPBC Act listed SSTF that would be impacted to varying degrees from the proposed action (DotEE 2013b) (**Figure 17** and **Figure 18**).

The 5.48 ha of impacted EPBC Act condition threshold SSTF includes the direct impacts of clearing, partial impacts associated with thinning to meet APZ requirements and indirect impacts to mapped SSTF within 30m of areas being impacted (buffer zones) where impacts will be very minimal. These impacts are summarized in **Table 8**.

Table 8: Impacts to SSTF

SSTF Condition	Direct Clearing (ha)	30m buffer (ha)	Total Impacted (ha)
A – Patch 3	0.24	0.53	0.77
A – Patch 9	1.54	0	1.54
B – Patch 4	0	0	0
D – Patch 7	1.84	1.33	3.17
Total Impacted	3.62	1.86	5.48

The proposed action will impact on 5.48 ha of SSTF as recognised under the EPBC Act. 3.17 ha are associated with the central SSTF (Patch 7). A further 1.54 ha is represented by a thin, linear extent of SSTF along the western road verge of Appin Road – which is generally no more than one tree in width. A final small impact will occur to the fringes of the western SSTF, totalling to 0.77 ha.

It is important to note that all of these impacts include impacts from a 30m buffer into the protected areas from the development layout. For SSTF, the 30m buffer impacts total to 1.86 ha (34% of all SSTF impacts). It is highly likely that a large amount of ecological value will be retained within the buffers as they are largely maintained as natural areas and even enhanced through weeding and removal of grazing as part of the management of the proposed offset areas. It is therefore considered that the impacts proposed in the document therefore represent a conservative total and that the final realised impact area will be up to 34% less than the stated impact of 5.84 ha.

The action will not fragment or increase fragmentation of the SSTF within the study area as most clearance is to occur along the existing thin linear strip of road verge vegetation along Appin road, or to already isolated, fragmented woodland where most clearance will occur to the edges only. Removal of this vegetation is not considered likely to decrease functionality of any biodiversity linkages. The SSTF on the eastern boundary is directly adjacent to contiguous woodland on the eastern side of Appin road which will not be impacted, and will still retain provision of woodland stepping stone habitats.

Almost half of the impacts to SSTF (42.0 %) will occur to lower condition (Class A), fringing vegetation that is not considered critical to the survival of an ecological community.

The proposed action will impact on the soil and potentially the soil seed bank. No ground water extraction is likely to impact on this community and no surface water changes are likely to occur.

The proposed action will result in the removal of a maximum of 5.48 ha of SSTF. This is approximately 0.057% of the total ~9600 ha estimated remaining SSTF (Tozer 2010). The removal of this relatively small area would not remove any specific functionally important species from the study area.

The study area is already substantially degraded through historical land clearing, extensive pasture improvement, ongoing grazing and establishment of agricultural weeds. The proposed action is not considered likely to cause a substantial reduction in the quality or integrity of an ecological community by assisting any invasive species harmful to the ecological community becoming established. A Construction Environmental Management Plan will be developed and implemented to minimise the risks associated with the introduction of any invasive weeds or pathogens.

The removal of 5.48 ha of SSTF is considered to be very minor, primarily due to the geographical layout consisting mostly of thin, fringing or linear strips of woodland which has been subjected to edge effects and under-scrubbing, or the bordering areas of an already fragmented patch of SSTF. While, the loss of 5.48 ha is not consistent with the recovery of the ecological community, the proposed action will restore and maintain at least 13.69 ha of SSTF to EPBC Act condition criteria through active management (Appendix D and E). This is considered to have an overall positive outcome for SSTF within the study area.

Considering the above, the impact to EPBC Act listed SSTF is considered to be minimal due to the distribution, size and current condition of the vegetation proposed to be cleared (**Figure 17** and **Figure 18**). Residual impacts to the community have been considered in **Sections 7** and **8** where both mitigation and offsets are discussed and detailed further.

Impacts to SSTF (as listed under both the TSC and EPBC Acts) have been limited by a range of avoidance, mitigation and management actions to be carried out pre-development, during development, and into the future. These are outlined in more detail in **Section 7** and include:

- Onsite offsets including the retention and management of at least 13.69 ha of SSTF which will all be managed to EPBC Act condition criteria through active management including exclusion fencing and fully funded in perpetuity conservation management under a Biobank Agreement or under the Local Government Act. Specifically:
 - Restoration and revegetation of an additional 11.43 ha of land within the western offset site, which in time will be restored to SSTF as recognised under the EPBC Act within 15 years.
 - The retention and conservation of 2.07 ha of SSTF within two council reserves within the center of the site, also to be used as an onsite offset. This conservation area will

be managed by Campbelltown City Council as a 'Natural Area – Bushland' under the Local Government Act.

Overall the impact on EPBC Act listed SSTF is to occur only on a very thin linear strip along Appin Road and on the borders of the protected central and western SSTF, and will not fragment or bisect any stands of the vegetation community. The SSTF along Appin Road is not considered to be viable in the long-term, particularly considering the proposed widening of Appin Road which would require the clearance of this roadside vegetation.

5.3 Cumberland Plain Woodlands and Shale-Gravel Transition Forest

5.3.1 Ecological community description

Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (CPW) is listed as critically endangered under the EPBC Act. The CPW complex represents occurrences of the coastal plain grassy eucalypt woodlands that are endemic to shale hills and plains of the Sydney Basin Bioregion and predominantly occupies the Cumberland Sub-region.

The ecological community is predominantly associated with clay soils that are derived from Wianamatta Shale geology. A part of the ecological community is also associated with shale soils with high concentrations of iron-indurated gravel or overlain by Tertiary Alluvium and those sites are marked by the shale-gravel transition forest component of the ecological community (DEWHA 2010). Under the EPBC Act, the community is characterised by the following structural features:

- a medium-height eucalypt woodland with a lower tree layer, dominated by a Grey Box – Forest Red Gum (*Eucalyptus moluccana* – *E. tereticornis*) canopy;
- an open, low shrub layer dominated by a Blackthorn (*Bursaria spinosa*) understorey;
- an abundant grassy groundcover comprised of a several different grass species.

The composition of the understorey (shrubby or grassy) can vary depending on the site's disturbance history, such as grazing or farming practices. Fire frequency is also known to affect the structure of associated plant species occurring within the community.

In NSW, CPW is further defined as two sub-communities - Shale Hills and Shale Plains Woodland. The composition of both of these sub-communities is consistent with the EPBC Act listing definition of CPW. Therefore, any references to Shale Hills and Shale Plains Woodland can be considered as references to the EPBC Act listed community of CPW, and considered as part of the EPBC Act listed community of CPW provided condition thresholds for patches are met.

The original extent of CPW has been significantly reduced since the introduction of agricultural and urban uses across the Cumberland Plain following European settlement. A field survey undertaken by Tozer (2003) coupled with detailed interpretation of colour aerial photography from between 1997 and 1998, determined that only 9% of the original extent (pre-1750) of the community remained with greater than 10% canopy cover, with a further 14% remaining as scattered trees across the landscape (NPWS, 2002).

A more recent study by the NSW Scientific Committee and Simpson (2008) re-assessed the status of the community in order to determine changes in distribution since November 1998. Comparing the 1997-1998 mapping undertaken by Tozer (2003) with ortho-rectified digital photography obtained in 2007, it was found that the remaining extent of the community had declined by approximately 442 ha or around 5.2% of its distribution nine years ago. Such clearing is likely to be a consequence of dispersed, small-scale clearing associated with urban development.

As of 2008, the extant CPW existed as approximately 1,857 fragmented patches with an average patch size of 3.3 ha. The largest remaining patch was 126 ha (NSWSC & Simpson, 2008) with an approximate remaining total of 11,000 ha. These patches are distributed among both private and public lands. Security from land clearing is provided for approximately 720 ha of the community through conservation in nature reserves, national parks, state conservation areas and regional parks.

5.3.2 Condition of CPW within study area

A long history of grazing, pasture improvement and weed invasion has fragmented and modified vegetation of this community. Two localised clumps of CPW are located along the northern border of the study site. These patches are generally found on clay soils in lower topography within Mt Gilead. It contains several large remnant trees including: *Eucalyptus tereticornis* (Forest Red Gum), *E. moluccana* (Grey Box) and *E. crebra* (Narrow-leaved Ironbark). The shrub layer is absent throughout most of the site and ground cover diversity is poor.

Some resilience is present within the soil seed bank with evidence of some native ground cover species present including: *Microlaena stipoides* (Weeping Grass), *Chloris truncata* (Windmill Grass) and *Aristida ramosa* (Purple Wiregrass). The majority of the vegetation community has a high incursion of exotic groundcover including *Pennisetum clandestinum* (Kikuyu) and *Ehrharta erecta* (Panic Veldtgrass), particularly within the areas that did not meet the EPBC Act condition thresholds (Patch 2). Native resilience is particularly prominent within the proposed offset areas adjacent to the Noorumba Reserve. These patches (patches 1 and 8) contained a shrub layer of *Bursaria spinosa* (Blackthorn) and diversity of native forbs and herbs not located in other areas: *Ajuga australis* (Austral Bugle), *Asperula conferta* (Common Woodruff) and *Hypericum gramineum* (Small St John).

Using the Biobanking Assessment Methodology site value calculations derived from floristic and structural data from 0.1 ha plots, the site value scores for CPW in the study area ranged from 22-38/100.

5.3.3 Impact to CPW

The proposed development at Mt Gilead will directly impact on 0.1 ha of CPW as recognised under the EPBC Act and potentially a further 0.4 ha (**Figure 17**). The 0.4 ha of potential impact is two small clumps of isolated trees on the edge of a farm dam that will be modified to a detention basin in the proposed open space area and will likely ultimately result in an enhanced area of native vegetation through active management under a plan of management. The direct impact represents less than 0.001% of the total CPW vegetation (11,000 ha) estimated to be remaining on the Cumberland Plain (NSWSC & Simpson, 2008). This impact is considered to be very small in the context of the surrounding stands of CPW within the locality including areas to be protected within the Offset Sites within the study area and in proposed and existing biobank areas in the locality (**Figure 17**).

The Significant Impact Guidelines were reviewed to assist in the impact assessment of the 0.1 ha of direct impact and 0.4 ha of managed impact on EPBC Act listed CPW that would be impacted from the proposed action (DotEE 2013b).

- The proposed action will reduce the extent of the ecological community by a very small amount (a combined total permanent area of 0.1 ha, with management of 0.4 ha).
- Despite some of the clearance being for a proposed fire trail traversing patch 8, the clearance of 0.1 ha will not fragment or increase fragmentation of CPW. Clearance for the fire trail will avoid trees and impact a narrow area (6 m wide) that will not disrupt connectivity through patch 8.
- Other than the clearance for the proposed fire trail, the proposed action will impact on the edges of patch 1 and 8 as shown in **Figure 17**.

- The proposed action will impact on the soil and potentially the soil seed bank within the 0.1 ha impacted area. The 0.1 ha of soil impacted is unlikely to contain a significant amount of seeds. No ground water extraction is likely to impact on this community and no surface water changes are likely to occur.
- The proposed action will result in the removal of 0.1 ha of CPW. As above, this is less than 0.001% of the total estimated extant CPW. The removal of this relatively small area would not remove any specific functionally important species from the study area.
- The proposed action is not considered likely to cause a substantial reduction in the quality or integrity of an ecological community by assisting any invasive species harmful to the ecological community becoming established. A Construction Environmental Management Plan will be developed and implemented to minimise the risks associated with the introduction of any invasive weeds or pathogens.
- The removal of 0.1 ha and management of 0.4 ha of CPW is considered to be very minor in area, however, the loss of 0.1 ha is not consistent with the recovery of the ecological community.

Considering the above, the impact to EPBC Act listed CPW is considered to be minimal in extent (0.1 ha and a total of two/three trees, and the management of 0.4 ha totaling five trees) and is not considered to represent a significant impact to the community. Accordingly, no further assessment or offsets are required.

Despite the proposed action not constituting a significant impact on CPW, it is noted that a considerable area of CPW (4.63 ha) will be protected in perpetuity where it exists within the Noorumba Biobank in the north of the site (Appendix F and G).

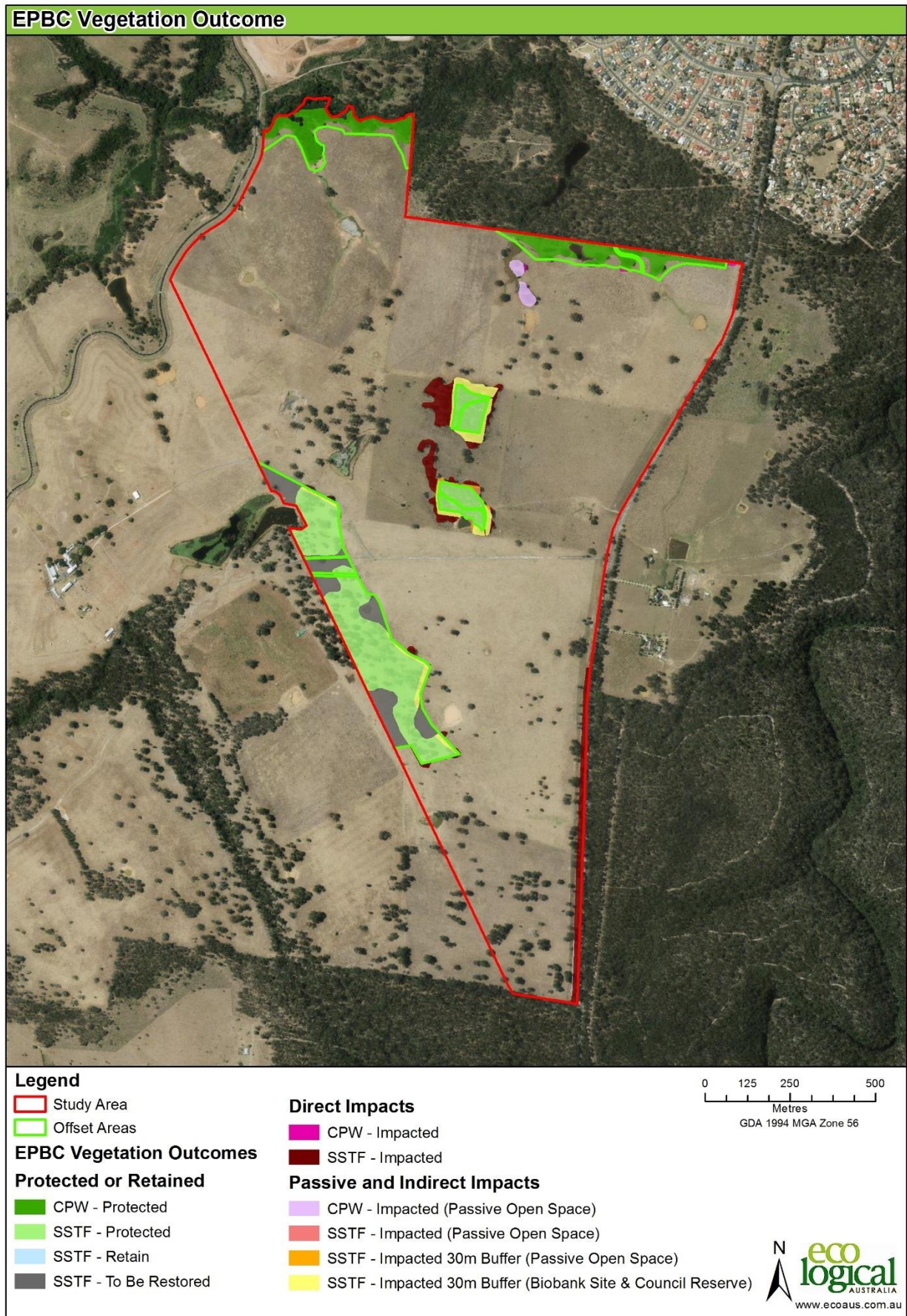


Figure 17: EPBC vegetation outcome

6 Threatened Fauna

This section provides detail on the relevant fauna MNES that require assessment under the EPBC Act at Mount Gilead. Other than Koala, these species are characterised as highly mobile species that have broad habitat requirements and are unlikely to use the site for nesting or roosting purposes. The species considered include:

- Swift Parrot (*Lathamus discolor*)
- Grey-headed Flying-fox (*Pteropus poliocephalus*)
- Large-eared Pied Bat (*Chalinobolus dwyeri*)
- Koala (*Phascolarctos cinereus*)

6.1 Swift Parrot (*Lathamus discolor*)

The Swift Parrot is fast-moving and distinctive, and is generally conspicuous where present. It has a loud, distinctive ‘clinking’ call that can be heard over the engine of a slow-moving vehicle. The Swift Parrot inhabits dry sclerophyll eucalypt forests and woodlands, in particular, temperate box ironbark woodlands. The species also occurs in forests of *Eucalyptus tereticornis*, *E. robusta*, *Corymbia maculata* and *C. gummifera* in coastal New South Wales/Queensland.

The Swift Parrot breeds in Tasmania and over-winters on mainland Australia. The principal over wintering habitat on the mainland is the box-ironbark forests and woodlands inland of the Great Dividing Range in Victoria and NSW. They occur in areas where eucalypts are flowering profusely and favoured feed trees including winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens*. Key habitat for Swift Parrots on the coast and coastal plains of NSW include Spotted Gum *Corymbia maculata*, Swamp Mahogany *Eucalyptus robusta* and Forest Red Gum *E. tereticornis* Forests. It is a highly mobile species able to utilise a variety of nectar sources over large areas.

On the mainland the main threat to Swift Parrot is loss of habitat through clearing for agriculture, and urban and industrial development. Collisions with wire netting fences, windows and cars during the breeding season and winter migration (especially where such obstacles are in proximity to suitable habitat) are also a threat to this species.

DotEE has requested further information on the amount of ‘important habitat’ or ‘habitat critical’ to the survival of the Swift Parrot that is likely to be impacted by the proposed action.

‘Important habitat’ for Swift Parrot includes White Box-Yellow Gum-Blakely's Red Gum woodland on the south-western slopes and southern tablelands of New South Wales (SPRAT profile, Swift Parrot).

‘Habitat critical’ to the survival of Swift Parrot is still to be defined through research. However, the National Recovery Plan (Saunders *et al.* 2011) states that:

Habitat critical to the survival of the Swift Parrot includes; those areas of priority habitat for which the Swift Parrot has a level of site fidelity or possess phenological characteristics likely to be of importance to the Swift Parrot, or are otherwise identified by the recovery team.

Priority habitat includes habitats used for:

- nesting,
- by large proportions of the Swift Parrot population,

- repeatedly between seasons (site fidelity), or
- for prolonged periods of time (site persistence).

The SPRAT profile for Swift Parrot states that box-ironbark habitat in drainage lines is thought to provide critical food resources during periods of drought or low food abundance elsewhere.

While the Swift Parrot was not recorded during field surveys, potential foraging habitat does occur on site in the form of 10.40 ha of TSC and/or EPBC Act listed CPW, 24.48 ha of TSC and/or EPBC Act listed SSTF, and 0.44 ha of Alluvial Woodland (AW). This totals 35.32 ha of potential habitat, a proportion of which includes favoured feed tree species in coastal areas i.e. Forest Red Gum (**Figure 18**).

The proposed development will result in the removal of approximately 10.94 ha of potential habitat, representing 28.9% of potential habitat in the site. Potential habitat to be removed is comprised of 2.59 ha of TSC and/or EPBC Act listed CPW and 8.36 ha of TSC and/or EPBC Act listed SSTF.

Based on the description of important habitat or habitat critical to the survival of the Swift Parrot in the SPRAT profile and National Recovery Plan, whilst the habitat to be impacted includes a proportion of key coastal fed trees, the proposal will not impact on habitat considered to be 'important' or 'critical' to the survival of Swift Parrot as the potential foraging habitat to be impacted does not support a large proportion of the overwintering population and there is no evidence to suggest that Swift Parrot use the site on a regular basis. Further, within a regional context, the loss of 10.94 ha of potential foraging habitat comprises a very small proportion of the potential foraging habitat available for the Swift Parrot. Within the Campbelltown area alone, there are over 23,000 ha of similar woodland habitat, with large consolidated stands of vegetation surrounding the study area. The loss resulting from the proposed action in relation to the amount of habitat in the Campbelltown area represents 0.05%.

In relation to the EPBC Act Significant Guidelines 1.1, the project is not expected to result in a significant impact to this species as shown in **Table 9** and therefore no further assessment or offsets are required.

Table 9: Significant Impact Assessment for the Swift Parrot

Criteria	Significant Impact?
An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will:	
<ul style="list-style-type: none"> • lead to a long term decrease in the size of a population 	No. Due to the species home ranges, wide distribution the extent of vegetation in the broader Macarthur region, loss of vegetation associated with the project is not expected to lead to a long term decrease in the size of the population.
<ul style="list-style-type: none"> • reduce the area of occupancy of the species. 	No. Due to the species home ranges, wide distribution the extent of vegetation in the broader Macarthur region, loss of vegetation associated with the project is not expected to reduce the area of occupancy of the species.
<ul style="list-style-type: none"> • fragment an existing population into two or more populations 	No.
<ul style="list-style-type: none"> • adversely affect habitat critical to the survival of a species. 	No. The recovery plan (Saunders and Tzaros 2011) for the species notes that habitat critical to the survival of the Swift Parrot includes: <i>“those areas of priority habitat for which the Swift Parrot has a level of site fidelity or possess phenological</i>

	<i>characteristics likely to be of importance to the Swift Parrot, or are otherwise identified by the recovery team</i> ". Therefore, the study area is unlikely to represent habitat critical to the survival of Swift Parrot.
<ul style="list-style-type: none"> • disrupt the breeding cycle of a population 	No.
<ul style="list-style-type: none"> • modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline 	No. See row two above.
<ul style="list-style-type: none"> • result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat 	No.
<ul style="list-style-type: none"> • introduce disease that may cause the species to decline, or interfere with the recovery of the species. 	No.
<ul style="list-style-type: none"> • interfere with the recovery of the species. 	No.

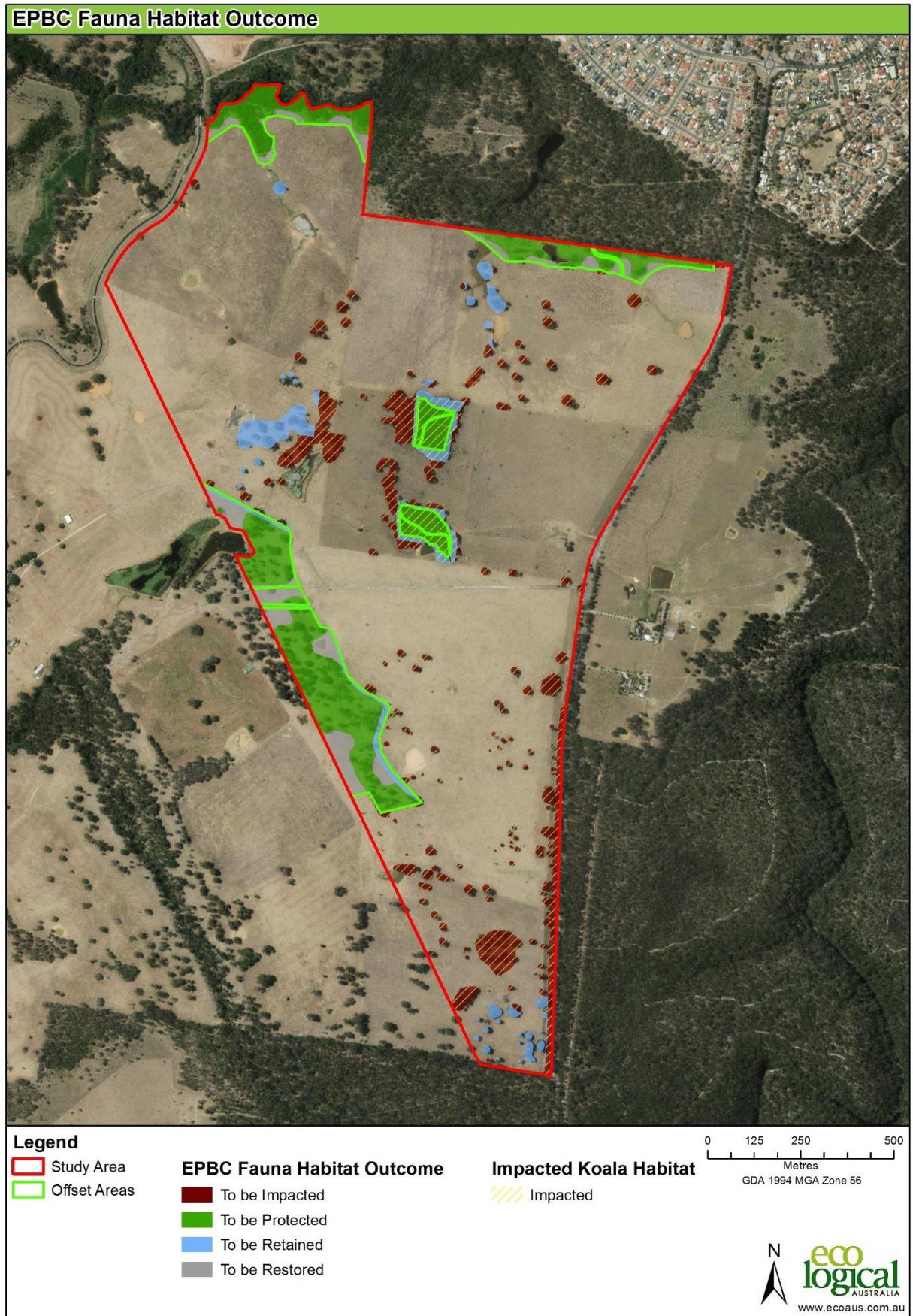


Figure 18: Potential habitat for EPBC Act listed threatened fauna species to be impacted or protected within the study area

6.2 Grey-headed Flying-fox (*Pteropus poliocephalus*)

The Grey-headed Flying-fox is known to occur along the eastern coast of Australia from Bundaberg in Queensland to Melbourne in Victoria (DotEE 2015). Due to the high mobility of the species, there are no separate or distinct populations as individuals move between camps and throughout its geographic distribution.

Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, or in vegetation with a dense canopy. Camps range from a few individuals up to over 70,000. While a few of these camps are permanent and occupied year round, most are temporary and seasonal.

This species may occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps and feeds on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia. They also feed on fleshy subtropical rainforest fruits, with around 100 species of plant having been recorded in their diet.

Individuals migrate in complex patterns in response to changes in food production. Sedentary individuals form the core population of continuously occupied camps. However, the majority are highly nomadic and move several hundred kilometres each year in largely unpredictable patterns.

GHFF occupies most areas in their distribution in highly irregular patterns, and therefore surveys based on animal sightings are unlikely to be reliable. A more effective survey method, as endorsed by DotEE, is to search appropriate databases and other sources for the locations of camps, and to conduct vegetation surveys to identify feeding habitat.

The main threat to the survival of the species is habitat loss and disturbance through the clearing of foraging habitat and roosting locations for development and farming. Loss of important areas of habitat has also caused increased fragmentation of suitable habitat, resulting in the species having to travel greater distances for food or resorting to alternative sources such as food crops. Other threats to the species include unregulated shooting and electrocution on power lines.

DotEE has requested further information on the amount of ‘important habitat’ or ‘habitat critical to the survival’ of the Grey-headed Flying-fox that is likely to be impacted by the proposed action.

The SPRAT profile for Grey-headed Flying-fox states that spring foraging resources are considered to be critical to the survival of the species.

The draft national recovery plan for the Grey-headed Flying-fox (DECCW 2009) states that:

Foraging habitat that meets at least one of the following criteria can be explicitly identified as habitat critical to survival, or essential habitat, for Grey-headed Flying-foxes. Natural foraging habitat that is:

- 1. productive during winter and spring, when food bottlenecks have been identified*
- 2. known to support populations of > 30 000 individuals within an area of 50 km radius (the maximum foraging distance of an adult)*
- 3. productive during the final weeks of gestation, and during the weeks of birth, lactation and conception (September to May)*
- 4. productive during the final stages of fruit development and ripening in commercial crops affected by Grey-headed Flying-foxes (months vary between regions)*

5. known to support a continuously occupied camp.

Clearing of winter foraging habitat is a particular concern for the species (DECCW 2009). The vegetation communities that contain winter-flowering *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus robusta* (Swamp Mahogany) and *Melaleuca quinquenervia* (Broad-leaved Paperbark) have been substantially cleared, are poorly represented in conservation reserves, occur primarily on privately owned land and continue to be cleared at high rates (DECCW 2009).

While the Grey-headed Flying-fox was not recorded during field surveys, potential foraging habitat that meets Criteria 1 of the recovery plans definition of ‘habitat critical to the survival of the species’ does occur on site in the form of 10.40 ha of CPW and 24.48 ha of SSTF as listed under the EPBC and/or TSC Acts, and an additional 0.44 ha of AW. This totals 35.32 ha of potential foraging habitat and includes winter flowering species including *Eucalyptus tereticornis* (Forest Red-gum), *Corymbia maculata* (Spotted Gum) and *Eucalyptus crebra* (Narrow-leaved Ironbark). *Eucalyptus tereticornis* mostly occurs in CPW and the other species within the SSTF (**Figure 18**).

The proposed development will result in the removal of 10.94 ha of woodland, representing 28.9% of potential habitat in the site. However, the areas of woodland that will be impacted at the site are already fragmented, consist largely of scattered paddock trees and a thin strip of vegetation along Appin Road and are surrounded by extensive areas of large intact bushland that provides a more optimal foraging resource for Grey-headed Flying-fox such as the 50 ha of forest in the Beulah Biobank site to the south of the study area, Campbelltown City Council’s 45 ha Noorumba Bushland Reserve to the north of the study area and extensive areas of bushland in the Georges River catchment immediately to the east of the study area that includes the Dharawal National Park (**Figures 1 and 2**). The landscape of the study area has been extensively modified by past agricultural uses. The site does not provide suitable roosting habitat for the species and there are no records of Grey-headed Flying-fox camps in the study area. Within a regional context, this loss of critical habitat comprises a very small proportion of the potential foraging habitat available for the Grey-headed Flying-fox. The amount to be removed is fragmented and proportionately small in the context of the woodland directly adjacent to the site.

In relation to the EPBC Act Significant Guidelines 1.1, the project is not expected to result in a significant impact to this species as shown in **Table 10** and therefore no further assessment or offsetting is required.

Table 10: Significant Impact Assessment for Grey-headed Flying -fox

Criteria	Significant Impact?
An action is likely to have a significant impact on an vulnerable species if there is a real chance or possibility that it will:	
<ul style="list-style-type: none"> lead to a long-term decrease in the size of an important population of a species 	No.
<ul style="list-style-type: none"> reduce the area of occupancy of an important population 	No.
<ul style="list-style-type: none"> fragment an existing important population into two or more populations 	No.
<ul style="list-style-type: none"> adversely affect habitat critical to the survival of a species. 	Spring foraging resources are considered to be critical to the survival of the species (DOE 2015i). Some of the dominant tree species in the study area flower in spring, including <i>Eucalyptus microcorys</i> , <i>Eucalyptus siderophloia</i> and <i>Eucalyptus pilularis</i> ; however these and other spring food trees are considered to be widely available in the

	area due to the extent of vegetation in the area the loss of 10.94 ha is not expected to result in a significant reduction in spring feeding resources in the surrounding region and therefore not result in a significant impact to the species.
<ul style="list-style-type: none"> disrupt the breeding cycle of an important population 	No. Spring feeding resources are important for the breeding cycle. See discussion in row above.
<ul style="list-style-type: none"> modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline 	No.
<ul style="list-style-type: none"> result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat 	No.
<ul style="list-style-type: none"> introduce disease that may cause the species to decline 	No.
<ul style="list-style-type: none"> interfere with the recovery of the species. 	No.

6.3 Large-eared Pied Bat (*Chalinobolus dwyeri*)

The Large-eared Pied Bat is a medium-sized insectivorous bat with large ears, glossy black dorsal fur and a white band of fur along the sides of the belly adjacent to the wing membrane. In NSW it is known from the central western to the mid to north-eastern parts of the state and as far south as Nowra. The species requires sandstone cliffs and fertile woodland valley habitat within close proximity of each other. In particular, the species shows a preference for box gum woodlands or river/rainforest corridors which are used for foraging (TSSC 2010). The species is largely restricted to the interface of sandstone escarpment for roosting habitat, and relatively fertile forests supporting woodlands and forests for foraging habitat. The species forages for insects in and around forest canopies.

Important populations for this species occur in the Hunter Valley, Sydney Basin and Southern Tablelands of NSW (DotEE 2016).

DotEE has requested further information on the amount of 'important habitat' or 'habitat critical to the survival' of the Large-eared Pied Bat that is likely to be impacted by the proposed action.

The national recovery plan for the Large-eared Pied Bat (DERM 2011) states that:-

Critical habitat includes any maternity roost and that these appear to be a very specific structure (arch caves with dome roofs). Caves need to be high and deep enough to allow juvenile bats to learn to fly safely inside and have indentations in the roof (DERM 2011).

Sandstone cliffs and fertile wooded valley habitat within close proximity of each other should also be considered habitat critical to the survival of the large-eared pied bat. The majority of records are from canopied habitat, suggesting a sensitivity to clearing, although narrow connecting riparian strips in otherwise cleared habitat are sometimes quite heavily used (DERM 2011).

Important (largest) populations within NSW, appears to be in the sandstone escarpments of the Sydney basin and northwest slopes of NSW. Much of this habitat occurs within state reserves. The species has also been recorded from a few locations in the sandstone escarpments of the Morton National Park at the southern end of its range (DERM 2011).

The species was recorded foraging during a supplementary survey in October 2016. The site is considered to provide some potential foraging habitat for the species. This potential foraging habitat is comprised of 10.40 ha of CPW and 24.48 of SSTF and an additional 0.44 ha of AW. This totals 35.32 ha of potential habitat. As described previously, this woodland is already heavily fragmented, at best - representing fringes of more consolidated patches, and the landscape has been extensively modified by past agricultural land use. As the species has a suggested sensitivity to cleared landscapes, this habitat likely represents marginal foraging habitat only (**Figure 18**).

While the site does contain hollow-bearing trees which may be utilised by the Large-eared Pied Bat for roosting, this would be marginal at best, as the species tends to use caves, sandstone overhangs, tunnels and culverts for roosting and breeding – none of which have been recorded within the study area. The site is not considered to provide any maternity roosts for the species.

The proposed action will result in the removal of approximately 10.94 ha of potential habitat, representing 28.9% of potential habitat in the site. Potential habitat to be removed is comprised of 2.59 ha of TSC and/or EPBC CPW and 8.36 ha of TSC and/or EPBC SSTF. Within a regional context, this loss comprises a very small proportion of the potential foraging habitat available for the Large-eared Pied Bat, particularly when considering the large expanses of woodland surrounding the site and to the south-east.

In relation to the EPBC Act Significant Guidelines 1.1, the project is not expected to result in a significant impact to this species as shown in **Table 11** and no further assessment or offsetting is required.

Table 11: Significant Impact Assessment for Large-eared Pied Bat

Criteria	Significant Impact?
An action is likely to have a significant impact on an vulnerable species if there is a real chance or possibility that it will:	
• lead to a long-term decrease in the size of an important population of a species	No.
• reduce the area of occupancy of an important population	No.
• fragment an existing important population into two or more populations	No.
• adversely affect habitat critical to the survival of a species.	No. The loss of 10.94 ha is not expected to result in a significant reduction in spring feeding resources in the surrounding region and therefore not result in a significant impact to the species.
• disrupt the breeding cycle of an important population	No.
• modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	No.
• result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	No.
• introduce disease that may cause the species to decline	No.
• interfere with the recovery of the species.	No.

6.4 Koala (*Phascolarctos cinereus*)

Koalas are associated with a wide range of temperate, tropical and sub-tropical forests as well as semi-arid communities. They feed almost exclusively on leaves of *Eucalyptus* species, although they have been known to forage on other genera as well (DotEE 2016). Koalas have large overlapping home ranges with larger home ranges present in areas of poorer quality habitat (recorded up to 135 hectares in central Queensland).

The survey undertaken by ELA for the rezoning assessment (ELA 2014) confirmed the presence of Koala feed trees within the study area although no Koalas were recorded. This survey was undertaken over five days on 25th and 26th March, 4th April, 27th June, and 20th September 2013 (ELA 2014). This survey was conducted in accordance with the DotEE endorsed Survey Guidelines for Mammals (2011), taking into consideration the known habitat resources as outlined in the Departments Koala species profile (SPRAT).

There are recent (2017) Koala records from Noorumba Reserve, on the northern boundary of the study area and the Beulah Biobank site, adjacent to the southern boundary of the study area and a Koala was recorded along the Nepean River in February 2017, 2.7 kms to west of study area. In addition there are several road kill records along Appin Road adjacent to the study area where Koalas are likely using habitat resources on both the eastern and western (north and south of site) sides of Appin Road. It is noted that most historic Koala records in the locality are along and east of Appin Road (**Figure 19**).

There are no Koala records on the study site or west of Appin Road in the study area. However, potential habitat occurs on site, with Koala food tree species, *Eucalyptus tereticornis*, *E. moluccana*, and *E. punctata*, identified in the study area. All three food tree species were recorded within some patches of SSTF, primarily along the western boundary (Patches 3 and 4) of the site, along the eastern boundary (Patch 9), and in the north of the site, while *E. tereticornis* and *E. moluccana* were recorded within patches of CPW and AW (Patches 1 and 8). Food tree species were however not recorded in Patch 7. Given the presence of food trees within all vegetation communities on site and Koala's use of scattered paddock trees, it is considered that approximately 35.32 ha of potential habitat occurs on site.

The proposed action will remove approximately 13.58 ha of potential foraging habitat, mainly a thin strip of trees along Appin Road (1.54 ha) and scattered paddock trees (6.48 ha), representing approximately 22.71% of habitat in the study area and 0.05% of habitat in the region, considering the amount of CPW and SSTF alone remaining in the Cumberland Plain (approximately 20,950 ha).

With reference to the *EPBC Act Significant Guidelines 1.1* and the *EPBC Act referral guidelines for the vulnerable koala* (DotEE 2014), and application of the habitat assessment tool that assesses whether habitat critical to the survival of the koala exists in the study area (Table 4 within the referral guidelines), the project will impact '*habitat critical to the survival of the koala*'. This is because a score of '**7**' was calculated using the habitat assessment tool (**Table 12**), and scores greater than five are considered to contain habitat critical to the survival of the koala according to Section 6 the referral guidelines (DotEE 2014).

Table 12: Koala habitat assessment tool

Attribute	Score	Discussion for coastal areas
Koala occurrence	+1 (medium)	There is evidence of one or more koalas within 2 km of the edge of the impact area within the last 5 years
Vegetation composition	+2 (high)	The site has forest or woodland with 2 or more known koala food tree species

Habitat connectivity	+2 (high)	The area is part of a contiguous landscape (≥ 500 ha)
Key existing threats	+1 (medium)	There is evidence of infrequent or irregular koala mortality from vehicle strike or dog attack is present in areas that score 1 or 2 for koala occurrence
Recovery value	+1 (medium)	It is uncertain whether the habitat is important for achieving the interim recovery objectives for the relevant context, as outlined in Table 1
Total	7	

According to Section 7 of the referral guidelines, significant impacts depend on a number of factors in combination when clearing <20 ha of habitat containing known Koala food trees in an area with a habitat score <8. These factors include:

- The score calculated for the impact area (higher score = greater risk of significant impact).
- Amount of koala habitat being cleared (more habitat cleared = greater risk of significant impact).
- Method of clearing (i.e. clear-felling has greater risk of significant impact than selective felling with understorey and koala food tree retention).
- The density or abundance of koalas (relatively high density or abundance for the region means greater risk of significant impact).
- Level of fragmentation

It should be noted, the score calculated for the impact area (7) was generated largely on Koalas in the wider area, habitat connectivity of the wider area, and evidence of Koala strike on an existing road, Appin Road, outside the study area (**Figure 19**). A relatively small amount (approximately 13.58 ha) of Koala habitat is proposed to be cleared. No Koalas have been recorded in the study area (**Figure 19**) suggesting the density or abundance of Koala within the study area is low. The level of fragmentation caused by the clearing is low.

Accordingly, the proposal is not likely to adversely affect habitat critical to the survival of the koala (Section 7 of referral guidelines).

Section 8 of referral guidelines lists impacts which are likely to substantially interfere with the recovery of the Koala. These are listed below alongside a comment on the applicability of the proposed action:

- *Increasing koala fatalities in habitat critical to the survival of the koala due to dog attacks to a level that is likely to result in multiple, ongoing mortalities.*
Increased koala fatalities from dog attacks will not occur as, while there may be an increase in dog numbers associated with the proposed action (residential development), dogs will be controlled by owners in public open spaces e.g. kept on leash at all times as per standard Local Government Act dog ownership regulations. Proposed conservation areas (BioBank sites and Council conservation reserves) will prohibit dogs. These areas will be actively managed and subject to enforcement powers under the Local Government Act.
- *Increasing koala fatalities in habitat critical to the survival of the koala due to vehicle-strikes to a level that is likely to result in multiple, ongoing mortalities.*

Increased koala fatalities from vehicle strike may occur as there will be an increase in traffic volume in the area from population increase. However, all roads within the proposed development will be local roads with a maximum speed limit of 50 km/h and will be associated with traffic calming measures.

Any potential for increased Koala mortality on Appin Rd, which is not part of this action, will be fully mitigated as part of a RMS EIA of the proposed Appin Rd widening and will likely include the following mitigation measures – Koala exclusion fencing, fauna underpasses, restricted urban speed limits compared to current 100 km/hr limits, signage and other traffic calming measures at intersections.

- *Facilitating the introduction or spread of disease or pathogens for example Chlamydia or Phytophthora cinnamomi, to habitat critical to the survival of the koala, that are likely to significantly reduce the reproductive output of koalas or reduce the carrying capacity of the habitat.*

Mitigation measures will be in place to prevent and minimise the introduction or spread of disease or pathogens as a result of the proposal and will be outlined in a CEMP.

- *Creating a barrier to movement to, between or within habitat critical to the survival of the koala that is likely to result in a long-term reduction in genetic fitness or access to habitat critical to the survival of the koala.*

As part of the planning proposal (CCC 2015), a key objective is to provide a secondary environmental corridor that links the existing Noorumba Reserve to the north of the project site with the existing Beulah Biobank site to the south and the Nepean River Corridor to the west. The project will retain and enhance at least 15.3117.08 ha of Koala habitat in proposed Offset sites within the study area and enhance movement corridors for the Koala between the east and west as shown by potential future offset areas (**Figure 19**).

- *Changing hydrology which degrades habitat critical to the survival of the koala to the extent that the carrying capacity of the habitat is reduced in the long-term.*

No streams will be impacted by the proposal, and it is unlikely that any changes in surface flows will degrade habitat critical to the survival of the Koala.

Within a local and regional context, the loss of foraging habitat comprises a very small proportion of the potential foraging habitat available for the Koala, particularly when considering the large expanses of woodland and known corridors surrounding and to the east of the site. Accordingly it is considered that the action will not result in a significant impact to the Koala and as such offsets are not required.

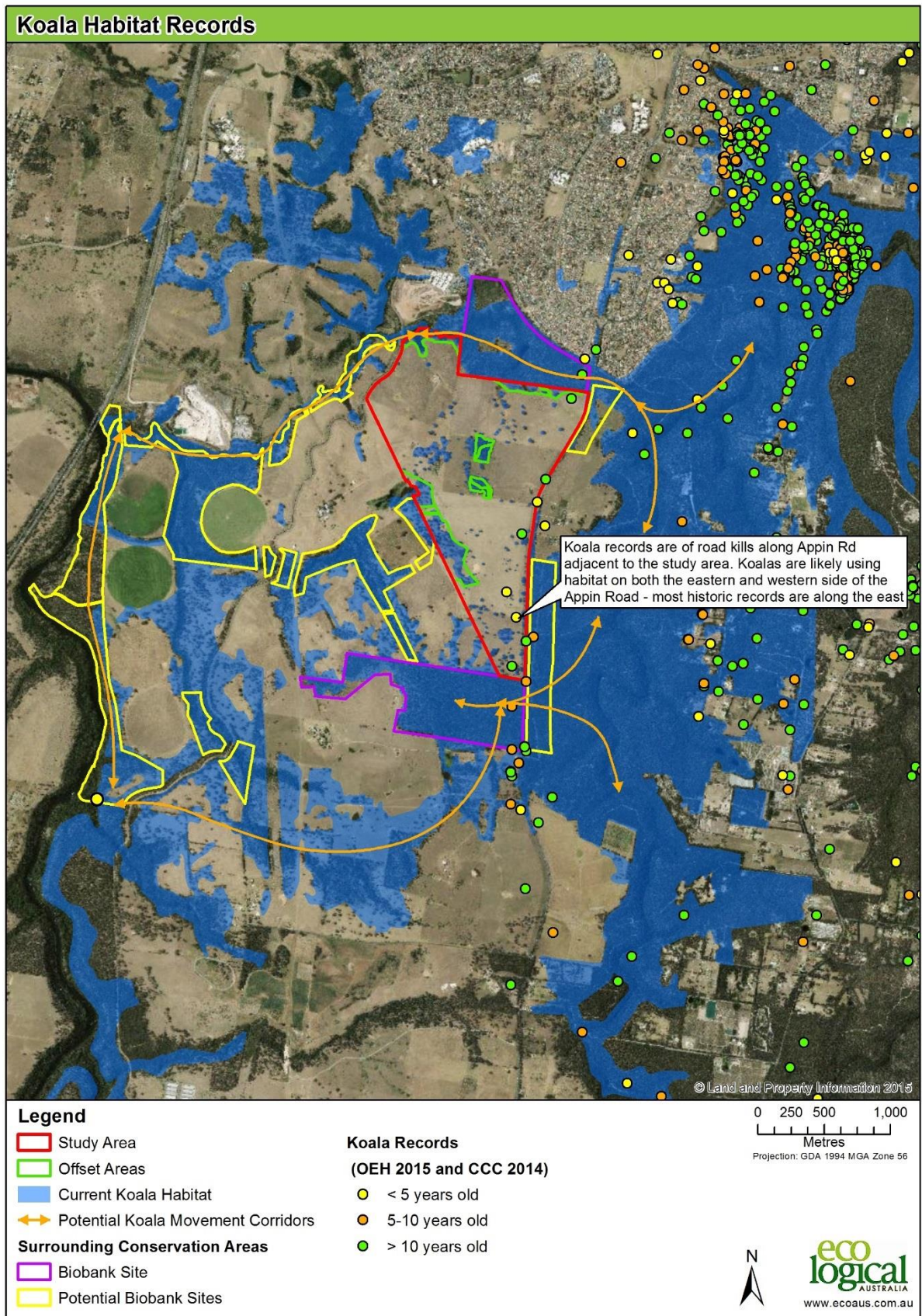


Figure 19: Koala habitat and records and potential movement corridors

7 Proposed Safeguards and Mitigation Measures

A range of safeguards and mitigation measures will accompany the proposed residential development. The goal of these actions is to firstly minimise the direct impact introduced by the development and secondly to ensure that indirect impacts do not eventuate, so all proposed offset areas and adjacent conservation areas are adequately protected and managed alongside the development.

7.1 Avoidance and minimisation

The design of the proposed action has followed Step 4 of the *Guidelines for threatened species assessment* (DEC 2004) and the Significant Impact Guidelines for MNES (DotEE 2013), which both identify important factors that must be considered when assessing the potential impacts on threatened species, populations, or ecological communities, or their habitats; namely to avoid, mitigate and finally to offset any residual impacts.

The ecological assessments conducted in the study area (ELA 2014 and 2015b) have been used to inform avoidance and minimisation of direct and indirect impacts to biodiversity values. These principles include:

- the layout design selection process must include consideration and analysis of the biodiversity constraints of the proposed action
- the project should be located in areas where the native vegetation and threatened species habitat is in the poorest condition
- the project should be in areas which avoid EECs or CEECs
- the project should aim to minimise the amount of clearing or habitat loss
- the project should be located in areas that do not have native vegetation or require the least amount of clearing

The proposed action is the result of a series of redesigns taking into account the above.

7.2 Management of potential indirect impacts

Activities within the development areas have the potential to indirectly impact avoided or retained native vegetation over both the short and the long term. These potential impacts, often referred to as 'edge effects', may include:

- the introduction of weeds and exotic species
- the spread of litter and rubbish
- introduction of domestic animals (cats and dogs)
- increased disturbance from pedestrian access
- runoff from construction containing nutrients, sediments and other pollutants
- inappropriate water, sewer and stormwater management leading to erosion
- recreational use of open space adjacent to offset areas
- recreational use of offset areas

The precinct and lot layout at Mt Gilead has been designed to remove and/or minimise to the maximum extent possible indirect impacts to remaining vegetation including that contained in Offset sites. The calculation of all direct impacts have been based on a worst case scenario – on the assumption of complete loss of all biodiversity values including where these losses are only partial e.g. detention basins.

Figure 4 (with more detail in **Figures 5** through to **10**) shows that the outer perimeter of the proposed residential footprint is present as a perimeter road. As such, there will be no residential blocks directly adjacent to bushland areas. This has been designed to:

- remove the likelihood of illegal encroachment into native vegetation by residents, thus removing the chance of degradation through illegal clearing, weed invasion, garden escapes, fires and predation by domestic animals;
- allow for the APZ to be absorbed (i.e. overlap with) the perimeter roads and the dwelling setback within the individual lots. Therefore, no clearing of vegetation will be required to create or maintain APZ's for the proposed development in offset or retained areas.

The proposed north and west offset sites are located along the boundary of the study area adjacent to native vegetation outside of the study area as shown in **Figure 2**. These offset sites will be fenced and actively managed in-perpetuity under a BioBanking agreement. This fully funded management will address any potential indirect impacts including weed establishment and growth and will improve the existing condition of the vegetation with the aim creating areas of CPW and SSTF that will meet the EPBC Act condition criteria in the future (discussed in detail in Section 8). The central offset council reserves will be managed under a similar management regime. Any changes to surface runoff will be managed through the proposed stormwater infrastructure and stormwater management strategy which will generally direct surface flows away from the offset sites and to specifically designed stormwater detention basins that minimise impacts to offset areas. The stormwater management strategy aims to ensure that post development peak discharges are equal to or less than pre development discharges (Worley Parsons 2014 – Appendix H). Recreational use of offset areas will be restricted or prohibited and discouraged through fencing and signage and managed in accordance with a Landscape Plan (Appendix I). Large areas of open space and recreation areas have been provided in the development design to cater for recreational needs of the community.

7.3 Buffer zones

The conservation advice for SSTF (TSSC 2014a) recommends that a 30 m vegetated buffer is provided between the development zone and the edge of the EPBC SSTF to mitigate against indirect impacts. While a 30 m vegetated buffer has been provided along most edges of the proposed offset sites that contain SSTF (in the form of council reserve land, bio-retention swales or perimeter roads), indirect impacts to this vegetation will be mitigated by the fully funded in perpetuity active conservation management and restoration of these areas as described in **Section 8** so that no impacts to the vegetation within the 30 m buffer will result with consideration that:

- A perimeter road is present between the offset areas and the proposed residential lots and all runoff will be directed along stormwater drainage away from the offset sites.
- The offset areas will be fully fenced and will not provide any recreational opportunities.
- Offset areas will be managed in perpetuity under registered biobank agreements with the NSW Office of Environment and Heritage (OEH) or as gazetted 'Natural Areas' under the Local Government Act with the same conservation management actions as biobank agreements, funding provided in perpetuity for conservation management of these sites. Further these areas will also be protected under a legally binding Biocertification Agreement, registered on title, between the NSW Minister for the Environment, Campbelltown City Council and the land owners.
- The current condition of some cleared areas within the offset sites do not meet the definition of SSTF under the EPBC Act but are considered to be SSTF under the TSC Act. Once managed for conservation under the proposed action, the condition of this vegetation will improve to meet EPBC Act condition criteria.

- If not protected within the proposed offset areas this area of SSTF would continue to degrade through current grazing practices.
- When considering the intent of the guidelines in terms of the buffer, while there is indeed a proposed change to the surrounding land use, given current grazing practices and considering future proposed in perpetuity management (Biobank agreements) it is considered that the change will result in a 'positive' impact for these retained offset patches.

Despite the above considerations and proactive master planning, on advice from the Department, the proposed action assumed for impacts to SSTF within the 30 m buffers and provides an offset strategy according to these total impacts. The result is a conservative approach to impacts which will provide an environmental outcome of much higher ecological value than that which currently exists.

The conservation advice for CPW (DEWHA 2009) does not reference the need for any buffer allowance when calculating impacts. It is noted, however, that the development layout has afforded a buffer to the retained CPW in the north of the site through the provision of boundary roads or natively landscaped detention basins between the interface of the development and the CPW.

7.4 Flooding, stormwater and water quality

A stormwater management plan has been prepared by Worley Parsons (2014) (Appendix H) to address engineering considerations, whilst placing a strong focus on conserving and enhancing the biodiversity, ecological health and positive water quality benefits of the site. The objectives of the stormwater quality management strategy are to preserve the state of existing watercourses and to ensure that post-development pollutant loads are consistent with Council stormwater pollutant load reduction targets.

The stormwater management strategy for the site involves the implementation of a treatment train approach to satisfy pre-determined stormwater quality objectives and includes rainwater tanks, GPTs and bio-retention systems. In order to satisfy stormwater quality management objectives, stormwater detention structures with multi-staged outlets will be provided adjacent to the proposed bio-retention systems in order to ensure that post-development peak discharges are equal to or less than predevelopment peak discharges.

The bio-retention basins/swales are designed to capture and treat run-off water, captured by a network of curb and guttering along all roads, including the perimeter roads adjacent to formal offset areas. The bio-retention basins, including those on land proposed as RE1 Public Recreation, will be owned and managed by Campbelltown City Council and on completion will be classified as Community Land under the Local Government Act (LG Act), and will have a Plan of Management prepared and adopted in accordance with the LG accordingly. It is noted that despite the positive environmental outcomes expected through management of the bio-retention basins/swales, these areas have been included in the impact calculation totals.

The detention basins will include appropriate plantings around the banks that will provide habitat for birds, frogs and foraging/nesting resources for bats, birds and arboreal mammals. This will provide a strong buffer area between the urban development interface with the proposed formal offset areas. An indicative design of the bio-retention basins/swales is depicted below in **Figure 20**. The water captured in the detention basins will only be retained for as long as required for it to be released at pre-development flow rates, once discharged (shortly after a rainfall event), the areas quickly dry out as an ephemeral water course. The quantity and quality of the water flowing out of the detention basins into natural watercourses, including through proposed offset areas, will be of a higher standard than pre development rural run-off and no different to the current high and low flow events.



A bioretention basin showing the transition from nature strip to vegetated basin, with footpath on farside and fenced off conservation area in the background.



Established native vegetation within a bioretention basin acting as a buffer to the conservation area in the background.



An aerial view of a bioretention basin functioning alongside residential development and conservation areas

Figure 20: Indicative design of the detention basins from nearby examples at Rouse Hill

Litter/sediment control

Local drainage from the urban areas will be filtered (using in-line filter pit inserts or equivalent) prior to discharge to water detention basins and to downstream ecosystems. This will allow for protection of the storages from gross pollutants and for the easy interception and collection of this pollutant material. The filtering system will remove nutrients and other pollutants to the agreed standards.

Water Sensitive Urban Design Features

Inappropriate water, sewer and stormwater management presents potential risks to the integrity of the Offset sites and conservation areas. For this reason, water sensitive urban design (WSUD) features will be incorporated in the development. The preferred strategy option for water cycle management includes:

- Vegetated swales incorporated into general streetscape
- Vegetated filter strips located within open areas/parks adjacent and upslope of riparian corridors
- Gross Pollutant Traps strategically located at outlet of stormwater drainage systems
- Bio-retention (filtration) system located at the outlet of stormwater drainage system and off-line from existing waterways (and outside riparian zones where practicable)
- Rehabilitated natural drainage channels incorporating stormwater treatment measures

7.5 Vegetation and habitat clearance

A Fauna Management Plan (FMP) for the proposed action will be prepared based on the following principles.

Vegetation clearance will be undertaken in a manner which is sensitive to the ecological values of the area. Strict clearing limits will be established and delineated to ensure that no over clearing occurs.

Hollow bearing trees (HBTs) will be cleared in a progressive manner in accordance with a hollow bearing tree clearance protocol to minimise potential impacts to hollow dependant fauna. A suitably qualified ecologist will be on site during any vegetation clearance in ecologically sensitive areas (including areas containing MNES) as well as during the clearance of HBTs.

The pre-clearing protocol will include:

- threatened fauna searches one week prior to tree removal;
- protocols for hollow-bearing tree removal;
- addition of fallen logs to BioBank areas
- supervision by an ecologist;

Woody weed material will be relocated to offset areas to supplement habitat features for fauna as described in the Biobank Assessment (ELA 2015 c and d). Surplus material will be mulched on site, piled into unobtrusive piles or disposed of at a facility licensed to receive green waste. All weed propagules especially noxious will be bagged and disposed of as directed by legislation at a facility licensed to receive green waste. All weed waste without propagules will be composted onsite in small unobtrusive piles.

7.6 Construction Environmental Management Plan

A construction management plan (CEMP) will be prepared prior to construction commencing. It will include the following mitigation measures designed to control potential impacts to the Offset sites and retained areas.

Erosion and sediment control measures are to be implemented during the construction phase in accordance with the requirements of Campbelltown City Council and the guidelines set out by Landcom (the “Blue Book” 2004).

The erosion and sediment controls will include the following measures:

- construction of temporary diversion drains or provision of staked straw bales on the high side of the disturbed areas to direct upstream runoff around the areas.
- the use of silt fencing on the downstream side of the area of works to retain soils.
- provision of a stabilised site access at appropriate points where construction vehicles will enter and leave the site to reduce the likelihood of vehicles tracking soil materials onto public roads.
- topsoil stockpile located adjacent to the areas of disturbance and to have an earth bank on the upslope side to divert runoff around the stockpile with a sediment fence located 1 to 2 metres downslope of the stockpile.
- rock wrapped in geofabric or straw bales will be installed in or around any stormwater drainage inlet.

Pre-start measures

Detailed pre-start measures will be developed and included in the CEMP. This will include requirements for ensuring the required controls are in place prior to construction, marking/fencing vegetation for retention and pre-clearance ecological surveys.

Fencing conservation areas

Fencing will be installed along the perimeter of the Offset Sites and additional conservation areas during nearby construction with the objectives of controlling entry to the area and to protect the habitat. The fence will be stock and vehicle proof.

Signage will be provided to increase community awareness of the importance of the offset sites. Gates will be included within the fence-lines to allow operational/management access and emergency services access. The fencing design will incorporate high tensile steel cables as required by the VPA (Voluntary Planning Agreements with CCC).

To allow for appropriate vehicle access for management purposes, including emergency access, a fire trail via a locked gate has been provided in the northern Biobank site.

Fencing will be monitored as part of the Biobanking reporting requirements to ensure their integrity remains intact. The fence lines will be regularly checked for weeds, particularly prior to any mowing to ensure propagules are not dispersed into the Offset sites, with any weeds surrounding these areas to be removed during regular landscaping.

Weed and pest management

Weeds and control of pests including rabbits and foxes will be managed as part of the BioBanking Agreement Management Plans, to be provided following completion.

Lighting controls

The potential for added light impacts will be addressed through a range of control measures on the lighting to be used within the residential area, including;

- ensuring the development complies with the Australian Standard 4282 – Control of the obtrusive effects of outdoor lighting, which provides recommended limits for lighting.
- incorporating a lighting strategy which prescribes limits on lights for various areas, such as;
 - Post top overhead street lighting to be used facing down with minimal spill into adjacent areas, in particular, offset areas.
 - Lighting to be set on timers where appropriate, and/or set on sensor switches.
 - Position and directional lighting to be located near the conservation area where deemed necessary but oriented away from the conservation area and back into the development where suitable.

Retention of dead timber and hollow bearing trees

Dead timber and hollow bearing trees will be retained within the development footprint open space areas where possible with consideration to public safety. Dead timber from the development areas will also be relocated to offset areas.

Grazing controls

Grazing will no longer be possible within the residential development areas. Stock will not be permitted to graze the conservation areas.

Waste management controls

All reasonable steps will be taken by the developer to remove waste deposited by others within the study area during the development stages. Construction waste management measures will be developed prior to construction as a component of the CEMP.

To deter any waste dumping within the Offset Sites in the longer term, hi tensile steel cable will be installed along the perimeter of existing vegetation remnants and the surrounds of the conservation areas (as described above). Additionally, signage will be erected along the boundary to deter dumping.

7.7 Parties responsible for implementation

LendLease Communities will ensure that all mitigation measures as aforementioned are undertaken until the completion of the development. On completion of the development, the responsibility for management will be passed to the CCC in accordance with the responsibilities outlined in the VPA and on completion. Where necessary, suitable environmental, conservation, and engineering contractors experienced in bushland conservation and management will be employed. The contractors will be chosen through a tender process which will likely take into account each tenderer's:

- experience with bushland conservation and management (previous environmental records)
- sustainability and efficiency
- cost
- availability of equipment

8 Offset Strategy

The EPBC Act Offset Policy requires residual significant impacts to MNES to be offset, namely the impact to 5.48 ha of SSTF. The proposed development has implemented a number of measures to avoid impacts to MNES, however, to progress development it was not possible to completely avoid all impacts and some residual impacts to MNES remain. Mt Gilead Pty Ltd is committed to offsetting these impacts in accordance with the Offset Policy.

There are two key components to the Mt Gilead offset strategy. These components are:

- offsets to be relinquished from onsite areas to account for the majority of impacts to SSTF
- offsets to be relinquished from an offsite location to account for the remaining impacts to SSTF

Conservation areas, are being provided (whether residual impacts are significant or not) for the following communities and species.

The EPBC Act offsets are summarised as below:

- 10.22 ha of existing EPBC Act listed SSTF, including
 - 8.15 ha of SSTF within the Macarthur-Onslow Biobank site (ELA 2015c - Appendix D)
 - 2.07 ha of SSTF within the central Council Reserve
 - as well as an additional 3.47 ha of SSTF which either does not currently meet the EPBC criteria (but will be restored to EPBC condition with 10 years) or SSTF to be retained but considered as impacted due to DotEEs interpretation of 30 m buffer zones.
- 6.5 ha of Off-site Offsets secured from an established offsite biobank known as Fernhill Central West

Additional Conservation Outcomes:

- CPW (4.63 ha of EPBC Act listed CPW within the Noorumba-Mt Gilead Biobank site (ELA 2015d – Appendix F) as well as an additional 1.58 ha to be restored through assisted regeneration
- Swift Parrot (15.31 ha of existing potential foraging habitat within the onsite offset sites)
- Grey-headed Flying Fox (15.31 ha of existing potential foraging habitat within the offset sites)
- Large-eared Pied Bat (15.31 ha of existing potential foraging habitat within the offset sites)
- Koala (15.31 ha of existing potential foraging habitat within the offset sites)

The offset strategy is consistent with the principles in the Commonwealth Offsets Policy. The proponent proposes to:

- deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by the EPBC Act and affected by the proposed action.
- offset at a size and scale proportionate to the residual impacts on the protected matter.
- be efficient, effective, timely, transparent, scientifically robust and reasonable with their offsets.
- have transparent governance arrangements including being able to be readily measured, monitored, audited and enforced.

8.1 On-site Offsets

The key conservation outcome to accompany the proposed action is the establishment of three large vegetation protection zones. These include the Macarthur Onslow-Mt Gilead BioBank site in the north (Appendix D and E), Noorumba-Mt Gilead BioBank site in the west (Appendix F and G), and the central Council Reserves. These areas total to 24.48 ha of predominantly good quality vegetation and potential habitat for many threatened species and provides the primary offset for the majority of residual significant impacts imposed by the proposed action.

8.1.1 Offset site management agreements

The registration of Biobank Agreements is the key conservation/security measure proposed to ensure biodiversity protection and management that will bring about an improved environmental outcome for the site. Biobank Agreements will be registered for the Macarthur Onslow-Mt Gilead site and the Noorumba-Mt Gilead site. Biobanking delivers ongoing benefits through fully funded active management of weeds, feral animals, access control, ecological burning regimes and restoration/revegetation of degraded areas. Under a Biobanking agreement, landholders are committed to improving or maintaining biodiversity values on a site in perpetuity with annual audits and reporting and the ability for the Minister to obtain court directions to rectify any issues that has not been managed to the satisfaction of OEH.

The third conservation area is the Council Reserve, which is represented by two central vegetation patches totalling to 2.07 ha of land to be formally used as an offset, within a larger 3.46 ha that will undergo management. The Council Reserve will be transferred to Campbelltown City Council for permanent protection, management and funding. This land will be categorised as ‘Community Land-Natural Areas’ under the *Local Government Act 1993* and will be subject to a Plan of Management under Division 2 of Part 2 of Chapter 6 of that Act that will manage the land primarily for nature conservation. The Council Reserve will be managed by the proponent until it is transferred to the Council, which is expected to occur by 2025. Whilst not a biobank site, this reserve will be managed to the same standard as a biobank site with the same suite of management actions and will be protected in perpetuity under a legally binding Biocertification Agreement, registered on title, between the NSW Minister for the Environment, Campbelltown City Council and the land owners.

24.48 ha of land within the study area will be retained for conservation. These conservation areas will be managed and funded in-perpetuity under registered BioBanking Agreements or as a Council Reserve under the LG Act.

A total of 8.15 ha of EPBC Act listed SSTF will be retained and managed within the Macarthur Onslow-Mt Gilead Biobank site (**Figure 21**) with an additional 3.37 ha of land to be restored to SSTF within 10 years through active management.

A total of 4.63 ha of EPBC Act listed CPW and 0.44 ha of Alluvial Woodland will be retained and managed within the Noorumba-Mt Gilead Biobank site (**Figure 21**). An additional area of 1.64 ha of land will be restored to CPW.

A total of 2.07 ha of EPBC Act listed SSTF will be retained and managed within the central council reserves (**Figure 21**).

The offset/conservation (Biobank) sites will be improved through a range of ecological restoration works set out in the BioBank Agreement Management Plans and Council Reserve Plan of Management. The restoration works will include fencing, removal of weeds, maintenance of drainage, and replanting where required. The offset sites will follow specific management, mitigation, and monitoring procedures to be conducted in these areas in accordance with the aforementioned biobank agreement.

The full cost of in perpetuity conservation management for the BioBanks will be provided by the proponent (Noorumba-Mt Gilead Biobank site \$854,000 and Macarthur-Onslow Mt Gilead Biobank site \$750,000) and held in the Biobanking Trust Fund.

Table 13: Conservation areas within Mt Gilead

Conservation Areas	Area (ha)	Existing Vegetation for Conservation	Proposed Management
Macarthur Onslow – Mt Gilead	11.98	SSTF (EPBC) – 8.15ha	Offset site to be managed as a private biobank site - fenced and managed for conservation in perpetuity (including revegetation of at least 3.284 ha of cleared land consistent with adjacent SSTF – which has not been included in offset calculator).
Noorumba – Mt Gilead	6.71	CPW (EPBC) – 4.63 ha RFEF (TSC) – 0.44 ha	This biobank site consists of two separate parts, both of which are contiguous with Noorumba Council Reserve (which is currently being assessed as a biobank site). This offset site will be transferred to Council and become part of the Noorumba Reserve to be managed for conservation in perpetuity. In addition, 1.64 ha of land within this site that is currently cleared will be revegetated consistent with CPW.
Proposed Council reserve	3.28	SSTF (EPBC) – 2.07 ha	This area consists of two separate parts within the site centre. They will be secured by transferring the land to Campbelltown City Council and will be managed in accordance with a Plan of Management adopted under the <i>Local Government Act 1993</i> (LG Act). The land will be classified as community land under the LG Act, and categorised as a 'natural area' with an adopted plan of management under Division 2 of Part 2 of Chapter 6 of that Act primarily for nature conservation. It is important to note that this 2.07 ha protected area is part of a larger 3.28 ha vegetated area which will all be retained and managed to some degree, however, when considering the 30m into the Council Reserve, only 2.07 ha can be formally protected in accordance with the Departments requirements.

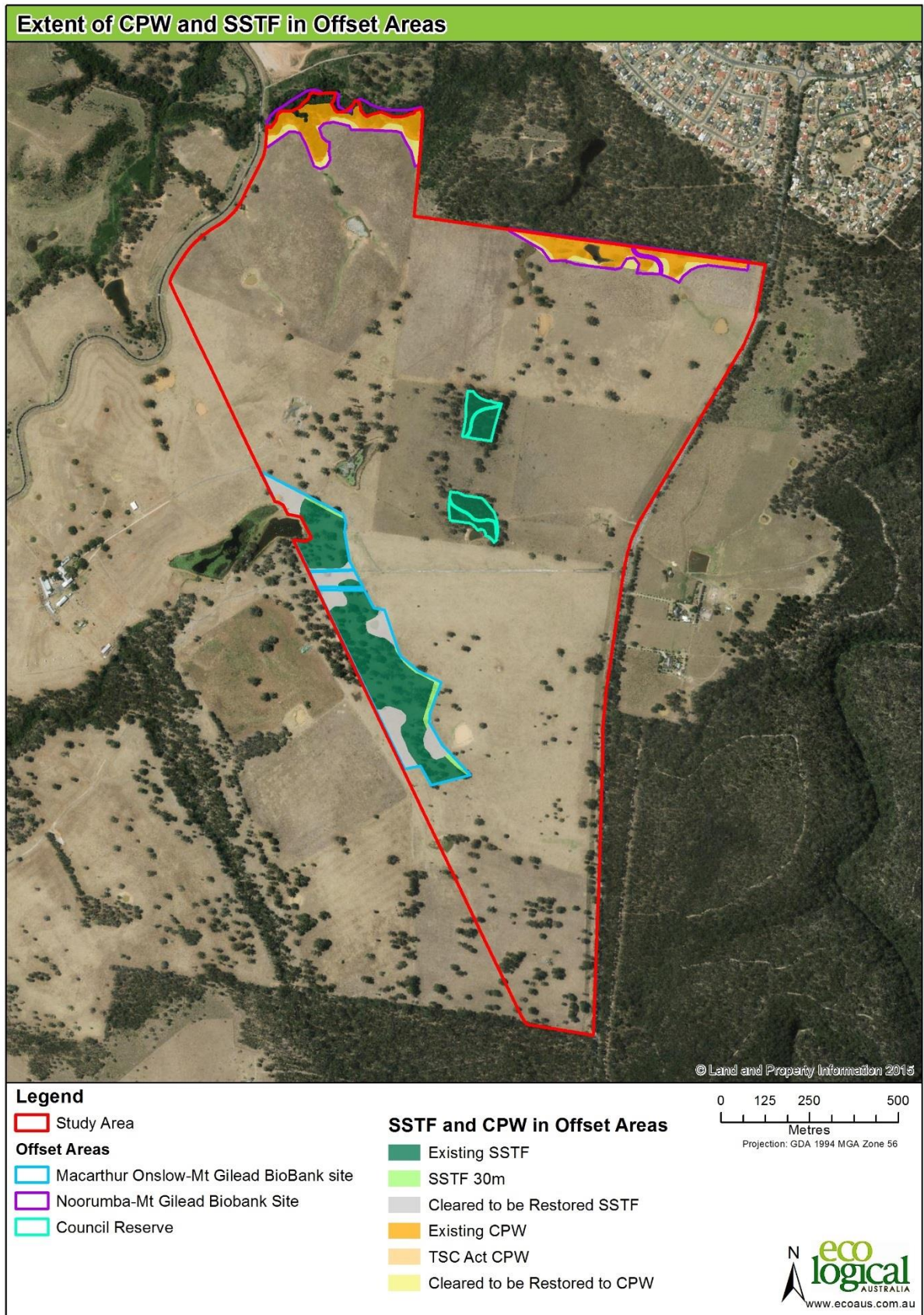


Figure 21: Onsite offset areas

8.1.2 EPBC listed associations with the On-site Conservation Areas

The following EPBC listed matters and their relevant associations are detailed in **Table 14** and further in subsequent sections.

Table 14: Species associations with the Onsite Conservation Areas

MNES	Impact	Onsite Conservation Offset
Offset		
SSTF	5.48 ha	10.22 ha of EPBC Act listed SSTF in offset sites At least 3.28 ha of land to be restored to EPBC Act SSTF within offset site areas currently not vegetated
Additional Conservation		
CPW	0.1 ha direct removal 0.4 ha managed within active open space area	4.63 ha of EPBC Act listed CPW in offset site 1.64 ha of land to be restored to EPBC Act CPW within offset site
Swift Parrot	10.20 ha of potential habitat	15.31 ha of existing potential foraging habitat in offset sites
Grey-headed Flying fox	10.20 ha of potential habitat	15.31 ha of existing potential foraging habitat in offset sites
Large-eared Pied Bat	10.20 ha of potential habitat	15.31 ha of existing potential foraging habitat in offset sites
Koala	13.58 ha of potential habitat	13.24 ha of existing potential foraging habitat in offset sites

8.1.3 EPBC Act Offset Requirements

ELA has constructed the following scoring system to provide a repeatable, measured and justified assessment of quality of the offset area for SSTF. This scoring system is informed by the DotEE *How to use the offsets assessment guide* and takes into account the recommended components of quality. These components are *site condition*, *site context*, and *species stocking rates* (species stocking rates is not considered relative to ecological communities). In this regard it is important to note that the assessment of quality for threatened ecological communities is not simply a scoring of vegetation ‘pristineness’.

Site condition is broadly an understanding of the condition of a site in relation to the ecological requirements of the specific ecological community. This includes considerations such as vegetation health and structure, the diversity of characteristic species present, and the number of relevant habitat features.

Site context is the relative importance of a site in terms of its position in the landscape, taking into account the connectivity needs of a threatened ecological community. This includes considerations such as the proximity of the site in relation to other areas of suitable habitat, threats that may occur nearby, and the role of the site in relation to the overall population or extent of the community.

In all cases, habitat quality needs to be assessed consistently on both the impact and offset areas and a score out of ten is required for each area as input in the Offset Calculator.

An individual quality score has been calculated for both the impacted SSTF and that which will be used as onsite offsets. This is based on the following where the sum of (1) – (4) are multiplied by the average of (5) and (6) to provide a score out of ten for input into the EPBC offsets calculator:

1. a score out of 3 for canopy cover
2. a score out of 3 for shrub cover
3. a score out of 4 for groundcover
4. a score out of 3 for absence of weeds
5. a multiplier score out of 100% for vegetation connectivity
6. a multiplier score out of 100% for nearby threats

The inputs used for the SSTF on site to be **impacted** are detailed in **Table 16**.

Table 15: Current quality of SSTF to be impacted

Parameter	<u>Category A</u> SSTF Condition Score	<u>Category D</u> SSTF Condition Score
Canopy cover	2 / 3	2 / 3
Shrub cover	0.5 / 3	2 / 3
Groundcover	1.5 / 4	3 / 4
Absence of weeds	1 / 3	1 / 3
Vegetation connectivity	60%	20%
Absence of nearby threats	50%	50%
Score	4.4 / 10	5.2 / 10

A final quality score of 4 and 5 is used as input within the Offset Calculator for the patch of Condition A and Condition D SSTF to be impacted respectively. **Table 16** and **Table 17** provides justification for the proposed offset strategy for SSTF with the EPBC Offset Calculator.

The inputs used for the SSTF within the **Onsite Offsets** are detailed in **Table 16** and **Table 17**.

Table 16: Current and future qualities of Category A SSTF offset

Parameter	Current Score	Future Score Without Management	Future Score With Management
Canopy cover	2 / 3	1.5 / 3	2 / 3
Shrub cover	1 / 3	0.5 / 3	2 / 3
Groundcover	1.5 / 4	1 / 4	3 / 4
Absence of weed cover	1 / 3	0 / 3	2.5 / -3
Vegetation connectivity	70%	40%	70%
Absence of nearby threats	50%	40%	70%
Score	4.8 / 10	2.9 / 10	7.2 / 10

Table 17: Current and future qualities of Category D SSTF offset

Parameter	Current Score	Future Score Without Management	Future Score With Management
Canopy cover	2 / 3	1.5 / 3	2.5 / 3
Shrub cover	2 / 3	1 / 3	2.5 / 3
Groundcover	3 / 4	1.5 / 4	3 / 4
Absence of weed cover	1 / 3	0.5 / 3	2.5 / -3
Vegetation connectivity	20%	20%	30%
Absence of nearby threats	50%	40%	70%
Score	5.2 / 10	3.3 / 10	7.1 / 10

A quality score of 5 and 5 has been used for Condition A SSTF and Condition D SSTF respectively as input within the Offset Calculator for the starting condition of the proposed Onsite Offsets, with a future score for each of the offset Condition areas as follows; 3/10 without management and 7/10 with management.

Table 18: Applicable attributes to the EPBC Act environmental offsets policy for SSTF Category A

IMPACT CALCULATOR ATTRIBUTE	IMPACT CALCULATOR INPUT	JUSTIFICATION
Ecological Community	Shale Sandstone Transition Forest (SSTF)	Field validation of vegetation was conducted by ELA (2013; 2015).
Area of impact (ha)	2.31	The project will result in a direct impact to 2.31 ha of Condition A SSTF.
Current quality of community	4	<p>An assessment of site condition and context, taking into account canopy cover, shrub cover, groundcover, weed cover, vegetation connectivity and nearby threats, was undertaken for the SSTF to be impacted. A weighted average out of ten was calculated to provide a quantified score for the current quality of the SSTF to be impacted. A score of 4 was calculated based on the below scoring system. Refer to Table 15.</p> <ul style="list-style-type: none"> • canopy cover 2/3 • shrub cover 0.5/3 • groundcover 1.5/4 • absence of weed cover 1/3 • vegetation connectivity 60% • absence of nearby threats 50%
Total Quantum of Impact (ha)	0.92	as per EPBC Offsets Calculator 2012
OFFSET CALCULATOR ATTRIBUTE	OFFSET CALCULATOR INPUT (PROPOSED OFFSET- ONSITE BIOBANKS)	JUSTIFICATION
Start area (hectares)	8.15 ha of Condition A SSTF within the Onsite Conservation Offset	To compensate for residual impacts to the species as a result of the project, an offsets package has been developed to conserve and enhance the total Onsite Conservation Offset which includes 8.15 ha of Condition A SSTF from the Macarthur Onslow-Mt Gilead BioBank. This offset will be secured in

IMPACT CALCULATOR ATTRIBUTE	IMPACT CALCULATOR INPUT	JUSTIFICATION
		<p>perpetuity and will be appropriately managed through Biobanking to ensure that a conservation outcome is achieved for SSTF.</p> <p>An additional 0.53 ha of SSTF is to be retained within the site, between the interface of the proposed development and the conserved SSTF. This is counted as providing a buffer, as required by DotEE, and therefore is considered to count as an impact, and is accounted for accordingly. In this regard, an additional 0.53 ha of retained and managed SSTF will not be recognised by the Commonwealth Offset Calculator, but will nonetheless contribute towards the ecological value of the retained SSTF. Furthermore, the revegetation and regeneration management within the Macarthur Onslow-Mt Gilead BioBank is expected to restore up to 3.28 ha to EPBC condition SSTF. This total to a maximum of 11.43 ha of SSTF being protected in perpetuity, despite only 8.15 ha being able to be used as an offset in accordance with the Commonwealth Offset Policy.</p>
Risk related time horizon (years)	20	<p>Considering that the risk related time horizon value is the number of years that the offset is expected to be in place, the maximum time of 20 years was chosen. This is because the impact consists of removal of the SSTF in perpetuity, with the cleared area to be used for residential development, therefore the risk to the SSTF will remain greater than 20 years.</p>
Time until ecological benefit	10	<p>Conservation gains will be achieved over both the short term and the long term. The majority, as well as the most significant gains are estimated to be made within the first two years of introduced management, in particular the removal of weeds from the offset area. Ecological benefits are expected to continue to be delivered in the form of gradual improvements (i.e. ongoing minor restoration and monitoring) to the biodiversity and condition of the woodlands in perpetuity. Once ecological benefit is realised, the Onsite Conservation Offset will continue to be managed under a full 'maintenance' directed prescription. Refer to section 8.1.4.</p>
Start quality of offset	5	<p>An assessment of site condition and context, taking into account canopy cover, shrub cover, groundcover, weed cover, vegetation connectivity and nearby threats, was undertaken for the SSTF to be impacted. A weighted average out of ten was calculated to provide a quantified score for the current quality of the SSTF to be used as an offset. A score of 4.8 was calculated based on the below scores.</p>

IMPACT CALCULATOR ATTRIBUTE	IMPACT CALCULATOR INPUT	JUSTIFICATION
		<ul style="list-style-type: none"> • canopy cover 2/3 • shrub cover 1/3 • groundcover 1.5/4 • absence of weeds 1 / 3 • vegetation connectivity 70% • absence of nearby threats 50%
Future quality without offset	3	<p>A drop to 2.9 / 10 has been projected for the likely condition of the proposed Onsite Conservation Offset Condition A SSTF in the absence of formal management. Without the conservation management actions there is a high probability that the SSTF will reduce in area and that a reduction in quality would also occur in the form of unmanaged and incidental actions (e.g. weed encroachment, and cattle sheep grazing). A weighted average out of ten was calculated to provide a quantified score for the current quality of the SSTF to be impacted. A score of 2.9 was calculated based on the below scores.</p> <ul style="list-style-type: none"> • canopy cover 1.5/3 • shrub cover 0.5/3 • groundcover 1/4 • absence of weed cover 0 / 3 • vegetation connectivity 40% • absence of nearby threats 40%
Future quality with offset	7	<p>The SSTF in the offset area will be improved through the formalisation of a range of ecological restoration works as part detailed management plans to be completed under the Biobanking Agreement. The offset area will become part of a formally managed and secured conservation area that will follow specific management, mitigation, and monitoring procedures to be conducted in these areas.</p> <p>Weed levels will be kept low across all retained SSTF. Exotic species will be aggressively targeted for removal. All woody weed works will include ongoing maintenance of all emerging weeds to allow natives to establish and consolidate. Once the weed seed bank has been reduced and native grasses are well established they are expected to be able to largely exclude weed germination.</p>

IMPACT CALCULATOR ATTRIBUTE	IMPACT CALCULATOR INPUT	JUSTIFICATION
		<p>All areas are expected to improve according to Biobanking management regimes to meet the predicted benchmarking based on the start quality.</p> <p>A score of 7.2 was calculated based on the below scores.</p> <ul style="list-style-type: none"> • canopy cover 2 / 3 • shrub cover 2 / 3 • groundcover 3 / 4 • absence of weeds 2.5 / 3 • vegetation connectivity 70% • absence of nearby threats 70%
Risk of loss without offset (%)	5	<p>A small risk exists based on the ever-present risk of bushfire within the Australian landscape, however, it is not likely that offset site will be lost without the formalisation of the offset.</p> <p>Furthermore, without the introduction of pest control in the conservation area it is likely that the damaging effects of uncontrolled feral grazing animals on ecosystems will increase the risk of loss to the SSTF community.</p>
Risk of loss with offset (%)	1	<p>The risk of losing the SSTF is effectively <i>Zero</i> given the proponent is bound by the BioBanking Agreement, as well as the proposed Commonwealth approval, to provide management in perpetuity. The proposed Onsite Conservation Offset, once formalised, is to be managed appropriately in terms of maintaining suitable fuel loads and ensuring appropriate fire regimes, as well maintaining appropriate fencing and signage to limit access, removal of weeds, and assisted regeneration.</p>
Raw gain	0.33-4.00	as per EPBC Offsets Calculator
Confidence in result (%)	90	<p>A high degree of confidence in conservation outcomes is achieved through the proponent's track record of environmental responsibility and stewardship, and the security provided by the proposed agreement between the proponent and the Minister of the Environment, as well as the BioBanking Agreement.</p>
Adjusted gain	0.29-3.60	as per EPBC Offsets Calculator

IMPACT CALCULATOR ATTRIBUTE	IMPACT CALCULATOR INPUT	JUSTIFICATION
Net Present Value	1.50	as per EPBC Offsets Calculator
TOTAL % Residual Impact offset	162.21%	Offset Calculator

Table 19: Applicable attributes to the EPBC Act environmental offsets policy for SSTF Category D

IMPACT CALCULATOR ATTRIBUTE	IMPACT CALCULATOR INPUT	JUSTIFICATION
Ecological Community	Shale Sandstone Transition Forest (SSTF) Category D	Field validation of vegetation was conducted by ELA (2013; 2015).
Area of impact (ha)	3.17	The project will result in a direct impact to 3.17 ha of SSTF.
Current quality of community	5	<p>An assessment of site condition and context, taking into account canopy cover, shrub cover, groundcover, weed cover, vegetation connectivity and nearby threats, was undertaken for the SSTF to be impacted. A weighted average out of ten was calculated to provide a quantified score for the current quality of the SSTF to be impacted. A score of 5.2 was calculated based on the below scoring system.</p> <ul style="list-style-type: none"> • canopy cover 2/3 • shrub cover 2/3 • groundcover 3/4 • absence of weeds 1/3 • vegetation connectivity 20% • absence of nearby threats 50%
Total Quantum of Impact (ha)	1.59	as per EPBC Offsets Calculator 2012
OFFSET CALCULATOR ATTRIBUTE	OFFSET CALCULATOR INPUT (PROPOSED OFFSET- ONSITE)	JUSTIFICATION
Proposed offset	2.07 ha of Category D SSTF within the Onsite Conservation Offset	To compensate for residual impacts to the species as a result of the project, an offsets package has been developed to conserve and enhance the total Onsite Conservation Offset which includes 2.07 ha of Category D SSTF within a central Council Reserve. The Onsite Conservation Offset will be secured in perpetuity and will be appropriately managed under a VPA to ensure that a conservation outcome is achieved for SSTF.

IMPACT CALCULATOR ATTRIBUTE	IMPACT CALCULATOR INPUT	JUSTIFICATION
		An additional 1.21 ha of SSTF is to be retained within the site, between the interface of the proposed development and the conserved SSTF. This is counted as providing a buffer, as required by DotEE, and therefore is considered to count as an impact, and is accounted for accordingly. In this regard, an additional 1.21 ha of retained and managed SSTF will not be recognised by the Commonwealth Offset Calculator, but will nonetheless contribute towards the ecological value of the retained SSTF.
Risk related time horizon (years)	20	Considering that the risk related time horizon value is the number of years that the offset is expected to be in place, the maximum time of 20 years was chosen. This is because the impact consists of removal of the SSTF in perpetuity, with the cleared area to be used for residential development, therefore the risk to the SSTF will remain greater than 20 years.
Time until ecological benefit	10	Conservation gains will be achieved over both the short term and the long term. The majority, as well as the most significant gains are estimated to be made within the first two years of introduced management, in particular the removal of weeds from the offset area. Ecological benefits are expected to continue to be delivered in the form of gradual improvements (i.e. ongoing minor restoration and monitoring) to the biodiversity and condition of the woodlands in perpetuity. Once ecological benefit is realised, the Onsite Conservation Offset will continue to be managed under a full 'maintenance' directed prescription. Refer to section 8.1.4.
Start quality of offset	5	<p>An assessment of site condition and context, taking into account canopy cover, shrub cover, groundcover, weed cover, vegetation connectivity and nearby threats, was undertaken for the SSTF to be impacted. A weighted average out of ten was calculated to provide a quantified score for the current quality of the SSTF to be impacted. A score of 5.2 was calculated based on the below scores.</p> <ul style="list-style-type: none"> • canopy cover 2/3 • shrub cover 2/3 • groundcover 3/4 • absence of weeds 1 /3 • vegetation connectivity 20% • absence of nearby threats 40%

IMPACT CALCULATOR ATTRIBUTE	IMPACT CALCULATOR INPUT	JUSTIFICATION
Future quality without offset	3	<p>A drop to 1.9 / 10 has been projected for the likely condition of the proposed Onsite Conservation Offset SSTF in the absence of formal management. Without the conservation management actions there is a high probability that the SSTF will reduce in area and that a reduction in quality would also occur in the form of unmanaged and incidental actions (e.g. weed encroachment, and cattle sheep grazing). A weighted average out of ten was calculated to provide a quantified score for the current quality of the SSTF to be impacted. A score of 3.3 was calculated based on the below scores.</p> <ul style="list-style-type: none"> • canopy cover 1.5/3 • shrub cover 1/3 • groundcover 1.5/4 • absence of weeds 0.5/3 • vegetation connectivity 20% • absence of nearby threats 40%
Future quality with offset	7	<p>The SSTF in the offset area will be improved through the formalisation of a range of ecological restoration works as part detailed management plans to be completed under the VPA and creation of a Council Reserve. The offset area will become part of a formally managed and secured conservation area that will follow specific management, mitigation, and monitoring procedures to be conducted in these areas.</p> <p>Weed levels will be kept low across all retained SSTF. Exotic species will be aggressively targeted for removal. All woody weed works will include ongoing maintenance of all emerging weeds to allow natives to establish and consolidate. Once the weed seed bank has been reduced and native grasses are well established they are expected to be able to largely exclude weed germination.</p> <p>All areas are expected to improve according to Biobanking management regimes to meet the predicted benchmarking based on the start quality.</p> <p>A score of 7.1 was calculated based on the below scores.</p> <ul style="list-style-type: none"> • canopy cover 2.5 / 3 • shrub cover 2.5 / 3 • groundcover 3 / 4

IMPACT CALCULATOR ATTRIBUTE	IMPACT CALCULATOR INPUT	JUSTIFICATION
		<ul style="list-style-type: none"> • absence of weeds 2.5 / 3 • vegetation connectivity 30% • absence of nearby threats 70%
Risk of loss without offset (%)	5	<p>A small risk exists based on the ever-present risk of bushfire within the Australian landscape, however, it is not likely that offset site will be lost without the formalisation of the offset.</p> <p>Furthermore, without the introduction of pest control in the conservation area it is likely that the damaging effects of uncontrolled feral grazing animals on ecosystems will increase the risk of loss to the SSTF community.</p>
Risk of loss with offset (%)	1	<p>The risk of losing the SSTF is effectively <i>Zero</i> given the proponent is bound by the VPA, as well as the proposed Commonwealth approval, to provide management in perpetuity. The proposed Onsite Conservation Offset, once formalised, is to be managed appropriately in terms of maintaining suitable fuel loads and ensuring appropriate fire regimes, as well maintaining appropriate fencing and signage to limit access, removal of weeds, and assisted regeneration.</p>
Raw gain	0.07-4.00	as per EPBC Offsets Calculator
Confidence in result (%)	90	<p>A high degree of confidence in conservation outcomes is achieved through the proponent's track record of environmental responsibility and stewardship, and the security provided by the proposed agreement between the proponent and the Minister of the Environment, as well as the.</p>
Adjusted gain	0.07-3.60	as per EPBC Offsets Calculator
Net Present Value	0.38	as per EPBC Offsets Calculator
TOTAL % Residual Impact offset	24.02%	Offset Calculator

8.1.4 Management of the On-site Offsets

The on-site offset /Biobank sites will be improved through a range of ecological restoration works set out in the BioBanking Agreement and its associated management plans, or within a Plan of Management for the Council Reserve. The restoration works will include fencing, removal of weeds, pest animal control, ecological burning and replanting where necessary. The offset sites will follow specific management, mitigation, and monitoring procedures to be conducted in these areas in accordance with a site specific regime.

The sites will be fenced to exclude inappropriate activities such as rubbish dumping, grazing, recreational use and vehicle access. Informative signs will provide information on the use of the sites as offsets for conservation purposes. Other initial management tasks may include weed control and deterrent native vegetation planting adjacent to biobank site boundaries to reduce public access (if appropriate).

As previously discussed, the ongoing management costs to address site maintenance (weed control, feral animal control, trail maintenance, APZ maintenance, rubbish removal and ecological burns) as well as monitoring (vegetation condition, feral animal abundance, weed prevalence etc) will be permanently funded through the biobank agreements and secured funding for implementation of the Plans of Management.

The major ongoing management issue will be the management and control of invasive weed species.

8.1.5 Time to achieve conservation gain

Conservation gains will be achieved over both the short term and the long term (**Table 20**). The most significant gains are estimated to be made within the first five years of introduced management within all of the Onsite Offsets for SSTF, however, our offset calculations have allowed for a 10 year period to reach the estimated future conditions scores.

Table 20: Timing of the conservation gains within the Onsite Conservation Area

Timing	Conservation Gain
Short Term (within 5 years)	Grazing managed/removed where needed
	Fencing, exclusion zones and signage established
	Weeds reduced to maintenance levels across 90% of site by end year 5.
	Revegetation management (tree, shrub, and ground cover planting and seeding)
	Increased species diversity, biomass, and resources
	Decreased native species competition with weeds for light and space
	Decreased risk of loss of SSTF community
	Improved surface hydrology
	Increased community awareness of the significance of SSTF conservation
Long Term (>5 years)	In perpetuity funding, management and security
	Increase in SSTF in the conservation area through gradual regrowth
	Weeds reduced to less than 10% cover across site by end year 9 and ongoing
	Maintenance of suitable fire regimes

Ecological benefits are expected to continue to be delivered in the form of gradual improvements (i.e. ongoing minor restoration and monitoring) to the biodiversity and condition of the woodlands in perpetuity. Once ecological benefit is realised, the Onsite Conservation Offset will continue to be managed under a full 'maintenance' directed prescription.

8.1.6 Level of certainty of conservation gain

Offsets that involve the restoration or regeneration of vegetation communities are subject to uncertainty in terms of the gains that can be achieved (Gibbons and Lindenmayer, 2007). However, when consideration is given to the likelihood of degradation to the site offset area under an unchanged land-use or lack of management regime (i.e. caused by gradual weed proliferation, uncontrolled grazing, and feral animals) it is clear that at a minimum, the introduction of funded management in perpetuity will have some level of conservation gain. To increase the gain, the management prescription for the Onsite Conservation Offset is based on the 'best practice' assisted regeneration as advocated by DECC (2005). This management prescription is based on tested conservation techniques with high levels of certainty DECC (2005).

Key to achieving a conservation gain for threatened vegetation communities is the management of woody weed species and invasion by exotic grasses. This will ensure that the threatened vegetation is not outcompeted by noxious species. Management of woody weed species has been shown to be highly effective and there is a high degree of certainty around the outcome of the management action when coupled with appropriate follow-up maintenance and on-going monitoring with revisions to management on a regular and as required basis.

Assisted regeneration is most successful when continued for long periods of time, often over ten years. Due to the bind resulting from incorporating the conservation area into the BioBanking Agreements and positive covenants under the LG Act, as backed by the VPA, the proponent enters an agreement with the State and Federal agencies to "maintain and improve" the condition of the onsite offsets in perpetuity. Because this agreement is perpetual it is certain that adequate management of all MNES and their habitat will be provided by the proponent, otherwise it will be enforced by the governing bodies.

Additionally, the onsite offsets will be monitored and subject to adaptive management to ensure that predicted gains translate into actual gains and that the actions applied continue to be fit for the purpose of achieving the desired outcomes.

8.1.7 Funding

The offset site will be fully funded by the allocation of \$747,800 (Macarthur Onslow Biobank site with SSTF) providing around \$40-\$50,000 per annum to manage the site in perpetuity. These funds will be held in a Government Trust Account (the BioBanking Trust Fund) and be subject to annual monitoring and reporting of the implementation of management actions administered by the OEH. The area will protect and restore:

- 8.15 ha of SSTF (currently meeting EPBC Act condition criteria)
- 3.28 ha of land to be restored and revegetated to SSTF

The management of the offset area includes removal of domestic animal grazing, access control, weed and feral animal control, ecological burns, supplementary planting of characteristic species where natural regeneration is inadequate and will improve the condition of the vegetation, so that EPBC Act condition criteria for degraded areas of SSTF will be met within an estimated 5-10 year period.

8.2 Off-site Offset

Off-site offsets will be used for the unavoidable impacts to MNES within from the proposed action that could not be accounted for within the onsite offset areas. A deficit of 75.98% for percent of SSTF (Category D) remains after all onsite conservation areas have been accounted for, as summarised in **Table 21**. These remaining offset requirements have been calculated using the EPBC Act Offset Calculator. Similar to the onsite offset sections above, this approach ensures that the project will provide positive ecological outcomes and comply with all relevant Commonwealth policy legislation.

Table 21: Offset liabilities, availabilities, surplus and deficits

Condition	Impact total (ha)	Offsets onsite (ha)	Percent of impact offset (%)	Deficit (%)
Category D – high	3.17	2.07	24.02	75.98
Category A – moderate	2.31	8.15	162.21	0 (+162.21)

It is proposed that the remaining required 75.98% of offsets for Category D SSTF is secured from an off-site BioBank, herein referred to as Fern Hill Central West BioBank (Appendix J). This will immediately offset the impact of clearing SSTF as Mount Gilead.

It is noted that a surplus of Category A SSTF is being offset from the on-site measures, going beyond the requirements of the Offsets Policy.

8.2.1 Off-site Offsets summary

The Fernhill Central West BioBank (Appendix J) site provides 6.5 ha of SSTF that is in EPBC Act condition Category D, which will be retained and managed within the overall Biobank to account for the SSTF required offsets. Key features of the (proposed) Fernhill Central West BioBank site are:

- it is located in the suburb of Mulgoa, forming part of the Penrith LGA.
- the site is approximately 40 km to the north of Mount Gilead (**Figure 22**).
- the BioBank total site area is 147.3 ha in size, of which 6.5 ha of SSTF will be used as an offset for this project
- lot 10 DP 615085 (**Figure 23**)
- intact vegetation on the Fernhill Central West BioBank site relative to the proposed offsets is mapped as Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest, which is assessed as meeting the EPBC Act criteria for Condition D SSTF (**Figure 24**)

The following sub-sections of the report provide site attribute information to provide adequate detail for assessment using the EPBC Act Offsets Calculator and Offsets Policy. The following only applies to the SSTF vegetation, and not the other vegetation communities within Fernhill Central West. The information used has been taken from the Fernhill Central West BioBank Assessment (GHD 2016) (Appendix J).

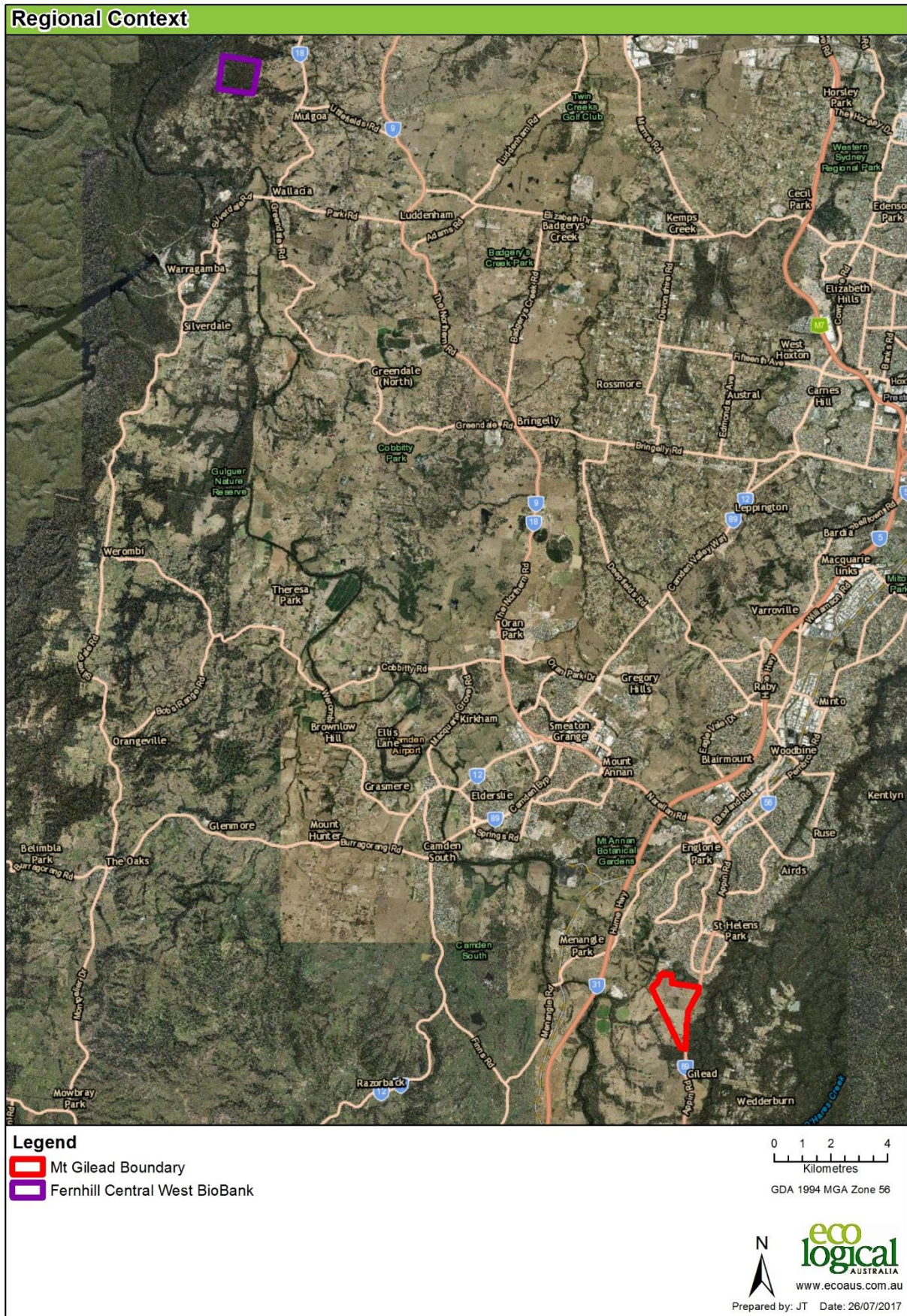


Figure 22: Fernhill Central West BioBank in relation to Mount Gilead

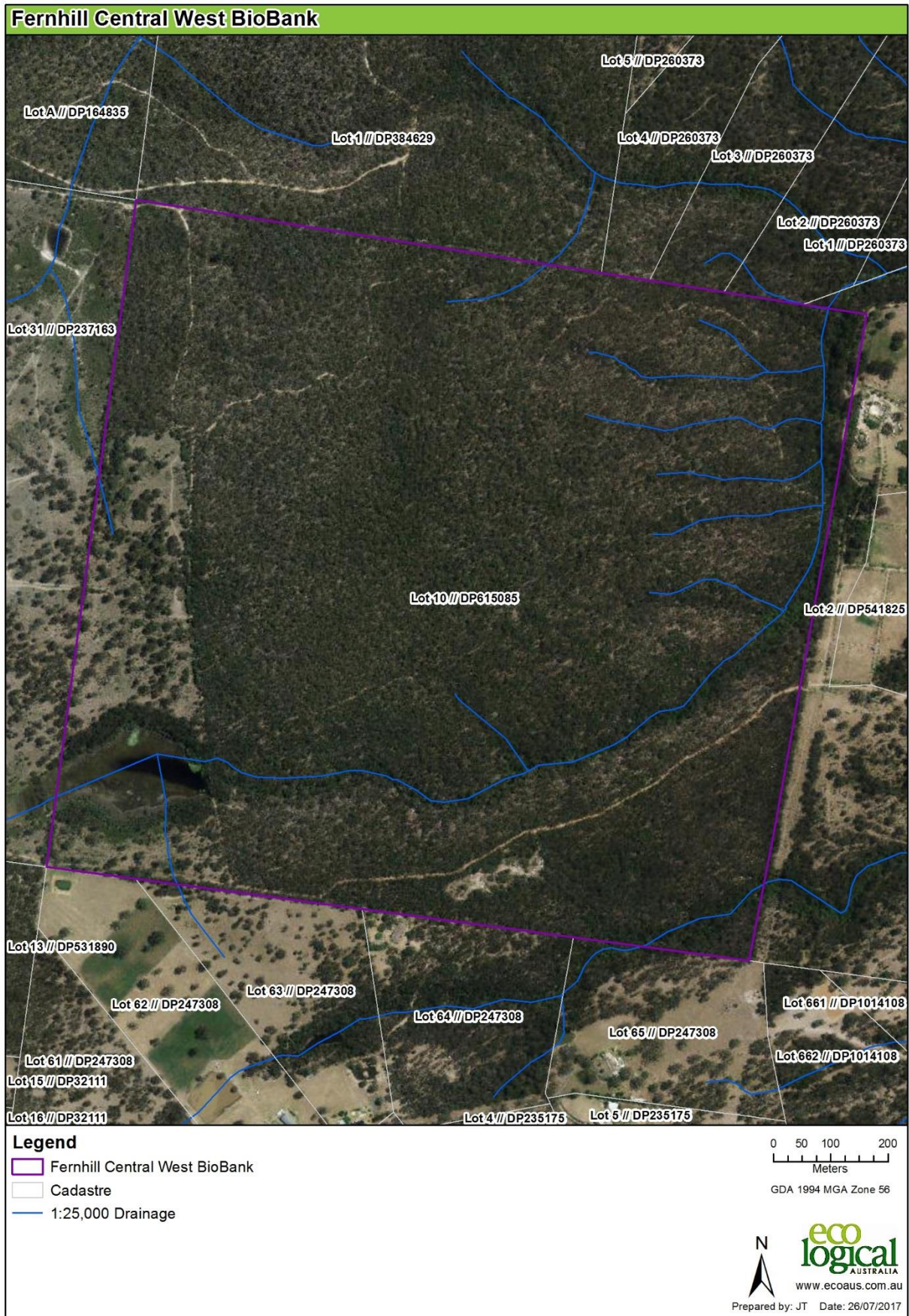


Figure 23: Fernhill Central West BioBank Site

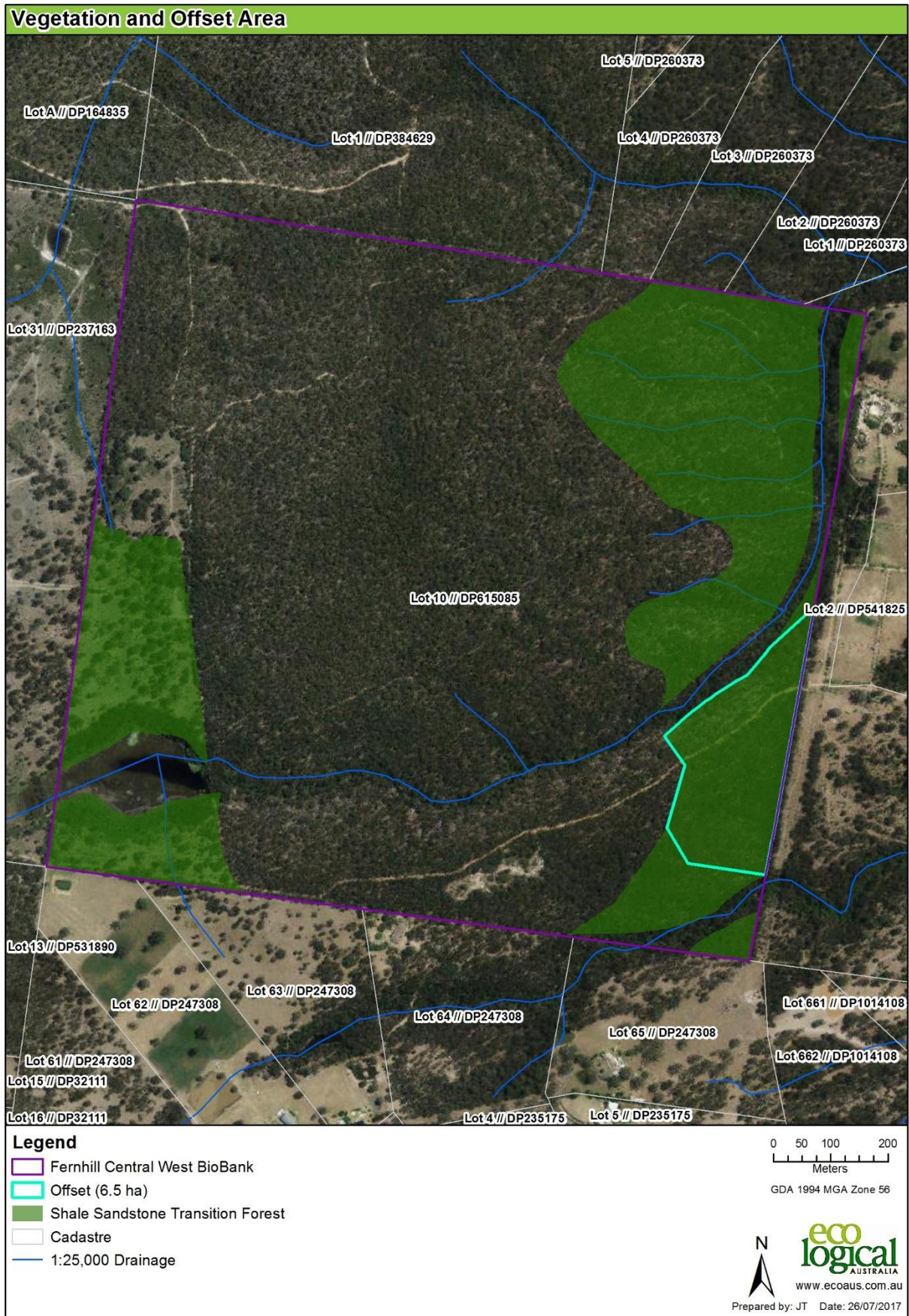


Figure 24: Validated vegetation and proposed area of offset

8.2.2 Diversity and structure of SSTF

The eastern portion of the BioBank site features mid-slopes with shale-influenced soils above lithic sandstone substrate. Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest occupies the majority of this area. This vegetation type is an occurrence of SSTF. These areas feature a shrubby understorey, reflecting a higher sandstone influence. The south-western also supports SSTF, but on gentler slopes and flats. These areas feature a grassy understorey, probably reflecting higher shale influence.

The SSTF at the biobank consists of an open forest structure with a canopy ranging up to approximately 25 m in height, dominated by Narrow-leaved Ironbark (*Eucalyptus crebra*), Broad-leaved Ironbark (*E. fibrosa*), Grey Gum (*E. punctata*), Narrow-leaved Stringybark (*E. eugenioides*) and Yellow Bloodwood (*Corymbia eximia*). There is moderately dense mid-storey containing Box-leaved Wattle (*Acacia buxifolia*), Thin-leaved Geebung (*Persoonia linearis*) and Dwarf Cherry (*Exocarpos strictus*) and scattered patches of Lantana. The groundcover is dominated by grasses and herbs at lower elevations in the south-western portions of the biobank and by shrubs in the centre and east. Patches with shrubbier understory probably reflect higher sandstone influence. Shrub species include Prickly Shaggy Pea (*Podolobium ilicifolium*), Large-leaf Hop-bush (*Dodonaea triquetra*), and Gorse Bitter Pea (*Daviesia ulicifolia*). Native grasses include Purple Wiregrass (*Aristida ramosa*), Bushy Hedgehog-grass (*Echinopogon caespitosus*), Two-colour Panic (*Panicum simile*) and Wiry Panic (*Entolasia stricta*). Characteristic herb and forbs include Burr-daisy (*Calotis dentex*), Many Flowered Mat Rush (*Lomandra multiflora*), *Glycine clandestina*, and *Phyllanthus hirtellus*.

Exotic species are occasionally present within the community and include noxious and environmental weeds such as Lantana, Cobbler's Pegs (*Bidens pilosa*) and Whiskey Grass (*Andropogon virginicus*).

8.2.3 Vegetation condition

The SSTF at the biobank is in a high moderate/good condition. Similar to the impact site, the majority of the 41.4 ha of SSTF at Fernhill Central West is considered at least somewhat disturbed due to the history of site usage of clearance/logging for grazing. Much of the site has been at least partially cleared and thinned historically. Canopy vegetation has since re-established across the majority of the BioBank. There are mature hollow-bearing trees in moderate densities throughout the BioBank.

There are a number of small, informal, dirt tracks that have been included in surrounding vegetation types because they do not comprise gap in over storey vegetation and they contain partial cover of native understorey vegetation.

There are occasional patches of noxious weeds such as Lantana (*Lantana camara*) and Blackberry (*Rubus fruticosus* spp. agg.). These weeds are most prevalent: on sheltered slopes and drainage lines; in the west; and where the BioBank adjoins an electricity easement in the east. The majority of the BioBank has very little exotic cover and features only very occasional wind borne exotic herbs.

Much of the site has been grazed, and canopy vegetation is likely to have been at least partially cleared or thinned historically. Canopy vegetation has since re-established across the majority of the BioBank. There are mature hollow-bearing trees in moderate densities throughout the BioBank.

BioBanking habitat attribute data from plot/transects confirms that this vegetation is largely intact and in good condition, with benchmark values for native plant species richness and vegetation cover, at least one hollow bearing tree and some fallen logs in each plot sampled. Exotic plant cover varied from nil to slight infestation (0 to 7% cover). There were moderate to high densities of leaf litter present throughout this vegetation type. All canopy species present in the vegetation type were observed regenerating.

This vegetation type has moderate potential for achieving gains in biodiversity values through management within a BioBank site. Improvements in biodiversity value could be obtained through continuing development of vegetation structure and habitat resources, removal of exotic plants, exclusion of grazing and associated impacts and management of pest fauna.

To ensure consistency with the method used to assign a condition score for the SSTF impact site at Mt Gilead, an individual quality score has been calculated for the total 6.5 ha of SSTF through the same calculations as used in section 5.8.5. This is based on a weighted average of the following:

- a score out of 3 for canopy cover
- a score out of 3 for shrub cover
- a score out of 4 for groundcover
- a negative score out of 3 for weed cover
- a multiplier score out of 100% for vegetation connectivity
- a multiplier score out of 100% for nearby threats

The inputs used for the SSTF to be impacted are detailed in **Table 22**. The score allocations for the canopy, shrub, ground and weed cover have all been inferred from the biobank results which are based on comprehensive site gathered data (GHD 2016; Appendix J). The score allocations for vegetation connectivity and nearby threats have been determined through the details in the below Section 8.2.4.

The scoring system resulted in a current condition of **6/10**. This is the value proposed for use in the EPBC offset calculator. The offset calculator input values are provided in **Table 23** and detail that the proposed 6.5 ha of SSTF from Fernhill Central West BioBank will provide over the required 75.75%.

Table 22: Current and future qualities of SSTF offsite offset

Parameter	Current Score	Future Score Without Management	Future Score With Management
Canopy cover	1.5 / 3	1.5 / 3	2.5 / 3
Shrub cover	2 / 3	1 / 3	2.5 / 3
Groundcover	2 / 4	1.5 / 4	3 / 4
Absence of weed cover	2 / 3	0.5 / 3	2.5 / 3
Vegetation connectivity	70%	60%	80%
Absence of nearby threats	60%	40%	70%
Score	6.1 / 10	4.0 / 10	7.9 / 10

8.2.4 Regional Significance

Whilst only a small proportion of the larger proposed BioBanking site at Fernhill Central West is provided as an offset for the Mt Gilead proposal under the EPBC Act, the site is noted to have approximately >40 ha of intact native vegetation, a large portion of which is threatened ecological communities, either at the 'critically endangered' or 'endangered' status under the NSW TSC Act and/or the EPBC Act, and has a very high degree of connectivity to the west past the Nepean River.

Within this regional context, Fernhill Central West is likely to facilitate the movement of more mobile species, such as birds and bats, as well as less mobile species (e.g. ground dwelling species) with strong connectivity to the west, beyond the Nepean into over 500 ha of densely forested parkland of the Blue Mountains National Park. This is in contrast to the SSTF remnants marked for development at Mount Gilead, which have a number of extensive barriers that, mostly due to historic clearance and fragmentation, limit their potential to allow for movement of less mobile species through the landscape. In this context, the Fernhill Central West BioBank site was afforded at score of 70% for vegetation connectivity for the quality scoring system in **Table 22**.

The biobank is currently partly zoned E2 Environmental Conservation (**Figure 25**) under the *Penrith City Council Local Environment Plan 2010*. The property is bounded by Fernhill Central West BioBank site to the west and by the Blue Mountains National Park further west. It is bounded to the south and east by rural residential land and the Fernhill Estate by the development precincts. The biobank site is approximately 800 m to the east of the Nepean River and lies approximately 10 km south of Penrith town centre.

The proposed offset, totalling 6.5 ha in area will result in a contribution of 0.065% of the remaining extent of SSTF left on the Cumberland Plain (9,950 ha) managed and conserved in perpetuity.

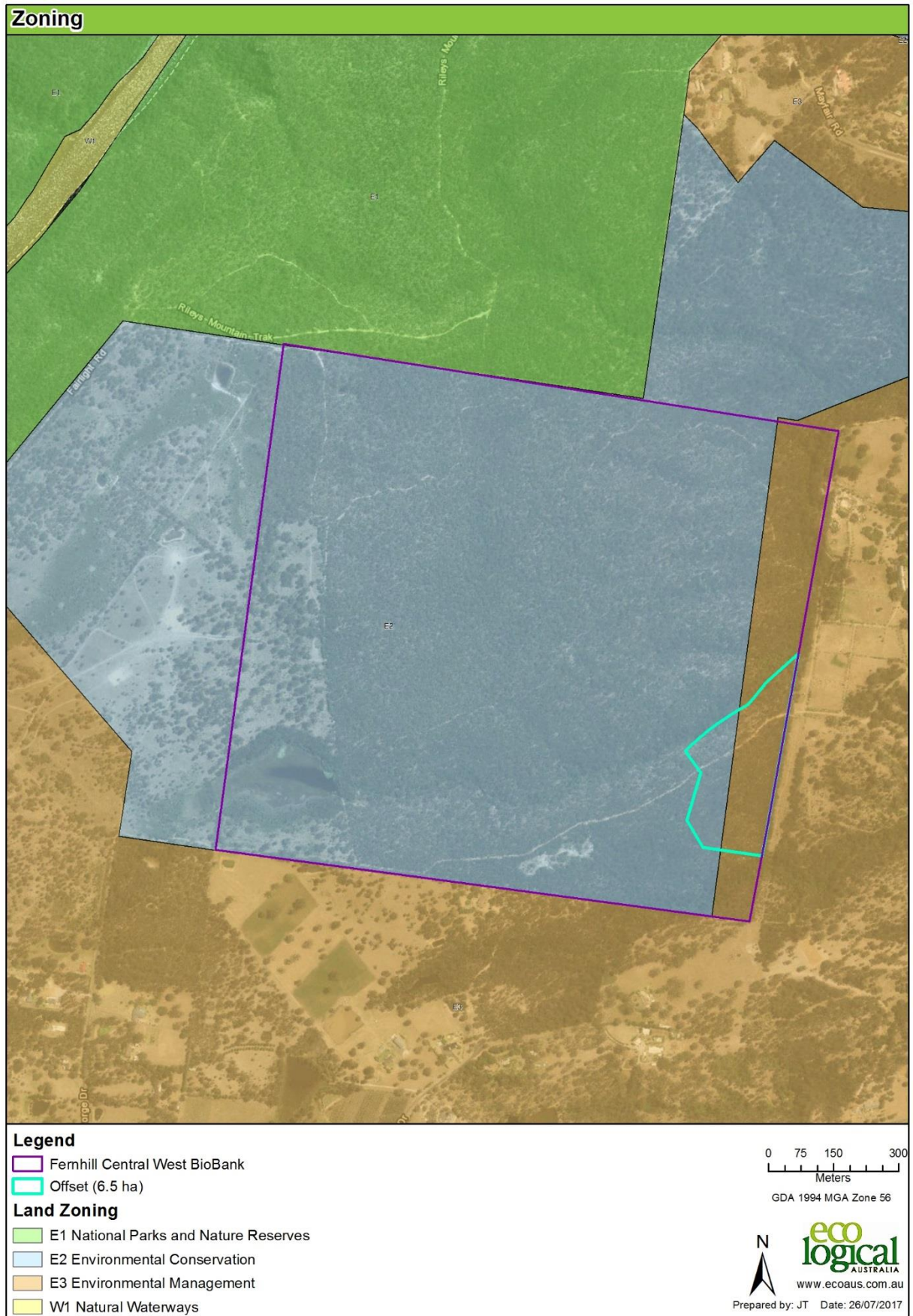


Figure 25: Zoning surrounding Fernhill Central West

Table 23: Applicable attributes to the EPBC Act environmental offsets policy for SSTF Category D

IMPACT CALCULATOR ATTRIBUTE	IMPACT CALCULATOR INPUT	JUSTIFICATION
Ecological Community	Shale Sandstone Transition Forest (SSTF) Category D	Field validation of vegetation was conducted by ELA (2013; 2015).
Area of impact (ha)	3.17	The project will result in a direct impact to 3.18 ha of SSTF.
Current quality of community	5	<p>An assessment of site condition and context, taking into account canopy cover, shrub cover, groundcover, weed cover, vegetation connectivity and nearby threats, was undertaken for the SSTF to be impacted. A weighted average out of ten was calculated to provide a quantified score for the current quality of the SSTF to be impacted. A score of 5.2 was calculated based on the below scoring system.</p> <ul style="list-style-type: none"> • canopy cover 2/3 • shrub cover 2/3 • groundcover 3/4 • absence of weeds 1/3 • vegetation connectivity 20% • absence of nearby threats 50%
Total Quantum of Impact (ha)	1.59	as per EPBC Offsets Calculator 2012
OFFSET CALCULATOR ATTRIBUTE	OFFSET CALCULATOR INPUT (PROPOSED OFFSET- FERNHILL CENTRAL WEST BIOBANK)	JUSTIFICATION
Proposed offset	6.5 ha of SSTF within the Fernhill Central West Biobank	To compensate for the remaining 75.98% of impacts to the Condition D SSTF impacted at Mt Gilead, an offsite offset will be used. The offsite offset, Fernhill Central West Biobank, will be used to retire 6.5 ha of good condition SSTF.

IMPACT CALCULATOR ATTRIBUTE	IMPACT CALCULATOR INPUT	JUSTIFICATION
Risk related time horizon (years)	20	Considering that the risk related time horizon value is the number of years that the offset is expected to be in place, the maximum time of 20 years was chosen. This is because the impact consists of removal of the SSTF in perpetuity, with the cleared area to be used for residential development, therefore the risk to the SSTF will remain greater than 20 years.
Time until ecological benefit	10	The vegetation has moderate potential for achieving gains in biodiversity values through management prescriptions within the BioBank Agreement. Improvements are considered achievable in the short to medium term through continuing development of vegetation structure and habitat resources, removal of exotic plants, exclusion of grazing and associated impacts and management of pest fauna. These are all management prescriptions which will provide ecological benefit within 10 years.
Start quality of offset	6	<p>An assessment of site condition and context, taking into account canopy cover, shrub cover, groundcover, weed cover, vegetation connectivity and nearby threats, was undertaken for the SSTF to be impacted. A weighted average out of ten was calculated to provide a quantified score for the current quality of the SSTF to be impacted. A score of 6.1 was calculated based on the below scores. This is consistent with the assessment of the area within the BioBanking Assessment (GHD 2016) which defined the proposed offset as 'moderate/good'. See section 8.2.3 above for further analysis of the vegetation condition.</p> <ul style="list-style-type: none"> • canopy cover 1.5/3 • shrub cover 2/3 • groundcover 2/4 • absence of weeds 2/3 • vegetation connectivity 70% • absence of nearby threats 60%
Future quality without offset	4	A drop to 4.0 / 10 has been projected for the likely condition of the proposed offsite offset of SSTF in the absence of formal management. Without the conservation management actions there is a high probability that the SSTF will reduce in area and that a reduction in quality would also occur in the form of unmanaged and incidental actions (e.g. weed encroachment, and cattle sheep grazing). A weighted average out of ten was calculated to provide a quantified score for the current quality of the SSTF to be impacted. A score of 4.0 was calculated based on the below scores.

IMPACT CALCULATOR ATTRIBUTE	IMPACT CALCULATOR INPUT	JUSTIFICATION
		<ul style="list-style-type: none"> • canopy cover 1.5/3 • shrub cover 1/3 • groundcover 1.5/4 • absence of weeds 0.5/3 • vegetation connectivity 60% • absence of nearby threats 40%
Future quality with offset	8	<p>The SSTF in the offset area will be improved through the formalisation of a range of ecological restoration works as part detailed management plans to be completed under the BioBank Agreement. The offset area is part of a formally managed and secured conservation area that will follow specific management, mitigation, and monitoring procedures to be conducted in these areas.</p> <p>Weed levels will be kept low across all retained SSTF. Exotic species will be aggressively targeted for removal. All woody weed works will include ongoing maintenance of all emerging weeds to allow natives to establish and consolidate. Once the weed seed bank has been reduced and native grasses are well established they are expected to be able to largely exclude weed germination.</p> <p>All areas are expected to improve according to Biobanking management regimes to meet the predicted benchmarking based on the start quality.</p> <p>A score of 7.9 was calculated based on the below scores.</p> <ul style="list-style-type: none"> • canopy cover 2.5 / 3 • shrub cover 2.5 / 3 • groundcover 3 / 4 • absence of weeds 2.5 / 3 • vegetation connectivity 80% • absence of nearby threats 70%
Risk of loss without offset (%)	5	<p>A small risk exists based on the ever-present risk of bushfire within the Australian landscape, however, it is not likely that offset site will be lost without the formalisation of the offset.</p>

IMPACT CALCULATOR ATTRIBUTE	IMPACT CALCULATOR INPUT	JUSTIFICATION
		Furthermore, without the introduction of pest control in the conservation area it is likely that the damaging effects of uncontrolled feral grazing animals on ecosystems will increase the risk of loss to the SSTF community.
Risk of loss with offset (%)	1	The risk of losing the SSTF is effectively <i>Zero</i> given the offset is bound by a BioBanking Agreement, as well as the proposed Commonwealth approval, to provide management in perpetuity. The proposed Onsite Conservation Offset is to be managed appropriately in terms of maintaining suitable fuel loads and ensuring appropriate fire regimes, as well maintaining appropriate fencing and signage to limit access, removal of weeds, and assisted regeneration.
Raw gain	0.26-4.00	as per EPBC Offsets Calculator
Confidence in result (%)	90	A high degree of confidence in conservation outcomes is achieved through the proponent's track record of environmental responsibility and stewardship, and the security provided by the proposed agreement between the proponent and the Minister of the Environment, as well as the.
Adjusted gain	0.23-3.60	as per EPBC Offsets Calculator
Net Present Value	1.21	as per EPBC Offsets Calculator
TOTAL % Residual Impact offset	76.05	Offset Calculator

8.2.5 Time to achieve conservation gain

The SSTF community at the Fernhill Central West BioBank is likely to achieve considerable ecological benefits following approval and continued management. Accordingly, the time until ecological benefit is effectively within the first year following the introduction of management. Ecological benefits are expected to continue to be delivered in the form of gradual improvements (i.e. ongoing minor restoration and monitoring) to the biodiversity and condition of the woodlands in perpetuity. Based on assessments conducted for the BBAM and current monitoring and results achieved by ELA bush regeneration staff at Harrington Grove, it is believed full ecological benefit will be achieved in a maximum of 10 years from the granting of Mount Gilead approval. Once full ecological benefit is realised, the Biobank site will continue to be managed under a full 'maintenance' directed prescription.

8.2.6 Tenure

The Fernhill Central West property proposed for use as an offset is currently under ownership of Angas Securities.

8.2.7 Management of the offset area

Offset areas proposed to compensate for the development at Mount Gilead will be managed according to the following principles, strongly influenced by the OEH Biobanking management actions. The OEH Biobanking management actions will be enforced as a bind resulting from the Biobanking of Fernhill Central West.

The management practices introduced at the biobank will result in reaching the predicted future quality score of at least 8/10 within 10 years.

8.2.8 Management of grazing for conservation

In certain areas, such as those with a high relative weed cover, grazing can contribute to controlling exotic grasses and in doing so, promote native plants. Using cattle grazing for conservation must be conducted under a controlled regime, if at all.

Stock must not be permitted to graze in any area of the biobank sites when there is less than 60% of living ground cover, except to improve biodiversity values. During May, August and November there should not be stocking of more than 60 cattle and no less than 40 cattle on the biobank site for no more than 1 consecutive weeks in any 12 month period. Stock must not be permitted to be present on the biobank site in areas where recent replanting has occurred. If, at any time, the landowner observes stock in any area of the biobank site, other than an area on the biobank site where grazing is permitted, the landowner must take necessary measures to remove the stock from the area immediately. Based on the experience of a similar landscape at Harrington Park, which is located 5 km of the site, grazing management is able to play an important role in controlling weeds, such as African Olive, infestations within pasture lands.

Specifically, Fernhill Central West has areas of SSTF at with varying degrees of weed infestation that may benefit from grazing. However, there are also areas which have been subjected to grazing by domestic animals in the past, which has resulted in a heavily disturbed understory in some areas. A management plan containing site specific management prescriptions, such as areas suitable for grazing, has been prepared through establishment of the Fernhill Central West BioBank.

8.2.9 Management of fire for conservation

Fires must not be lit on the biobank site other than for the purpose of ecological burning in accordance with a fire management plan or as permitted as a permissible human activity on the biobank site.

8.2.10 Management of human disturbance

Human activities that adversely affect biodiversity values on the biobank site (including horse riding, cycling, and vehicle access [excluding for the purposes of undertaking management actions]) must not be carried out, or caused or permitted to be carried out, on the biobank site. All waste (e.g. remained plastics from planting) must be removed from the biobank site in an appropriate manner. The landowner must not store, dispose of, or cause or permit to be disposed of, any waste on the biobank site. The landowner must take all reasonable steps to remove waste deposited by others on the biobank site, or which is otherwise present on the biobank site.

Stock proof fencing and signage must be installed and maintained to deter human disturbance including waste dumping. Signage must include the words: "This biobank site is managed for biodiversity conservation".

8.2.11 Retention and regrowth and remnant native vegetation

Native vegetation (whether remnant native vegetation or regrowth) on the biobank site must not be cut down, felled, thinned, logged, killed, destroyed, poisoned, ringbarked, uprooted, burnt or otherwise removed except in accordance with relevant and approved management plans.

Native vegetation on the biobank site may be managed to improve biodiversity values by thinning to benchmark stem densities over no more than 80% of each management zone. A benchmark stem density has the same meaning as defined in the Vegetation Benchmark Database as published by OEH and updated from time to time. An approval under the *Native Vegetation Act 2003* may be required to carry out thinning or any other removal or damage to native vegetation under this item.

8.2.12 Weed control

The landowner must perform the methods of weed control and other weed management activities and monitoring in the weed management plan by the methods for all weeds.

8.2.13 Replanting or supplementary planting where natural regeneration will not be sufficient

The landowner must undertake planting or seeding of the native groundcover/shrub/tree species indicated in the planting schedule for the biobank site in the areas of planting and within the timeframe indicated in the planting schedule. If the landowner cannot complete the planting within the timeframe indicated in the planting schedule due to local weather conditions, the landowner must complete the planting as soon as possible after that date and must make a record of and retain the reasons why the planting was not completed by the required time. Appropriate site treatment (e.g. weed control) of each area of planting or seeding identified in the planting schedule must be undertaken prior to such planting.

Areas of planting or seeding as set out in the planting schedule must be protected from grazing for the first 4 years after planting or seeding or until the plants exceed 200 cm in height to ensure that the plants are established to such an extent that biodiversity values will be improved by such grazing and the plants will not be adversely impacted by grazing.

Areas of planting and seeding must be managed as required to assist the establishment and survival of native plant species. Management includes watering, slashing, scalping, spraying of weeds, plant replacement and strategic grazing by stock at strategic times of the year to control weeds to improve biodiversity values. The dates of planting must be recorded in accordance with the record keeping requirements.

Seeds and plants used for planting and seeding must be obtained from locally collected provenances, unless there are reasons to do otherwise (e.g. to ensure genetic variability or for adaptation to climate change).

8.2.14 Retention of dead timber

Dead timber (whether standing or fallen and including branches and leaf litter) must not be removed from or moved within the biobank site except for the personal (non-commercial) use by the landowner for firewood for one dwelling only or for repair of fencing (not for construction of fencing).

Dead timber used for fencing repair must be documented by the landowner in writing and records must be kept in accordance with the record keeping requirements. The landowner must record the approximate amount of dead timber collected from the biobank site for use in fencing, the location that that dead timber was collected from and the date it was collected (month, year).

Timber from outside the biobank site may be introduced to and placed on the biobank site to improve biodiversity values. Timber brought from outside the biobank site must be documented by the landowner in writing and records must be kept in accordance with the record keeping requirements. The landowner must record the approximate amount of timber brought from outside the biobank site, the location where the timber was placed on the biobank site and the date on which it was placed (month, year).

8.2.15 Erosion control

All reasonable steps must be undertaken to prevent, control and remedy erosion on the biobank site. Soil management for preventing and controlling erosion is to be undertaken using best practice management, such as that developed by the Soil Conservation Service, applied as relevant for the biobank site.

8.2.16 Retention of rocks

The landowner must not remove, or cause or permit to be removed, rocks from the biobank site or move, or cause or permit to be moved, rocks within the biobank site. Rocks from outside the site may be placed on the biobank site to improve habitat for threatened species. The landowner must make and retain records of the location of the rocks placed on the site and the date the rocks were brought onto the site in accordance with the record keeping requirements.

8.2.17 Nutrients

Fertilisers, pesticides and herbicides must not be applied on the biobank site, except where required to undertake the management actions. Use of fertilisers for establishing native vegetation through planting or seeding, use of herbicides for controlling weeds or use of pesticides for controlling vertebrate pests or feral herbivores can be undertaken in accordance with best practice management when required to undertake the management actions.

9 Monitoring and reporting

9.1 Monitoring

Monitoring is to be undertaken and reported annually in accordance with the BioBanking Agreements to determine the status of the CEEC' within onsite and offsite offset areas to assess the effectiveness of the threat abatement measures and management in place. Photographs will be taken at photo-points at pre-determined locations and in identified directions at the conservation area. This will be undertaken prior to management, within 12 months of the commencement date and then at least every 12 months thereafter. The purpose of the photographs is to show changes over time. Photographs will be taken at approximately the same direction, location, height and time of day (during daylight hours). All photographs will be dated, stating their direction and identified with their locations such that they may be utilised as a performance indicators.

An annual audit of the offset sites will also be undertaken by OEH in accordance with the Biobanking Agreement.

9.2 Measurability and performance measures

Standardised indicators can be very informative for use as performance measures. Baseline data will be gathered once approval has been granted and will use the above standardised indicators. This will coincide with the initial site inspection and monitoring to focus and inform any required targeted weeding. As this is a long term project that will be implemented over a number of years, an adaptive management approach will be implemented that enables the management contractor to learn from and respond to successful and unsuccessful techniques used on the site.

The success of the works will be determined by meeting the performance criteria (**Table 24**).

Table 24: Performance criteria

	Year 1 and 2	Year 3 to 5	Year 6 onwards
Offset site	Identification of weed hotspots and commencement of weed eradication	Woody and herbaceous weeds to be controlled to maintenance levels over 90% of the Biobank site	All weeds reduced to less than 10% cover by year 9 and maintained
	Removal of any identified waste	Maintenance of no waste in conservation area	No establishment of new noxious or woody species
	Commencement of pest fauna eradication – focus on rabbits	Pest fauna having negligible impact on biodiversity values	Maintenance of native cover and diversity and a demonstrated decrease in exotic cover and diversity
	No establishment of new noxious or woody species	No establishment of new noxious or woody species	Maintenance of a site condition score > 7/10
	Maintenance of native cover and diversity and a demonstrated decrease in exotic cover and diversity	Maintenance of native cover and diversity and a demonstrated decrease in exotic cover and diversity	

	A site condition score of 5/10	A site condition score of 6/10	
--	--------------------------------	--------------------------------	--

9.3 Annual report

The offset site owner/s will complete an annual report using the BioBanking annual reporting template. The report will detail all management actions undertaken, any incidents or events that have adversely affected the biodiversity values at the conservation areas, include all required photographs, results of inspections, and results on monitoring performance towards achieving outcomes.

10 Biodiversity Outcome Summary and Conclusion

A key driver of planning and design for development at Mt Gilead has been the delivery of a good conservation outcome for the environment, in particular, MNES. This has followed the hierarchical principles of:

- first, avoid losses and protect biodiversity *in situ*
- second, mitigate impacts to the greatest reasonable extent
- third, offset remaining impacts as a last resort.

Proposed environmental outcomes that will be achieved for Matters of National Environmental Significance (MNES) as a result of the proposed action include the following:

Environmental Outcomes for SSTF including EPBC Offsets

A cumulative total of 11.96 ha of SSTF will be retained on site with the majority to undergo conservation management, regeneration and revegetation to ensure ecological benefits and improvements on the current condition of the EPBC Act condition SSTF, including 10.22 ha of formal SSTF offsets. An additional 3.28 ha of land within the offset areas will undergo assisted regeneration to meet the EPBC Act thresholds. This outcome will be provisioned as follows:

- Retention and management of 10.22 ha of onsite EPBC Act listed SSTF including exclusion fencing in the Macarthur-Onslow-Mount Gilead Offset Site and Council Reserve Offset Site
- Restoration and revegetation of an additional 3.28 ha of land within the Macarthur-Onslow-Mount Gilead BioBank, which in time will be restored to SSTF as recognised under the EPBC Act
- Maintenance and retention of 1.74 ha of SSTF that falls within 30m of the development footprint, which has not been considered as an offset, but will be retained such that the ecological value is not lost
- An additional 6.5 ha of SSTF offsite offsets has been secured and managed in perpetuity within the Fernhill Central West BioBank

Environmental Outcomes for CPW

A cumulative total of 4.63 ha of EPBC Act CPW will be retained onsite, all of which will undergo conservation management, regeneration and revegetation to ensure ecological benefits and improvements on the current condition of the vegetation. This outcome will be provisioned as follows:

- Retention and management of 4.63 ha of on-site EPBC Act listed CPW including exclusion fencing in the Noorumba-Mt Gilead Biobank
- Restoration and revegetation of 1.64 ha of land on-site to CPW in the Noorumba-Mt Gilead Biobank, which in time will be restored to CPW as recognised under the EPBC Act

Potential habitat for the Koala, Swift Parrot, Large-eared Pied Bat and Grey-headed Flying Fox will be managed and protected within the local area in the form of the abovementioned CPW and SSTF

environmental outcomes and an additional 0.44 ha of Alluvial Woodland. The total minimum area of habitat that will contribute to the environmental outcomes for these species is 15.31 ha.

The conservation areas will be improved through a range of ecological restoration works set out in management plans detailed in **Section 7**. A minimum of 21.97 ha will be subject to formal management practices within the three conservation areas - Macarthur-Onslow-Mount Gilead offset site, Noorumba-Mount Gilead offset site and Council Reserve offset site.

BioBanking is the key conservation measure proposed to ensure biodiversity protection and management that will bring about an improved environmental outcome for the site. BioBanking delivers ongoing benefits through active management of BioBank sites through activities such as revegetation, strategic grazing, and control of weeds and feral animals. Under a BioBanking agreement, landholders are committed to improving or maintaining biodiversity values on a site in perpetuity under the TSC Act.

The Council Reserve will be protected under a Natural Area – Bushland Reserve (under the LG Act) to ensure the area is protected in perpetuity, subject to a comprehensive management plan and used only for the purposed of conservation. The final conservation area relevant to the proposed action is the Fernhill Central West Biobank which is also covered by a BioBank Agreement and will be subject to perpetual conservation management.

The conservation efforts for MNES at Mt Gilead entail substantial costs. It is important to acknowledge that these conservation gains can only be achieved as a product of development. Funding from development will provide the ongoing resources for protection, management and improvement of the offset sites and that will add to the growing private conservation areas in this region.

In the absence of development at Mt Gilead, current pressures will continue to degrade MNES. The major pressures include impacts from grazing, farming practices and continued invasion from exotic species. Without timely and effective management, such as those proposed for the Mt Gilead offset sites, the integrity of these patches of woodland and potential threatened species habitat is expected to decline.

References

- Bionet 2016. The website for the Atlas of NSW Wildlife: <http://www.bionet.nsw.gov.au/>
- Buchanan, R. 2009. Restoring natural areas in Australia. NSW Department of Primary Industries.
- Campbelltown City Council (CCC) 2015. *Mt Gilead Planning Proposal*. Prepared January 2015.
- Department of Environment and Conservation (DEC) 2004. Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities. Working Draft
- Department of Environment and Climate Change (DECC) 2005. Best Practice Guidelines for Bush Regeneration on the Cumberland Plain.
- Department of Environment, Climate Change and Water (DECCW) NSW. 2009. Draft National Recovery Plan for the Grey-headed Flying-fox *Pteropus poliocephalus*. Prepared by Dr Peggy Eby. Department of Environment, Climate Change and Water NSW, Sydney.
- Department of Environment and Resource Management (DERM). 2011. National recovery plan for the large-eared pied bat *Chalinolobus dwyeri*. Report to the Department of Sustainability, Environment, Water, Population and Communities, Canberra.
- Department of the Environment, Water, Heritage and the Arts 2010. Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest. A guide to identifying and protecting the nationally threatened ecological community *Environment Protection and Biodiversity Conservation Act 1999* Policy Statement 3.31.
- Department of Planning and Environment 2013. *The Draft Metropolitan Strategy for Sydney to 2031*. Available from http://planspolicies.planning.nsw.gov.au/index.pl?action=view_job&job_id=6051
- Department of Planning and Environment 2014. 2014 NSW Population Projections data.
- Department of Planning and Environment (NSW) (DPE) (2015). Greater Macarthur Land Release Investigation – Preliminary Strategy and Action Plan.
- Department of the Environment (DotEE) 2016. *Species Profile and Threats Database*. [Online] Available from: <http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>
- Department of the Environment (DotEE) 2014. *EPBC Act Referral Guidelines for the vulnerable koala (combined populations of Queensland, New South Wales and the Australian Capital Territory)*. Commonwealth of Australia, Canberra.
- Department of the Environment (DotEE) 2013a. The Draft survey guidelines for Australia's threatened orchids: Guidelines for detecting orchids listed As 'Threatened' under The *Environment Protection and Biodiversity Conservation Act 1999*.
- Department of the Environment (DotEE) 2013b. *Matters of National Environmental Significance – Significant impact guidelines 1.1*. [Online] Available from: http://www.environment.gov.au/system/files/resources/42f84df4-720b-4dcf-b262-48679a3aba58/files/nes-guidelines_1.pdf

Eco Logical Australia 2006. *Mt Gilead Flora and Fauna Assessment: Stage 2*. Report prepared for Australand.

Eco Logical Australia 2014. Mt Gilead Rezoning Ecological Assessment. Prepared for Mt Gilead Pty Ltd and S & A Dzwonnik, September 2014.

Eco Logical Australia 2015a. Bushfire Protection Assessment: Proposed subdivision – Mount Gilead. Prepared for Mt Gilead Pty Ltd and S & A Dzwonnik.

Eco Logical Australia ELA 2015b. *Mt Gilead – Biodiversity Certification Assessment Report and Biocertification Strategy*. Prepared for Mt Gilead Pty Ltd and Mr & Mrs Dzwonnik, October 2015.

Eco Logical Australia 2015c. *Biobanking Agreement Credit Assessment Report: Macarthur-Onslow Mt Gilead Biobank Site*. Prepared for Mt Gilead Pty Ltd.

Eco Logical Australia 2015d. *Biobanking Agreement Credit Assessment Report: Noorumba-Mt Gilead Biobank Site*. Prepared for Mt Gilead Pty Ltd.

GHD 2016. Fernhill Central West Biobank Site Credit Assessment Report. Prepared for Angas Securities.

Eco Logical Australia 2015e. *Mount Gilead Urban Investigation Area – Biodiversity and Bushfire Due Diligence*. Prepared for Lend Lease.

Gibbons, P. and Lindenmayer, D. (2007) 'Offsets for land clearing: No net loss or the tail wagging the dog?' *Ecological Management and Restoration* 8: 26-31.

Hazelton P.A. and Tille P.J., 1990, *Soil Landscapes of the Wollongong-Port Hacking 1:100,000 Sheet* map and report, Soil Conservation Service of NSW, Sydney.

JBA Urban Planning Consultants (JBA) 2014. *Final Planning Proposal, Mt Gilead*. Report prepared on behalf of Mt Gilead Pty Ltd and S. and A. Dzwonnik and submitted to Campbelltown City Council.

Landcom 2004. Managing Urban Stormwater: Soils and Construction.

Mac Nally, R. & Horrocks, G., 2002. Habitat change and restoration: responses of a forest-floor mammal species to manipulations of fallen timber in floodplain forests. *Animal Biodiversity and Conservation*, 25.1: 41–52.

Navin Officer and Tropman & Tropman Architects 2014. European Heritage Assessment of Mt Gilead. Report prepared for S&A Dzwonnik and Old Mill Properties Pty Ltd to accompany the Mt Gilead Planning Proposal for submission to Campbelltown Council, June 2014.

NSW Department of Planning 2010. Metropolitan Plan for Sydney 2036.

NSW Scientific Committee, Simpson CC (2008) Change in the distribution of Cumberland Plain Woodland. NSW Scientific Committee, Sydney.

NSW NPWS, 2004. Environmental Impact Assessment Guidelines, *Pimelea spicata*.

NSW National Parks and Wildlife Service (NPWS), 2002. The Native Vegetation of the Cumberland Plain, Western Sydney – Technical Report, NSW NPWS, Hurstville.

NSW National Parks and Wildlife Service (NPWS), 2002. Interpretation Guidelines for the Native Vegetation Maps of the Cumberland Plain, Western Sydney, Final Edition NSW NPWS, Hurstville.

NSW Rural Fire Service (RFS). Planning for Bushfire Protection: a Guide for Councils, Planners, Fire Authorities and Developers.

Office of Environment and Heritage (OEH) 2015. Shale Sandstone Transition Forest in the Sydney Basin Bioregion – profile. <http://www.environment.nsw.gov.au/ThreatenedSpeciesApp/profile.aspx?id=10755>

OEH 2014. Biobanking Assessment Methodology
<http://www.environment.nsw.gov.au/resources/biobanking/140661BBAM.pdf>

Reid, J.R.W. 1999. Threatened and Declining Birds in the NSW Sheep-Wheat Belt: 1. Diagnosis, Characteristics and Management. Unpublished report. NSW National Parks and Wildlife Service, Queanbeyan, NSW.

Saunders, D.L. and Tzaros, C.L. 2011. National Recovery Plan for the Swift Parrot *Lathamus discolor*, Birds Australia, Melbourne.

Threatened Species Scientific Committee (TSSC) 2014a. Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) Approved Conservation Advice (including listing advice) for Shale Sandstone Transition Forest of the Sydney Basin Bioregion (EC25R).

Threatened Species Scientific Committee (TSSC), 2014b. Commonwealth Conservation Advice for *Genoplesium baueri* (Yellow Gnat-orchid).

Threatened Species Scientific Committee (TSSC) (2010). Commonwealth Listing Advice on *Chalinolobus dwyeri* (Large-eared Pied Bat). Unpublished report. Canberra: Department of Sustainability, Environment, Water, Population and Communities.

Threatened Species Scientific Committee (TSSC) 2008. Commonwealth Listing Advice on Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest.

Tozer M (2003). The native vegetation of the Cumberland Plain, western Sydney: systematic classification and field identification of communities. *Cunninghamia* 8 (1), 1–75.

Worley Parsons 2014. Mount Gilead Rezoning Stormwater Management and Flooding Assessment. Report prepared for Mount Gilead Pty Ltd and S&A Dzwonnik, 4 September 2014.

Appendix A: Mt Gilead Biodiversity Certification Assessment Report and Biocertification Strategy

Provided as a separate document (Pdf file)

Appendix B: Protected Matters Search Tool Results

The Protected Matters Search Tool (<http://www.environment.gov.au/epbc/protected-matters-search-tool>) was accessed on 23rd April 2015. The results are summarized below along with the likelihood of occurrence for the species or community. This likelihood is based on database or other records, presence or absence of suitable habitats, features of the proposed site, results of field surveys and professional judgement.

Five terms used for the likelihood of occurrence of species are defined as follows:

- “Known” = the species was or has been observed on the subject site
- “Likely” = a medium to high probability that a species uses or occurs on the subject site,
- “Potential” = suitable habitat for a species occurs on the subject site, but there is insufficient information to categorise the species as likely to occur, or unlikely to occur,
- “Unlikely” = a very low to low probability that a species uses the subject site or occurs on the site,
- “No” = habitat on the subject site and in the vicinity is unsuitable for the species.

Threatened Ecological Communities

Name	EPBC listing status	Description	Distribution	Habitat	Likelihood of Occurrence
<i>Coastal Upland Swamps in the Sydney Basin Bioregion</i>	Endangered	May include tall open scrubs, tall closed scrubs, closed heaths, open graminoid heaths, sedgeland and fernlands. Larger examples may include a complex of these structural forms.	Endemic to NSW and confined to the Sydney Basin Bioregion. It occurs in the eastern Sydney Basin from the Somersby district in the north (Somersby-Hornsby plateaux) to the	Occur primarily on impermeable sandstone plateaux with shallow groundwater aquifers in the headwaters and impeded drainage lines of streams, and on sandstone benches with abundant seepage	No

Name	EPBC listing status	Description	Distribution	Habitat	Likelihood of Occurrence
			Robertson district in the south (n the Woronora plateau).	moisture. Generally associated with acidic soils.	
<i>Cumberland Plains Shale Woodlands and Shale-Gravel Transition Forest</i>	Critically Endangered	The minimum projected foliage cover of canopy trees is 10% or more and the tree canopy is typically dominated by <i>Eucalyptus moluccana</i> (Grey Box), <i>E. tereticornis</i> (Forest Red Gum) and/or <i>E. fibrosa</i> (Red Ironbark). A sparse lower tree layer may be present, typically with young eucalypts of upper tree canopy species and species of <i>Acacia</i> , <i>Exocarpos</i> and <i>Melaleuca</i> . The understorey typically is dominated by the ground layer, typically comprising a variety of perennial native graminoids and forbs.	Endemic to the shale hills and plains of the Sydney Basin Bioregion in NSW, occurring primarily in, but not limited to, the Cumberland Sub-region.	Flat to undulating or hilly terrain, at elevations up to approximately 350 metres above sea level. Predominantly associated with clay soils, that are derived from Wianamatta Shale geology. Minor occurrences may be present on other soil groups, notably Holocene Alluvium and soils derived from the Mittagong Formation.	Known
<i>Shale Sandstone Transition Forest of the Sydney Basin Bioregion</i>	Critically Endangered	The main tree species include <i>Eucalyptus tereticornis</i> (Forest Red Gum), <i>E. punctata</i> (Grey Gum), stringybarks (<i>E. globoidea</i> , <i>E. eugenioides</i>) and ironbarks (<i>E. fibrosa</i> and <i>E. crebra</i>). Areas of low sandstone influence (more clay-loam soil texture) have an understorey that is closer to Cumberland Plain Woodland.	Occurs at the edges of the Cumberland Plain in western Sydney, most now occurs in the Hawkesbury, Baulkham Hills, Liverpool, Parramatta, Penrith, Campbelltown and Wollondilly local government areas.	Intergrade between clay soils from the shale rock and earthy and sandy soils from sandstone, or where shale caps overlay sandstone.	Known
<i>Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion</i>	Endangered	Typically occurs as an open to tall open forest with a sparse to dense layer of shrubs and vines, and a diverse understorey of native grasses, forbs, twiners and ferns. Dominant canopy species are most often <i>Eucalyptus fastigata</i> (brown barrel), <i>E. viminalis</i> (ribbon gum) and <i>E. radiata</i> subsp. <i>radiata</i> (narrow-leaved peppermint). <i>Eucalyptus obliqua</i> (messmate stringybark) <i>E. elata</i> (river	Generally confined to the Sydney Basin bioregion, including the Moss Vale, Ettrema, Burragorang, Sydney Cataract, and Wollemi IBRA sub-regions. However, some patches may extend into in the Kanangra and Oberon IBRA sub	Found on igneous rock (predominately Tertiary basalt and microsyenite). Typically occurs at elevations between 650 and 1050 m above sea level.	No

Name	EPBC listing status	Description	Distribution	Habitat	Likelihood of Occurrence
		peppermint), <i>E. quadrangulata</i> (white-topped box) and <i>E. smithii</i> (ironbark peppermint) are also common. <i>Eucalyptus oreades</i> (Blue Mountains ash) and <i>E. blaxlandii</i> (Blaxland's stringybark) are prevalent in the Blue Mountains forms. <i>Eucalyptus cypellocarpa</i> (mountain grey gum) is widespread in drier sites, while <i>E. piperita</i> (Sydney peppermint) and <i>Eucalyptus ovata</i> (swamp gum) may also be present. <i>Acacia melanoxylon</i> (blackwood) is a common subcanopy tree. Occasional rainforest trees such as <i>Doryphora sassafras</i> (sassafras) and <i>Hedycarya angustifolia</i> (native mulberry) may also occur.	-regions of the South Eastern Highlands bioregion.		
Western Sydney Dry Rainforest and Moist Woodland on Shale	Critically Endangered	Typically a low closed forest, slightly more open in the moist woodland form, with emergent trees up to 25 m high and a lower tree layer. In sheltered gullies and on lower slopes the canopy layer is typically dominated by <i>Melaleuca styphelioides</i> (prickly-leaved paperbark). Other diagnostic tree species include <i>Acacia implexa</i> (hickory wattle), <i>Alectryon subcinereus</i> (native quince), <i>Brachychiton populneus</i> (kurrajong), <i>Corymbia maculata</i> (spotted gum), <i>Melicope micrococca</i> (white euodia) and <i>Streblus pendulinus</i> (whalebone tree). Generally on upper slopes to undulating terrain, or at more disturbed sites, the ecological community exhibits its moist woodland form with the canopy dominated by <i>E. moluccana</i> , <i>E. tereticornis</i> , <i>E. crebra</i> and/or <i>Corymbia maculata</i> . Characteristic shrub species include <i>Breynia oblongifolia</i>	Cumberland Plain Sub-region of the Sydney Basin Bioregion.	It generally occurs in rugged terrain and other patches may occur on undulating terrain, with dry rainforest patches typically occupying steep lower slopes and gullies, and moist woodland patches typically occupying upper sections of the slope. Occurs almost exclusively on clay soils derived from Wiannamatta Group shales.	No

Name	EPBC listing status	Description	Distribution	Habitat	Likelihood of Occurrence
		(false coffee bush), <i>Clerodendrum tomentosum</i> (hairy clerodendrum) and <i>Notelaea longifolia</i> f. <i>longifolia</i> (large mock-olive). Vines and other climber species are typically common. The ground layer is variable and generally sparse with a diverse mix of forbs, ferns and shade-tolerant grasses.			

Flora

Scientific name	Common name	EPBC Act	Habitat association	Recorded on site	Likelihood	Justification	Additional survey required
<i>Acacia bynoeana</i>	Bynoe's Wattle	V	<i>Acacia bynoeana</i> is found in central eastern NSW, from the Hunter District (Morisset) south to the Southern Highlands and west to the Blue Mountains, and has recently been found in the Colymea and Parma Creek areas west of Nowra. It is found in heath and dry sclerophyll forest, typically on a sand or sandy clay substrate, often with ironstone gravels (OEH 2015d).	No	No	No suitable habitat present.	No. Already surveyed for by ELA (2014)
<i>Allocasuarina glareicola</i>		E	<i>Allocasuarina glareicola</i> is primarily restricted to the Richmond district on the north-west Cumberland Plain, with an outlier population found at Voyager Point. It grows in Castlereagh woodland on lateritic soil (OEH 2015d).	No	No	No habitat present and outside known range.	No
<i>Asterolasia elegans</i>		E	<i>Asterolasia elegans</i> is restricted to a few localities on the NSW Central Coast north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby LGAs. It is found in sheltered forests	No	No	No habitat present and outside known range.	No

Scientific name	Common name	EPBC Act	Habitat association	Recorded on site	Likelihood	Justification	Additional survey required
			on mid- to lower slopes and valleys, in or adjacent to gullies (OEH 2015d).				
<i>Caladenia tessellata</i>	Thick Lip Spider Orchid	V	<i>Caladenia tessellata</i> occurs in grassy sclerophyll woodland, often growing in well-structured clay loams or sandy soils south from Swansea, usually in sheltered moist places and in areas of increased sunlight. It flowers from September to November (OEH 2015d).	No	No	Outside known range	No
<i>Cryptostylis hunteriana</i>	Leafless Tongue Orchid	V	<i>Cryptostylis hunteriana</i> is known from a range of vegetation communities including swamp-heath and woodland. The larger populations typically occur in woodland dominated by Scribbly Gum (<i>Eucalyptus sclerophylla</i>), Silvertop Ash (<i>E. sieberi</i>), Red Bloodwood (<i>Corymbia gummifera</i>) and Black Sheoak (<i>Allocasuarina littoralis</i>); where it appears to prefer open areas in the understorey of this community and is often found in association with the Large Tongue Orchid (<i>C. subulata</i>) and the Tartan Tongue Orchid (<i>C. erecta</i>). Coastal Plains Scribbly Gum Woodland and Coastal Plains Smoothed-barked Apple Woodland is potential habitat on the Central Coast. Flowers between November and February, although may not flower regularly (OEH 2015d).	No	No	No suitable habitat present.	No
<i>Cynanchum elegans</i>	White-flowered Wax Plant	E	<i>Cynanchum elegans</i> is a climber or twiner with a variable form, and flowers between August and May, peaking in November. It occurs in dry rainforest gullies, scrub and scree slopes, and prefers the ecotone between dry subtropical rainforest and sclerophyll woodland/forest. The species has also been found in littoral rainforest; <i>Leptospermum laevigatum</i> – <i>Banksia integrifolia</i> subsp. <i>integrifolia</i> coastal scrub; <i>Eucalyptus tereticornis</i> open forest/ woodland; <i>Corymbia maculata</i> open	No	No	No suitable habitat present.	No. Already surveyed for by ELA (2014)

Scientific name	Common name	EPBC Act	Habitat association	Recorded on site	Likelihood	Justification	Additional survey required
			forest/woodland; and <i>Melaleuca armillaris</i> scrub to open scrub (OEH 2015d).				
<i>Genoplesium baueri</i>	Bauer's Midge Orchid	-	Known from coastal areas from northern Sydney south to the Nowra district. Previous records from the Hunter Valley and Nelson Bay are now thought to be erroneous. Grows in shrubby woodland in open forest on shallow sandy soils (OEH 2015d).	No	No	No suitable habitat present.	No
<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	Small-flower Grevillea	V	<i>Grevillea parviflora</i> subsp. <i>parviflora</i> is sporadically distributed throughout the Sydney Basin mainly around Picton, Appin and Bargo. Separate populations are also known further north from Putty to Wyong and Lake Macquarie and Cessnock and Kurri Kurri. It grows in sandy or light clay soils over thin shales, often with lateritic ironstone gravels. It often occurs in open, slightly disturbed sites such as tracks (OEH 2015d).	No	No	Marginal habitat present.	No. Already surveyed for by ELA (2014)
<i>Haloragis exalata</i> subsp. <i>exalata</i>	Wingless Raspwort	V	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. It appears to require protected and shaded damp situations in riparian habitats (OEH 2015d).	No	No	No suitable habitat present.	No
<i>Leucopogon exolasius</i>	Woronora Beard-heath	V	<i>Leucopogon exolasius</i> is found along the upper Georges River area and in Heathcote National Park. It is associated with Sydney Sandstone Gully Forest on rocky hillsides and creek banks (OEH 2015d).	No	No	No suitable habitat present.	No
<i>Melaleuca deanei</i>	Deane's Paperbark	V	Found in heath on sandstone, and also associated with woodland on broad ridge tops and slopes on sandy loam and lateritic soils (OEH 2015d).	No	No	No suitable habitat present.	No. Already surveyed for by ELA (2014)

Scientific name	Common name	EPBC Act	Habitat association	Recorded on site	Likelihood	Justification	Additional survey required
<i>Pelargonium sp. striatellum</i>	Omeo's Stork's Bill	E	The species is known to occur in habitat usually located just above the high water level of irregularly inundated or ephemeral lakes. During dry periods, the species is known to colonise exposed lake beds. It is not known if the species' rhizomes and/or soil seedbank persist through prolonged inundation or drought (OEH 2015d).	No	No	No suitable habitat present.	No
<i>Persoonia bargoensis</i>	Bargo Geebung	V	Associated with woodland to dry sclerophyll forest, on sandstone and clayey laterite on heavier, well-drained, loamy, gravelly soils of the Hawkesbury Sandstone and Wianamatta Shale in the catchments of the Cataract, Cordeaux and Bargo Rivers (OEH 2015d).	No	Unlikely	Marginal habitat present.	No. Already surveyed for by ELA (2014)
<i>Persoonia hirsuta</i>	Hairy Geebung	E	<i>Persoonia hirsuta</i> occurs from Singleton in the north, south to Bargo and the Blue Mountains to the west. It grows in dry sclerophyll eucalypt woodland and forest on sandstone (OEH 2015d).	No	No	No suitable habitat present.	No. Already surveyed for by ELA (2014)
<i>Pimelea curviflora</i> var. <i>curviflora</i>		V	<i>Pimelea curviflora</i> var. <i>curviflora</i> is confined to the coastal area of Sydney between northern Sydney in the south and Maroota in the north-west. It grows on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands (OEH 2015d).	No	Unlikely	Marginal habitat present.	No. Already surveyed for by ELA (2014)
<i>Pimelea spicata</i>	Spiked Rice-flower	E	In western Sydney, <i>Pimelea spicata</i> occurs on an undulating topography of well structured clay soils, derived from Wianamatta shale. It is associated with Cumberland Plains Woodland (CPW), in open woodland and grassland often in moist depressions or near creek lines. Has been located in disturbed areas that would have previously supported CPW (OEH 2015d).	No	Unlikely	Marginal habitat present.	No. Already surveyed for by ELA (2014)

Scientific name	Common name	EPBC Act	Habitat association	Recorded on site	Likelihood	Justification	Additional survey required
<i>Pomaderris brunnea</i>	Rufous Pomaderris	V	<i>Pomaderris brunnea</i> occurs in a limited area around the Colo, Nepean and Hawkesbury Rivers, including the Bargo area and near Camden. It also occurs near Walcha on the New England tablelands and in far eastern Gippsland in Victoria. It grows in moist woodland or forest on clay or alluvial soils of floodplains and creek lines (OEH 2015d).	No, although found to the west in Stage 2 Mt Gilead along creek	No	Marginal habitat present.	No. Already surveyed for by ELA (2014)
<i>Pterostylis saxicola</i>	Sydney Plains Greenhood	E	Most commonly found growing in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines. The vegetation communities above the shelves where <i>Pterostylis saxicola</i> occurs are sclerophyll forest or woodland on shale/sandstone transition soils or shale soils. Restricted to western Sydney between Freemans Reach in the north and Picton in the south. There are very few known populations and they are all very small and isolated (OEH 2015d).	No	No	No suitable habitat present.	No. Already surveyed for by ELA (2014)
<i>Streblus pendulinus</i>	Siah's backbone	E	On the Australian mainland, Siah's Backbone is found in warmer rainforests, chiefly along watercourses. The altitudinal range is from near sea level to 800 m above sea level. The species grows in well developed rainforest, gallery forest and drier, more seasonal rainforest (OEH 2015d).	No	No	No suitable habitat present.	No
<i>Thelymitra</i> sp. Kangaloon	Kangaloon Sun-orchid	CE	<i>Thelymitra</i> sp. <i>Kangaloon</i> is only known to occur on the southern tablelands of NSW in the Robertson / Kangaloon / Fitzroy Falls area at 550-700 m above sea level. It is thought to be a short-lived perennial, flowering in late October and early November. It is found in swamps in sedgelands over grey silty grey loam soils. It is known to occur at three swamps that are above the Kangaloon Aquifer, and that are a part of the ecological community "Temperate Highland Peat Swamps on Sandstone" which is listed under the EPBC Act.	No	No	Outside known range.	No

Scientific name	Common name	EPBC Act	Habitat association	Recorded on site	Likelihood	Justification	Additional survey required
<i>Thesium australe</i>	Austral Toadflax	V	Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast (OEH 2015d).	No	No	Outside known range.	No

Fauna

Group	Scientific name	Common name	EPBC Act	Habitat association	Likelihood	Justification	Additional survey required
Amphibian	<i>Heleioporus australiacus</i>	Giant Burrowing Frog	V	Forages in woodlands, wet heath, dry and wet sclerophyll forest. Associated with semi-permanent to ephemeral sand or rock based streams, where the soil is soft and sandy so that burrows can be constructed (OEH 2015d).	No	No suitable habitat present	No
Amphibian	<i>Litoria aurea</i>	Green and Golden Bell Frog	V	This species has been observed utilising a variety of natural and man-made waterbodies such as coastal swamps, marshes, dune swales, lagoons, lakes, other estuary wetlands, riverine floodplain wetlands and billabongs, stormwater detention basins, farm dams, bunded areas, drains, ditches and any other structure capable of storing water. Preferable habitat for this species includes attributes such as shallow, still or slow flowing, permanent and/or widely fluctuating water bodies that are unpolluted and without heavy shading. Large permanent swamps and ponds exhibiting well-established fringing vegetation (especially bulrushes– <i>Typha</i> sp. and spikerushes– <i>Eleocharis</i> sp.) adjacent to open grassland areas for foraging are preferable. Ponds that are typically inhabited tend to be free from	Unlikely	No suitable habitat present. Targeted searches conducted (October 2016) with no records or suitable habitat detected. <i>Gambusia</i> present in all water bodies.	No

Group	Scientific name	Common name	EPBC Act	Habitat association	Likelihood	Justification	Additional survey required
				predatory fish such as Mosquito Fish (<i>Gambusia holbrooki</i>) (OEH 2015d).			
Amphibian	<i>Litoria littlejohnii</i>	Littlejohn's Tree Frog	V	Littlejohn's Tree Frog occurs along permanent rocky streams with thick fringing vegetation associated with eucalypt woodlands and heaths among sandstone outcrops. It appears to be restricted to sandstone woodland and heath communities at mid to high altitude (OEH 2015d).	No	No suitable habitat present	No
Amphibian	<i>Litoria raniformis</i>	Southern Bell Frog	V	Relatively still or slow-flowing sites such as billabongs, ponds, lakes or farm dams, especially where <i>Typha</i> sp., <i>Eleocharis</i> sp. and <i>Phragmites</i> sp. (Bulrushes) are present. This species is common in lignum shrublands, black box and River Red Gum woodlands, irrigation channels and at the periphery of rivers in the southern parts of NSW. This species occurs in vegetation types such as open grassland, open forest and ephemeral and permanent non-saline marshes and swamps. Open grassland and ephemeral permanent non-saline marshes and swamps have also been associated with this species (OEH 2015d).	No	No suitable habitat present	No
Reptile	<i>Hoplocephalus bungaroides</i>	Broad-headed Snake	V	Typical sites consist of exposed sandstone outcrops and benching where the vegetation is predominantly woodland, open woodland and/or heath on Triassic sandstone of the Sydney Basin. They utilise rock crevices and exfoliating sheets of weathered sandstone during the cooler months and tree hollows during summer (OEH 2015d).	No	No suitable habitat present	No
Birds	<i>Anthochaera phrygia</i>	Regent Honeyeater	E & M	Associated with temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts, and riparian forests of River	Unlikely	Marginal habitat present	No. Bird surveys already

Group	Scientific name	Common name	EPBC Act	Habitat association	Likelihood	Justification	Additional survey required
				Oak (<i>Casuarina cunninghamiana</i>). Areas containing Swamp Mahogany (<i>Eucalyptus robusta</i>) in coastal areas have been observed to be utilised. The Regent Honeyeater primarily feeds on nectar from box and ironbark eucalypts and occasionally from banksias and mistletoes. As such it is reliant on locally abundant nectar sources with different flowering times to provide reliable supply of nectar (OEH 2015d).			undertaken by ELA (2014)
Birds	<i>Botaurus poiciloptilus</i>	Australasian Bittern	E	Terrestrial wetlands with tall dense vegetation, occasionally estuarine habitats. Reedbeds, swamps, streams, estuaries (OEH 2015d).	No	No suitable habitat present	No. Bird surveys already undertaken by ELA (2014)
Birds	<i>Dasyornis brachypterus</i>	Eastern Bristlebird	E	Habitat is characterised by dense, low vegetation and includes sedgeland, heathland, swampland, shrubland, sclerophyll forest and woodland, and rainforest, as well as open woodland with a heathy understorey. In northern NSW occurs in open forest with tussocky grass understorey. All of these vegetation types are fire prone, aside from the rainforest habitats utilised by the northern population as fire refuge. Age of habitat since fires (fire-age) is of paramount importance to this species; Illawarra and southern populations reach maximum densities in habitat that has not been burnt for at least 15 years; however, in the northern NSW population a lack of fire in grassy forest may be detrimental as grassy tussock nesting habitat becomes unsuitable after long periods without fire; northern NSW birds	No	No suitable habitat present	No. Bird surveys already undertaken by ELA (2014)

Group	Scientific name	Common name	EPBC Act	Habitat association	Likelihood	Justification	Additional survey required
				are usually found in habitats burnt five to 10 years previously (OEH 2015d).			
Birds	<i>Lathamus discolor</i>	Swift Parrot	E	Breeds in Tasmania between September and January. Migrates to mainland in autumn, where it forages on profuse flowering Eucalypts. Hence, in this region, autumn and winter flowering eucalypts are important for this species. Favoured feed trees include winter flowering species such as Swamp Mahogany (<i>Eucalyptus robusta</i>), Spotted Gum (<i>Corymbia maculata</i>), Red Bloodwood (<i>C. gummifera</i>), Mugga Ironbark (<i>E. sideroxylon</i>), and White Box (<i>E. albens</i>) (OEH 2015d).	Potential	Suitable habitat present	No. Bird surveys already undertaken by ELA (2014).
Birds	<i>Rostratula australis</i>	Painted Snipe (Australian subspecies)	V	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds. Breeding is often in response to local conditions; generally occurs from September to December. Forages nocturnally on mud-flats and in shallow water. Feeds on worms, molluscs, insects and some plant-matter (OEH 2015d).	No	No suitable habitat present	No. Bird surveys already undertaken by ELA (2014)
Mammal	<i>Dasyurus maculatus</i> <i>Dasyurus maculatus maculatus</i>	Spotted-tailed Quoll Spotted-tailed Quoll (SE mainland population)	- E	The Spotted-tailed Quoll inhabits a range of forest communities including wet and dry sclerophyll forests, coastal heathlands and rainforests, more frequently recorded near the ecotones of closed and open forest. Individual animals use hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites. Maternal den sites are logs with cryptic entrances; rock outcrops; windrows; burrows (OEH 2015d).	No	Marginal habitat present	No. Already surveyed for by ELA (2014)

Group	Scientific name	Common name	EPBC Act	Habitat association	Likelihood	Justification	Additional survey required
Mammal	<i>Isoodon obesulus</i>	Southern Brown Bandicoot	E	This species is associated with heath, coastal scrub, heathy forests, shrubland and woodland on well drained soils. This species is thought to display a preference for newly regenerating heathland and other areas prone to fire (OEH 2015d).	No	No suitable habitat present	No
Mammal	<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	V	Rocky areas in a variety of habitats, typically north facing sites with numerous ledges, caves and crevices (OEH 2015d).	No	No suitable habitat present	No
Mammal	<i>Phascolarctos cinereus</i>	Koala	V	Associated with both wet and dry Eucalypt forest and woodland that contains a canopy cover of approximately 10 to 70%, with acceptable Eucalypt food trees. Some preferred Eucalyptus species are: <i>Eucalyptus tereticornis</i> , <i>E. punctata</i> , <i>E. cypellocarpa</i> , <i>E. viminalis</i> (OEH 2015d)	Likely	Marginal habitat present	No. Presence assumed
Mammal	<i>Pseudomys novaehollandiae</i>	New Holland Mouse	V	A small burrowing native rodent with a fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Inhabits open heathlands, open woodlands with a heathland understorey and vegetated sand dunes. A social animal, living predominantly in burrows shared with other individuals. The home range of the New Holland Mouse ranges from 0.44 ha to 1.4 ha and the species peaks in abundance during early to mid stages of vegetation succession typically induced by fire (OEH 2015d).	No	No suitable habitat present	No
Mammal-bat	<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	The Large-eared Pied Bat has been recorded in a variety of habitats, including dry sclerophyll forests, woodland, sub-alpine woodland, edges of rainforests and wet sclerophyll forests. This species roosts in caves, rock overhangs and disused mine shafts and as such is usually associated with	Potential	Marginal habitat present	No. Targeted bat survey undertaken by ELA (2014)

Group	Scientific name	Common name	EPBC Act	Habitat association	Likelihood	Justification	Additional survey required
				rock outcrops and cliff faces. Found in well-timbered areas containing gullies (OEH 2015d).			
Mammal-bat	<i>Pteropus poliocephalus</i>	Grey-headed Flying-Fox	V	Inhabits a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated areas. Camps are often located in gullies, typically close to water, in vegetation with a dense canopy (OEH 2015d).	Potential	Suitable habitat present	No. Assumed presence and no suitable breeding habitat
Migratory	<i>Apus pacificus</i>	Fork-tailed Swift	M	Sometimes travels with Needletails. Varied habitat with a possible tendency to more arid areas but also over coasts and urban areas.	Potential	Species may use site on occasion	No. Assumed occasional presence.
Migratory	<i>Ardea alba</i>	Great Egret	M	The Great Egret is common and widespread in Australia. It forages in a wide range of wet and dry habitats including permanent and ephemeral freshwaters, wet pasture and estuarine mangroves and mudflats.	Potential	Suitable wetland areas present	No. Assumed occasional presence.
Migratory	<i>Ardea ibis</i>	Cattle Egret	M	Cattle Egrets forage on pasture, marsh, grassy road verges, rain puddles and croplands, but not usually in the open water of streams or lakes and they avoid marine environments. Some individuals stay close to the natal heronry from one nesting season to the next, but the majority leave the district in autumn and return the next spring. Cattle Egrets are likely to spend the winter dispersed along the coastal plain and only a small number have been recovered west of the Great Dividing Range.	Known	Recorded by ELA (2014)	No as already recorded.
Migratory	<i>Gallinago hardwickii</i>	Latham's Snipe	M	A variety of permanent and ephemeral wetlands, preferring open fresh water wetlands with nearby cover. Occupies a	No	No suitable habitat present	No

Group	Scientific name	Common name	EPBC Act	Habitat association	Likelihood	Justification	Additional survey required
				variety of vegetation around wetlands including wetland grasses and open wooded swamps.			
Migratory	<i>Haliaeetus leucogaster</i>	White-bellied Sea Eagle	M	Forages over large open fresh or saline waterbodies, coastal seas and open terrestrial areas. Breeding habitat consists of tall trees, mangroves, cliffs, rocky outcrops, silts, caves and crevices and is located along the coast or major rivers. Breeding habitat is usually in or close to water, but may occur up to a kilometre away.	No	No suitable habitat present	No
Migratory	<i>Hirundapus caudacutus</i>	White throated Needletail	M	Forages aerially over a variety of habitats usually over coastal and mountain areas, most likely with a preference for wooded areas. Has been observed roosting in dense foliage of canopy trees, and may seek refuge in tree hollows in inclement weather.	Potential	Species may use site on occasion	No. Assumed occasional presence.
Migratory	<i>Merops ornatus</i>	Rainbow Bee-eater	M	Resident in coastal and subcoastal northern Australia; regular breeding migrant in southern Australia, arriving September to October, departing February to March, some occasionally present April to May. Occurs in open country, chiefly at suitable breeding places in areas of sandy or loamy soil: sand-ridges, riverbanks, road-cuttings, sand-pits, occasionally coastal cliffs. Nest is a chamber at the end of a burrow, up to 1.6 m long, tunnelled in flat or sloping ground, sandy back or cutting.	Potential	Suitable open and wetland habitats available	No. Assumed occasional presence.
Migratory	<i>Monarcha melanopsis</i>	Black-faced Monarch	M	Rainforest and eucalypt forests, feeding in tangled understorey.	No	No suitable habitat present	No
Migratory	<i>Myiagra cyanoleuca</i>	Satin Flycatcher	M	Wetter dense forest.	No	No suitable habitat present	No

Group	Scientific name	Common name	EPBC Act	Habitat association	Likelihood	Justification	Additional survey required
Migratory	<i>Pandion cristatus</i>	Eastern Osprey	M	Favour coastal areas, especially the mouths of large rivers, lagoons and lakes.	No	No suitable habitat present	No
Migratory	<i>Rhipidura rufifrons</i>	Rufous Fantail	M	The Rufous Fantail is a summer breeding migrant to southeastern Australia. The Rufous Fantail is found in rainforest, dense wet eucalypt and monsoon forests, paperbark and mangrove swamps and riverside vegetation. Open country may be used by the Rufous Fantail during migration.	No	No suitable habitat present	No

Appendix C: Species list from Plot data and EPBC Act condition assessment

Provided as a separate document (excel file)

Appendix D: Macarthur Onslow BioBank Assessment

Provided as a separate document (Pdf file)

Appendix E: Macarthur Onslow Credit Report

Provided as a separate document (Pdf file)

Appendix F: Noorumba BioBank Assessment

Provided as a separate document (Pdf file)

Appendix G: Noorumba Credit Report

Provided as a separate document (Pdf file)

Appendix H: Stormwater Management and Flooding Assessment

Provided as a separate document (Pdf file)

Appendix I: Conceptual Landscape Plans

Provided as a separate document (Pdf file)

Appendix J: Fernhill Central West BioBank BioBanking Assessment

Provided as a separate document (Pdf file)

**HEAD OFFICE**

Suite 4, Level 1
2-4 Merton Street
Sutherland NSW 2232
T 02 8536 8600
F 02 9542 5622

CANBERRA

Level 2
11 London Circuit
Canberra ACT 2601
T 02 6103 0145
F 02 6103 0148

COFFS HARBOUR

35 Orlando Street
Coffs Harbour Jetty NSW 2450
T 02 6651 5484
F 02 6651 6890

PERTH

Suite 1 & 2
49 Ord Street
West Perth WA 6005
T 08 9227 1070
F 08 9322 1358

SYDNEY

Level 6
299 Sussex Street
Sydney NSW 2000
T 02 8536 8650
F 02 9264 0717

NEWCASTLE

Suites 28 & 29, Level 7
19 Bolton Street
Newcastle NSW 2300
T 02 4910 0125
F 02 4910 0126

ARMIDALE

92 Taylor Street
Armidale NSW 2350
T 02 8081 2681
F 02 6772 1279

WOLLONGONG

Suite 204, Level 2
62 Moore Street
Austinmer NSW 2515
T 02 4201 2200
F 02 4268 4361

ST GEORGES BASIN

8/128 Island Point Road
St Georges Basin NSW 2540
T 02 4443 5555
F 02 4443 6655

NAROOMA

5/20 Canty Street
Narooma NSW 2546
T 02 4476 1151
F 02 4476 1161

MUDGEES

Unit 1, Level 1
79 Market Street
Mudgee NSW 2850
T 02 4302 1230
F 02 6372 9230

GOSFORD

Suite 5, Baker One
1-5 Baker Street
Gosford NSW 2250
T 02 4302 1220
F 02 4322 2897