



ACS Environmental Pty Ltd

DRAFT BIODIVERSITY STUDY

FOR A

PLANNING PROPOSAL

FOR

PART OF THE ABBOTSFORD PROPERTY

NO. 1 ABBOTSFORD ROAD, PICTON,

PART 1 LOT 1 DP 1086066

Prepared for:

THE OWNERS (ZIEMS, ARBER & THOMPSON) OF THE LAND AT ABBOTSFORD FARM
C/- KERRY DUNN

DECEMBER 2012

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The principals of 'ACS Environmental P/L' have completed the NSW Consulting Planners Bushfire Training Course organised by the Planning Institute of Australia NSW Division for planning consultants and allied professionals relating to the implementation of 'Planning for Bushfire Protection', in June 2003.

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EXECUTIVE SUMMARY

ACS Environmental P/L were commissioned to survey an area of about 65ha at Abbotsford Farm, No. 1 Abbotsford Road, Picton, in Wollondilly Shire. A Planning Proposal has been lodged by the Client's representative Rein Warry & Co Pty Ltd, (Principal Darryl Warry), in relation to a rezoning of the Study Area. The Planning Proposal has been lodged with Wollondilly Shire Council and the Department of Planning and Infrastructure (DOP & I).

Subsequent to Council's approval, the upgraded Planning Proposal will be submitted to the DOP & I for comments and/or approval.

The natural vegetation of the Study Area has mostly been cleared, grazed, disturbed and otherwise degraded, such that no patches of relatively weed-free, full-structured vegetation remain.

Five relatively distinct vegetation communities could be recognized over the Study Area, including two communities (Woodland and Blackberry-dominated Scrub) within which a further three, and two, structural and floristic variants respectively, could be delineated.

Five distinct vegetation communities delineated within the Study Area include:

- Patches of eucalypt-dominated woodland;
- Blackthorn-dominated scrub;
- Scrub dominated by the noxious woody weed, Blackberry;
- Cleared exotic grassland, and;
- Areas of ornamental plantings associated with living areas surrounding former residences and other building structures.

Variation in woodland assemblages and scrub assemblages dominated by Blackthorn and Blackberry occur in relation to floristic compositions that have been modified due to the extent and nature of past disturbance influencing structural and floristic history.

The floristically discrete ecological communities occurring over the landscape include two Endangered Ecological Communities described in DECCW (2009) as:

- Cumberland Moist Shale Woodland (EEC); and
- Cumberland Shale Hills Woodland (CEEC),

Due to the extensive degradation and low species diversity characteristic of the small patches of remnant woodland occurring in the Study Area, as well as the intrinsically comparative similarity in physical and floristic elements of these ecological communities, it is difficult to positively identify potentially variable assemblages. Mapping by DEC (2002) has been considered, (Figure 5), and woodland vegetation occurring on south-facing hillslopes can be regarded as comprising Cumberland Moist Shale Woodland, whereas some residual

wooded assemblages occurring on east and north facing hillslopes possibly incorporate elements of Cumberland Shale Hills Woodland (Table 2, Figures 4 & 5).

The relative Conservation Value or 'disturbance' level of the vegetation can be ranked as follows:

- Structured, stratified vegetation with three to four identifiable strata, though mostly incorporating high levels of degradation and woody weed occurrence in mid- and understorey strata. These patches of degraded, either structurally or floristically modified, natural woodland vegetation distributions equate to areas of relatively 'High Biodiversity Conservation Value'.
- Modified vegetation where regrowth of a native understorey stratum in the absence of a tree canopy is occurring. These areas are dominated by Blackthorn, a diagnostic shrub species in Cumberland Plain Woodland vegetation, probably undergoing regrowth after former clearing, regrowth derived from seed sources occurring in proximal woodland assemblages. This scrub vegetation provides suitable habitat into which dispersal of eucalypt propagules may occur, thus facilitating potential for regrowth of woodland vegetation. These patches of modified vegetation in the absence of a tree cover equate to areas of 'Moderate Biodiversity Conservation Value'.
- Highly modified assemblages containing few remnant indigenous trees, such as cleared exotic grasslands and Blackberry-dominated scrub vegetation, including those where patches of Blackthorn are incorporated into larger distributions of Blackberry-dominated vegetation, have little opportunity for regrowth to any form of natural vegetation. These patches of highly modified vegetation, with very limited natural tree, shrub or ground cover species occurring in the assemblage, and where there is little opportunity for restoration to natural vegetation, equate to areas of 'Low Biodiversity Conservation Value'.

The total indicative number of indigenous species recorded for the Study Area is 21, including 5 species of grasses, 7 species of herbs and twiners, 3 species of shrubs or small trees and 5 large tree species.

The total indicative number of exotic species recorded for the Study Area is 35, including 8 species of noxious weeds. Woody noxious weeds occurring at high frequency in wooded sections of the Study Area include Lantana, Blackberry and African Box-thorn.

The indicative number of indigenous species occurring in any particular assemblage is relatively low, usually only between 5 and 9, whereas the indicative number of exotic species in any assemblage is often greater than 9, and over the large extent of cleared grazed areas, this number increases up to 24.

OEH Atlas of NSW Wildlife records for an area 5km radius around the Study Area indicate that 2 flora species of conservation significance have been recorded since 1987. According to guidelines listed by the EPBC 'Protected Matters Search Tool' (November 2012), it is deemed that habitat may potentially occur for a further 10 threatened flora species.

Records of threatened flora species occur from locations in natural bushland near Razorback Ridge or in the vicinity of Maldon to the north-east of the Study Area.

Targeted searches were made in suitable habitats for any individuals of threatened flora species, including White-flowered Wax Plant (*Cynanchum elegans*) and Small-flowered Grevillea (*Grevillea parviflora* subsp. *parviflora*), species recorded on the OEH Atlas of NSW Wildlife (Cropper 2003, DEC 2004). Targeted searches were also made for 10 other flora species of conservation significance where suitable habitat is deemed to potentially occur, but none were located. As such, it is considered that none of these threatened flora species are likely to occur within the highly degraded habitats of the Study Area.

The fauna survey was undertaken to record fauna species currently utilizing Abbotsford Farm resources and to assess the habitat values of the area for threatened species listed in the database for the Study Area.

Database searches at Local, State and Federal Government level were undertaken to identify threatened species that had been recorded previously in the Study Area. No threatened fauna species listed were recorded during this current survey.

Threatened species identified as having potential to occur within the woodland habitat include the Swift Parrot and Regent Honeyeater, which are only expected as rare winter visitors to forage in Forest Redgum when resources in other areas are low.

The presence of hollows, spouts and fallen tree trunks which have potential to serve as nesting structures and protective hides would be expected to support a high diversity of small mammals. This was not found to be the case, as no small ground dwelling mammalian fauna were recorded. Factors influencing this low diversity possibly include predation by the European Fox. Currently there is easy access for Fox to enter the Study Area and the presence of Rabbit ensures a continual food source.

The use of the land for agricultural purposes has resulted in habitat loss and fragmentation of small isolated pockets of fauna habitat with minimal connectivity. Habitat loss and fragmentation have a large negative effect on biodiversity, which is reflected in the low species numbers recorded.

In relation to potential biobanking assessment and application, there is potential for biobanking schemes to be utilized and undertaken in relation to other sections of the Study Area with potential for offsets to also occur off site within the Hawkesbury – Nepean CMA. It is considered that the small localized patches of vegetation assessed as belonging to a threatened ecological community, having moderate or high conservation value and with moderate to high recovery and ecological potential, may present greater potential constraints in relation to development.

Conclusions

A Planning Proposal has been lodged by the Client's representative Rein Warry & Co Pty Ltd, (Principal Darryl Warry), in relation to a rezoning of the Study Area. The Planning Proposal has been lodged with Wollondilly Shire Council and the Department of Planning and Infrastructure (DOP & I).

Subsequent to Council's approval, the upgraded Planning Proposal will be submitted to the DOP & I for comments and/or approval.

The natural vegetation of the Study Area has mostly been cleared, grazed, disturbed and otherwise degraded, such that no patches of relatively weed-free, full-structured vegetation remain.

The pattern of remnant vegetation represents a mosaic of relatively natural and modified vegetation structure and floristic variation across the landscape, including small areas of highly modified Endangered Ecological Communities. The pattern of assessed ecological communities and their conservation significance assessment broadly reflects assessments of the same made by DEC (2002).

The vegetation has been mapped according to separate assessments of conservation significance value, recovery and ecological potential and biodiversity potential. No threatened flora species were recorded.

On the basis of the various assessments of significance of flora, fauna and ecological communities, and on the basis of the current zoning for the Study Area, it was considered that re-zoning of the Study Area is feasible.

A minimum allotment size of, for example 4000m², on areas of level topography occurring in the eastern sections of the Study Area, would be an appropriate strategic mechanism as it allows a greater density of allotments on readily developable areas assessed as having a 'low biodiversity value' whilst simultaneously allowing larger combined allotment sizes that may include areas assessed as having 'high biodiversity values'. It would be a strategic priority to maintain an area of 'high biodiversity land' within one new allotment rather than the allotment being fragmented into many multiple ownerships (Warry *pers comm.*).

An indicative lot number (assuming an area of 4000m² in more level topographical areas of the site) of new allotments of around **40 – 50 lots** is based on consideration of areas of **low biodiversity** and **low conservation significance value** and in recognition of site constraints such as corresponding areas of remnant moderate and high conservation/biodiversity values in the Study Area, as well as other site restrictions such as steepness of topography, road networks etc.

GLOSSARY

CCPD – Crown Canopy Projective Density (DEC 2002)

CEEC – Critically Endangered Ecological Community

CMA – Catchment Management Authority

CSHW – Cumberland Shale Hills Woodland (DECCW 2009)

DEC – State Department of Environment and Conservation

DECCW – State Department of Environment, Climate Change and Water

DOP & I - Department of Planning and Infrastructure

EEC – Endangered Ecological Community

EPA Act – Environment Protection Act

EPBC Act – Environment Protection and Biodiversity Conservation Act

ESD – Ecologically Sustainable Development

LPI – NSW Land and Property Information

NPWS – State National Parks and Wildlife Service

OEH – Office of the Environment and Heritage

PCL – Priority Conservation Lands

RoTAP – Rare and Threatened Australian Plants

SEWPaC – Commonwealth Department of Sustainability, Environment, Water, Populations and Communities

SMCMA – Sydney Metropolitan Catchment Management Authority

TSC Act – Threatened Species Conservation Act

1.0 Introduction

1.1 Background

A Planning Proposal has been lodged by the Client's representative, Rein Warry & Co. P/L, on behalf of the owners of the subject land that forms Part 1 of Lot 1 DP 1086066, known as Abbotsford Farm, located on Fairley Road and Abbotsford Road, Picton. The Planning Proposal relates to a rezoning of the area of land forming Part 1 of Lot 1 DP 1086066 (hereafter described as the Study Area) that has been produced in accordance with the adopted Wollondilly Growth Management Strategy 2011, as well as in accordance with other relevant state and regional growth strategies, policies, directions and certificates (Rein Warry & Co 2011).

The Planning Proposal has been lodged with the Wollondilly Council and the Department of Planning and Infrastructure (DOP & I). The DOP & I's 'Gateway Determination' requires that the Planning Proposal be upgraded by Specialist Studies.

The planning process requires that both the Council and the DOP & I give approvals for the Planning Proposal once the Planning Proposal has been upgraded by the Clients' representative (Rein Warry & Co P/L) on the basis of the results of the various Specialist Studies.

The 'Specialist Biodiversity Study Assessment Report' will be used by the client to upgrade the current Planning Proposal.

Subsequent to Council's approval, the entire upgraded Planning Proposal will be submitted to the DOP & I for comments and/or approval.

The extent of the Study Area encompasses part of the Abbotsford Farm property. The boundaries of the Study Area are depicted in Figure 1.

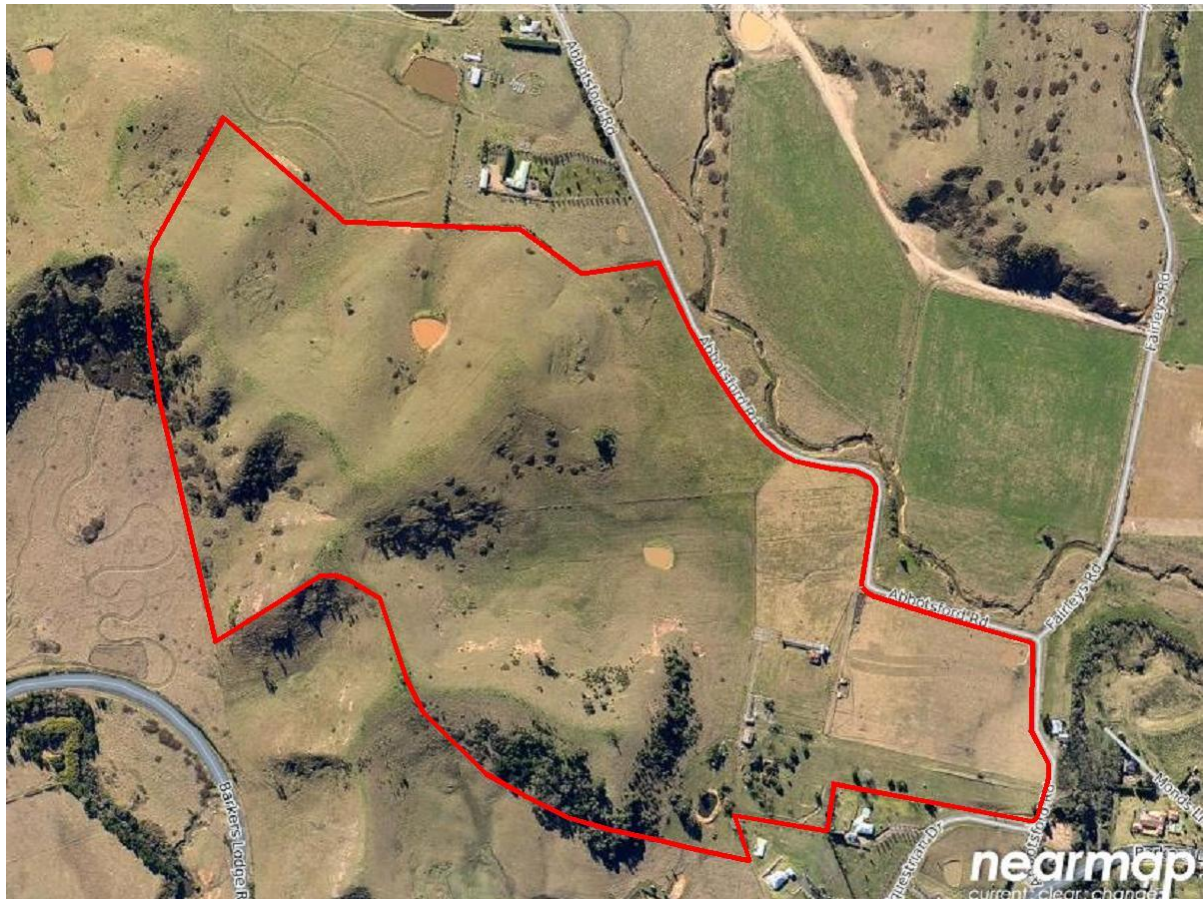


Figure 1 – Aerial view of the extent of Part 1 of Lot 1 DP 1086066, No. 1 Abbotsford Road, Picton, (boundary marked in red), hereafter described as the Study Area

1.2 Objectives and scope of the study

The objectives and scope of the study are:

- To identify, locate and describe the biodiversity values of the Study Area and its environmental context in the region by undertaking detailed flora and fauna field surveys. A description of the flora and fauna communities will be prepared and related to that contained in existing maps, aerial photography, reports and studies. Current and detailed information will be obtained on the following:
 - Identification of the flora and fauna that occur within the Study Area including documentation of species lists and mapping of identifiable plant communities;
 - Identification of Threatened (Endangered and Vulnerable) species, populations, communities and habitats as listed in Schedules 1 & 2 of the Threatened Species Conservation Act 1995 (TSC Act), including Preliminary Determinations of the NSW Scientific Committee, and the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), RoTAP species (Briggs & Leigh 1996) and regionally and locally significant species;

- Identification of fauna species including amphibians, reptiles, birds or mammals, not directly recorded during surveys but that could potentially occur in the Study Area as indicated by the presence of associated habitat;
- Description of the identifiable vegetation communities occurring within the Study Area indicating their current condition, conservation value and level of degradation;
- Recording of the area and extent of Noxious (and other significant) weed species in the Study Area;
- To assess the condition and recovery potential of the identified communities and to recommend strategies to conserve the ecological attributes of the landscape;
- To develop a strategy to conserve biodiversity values, in accordance with the principles and objectives of the *Threatened Species Conservation Act 1995*, of the Study Area and to improve the potential condition of the remnant vegetation communities and regional linkages to support native flora and fauna;
- To develop principles for the integration of rural/residential development and the ecological values of the Study Area, whilst considering the requirements for bushfire management and asset protection;
- To recommend zoning regimes and minimum lot sizes to support and maintain the ecological values of the Study Area;
- To identify Bio-banking potential within the Study Area;
- To identify biodiversity values that developer contributions should address;
- To review and integrate all relevant requirements of Government Departments detailed in the Planning Proposal and Gateway Determination; and
- To prepare a comprehensive report on the assessment for the review, comment and approval of the Client's representative, Council and the DOP & I.

1.3 Environmental Planning Instruments

1.3.1 Planning Proposal and Gateway Determination

The rezoning of land indicated by the natural and cadastral boundaries shown in Figure 1 has been the subject of a Gateway Determination by the Director General of the DPI in accordance with section 56 of the EPA Act 1979, for the Planning Proposal for the Wollondilly Growth Management Strategy 2011.

At its Ordinary Council meeting (12.12.2011) Wollondilly Shire Council has resolved the following:

- That subject to Gateway Determination, Council support a change to the Planning Proposal project that would involve the preparation of an LES for public exhibition;
- That Council commit to progressing the Planning Proposal project in a manner that is efficient, timely and legislatively correct.

As such, under the Gateway Determination, a fixed time is allocated to the rezoning process and time will be of the essence in preparation of this specialist study

1.3.2 Environmental planning instruments

Environmental Planning Instruments consulted as part of this survey include:

- *Threatened Species Conservation Act 1995 (TSC Act) (NSW)*
The objectives of this Act are:
 - *to provide for the conservation of threatened species, populations and ecological communities of animals and plants. The Act sets out a number of specific objects relating to the conservation of biological diversity and the promotion of ecologically sustainable development.*
- *Environmental Planning and Assessment Act 1979 (EP&A Act) (NSW)*
The objectives of this Act are:
 - *to encourage the proper management, development and conservation of natural and artificial resources, specifically the protection of the environment, native animals and plants and threatened species, populations and ecological communities, and their habitats.*
- *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) (Comm.)*
The objectives of this Act are:
 - *to provide for the protection of the environment, especially matters of national environmental significance*
 - *conserve Australian biodiversity*
 - *provide a streamlined national environmental assessment and approval process*
 - *enhance the protection and management of important natural and cultural places*
 - *promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources*
- *Noxious Weeds Act 1993 (NW Act) (NSW)*
The objects of this Act are:
 - *to reduce the negative impact of weeds on the economy, community and environment of this State by establishing control mechanisms to:*
 - *prevent the establishment in this State of significant new weeds, and*
 - *restrict the spread in this State of existing significant weeds, and*
 - *reduce the area in this State of existing significant weeds,*
 - *to provide for the monitoring of and reporting on the effectiveness of the management of weeds in this State*
- *Native Vegetation Conservation Act 1997 (NVC Act) (NSW)*
The objects of this Act are:
 - *to provide for the conservation and management of native vegetation on a regional basis.*
 - *to encourage and promote native vegetation management in the social, economic and environmental interests of the State.*
 - *to protect native vegetation of high conservation value.*
 - *to improve the condition of existing native vegetation.*

- *to encourage the revegetation of land, and the rehabilitation of land, with appropriate native vegetation.*
 - *to prevent the inappropriate clearing of vegetation.*
 - *to promote the significance of native vegetation.*
- ***State Environmental Planning Policy No. 44 - Koala Habitat Protection (SEPP 44)***
This Policy aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas to ensure a permanent free-living population over their present range and reverse the current trend of koala population decline.
 - ***Wollondilly Local Environmental Plan 2011***
The objectives of this plan are as follows:
 - *to make local environmental planning provisions for land in Wollondilly in accordance with the relevant standard environmental planning instrument under section 33A of the Act.*
 - *The particular aims of this Plan are as follows:*
 - (a) *to provide for the management of natural resources and the protection of the natural landscape character,*
 - (b) *to protect, conserve and enhance the built, landscape and Aboriginal cultural heritage,*
 - (c) *to protect water quality in land that is situated within water supply catchments,*
 - (d) *to encourage development that provides for an integrated transport and infrastructure system and adequate facilities and service provision for future growth,*
 - (e) *to recognise, manage and protect rural resource lands for sustainable agriculture and extractive industry practices,*
 - (f) *to maintain the separation between towns and villages to retain their unique character and rural and natural settings.*

1.4 Ecologically sustainable development

Four principles of Ecologically Sustainable Development (ESD) that should be considered whenever any development is planned for an area of land containing native bushland include: Conservation of Biological Diversity and Ecological Integrity, Precautionary Principle, Inter-generational Equity, and Improved Valuation and Pricing of Environmental Resources.

2.0 Existing environment of Study Area

2.1 Site location

The Study Area incorporates approximately 60 hectares land as shown in Figure 1. The Study Area, (Part of Lot 1 DP 1086066), is bounded by the Equestrian Drive Community Title Subdivision to the south and west, Fairleys Road to the east, Abbotsford Road to part of the north with an approved Community Title Subdivision to the remainder of the north (Figure 1).

2.2 Site description and land use of the Study Area

The Study Area occurs largely within a rural setting with most of the area having been cleared for grazing and with only relatively small patches of remnant trees and shrubs remaining. Grazing by cows and a horse is currently occurring over most sections of the Study Area. Patches of remnant woodland with modified structure dominated by Grey Box and Forest Red Gum, and degraded plant assemblages occur mainly in the southern sections of the Study Area. Blackberry Scrub occurs within the central and western sections of the Study Area creating a mosaic of semi-natural and incursive vegetation distribution across an otherwise cleared landscape (Figure 1).

2.3 Topography, geology and soils

The hilly sections of the Study Area occur across two sedimentary stratigraphies of the Wianamatta Group of Shales, the more elevated areas associated with the Bringelly Shale sediments overlying sediments derived from Ashfield Shale sediments (Figure 2). The lower flat areas of land to the very east of the Study Area are associated with Quaternary Holocene Alluvial sediments derived from fluvial flows of Crawfords Creek and its tributaries (Figure 2).

The hilly terrain of the Study Area occurs as two ridgelines generally aligned in an east to west direction, separated by a long valley located between the ridgelines (Figure 1). A series of small spurs and interposed valleys are orientated northwards, subtended from the northern east-west axial ridgeline (Figure 1). Generally hillslope gradients vary from about 10 – 25°.

Figure 2 is an aerial map of the geology of the Study Area.

The lithological parent material of the Ashfield Shale Sub-group of the Wianamatta Group of Shales is largely comprised of laminite and dark grey siltstone (Sherwin & Holmes 1985). The lithological parent material of the Bringelly Shale Sub-group of the Wianamatta Group of Shales, occurring over much of the upper sections of the Study Area, is largely comprised of shale, carbonaceous claystone and laminite (Sherwin & Holmes 1985).

The lithology of the Quaternary Alluvium sediments includes quartz and lithic 'fluvial' sand, silt and clay (Sherwin & Holmes 1985).

The Soil Landscape series associated with the Ashfield and Bringelly Shale sediments of the Wianamatta Group of Shales is largely the colluvial 'Picton' Soil Landscape Series (Hazelton, Bannerman & Tille 1990). This soil landscape is typified by steep to very steep sideslopes characterized by mass movement and terracettes on Wianamatta Shale and derived colluvial materials, the landscape often having a southerly aspect (Hazelton, Bannerman & Tille 1990). Soils derived from this Soil Landscape Series include shallow to deep red and brown podzolics on upper slopes, brown and yellow podzolics and soloths on lower slopes and benches with red and brown earths on colluvial material. Very deep yellow podzolics and soloths occur on lower slopes and drainage lines (Hazelton, Bannerman & Tille 1990).

The low lying area to the east and south-east of the Study Area is associated with the fluvial Monkey Creek Soil Landscape Series characteristic of floodplains, valley flats and drainage depressions of creeks flowing across the Cumberland Plain (Hazelton, Bannerman & Tille 1990). Typical soils include yellow podzolics and solodic soils on floodplains and valley floors, whereas alluvial soils and gleyed podzolics occur in poorly drained depressions and close to recent periodic flows (Hazelton, Bannerman & Tille 1990).

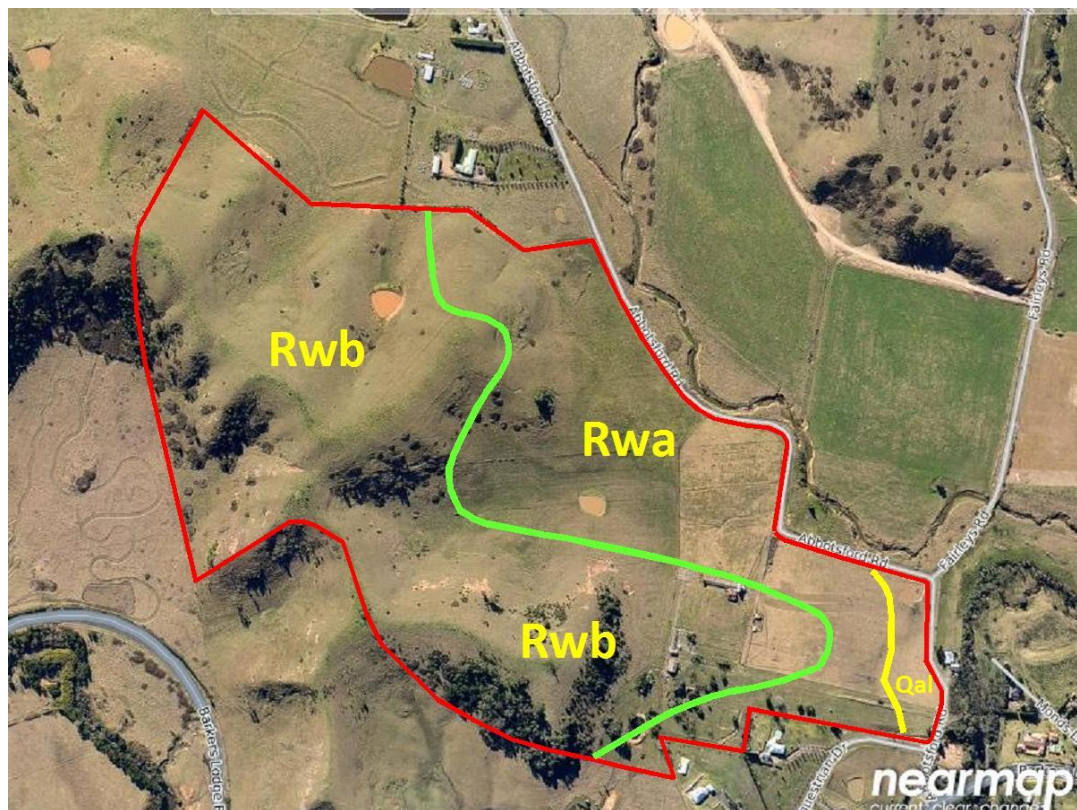


Figure 2 – Study Area showing geological distribution of the Bringelly/Ashfield Shale (Rwb/Rwa respectively) Formation of the Wianamatta Group of Shales with Quaternary Alluvium (Qal) occurring in the far east of the Study Area

3.0 Methods

3.1 Background searches and literature reviews

Existing information on 'Threatened Flora of the Locality', defined as a 5km radius around the Study Area, was accessed from the OEH Atlas of NSW Wildlife (1:100,000 map sheet 9029 Wollongong (November 2012), EPBC 'Protected Matters Environmental Reporting Tool' (November 2012) and RoTAP (Briggs & Leigh, 1996) databases. Other literature detailing locally threatened flora and fauna, as well as endangered populations and plant communities of the Study Area included NSW Scientific Committee Final Determinations (1996-2012), Native Vegetation of the Cumberland Plain – Final Edition (DEC 2002) and The Native Vegetation of the Sydney Metropolitan Catchment Management Authority Area – Draft (DECCW 2009).

Searches for terrestrial fauna were undertaken from the OEH Atlas of NSW Wildlife database (November 2012) for a 5km radius of the site, as well as the Department of Sustainability, Environment, Water, Population and Communities (SEWPaC) 'Protected Matters Search Tool' Database (November 2012) for threatened fauna species or populations of fauna likely to occur in the Study Area. Searches of JAMBA (Japan and Australia Migratory Bird Agreement), CAMBA (China and Australia Migratory Bird Agreement) and ROKAMBA (Republic of Korea Migratory Bird Agreement) databases were also consulted in regard to the distribution of migratory bird species.

3.2 Field surveys

The Study Area was inspected by 'ACS Environmental P/L' on the 8th, 15th and 16th of November 2012 for the presence of flora and fauna.

3.2.1 Flora Survey

Comprehensive surveys of the Study Area were undertaken on foot by the diversity search method of Cropper (1993) and DEC 'Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities' (2004) to identify the existence of extant flora and assessment of ecological communities.

Initial examination of the Study Area indicated that up to five distinct vegetation assemblages could be recognized. Within some of these broadly discrete assemblages, a number of distinct sub-communities could be distinguished, resulting in a total of 8 discernible floristic/structural assemblages.

These assemblages equate to discrete, floristically and/or structurally variable ecological communities over the landscape as indicated in Table 1 as follows:

Table 1 – Summary of distinguishable vegetation assemblages occurring throughout the Study Area

ECOLOGICAL COMMUNITY CODE	ECOLOGICAL COMMUNITY TYPE	SUB-ASSEMBLAGE COMMUNITY CODE	SUB-ASSEMBLAGE CHARACTERISTIC ATTRIBUTES – STRUCTURAL & FLORISTIC
1	MOIST SHALE WOODLAND/CUMBERLAND PLAIN WOODLAND (CUMBERLAND MOIST SHALE WOODLAND/CUMBERLAND SHALE PLAINS WOODLAND – DECCW 2009)	1A	Main canopy trees Grey Box and Thin-leaved Stringybark. Woodland to 15% CCPD to 12m tall; Lantana and Blackthorn understorey to 90%CCPD to 2.5m tall
		1B	Main canopy trees Grey Box and Forest Red Gum. Woodland to 25% CCPD to 20m tall; Lantana and Blackthorn understorey to 70%CCPD to 2m tall
		1C	Main canopy trees Grey Box and Forest red Gum. Open woodland 10 - 15% CCPD to 15m tall; Blackthorn and/or African Box Thorn in understorey
2	STRUCTURALLY MODIFIED MOIST SHALE WOODLAND/CUMBERLAND PLAIN WOODLAND	2	Patches of scrub dominated by Blackthorn, no tree canopy stratum
3	PATCHES OF BLACKBERRY-DOMINATED SCRUB	3A	Patches of Blackberry-dominated scrub associated with Blackthorn, usually occurring upslope of Blackberry scrub
		3B	Patches of Blackberry-dominated scrub with no Blackthorn
4	CLEARED PASTURE EXOTIC GRASSLAND	4	Grazed, cleared pasture with mixture of exotic and indigenous grasses and herbs
5	FORMER LANDSCAPED AREAS WITH ORNAMENTAL PLANTINGS ASSOCIATED WITH FORMER RESIDENTIAL LIVING AREAS	5	Cleared areas associated with heritage buildings and former living areas, cleared areas including ornamental plantings

As variation in structure and floristics of the vegetation occurs over the range of ecological plant community variation, floristic data from representative sample quadrats of 20m x 20m (400m²) (DEC 2004) were collected throughout patches of ecological communities over the range of discernible disturbance or structural modification regimes.

Quadrats were selected in various assemblages where the extent of area was greater than 1ha, according to discrete floristic and/or structural variation, and sampled in areas of wooded ecological communities or habitat present where the extent of area was greater than 1ha (DEC 2004). In relation to mapping and species audit information, quadrat data was augmented by extensive visual observation and spot recording in tracts of vegetation within the variable structural and floristic units.

Since the greater extent of the Study Area has been cleared, the floristic data from a total of 4 quadrats, including species occurring in the vicinity of quadrats, was recorded. Data was ranked in these quadrats by using a modified Braun-Blanquet Cover Ranking Scale system. Representative quadrat locations within patches of woodland and scrub vegetation occurring throughout the Study Area are shown in Figure 3. In areas where quadrats were not employed, a ranked species frequency of occurrence measure was undertaken. Ranked species cover data in quadrats and ranked species frequency of occurrence data were recorded for discernible ecological communities occurring in the Study Area (Appendix 1).

The survey included a complete floristic inventory of indigenous and exotic species and an assessment of the presence, or likelihood of occurrence, of any threatened, rare (RoTAP), regionally or locally significant species or ecological plant community occurring in the Study Area.

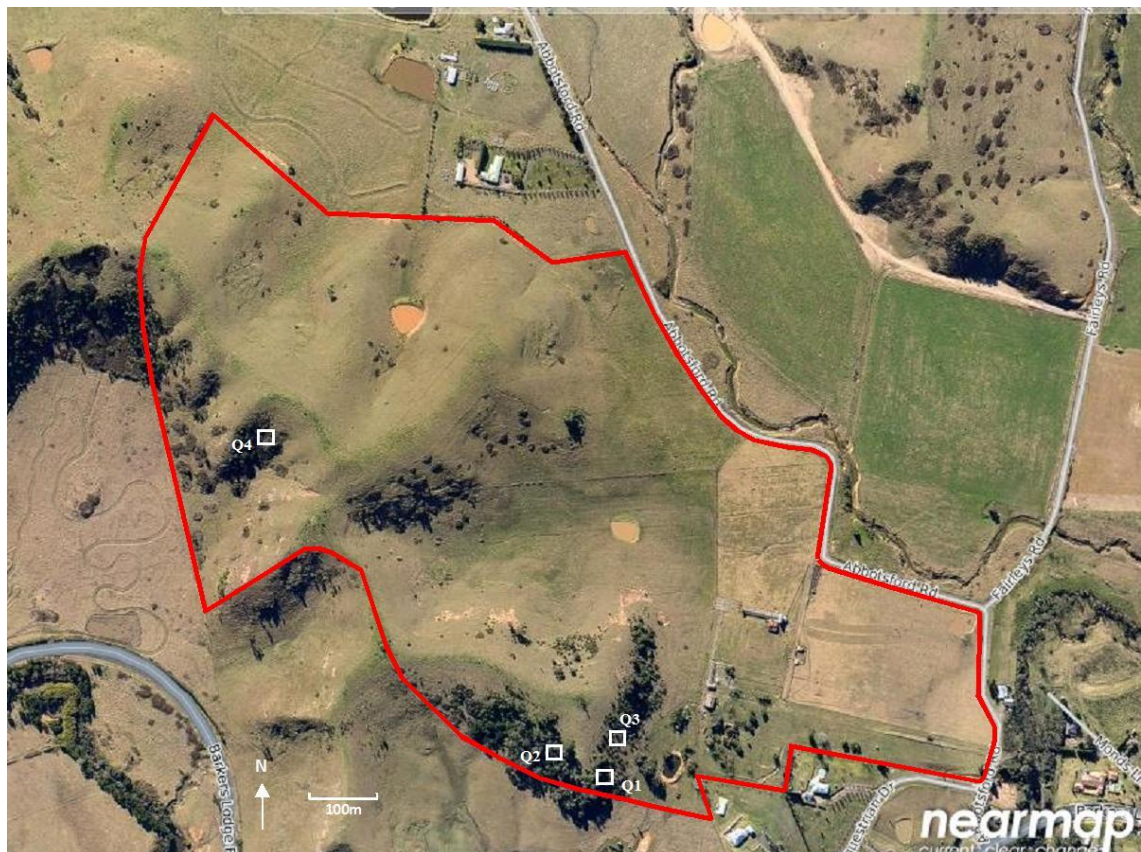


Figure 3 – Study Area showing location of 4 x 400m² quadrats in woodland and scrub vegetation in the southern and western parts of the area

3.2.2 Fauna Survey

The fauna survey was undertaken as a habitat based assessment. The survey involved different search strategies and protocols and all extant fauna or evidence of fauna was

recorded. Threatened fauna species not recorded in the surveys but with the potential to be present as indicated by habitat were recorded.

Strategies employed for the field investigation of the Study Area were:

Assessment of the value of habitat suitable for native fauna species and specific habitat structures/resources was identified that were considered important in life cycles. These structures or resources included:

- Mature trees with hollows for breeding, roosting and/or nesting;
- Large woodland stands for sheltering, roosting and foraging;
- Particular foraging resources such as certain tree or shrub species;
- Dispersal, migratory or foraging corridors for fauna;
- Leaf litter and ground search for reptiles, frogs and threatened invertebrates;
- Identification of scats and other indirect evidence to suggest fauna utilisation such as tracks, scratch marks or diggings;
- Assessment was carried out with particular regard for species listed as 'threatened' under the Threatened Species Conservation Act, 1995 (TSC Act).

3.2.4 Limitations of the study

Limitations of the study may arise where certain cryptic species of plants may occur as soil-stored seed or as subterranean vegetative structures. Some species are identifiable above-ground only after particular environmental circumstances occur that may be related to factors such as periodic fire frequency, intensity or seasonality, soil moisture regime, grazing pressure, biological life-cycle patterns as in the case of small geophytic taxa such as species of orchids etc.

Diurnal surveys at one time of the year cannot be expected to detect the presence of all species occurring, or likely to occur, in the Study Area. This is because some species may (a) occur seasonally, (b) utilise different areas periodically (as a component of a more extensive home range), or (c) become dormant during specific periods of the year. Rather, the survey provides the opportunity to sample the area, search specifically for species likely to be encountered within the available time frame, and assess the suitability of habitat for particular species.

These potential limitations to the location of certain cryptic or diurnally active species are not expected to cause any significant constraints to the purposes of this assessment.

4.0 Results

4.1 Background searches and literature reviews

OEH Atlas of NSW Wildlife (November 2012) records for an area of 5km radius around the Study Area indicate that 2 species of flora of conservation significance have been recorded since 1987. According to guidelines listed by the EPBC 'Protected Matters Search Tool' (November 2012), it was deemed that habitat may potentially occur for a further 8 threatened flora species. Appendix 2 lists these 10 species with an account of their threatened status, geographical range, physiognomic attributes, habitat features and likelihood of occurrence in the Study Area.

The OEH Atlas of NSW Wildlife database (November 2012) listed seventeen (17) species of fauna classified as threatened under the Threatened Species Conservation Act, 1995 (TSC Act) and Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) within a 5 km radius of the Study Area (Table 3). Searches of JAMBA, CAMBA and ROKAMBA databases determined that two (2) migratory bird species had been recorded within 5km of the Study Area since 1987 (Table 4).

4.2 Flora Results

4.2.1 Indigenous and exotic species

Appendix 1 is a floristic species list of terrestrial indigenous and exotic species occurring in quadrats (400m²) in bushland and in other general areas within the Study Area.

Table 2 - lists the indicative number of indigenous and exotic species occurring over the range of ecological community types identified within the Study Area (Figure 1, Table 1) as follows:

ECOLOGICAL COMMUNITY CODE	ECOLOGICAL COMMUNITY TYPE	INDICATIVE NUMBER INDIGENOUS SPECIES	INDICATIVE NUMBER EXOTIC SPECIES	INDICATIVE NUMBER NOXIOUS WEEDS	PLANTED ORNAMENTAL SPECIES
1A (QUADRAT 1)	MOIST SHALE WOODLAND/CUMBERLAND PLAIN WOODLAND (CUMBERLAND MOIST SHALE WOODLAND/CUMBERLAND SHALE HILLS WOODLAND – DECCW 2009)	8	9	2	NA
1B (QUADRAT 2)		5	10	4	NA
1C		3	4	2	NA
2 (QUADRAT 3)	STRUCTURALLY MODIFIED MOIST SHALE WOODLAND/CUMBERLAND SHALE HILLS WOODLAND	7	12	4	NA

ECOLOGICAL COMMUNITY CODE	ECOLOGICAL COMMUNITY TYPE	INDICATIVE NUMBER INDIGENOUS SPECIES	INDICATIVE NUMBER EXOTIC SPECIES	INDICATIVE NUMBER NOXIOUS WEEDS	PLANTED ORNAMENTAL SPECIES
3A (QUADRAT 4)	PATCHES OF BLACKBERRY-DOMINATED SCRUB ASSOCIATED WITH BLACKTHORN THAT USUALLY OCCURS UPSLOPE OF BLACKBERRY SCRUB	9	11	4	NA
3B	PATCHES OF BLACKBERRY-DOMINATED SCRUB WITH NO BLACKTHORN	2	10	4	NA
4	CLEARED PASTURE EXOTIC GRASSLAND	7	24	4	NA
5	FORMER LANDSCAPED AREAS WITH ORNAMENTAL PLANTINGS ASSOCIATED WITH FORMER RESIDENTIAL LIVING AREAS	-	3	2	11

The total indicative number of indigenous species recorded for the Study Area is 21, including 5 species of grasses, 7 species of herbs and twiners, 3 species of shrubs or small trees and 5 species of tree (Appendix 1).

The total indicative number of exotic species recorded for the Study Area is 35, including 8 species of noxious weeds (Appendix 1). Woody noxious weeds occurring at high frequency in wooded sections of the Study Area include Lantana, Blackberry and African Box-thorn (Appendix 1).

Table 2 shows that the indicative number of indigenous species occurring in any particular assemblage is relatively low, usually only between 5 and 9, whereas the indicative number of exotic species in any assemblage is often greater than 9, and over a large extent of the cleared grazed areas, is up to 24 (Table 2).

4.2.2 Vegetation Communities

Five distinct vegetation communities can be delineated within the Study Area including patches of eucalypt-dominated woodland, Blackthorn scrub and scrub dominated by the noxious woody weed, Blackberry. The largest section of the Study Area comprises cleared exotic grassland and floristic variation also occurs in areas surrounding former residences and other building structures. Variation in relation to floristic assemblages occurs within some communities depending on the extent and nature of past disturbance/structural modification history.

Descriptions of these communities are derived from definitions given in current mapping of the SMCMA by DECCW (2009), and even though the subject Study Area lies outside the Sydney Metropolitan Catchment Area, the descriptions of the ecological communities can be interpolated to include those occurring in the Study Area.

Equivalent Endangered Vegetation Communities (EEC's) listed by State and Commonwealth registers to comparable ecological community descriptions given by DECCW (2009) are as follows:

Listed EEC (TSC Act; EPBC Act) (description as given by DEC (2002))	EEC Description given by DECCW (2009)
<i>Moist Shale Woodland</i> <i>Cumberland Plain Woodland</i>	<i>Cumberland Moist Shale Woodland</i> <i>Cumberland Shale Hills Woodland</i>

Figure 4 indicates the distribution of these communities in relation to extent of historical structural modification. The degree of structural and floristic modification of patches of an ecological community directly reflects their conservation significance status. Figure 5 indicates previous mapping of the subject area in relation to ecological community terminology as described in DEC (2002).

Figures 4 & 5 indicate that patterns in the resulting historical ecological distributions of discernible plant communities occurring in the Study Area are closely associated with patterns in the physical substrate geology and the colluvial environment of the 'Picton' Soil Landscape Series. This soil landscape is typified by steep to very steep sideslopes characterized by mass movement and terracettes on Wianamatta Shale sediments and derived colluvial materials, the landscape often having a southerly aspect (Hazelton, Bannerman & Tille 1990).

Distributions of Cumberland Moist Shale Woodland/Cumberland Shale Plains Woodland, as well as patches of Blackberry-dominated scrubs, occur mainly on steep, often south-facing hillslopes associated with soils of the 'Picton' Soil Landscape Series derived from the Ashfield/Bringelly Shale Sub-groups of the Wianamatta Group of Triassic Shales (Figure 2).

The mapping of the area of Cumberland Shale Plain Woodland by DEC (2002) (Code: 10) indicated for the study area in Figure 5 is likely interpreted from aerial photographs and other digital information. However, ground-truthing indicates that this patch of woodland occurs throughout the former residential living areas of the former residence and the trees in this area are largely comprised of ornamental plantings, some probably as long as 100years ago (Figure 4).

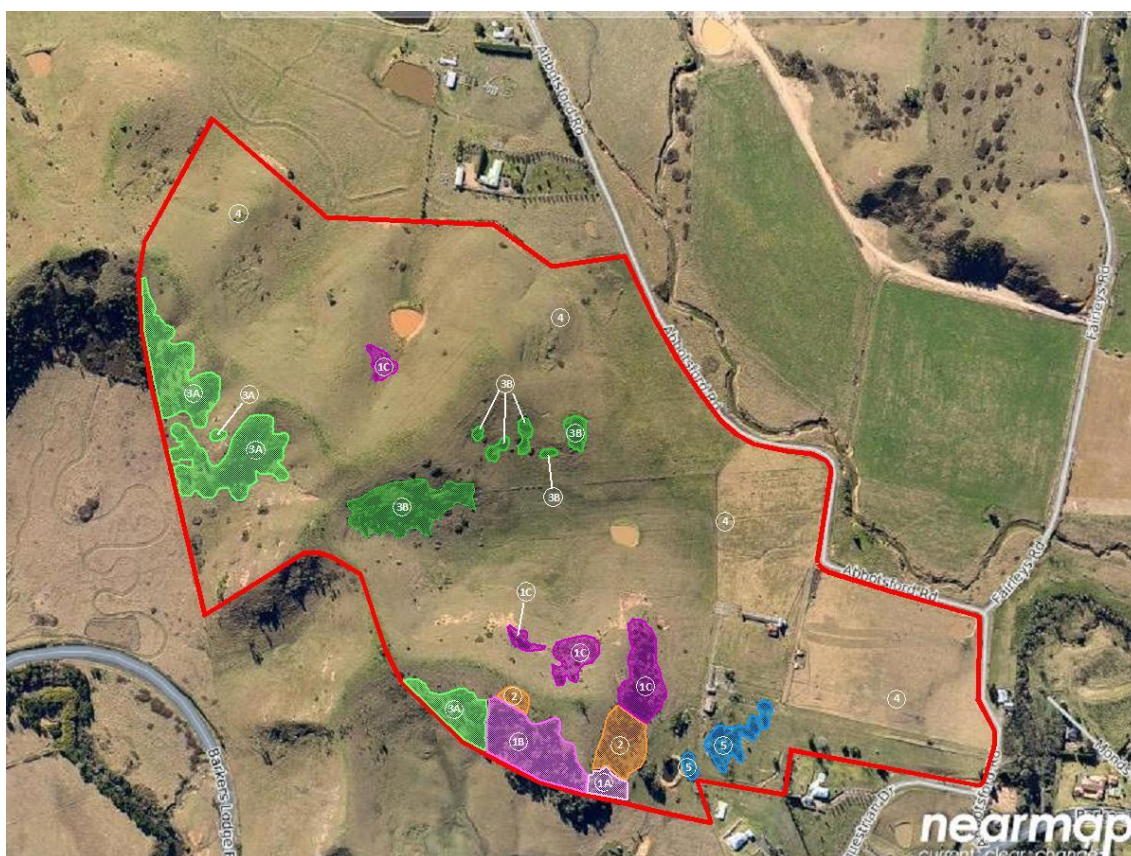


Figure 4 – Distribution of discrete vegetation assemblages including patches of woodland and Blackberry-dominated scrub in the Study Area (see text for description of numerical code nos.)

Grey Box (*Eucalyptus moluccana*) with Thin-leaved Stringybark (*Eucalyptus eugenioides*) occurring less frequently. Hickory Wattle is also a common small tree species occurring in these assemblages (DECCW 2009). Both assemblages occur primarily on protected aspects on steeper shale hills and rises in the southern and south-western sections of the Cumberland Plain (DECCW 2009).

In the case of typical compositions of Cumberland Moist Shale Woodland, characteristic understorey and twiner species such as Hairy Clerodendrum (*Clerodendrum tomentosum*) and Slender Grape (*Cayratia clematidea*) respectively, are regarded as indicators of this community (DECCW 2009). However, the remnant patches of woodland occurring at the Study Area are highly degraded and few indigenous species remain such that no characteristic indicator species for any variant of Cumberland Plain Woodland vegetation are evident. A total of only 5 diagnostic indigenous species (Blackthorn, Kidney Weed (*Dichondra repens*), Thin-leaved Stringybark, Grey Box and Forest Red Gum) were recorded in these assemblages (DECCW 2009) (Appendix 1) from a total of 26 diagnostic species, these five species occurring relatively ubiquitously over the Cumberland Plain and recorded in most surveys of variants of Cumberland Plain Woodland.

In the case of typical compositions of Cumberland Shale Hills Woodland, there is often an established small tree stratum of which Hickory Wattle is common, and a well-formed ground stratum characteristically comprised of native grasses (DECCW 2009). However, the remnant patches of woodland mapped as such by DEC (2002) (Figure 5) occurring at the Study Area are highly degraded with high frequencies of noxious and other woody weeds such as Lantana, Blackberry, African Box-thorn, Large-leaved Privet and Small-leaved Privet (Appendix 1). Few indigenous species remain such that no characteristic indicator species for any variant of Cumberland Plain Woodland vegetation are evident. A total of only 6 diagnostic indigenous species, similar to the diagnostic species listed for Cumberland Moist Shale Woodland above (DECCW 2009), were recorded in these assemblages (Appendix 1) from a total of 35 diagnostic species (DECCW 2009). These six species occur relatively ubiquitously and in generally high frequencies over much of the Cumberland Plain and have been recorded in most surveys of variants of Cumberland Plain Woodland.

Woodland assemblages mapped as Moist Shale Woodland (Figure 4, Codes: 1A, 1B & 1C) have a %CCPD from 15 – 25% with trees attaining heights from 12 to 20m, often with regenerating eucalypts forming a mid-storey stratum to about 8m tall. The understorey stratum is comprised largely of woody weeds, mostly Lantana, but also including high cover values for Blackthorn (*Bursaria spinosa*), forming closed canopies to 70% CCPD as shown in Figures 6 & 7. Figures 6 & 7 indicate highly degraded areas of woodland occurring in the south-central section of the Study Area (Figure 4).

Species richness

The degraded community is relatively species poor, with an indicative species diversity value of about 10 indigenous species/800m² (Table 2).

Similarly, exotic (including noxious weed species) species in these degraded assemblages have an indicative value of about 11 exotic species/800m² (Table 2).



Figure 6 – Area of Cumberland Moist Shale Woodland occurring at Quadrat 1 in the Study Area (Figure 3), the canopy cover dominated by Grey Box and Thin-leaved Stringybark (Figure 4).



Figure 7 – Area of Cumberland Moist Shale Woodland occurring at Quadrat 2 (Figure 3) in the Study Area, the canopy cover dominated by Grey Box and Forest Red Gum (Figure 4).

Floristic composition

The floristics of the three mappable entities of Cumberland Moist Shale Forest/Cumberland Hills Shale Woodland occurring in the Study Area are sufficiently variable to separate these assemblages as follows:

1A – This patch of degraded woodland with %CCPD to 15% with trees to 12m tall has an easterly aspect and is characterised by a canopy dominated by Grey Box and Thin-leaved Stringybark. A scrub understory comprised of Lantana and Blackthorn to 2.5m tall attains a %CCPD to 90%. Bare earth accounts for up to 20% of the ground surface with 10% cover comprised of grasses such as Weeping Grass (*Microlaena stipoides*) and herb species such as Fishweed (*Einadia trigonos*) and Kidney Weed (*Dichondra repens*) (Appendix 1).

1B - This patch of degraded woodland with %CCPD to 25% includes mature trees to 20m tall with regenerating eucalypts to about 8m in height. The remnant woodland has a southerly aspect and is characterised by a canopy dominated by Grey Box and Forest Red Gum. A scrub/low tree understory/mid-storey stratum is comprised of Lantana, Large-leaf Privet and Blackthorn to 2.5 - 4m tall attains a %CCPD to 70%. Bare earth accounts for up to 40% of the ground surface (Appendix 1).

1C - These areas of modified and degraded woodland have canopy cover values of %CCPD ranging from 10 to 15% and includes mature trees to 15m tall with regenerating eucalypts to about 8m in height (Figure 8). These remnant woodlands have either an easterly or northerly aspect and are characterised by canopies dominated by either Grey Box or Forest Red Gum. A scrub understory stratum is comprised of Blackthorn and African Box-thorn to 2.5m tall with %CCPD to 50%. Bare earth and exotic and indigenous species of grasses and herbs comprise the ground stratum (Appendix 1).



Figure 8 - Area of Cumberland Moist Shale/Shale Hills Woodland occurring on the northern side of the southernmost ridge of the Study Area, the canopy cover dominated by Grey Box and Forest Red Gum with a scrub layer comprised of Blackthorn (Figure 4).

Previous Mapping

Mapping by DEC (2002) (Figure 5) broadly confirms the current assessment of the distribution of Cumberland Moist Shale Woodland/Cumberland Shale Hills Woodland in the southern central section of the Study Area (Figure 4).

Vegetation classification and status

Cumberland Moist Shale Woodland/Cumberland Shale Hills Woodland is a component of Cumberland Plain Woodland and is listed as a 'Critically Endangered Ecological Community' under Part 2 of Schedule 1A of the NSW *TSC Act (1995)*. This community is also listed as a 'Critically Endangered Ecological Community' as a component of Cumberland Plain Shale Woodlands under the *EPBC Act (1999)*. Areas of the vegetation community are represented and conserved in Prospect Nature Reserve, Western Sydney Regional Park and Leacock Regional Park (DECCW 2009).

The Biometric Vegetation Type for the Hawkesbury-Nepean CMA Data Base (DECCW 2008) describes this community as 'Grey Box - Forest Red Gum shrubby woodland on shale of the southern Cumberland Plain, Sydney Basin' listed as an Endangered Ecological Community.

4.2.2.2 **Blackthorn-dominated Scrub - Code: 2 (Figures 3, 4 & 9)**

Location

Patches of Blackthorn-dominated Scrub occur near the top and along the sideslopes of some ridges in the lee of the south and east-facing hillslopes of the lower south and western sections of the Study Area (Figure 4).

Description and distinguishing features

These Blackthorn-dominated scrub assemblages have probably established after clearing of original forested vegetation in the Study Area. Sufficient Blackthorn populations have been retained in wooded sections of the area to facilitate dispersal of seed into suitable habitats, and where not grazed for extended periods, Blackthorn has been able to establish and proliferate.

In particular areas, Blackthorn occurs in conjunction with often elevated locations above Blackberry infestations, otherwise the species forms a singular scrub canopy (Figures 3 & 9)

Blackthorn occurs relatively ubiquitously over the Cumberland Plain in both Cumberland Moist Shale/Shale Hills Woodland (DECCW 2009) and is recorded in most surveys of variants of Cumberland Plain Woodland.

Blackthorn-dominated assemblages (Figure 4, Code: 2) have a %CCPD ranging from 50 – 75% with shrubs attaining heights from 2 to 4m. The ground stratum comprised of native and exotic grass and herb species has a cover of about 50 - 90%CCPD to 0.5m tall (Figure 9).

Species richness

The shrub-dominated community is relatively species poor, with an indicative species diversity value of about 7 indigenous species/400m² (Table 2).

Exotic (including noxious weed species) species in these assemblages have an indicative value of about 12 exotic species/400m² (Table 2).



Figure 9 – Area of Blackthorn-dominated vegetation occurring at Quadrat 3 in the Study Area (Figures 3 & 4)

Floristic composition

The scrub over-story stratum is singularly comprised Blackthorn to 4m tall attains a %CCPD to 75%. Bare earth accounts for 5 - 10% of the ground surface with native ground cover comprised of grasses such as Weeping Grass (*Microlaena stipoides*), Redgrass (*Bothriochloa macra*), Short-hair Plumegrass (*Dichelachne micrantha*) and Kangaroo Grass (*Themeda australis*) and herb and twiner species such as Love Creeper (*Glycine tabacina*) and Kidney Weed (*Dichondra repens*) (Appendix 1).

Previous Mapping

Mapping by DEC (2002) (Figure 5) does not reflect distributions of Blackthorn occurring without a tree canopy (Figure 4).

Vegetation classification and status

Blackthorn-dominated scrubs can be considered to be a highly modified component of Cumberland Plain Woodland where establishment in cleared areas has likely occurred from seed sources in nearby wooded assemblages. Cumberland Plain Woodland is listed as a 'Critically Endangered Ecological Community' under Part 2 of Schedule 1A of the NSW *TSC Act (1995)*. This community is also listed as a 'Critically Endangered Ecological Community' as a component of Cumberland Plain Shale Woodlands under the *EPBC Act (1999)*. Areas of the vegetation community are represented and

conserved in Prospect Nature Reserve, Western Sydney Regional Park and Leacock Regional Park (DECCW 2009).

4.2.2.3 Blackberry-dominated Scrub – Codes: 3A & 3B (Figures 4, 10 & 11)

Location

Patches of Blackberry-dominated Scrub occur in the lee of the south-east and south-west facing hillslopes of the central and western sections of the Study Area (Figure 4).

Description and distinguishing features

These Blackberry-dominated scrub assemblages have established in the lee of hillslopes following clearing of original forested vegetation in the Study Area. Cattle probably avoid these steeper hillslope sections of the local landscape allowing Blackberry and related woody and other weeds to establish and proliferate.

In particular areas, Blackthorn occurs in conjunction with distributions of Blackberry infestations, otherwise the species forms a scrub canopy with other weeds such as African Box-thorn and Spear Thistle (*Cirsium vulgare*) (Figures 3, 4, 10 & 11)

Blackberry-dominated assemblages (Figure 4, Codes: 3A & 3B) have a %CCPD ranging from 85 – 100% with shrubs attaining heights to 1.5 with emergent small trees and shrubs to 2.5m (Figures 10 & 11).

Species richness

The shrub-dominated community is relatively species poor, with an indicative species diversity value of about 9 indigenous species/400m² when Blackthorn distributions are associated with Blackberry infestations (Code: 3A) and an indicative species diversity value of only 2 indigenous species /400m² when Blackthorn distributions are absent (Table 2).

Exotic (including noxious weed species) species in these assemblages have an indicative value of about 10 - 11 exotic species/400m² (Table 2).



Figure 10 – Area of Blackberry-dominated vegetation where distributions of Blackthorn occurs in association with Blackberry infestations (Code: 3A) occurring in the vicinity of Quadrat 4 in the Study Area (Figures 3 & 4). The lighter green, taller spindly shrubs are patches of Blackthorn



Figure 11 – Area of Blackberry-dominated vegetation (Code: 3B) where emergent small trees include Hickory Wattle though Blackthorn is not associated with these distributions of Blackberry-infestations (Figure 4)

Floristic composition

The floristics of the two mappable entities of Blackberry Scrub occurring in the Study Area is sufficiently variable to separate these assemblages as follows:

3A – These assemblages of Blackberry-infested Scrub are commonly associated with distributions of Blackthorn. Other indigenous species occurring in the assemblage include Hickory Wattle, Parramatta Green Wattle, Shorthair Plumegrass (*Dichelachne micrantha*), Tussock Grass (*Poa labillardiera*) and Kangaroo Grass (*Themeda australis*) (Appendix 1).

Common exotic species occurring with Blackberry include Common Spear Thistle (*Cirsium vulgare*) and Cats Ears (*Hypochaeris radicata*),

3B – These assemblages of Blackberry-infested Scrub include Hickory Wattle and infrequently, individuals of Kurrajong (*Brachychiton populneus*) (Appendix 1).

Common exotic species occurring with Blackberry include African Box-thorn (*Lycium ferrocissimum*), Darwins Berberis (*Berberis aristata*), Lantana (*Lantana camara*), Purpletop (*Verbena bonariensis*) and Common Spear Thistle (*Cirsium vulgare*) (Appendix 1).

Previous Mapping

Mapping by DEC (2002) (Figure 5) does not reflect distributions of Blackthorn occurring in association with Blackberry infestations (Figure 4).

4.2.2.4 [Cleared pasture exotic grassland – Code: 4 \(Figures 4 & 12\)](#)

Location

Cleared pasture comprised largely of exotic grassland incorporates greater than about 80% of the Study Area (Figure 12). Generally only the steeper south and east facing hillslopes contain wooded vegetation (Figure 4).

Description and distinguishing features

The cover of exotic grassland is greater than 95%, the vegetation being continually grazed and maintained at a relatively low height (Figure 12), with Spear Thistle occasionally emergent in grassland particularly on hillcrests (Figure 13).

Species richness

The exotic grassland-dominated community is relatively species poor in regard to indigenous grass and herbaceous species, with an indicative species diversity value of about 7 indigenous species/400m² (Table 2).

Exotic (including noxious weed species) species in this assemblage have a relatively high indicative value of about 24 exotic species/400m² (Table 2).



Figure 12 – Exotic grassland landscape indicating the cropped height of continually grazed grasses and herbs in the assemblage



Figure 13 – Areas of common distribution of Common Spear Thistle occur mainly on ridgelines in particular sections of the Study Area

Floristic composition

Exotic grassland assemblages commonly include indigenous species of grasses such as Redgrass (*Bothriochloa macra*), Tussock Grass (*Poa labillardierei*), Weeping Grass (*Microlaena stipoides*) and Kangaroo Grass (*Themeda australis*) (Appendix 1).

Common exotic species include Common Spear Thistle (*Cirsium vulgare*), Cudweed (*Gamochaeta coarctatum*), Cats Ears (*Hypochaeris radicata*), Fireweed (*Senecio madagascariensis*), Hop Clover (*Trifolium campestre*), Centaury (*Centaureum tenuiflorum*), Plantain (*Plantago lanceolata*), Purpletop (*Verbena bonariensis*), Perennial Ryegrass (*Lolium perenne*), Serrated Tussock (*Nasella trichotoma*) (a noxious weed), Parramatta Grass (*Sporobolus africanus*) and Squirrel-tail Fescue (*Vulpia bromoides*) (Appendix 1)

4.2.2.5 Ornamental plantings associated with former residential living areas - Code: 5 (Figures 4 & 14)

Location

Original residences and associated buildings were established in the lower east flatter to gently rising landforms. Associated with residential buildings and access ways were ornamental plantings of exotic and native trees, shrubs and vines (Figures 4 & 14).

Description and distinguishing features

These plantings were established in cleared areas some time ago, possibly as long ago as 100 years, with individuals of tall remnant mature exotic and native trees indicative of former landscaping programs. The landscaped plantings are currently mixed with woody noxious weeds that have also established in this area (Figure 14).

Species richness

An indicative number of ornamental plantings in the established residential and recreational areas of Abbotsford Farm totals some 12 species of tree, shrub or vine (Appendix 1) (Table 2).

Exotic small tree and shrub (including noxious weed species) species in these assemblages totals some 3 species (Table 2).



Figure 14 – Area of former building structures remaining in the south-eastern part of the Study Area indicating a mix of planted ornamental small tree, shrub and vine species mixed with noxious woody weeds such as Lantana (Figure 4)

Floristic composition

Ornamental plantings remaining at the former residential sections of the Study Area include mature individuals of Smooth-leaved Elm (*Ulmus minor*), White Cedar (*Melia azederach*), Wistaria (*Wistaria chinensis*), Pepper Tree (*Schinus areira*), Allamanda (*Allamanda neriifolia*), Osage Orange (*Maclura pomifera*) and Bunya Pine (*Araucaria bidwillii*) (Appendix 1).

Environmental and noxious woody weeds occurring in the assemblage include Large-leaf Privet (*Ligustrum lucidum*), African Box-thorn and Lantana (Appendix 1).

Previous Mapping

Mapping by DEC (2002) (Figure 5) erroneously indicates that this area is associated with Cumberland Shale Plain Woodland (Figure 4).

4.2.3 Flora species of conservation significance

Threatened species

OEH Atlas of NSW Wildlife (November 2012) records for an area of 5km radius around the Study Area indicate that 2 flora species of conservation significance have been recorded since 1987. According to guidelines listed by the EPBC 'Protected Matters Search Tool' (November 2012), it was deemed that habitat may potentially occur for a further 8 threatened flora species. Appendix 2 lists these 10 species with an account of their threatened status, geographical range, physiognomic attributes, habitat features and likelihood of occurrence in the Study Area.

The few records of threatened flora species listed as occurring within a 5km radius of the Study Area occur from locations in natural bushland at least some 4km to the north-east of the Study Area at Razorback Ridge or Maldon (OEH Atlas of NSW Wildlife Wollongong 1:100 000 Sheet November 2012).

Targeted searches were made in suitable habitats for any individuals of species recorded on the OEH Atlas of NSW Wildlife (Cropper 2003, DEC 2004), as well as for the 10 other flora species of conservation significance where suitable habitat is deemed to potentially occur, but none were located. As such, it is considered that more than likely, none of these species are likely to occur within the highly degraded habitats of the Study Area.

RoTAP species

No RoTAP species (Briggs & Leigh 1996) were recorded in the subject area.

Species of local or regional significance

No individuals of any species of regional significance were found to occur in the highly degraded habitats of the Study Area.

4.2.4 Site potential to form part of a flora habitat corridor

There is very limited opportunity for any relatively natural habitat occurring in the Study Area to form a significant habitat corridor. Distributions of patches of natural vegetation are degraded, discontinuous and fragmented and well removed over a distance of some 560m from the nearest distribution of similar vegetation to the south-west (Figure 15). Notwithstanding the relative fragmentation of woodland distribution in the locality, there is still, however, some opportunity for potential dispersal of genetically-variable pollen and seed propagules over large areas of the landscape.

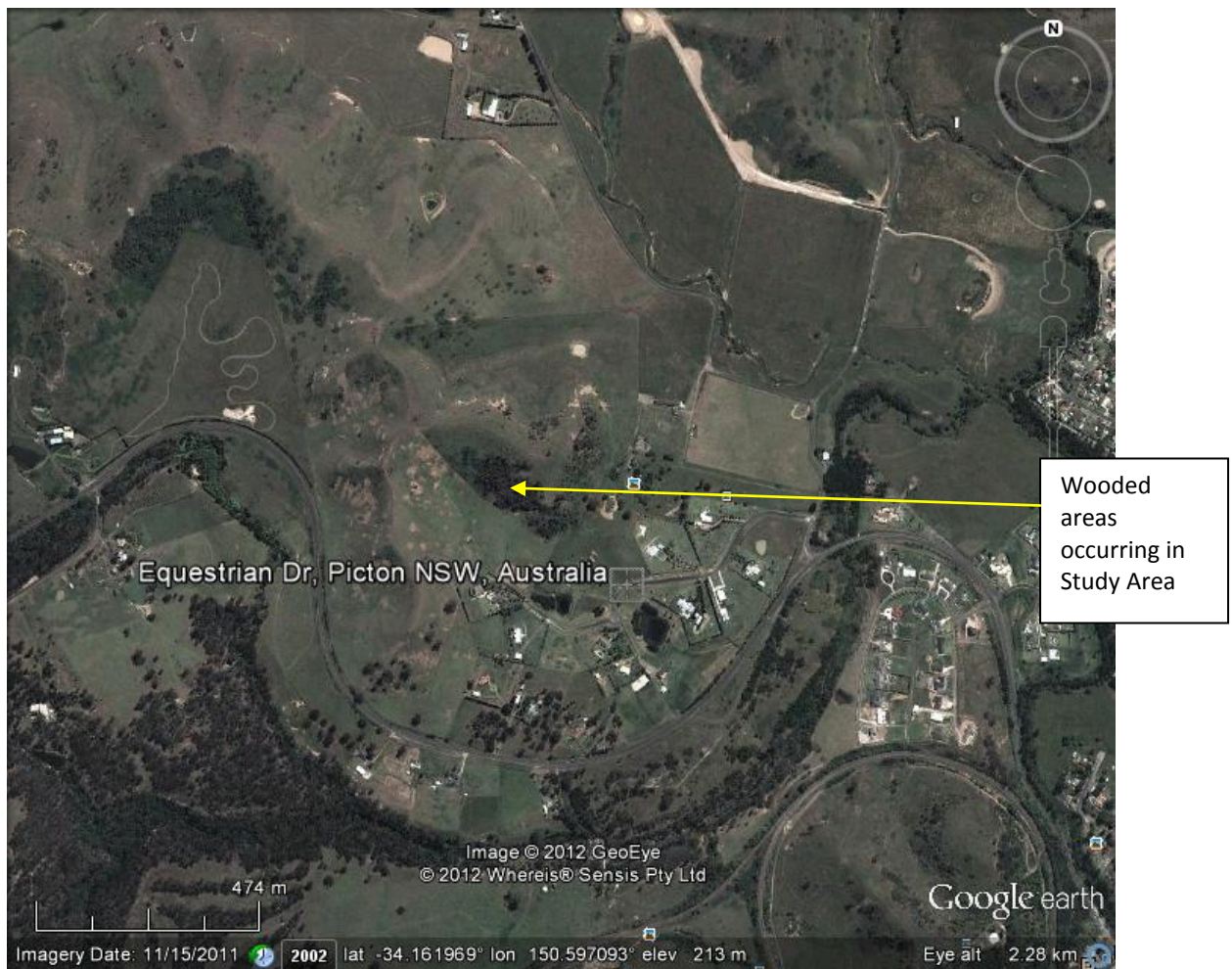


Figure 15 – Aerial overview of landscape including Study Area indicating fragmented distributions of woodland vegetation throughout the locality

4.2.5 Key threatening processes

A number of Key Threatening Processes are identified as occurring throughout the habitats of the Study Area. These are described as follows:

4.2.5.1 Clearing of native vegetation

The Scientific Committee, established by the Threatened Species Conservation Act, has made a Final Determination to list "Clearing of native vegetation" as a KEY THREATENING PROCESS on Schedule 3 of the Act. The listing of Key Threatening Processes is provided for by Part 2 of the Act.

Clearing of native vegetation is recognised as a major factor contributing to loss of biological diversity.

Land Clearance is also listed as a Key Threatening Process under the Commonwealth's Environment Protection and Biodiversity Act, 1999.

Comment: No remnant native vegetation is proposed for removal as part of the rezoning application or any future development of the site.

4.2.5.2 Invasion of Native Plant Communities by African Olive (*Olea europaea* L. subsp. *cuspidata*) (Wall ex G.Don Ciferri)

African Olive, *Olea europaea* L. subsp. *cuspidata* (Wall ex G.Don Ciferri), is an evergreen dense crowned shrub or small tree with a centre of natural distribution in eastern Africa.

*It is the opinion of the Scientific Committee that the Invasion of Native Plant Communities by African Olive *Olea europaea* L. subsp. *cuspidata* (Wall ex G.Don Ciferri) results in:*

- (a) Adverse effects on threatened species, populations or ecological communities, or*
- (b) Could cause species, populations or ecological communities that are not yet 'threatened' to become 'threatened'.*

Comment: As part of any future development of the site a Vegetation Management Plan (VMP) should be prepared to direct and monitor the complete removal of this invasive species.

4.2.5.3 Invasion, establishment and spread of *Lantana camara*

L. camara has spread along the east coast of Australia, from southern NSW north to Cape York, and from sea-level up to 600 m altitude, or less commonly to 1000 m. It has invaded at least 4 million hectares, mainly in NSW and Queensland (CRC Weed Management website, www.weeds.crc.org.au/main/wom_lantana_c.html, apparently based partly on Culvenor (1985)). In NSW most infestations are north of the Clyde River.

L. camara is "regarded as one of the worst weeds in Australia because of its invasiveness, potential for spread, and economic and environmental impacts" (CRC Weed Management 2003). It is one of the initial 20 Weeds of National Significance declared under the National Weeds Strategy, and a national Lantana Strategic Plan has been adopted (ARMCANZ ANZECC&FM 2001). It is recognised in most States and Territories of actual or potential occurrence as a serious weed of agriculture or the environment or both.

*In the opinion of the Scientific Committee the Invasion, establishment and spread of Lantana (*Lantana camara* L. sens. lat.) is listed as a key threatening process because:*

- (a) It adversely affects threatened species, populations or ecological communities, and*
- (b) It can cause species, populations or ecological communities that are not threatened to become threatened*

Comment: As part of any future development of the site a Vegetation Management Plan (VMP) should be prepared to direct and monitor the complete removal of this invasive species.

4.3 Conclusions of the flora assessment

Conclusions from the flora assessment are as follows:

The natural vegetation of the Study Area has mostly been cleared, grazed, disturbed or otherwise degraded such that no patches of relatively weed-free, full-structured vegetation remain.

Five relatively distinct vegetation communities could be recognized over the Study Area, including two communities (Woodland and Blackberry-dominated Scrub) within which a further three, and two structural and floristic variants, respectively, could be delineated (Table 2, Figure 4).

Five distinct vegetation communities delineated within the Study Area include:

- Patches of eucalypt-dominated woodland;
- Blackthorn-dominated scrub;
- Scrub dominated by the noxious woody weed, Blackberry;
- Cleared exotic grassland, and;
- Ornamental plantings associated with living areas surrounding former residences and other building structures.

Variation in woodland assemblages and those scrub assemblages dominated by Blackberry, occur in relation to floristic compositions depending on the extent and nature of past disturbance/structural and floristic modification history.

These floristically discrete ecological communities occurring over the landscape include two Endangered Ecological Communities that are described in DECCW (2009) as follows:

- Cumberland Moist Shale Woodland; and
- Cumberland Shale Hills Woodland (CEEC),

Due to the extensive degradation and low species diversities of the small patches of remnant woodland occurring at the Study Area, and the intrinsically comparative similarity in physical and floristic elements of these ecological communities, it is difficult to positively identify potentially variable assemblages of these threatened communities (DECCW 2009). Mapping by DEC (2002) has been considered (Figure 5) and woodland vegetation occurring on south-facing hillslopes can be regarded as comprising degraded Cumberland Moist Shale Woodland, whereas some residual wooded assemblages occurring on east and north facing hillslopes possibly incorporate elements of Cumberland Shale Hills Woodland (Table 2, Figures 4 & 5).

The relative Conservation Value or 'disturbance' level of the vegetation can be ranked as follows:

- Structured, stratified woodland vegetation with three to four identifiable strata, though mostly incorporating high levels of degradation and weed occurrence in mid- and understorey strata.

These patches of degraded, either structurally or floristically modified, natural woodland vegetation distributions equate to areas of relatively 'High Biodiversity Conservation Value'.

- Modified vegetation where regrowth of a native understorey stratum in the absence of a tree canopy is occurring. These areas are dominated by Blackthorn, a diagnostic shrub species in Cumberland Plain Woodland vegetation, probably undergoing regrowth after former clearing, seed derived from seed sources in proximal woodland assemblages. This scrub vegetation provides habitat for dispersal by eucalypt propagules facilitating potential for regrowth of woodland vegetation.

These patches of modified vegetation with an absence of tree cover equate to areas of 'Moderate Biodiversity Conservation Value'.

- Highly modified assemblages with no remnant indigenous trees remaining, such as cleared exotic grasslands and Blackberry-dominated scrub vegetation, including those containing patches of Blackthorn, have little opportunity for regrowth to any form of natural vegetation.

These patches of highly modified vegetation, with no tree and very limited shrub or ground cover species occurring in the assemblage, and where there is little opportunity for restoration to natural vegetation, equate to areas of 'Low Biodiversity Conservation Value'.

The total indicative number of indigenous species recorded for the Study Area is 21, including 5 species of grasses, 7 species of herbs and twiners, 3 species of shrubs or small trees and 5 species of tree (Appendix 1).

The total indicative number of exotic species recorded for the Study Area is 35, including 8 species of noxious weeds (Appendix 1). Woody noxious weeds occurring at high frequency in wooded sections of the Study Area include Lantana, Blackberry and African Box-thorn (Appendix 1).

Table 2 shows that the indicative number of indigenous species occurring in any particular assemblage is relatively low, usually only between 5 and 9, whereas the indicative number of exotic species in any assemblage is often greater than 9, and over a large extent of the cleared grazed areas, is up to 24 (Table 2).

OEH Atlas of NSW Wildlife records for an area of 5km radius around the Study Area indicate that 2 flora species of conservation significance have been recorded since 1987. According to guidelines listed by the EPBC 'Protected Matters Search Tool' (November 2012), it was deemed that habitat may potentially occur for a further 10 threatened flora species.

Records of threatened flora species occur from locations in natural bushland near Razorback Ridge or in the vicinity of Maldon to the north-east of the Study Area.

Targeted searches were made in suitable habitats for any individuals of species, including White-flowered Wax Plant (*Cynanchum elegans*) and Small-flowered Grevillea (*Grevillea parviflora* subsp. *parviflora*) recorded on the OEH Atlas of NSW Wildlife (Cropper 2003, DEC 2004), as well as for the 10 other flora species of conservation significance where suitable habitat is deemed to potentially occur, but none were located. As such, it is considered that none of these species are likely to occur within the highly degraded habitats of the Study Area.

4.4 Fauna Results

4.4.1 Weather conditions during survey periods

08.11.12 - 1030hrs-1800hrs, temp 20 °C -25°C; fine, no wind

15.11.12 - 1130hrs-1800hrs, temp 26 °C -33°C; fine, no wind

16.11.12 - 0630hrs-1500hrs, temp 25°C; light rain, cloud cover 85%; light wind

4.4.2 Site potential to form part of a fauna habitat corridor

There is very limited opportunity for any relatively natural habitat occurring in the Study Area to form a significant fauna habitat corridor. Habitat loss and fragmentation have a large negative effect on biodiversity. The use of the land for agricultural purposes has produced small isolated pockets of fauna habitat, none of which are connected to any large tracts of vegetation that could be useful for fauna movement.

4.4.3 Fauna habitats

Quality of fauna habitat is categorised by the presence of certain features which include vegetation structure, shelter, food resources and nesting or roosting opportunity. Other elements that contribute to the quality of habitat are the presence of tree hollows, dead and fallen timber, rock crevices and caves. The contribution an area has towards a fauna movement corridor is also considered. There are three categories chosen for this survey to qualify fauna habitat value.

Good: contains a combination of any of the following: good canopy coverage with a relatively undisturbed indigenous floristic ground cover; and established mid-storey vegetation coverage; high number of nesting structures and shelter present in the form of fallen timber, hollow logs or tree hollows; water structure; high diversity of fauna species; contributes to a fauna movement corridor.

Moderate: contains a combination of any of the following: moderate canopy coverage with a moderate coverage of indigenous floristic ground cover; some to no mid-storey coverage; some nesting structures in the form of fallen timber, hollow logs; no tree

hollows; a moderate diversity of fauna species; fragmented contribution to fauna movement corridor.

Poor: contains a combination of any of the following: very open to no canopy coverage with a low number of indigenous floristic ground cover; no mid-storey coverage; very few nesting structures, no fallen timber, no hollow logs or tree hollows; a very low diversity of fauna species; no contribution to fauna movement corridor.

4.4.4 Fauna habitat recorded

1) Woodland

Woodland habitat is characterised by canopies dominated by Forest Red Gum (*Eucalyptus tereticornis*) and Grey Box (*Eucalyptus moluccana*) with Thin-leaved Stringybark (*Eucalyptus eugenioides*) occurring less frequently. Some canopy trees within the woodland contained small spouts, large enough for hollow-dwelling bats to roost. Leaf litter was present to a depth of 5mm. In some areas weed incursions of spiky and thorny weeds provides shelter for small woodland birds.

Agricultural activity has produced significant edge effects around the woodland which would reduce fauna diversity. Past history of agricultural disturbance rendered the area not optimal for the Cumberland Plain Land Snail. The quality of fauna habitat in these areas is rated as good.

2) Homestead and old dairy

Over mature exotic tree plantings surrounding the remains of the old homestead and dairy contain many large hollows that could accommodate arboreal fauna such as possums or bats (Figure 16). The hollows are too close to the ground to provide nesting for birds. Crevices in the brickwork and stone of the old homestead provide crevices for small skinks and mammals to shelter. The old dairy contains many crevices in the roof for bats and birds to roost. The quality of fauna habitat in these areas is rated as moderate.



Figure 16 Many of the over-mature exotic trees near the homestead contain large hollows suitable for fauna habitation.

3) Dams

Three dams are present within the survey area. Two are in the open pasture area and are used to water cattle and sheep and have no vegetation surrounding them. The third dam is situated behind the old homestead. This dam has some emergent vegetation suitable for some frogs in addition to shrubbery surrounding it, which provides shelter for small birds nesting in the vegetation as well as habitat for some water bird species. The quality of fauna habitat in these dam areas is rated as moderate to poor.

4) Exotic/native pasture

Exotic pasture covers most of the developed agricultural areas of the study site. Heavily grazed paddocks represent very poor habitat for most native species. Where tall native grasses are present they provide habitat for small birds and reptiles. Dams are interspersed for cattle but with no supporting vegetation surrounding the banks they offer poor quality habitat for many frogs and water fowl. In many locations rabbits have caused severe erosion. The rabbits however do provide a food resource for birds of prey. Cattle, horse, sheep and rabbit foraging has left eroded areas that offer no protection for native species from predators. There is connectivity to fauna movement corridors. The quality of fauna habitat in these areas is rated as very poor.

Fauna habitats 1-4 are illustrated below in Figure 17.

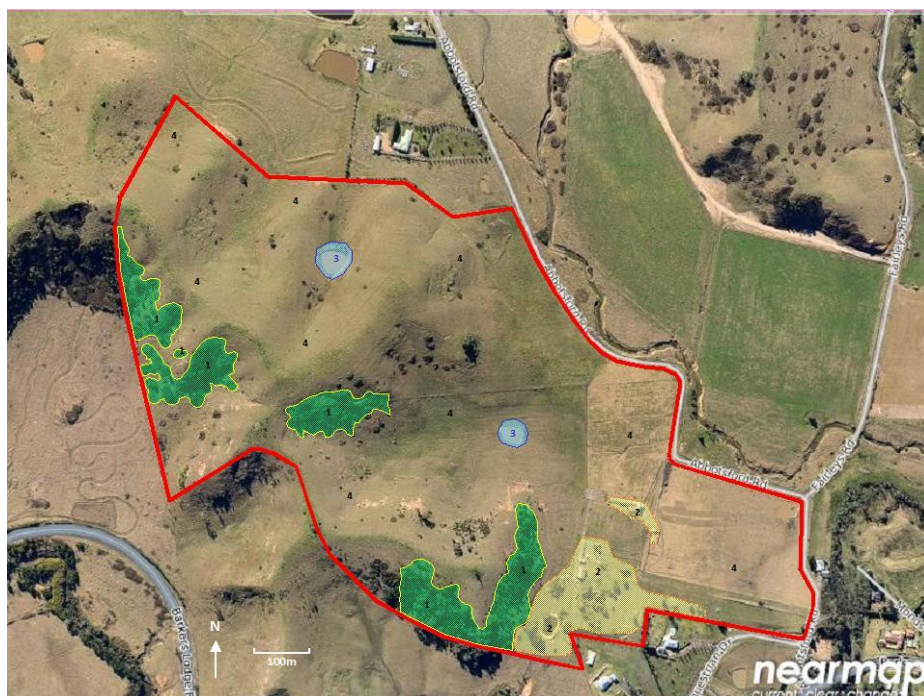


Figure 17 - Fauna habitat is categorised by the presence of certain features which include shelter, food resources and nesting or roosting opportunity. Four distinct fauna habitat types occur on the subject land (1 woodland; 2 homestead and old dairy; 3 dams; 4 exotic/native pasture).

4.4.5 Fauna recorded

Opportunistic fauna were recorded at locations throughout the habitat areas as shown in Figure 17. The number of species sighted was low due to the fragmented fauna habitat areas identified and the presence of feral animals. Some fauna was recorded only within the habitats specified. These are listed below. All fauna recorded during the survey are listed in Appendix 3.

Woodland

Several bird species were recorded in this area, the most common was the Eastern Rosella (*Platycercus eximius*). Other species include the Noisy Miner (*Manorina melanocephala*), Grey Fantail (*Rhipidura albiscapa*), Grey Butcherbird (*Cracticus torquatus*), Eastern Whipbird (*Psophodes olivaceus*) and the Spotted Pardalote (*Pardalotus punctatus*). Species noted flying above the tree canopies included the Sulphur-crested Cockatoo (*Cacatua galerita*), Pied Currawong (*Strepera graculina*), Raven (*Corvus coronoides*), Laughing Kookaburra (*Dacelo novaeguineae*).

The Common Wallaroo (*Macropus robustus*) was sighted and abundant scat from this species was noted within this habitat (Figure 18). Rabbits and rabbit scat was also recorded.



Figure 18 The Common Wallaroo was sighted within the woodland habitat. Abundant scat in this area suggests it frequently utilises resources in this habitat area.

Homestead and old dairy

The most common bird species in this habitat was the Superb Fairy-wren (*Malurus cyaneus*). Other birds included the Yellow Thornbill (*Acanthiza nana*), Red-whiskered Bul-bul (*Pycnonotus jocosus*) and the Little Corella (*Cacatua sanguinea*).

Scat from the Black Rat (*Rattus rattus*) and Rabbit were abundant in this habitat area.

Dams

The two dams within the pasture habitat were utilised daily for watering livestock. The sides of the dams were badly eroded and did not have emergent vegetation or surrounding shrubbery. These dams infrequently supported some water birds.

The dam close to the homestead had emergent vegetation and low shrubs surrounding half the circumference. Frogs calling in or near to the homestead dam included the Eastern Dwarf Tree Frog (*Litoria fallax*), Peron's Tree frog (*Litoria peronii*) and Common Eastern Froglet (*Crinia signifera*).

Birds recorded in the immediate vicinity of the homestead dam included the European Goldfinch (*Carduelis carduelis*) and Double-barred Finch (*Taeniopygia bichenovii*). Water birds include the Eurasian Coot (*Fulica atra*), Australian Wood Duck (*Chenonetta jubata*) and Purple Swamphen (*Porphyrio porphyrio*).

Exotic/native pasture

The most recorded fauna within the pasture habitat was the Rabbit (*Oryctolagus cuniculus*). Fox (*Vulpes vulpecular*) was also sighted on two occasions. Some grass seed eating birds were recorded utilising resources within this habitat. These included the Masked Lapwing (*Vanellus miles*) and Australian Pipit (*Anthus novaeseelandiae*). The Willie Wagtail (*Rhipidura leucophrys*) and Magpie-lark (*Grallina cyanoleuca*) were common.

Birds recorded frequently overhead were the Australian Raven (*Corvus coronoides*) and Nankeen kestrel (*Falco cenchroides*).

A low diversity of native mammalian species was found across the survey area, with no evidence of small ground dwelling native mammalian species. The presence of the predatory Fox could have produced these results as well as the discontinuous and fragmented landscape.

Only one reptile was recorded, this was the Dark-flecked Skink (*Lampropholis delicata*). Expected to occur are the Red-bellied Black Snake and Eastern Brown Snake.

Microchiropteran bats were recorded near the homestead. Foraging habitat also exists for small bats. Over two nights, using an Anabat II Bat Detector, the most recorded bat was the Gould's Wattled Bat (*Chalinolobus gouldii*). Also recorded were the White-striped Freetail Bat (*Tadarida australis*), Lesser Long-eared Bat (*Nyctophilus geoffroyi*), Undescribed Freetail bat (*Mormopterus 'species 2'*) and Little Forest Bat (*Vespadelus vulturnus*).

All fauna recorded during the survey are listed in Appendix 3

4.5 Fauna species of conservation significance

4.5.1 Threatened species

The Atlas of NSW Wildlife database 2012 (Office of Environment and Heritage within the Department of Premier and Cabinet) listed seventeen (17) species of fauna classified as

threatened under the Threatened Species Conservation Act, 1995 (TSC Act). Four of these species are also classified as threatened under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). Records are from a 5 km radius of the survey area (Table 3).

Table 3 Sightings of threatened species of fauna recorded within 5 km radius
(Sightings numbers source: OEH Atlas of NSW Wildlife Database 2012.)

Family & Order	Common Name	Scientific Name	TSC Act	EPBC Act	No. of sightings within a 5km radius
AVES					
Accipitridae	Little Eagle	<i>Hieraetus morphnoides</i>	V		1
	Square-tailed Kite	<i>Lophoictinia isura</i>	V		1
Cacatuidae	Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>	V		4
	Glossy Black-Cockatoo	<i>Calyptorhynchus lathami</i>	V		4
Psittacidae	Swift Parrot	<i>Lathamus discolor</i>	E1	E	1
Strigidae	Barking Owl	<i>Ninox connivens</i>	V		1
	Powerful Owl	<i>Ninox strenua</i>	V		2
Climacteridae	Brown Treecreeper (eastern subspecies)	<i>Climacteris picumnus victoriae</i>	V		1
Acanthizidae	Speckled Warbler	<i>Chthonicola sagittata</i>	V		3
Meliphagidae	Regent Honeyeater	<i>Anthochaera phrygia</i>	E4A	E	3
Neosittidae	Varied Sittella	<i>Daphoenositta chrysoptera</i>	V		1
Petroicidae	Hooded Robin (south-eastern form)	<i>Melanodryas cucullata cucullata</i>	V		1
	Scarlet Robin	<i>Petroica boodang</i>	V		1
Estrildidae	Diamond Firetail	<i>Stagonopleura guttata</i>	V		1
MAMMALIA					
Phascolarctidae	Koala	<i>Phascolarctos cinereus</i>	V	V	3
Pteropodidae	Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	V	V	1
GASTROPODA					
Camaenidae	Cumberland Plain Land Snail	<i>Meridolum corneovirens</i>	E1		2

Key	
<i>Environmental Protection and Biodiversity Conservation Act (EPBC Act) 1999</i>	<i>Threatened Species Conservation Act (TSC Act) 1995</i>
<i>E - Endangered</i>	<i>E1 - Endangered</i>
<i>V - Vulnerable</i>	<i>E4 - critically endangered</i>
	<i>V - Vulnerable</i>

4.5.2 Species listed by the Commonwealth SEWPAC (Commonwealth Protected Matters Search Tool) as potential inhabitants of the site

Threatened species listed by the SEWPAC (Canberra) were reviewed in relation to the distribution, habitat and likelihood of occurrence (Table 4).

Table 4 Sightings of threatened species of fauna listed by SEWPAC as potential inhabitants of the study area.

Common Name Birds	Scientific Name
Regent Honeyeater	<i>Anthochaera phrygia</i>
Australasian Bittern	<i>Botaurus poiciloptilus</i>
Red Goshawk	<i>Erythrotriorchis radiatus</i>
Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>
Swift Parrot	<i>Lathamus discolor</i>
Australian Painted Snipe	<i>Rostratula australis</i>
Common Name Amphibians	Scientific Name
Giant Burrowing Frog	<i>Heleioporus australiacus</i>
Common Name Mammals	Scientific Name
Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>
Spotted-tailed Quoll	<i>Dasyurus maculates (SE mainland population)</i>
Brush-tailed Rock-wallaby	<i>Petrogale penicillata</i>
Koala	<i>Phascolarctos cinereus</i>
Long-nosed Potoroo	<i>Potorous tridactylus</i>
New Holland Mouse	<i>Pseudomys novaehollandiae</i>
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>
Common Name Reptiles	Scientific Name
Broad-headed Snake	<i>Hoplocephalus bungaroides</i>

4.5.3 Species listed by the Atlas of NSW Wildlife and Commonwealth SEWPAC (Commonwealth Protected Matters Search Tool) as potential migratory inhabitants of the site.

Each of the migratory species listed was reviewed in relation to the distribution, habitat and likelihood of occurrence (Table 5 and 6).

Table 5 Sightings of migratory species listed by the NSW Atlas of Wildlife as occurring within a 5km radius of the survey area.

Common Name	Scientific Name	TSC Act	EPBC Act	No. of sightings within 5km
White-throated Needletail	<i>Hirundapus caudacutus</i>	P	C,J,K	1
Rainbow Bee-eater	<i>Merops ornatus</i>	P	J	1

Table 6 Sightings of migratory species of fauna listed by SEWPAC as potential inhabitants of the study area.

Common Name	Scientific Name	TSC Act	EPBC Act
White-bellied Sea-eagle	<i>Haliaeetus leucogaster</i>	P	M
White-throated Needletail	<i>Hirundapus caudacutus</i>	P	M
Rainbow Bee-eater	<i>Merops ornatus</i>	P	M
Black-faced Monarch	<i>Monarcha melanopsis</i>	P	M
Satin Flycatcher	<i>Myiagra cyanoleuca</i>	P	M
Rufous Fantail	<i>Rufous rufifons</i>	P	M
Regent Honeyeater	<i>Xanthomyza phrygia</i>	P	M
Great Egret	<i>Ardea alba</i>	P	M
Cattle Egret	<i>Ardea Ibis</i>	P	M
Latham's Snipe	<i>Gallinago hardwickii</i>	P	M
Painted Snipe	<i>Rostratula benghalensis</i>	P	M

P = protected M= migratory

Those expected to occur are the Cattle Egret in pasture.

4.6 Introduced/ invasive pest fauna

Two introduced invasive pest species and one introduced predator species were recorded within the survey area. They were the Rabbit (*Oryctolagus cuniculus*). Numerous rabbits were sighted over the survey area, with warrens and digging activity in most of the pasture areas. The Black Rat (*Rattus rattus*) was active in areas surrounding the old homestead and dairy sheds. The European Red Fox was sighted and recorded by scat evidence in several locations near areas containing rabbit warrens.

4.7 Key Threatening Processes (as per Schedule 3 of the TSC Act, 1995) that may affect fauna habitat surrounding survey area.

Listed under the TSC Act:

1. Clearing of native vegetation - Destruction of habitat is the major cause of loss of biological diversity. For species of restricted distribution, clearing of native vegetation may result in total extinction, for more widespread species there may be loss of local genotypes. Clearing, as defined by the determination, refers to the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation.
2. Removal of dead wood and dead trees - Removal of dead old trees (either standing or on the ground) results in the loss of important habitat such as hollows and decaying wood for a wide variety of vertebrates, invertebrates and microbial species.
3. Competition and grazing by the feral rabbit- Grazing and burrowing by rabbits can cause massive erosion problems, reduce recruitment and survival of native plants, and alter entire landscapes. Rabbits also threaten the survival of a number of native animal species by altering habitat, reducing native food sources, displacing small animals from burrows and attracting introduced predators such as foxes.

4.8 Conclusions of fauna assessment

This fauna survey was undertaken to record fauna species currently utilizing the Study Area and to assess the habitat values for threatened species listed in the database for the Study Area.

Database searches at Local, State and Federal Government level were undertaken to identify threatened species that had been recorded previously in the Study Area. No threatened fauna species listed were recorded during this current survey.

Threatened species identified as having potential to occur within the woodland habitat include the Swift Parrot and Regent Honeyeater, which are only expected as rare visitors when resources in other areas are low.

The presence of fallen tree trunks and branches, which serve as nesting structures and protective hides would be expected to support a high diversity of small mammals. This was not found to be the case, as no small ground dwelling mammalian fauna were recorded. Factors influencing this low diversity possibly include predation by the European Fox. Currently there is easy access for Fox to enter the Study Area and the presence of Rabbit ensures a continual food source.

5 Assessment of biodiversity values

5.1 Conservation significance of remnant ecological communities in Study Area.

5.1.1 Assessed conservation significance of remnant vegetation communities in Study Area.

Figure 19 indicates the distribution of relative ranked conservation significance assessed for the vegetation of the Study Area, with areas denoted as being either of 'high', 'moderate' or 'low' conservation significance.

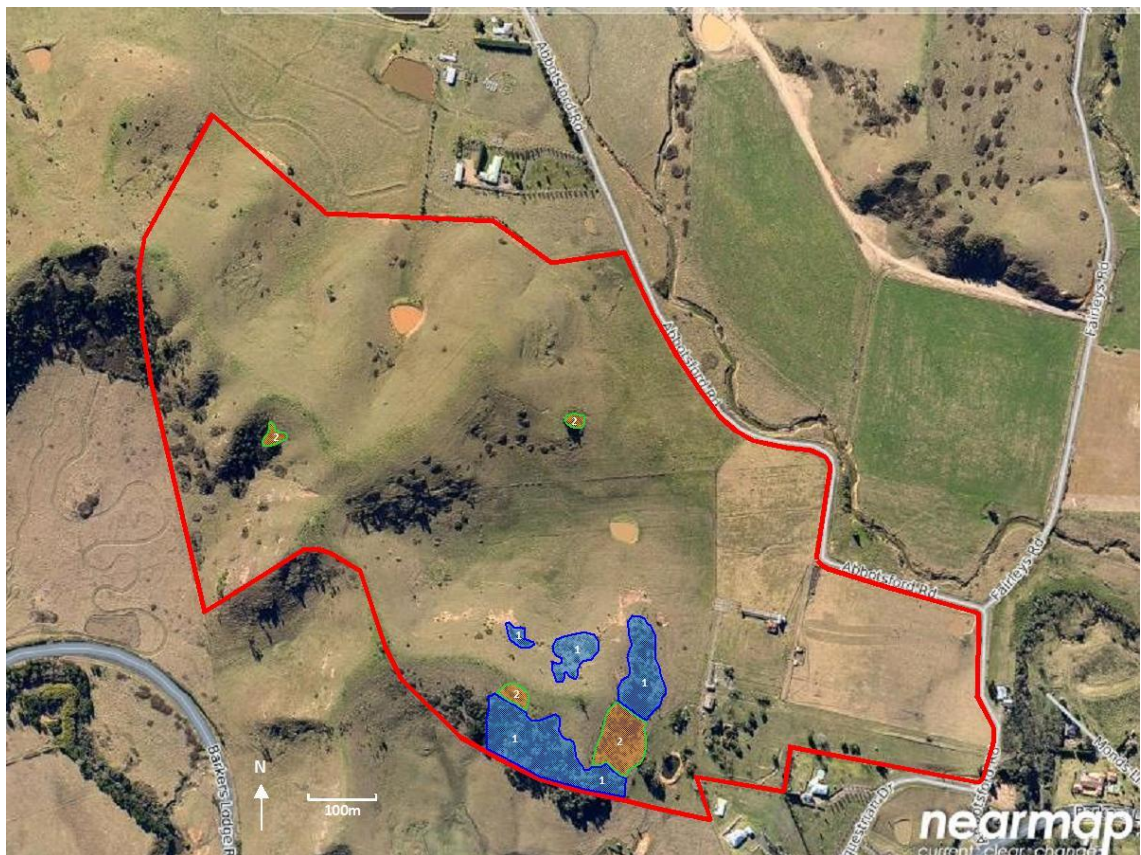


Figure 19 - indicates the distribution of relative ranked conservation significance assessed for the vegetation of the Study Area, with areas denoted as being either of 'high' (1), 'moderate' (2) or 'low' conservation significance (3).

Figure 20 indicates the mapping of the locality including the Study Area as an Assessment of Conservation Significance by DEC (2002).

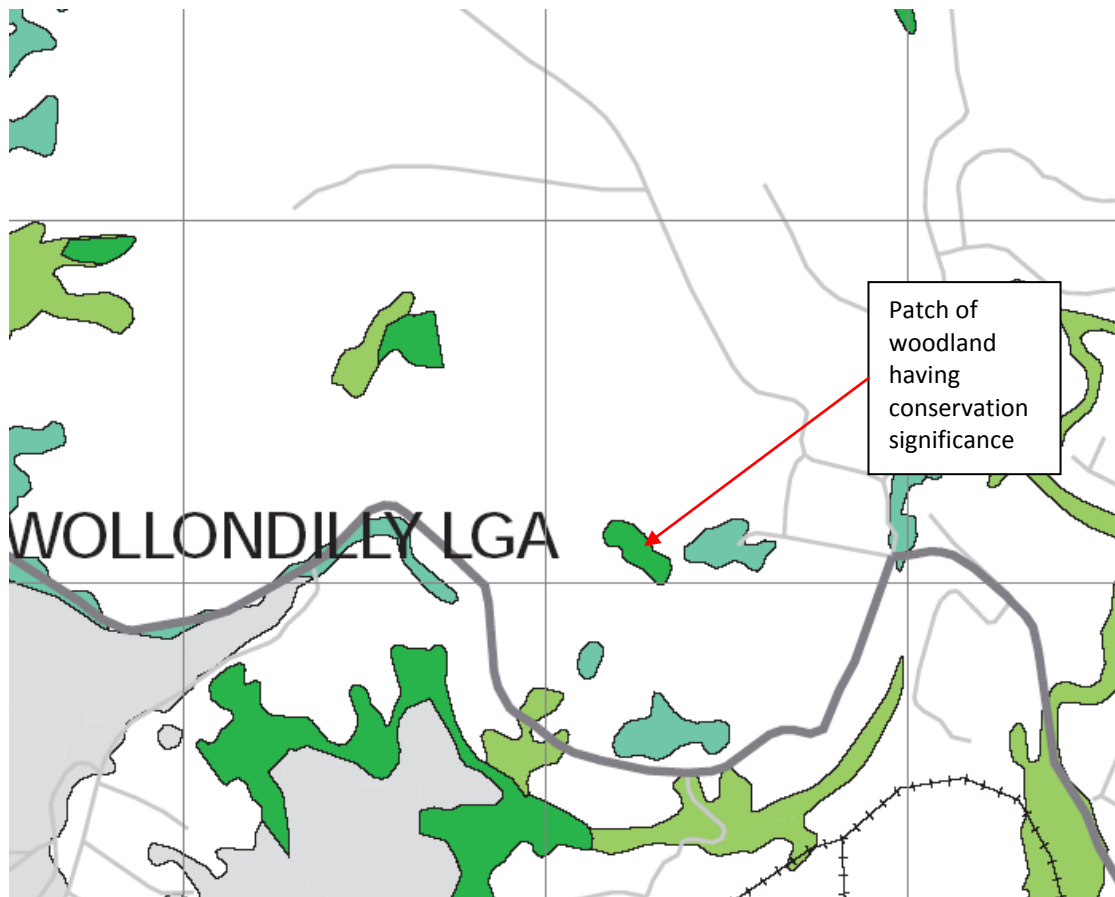


Figure 20 – Indicates mapping by DEC (2002) of the Conservation Significance Assessment of the locality including the Abbotsford Farm Study Area. The dark green polygons represent ‘Core Habitat’, the light green polygons represent ‘Areas that are Support for Core Habitat’, and the blue-green polygons represent ‘Other Vegetation’ with grey areas representing ‘Unclassified Vegetation’ (DEC 2002)

‘Core Habitat’ includes areas of vegetation that constitute a framework of a viable conservation network across the local landscape (core areas) or, as in the case of Cumberland Plain Woodland, endangered communities that are at imminent risk of extinction (critically endangered communities) (DEC 2002).

Areas denoted as ‘Support for Core Habitat’ are areas of vegetation that provide a range of supporting values to the areas of ‘Core Habitat’, including an increase in potential size of remnant, providing corridor connections and providing buffering relief from potential edge effects (DEC 2002). Usually this includes areas where the remnant vegetation has less than 10% CCPD or lacks floristic diversity and structure with understorey and mid-storey strata having been removed, but where these areas are contiguous with areas of ‘Core Habitat’.

Figure 4 indicates that the vegetation of the Study Area represents fragmented distributions of two effectively similar modified Endangered Ecological Communities: Cumberland Moist Shale Woodland possibly intergrading with Cumberland Shale Hills Woodland (Figures 4 & 5).

The extant vegetation of the Study Area including the intergrading distributions of these two ecological community types can be delineated into three discrete conservation classes depending on the extent of local retention of degraded natural vegetation, the degree of historical clearing, disturbance and weed incursion, and the resultant structural and floristic attributes of the remnant vegetation.

These three levels of conservation value relating to vegetation remnants are as follows (Figure 19):

High Conservation Value

Where there has been little historical clearing of the overstorey, even where significant removal of native understorey has occurred and been replaced by incursive woody weeds, then a stratified, or structurally intact vegetation may still be retained. This vegetation may comprise a relatively low value of indigenous species diversity or species richness and a high density and cover of understorey woody weed species (Table 2). Tree canopy cover (%CCPD) in these patches is usually greater than 15% and up to 25% over areas >0.5 ha (Figure 4).

This delineation is comparable to that used for mapping of Cumberland Plain vegetation by DEC (2002), the classification Code 'A' given to natural remnant vegetation where the canopy is intact forming a natural overstorey density and including a relatively undisturbed understorey stratum (Figure 20) (DEC 2002 extracted from Roberts (1999)).

Areas of High Conservation Value mapped within the Study Area in Figure 19 loosely coincide with those mapped by DEC (2002) as 'Core Habitat' (Figure 20), though potential linkages from hillslope vegetation through to creeklines to the east, west and south are fragmented (Figures 19 & 20). 'Core Habitat' includes areas of vegetation that potentially constitute a framework of a viable conservation network across the local landscape (core areas) or, as in the case of Cumberland Plain Woodland, endangered communities that are at imminent risk of extinction (critically endangered communities) (DEC 2002).

Areas of vegetation mapped as having High Conservation Value (Figure 19), equivalent to those mapped by DEC (2002) as 'Core Habitat' (Figure 20), have significant conservation attributes in relation to both flora and fauna and meet the criteria for recognition as a listed threatened ecological community as defined in the TSC Act or by the NSW Scientific Committee (2009).

Stands of even degraded remnant woodland vegetation may contain varied and valuable habitat resources such as mature trees with nesting and breeding hollows, roosting sites, food sources for insectivorous birds, dead or hollow fallen logs, diverse groundcovers of grass, sedge and forb species, watercourses, rocks, understorey shrubs, and leaf litter. Restoration of the structural and floristic diversity of extensively disturbed or cleared areas is difficult to recreate and emphasis is given to retaining areas of remnant vegetation (DEC 2005).

These relatively small patch size areas of remnant woodland vegetation equate to remnant areas of High Biodiversity Conservation Value having relatively high potential for rehabilitation and regeneration, and potentially diverse flora and faunal habitats.

Moderate Conservation Value

Most of the natural vegetation of the Study Area has incurred significant historical clearing and modification to the structural integrity of the vegetation, with only small patches of woodland retained.

Where there is evident natural regeneration of an understorey stratum such as produced by the shrub species Blackthorn, even in the absence of a tree canopy (Figure 4), this provides habitat for potential seed establishment of other native species of herbs and grasses, and possibly in the long term, to the dispersal of, and establishment of canopy species such as Grey Box and Forest Red Gum from adjacent sites.

This delineation is loosely comparable to that used for mapping of Cumberland Plain vegetation by DEC (2002) (Figure 5). DEC (2002) however denotes the classification Code 'B' to natural remnant vegetation where the canopy includes substantial gaps, particularly the small tree and shrub canopies, and where crown canopies may be clustered rather than evenly spaced (DEC 2002, extracted from Roberts (1999)). In the case of conservation assessment derived in Figure 19 however, the tree canopy over small patches of Blackthorn scrub vegetation has been removed and is non-existent.

The small patches of Blackthorn-dominated scrub occurring over the Study Area and assessed as having Moderate Conservation Value are not mapped by DEC (2002) as having any particular significance (Figures 19 & 20).

Areas of vegetation mapped as having Moderate Conservation Value (Figure 19) may have significant conservation attributes, and as either or both the upper stratum or mid-storey stratum may be absent from the community, the presence of a well-defined understorey shrub stratum may still meet the criteria for recognition as a listed threatened ecological community as defined in the TSC Act or by the NSW Scientific Committee (2009).

Stands of structurally modified vegetation, where the tree canopy has been removed and only a shrub stratum exists, may still contain valuable habitat resources such as nesting and roosting sites and food sources for insectivorous birds. Other habitat features such as dead or hollow fallen logs and leaf litter are not well represented in these structurally modified vegetations. Restoration of the structural and floristic diversity of such modified areas is feasible given sufficient time and where natural regeneration from soil stored or windborne seed sources is facilitated by the exclusion of grazing and other modifying anthropogenic management regimes.

Such fragmented patches of native Blackthorn-dominated scrubland occur over only a small part of the Study Area (Figure 4).

These small patches of modified vegetation with no current native tree cover, but with the potential for canopy species to disperse into and establish, constitute areas of Moderate Biodiversity Conservation Value.

Low Conservation Value

Most of the remnant natural vegetation of the Study Area has incurred extensive historical clearing of the vegetation, including the upper tree and lower shrub canopies, for grazing, and is currently continually exposed to grazing pressure. These areas are characterised by having few individuals of remnant indigenous trees remaining providing a cover of <1% CCPD, having no understorey or mid-storey strata, but comprising an exotic pasture-providing grassland that may include a partial natural grassy ground cover (Figures 5 & 12).

In areas occurring in the lee of hillslopes, Blackberry-dominated scrub vegetation may establish and proliferate to form a mosaic of patches of this vegetation evident across the landscape (Figures 5, 10 & 11)

This vegetation includes the following:

- **Exotic grassland cleared pasture** - usually contains relatively low indigenous species diversities or species richness, though whilst including some indigenous grass and herb species, the ground cover includes relatively higher numbers and abundances of exotic grass and herb species (Table 2). Tree and shrub canopy cover (%CCPD) in these areas is less than 1% over areas >0.5 ha. Figure 12 indicates an area of mostly cleared vegetation, with none or few scattered trees, though containing some indigenous grass and forb species, generally having a relatively high percentage cover of exotic grass and herbs.
- **Blackberry-dominated Scrub** – dense copses of Blackberry-dominated vegetation, sometimes with patches of Blackthorn interdispersed either throughout the scrub or occurring upslope of the main cover of Blackberry. Occasional small emergent trees of Hickory Wattle, Parramatta Green Wattle or Kurrajong (*Brachychiton populneus*) may also be present
- **Ornamental trees established in former residential living areas** - Woodland comprising mostly ornamental trees has been retained in the vicinity of former living areas and building structures (Figure 14). The area is mistakenly mapped as Cumberland Shale Plain Woodland by DEC (2002) (Figure 5), presumably identified by aerial imagery, though ground-truthing interpretation identifies the vegetation as ornamental tree, shrub and vine plantings. The vegetation includes noxious woody weeds such as Lantana and African Box-thorn, the associated grassy areas mostly comprising exotic grass and herb species (Figure 14).

This delineation is loosely comparable to that used for mapping of Cumberland Plain vegetation by DEC (2002), the classification Code 'Tx' and 'Txr' given to remnant vegetation where the canopy includes a low frequency of scattered native tree species associated with agriculture or rural residential development (DEC 2002 extracted from Roberts (1999)).

Most cleared, grazed areas containing only a few scattered trees (Figure 4), and areas where Blackberry-dominated scrub has established, are denoted as having no conservation significance in mapping of the Study Area by DEC (2002) (Figure 20).

Most areas of vegetation mapped as 'Tx' and 'Txr' (DEC 2002) have little conservation value (DEC 2002) and would not likely meet the criteria for recognition as a listed threatened ecological community as defined in the TSC Act or by the NSW Scientific Committee (2009).

Stands of structurally modified vegetation where a few mature trees remain contain limited habitat resources such as nesting and breeding hollows, roosting sites and food sources for insectivorous birds. Restoration of the structural and floristic diversity of these extensively cleared areas is a slow process where the desired end point may take decades or may never be reached at all (Wilkins *et al* 2003, DEC 2005).

These patches of mostly cleared exotic grassland vegetation with relatively low native tree cover and no mid-stratum or understorey species canopies, or areas dominated by dense copses of Blackberry scrub, constitute areas of Low Biodiversity Conservation Value (Figures 4, 19 & 20).

5.1.2 Indicative conservation significance attributes of Study Area as shown on maps in Wollondilly LEP 2011.

The following maps available on the Wollondilly Local Environmental Plan 2011 were examined and assessed as to indicative criteria of conservation significance in the Study Area:

1. Land Reservation Acquisition Map

Land reservation acquisition maps indicate that there are no criteria for land reservation acquisition in the Study Area (Figure 21)



Figure 21 - Land reservation acquisition map including Abbotsford Farm, showing no land reservation acquisition in the Study Area

2. Natural Resource – Biodiversity Map

The mapping contained within the Wollondilly LEP 2011 does not indicate any natural biodiversity resource areas mapped within the Study Area.

The principal indicators of mapped biodiversity have previously been indicated by DEC (2002) mapping of Ecological Communities of Conservation Significance (Figure 5) and assessment of Conservation Significance (Figure 20)

5.2 *Recovery potential and ecological potential of vegetated and cleared land*

The Study Area lies well outside areas denoted as Priority Conservation Lands (PCLs) for Wollondilly Shire as mapped in the Recovery Plan for Cumberland Plain Woodlands (DECCW 2011).

Figure 22 indicates the potential and ecological recovery assessment for vegetated and cleared areas of the Study Area.

The principal areas where potential ecological recovery can readily be facilitated include those areas of woodland with canopies provided by Grey Box and Forest Red Gum, with patches of Blackthorn-dominated scrub also affording potential recovery of ecological values (Figure 22). The potential ecological recovery of these assemblages is consistent with the assessment of conservation significance for these communities as depicted in Figures 5 & 22.

Most of the Study Area has been extensively cleared and occurs as grazed exotic pasture with the establishment of significant copses of Blackberry-dominated scrub in the lee of steep hillslopes forming a mosaic of noxious woody weed clumps throughout parts of the Study Area (Figures 4, 10 & 11).

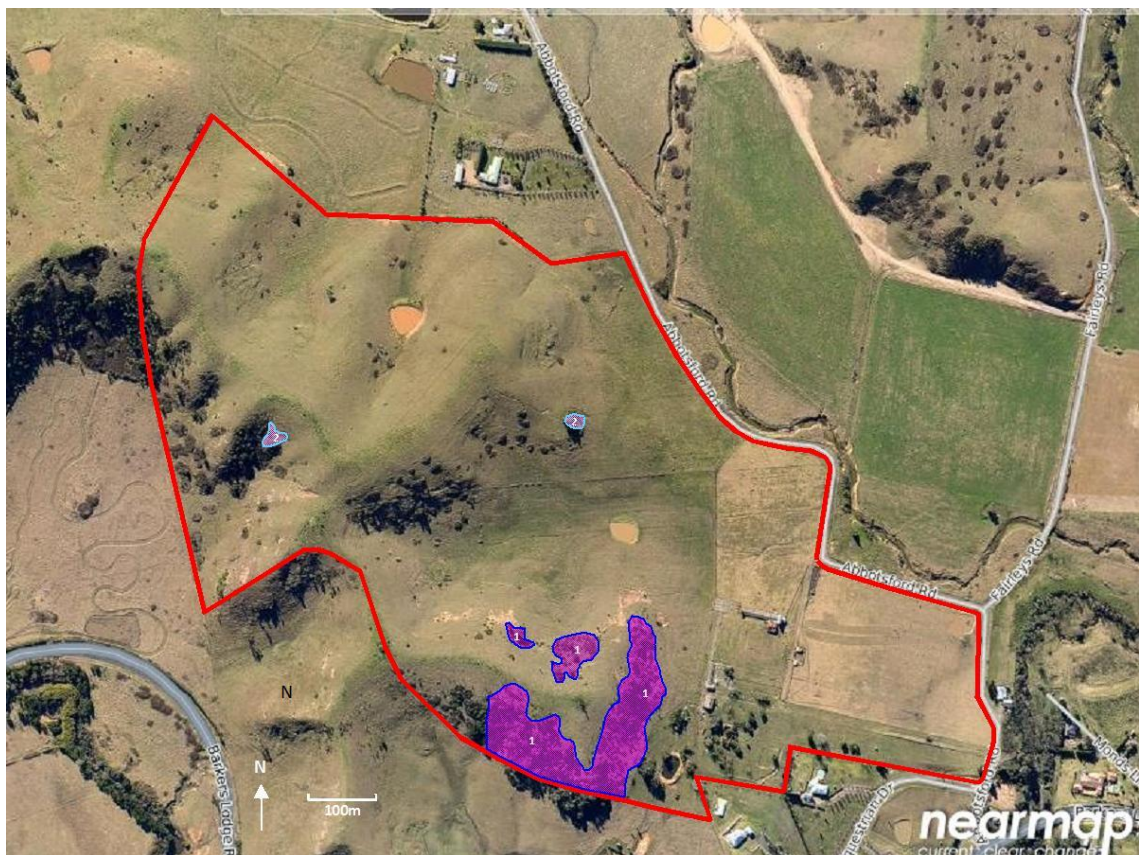


Figure 22 - Relative recovery potential of tracts of woodland and patches of scrub occurring in the Study Area with areas denoted as being either of 'high' (1) or 'moderate' (2) recovery potential.

Descriptions of criteria distinguishing relative recovery and related ecological potential of discrete vegetation patches over the Study Area landscape are as follows:

Areas of high recovery potential and ecological significance

Figure 22 indicates areas having the greatest potential for recovery within the Study Area. These areas include patches of woodland vegetation assessed as having a high conservation value and patches of Blackthorn-dominated scrub assessed as having moderate conservation value as indicated in Figure 22. In cases where vegetation assessed as having moderate conservation value adjoins patches of vegetation of high conservation value, the combined vegetative area would be considered to have a high recovery potential (Figures 19 & 22). This is because, if grazing and other modifying management regimes were removed, as well as undertaking the removal and control of invasive weeds, then proximity to sources of seed and vegetative regeneration from adjoining vegetation would similarly stimulate significant recovery in these areas.

Areas of moderate recovery potential and ecological significance

Areas of vegetation with moderate recovery potential typically include small patches of Blackthorn-dominated scrub that occur some distance from woodland assemblages and where other natural sources of seed dispersal are not readily available.

Where patches of an ecological community have been mapped as having 'moderate recovery potential', these areas of vegetation are capable of some recovery where appropriate restoration technologies are undertaken (Scientific Determination Cumberland Plain Woodland 2009, OEH 2012).

Areas of low recovery potential and ecological significance

Areas of vegetation having a low recovery potential typically include the majority of mostly cleared land in the Study Area, where tree canopy cover (%CCPD) is < 1% and the ground stratum is a mixture of indigenous and exotic grass species (Figures 4, 12 & 13). Other patches of vegetation that are included as having low recovery potential are those where natural vegetation assemblages would prove difficult to restore as in the case of copses of noxious woody-weed infested scrub (Figures 4, 10 & 11) (Scientific Determination 2009, OEH 2012).

Theoretically, even where areas of vegetation have been assessed as having a 'low recovery potential', interventional techniques can be employed to restore comparable native assemblages. Such techniques include 'reconstruction', where active steps are undertaken to plant out native seedlings amongst an underlying matrix of native ground cover species to commence the process of native plant restoration, or 'fabrication' where the entire 'restored' woodland is undertaken by revegetation and reseedling (DEC 2005).

5.3 Significance of habitat for flora and fauna species of conservation significance

5.3.1 Flora

Threatened species

Targeted searches for 12 species of threatened flora, either recorded within the last 25 years, or where habitat was deemed to be suitable, were undertaken. No threatened species of flora were located within any part of the accessible Study Area. Potential Habitat for three species of threatened status (OEH Atlas Of NSW Wildlife November 2012) was considered to occur within the Study Area.

These species included Small-flowered Grevillea (*Grevillea parviflora* subspecies *parviflora*), Spike-flowered Rice-flower (*Pimelea spicata*) and Brown Pomaderris (*Pomaderris brunnea*). These species mostly have typically conspicuous large life-forms but were not observed in targeted searches of representative vegetation assemblages. Life-form and potential habitat for these species is as follows:

- **Small-leaved Grevillea** – Erect shrub to 150cm tall. Occurs in light clayey soils over shale on ridges or rocky sandstone slopes in dry shrubby sclerophyll forest, from Gosford to Sydney district. Known to occur or have occurred in south-western Sydney from Prospect to Camden and Appin. The habitat of areas within Study Area is considered sub-optimal. The nearest records recorded in the vicinity occur in natural bushland some 4km to the north-east at the North end of Wilton Park Road, about 400 m South of Maldon Bridge and near the corner of Jokes Way and Marcus St, in the Maldon area.
- **Spike-flowered Rice-flower** - Small upright shrub to 35cm tall occurring on clay soils derived from Wianamatta Shale. Although habitat occurs in the subject area, there are no records of occurrence within a 5km radius of the Study Area. The species occurs mainly in Western Sydney though disjunct populations occur between Shellharbour and Minnamurra.
- **Brown Pomaderris** – Shrub to 3m tall occurring on clay or alluvial soils overlying shale, generally in open woodland. Potential habitat may occur in Study Area, though highly degraded. However, the absence of otherwise large life-form individuals is deemed to indicate non-occurrence.

Regionally significant species

No individuals of any regionally significant species were located within the Study Area.

Locally significant species

No individuals of locally significant species were recorded in the Study Area

5.3.2 Fauna

Threatened species

No species of conservation significance listed in Table 3 were recorded during this survey:

Species of the 'threatened' fauna, listed in Table 3, with potential to occur in the woodland habitat as indicated by both foraging and roosting habitat being present are:

1. Regent Honeyeater (*Anthochaera Phrygia*). Foraging is present for this species in Forest Redgum during the winter months. As Capertee Valley, near Lithgow, is a recorded breeding area for the species, it is possible for individuals to fly over the Great Dividing Range to forage during winter.
2. Gang-gang Cockatoo (*Callocephalon fimbriatum*). Gang-gang Cockatoo tend to occur during the winter months at lower altitudes than during the summer months and in often in drier more open eucalypt forests and woodlands occurring in, and in the vicinity of, urban areas.
3. The Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*). Foraging habitat is present for populations of this species however it is unlikely that the bat roosts within the Study Area, as no large caves are present. Larger caves may be present within the Nattai National Park for roosting. Deep cave sites that are required as maternity caves may be present within the larger expanse of the Picton locality.

Regionally significant species

1. Grey-headed Flying Fox (Grey-headed Flying Fox (*Pteropus poliocephalus*), may potentially visit the study Area during the flowering periods of eucalypts.
2. Swift Parrot (*Lathamus discolor*). During the winter months the Swift Parrot will forage for lerp and nectar from specific eucalypt trees along the NSW coastal area. Swift Parrot will feed in Forest Redgum (*Eucalyptus tereticornis*) recorded in the woodland habitat, although only one recordings have been made of the Swift Parrot in the Picton area.

Migratory species

1. Cattle Egret (*Ardea ibis*). Cattle Egrets nesting in Australia migrate to cooler climes in Tasmania and New Zealand in the winter and return in the spring (Maddock 1990). The breeding season in Australia is from November to early January, with one brood laid per season (Beruldsen 2003). The Cattle Egret is a popular bird with cattle breeders for its perceived role as a bio-control of cattle parasites such as ticks and flies. This species was not recorded during the current survey.

5.4 *Relative biodiversity values of the Study Area*

From an integration of the assessment of Conservation Value of Endangered Ecological Communities occurring across the Study Area (Figure 22), the assessed recovery and ecological potential of the patches of vegetation occurring within the Study Area (Figure 22), and the conservation significance of potential distributions of threatened species of flora and fauna within the Study Area, a map of assessed biodiversity values within the Study Area can be constructed (Figure 23).

This map is derived from a generalised pattern of the overlay of EEC conservation value and vegetation recovery potential assessment throughout the Study Area.

The map of relative biodiversity values indicates a 'high biodiversity value' in the woodland assemblages and Blackthorn-dominated scrub where the latter scrub vegetation is contiguous with wooded vegetation occurring in the Study Area (Figures 4, 19 & 22).

The area assessed as having a 'High biodiversity value' mostly contains degraded woodland vegetation with some mature trees and regenerating cohorts of eucalypts, though often having a high density and understorey cover canopy of Lantana in association with Blackthorn (Figures 6, 7 & 8). The ground stratum often includes a relatively high extent of bare ground cover below shrubs of Lantana and where cattle occasionally track through the bushland, though some native ground stratum species are evident (Appendix 1).

Small patches of 'Moderate biodiversity value' occur in isolated occurrences of Blackthorn-dominated scrub or where mature trees have been retained and where either recovery potential or assessed conservation value is moderate (Figures 19 & 22), and where connectivity is not closely linked between various patches in the mosaic of vegetation across the Study Area (Figures 4, 19 & 22).

Areas such as extensive exotic grassland pastures and Blackberry-dominated patches of scrub, with few scattered trees, are considered to have 'low biodiversity values'.

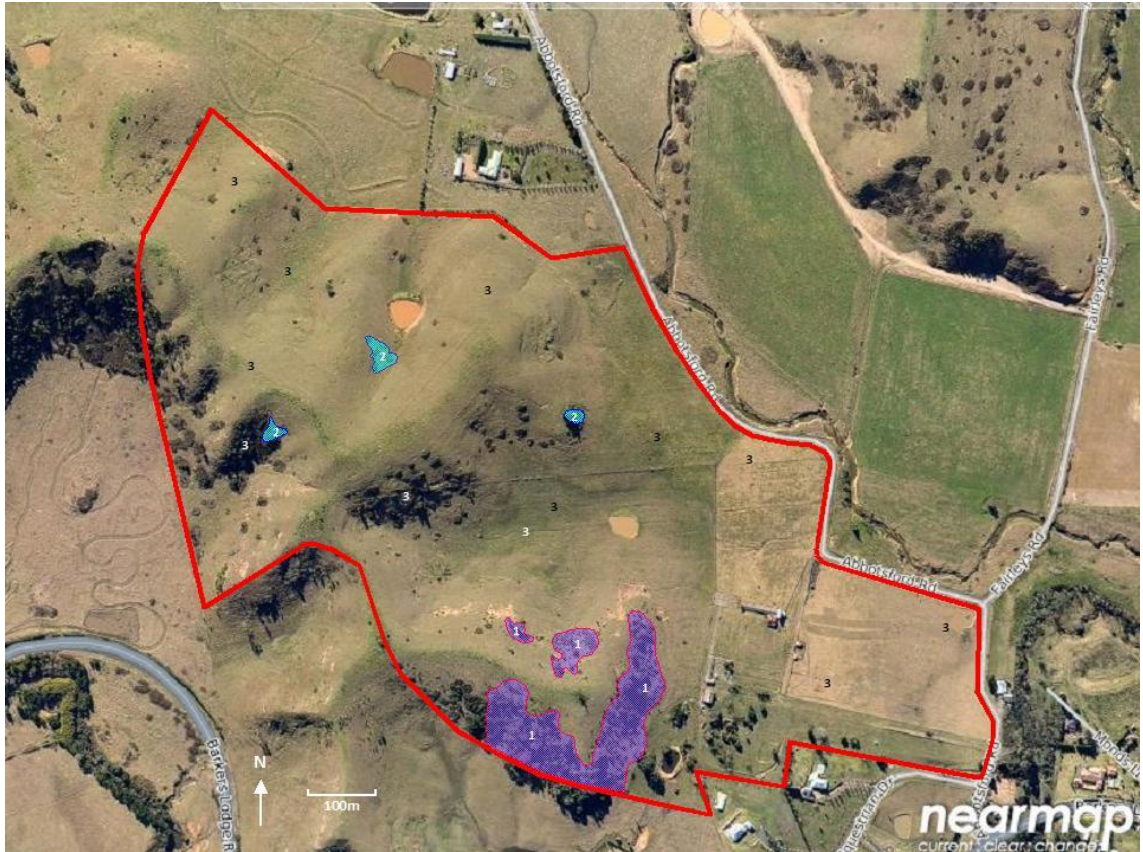


Figure 23 - Relative biodiversity values of tracts of woodland and patches of scrub occurring in the Study Area with areas denoted as being either of 'high' (1) or 'moderate' (2) biodiversity value.

5.5 Conclusions including assessment of biodiversity values required to be addressed by developer contributions

5.5.1 Flora

Endangered Ecological Communities

Two Endangered Ecological Communities that are described in DECCW (2009) but are difficult to distinguish in the Study Area include:

- Cumberland Moist Shale Woodland; and
- Cumberland Shale Hills Woodland (CEEC),

Due to the high level of degradation and low species diversities of the small patches of remnant woodland occurring at the Study Area, and the intrinsically comparative similarity in physical and floristic elements of these two ecological communities, it is difficult to positively identify and separate potentially variable assemblages that may comprise these communities. Mapping by DEC (2002) has been considered (Figure 5), and as such, well-structured woodland vegetation occurring on south-facing hillslopes can be regarded as comprising Cumberland Moist Shale Woodland, whereas some

residual, less structured wooded assemblages occurring on east and north facing hillslopes could possibly incorporate elements of Cumberland Shale Hills Woodland as also indicated by DEC (2002) mapping (Table 2, Figures 4 & 5).

Conservation Significance of Endangered Ecological Communities

The conservation significance of the mosaic of endangered ecological communities that occurs in the Study Area is depicted in Figure 19 (see also mapping in Figure 20 by DEC 2002).

Those distributions of high conservation value, and to less extent moderate conservation significance, may provide constraints to potential development within those vegetated areas. However, as all vegetation assessed as having relatively high significance occurs on steep, potentially highly erosive hillslopes, the constraints to development as a result of topography is equally important.

Areas of low conservation significance would not likely be considered a significant impediment to potential rezoning and development (Figures 19, 20 & 21).

Recovery and ecological potential of Endangered Ecological Communities

Distributions of vegetation that have a relatively high recovery and ecological potential largely reflect the patches of woodland vegetation assessed as having high conservation significance, these compared in Figures 19, 22 & 23.

The recovery potential identified among these vegetation distributions provides potential local ecological linkages for the floristic exchange of genetically variable pollen and genetically variable seed dispersal. Areas of high recovery potential of endangered ecological communities in the Study Area reflect a similar level of constraint to development as those assessed as having 'high conservation significance' (Figures 19 & 20).

5.5.2 Fauna

Woodland habitat should be preserved to conserve resources for threatened migratory avian species which may utilise resources during the winter months. Forest Redgum (*Eucalyptus teterticornis*), which is present within the woodland vegetation, is a valuable winter foraging resource for the Swift Parrot and Regent Honeyeater.

6 Potential lot number and size distribution in Study Area

6.1 Current zoning and Lot Sizes of the Study Area

The Study Area is currently zoned for most part as 'Rural Landscape' (RU2) (Wollondilly Council LEP 2011) (Figure 24).

Lot Sizes for 'Rural Landscape Holdings' are currently 20ha (Figure 25) (Wollondilly Council LEP 2011)

The following maps (Figures 24 & 25) available on the Wollondilly Local Environmental Plan 2011 show the current zoning and Lot sizes for the locality including the Study Area as follows:

1. Land Zoning Maps

The Study Area is currently zoned as 'Rural Landscape' (RU2) (Figure 24)

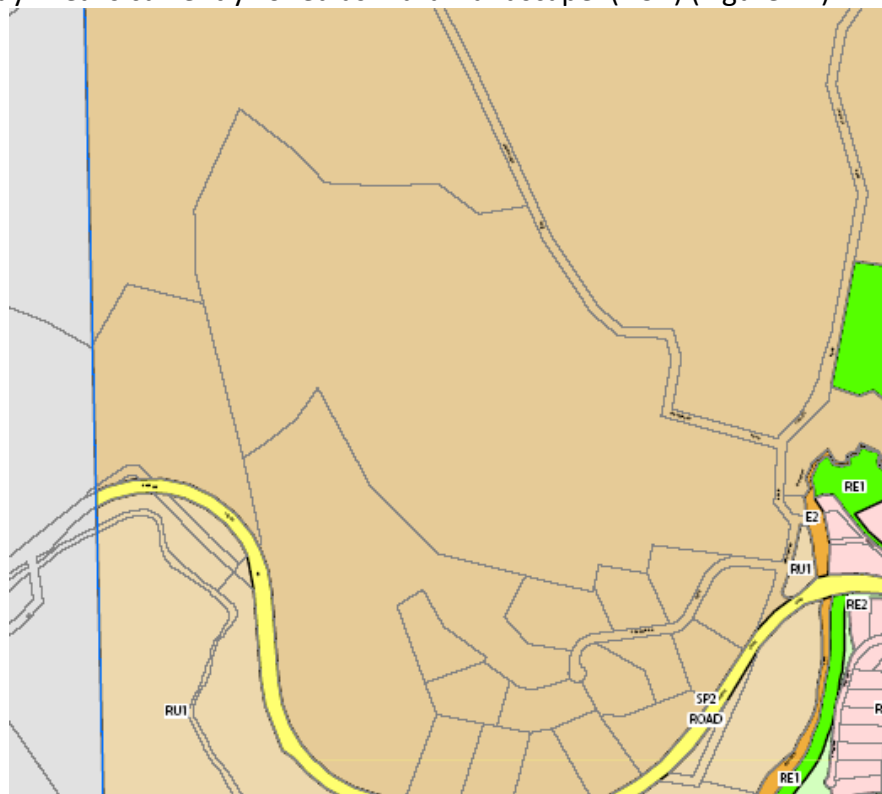


Figure 24 - Zoning (RU2) in Study Area – Rural Landscape

2 Lot size maps

The Study Area currently has a Lot Size area of 20ha where it is zoned as 'Rural Landscape' (RU2) (Figure 25).



Figure 25 – Current Lot Size Map – AB2 (= 20ha Lot Size shown in maroon) in the Study Area

6.2 Potential rezoning of the Study Area

A potential lot number and allotment size distribution in relation to rezoning of the Study Area would strategically combine the principles of integration of rural/residential living development with the support and maintenance of the biodiversity and ecological values of the Study Area.

Potential lot number and allotment size distribution can be assessed by consideration of the cumulative and generalized pattern of the range of biodiversity values of the Study Area (shown in Figure 23). The biodiversity value assessment incorporates an assessment of recovery potential in patches of natural vegetation, as well as the pattern of assessed conservation significance value of the mosaic of vegetation variation, and also includes an assessment of the potential occurrence of threatened species of flora and fauna habitat within the Study Area.

A minimum allotment size on the lower, more level areas that occur in the eastern sections of the Study Area (Figure 1) of, for example 4000m², would be an appropriate strategic mechanism as it allows a greater density of allotments within areas of 'low biodiversity value' whilst simultaneously allowing larger allotment sizes within areas

having more hilly terrain that may be associated with having 'high biodiversity values' (Figure 20). Indicative numbers of lots for the level and hilly sections of the Study Area are as follows:

- An indicative lot number on the lower, more level areas that occur in the eastern sections of the Study Area (Figure 1) (assuming a lot size area of 4000m²) of new allotments of around **30 - 40 lots** is based on consideration of areas of **low biodiversity and low conservation significance value** and in recognition of site restrictions such as road networks etc.
- An indicative lot number on areas having more hilly terrain that occur to the west of the level sections of the Study Area (Figure 1) (assuming a lot size area of 5ha) of new allotments of around **10 lots** is based on consideration of areas of **low biodiversity and low conservation significance value** and in recognition of site restrictions such as areas of high biodiversity and high conservation value associated with degraded woodland vegetation occurring in the central south of Study Area (Figures 4, 19, 22 & 23) as well as road networks etc.

This strategic outcome would ensure that there is an incentive for landowners, where land is proposed for development, to avoid areas of higher biodiversity and conservation value and preferentially develop all new allotments into areas assessed as having a low biodiversity and conservation significance (as shown in Figures 4, 19, 22 & 23).

If differing sizes of allotments are imposed in respect of varying assessments of biodiversity and conservation values, as well as consideration given for the highly variable terrain associated with the Study Area across the landscape, then this would remove the constraint that would arise from forcing a singular allotment size for the Study Area.

7 Biobanking potential

7.1 *Potential development involving the mechanism of biobanking*

The Biobanking mechanism is a tool that can be used to potentially streamline the threatened species assessment process for development applications resulting in an improvement of overall natural biodiversity (DECC 2009).

Biobanking is a voluntary scheme utilising a consistent, scientific-based methodology to provide reliable biodiversity conservation outcomes during the development process. It is a market-based scheme that provides an environmental service to:

- *Landowners who can potentially generate 'biodiversity credits' from a registered 'biobank site', and*
- *Purchasers, such as developers, who potentially buy the credits created as a mechanism to 'offset' biodiversity loss from a new development site.*

Where a biobanking statement is granted for a development site, the consent authority must accept that the requirements for threatened species under Section 79C of the EP& A Act 1979 have been satisfied. A biobanking statement cannot be appealed in the Land and Environment Court, except in special circumstances such as where a necessary road corridor is required.

Biobanking potentially allows developers to assess and offset biodiversity losses on a development site where the offsets may be located in another area with similar vegetation types, an outcome that minimises costs to the developer while maximising gains to biodiversity (DECC 2009).

7.2 *Biobanking potential within the Study Area*

The small remnant patches of highly degraded wooded vegetation occurring within the Study Area are considered to have a high biodiversity conservation value as they may represent isolated examples of Cumberland Moist Shale Woodland in the locality (see Figures 4, 5, 19, 20, 22 & 23).

Under the TSC Act, a biobanking statement can only be issued for a proposed development if the Director General makes a determination under the methodology that the development will 'improve or maintain' biodiversity values. The biobanking assessment methodology establishes the circumstances under which the development can be regarded as improving or maintaining biodiversity values. This includes circumstances where the impacts of clearing on biodiversity values at the development site are offset against the beneficial impacts of management actions that create biodiversity credits at the biobank site.

A development is regarded as improving or maintaining biodiversity values if:

1(a) The development does not directly impact on biodiversity values on a red flag area on the development site*

or

1(b) The development does directly impact on biodiversity values on a red flag area on the development site but the Director General makes a determination that the development be regarded as improving or maintaining biodiversity values according to section 2.3 of the biobanking assessment methodology (DECC 2008)*

and

2. The direct impacts of the development on biodiversity values on the development site are offset by the retirement of biodiversity credits determined in accordance with the offset rules in the methodology

and

3. The Director General determines that any indirect impacts of the development on onsite and off-site biodiversity values that cannot be mitigated through on-site measures are offset by the retirement of biodiversity credits determined in accordance with the offset rules in the methodology.

If a development impacts on all or part of a red flag area on the development site but the Director General makes a determination that the development is to be regarded as improving or maintaining biodiversity values (according to section 2.3 of the methodology), the Director General must publish the reasons for that determination on the register of biobanking statements. A copy of the impact assessment will also be made publicly available on this register (DECC 2008).*

It is considered that the small patches of vegetated areas of EEC occurring in the Study Area mapped as having high and moderate conservation value and correspondingly high recovery potentials and high biodiversity values would represent red flag areas* to development were there may be a direct or indirect impact of potential development (DECC 2008).

Where a proposed development or any part a development is on land that is, or forms part of, a red flag area, a biobanking statement may still be issued where the Director General makes a determination that it is possible for the development to be regarded as improving or maintaining biodiversity values. The Director General can only make that determination if satisfied that the criteria set out in section 2.3 of the methodology have been met (DECC 2008).*

Information demonstrating how these criteria are met must be included as part of the impact assessment section in the BioBanking Assessment Report that

accompanies an application for a biobanking statement if the proposed development or any part of it, is on land that is, or forms part of, a red flag area. Where the Director General determines that a development is to be regarded as improving or maintaining biodiversity values under section 2.3 of the methodology, then credits to offset the impacts of the development, including those on red flag areas*, must be retired in accordance with section 2.1 of the methodology (see also section 2.1 of this operational manual (DECC 2008)). Furthermore, the Director General must publish the reasons for that determination on the register of biobanking statements.*

The Director General must be satisfied that reasonable measures have been considered to:

- (a) avoid adverse impacts on the red flag area*; and*
- (b) improve or retain the viability of the red flag area* through ongoing management.*

A development impacts on a red flag area when the development footprint affects the biodiversity values of the red flag area*. This includes direct impacts (such as from clearing) and indirect impacts on biodiversity values of red flag areas* (such as from changes in water quality) (DECC 2008).*

Red Flag area* – *an area of land assessed as having high biodiversity conservation values such as if it contains vegetation characterised as being either a ‘critically endangered’ or ‘endangered’ ecological community (CEEC or EEC as listed under the TSC Act or EPBC Act) where the vegetation is not in a ‘low’ or degraded condition (that is where the native overstorey cover is <5% and the ground stratum has <50% cover of indigenous plant species or in the case of derived grasslands where extensive clearing has occurred and the ground stratum has <50% cover of indigenous plant species) (DECC 2008).*

Under part (a) of this criterion, the application for a biobanking statement will need to demonstrate that the applicant has considered options to avoid adverse impacts on biodiversity values on the red flag area. This could include reconfiguring the development footprint to avoid the red flag area*, or taking measures to minimise any impacts on biodiversity values on the red flag area*, such as retention of a buffer zone to minimize impacts where the clearing occurs up to the boundary of a red flag area*.*

For part (b) of this criterion, the application could demonstrate that the applicant has considered measures to improve or retain the viability of the red flag area through ongoing management. Such measures could include designating patches comprising the red flag areas* as an urban bushland park or a reserve within an urban precinct, or managing red flag areas* by using conservation-based mechanisms such as a biobanking agreement or a planning agreement under Section 93F(2)(f) of the EP&A Act.*

The application for a biobanking statement needs to provide evidence that the contribution of the red flag area to regional biodiversity values is low. For this criterion, region is defined as both the CMA subregion where the red flag area* is located and the adjoining CMA subregions. The purpose of this criterion is to consider the contribution of the biodiversity values of the red flag area* to regional biodiversity values.*

Under this criterion, each of five factors outlined in the Biobanking Methodology (DECC 2008) must be addressed in the impact assessment section of the application for a biobanking statement.

7.3 Concluding remarks in relation to biobanking potential within the Study Area

The small patches of woodland that occur in the Study Area (Figure 4) are located on relatively steep hillslopes where development may be impracticable. However, in relation to potential biobanking assessment and application, there is potential for biobanking schemes to be utilized and undertaken and also potential for offsets that would occur off site within the Hawkesbury – Nepean CMA. Red flag areas* may present greater constraints to development but each application, for both creditor and purchaser, would necessarily be assessed according to particular environmental criteria pertaining to the allotment.

It is considered that greater constraints could be incurred by potential development that may impact directly or indirectly on patches of vegetation assessed as belonging to a threatened ecological community having moderate or high conservation value and moderate to high recovery and ecological potential compared with that in the greater extent of the Study Area where biodiversity values are low (Figure 23).

Ideally, a potential network of rural (5ha) and rural-residential development, conserving the current small and topographically unsuitable areas of moderate to high conservation value among smaller lots of about 4000m² area, would satisfy requirements for the conservation of biodiversity of EEC's, with potential clusters of smaller rural/residential allotments developed across the mosaic of available wooded/non-wooded landscapes of the Study Area.

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Appendix 1: Floristic species assemblage recorded in areas within the Abbotsford Farm Study Area

KEY

Status

* Exotic species

pl (orn) – planted ornamental

nat – naturalised in area

C4 - Noxious weeds as listed on the *NSW Noxious Weeds Act (1993)*

Vegetation

Vegetation Units – Site Identification

1A – Cumberland Moist Shale Woodland (Code: S_GW01) (DECCW 2009) – Full structured sites dominated by Grey Box with Lantana and Blackthorn comprising understorey

1B – Cumberland Moist Shale Woodland (Code: S_GW01) (DECCW 2009) – Full structured sites dominated by Grey Box and Forest Red Gum with Lantana and Blackthorn in understorey

1C – Cumberland Moist Shale Woodland/Cumberland Shale Plains woodland (Code: S_GW01/GW02) (DECCW 2009) – Sites structurally modified, dominated by either Forest Red Gum or Grey Box with Blackthorn and often African Box Thorn in understorey

2 – Structurally modified Cumberland Moist Shale Woodland/Cumberland Shale Plains woodland (Code: S_GW01/GW02) (DECCW 2009) – Sites structurally modified, scrubland dominated by Blackthorn

3A – Blackberry scrub with Blackthorn occurring on upper slopes

3B – Blackberry scrub without Blackthorn

4 – Cleared Pasture

5 – Area planted with ornamental plants associated with heritage building structures and former living quarters

Relative ranked frequency of occurrence

c very common – common (Braun-Blanquet Scale 3 or >3)

o moderately common – occasional (Braun-Blanquet Scale 2 or 3)

u relatively uncommon – uncommon (Braun-Blanquet Scale 1)

STATUS	SCIENTIFIC NAME	COMMON NAME	1A	1B	1C	2	3A	3B	4	5
	GYMNOSPERMAE: CONIFERALES									
*pl (orn)	Araucariaceae <i>Araucaria bidwillii</i>	Bunya Pine								1 tree
*pl (orn)	Cupressaceae <i>Cupressocyparis leylandii</i>	Leyland Cypress								1 tree
	<i>Callitris rhomboidea</i>	Port Jackson Pine				1 tree				

STATUS	SCIENTIFIC NAME	COMMON NAME	1A	1B	1C	2	3A	3B	4	5
	MAGNOLIOPSIDA:									
	MAGNOLIDAE									
	Anacardiaceae									
*pl (orn)	<i>Schinus areira</i>	Pepper Tree								o
	Apocynaceae									
*pl (orn)	<i>Allamanda neriifolia</i>	Allamanda								o
	Asclepiadaceae									
*	<i>Gomphocarpus fruticosus</i>	Swan Plant					1 (u)			
	Asteraceae									
*	<i>Aster subulatus</i>								o	
*	<i>Cirsium vulgare</i>	Common Thistle	2 (o)	2 (o)	2 (o)	3 (o)	3 (o)	c	c	
*	<i>Conyza bonariensis</i>	Flaxleaf Fleabane		2 (o)				o	o	
*	<i>Gamochaeta coarctatum</i>	Cudweed				3 (c)			c	
*	<i>Hypochaeris radicata</i>	Cats Ears					3 (o)		c	
*	<i>Onopordum acanthium</i>	Scotch Thistle							o	
*	<i>Senecio madagascariensis</i>	Fireweed	3 (c)			3 (c)	2 (o)		c	
	Berberidaceae									
* nat	<i>Berberis aristata</i>	Barberry	2 (o)	2 (o)				o		u
* nat	<i>Berberis aff thunbergia</i>	Japanese Barberry		2 (o)			1 (u)	o		
	Boraginaceae									
C4	<i>Echium plantagineum</i>	Patersons Curse							u	
	Campanulaceae									
	<i>Wahlenbergia gracilis</i>	Spreading Bluebell							o	
	<i>Wahlenbergia stricta</i>	Tall Bluebell					1 (u)			
	Chenopodiaceae									
	<i>Einadia trigonos ssp trigonos</i>	Fish Weed	2 (o)							

STATUS	SCIENTIFIC NAME	COMMON NAME	1A	1B	1C	2	3A	3B	4	5
C4	Clusiaceae <i>Hypericum perforatum</i>	St Johns Wort				2 (o)				
	Convolvulaceae <i>Dichondra repens</i>	Kidney Weed	3 (c)			3 (c)				
	Fabaceae: Faboideae <i>Glycine tabacina</i> spp complex					2 (o)				
	* <i>Trifolium campestre</i>	Hop Clover							c	
	* <i>Trifolium repens</i>	White Clover							o	
	*pl (orn) <i>Wistaria chinensis</i>	Wistaria								o
	Gentianaceae * <i>Centaurium tenuiflorum</i>		2 (o)	2 (o)	o	2 (o)			c	
	Lauraceae *pl (orn) <i>Laurus nobilis</i>	Bay Tree								1 tree
	Linaceae * <i>Linum trigynum</i>	French Flax							u	
	Loranthaceae <i>Dendrophthoe vitellina</i>						1 (u)			
	Lythraceae *pl (orn) <i>Lagerstroemia indica</i>	Crepe Myrtle								u
	Malaceae *nat <i>Malus pumila</i>	Apple					1 (u)			
	Malvaceae <i>Brachychiton populneus</i>	Kurrajong						1 (u)		
	Meliaceae pl (orn) <i>Melia azederach</i>	White Cedar								c
	Mimosaceae <i>Acacia implexa</i> <i>Acacia parramattensis</i>	Hickory Wattle Parramatta Wattle	1 (u)	1 (u)			3 (o) 3 (o)	o		

STATUS	SCIENTIFIC NAME	COMMON NAME	1A	1B	1C	2	3A	3B	4	5
*pl (orn)	Moraceae <i>Maclura pomifera</i>	Osage Orange								o
*	Myrsinaceae <i>Anagallis arvensis</i>	Pimpernel							o	
	Myrtaceae <i>Eucalyptus eugenioides</i>	Thin-leaved Stringybark	4 (c)							
	<i>Eucalyptus moluccana</i>	Grey Box	4 (c)	5 (c)	3 - 4 (o - c)					
	<i>Eucalyptus tereticornis</i>	Forest Red-gum		4 (c)	3 (o)					
*	Oleaceae <i>Ligustrum lucidum</i>	Large-leaved Privet	3 (o)	4 (c)		2 (o)				c
*	<i>Ligustrum sinense</i>	Small-leaved Privet					1 (u)			
*	<i>Olea europea</i> var <i>cuspidata</i>	African Olive	2 (o)	2 (o)						
	Pittosporaceae <i>Bursaria spinosa</i>	Blackthorn	4 (c)	3 (o)	4 - 5 (c)	6 (c)	4 - 5 (c)		u	
*	Plantaginaceae <i>Plantago lanceolata</i>	Plantain				3 (c)			c	
	Polygonaceae <i>Rumex brownii</i>								o	
	Ranunculaceae <i>Clematis aristata</i>		1 (u)	2 (o)			1 (u)			
*pl (orn)	Rosaceae <i>Chaenomeles lagenaria</i>	Flowering Quince								u
C4	<i>Rosa rubiginosa</i>	Sweet Briar					1 (u)	u		
C4	<i>Rubus ulmifolius</i>	Blackberry	2 (o)	2 (o)		3 (o)	5 (c)	c	o	
C 4	Solanaceae <i>Lycium ferocissimum</i>	African Box-thorn			3 - 4 (o - c)	2 (o)		o	u	o

STATUS	SCIENTIFIC NAME	COMMON NAME	1A	1B	1C	2	3A	3B	4	5
*pl (orn)	Ulmaceae <i>Ulmus minor</i>	Smooth-leaved Elm								2 trees
C4	Verbenaceae <i>Lantana camara</i>	Lantana	5 (c)	5 (c)	1 (u)	2 (o)	1 (u)	o		
*	<i>Verbena bonariensis</i>	Purple Top	2 (u)	2 (u)		3 (o)		o	c	
	MAGNOLOPSIDA: LILIDAE									
C4	Asparagaceae <i>Asparagus asparagoides</i>	Bridal-veil Creeper					1 (u)			
	Poaceae <i>Bothriochloa macra</i>	Redgrass				2 (o)			o	
*	<i>Briza subaristata</i>								u	
*	<i>Bromus catharticus</i>	Prairie Grass							o	
	<i>Dichelachne micrantha</i>	Short-hair Plumegrass				2 (o)	3 (o)			
*	<i>Lolium perenne</i>	Perennial Ryegrass							c	
	<i>Microlaena stipoides</i> var <i>stipoides</i>	Weeping Grass	3 (o)			3 (o)			c	
C4	<i>Nassella trichotoma</i>	Serrated Tussock							o	
*	<i>Pennisetum clandestinum</i>	Kikuyu							o	
*	<i>Phalaris aquatica</i>	Toowoomba Canary Grass						u		
	<i>Poa labillardierei</i>	Tussock Grass					3 (c)		c	
*	<i>Sporobolus africanus</i>	Parramatta Grass							c	
	<i>Themeda australis</i>	Kangaroo Grass					3 (o)		o	
*	<i>Vulpia bromoides</i>	Squirrel Tail Fescue				3 (o)			c	

LEGEND TO APPENDIX 1 - NOXIOUS WEEDS IN WOLLONDILLY SHIRE COUNCIL LGA

C4 - A noxious weed the growth and spread of which must be controlled according to the measures specified in a management plan published by the local control authority

Appendix 2: Plant species of conservation significance recorded within a 5km radius of the Study Area since 1987 where potential habitat may occur (NPWS Atlas of NSW Wildlife 2012 ^α) or where potential habitat is deemed to potentially occur (Commonwealth Environmental Reporting Tool 2012 ^β)

Scientific Name	Common Name	Status (EPBC Act 1999)	Status (TSC Act 1995)	RoTAP	Habit/potential habitat/general geographic location	Likelihood of occurrence in Study Area & Likelihood of potential impacts from development and requirement for further assessment	Reference material derived from 'Final Determinations' (Scientific Committee) and others listed below:
<i>Acacia flocktoniae</i> ^β	Flockton's Wattle	V*	V	2VC-	Slender upright shrub to 2m tall in open dry eucalypt forest in sandy soils occurring in the remote areas of the Blue Mountains between Yerranderie and Hartley	Highly unlikely – location and habitat in Study Area unsuitable	OEH Atlas of NSW Wildlife (2012); James et al (1999); Fairley (2004)
<i>Caladenia tessellata</i> ^β	Tesselated Spider Orchid	V*	E1	3V	Terrestrial herb. Clay or sandy soils in moist forests or scrubs on coastal ridgetops	Unlikely – Habitat not suitable. Old records from 1945 and 1948 occur from Woronora River. Other populations occur near Braidwood and near Wyong. Only evident following fire.	OEH Atlas of NSW Wildlife (2012); Robinson (2000)
<i>Cynanchum elegans</i> ^{α β}	White-flowered Wax Plant	E*	E1	3ECi	Climber or twiner of variable form with stems up to 10m high and 3.5cm thick, occurs mainly at the ecotone between dry subtropical closed forest and sclerophyll forest/woodland communities	Unlikely – Habitat unsuitable. Recorded observation in 1999 occurs some 4km to the north-east of the Study Area at Mt Hercules Rd, Razorback Range. Targeted searches among remnant patches of natural vegetation failed to locate any individuals. Absence of otherwise conspicuous individuals in Study Area deemed to indicate non-occurrence.	OEH Atlas of NSW Wildlife (2012)

Scientific Name	Common Name	Status (EPBC Act 1999)	Status (TSC Act 1995)	RoTAP	Habit/potential habitat/general geographic location	Likelihood of occurrence in Study Area & Likelihood of potential impacts from development and requirement for further assessment	Reference material derived from 'Final Determinations' (Scientific Committee) and others listed below:
<i>Grevillea parviflora</i> subspecies <i>parviflora</i> ^{α β}	Small-flower Grevillea	V*	V		Erect shrub to 150cm tall. Occurs in light clayey soils over shale on ridges or rocky sandstone slopes in dry shrubby sclerophyll forest, from Gosford to Sydney district. Known to occur or have occurred in south-western Sydney from Prospect to Camden and Appin.	Unlikely – Habitat of areas within Study Area suboptimal. Nearest records occur in natural bushland some 4km to the north-east at the North end of Wilton Park Road, about 400 m South of Maldon Bridge and near the corner of Jokes Way and Marcus St, in the Maldon area. Absence of otherwise conspicuous large-life form individuals in Study Area deemed to indicate non-occurrence.	OEH Atlas Of NSW Wildlife (2012); James et al (1999); Fairley (2004)
<i>Pelargonium sp Striatellum</i> ^β	Omeo Storksbill	E*	E1		Tufted perennial forb with leaves in a basal rosette occurring in clonal colonies at the high water mark of irregularly inundated ephemeral lakes	Highly unlikely – Habitat unsuitable.	OEH Atlas of NSW Wildlife (2012)
<i>Pimelea spicata</i> ^β	Spike-flowered Rice-flower	E*	E1	3ECi	Small upright shrub to 35cm tall occurring on clay soils derived from Wianamatta Shale.	Unlikely – Although habitat occurs in the subject area, there are no records of occurrence within a 5km radius of the Study Area. The species occurs mainly in Western Sydney. Disjunct populations occur between Shellharbour and Minnamurra.	OEH Atlas of NSW Wildlife (2012); James et al (1999); Fairley (2004).
<i>Pomaderris brunnea</i> ^β	Brown Pomaderris	V*	V	2VC-	Shrub to 3m tall occurring on clay or alluvial soils overlying shale, generally in open woodland	Unlikely - Habitat may occur in Study Area, though highly degraded. However, the absence of otherwise large life-form individuals is deemed to indicate non-occurrence.	OEH Atlas of NSW Wildlife (2012); James et al (1999); Fairley (2004).

Scientific Name	Common Name	Status (EPBC Act 1999)	Status (TSC Act 1995)	RoTAP	Habit/potential habitat/general geographic location	Likelihood of occurrence in Study Area & Likelihood of potential impacts from development and requirement for further assessment	Reference material derived from 'Final Determinations' (Scientific Committee) and others listed below:
<i>Pterostylis saxicola</i> ^β	Sydney Plains Greenhood Orchid	E*	E1		Ground orchid with reddish brown and green translucent flowers on a slender stem to 35cm tall. Most commonly occurs in small pockets of shallow soil in depressions on sandstone rock shelves above cliff-lines in association with sclerophyllous forest or woodland on shale/sandstone transition soils.	Unlikely – Habitat unsuitable. Occurs in flat areas, either on top of stony ridges or on mossy rocks in gullies. No records within 5km of Study Area.	OEH Atlas Of NSW Wildlife (2012); Bishop (2000).
<i>Streblus pendulinus</i>	Siah's Backbone	E*			Shrub or small tree to 6m tall, occurs in or near warmer rainforest especially near watercourses from drier seasonal rainforest to well developed moist gallery forest	Highly Unlikely – occurs from Cape York to Milton, south-east NSW. Habitat unsuitable. Absence of conspicuous large-life form individuals indicates non-occurrence	Sprat Profiles www.environment.gov.au (2012) SEWPaC list of threatened plant species (2012)
<i>Thelymitra</i> sp Kangaloon ^β	Kangaloon Sun Orchid	EC*			Herb to 60cm high. Occurs in damp situations and swamps from three locations near Robertson in the Southern Highlands	Highly unlikely – habitat and recorded locations are not suitable for the occurrence of this species.	SEWPaC list of threatened plant species (2012)

Key for Appendix 2:

EPBC Act Threatened species status ^β

EX – Presumed extinct

E* - Endangered

V* - Vulnerable

TSC Act Threatened species status ^α

E4A – presumed extinct, recently recorded

E1 – Endangered

E2 – Endangered population

V - Vulnerable

Key to Conservation Status:**Commonwealth legislation**

Environmental Protection and Biodiversity Conservation Act, 1999

EX – Presumed extinct

E* - Endangered

V* - Vulnerable

NSW legislation

Threatened Species Conservation Act, 1995

E4A – Schedule 1 Part 1 – Presumed extinct, recently recorded

E1 Schedule 1 Part 1 – Endangered

E2 Schedule 1 Part 1 – Endangered Population

V Schedule 2 - Vulnerable

RoTAPConservation code

2 - geographic range <100km

3 - geographic range >100km

Conservation status

E - endangered to point of extinction if current land use and other threats continue to operate

V - vulnerable, at risk of depletion over 20-50- years if land use that threatens survival is maintained

C - at least one population conserved in a national park or proclaimed conservation area

Size class of reserved populations

a - >1000 plants in conservation reserve

i - < 1000 plants in conservation reserve

- reserved population size not accurately known

Appendix 3: Fauna species observed within the Abbotsford Farm Study Area in habitat areas 1 – 4 as depicted in Figure 17

FAMILY	SCIENTIFIC NAME	COMMON NAME	Habitat			
			1	2	3	4
AMPHIBIANS						
Hylidae	<i>Litoria fallax</i>	Eastern Dwarf Tree Frog			h	
	<i>Litoria peronii</i>	Peron's Tree Frog			h	
Myobatrachidae	<i>Crinia signifera</i>	Common Eastern Froglet		h	h	
AVES						
Acanthizidae	<i>Acanthiza nana</i>	Yellow Thornbill		>10		
Alcedinidae	<i>Dacelo novaeguineae</i>	Laughing Kookaburra	2	1		
Anatidae	<i>Anas superciliosa</i>	Pacific Black Duck			2	
	<i>Chenonetta jubata</i>	Australian Wood Duck			6	3
Ardeidae	<i>Egretta novaehollandiae</i>	White-faced Heron				1
Artamidae	<i>Cracticus tibicen</i>	Australian Magpie		2		2
	<i>Cracticus torquatus</i>	Grey Butcherbird				1
	<i>Strepera graculina</i>	Pied Currawong				2 OH
Cacatuidae	<i>Cacatua galerita</i>	Sulphur-crested Cockatoo	3 OH			
	<i>Eolophus roseicapillus</i>	Galah		2		
	<i>Cacatua sanguinea</i>	Little Corella		2		
Campephagidae	<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	2			
Charadriidae	<i>Vanellus miles</i>	Masked Lapwing				3
Columbidae	<i>Ocyphaps lophotes</i>	Crested Pigeon	1			
	<i>Streptopelia chinensis</i>	Spotted Turtle-Dove*		1		
Corvidae	<i>Corvus coronoides</i>	Australian Raven				6 OH
Estrildidae	<i>Taeniopygia bichenovii</i>	Double-barred Finch			>5	
Falconidae	<i>Falco cenchroides</i>	Nankeen Kestrel				1 OH

FAMILY	SCIENTIFIC NAME	COMMON NAME	Habitat			
			1	2	3	4
Fringillidae	<i>Carduelis carduelis</i>	European Goldfinch*				
Hirundinidae	<i>Hirundo neoxena</i>	Welcome Swallow		>10 OH		>10 OH
	<i>Petrochelidon ariel</i>	Fairy Martin		>10		
Maluridae	<i>Malurus cyaneus</i>	Superb Fairy-wren	>3	>10		
Meliphagidae	<i>Manorina melanocephala</i>	Noisy Miner	>5			
Monarchidae	<i>Grallina cyanoleuca</i>	Magpie-lark				>2
Motacillidae	<i>Anthus novaeseelandiae</i>	Australian Pipit				2
Pardalotidae	<i>Pardalotus punctatus</i>	Spotted Pardalote	>1			
Psittacidae	<i>Platycercus elegans</i>	Crimson Rosella	>1			
	<i>Platycercus eximius</i>	Eastern Rosella	6			
	<i>Trichoglossus haematodus</i>	Rainbow Lorikeet		>2 OH		
Psophodidae	<i>Psophodes olivaceus</i>	Eastern Whipbird	h			
Pycnonotidae	<i>Pycnonotus jocosus</i>	Red-whiskered Bul-bul*		>3		
Rallidae	<i>Fulica atra</i>	Eurasian Coot			2	
	<i>Porphyrio porphyrio</i>	Purple Swampphen			2	1
	<i>Gallinula tenebrosa</i>	Dusky Moorhen			1	
Rhipiduridae	<i>Rhipidura albiscapa</i>	Grey Fantail	>1			
	<i>Rhipidura leucophrys</i>	Willie Wagtail				>3
Sturnidae	<i>Sturnus vulgaris</i>	Common Starling*		>5		
Turdidae	<i>Turdus merula</i>	Eurasian Blackbird*		2		
MAMMALS						
Bovidae	<i>Bos taurus</i>	European cattle*				>100
	<i>spp</i>	Sheep*				>30
Canidae	<i>Vulpes vulpes</i>	Fox*				>2
Equidae	<i>Equus caballus</i>	Horse*				1
Leporidae	<i>Oryctolagus cuniculus</i>	Rabbit*	>1	>5		>20

FAMILY	SCIENTIFIC NAME	COMMON NAME	Habitat			
			1	2	3	4
	<i>Lepus capensis</i>	Brown hare*	1			
Macropodidae	<i>Macropus giganteus</i>	Eastern Grey Kangaroo	scat			
	<i>Macropus robustus</i>	Common Wallaroo	1			
Molossidae	<i>Mormopterus Species 2</i>	Undescribed Freetail-bat		anabat		
	<i>Tadarida australis</i>	White-striped Freetail-bat		anabat		
Vespertilionidae	<i>Chalinolobus gouldii</i>	Gould's Wattled Bat		anabat		
	<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat		anabat		
	<i>Vespadelus vulturnus</i>	Little Forest Bat		anabat		
Muridae	<i>Rattus rattus</i>	Black Rat		>1		
REPTILES						
Elapidae	<i>Pseudechis porphyriacus</i>	Red-bellied Black Snake				e
Scincidae	<i>Lampropholis delicata</i>	Dark-flecked Garden Sunskink	>1			
INSECTA						
	<i>Bubus bison</i>	Dung Beetle				>6
TOTAL SPECIES			16	21	9	19

KEY FOR APPENDIX 3

No. recorded - on site
 OH – overhead
 * introduced species
 e – expected to visit occasionally

heard - characteristic call heard in nearby bushland
 scat – faeces belonging to fauna collected on site

Appendix 4: Habitat requirements for threatened species recorded within 5km of the Abbotsford Farm study area.

(Sightings numbers source: OEH Atlas of NSW Wildlife Database 2012.)

Species	Status EPBC Act	Status TSC Act	Distribution, Habitat	Likelihood of occurrence in surveyed areas & requirement for further assessment	Material source
Birds			Distribution, Habitat		
Little Eagle <i>Hieraaetus morphnoides</i>		V	Distribution; The Little Eagle is found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. It occurs as a single population throughout NSW. Habitat; Occupies open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter. Preys on birds, reptiles and mammals, occasionally adding large insects and carrion.	Unlikely -the habitat is not optimal. Vegetation structure required is not present.	OEH Atlas of NSW Wildlife (2012) 1 sighting
Square-tailed Kite <i>Lophoictinia isura</i>		V	Distribution; The Square-tailed Kite inhabits open eucalypt forest and woodland, and the sand-plains of coastal and sub-coastal mainland from south WA, the Top End, Eastern Queensland, NSW to Victoria. Habitat; In NSW the Square-tailed Kite is often associated with ridge and Gully forests dominated by Woollybutt <i>Eucalyptus longifolia</i> , Spotted Gum <i>Eucalyptus maculata</i> , or Peppermint Gum <i>Eucalyptus elata</i> . It has also been sighted in forests containing <i>Angophora spp.</i> and <i>Callitris spp.</i> with a shrubby understorey and Box-Ironbark woodland. It feeds on honeyeating birds and insects in the tree canopy. They have a large foraging range and hunt prey early morning and evening. Nesting sites are along or close to watercourses in a fork or large horizontal limb of a <i>Eucalyptus</i> or <i>Angophora</i> species (Pizzey and Knight 2003).	Unlikely -the habitat is not optimal. No gully forests or preferred tree species are present.	OEH Atlas of NSW Wildlife (2012) 1sighting

Birds	Status EPBC Act	Status TSC Act	Distribution, Habitat	Likelihood of occurrence in surveyed areas & requirement for further assessment	Material source
Gang-gang Cockatoo <i>Callocephalon fimbriatum</i>		V	Distribution; In New South Wales, the Gang-gang Cockatoo is distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes (Pizzey & Knight 2003). Habitat; In summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas. May also occur in sub-alpine Snow Gum <i>Eucalyptus pauciflora</i> woodland and occasionally in temperate rainforests.	Unlikely -the habitat is not optimal. No heavily vegetated woodland which is preferred by this species.	OEH Atlas of NSW Wildlife (2012) 4 sightings
Glossy Black Cockatoo <i>Calyptrorhynchus lathami</i>		V	Distribution: The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. (Pizzey & Knight 2003). Habitat: The Glossy Black-Cockatoo inhabits eucalypt woodland, forest or timbered watercourses where casuarinas (She-oaks) are common. In NSW, the Glossy Black-Cockatoo occurs in coastal and mountain districts, extending west along spurs of the Great Dividing Range. The Glossy Black Cockatoo feeds almost exclusively on the seeds of She-oaks, mostly Forest She-oak <i>Allocasuarina torulosa</i> and Black She-oak <i>A. littoralis</i> although they are also known to eat the seeds of Shrub She-oak <i>A. distyla</i> at times (Smith and Smith 2000). Breeding pairs, often with a juvenile, can travel over large distances in search of food. The Glossy Black-Cockatoo nests in tree trunks, spouts or stump hollows, mostly in <i>Eucalyptus</i> , living or dead.	Unlikely -the habitat is not optimal.	OEH Atlas of NSW Wildlife (2012) 4 sightings

Birds	Status EPBC Act	Status TSC Act	Distribution, Habitat	Likelihood of occurrence in surveyed areas & requirement for further assessment	Material source
Swift Parrot <i>Lathamus discolor</i>	E	E1	On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. In winter they migrate to coastal NSW where they will feed in the following trees; Swamp Mahogany (<i>E. robusta</i>), Forest Redgum (<i>E. tereticornus</i>), Spotted Gum (<i>Corymbia maculata</i>), Red Bloodwood (<i>Corymbia gummifera</i>).	possible-winter migrant. Suitable foraging habitat in Forest Regum is present but is more extensive within reserves of the area. Given there is only one record of the species in the area it is unlikely it would forage within survey area.	OEH Atlas of NSW Wildlife (2012) 1 recorded sighting
Barking Owl <i>Ninox connivens</i>		V	Inhabits eucalypt woodland, open forest, swamp woodlands and, especially in inland areas, timber along watercourses. Denser vegetation is used occasionally for roosting. During the day they roost along creek lines, usually in tall understorey trees with dense foliage such as Acacia and Casuarina species, or the dense clumps of canopy leaves in large Eucalypts. Live alone or in pairs. Territories range from 30 to 200 hectares and birds are present all year.	Unlikely-the habitat is not optimal. The vegetation structure is not dense enough for this cryptic species.	OEH Atlas of NSW Wildlife (2012) 1 recorded sighting
Powerful Owl <i>Ninox strenua</i>		V	Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. It roosts by day in dense vegetation such as Turpentine <i>Syncarpia glomulifera</i> , Black She-oak <i>Allocasuarina littoralis</i> , Blackwood <i>Acacia melanoxylon</i> , Rough-barked Apple <i>Angorophora floribunda</i> , Cherry Ballart <i>Exocarpus cupressiformis</i> and a number of other eucalypt species.	Unlikely-the habitat is not optimal. The vegetation structure of dense woodland overlooking water is not present and there are no large hollows present for nesting.	OEH Atlas of NSW Wildlife (2012) 2 recorded sighting

Birds	Status EPBC Act	Status TSC Act	Distribution, Habitat	Likelihood of occurrence in surveyed areas & requirement for further assessment	Material source
Brown Treecreeper <i>Climacteris picumnus victoriae</i>		V	<p>Distribution: The eastern subspecies of the Brown Treecreeper is distributed through central NSW on the western side of the Great Dividing Range and sparsely scattered to the east of the Divide in drier areas such as the Cumberland Plain of Western Sydney, and in parts of the Hunter, Clarence, Richmond and Snowy River valleys.</p> <p>Habitat: The Brown Treecreeper occupies eucalypt woodlands, particularly open woodland lacking a dense understorey. It is sedentary and nests in tree hollows within permanent territories, breeding in pairs or communally in small groups. Birds forage on tree trunks and on the ground amongst leaf litter and on fallen logs for ants, beetles and larvae.</p>	Unlikely- this species is unlikely to utilise resources of flowering eucalypts in the area.	<p>OEH Atlas of NSW Wildlife (2012)</p> <p>1 recorded sighting</p>
Regent Honeyeater <i>Anthochaera phrygia</i>		E4A	<p>Distribution: The Regent Honeyeater is a nomadic species. In NSW the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands. In some years non-breeding flocks converge on flowering coastal woodlands and forests (Pizzey & Knight 2003).</p> <p>Habitat: The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Every few years non-breeding flocks are seen foraging in flowering coastal Swamp Mahogany, Spotted Gum forests and Forest Redgum.</p>	possible-winter. The location of the habitat is not optimal. Foraging resources for winter are present in Forest Redgum.	<p>OEH Atlas of NSW Wildlife (2012)</p> <p>3 recorded sighting</p>
Varied Sittella <i>Daphoenisitta chrysoptera</i>		V	<p>Distribution: The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands, with a nearly continuous distribution in NSW from the coast to the far west (Higgins and Peter 2002; Barrett <i>et al.</i> 2007).</p> <p>Habitat: It inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and <i>Acacia</i> woodland. The Varied Sittella feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees, and from small branches and twigs in the tree canopy.</p>	Unlikely- the rough-barked angophoras and eucalypts in the less disturbed areas may on occasion attract this species.	<p>OEH Atlas of NSW Wildlife (2012)</p> <p>1 recorded sighting</p>

Birds	Status EPBC Act	Status TSC Act	Distribution, Habitat	Likelihood of occurrence in surveyed areas & requirement for further assessment	Material source
Hooded Robin <i>Melanodryas cucullata cucullata</i>		V	Distribution: The Hooded Robin is widespread, found across Australia, except for the driest deserts and the wetter coastal areas - northern and eastern coastal Queensland and Tasmania. However, it is common in few places, and rarely on the coast. The south-eastern form (subspecies <i>cucullata</i> is found from Brisbane to Adelaide and throughout much of inland NSW. Habitat: Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses. Territories range from around 10 ha during the breeding season, to 30 ha in the non-breeding season.	Unlikely- habitat not present .	OEH Atlas of NSW Wildlife (2012) 1 recorded sighting
Scarlet Robin <i>Petroica boodang</i>		V	Distribution; The Scarlet Robin is found from SE Queensland to SE South Australia and also in Tasmania and SW Western Australia. In NSW, it occurs from the coast to the inland slopes. Habitat; The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs and usually contains abundant logs and fallen timber: these are important components of its habitat. In autumn and winter many Scarlet Robins live in open grassy woodlands, and grasslands or grazed paddocks with scattered trees.	Unlikely- the habitat is not optimal. Grassy woodland with fallen timber is preferred habitat.	OEH Atlas of NSW Wildlife (2012) 1 recorded sighting
Diamond Firetail <i>Stagonopleura guttata</i>		V	Distribution; The Diamond Firetail is endemic to south-eastern Australia, extending from central Queensland to the Eyre Peninsula in South Australia. It is widely distributed in NSW, with a concentration of records from the Northern, Central and Southern Tablelands, the Northern, Cental and South Western Slopes and the North West Plains and Riverina. Not commonly found in coastal districts, though there are records from near Sydney, the Hunter Valley and the Bega Valley. Habitat; Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum <i>Eucalyptus pauciflora</i> Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland.	Unlikely- the habitat is not optimal. The small area of woodland does not contain components necessary for preferred habitat.	OEH Atlas of NSW Wildlife (2012) 1 recorded sighting

Mammals	Status EPBC Act	Status TSC Act	Distribution, Habitat	Likelihood of occurrence in surveyed areas & requirement for further assessment	Material source
Koala <i>Phascolarctos cinereus</i>	V	V	<p>The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In NSW it mainly occurs on the central and north coasts with some in the western region.</p> <p>The inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size.</p> <p><i>Eucalyptus punctata</i> is a critical habitat component. Other favoured food trees are <i>E.haemastoma</i>, <i>E. robusta</i> and <i>E. racemosa</i>. The available information suggests that the next most important food trees in the area are <i>Angophora costata</i>, <i>Corymbia gummifera</i>, <i>C. maculata</i>, <i>Eucalyptus botryoides</i>, <i>E. globoidea</i>, <i>E. paniculata</i>, <i>E. piperita</i> and <i>E. umbra</i>.</p>	Unlikely -the habitat is not optimal. No preferred food tree species are present and the open pasture unsuitable for this species.	OEH Atlas of NSW Wildlife (2012) 3 recorded sighting
Grey-headed Flying-fox <i>Pteropus poliocephalus</i>	V	V	<p>The species congregates in large camps and is found in a variety of habitats including rainforest, mangroves, Melaleuca swamps, wet and dry sclerophyll forests and also cultivated areas. The species feeds on the blossoms of more than 80 plant species, especially eucalyptus blossom and the fruits of a number of tree and palm species. They feed on the blossoms of more than 80 plant species. The major plant food is Eucalyptus blossom and the native fruits of a number of tree species. Winter flowering species, such as Swamp Mahogany (<i>Eucalyptus robusta</i>), Forest Red Gum (<i>Eucalyptus tereticornis</i>) and Paperbarks (<i>Melaleuca quinquenervia</i>), are particularly important. Distances of up to 30km from the camp are often travelled, with 60-70km sometimes covered per night to reach a particular food source</p>	Likely -the habitat is not optimal due to the hilltop location of the Forest Regum and the small size of the patch of woodland. These trees will not be removed by the proposal.	OEH Atlas of NSW Wildlife (2012) 1 recorded sighting

Mammals	Status EPBC Act	Status TSC Act	Distribution, Habitat	Likelihood of occurrence in surveyed areas & requirement for further assessment	Material source
Cumberland Plain Land Snail <i>Meridolum corneovirens</i>		E1	<p>Distribution; This large native land snail occurs over a very restricted area between Prospect and Liverpool to the east and the Hawkesbury-Nepean River to the west. To the south it extends as far as Picton and to the north to the Windsor-Richmond area.</p> <p>Habitat; Its habitat has been largely destroyed by urbanisation and it now is reported as surviving only as isolated populations in some remnant areas of bushland. Large Land Snails (<i>Meridolum corneovirens</i>) burrow into the soft soil around the base of trees and during dry period can appear to be lost from an area. However following prolonged wet periods they will re-emerge into the litter to feed on decaying wood and fungi.</p>	<p>Unlikely-the level of disturbance in areas of Cumberland Plain vegetation is high and not optimal for the species which is generally found in areas where the landscape has not experience high levels of agricultural use.</p>	<p>OEH Atlas of NSW Wildlife (2012)</p> <p>2 recorded sighting</p>

Appendix 5 - Threatened Species Listed by Commonwealth Department of Sustainability, Environment, Water, Population and Communities (Canberra SEWPaC) as having habitat within the Abbotsford Farm study Area.

Species name	Species Distribution	Presence on site
Giant Burrowing Frog <i>Heleioporus australiacus</i>	Distribution: This species is found from the central coast of NSW to eastern Victoria (Barker et al 1995, Cogger 2000). Habitat restricted to Hawkesbury Sandstone. Habitat: Usually found in sandy creek beds with crayfish burrows in the area.	Unlikely -no suitable habitat
Regent Honeyeater <i>Anthochaera phrygia</i>	Distribution: Autumn – winter migrant to coastal NSW. Southern and central tablelands through north-western slopes. Habitat: eucalypt woodland and open forest flanking the Great Dividing Range. Forage in box ironbark woodlands and mistletoe-infested areas. Forages coastally in Swamp Mahogany.	possible-winter. The habitat is not optimal but may forage when Forest Redgum is in flower.
Red Goshawk <i>Erythrotriorchis radiatus</i>	Distribution: The Red Goshawk is endemic to Australia. It is very sparsely dispersed across approximately 15% of coastal and sub-coastal Australia, from western Kimberley Division (north of 19°S) to northeastern NSW (north of 33°), and occasionally on continental islands. Habitat: In NSW favoured habitat is mixed subtropical rainforest and Melaleuca forest along coastal rivers, often in rugged terrain .	Unlikely -no suitable habitat
Gang-gang Cockatoo <i>Callocephalon fimbriatum</i>	Distribution: from southern Victoria through south- and central-eastern New South Wales. In New South Wales, distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes. Habitat: In summer, generally found in tall mountain forests and woodlands. In winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas. Move to lower altitudes in winter, preferring more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas.	Unlikely -the woodland area is too small and fragmented from other areas of woodland
Australian Painted Snipe <i>Rostratula australis</i>	Distribution: The Australian race of Painted Snipe appears non-migratory, but nomadic, occurring across eastern and northern Australia, mainly inland in muddy, freshwater swamps in Murray-Darling and Great Artesian Basins. Habitat: Prefers shallow freshwater swamps and marsh with adequate cover.	Unlikely -no suitable habitat
Large-eared Pied Bat <i>Chalinolobus dwyeri</i>	Distribution: South-eastern Queensland to New South Wales from the coast to the western slopes of the Divide. Endemic to Australia. Habitat: These bats roost in shallow caves in escarpments, particularly in sandstone and forage in remnant native dry and wet open forests, woodlands and rainforests.	Unlikely -no suitable habitat
Spotted-tailed Quoll <i>Dasyurus maculatus</i>	Distribution: Sparsely distributed from Fraser Island to south-western Victoria and widespread in Tasmania. Habitat: Inhabits rainforest, wet and dry sclerophyll forest, coastal heath and scrub, often found associated with Forest Red Gum along inland rivers. The species dens in tree hollows, hollow logs or rock crevices.	Unlikely -no suitable habitat

Species name	Species Distribution	Presence on site
Long-nosed Potoroo <i>Potorous tridactylus tridactylus</i>	Distribution: Locally common in Tasmania, patchy distribution from coastal south-west Victoria to south-east Queensland. Habitat: inhabits moist sclerophyll forest with a dense shrub layer to coastal heath woodland. Prefers dense cover for shelter adjacent to open foraging sites.	Unlikely -no suitable habitat
New Holland Mouse <i>Pseudmys novaehollandiae</i>	Distribution: The New Holland Mouse has a fragmented distribution across Tasmania, Victoria, NSW and Queensland. In NSW, the New Holland Mouse is known from: Royal National Park Habitat: The New Holland Mouse has been found from coastal areas and up to 100 km inland on sandstone country with deeper topsoils for digging burrows. Due to the grain diet of the species, areas high in floristic diversity, are essential.	Unlikely -no suitable habitat
Grey-headed flying Fox <i>Pteropus poliocephalus</i>	Distribution: East coast of Australia from Rockhampton in Queensland to western Victoria. Endemic to Australia (Churchill 1998). Habitat: Found in a variety of habitats, including rainforest, mangroves, paperbark swamps, wet and dry sclerophyll forests and cultivated areas.	Likely . Foraging resources are present within the woodland areas.
Broad-headed Snake <i>Hoplocephalus bungaroides</i>	Distribution: Preferred habitat is associated with Triassic sandstone of the Sydney Basin. Nocturnal. Habitat: Shelters in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring. Moves from the sandstone rocks to shelters in hollows in large trees within 200 m of escarpments in summer. Feeds mostly on geckos and small skinks; will also eat frogs and small mammals occasionally. Prefers sandstone outcrops that occur in vegetation that include <i>Corymbia gummifera</i> (Red Bloodwood) and <i>Eucalyptus sieberi</i> (Silver-top Ash).	Unlikely -no suitable habitat

Appendix 6 - Migratory Species Listed by Commonwealth Department of Sustainability, Environment, Water, Population and Community (Canberra SEWPAC) as having habitat within the Abbotsford Farm study Area.

Birds listed under CAMBA ○ and JAMBA Δ and ROKAMBA □

Migratory	Species Distribution	Presence on site
White-bellied Sea-eagle ○ <i>Haliaeetus leucogaster</i>	Distribution: Coastal mainland Australia and Tasmania and large waterbodies and rivers inland. Habitat: Major rivers, inshore seas and large estuaries as well as upper reaches of rivers and large inland waterbodies.	Unlikely -no suitable habitat
Black-faced Monarch <i>Monarcha melanopsis</i>	Distribution: Summer migrant to east coast of NSW. Coastal eastern Australia from Cape York to far eastern Victoria mostly east of Great Divide. Habitat: Rainforests, eucalypt woodlands, coastal scrubs, wet gullies and woodlands. Prefers to feed in the middle layers of rainforest and wet eucalypt forest. Also prefers a dense understorey tangle where it feeds into the cracks and crevices.	Unlikely -no suitable habitat
Rainbow Bee-eater <i>Merops ornatus</i>	Distribution: The Rainbow Bee-eater is found throughout mainland Australia, as well as eastern Indonesia, New Guinea and, rarely, the Solomon Islands. In Australia it is widespread, except in desert areas, and breeds throughout most of its range, although southern birds move north to breed. Habitat: The Rainbow Bee-eater is most often found in open forests, woodlands and shrublands, and cleared areas, usually near water. It will be found on farmland with remnant vegetation and in orchards and vineyards. It will use disturbed sites such as quarries, cuttings and mines to build its nesting tunnels.	Unlikely -no suitable habitat
Satin Flycatcher <i>Myiagra cyanoleuca</i>	Distribution: Breeding Queensland to Tasmania, they migrate north to Torres Strait and New Guinea in winter. Habitat: Winters in northern Australia. Occupies rolling plains and steep heavily vegetated mountain gullies in forests, woodlands.	Unlikely -no suitable habitat
Rufous Fantail <i>Rufous rufifons</i>	Distribution: Breeds north as far as Cooktown in Queensland and down to south-western Victoria. They travel north during March April. September-October to winter in north-eastern Queensland and Northern New Guinea, returning September-October. Habitat: Undergrowth of wet forests and scrubs, monsoon forests and paperbarks, coastal scrubs, mangroves and watercourses.	Unlikely -no suitable habitat
Regent Honeyeater <i>Xanthomyza phrygia</i>	Distribution: Autumn – winter migrant to coastal NSW. Southern and central tablelands through north-western slopes. Habitat: Prefers well shrubbed eucalypt woodland and open forest flanking the Great Dividing Range. Forage in box ironbark woodlands and mistletoe-infested areas. Forages coastally in Swamp Mahogany.	possibly -during the winter months in areas where Forest Redgum is flowering.

Swift Parrot <i>Lathamus discolor</i>	<p>Distribution: Autumn – winter migrant to coastal NSW. In NSW mostly occurs on the coast and south west slopes (Pizzey & Knight 2003).</p> <p>Habitat: Occurs on the mainland in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Will feed in the following trees; Swamp Mahogany (<i>Eucalyptus robusta</i>), Forest Redgum (<i>E. tereticornus</i>), Spotted Gum (<i>Corymbia maculata</i>), Red Bloodwood (<i>Corymbia gummifera</i>).</p>	Likely -during the winter months in areas where Forest Redgum is flowering.
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Migratory Wetland and Marine	Species Distribution	Presence on site
Painted Snipe ○ <i>Rostratula benghalensis</i>	<p>Distribution: South-eastern Australia, including throughout NSW</p> <p>Habitat: Well-vegetated shallows and margins of wetlands, wet pastures, marshlands, lignum and tea-tree scrub.</p>	Unlikely -no suitable habitat
Fork-tailed swift <i>Apus pacificus</i> ○△□	<p>Distribution: Breeds in Siberia to Himalayas. Regular summer migrants to north-east Australia in early October. Most leave mid April.</p> <p>Habitat: Well-vegetated shallows and margins of wetlands, wet pastures, marshlands, lignum and tea-tree scrub.</p>	Unlikely -no suitable habitat
Great Egret ○ <i>Ardea alba</i>	<p>Distribution: Occurs in mainland Australia, Tasmania, Lord Howe Island and Antarctica.</p> <p>Habitat: Forages along shallow rivers, estuaries, tidal mudflats, freshwater wetlands, sewerage ponds, irrigation areas and large dams.</p>	Unlikely -no suitable habitat
Cattle Egret ○△ <i>Ardea ibis</i>	<p>Distribution: Colonised the Northern territory. Occurs in coastal north east and south-eastern Australia to Western Australia, Papua New Guinea and New Zealand.</p> <p>Habitat: Occurs in stock paddocks, pastures, croplands, garbage tips, tidal mudflats and drains.</p>	Likely -during the summer months in pastures areas with cattle.