INO Angas Securities Ltd

Mayfair Road

Ecological Assessment

July 2015

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1. Introduction

1.1 Overview

GHD Pty Ltd (GHD) has been engaged by INO Angas Securities Limited to prepare an Ecological Assessment of five proposed dwellings on residential lots adjoining Mayfair Road (Mayfair Road residential lots) to support an application for two Development Applications (DAs) within the Fernhill Estate at Mulgoa, NSW (see Figure 1). The first DA relates to the construction of a dwelling on Lot 12 DP610186 with the 2nd DA being for the construction of dwellings on Lots 1, 2, 3 and 4 DP260373. The DAs would be submitted to Council for approval under Part 4 of the *Environment Protection and Assessment Act 1979* (EPA Act). This Ecology Assessment comprises a specialist appendix for inclusion in the DAs. It assesses the potential for impacts on ecological values at the site, with particular emphasis on threatened ecological communities, populations and species listed under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and *Fisheries Management Act 1994* (FM Act), and *Matters of National Environmental Significance* (MNES) listed under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). Recommended mitigation measures to ameliorate potential impacts of the proposal are included in Section **6** of this report.

1.2 Proposal description

The proposal is for five dwellings to be constructed 5 Lots accessed from Mayfair Road (Figure 2). The proposal comprises the following land parcels: Part Lot 1, DP260373; Lot 2, DP260373; Lot 3, DP260373; Lot 4, DP260373 and Lot 12, DP610186. The site is located in the Penrith Local Government Area (LGA) and is currently zoned E3 Environmental Management under the LEP. The proposal will involve vegetation removal in areas for the indicative dwelling ands and also vegetation modification for the creation of Asset Protection Zones (APZs) and additional areas associated with its operation and maintenance.

The proposed development will include:

- Construction of five dwelling pads approximately 360m^2 in area comprising a 30 m x 12 m rectangle approximately parallel to the slope and the front lot boundary.
- Associated asset protection zones (APZs).
- A minimum 15 metre setback from Mayfair Road.
- Construction of a residential entrance, stormwater infrastructure and services to the allotments.

Consideration has been given to avoiding impacts on the natural environment through:

- The location of the indicative dwelling pads with the existing cleared land and areas with exotic grassland as far as practicable.

The maintenance and enhancement of ecologically significant communities south of the dwelling locations and APZs, which are conserved under a BioBanking agreement (BA117).The site location and layout is shown in Figure 1.

1.3 Terms and definitions

The following terms are used in this report:

The proposal: the proposed construction of 5 dwellings along Mayfair Road at Mulgoa, NSW that is the subject of the DA.

Development footprint: the area to be directly impacted by the proposal (see Figure 1). In this case, it comprises the indicative dwelling pads, Asset Protection Zone (APZ) and any other ancillary vegetation removal.

Site: the five lots that will be subjected to the construction of the dwellings.

Study area: the site and any additional areas which are likely to be affected by the proposal, either directly or indirectly. .

Locality: the area within a 10 kilometre radius of the site.

Threatened biota: Threatened species, populations and communities that are listed under the TSC Act, FM Act and/or the EPBC Act.

1.4 Scope of assessment

The scope of this ecological assessment is to:

- Describe the existing environment of the study area, including flora species, vegetation communities, fauna habitats and flora and fauna species known or likely to occur.
- Assess the value and conservation significance of native vegetation and habitats in the study area and the likelihood of occurrence of threatened biota based on the habitats present.
- Compile a list of threatened biota previously recorded, or predicted to occur in the locality and an assessment of their potential to occur in the study area and/or be affected by the proposal.
- Assess impacts of the proposal, addressing potential effects on native flora and fauna and particularly threatened biota and their habitats.
- Complete assessments of significance according to s.5A of the EPA Act (the seven part test) for threatened biota known or likely to occur in the study area and/or be affected by the proposal.
- Assess the potential for a significant impact on any Matters of National Environmental Significance (MNES) listed under the EPBC Act, including in particular threatened species or ecological communities and migratory species listed under the Act.
- Recommend mitigation measures to reduce impacts on biodiversity values.
- Provide concluding statements regarding the likely significance of impact of the proposed development on threatened biota and EPBC Act MNES and the requirement or otherwise for further assessment or approvals at the State or Commonwealth level.

1:4,000 (at A3)

0 25 50 100 150 200

Metres

Horizontal Datum: GDA 1994
Grid: GCS GDA 1994

N

LEGEND

- Site
- Lot boundary*
- Fernhill East biobank site boundary
- Roads
- Waterways

* - Lot boundaries have been plotted based on the digital cadastral database from the LPI (2013) and are subject to slight inaccuracy at this scale. The site boundary has been plotted based on Land Partners Limited survey and is accurate.

GHD

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Fernhill
Mayfair Ecological Assessment

Job Number	22-16709
Revision	0
Date	23 Jun 2015

Site location

Figure 1

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

1:2,000 (at A3)

0 10 20 40 60 80 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Site
- Development Footprint
- Fernhill East Biobank Site Boundary
- Indicative Dwelling Footprint
- Full Removal
- Partial Conservation
- Cadastre
- Contour
- Road Corridor

Angas Securities Limited
Fernhill
Mayfair Ecological Assessment

Job Number	22-16709
Revision	0
Date	24 Jun 2015

Development Footprint

Figure 2

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

2. Legislative context

2.1 Commonwealth legislation

2.1.1 Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

The purpose of the EPBC Act is to ensure that actions likely to cause a significant impact on MNES undergo an assessment and approval process. Under the EPBC Act, an action includes a proposal, undertaking, proposal or activity. An action that 'has, will have or is likely to have a significant impact on a matter of national environmental significance' is deemed to be a 'controlled action' and may not be undertaken without prior approval from the Australian Government Minister for the Environment.

The EPBC Act identifies MNES as:

- World heritage properties.
- National heritage places.
- Wetlands of international importance (Ramsar wetlands).
- Threatened species and ecological communities.
- Migratory species.
- Commonwealth marine areas.
- Nuclear actions (including uranium mining).
- A water resource, in relation to coal seam gas development and large coal mining development.

Potential impacts on any MNES must be subject to assessments of significance pursuant to the *Significant Impact Guidelines* (DotE 2013). If a significant impact is considered likely, a referral under the EPBC Act must be submitted to the Commonwealth Environment Minister. These MNES have been included in Section 5A assessments of significance in Appendix C of this report.

2.2 NSW legislation

2.2.1 Environmental Planning and Assessment Act 1979 (EPA Act)

The EPA Act forms the legal and policy platform for proposal assessment and approval in NSW and aims to, inter alia, 'encourage the proper management, proposal and conservation of natural and artificial resources'. All development in NSW is assessed in accordance with the provisions of the EPA Act and EPA Regulation 2000. The proposal, as an activity that requires consent, is to be determined under Part 4 of the Act and Council is the 'consent authority' for the purposes of the Act.

Section 5A of the EPA Act lists seven factors that must be taken into account in the determination of the significance of potential impacts of a proposed activity on threatened species, populations or ecological communities (or their habitats) listed under the TSC Act and the FM Act. The '7-part test' is used to assist in the determination of whether a proposal is 'likely' to impose 'a significant effect' on threatened biota and thus whether a species impact statement (SIS) is required. 7-part tests for threatened biota considered to have the potential to occur in the study area are included in Appendix C.

2.2.2 Threatened Species Conservation Act 1995 (TSC Act)

The TSC Act provides legal status for biota of conservation significance in NSW. The Act aims to, inter alia, 'conserve biological diversity and promote ecologically sustainable proposal'. It contains schedules that list endangered, critically endangered and vulnerable species, populations, ecological communities, and key threatening processes in NSW. Potential impacts on any of these biota must be subject to an impact significance assessment (7-part test) through the provisions of section 5A of the EPA Act. Seven-part tests have been prepared for threatened biota listed under the TSC Act, and are presented in Appendix C.

If a significant impact on threatened biota is likely, a Species Impact Statement (SIS) must be completed and a licence obtained pursuant to Part 6 of the TSC Act.

2.2.3 National Parks and Wildlife Act 1979

The National Parks and Wildlife Act 1974 (NPW Act) provides the basis for the legal protection of native animals and plants in NSW. A wildlife licence is required under the NPW Act to harm or pick protected fauna and flora. All surveys were carried out under a Section 132C scientific licence (SL100146).

2.2.4 Fisheries Management Act 1994 (FM Act)

The FM Act contains schedules that list endangered, critically endangered and vulnerable aquatic species, populations, ecological communities, and key threatening processes of relevance to aquatic environments. As for biota listed under the TSC Act, potential impacts on any of these species must be addressed through 7 part tests in accordance with section 5a of the EPA Act. If a significant impact is likely, an SIS must be completed and a licence obtained pursuant to Part 7a of the FM Act. The proposal does not involve any dredgeing or reclamation that would require specific consideration under the Act.

2.2.5 Noxious Weeds Act 1993 (NW Act)

The NW Act provides for the declaration of noxious weeds by the Minister for Primary Industries. Noxious weeds may be considered noxious on a National, State, Regional or Local scale. All private landowners, occupiers, public authorities and Councils are required to control noxious weeds on their land under Part 3 Division 1 of the NW Act. As such, if present, noxious weeds on the site should be assessed and controlled.

There are six noxious weed species present in the adjacent Fernhill East Biobank which have the potential to occur within the site. Should they occur, these species would require management during construction of the proposal and control once the residential subdivision has been established.

2.3 NSW policies and guidelines

2.3.1 Local Environment Plan

The site falls within the *Penrith City Council Local Environment Plan 2010* (the LEP). The site is currently zoned as E3 Environmental Management under the LEP. The objectives of the E3 zone include: to protect, manage and restore areas with special ecological, scientific, cultural or aesthetic values; and to provide for a limited range of development that does not have an adverse effect on those values.

The proposal is subject to development application under Clause 5.10 Heritage Conservation (10) Conservation incentives of the LEP. This clause allows the consent authority to grant consent to development for any purpose of a building that is a heritage item or of the land on which such a building is erected, or for any purpose on an Aboriginal place of heritage significance, even though development for that purpose would otherwise not be allowed by this Plan, if the consent authority is satisfied that:

(a) the conservation of the heritage item or Aboriginal place of heritage significance is facilitated by the granting of consent, and

(b) the proposed development is in accordance with a heritage management document that has been approved by the consent authority, and

(c) the consent to the proposed development would require that all necessary conservation work identified in the heritage management document is carried out, and

(d) the proposed development would not adversely affect the heritage significance of the heritage item, including its setting, or the heritage significance of the Aboriginal place of heritage significance, and

(e) the proposed development would not have any significant adverse effect on the amenity of the surrounding area.

The general intent of the LEP is to conserve and manage the natural environment of the Penrith LGA. The objectives of the E3 zone, Clause 5.10 and the principals of the LEP have been addressed in this report by the due consideration of the potential for impacts on native biota and the local environment in Section **5**, and through impact mitigation and management recommendations provided in Section 6.

3. Methods

3.1 Desktop assessment

A desktop assessment was undertaken to identify threatened flora and fauna species, populations and ecological communities listed under the TSC Act and FM Act, and MNES listed under the EPBC Act that may be affected by the proposal. Database records pertaining to the study area and locality (i.e. within a 10 km radius of the study area) were reviewed and included:

- NSW Office of Environment and Heritage (OEH) Wildlife Atlas database for records of threatened species listed under the TSC Act (OEH 2015a; data downloaded on 21 May 2015).
- Department of the Environment(DotE) Protected Matters Online Search Tool for MNES listed under the EPBC Act and predicted to occur in the locality (DotE 2015; database queried on 21 May 2015).
- Department of Primary Industries (DPI) Threatened Species Records Viewer (DPI 2015; database queried 21 May 2015) for threatened species listed under the FM Act and recorded within the Sydney Metropolitan catchment.
- NPWS (2002) *Native Vegetation of the Cumberland Plain, Western Sydney* to identify threatened ecological communities previously mapped as occurring within the locality of the site.
- OEH (2013a) *NSW Vegetation Types Database* and DECC (2009) BioBanking operation manual to define vegetation types and condition classes in the study area.
- EcoLogical Australia (2010) *Owston Estate (Fernhill) Ecological Assessment of Proposed Rezoning*. This document was reviewed to provide information on biodiversity values of the entire Fernhill Estate.

The habitat resources present at the site (determined during the site survey) were compared with the known habitat associations/requirements of the threatened and migratory biota highlighted by the desktop review. This was used to determine the likelihood of each threatened ecological community, endangered population and threatened or migratory species occurring within the study area. The results of this assessment are presented in Appendix A and discussed in Section 7.

3.2 Site survey

3.2.1 Survey effort

The site was originally surveyed as part of the BioBanking agreement for the Fernhill Estate East Biobank (GHD 2013a), which occurs adjacent and to the south of the proposal. The site was later excluded from the biobanking agreement to allow for the construction of residential dwellings ascurrently proposed. An understanding of the existing environment of the site and study area has been compiled from the results of the surveys undertaken for the broader East Biobank assessment, a subsequent site survey and through surveys undertaken within the the broader Fernhill Estate. Plot/transects sampled within vegetation zones at the Fernhill East Biobank immediately adjoining the site provide a appropriate and conservative sample of vegetation condition and value of habitats within the site.

Survey effort that has directly contributed to this ecological assessment is summarised in Table 1 and described below.

Table 1 Survey effort

Survey	Date	Survey Technique	Contribution to the current assessment
Mayfair Road residential lots ecology assessment survey (current)	26 February 2015	Detailed vegetation mapping, habitat assessments, mapping of suitable indicative dwelling pad locations	Mapping of vegetation zones, potential habitat resources and conservation significance within the site
Fernhill East Biobank ecosystem survey (GHD 2013a)	28-30 May, 6 - 7 June, 10 July , 25 and 26 November 2013	Fine-scale vegetation survey and vegetation mapping, 31 20 m x 50 m BioBanking plot / transects, random meander searches for threatened plants, habitat assessments, opportunistic fauna observations.	Mapping of vegetation types and condition classes within the site and adjoining areas, vegetation sampling and targeted threatened species surveys within vegetation in the study area
Fernhill Eastern Precinct Supplementary Cumberland Plain Land Snail survey (GHD 2013b)	20 June 2013	Active searches for Cumberland Plain Land Snail, habitat assessments and opportunistic fauna observations.	Targeted Cumberland Plain Land Snail surveys in suitable habitat in the study area
Fernhill Eastern Precinct ecology assessment survey(GHD 2013b)	6 and 7 June 2013	Four 20 m x 50 m biobanking plot / transects, random meander searches for threatened plants, 2 x full nights Anabat recording, 2 x 2 hours of walked spotlighting surveys on separate nights, 2 x call playback on separate nights, 2 x diurnal bird surveys on separate mornings, approx. 4 hours of active searches for Cumberland Plain Land Snail and herpetofauna, habitat assessments, opportunistic fauna	Vegetation sampling, flora and fauna surveys and targeted threatened species surveys in suitable habitat in the study area

Survey	Date	Survey Technique	Contribution to the current assessment
		observations	

Vegetation mapping

Vegetation types in the site were originally mapped as part of the Fernhill East Biobank (GHD 2013a). Initial desktop mapping was ground-truthed in the field via systematic walked transects across the entire site and parts of the study area and by walking the boundary of vegetation communities. Field ecologists mapped more detailed vegetation polygons with a hand-held Trimble GPS unit loaded with aerial photography and draft vegetation mapping within the site.. Adjustments to vegetation types and boundaries were made by hand on aerial photographs of the site and by capturing waypoints at vegetation community boundaries. Vegetation types were defined using the OEH (2013a) Vegetation Types Database.

Vegetation types were further divided into broad condition classes in accordance with the BBAM.

Flora sampling

The site forms a continuous patch of vegetation with the adjacent Fernhill East Biobank and the minimum number of plots required by the DECC (2009) methodology for this patch of vegetation has been previously fulfilled. A random meander technique was used to select the location of indicative dwelling pads in areas of lower ecological value.

Plot and transect surveys within the study area were conducted in accordance with the BBAM as part of the Fernhill East Biobank. The site value was determined by assessing 10 site condition attributes against benchmark values. Benchmarks are quantitative measures of the range of variability in condition in vegetation with relatively little evidence of alteration, disturbance or modification by humans since European settlement (DECC, 2009). Species were identified according to the nomenclature of the Royal Botanic Gardens and Domain Trust (2013). Cover abundance data was also collected for each species within the 20 metre x 20 metre portion of each plot/transect.

A total of 31 plots were sampled within the Fernhill East Biobank site, 13 plots of these were sampled in the same vegetation zones as those recorded in the site and within the same overall patch of vegetation (see GHD 2013a for locations of selected plots).

Fauna observation

Opportunistic and incidental observations of fauna species were recorded during the current survey of the site and during field surveys of the adjacent Fernhill East Biobank. Casual fauna observations were made in suitable areas of habitat throughout the course of the flora survey and while incidentally traversing the study area. This included visual inspection of nests, creeklines, overhangs and woody debris, and opportunistic observation of scats, tracks, burrows or other traces. The locations of any threatened fauna or suspected evidence of threatened fauna identified within the site were captured with a handheld GPS.

Targeted searches for the Cumberland Plain Land Snail were conducted in the Fernhill East Biobank as part of the survey effort undertaken for the Fernhill Eastern Precinct ecology assessment (GHD 2013b).

3.3 Survey limitations

The desktop assessment provided a list of the native flora and fauna and especially threatened biota that could potentially occur in the study area or be affected by the proposal (including seasonal, transient or cryptic species). The habitat assessment conducted for the site allows for

identification of habitat resources for such species. As such, the survey was not designed to detect all species, rather to provide an overall assessment of the ecological values on site in order to predict potential impacts of the proposal, with particular emphasis on endangered ecological communities, threatened species and their habitats.

3.4 Staff qualifications

Field surveys and reporting were undertaken by GHD ecologists. The qualifications and experience of key personnel are presented in Table 2.

Table 2 Staff qualifications

Name	Position / Project Role	Qualifications	Relevant Experience
Ben Harrington	Senior Ecologist / desktop assessment, site surveys, and reporting	BSc, MSc (Physical Geography) BioBanking Assessor Accreditation[1]	10+ years
Mal Weerakoon	Graduate Ecologist / site surveys, desktop assessments	BSc (Biological Sciences), MPhil (Zoology)	2+ years
Jayne Tipping	Principal Ecologist / Technical review	BSc, MEnvLaw	20+ years

1 Refer to OEH (2013b) list of accredited assessors.

4. Existing environment

4.1 Site context

4.1.1 Location and land uses

The site is located within the Fernhill Estate at Mulgoa as shown in Figure 1. The site is bound by:

- Mayfair Road to the north.
- Blue Mountains National Park to the west.
- Fernhill East Biobank and other adjoining private properties to the south and east. The biobank site is approximately two kilometres to the east of the Nepean River and lies on the northern edge of the village of Mulgoa and approximately 10 kilometres south of Penrith town centre.

The site falls within the Hawksbury/Nepean catchment (CMA), and within the Sydney Basin Bioregion.

Historical land uses within the site and also the adjacent East Biobank include grazing, livestock keeping and timber getting. Areas within the site that have been disturbed include those areas adjacent to fence lines and gates.

4.1.2 Climate

The site has a relatively mild climate, typical of western Sydney. Based on data from the Orchard Hills Treatment Works weather station (number 067084), the site has a mean annual rainfall of 803 mm, mean daily maximum temperature of 23.4°C and a mean daily minimum temperature of 11.6°C. The site does experience regular extremes in temperature, with average ranges of a mean daily maximum temperature of 5.3°C to mean daily maximum temperature of 17.2°C in July, through to a mean daily maximum temperature of 15.5°C to mean daily maximum temperature of 28.5°C in December (BOM 2013).

4.1.3 Hydrology

No drainage lines or waterbodies occur on the site. Littlefield Creek flows through the southern portion of the adjoining Fernhill East biobank and the biobank is dissected by other unnamed first and second order drainage lines.

4.1.4 Landscape context

The site is contained within the Cumberland Plain Mitchell Landscape (DECC, 2008a). This landscape is comprises 'low rolling hills and valleys in a rain shadow area between the Blue Mountains and the coast' (DECC 2008). Vegetation is characterised by 'woodlands and open forest of Grey Box (*Eucalyptus moluccana*), Forest Red Gum (*Eucalyptus tereticornis*), Narrow-leaved Ironbark (*Eucalyptus crebra*), Thin-leaved Stringybark (*Eucalyptus eugenioides*), Cabbage Gum (*Eucalyptus amplifolia*) and Broad-leaved Apple (*Angophora subvelutina*). Grassy to shrubby understorey often dominated by Australian Boxthorn (*Bursaria spinosa*), poorly drained valley floors, often salt affected with Swamp Oak (*Casuarina glauca*) and paperbark (*Melaleuca* sp.)' (DECC 2008b).

The geology of the landscape consists of Triassic shales and lithic sandstones, with a small number of volcanic vent intrusions. Tertiary river gravels and sands partially cover much of the landscape, in addition to Quaternary alluvium along the main watercourses. The soils consist of

'pedal uniform red to brown clays on volcanic hills. Red and brown texture-contrast soils on crests grading to yellow harsh texture-contrast soils in valleys' (DECC 2008b).

According to the Soil Landscapes of the Penrith 1:100,000 Map Sheet (Bannerman and Hazelton, (1990)), the majority of the site is part of the erosional soil landscape. The site consists primarily of the Liverpool subgroup of Triassic Wianamatta Shales, which are characterised by shale with some sandstone beds.

4.2 Flora

4.2.1 Flora species

One hundred and thirty-five species of flora from 48 families were recorded within the adjacent Fernhill East Biobank in the same vegetation types as the site, comprising 112 indigenous native and 23 exotic or non-indigenous native species. The Poaceae (grasses, 31 species, 21 native), Fabaceae (forbs and shrubs, 15 species, all native), Asteraceae (flowering herbs and sub-shrubs, 13 species, 8 native) and Myrtaceae (flowering trees and shrubs, 9 species, all native) were the most diverse families recorded. No threatened flora species were recorded. The full list of species recorded is presented in Appendix A. Species recorded are discussed below in relation to the vegetation types occurring within the study area.

4.2.2 Vegetation types

Field surveys confirmed the presence of three NSW vegetation types within the site.

- Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest
- Grey Box - Forest Red Gum grassy woodland on hills
- Forest Red Gum - Grey Box shrubby woodland.

The vegetation types in the site are in moderate/good condition, with the exception of vegetation in the site and directly adjacent to Mayfair Road which is in low condition. Vegetation on the site is continuous within vegetation of the East Biobank but the site is in generally lower condition (vegetation within the biobank is all in moderate/good condition). Accordingly, flora species diversity is likely to be lower in the site than that recorded in the same vegetation types within the Fernhill East Biobank.

The distribution of vegetation in the site is closely tied to soil type, underlying geology and geomorphic position. Lower slopes support Grey Box - Forest Red Gum grassy woodland on hills which integrades into Forest Red Gum - Grey Box shrubby woodland which is distinguished from adjoining grassy woodlands on shale by the presence of a shrub layer and mesic understorey species in the site. At higher elevations, Narrow-leaved Ironbark- Broad-leaved Ironbark- Grey Gum Open Forest is present. Adjacent vegetation within the study area and within the wider East Biobank includes Narrow-leaved Ironbark- Broad-leaved Ironbark- Grey Gum Open Forest and Forest Red Gum - Grey Box shrubby woodland.

There are moderate to severe infestations of noxious weeds, such as Lantana (*Lantana camara*) and Blackberry (*Rubus fruticosus* spp. agg.). These weeds are most prevalent around the edges of woodland patches, on sheltered slopes.

Canopy vegetation of the site is likely to have been at least partially cleared or thinned historically, in particular for access to the powerline easement located through its central portion. Canopy vegetation has since re-established parts of the site. Where canopy vegetation is absent, a moderate infestation with exotic grasses and herbaceous environmental weeds is present.

All three of the vegetation types within the site comprise local occurrences of threatened ecological communities (TECs) listed under the EPBC Act and/or TSC Act (see Table 3 and Section 4.4.1).

Table 3 Vegetation types within the site

Vegetation type (OEH 2013a)	Condition	Area within Site (ha)	Conservation Significance
Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest	Moderate/good_high	1.21	CEEC listed under TSC Act and EPBC Act (Shale Sandstone Transition Forest)
Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest	Moderate/good_poor[1]	0.34	EEC listed under the TSC Act Act (Shale Sandstone Transition Forest)
Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest	Low[1]	0.30	EEC listed under the TSC Act Act (Shale Sandstone Transition Forest)
Grey Box - Forest Red Gum grassy woodland on hills	Moderate/good_high	1.48	CEEC listed under the TSC Act and EPBC Act (Cumberland Plain Woodland)
Grey Box - Forest Red Gum grassy woodland on hills	Moderate/good_poor[2]	0.19	CEEC listed under the TSC Act (Cumberland Plain Woodland)
Forest Red Gum - Grey Box shrubby woodland	Moderate/good_high	1.54	EEC listed under the TSC Act (Moist Shale Woodland in the Sydney Basin Bioregion) and CEEC listed under the EPBC Act (Western Sydney Dry Rainforest and Moist Woodland on Shale)
Forest Red Gum - Grey Box shrubby woodland	Moderate/good_poor[3]	0.62	EEC listed under the TSC Act (Moist Shale Woodland in the Sydney Basin Bioregion)
Forest Red Gum - Grey Box shrubby woodland	Low[3]	0.85	EEC listed under the TSC Act (Moist Shale Woodland in the Sydney Basin Bioregion)
	Total area	**6.53**	

Notes: [1]Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest in Moderate/good - poor or Low condition does not qualify as the EPBC Act listed form of Shale-sandstone Transition Forest because derived grasslands or shrublands are not recognised as part of the nationally protected ecological community (TSSC, 2014).

[2]Grey Box - Forest Red Gum grassy woodland on hills in Moderate/good - poor condition does not qualify as the EPBC Act listed form of Cumberland Plain Woodland because native tree species are not present with a minimum projected foliage cover of greater than 10% (DEWHA, 2010).

[3]Forest Red Gum - Grey Box shrubby woodland vegetation in Moderate/good - poor or Low condition does not qualify as the EPBC Act listed form of Western Sydney Dry Rainforest and Moist Woodland on Shale because a tree canopy layer is not present (TSSC, 2013).

The structure, species composition and condition of each of the three vegetation types within the site are described below. Species lists are provided in Appendix B and include biota recorded in the adjacent Fernhill East Biobank.

Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest

This vegetation type is in moderate/good and low condition in the site and study area. This vegetation type is consistent with the critically endangered ecological community of Shale Sandstone Transition Forest in the Sydney Basin bioregion under the TSC and EPBC Acts.

Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest occurs on mid and upper slopes in the western portion of the site. It has an open forest structure with a canopy up to 25 metres in height, dominated by Narrow-leaved Ironbark (*Eucalyptus crebra*), Broad-leaved Ironbark (*E. fibrosa*), Grey Gum (*E. punctata*), Thin-leaved Stringybark and Forest Red Gum. Regeneration of some canopy species was observed. The mid-storey is moderately dense and contains Box-leaved Wattle (*Acacia buxifolia*), Thin-leaved Geebung (*Persoonia linearis*), Black Thorn (Bursaria spinosa), Black Wattle (*Acacia decurrens*) and scattered patches of Lantana. Shrub species include Large-leaf Hop-bush (*Dodonaea triquetra*), Shrubby Platysace (*Platysace lanceolata*) and Hairy Clerodendrum (*Clerodendrum tomentosum*). Native grasses include Purple Wiregrass (*Aristida ramosa*), Bushy Hedgehog-grass (*Echinopogon caespitosus*), Weeping Meadow Grass (*Microlaena stipoides var. stipoides*) and Bordered Panic (*Entolasia marginata*). Characteristic herb and forbs include Burr-daisy (*Calotis dentex*), *Lomandra obliqua*, *Glycine clandestina*, and Indian Pennywort (*Centella asiatica*).

Exotic species are present within the community, especially in open grassland adjacent to Mayfair Road, where Rhodes Grass (*Chloris gayana*) and Paspalum (*Paspalum dilatatum*) are dominant. Other introduced species include Lantana, Rhodes Grass, Cobbler's Pegs (*Bidens pilosa*) and Small-leaved Privet (*Ligustrum sinense*).

Grey Box - Forest Red Gum grassy woodland on hills

This vegetation type is in moderate/good and low condition in the site and study area. Grey Box - Forest Red Gum grassy woodland on hills is consistent with the crtitically endangered ecological community of Cumberland Plain Woodland listed under the NSW TSC Act and Commonwealth EPBC Act. '

Grey Box - Forest Red Gum grassy woodland on hills occurs on the lower slopes of the site. It features an open canopy up to 20 metres in height, dominated by Forest Red Gum, Narrow-leaved Ironbark, Grey Box and Thin-leaved Stringybark. The mid-storey contains Hickory Wattle (*Acacia implexa*), Black Thorn, Black Wattle, very sparse Kurrajong (*Brachychiton populneus*) and occasional patches of Lantana. Groundcover species include Kangaroo Grass, Weeping Meadow Grass, Bordered Panic, Kidney Weed (*Dichondra repens*), Australian Basket Grass, Native wandering Jew (*Commelina cyanea*), *Lomandra gracilis*, *Glycine clandestina,* Small-leaf Glycine (*G. microphylla*) and Indian Pennywort.

Introduced species are common in this vegetation type and include exotic pasture grasses as well as noxious and environmental weeds such as Lantana, Paddys Lucerne (*Sida rhombifolia*), Rhodes Grass, Fireweed (*Senecio madagascariensis*), Paspalum (*Paspalum dilatum*), Catsear (*Hypochaeris radicata*) and Lamb's Tongues (*Plantago lanceolata*).

All canopy species recorded in this vegetation type were regenerating.

Forest Red Gum - Grey Box shrubby woodland

This vegetation type is in moderate/good and low condition in the site and study area. Forest Red Gum - Grey Box shrubby woodland is consistent with the endangered ecological community of Moist Shale Woodland in the Sydney Basin bioregion listed under the TSC Act and critically endangered under the EPBC Act.'

Forest Red Gum - Grey Box shrubby woodland has a closed canopy approximately 20 metres in height dominated by Forest Red Gum, Narrow-leaved Ironbark, Grey Box and Rough-barked Apple. There is a dense mid-storey of Hickory Wattle, Black Thorn, Black Wattle and occasional Kurrajong, Lantana and African Olive (*Olea europaea* subsp. *cuspidata*). There is also a characteristic mesic tall shrub layer including Hairy Clerodendrum and Rough-fruited Pittosporum (*Pittosporum revolutum*) and frequently recorded climbers such as *Passiflora herbertiana*, Old Man's Beard (*Clematis aristata*) and Scrambling Lily (*Geitonoplesium cymosum*). The understorey is a patchy, variable mix of shrubs, grasses, herbs and ferns including White Dogwood (*Cyclothamnus diosmifolius*), Wiry Panic (*Entolasia stricta*), Weeping Meadow Grass, *Senecio diaschides*, *Vernonia cinerea*, *Cyperus sanguinolentus, Plectranthus parviflorus* and Maidenhair Fern (*Adiantum aethiopicum).*

Exotic species are present within the community, especially in open grassland adjacent to Mayfair Road, where Rhodes Grass (*Chloris gayana*) and Paspalum (*Paspalum dilatatum*) are dominant. Open grassland adjacent to Mayfair Road is representative of the low and poor condition form of this vegetation type. Severe Lantana infestations were observed on the integrade of grassland and woodland. Other environmental weeds present include Rhodes Grass, Cobblers Pegs, Wild Tobacco Bush (*Solanum mauritianum*) and Moth Vine (*Araujia sericifera*).

281,500

MAYFAIR ROAD

Lot 4
DP260373

Lot 3
DP260373

Lot 2
DP260373

Lot 1
DP260373

Lot 12
DP610186

Lot 2
DP211795

Lot 11
DP615085

6,255,500

281,500

Vegetation Zones

- Forest Red Gum - Grey Box shrubby woodland (Moderate /good)
- Forest Red Gum - Grey Box shrubby woodland (Moderate /good - poor)
- Forest Red Gum - Grey Box shrubby woodland (Low)
- Grey Box - Forest Red Gum grassy woodland on hills (Moderate /good)
- Grey Box - Forest Red Gum grassy woodland on hills (Moderate /good - poor)
- Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest (Moderate /good)
- Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest (Moderate /good - poor)
- Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest (Low)

1:2,000 (at A3)

0 10 20 40 60 80 100

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Site
- Fernhill East Biobank Site Boundary
- Road Corridor
- Full Removal
- Partial Conservation
- Cadastre

Angas Securities Limited
Fernhill
Mayfair Ecological Assessment

Job Number	22-16709
Revision	0
Date	25 Jun 2015

Vegetation Zones

Figure 3

N:\AU\Sydney\Projects\22\16709\GIS\Maps\Mayfair\22_16709_Z001_Mayfair_Vegetation_Assessment.mxd

Data Source: Geoscience Australia: 250k Data - Jan 2011;ESRI World Imagery: Aerial Imagery, Accessed: 2015; GHD: Vegetation, 03-3-2015. Created by: cjchung

Level 15, 133 Castlereagh Street Sydney NSW 2000 **T** 61 2 9239 7100 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

4.2.3 Noxious and environmental weeds

The *Noxious Weeds Act 1993* provides for the declaration of noxious weeds in local government areas. Landowners and occupiers must control noxious weeds according to the control category specified in the Act. Public authorities must control noxious weeds according to the control category to the extent necessary to prevent their spread to adjoining land.

The sitecontains at least six species declared as noxious weeds in the Penrith LGA and recorded in the adjacent Fernhill East Biobank (Table 4). These noxious species occur in low densities in woodland and forest throughout the site. Notably there is moderate to severe Lantana infestation throughout the Forest Red Gum - Grey Box shrubby woodland vegetation in Lot 1 and Lot 2 DP 260373 of the site.

The distribution of noxious and environmental weeds in the study area is closely tied to disturbance, with the concentration of weeds greater where the site adjoins cleared areas dominated by exotic plant species adjacent to Mayfair Road.

Table 4 Declared noxious weeds recorded during the field survey

Scientific Name	Common Name	Control category	Legal Requirements
Asparagus asparagoides	Bridal creeper	4	The plant must not be sold propagated or knowingly distributed
*Lantana camara**	Lantana	4	The growth of the plant must be managed in a manner that reduces its numbers, spread and incidence and continuously inhibits its reproduction
*Ligustrum lucidum**	Privet (Broad-leaf)	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its flowering and reproduction
*Ligustrum sinense**	Privet (Narrow-leaf/Chinese)	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its flowering and reproduction
Olea europea subspecies *cuspidata*	African Olive	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction and the plant must not be sold propagated or knowingly distributed
Rubus fruticosus aggregate species	Blackberry	4	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its reproduction and the plant must not be sold propagated or knowingly distributed

4.3 Fauna

4.3.1 Fauna species

A total of 86 species of native fauna were recorded in the study area including the Fernhill East Biobank. The site contains habitat for 72 of these species including 59 bird species, 5 mammal species, two reptile species, one frog species and one snail (see Appendix B).

A further four exotic fauna species were recorded (one bird and three mammals).

The fauna species that were recorded, habitat associations and additional species of fauna that may occur based on the habitats present are described below.

Birds

The majority of bird species recorded in the study area are common woodland birds. Wetland bird species were also recorded, but they would not utilise habitats in the site due to the absence of wetland habitat. Bird species recorded within the site and in the wider study area is representative of the diversity of bird species in the Fernhil Estate and locality (GHD 2013a, GHD 2013b, GHD 2014). Grassland adjoining Mayfair Road and in the site has lower habitat value for most native bird species than vegetation in the study area because they contain fewer habitat resources e.g. canopy cover, midstorey, shrub layer, woody debris and an absence of hollow-bearing trees.

Bird species likely to utilise the site included:

- Large, generalist bird species common in urban areas, including the Sulphur-crested Cockatoo (*Cacatua galerita*), Australian Magpie (*Cracticus tibicen*), Australian Raven (*Corvus coronoides*) and Rainbow Lorikeet (*Trichoglossus haematodus*).
- Birds of open woodlands, including Thornbills (*Acanthiza* spp.), Fairy-wrens (*Malurus* spp.) the Restless Flycatcher (*Myiagra inquieta*), Red-rumped Parrot (*Psephotus haematonotus*) and Jacky Winter (*Microeca fascinans*).
- Birds of denser forests such as the Red-browed Finch (*Neochmia temporalisi)*, Rose Robin (*Petroica rosea*), Golden Whistler (*Pachycephala pectoralis*) and Eastern Yellow Robin (*Eopsaltria australis*).
- Birds of wet grassland such as the Cattle Egret (*Ardea ibis*).
- The exotic Eurasian Blackbird (*Turdus merula*).

The full list of species observed is included in Appendix B.

A group of seven Varied Sitellas' (*Daphoenositta chrysoptera*) were observed foraging in Grey Box – Forest Red Gum grassy woodland south of the site in the study area (Figure 4).

Mammals

The Eastern Horseshoe-bat (*Rhinolophus megaphyllus*) and an undescribed Freetail Bat (*Mormopterus "Species 2"*) have been recorded in the study area of the Fernhill East Biobank. It is likely that these species and a mixture of other microbat species would sporadically utilise the site including forest bats (*Vespadelus* species), wattled bats (*Chalinolobus* species) and the White-striped Freetail-bat (*Tadarida australis*). The study area may also contain hollow-roosting threatened microbats such as the Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*), and Eastern Freetail-bat (*Mormopterus norfolkensis*) or the Large-eared Pied Bat (*Chalinolobus dwyeri*), which would likely roost in sandstone escarpment country to the west but may occasionally forage in the study area.

Eastern Grey Kangaroos (*Macropus giganteus* have been observed foraging in exotic grassland adjacent to the site. This species would also forage in native woodland and forest and would favour these habitats for shelter. The presence of unidentified macropod scats in the site likely to indicate the presence of wallabies (*Wallabia* spp.) in addition to Eastern Grey Kangaroos.

Common Brushtail Possums (*Trichosurus vulpecula*) were observed foraging in the study area and it is likely that other common arboreal mammal species such as Common Ringtail Possums (*Pseudocheirus peregrinus*) would also occur within the site.

European Cattle (*Bos taurus*) and the feral Rusa Deer (*Cervus timorensis*) were recorded in the study area. There are domestic and feral populations of a variety of other mammal species on the locality that would also occur in the site on occasion.

Frogs and reptiles

No frogs were observed within the site, however a wide variety of common species have been recorded in the study area including the Common Eastern Froglet (*Crinia signifera*), Brown-striped Frog (*Limnodynastes peronii*) and Verreaux's Tree Frog (subsp) (*Litoria verreauxii verreauxii*). The study area would also contain habitat for stream breeding frogs including the Leaf-green Tree Frog (*Litoria phyllochroa*), Lesueur's Frog (*Litoria lesueurii*) and potentially Littlejohn's Tree Frog (*Litoria Littlejohnii*). The absence of dam, drainage lines and depressions within the site is likely to reduce the diversity of frogs utilising the site, however frogs and reptiles associated with forest and woodland are still likely to occur.No reptiles were observed within the site; however common species such as *Lampropholis* species, the Common Blue-tongue Lizard (*Tiliqua scincoides*) and common snake species are likely to occur.

Cumberland Plain Land Snail

The Cumberland Plain Land Snail was not recorded in the site, although survey effort was limited. This species has been recorded nearby in the Fernhill East Biobank in the study area and sheltering beneath woody debris, sheet metal or leaf litter in Grey Box – Forest Red Gum woodland on flats (i.e. Cumberland Plain Woodland). The Cumberland Plain Land Snail is closely associated with this ecological community and is generally considered to be restricted to the Cumberland Plain and Castlereagh Woodlands of Western Sydney and also along the fringes of River Flat Forest, especially where it meets Cumberland Plain Woodland (NPWS 2000).

4.3.2 Fauna habitats

Two broad fauna habitat types were recorded within the study area:

- Exotic grassland and exotic vegetation.
- Native woodland and forest.

The suitability of these habitats for native fauna are discussed below, with particular emphasis on habitat resources of relevance to threatened fauna.

Grassland and exotic vegetation

Up to 1.89 hectares of the site contains grassland and exotic shrubs. These areas would have historically supported native woodland vegetation but have been extensively modified by previous clearing, agriculture and for access to the powerline easement located in the central portion of the site.

Grassland and exotic vegetation are subject to noise levels and light spill and contain only a few habitat resources of relevance to most native fauna species. Exotic grasses and herbs would

provide foraging resources for relatively mobile and opportunistic native fauna including birds such as the Australian Magpie and Galah, and mammals such as the Eastern Grey Kangaroo.

Regrowth trees and shrubs would provide some foraging resources for native woodland birds such as Thornbills and Red-browed Finches which were observed in these areas during the survey. Some native reptile and frog species would also forage, shelter or bask in areas of exotic grassland particularly where they adjoin woodland. Most of these species would use these areas as an adjunct to the higher quality, more extensive areas of suitable habitat available in the study area.It is unlikely that any local populations of native fauna would be reliant on the exotic grassland on the site for their survival.

These areas contain little to no habitat features of relevance to threatened fauna. The Cumberland Plain Land Snail and several species of threatened birds and microbats would be considered likely to occur in adjacent habitats within native woodland or shrubland (see below) but would be unlikely to occur within areas of grassland or exotic vegetation. The Cumberland Plain Land Snail can occur in disturbed environments provided that ground cover of woody debris or rubbish is available (NPWS 2000). Grassland in the site does not contain suitable shelter sites and is unlikely to be occupied by the species.

Native woodland and forest

Native woodland and forest in the site occurs on the edge of grassland and integrades between low to good quality habitat. Habitat resources include a few mature canopy trees and associated nectar, fruits and leaves as well as patches of dense understorey shrubs; a range of fruiting and flowering small trees and shrubs. The site contains relatively few pre-European age trees and no hollow bearing trees. Native woodland and forest in the south portion of the site form good connectivity with extensive patches of vegetation in the study area which includes the Fernhill East Biobank. Vegetation within the site forms edge habitat for these larger tracts of native vegetation in the study area. There is some noise and light disturbance, associated with vehicular traffic on Mayfair Road. Based on these attributes this vegetation would be expected to support a low to moderate suite of native fauna.

Eucalypts in the study area predominantly occur in the south of the site, where intact native vegetation is present. They represent known or preferred feed trees for a number of fauna species, including threatened birds, the Koala and the Grey-headed Flying-fox. The canopy species Grey Box and Forest Red Gum are nectar and seed-bearing and would provide a food resource for native fauna, including the Grey-headed Flying Fox and arboreal mammals. *Eucalyptus* species may also provide seasonal nectar resources for migratory species, including the Regent Honeyeater (*Anthochaera phrygia*). Eucalypt species in the site are summer and autumn-flowering (Brooker and Koenig, 2006) and so would not provide winter foraging resources for the Swift Parrot (*Lathamus discolor*). Winter-flowering acacias at the site would help provide year-round foraging resources for a range of native birds, bats and mammals. Forest Red Gum is a Koala food tree listed under Schedule 2 of SEPP 44 and is a regional primary food trees identified in the Koala Recovery Plan.

Native woodland and forest does not provide foraging substrate, abundant woody debris or leaf litter due to past clearing disturbances in the past. The absence of woody debris and thick leaf litter would provide limited shelter and foraging substrate for native reptiles, frogs and invertebrates including the Cumberland Plain Land Snail within the site.

Other habitat resources

The site is composed of shale-derived colluvium and alluvial sediments on mid slopes. There are no caves, cliffs, rock outcrops or surface rock fragments in the site or the broader study area. The study area would not support fauna that rely on rocky substrate for shelter. There are a number of threatened reptile and frog species known or predicted to occur in the locality

(OEH, 2015a; DotE, 2015), including the Broad-headed Snake (*Hoplocephalus bungaroides*), Giant Burrowing Frog (*Heleioporus australiacus),* and Littlejohns Treefrog (*Litoria littlejohni*). Records of these species within the locality are from Hawkesbury Sandstone substrates at higher elevations. These species depend on specific habitat resources from these environments (OEH, 2015b; Ehman, 1997) and would not occur in the site.

There are significant cave and cliff formations in the locality in the Blue Mountains National Park, approximately six kilometres to the west of the site. Cave-roosting microbats such as the Eastern Bentwing-bat (*Miniopterus schreibersii oceanensisi)* and Large-eared Pied Bat (*Chalinolobus dwyeri*) may roost and breed in these areas but would only use potential aerial foraging habitat in the study area.

Patch size and connectivity

The site occurs as edge habitat separated from agricultutal habitat in the north by Mayfair Road. Where grassland within the site meets Mayfair Road, this habitat has little value for many species of native fauna and the majority of threatened fauna. The site is affected by limited noise and light spill from Mayfair Road but there would be a moderate risk of predation by feral and domestic predators and vehicle collisions. This context reduces the value of the habitat within the site in comparison with equivalent habitat in more extensive patches of native vegetation, that are remote from cleared or developed land.

The site adjoins Fernhill East Biobank to the south which forms a large patch of intact vegetation eventually joining Blue Mountains National Park (see Figure 1). Fauna movement and other ecological processes would occur around the site via the vegetated woodland and forest of the adjacent East Biobank. Patch-size dependant species of fauna such as threatened woodland birds and the Spotted-tailed Quoll could use these vegetated areas to access habitat within the study area, but would be more likely to frequent less fragmented areas of habitat, in better condition, that are located farther to the west.

4.4 Conservation significance

Based on the desktop assessment the following threatened biota and MNES are known or predicted to occur in the locality:

- 28 threatened ecological communities (TECs).
- 25 threatened flora species.
- 50 threatened fauna species, comprising six frogs, 24 birds, two fish, three invertebrates, 14 mammals and one reptile
- One endangered population.
- 15 migratory species.
- One National and World Heritage Place.
- One Ramsar wetland.

This list does not include marine threatened and migratory species or shorebirds which were highlighted by the database searches because the locality does not contain any marine or estuarine habitats.

The status of these threatened biota and MNES within the site and study area is described below.

4.4.1 Threatened biota (TSC Act and FM Act)

The database searches identified 23 threatened flora species, 48 threatened fauna species and 28 TECs listed under the TSC Act as having been previously recorded or predicted to occur in the locality (see Appendix C).

One fish and three invertebrates listed under the FM Act have been previously recorded or are predicted to occur in the locality (see Appendix C).

Threatened ecological communities

All native vegetation types at the site are consistent with TECs listed under the TSC Act:

- Forest Red Gum - Grey Box shrubby woodland - consistent with Moist Shale Woodland in the Sydney Basin Bioregion endangered ecological community.
- Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest -consistent with Shale Sandstone Transition Forest in the Sydney Basin Bioregion critically endangered ecological community.
- Grey Box - Forest Red Gum grassy woodland - consistent with Cumberland Plain Woodland in the Sydney Basin Bioregion critically endangered ecological community.

The distribution of these TECs in the site is shown in Figure 3 and 4.

Two other threatened ecological communities; River Flat Eucalypt Forest and Western Sydney Dry Rainforest are also present in the study area (Figure 4). They are not discussed further as they do not occur on the site or will be affected by the proposal.

Threatened flora species

No threatened flora species were recorded during the field surveys.

Of the 11 threatened flora species previously recorded in the locality, seven can be discounted as having nil chance of occurring in the study area or being affected by the proposal. These species are associated with specific habitat types that are not present in the study area. Notably there are a number of plant species associated with tertiary gravel habitats of the Castlereagh forests, or sandstone habitats of higher elevations which are present within the locality but can be reliably excluded from occurring in the habitats within the study area.

There is broadly suitable habitat for four threatened plant species within the site and they are known from the locality:

- Camden White Gum (*Eucalyptus benthamii*) (vulnerable, TSC Act and EPBC Act).
- *Marsdenia viridiflora viridiflora* population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas (*Marsdenia viridiflora* subsp. *viridiflora*) (endangered population, TSC Act).
- Juniper-leaved Grevillea (*Grevillea juniperina juniperina*) (vulnerable, TSC Act and EPBC Act).
- Spiked Rice-flower (*Pimelea spicata*) (endangered, TSC Act and EPBC Act).

Camden White Gum, *Marsdenia viridiflora viridiflora* and Juniper-leaved Grevillea can be reliably discounted as occurring based on the field survey effort. EcoLogical (2010) recorded the Juniper-leaved Grevillea in the Fernhill Western Precinct around three kilometres to the west of the site. These three species are a tree, a climber and shrub respectively. They are not cryptic nor do they require seasonal surveys. It is unlikely that they would not have been detected if they were present in the site for this assessment.

The Spiked Rice-flower is known to be difficult to detect when not flowering and may persist in grazed native vegetation (OEH, 2015b). This species flowers sporadically and targeted surveys are generally timed to coincide with flowering of a known reference population. This survey approach was not part of the current assessment and so a precautionary approach has been undertaken and the study area is assumed to comprise habitat for a local population of the Spiked Rice-flower.

4.4.2 Threatened fauna species

Three threatened fauna species have been recorded within or adjacent to the study area during recent field surveys:

- Varied Sittella (*Daphoenositta chrysoptera*) - vulnerable under the TSC Act.
- Glossy Black-cockatoo (*Calyptorhynchus lathami*) - vulnerable under the TSC Act.
- Cumberland Plain Land Snail (*Meridolum corneovirens*) - endangered under the TSC Act.

The Varied Sittella and Cumberland Plain Land Snail were recorded within Grey Box - Forest Red Gum grassy woodland and Forest Red Gum - Rough-barked Apple grassy woodland in the Fernhill Eastern Precinct located south east of the site in the locality. The Glossy Black-cockatoo was recorded flying over the Eastern Precinct in the locality.

The Varied Sittella would forage and probably also breed locally in native grassy woodland and forest vegetation types in the study area, the Fernhill Estate and throughout the locality. There are a total of 18 records of the Varied Sitella within the locality (OEH 2015a) and it has previously been recorded within study area (Birdata 2013).

Up to 45 live Cumberland Plain Land Snail individuals or shells have been recorded in the Fernhill Estate to date. These areas contain good quantities of habitat resources such as woody debris and leaf litter. The local population of the Cumberland Plain Land Snail occurs in relatively extensive patches of Cumberland Plain Woodland in the locality, including elsewhere in the Fernhill Estate (B Harrington *pers. obs.*; EcoLogical, 2010), in the vicinity of numerous BioNet records to the east of Mulgoa Road (OEH, 2015a) and in Mulgoa Nature Reserve (DECC, 2008b). There are 72 previous records of the species in the locality (OEH, 2015a) and around 2100 hectares of suitable habitat in shale woodlands or forest based on regional vegetation mapping (Tozer 2010). There is relatively poor habitat for the Cumberland Plain Land Snail in the site because the woodland contains little native understorey vegetation or shelter sites.

There are a number of records of threatened fauna from Mulgoa Nature Reserve (OEH 2015a) kilometres to the north east of the site and the Blue Mountains National Park six kilometres to the west, including large forest owls, microchiropteran bats and woodland birds (OEH, 2015a). Mulgoa Nature Reserve contains similar vegetation types and habitat resources to the study area and has been subject to relatively intensive survey and assessment (DECC, 2008b): "seven animal species listed as vulnerable under the TSC Act have been recorded in the reserve: the Masked Owl (*Tyto novaehollandiae*), Barking Owl (*Ninox connivens*), Grey-headed Flying-fox (*Pteropus poliocephalus*), Eastern Freetail bat (*Mormopterus norfolkensis*), Large-eared Pied Bat (*Chalinolobus dwyeri*), Eastern Bentwing Bat (*Miniopterus australis*) and Large-footed Myotis (*Myotis adversus*). Other threatened species occurring in the local area, and that may from time to time occur in the reserve, are the Spotted-tailed Quoll (*Dasyurus maculatus*), Turquoise Parrot (*Neophema pulchella*), Glossy Black Cockatoo (*Calyptorhynchus lathami*), Powerful Owl (*Ninox strenua*), Square Tailed Kite (*Lophoictinia isura*), Swamp Harrier (*Circus approximans*)"[sic – not a threatened species] "Red-crowned Toadlet (*Pseudophryne australis*) and Greater Broad-nosed Bat (*Scoteanax rueppellii*)."

The site contains limited habitat for these mobile threatened fauna species given the extent of grassland and edge habitat. There are no on-site records or specific habitat resources that suggest that permanent local populations of any of these threatened fauna are present in the study area. Individual threatened fauna may utilise habitat in the broader study area on a transitory or opportunistic basis. Given the small extent of the site, none of these mobile threatened fauna are likely to occur in the site.

The remainder of the threatened fauna species that are known or predicted to occur in the locality have a close association with specific habitat resources that are not present in the study area. Notably there are a number of fauna species that are associated with shrubby, sclerophyll vegetation types on sandstone substrates or rocky escarpments that would not occur in the grassy woodlands on flat, shale landscapes that characterise the study area.

The desktop review revealed two threatened fish species (Macquarie Perch *Macquaria australasica* and Australian Grayling *Prototroctes maraena*) and two aquatic invertebrates Adam's Emerald Dragonfly (*Archaeophya adamsi* and Sydney Hawk Dragonfly *Austrocorduia leonardi)* which are predicted to occur in the locality. Each of these species is associated with clear, deep streams with rocky or gravel substrates, whereas the aquatic habitats in the study area are shallow and turbid with clay substrate. No aquatic habitats occur in the site (Appendix A).

4.4.3 EPBC Act MNES

The database searches identified 17 threatened ecological communities, 23 threatened flora species, 21 threatened fauna species and one migratory species listed under the EPBC Act as potentially occurring in the study area (see Appendix A). One additional MNES, The Greater Blue Mountains Areaoccurs in the locality.

Threatened ecological communities

All native vegetation communities within the site are listed as CEECs under the Commonwealth EPBC Act legislation and include Western Sydney Dry Rainforest and Moist Woodland on Shale, Cumberland Plain Shale Woodlands and Shale/Sandstone Transition Forest. However, the listing of these CEECs is subject to thresholds on the condition of the vegetation under the EPBC Act.

Grey Box - Forest Red Gum grassy woodland occurs in the eastern edge site as near intact moderate/good condition vegetation and as moderate/good_poor condition woodland vegetation dominated by grasses. While both condition classes on site comprise the Cumberland Plain Woodland CEEC listed under the TSC Act, the moderate/good_poor condition woodland does not meet the condition thresholds for inclusion as the EPBC Act-listed CEEC.

Narrow-leaved Ironbark –Broad-leaved Ironbark – Grey Gum open forest occurs in the in the western edge of the site as intact moderate/good condition vegetation, as moderate/good _poor condition woodland vegetation dominated by grasses with a variable native midstorey and as low condition dominated by grasses. All condition classes comprise the Shale/Sandstone Transition Forest CEEC listed under the TSC Act, but the moderate/good _poor and low condition does not meet the condition thresholds for inclusion as the EPBC Act-listed CEEC.

Forest Red Gum- Grey Box shrubby woodland occurs in the central portion of the site as intact moderate/good condition vegetation on the lower slopes. Moderate/good_poor and low condition vegetation of this TEC does not meet the condition thresholds for inclusion as the EPBC Act-listed CEEC.

Threatened flora

No threatened flora species listed under the EPBC Act were recorded within the study area. Based on the site surveys and habitat assessments conducted one threatened flora species may occur in the study area and/or be affected by the proposal: the Spiked Rice-flower (see Section 7.3.1).

Threatened fauna

No threatened fauna species listed under the EPBC Act were recorded within the study area. Based on the site surveys and habitat assessments, one fauna species may occur in the study area and/or be affected by the proposal. This species is also listed under the TSC Act and is discussed in Section 4.4.2 above.

Migratory and marine fauna

Three marine bird species, four wetland birds (two of which are also listed as marine species) and seven 'terrestrial' bird species were identified by the EPBC Online Protected Matters Search Tool results (DotE 2015), comprising:

- Wetland species:
  - Great Egret (*Ardea alba*; also listed as marine)
  - Cattle Egret (*Ardea ibis*; also listed as marine)
  - Latham's Snipe (*Gallinago hardwickii*)
  - Painted Snipe (*Rostratula benghalensis*), also listed as endangered
- 'Terrestrial' species
  - White-bellied Sea-eagle (*Haliaeetus leucogaster*)
  - White-throated Needletail (*Hirundapus caudacutus*)
  - Rainbow Bee-eater (*Merops ornatus*)
  - Black-faced Monarch (*Monarcha melanopsis*)
  - Satin Flycatcher (*Myiagra cyanoleuca*)
  - Rufous Fantail (*Rhipidura rufifrons*)
  - Regent Honeyeater (*Xanthomyza phrygia*), also listed as endangered
- 'Marine' species
  - Fork-tailed Swift (*Apus pacificus*).

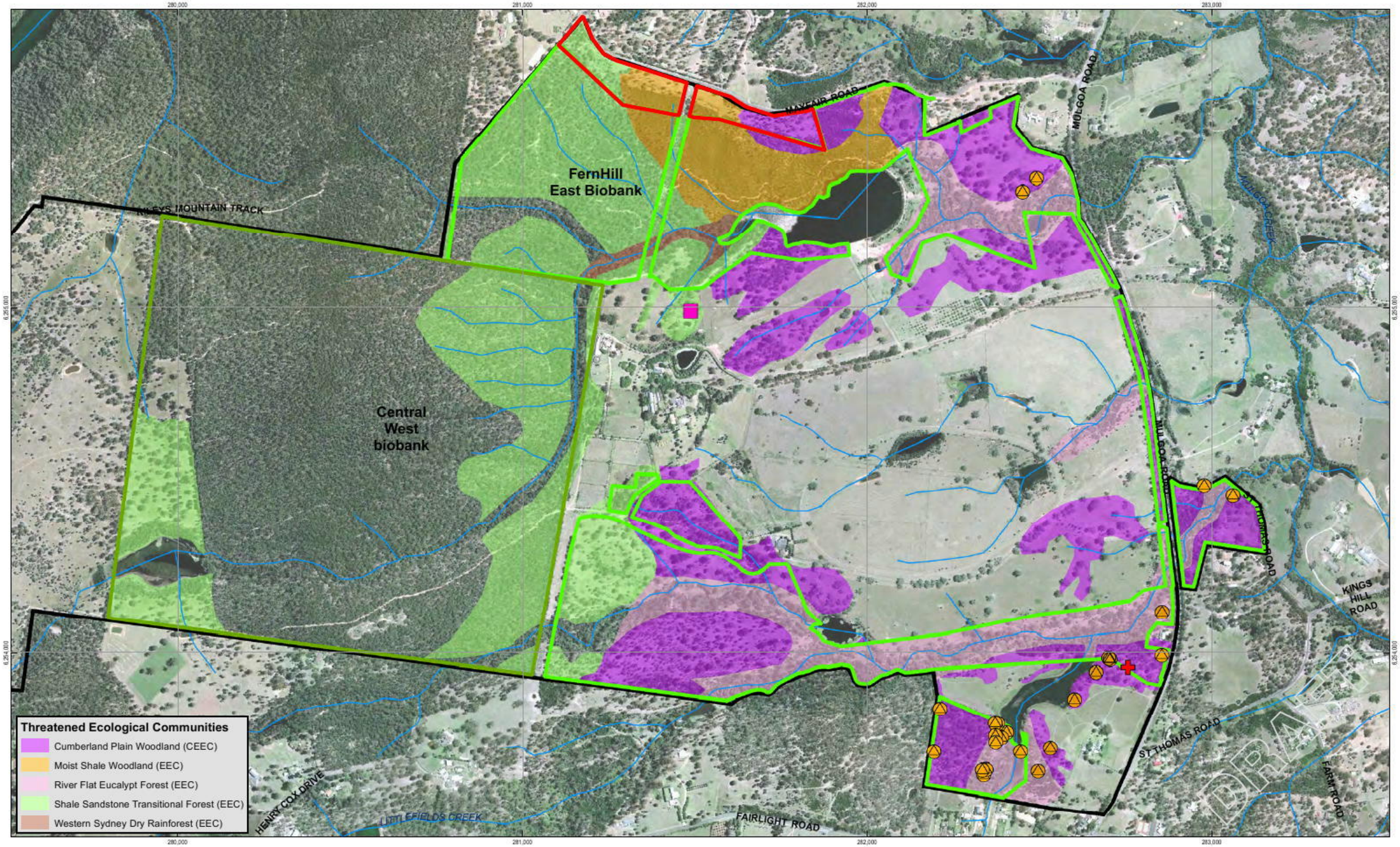
One migratory species the Cattle Egret (*Ardea ibis*) has been observed in the wider study area foraging in moist grassland adjacent to the large dam to the south of the site. This species and each of the other predicted species listed above may occur in the study area on occasion.

The EPBC Act lists migratory species listed under international agreements, as well as families of birds (such as ducks, waders, eagles and hawks) that are also known to be migratory but are not listed under international agreements. No waterfowl, waders or their habitats have been recorded in the study area and are unlikely to occur there. Other seasonally migratory or nomadic species would be likely to utilise habitats within the study area on occasion.

Additional MNES

The protected matters search (DotE 2015a) identified 'The Greater Blue Mountains Area' which is listed as a declared World Heritage Property and a National Heritage Place under the EPBC Act. The Greater Blue Mountains Area is located about six kilometres to the west of the study area and is separated from the site by native vegetation, agricultural land and the Nepean

River. There is no risk of direct or indirect impacts of the proposal on the Greater Blue Mountains Area.



Paper Size A3

0 50 100 200 300 400

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

- Site
- Fernhill Central West Biobank Site Boundary
- Fernhill East Biobank Site Boundary
- Fernhill Estate
- Cumberland Plain Land Snail (endangered species under TSC Act)
- Varied Sittella (vulnerable species under TSC Act)
- Glossy Black Cockatoo (vulnerable species under TSC Act)
- Waterways

Angas Securities Limited
Fernhill
Mayfair Ecological Impact Assessment

Job Number 22-16709
Revision A
Date 24 Jun 2015

Threatened Biota

Figure 4

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Data Source: Geoscience Australia: GEA Data - Jan 2011;Google Earth Pro: Aerial Imagery, Accessed: 2015; GHD: Vegetation, 03-3-2015. Created by: qjchung

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5. Potential Impacts

5.1 Direct impacts

5.1.1 Vegetation clearing and habitat removal

The proposal would result in the removal or modification of about 2.89 hectares of native vegetation, the majority in moderate/good – poor or low condition in accordance with the BBAM, within an overall site of 6.53 hectares as shown on Figure 3. Impacts would include vegetation clearing for permanent infrastructure such as residential lots, access roads, fire trails, Asset Protection Zones (APZ) and all associated earthworks. Vegetation modification (partial conservation), would involve the creation of APZ's and additional areas where practical for the effective operation and maintenance of this area (Figure 3). It is assumed that construction site compounds, temporary sediment management structures and any other ancillary structures would be entirely contained within the site. There is scope to retain native trees and some understorey vegetation in areas of vegetation to be modified.

The extent of clearing of vegetation and habitats within the proposal is summarised in Table 5, below.

Table 5 Extent of clearing of vegetation and TECs within the site

Vegetation Type (OEH, 2013a)	Conservation Significance	Condition[1]	Site area (ha)	Full vegetation removal within site (ha)	Partial conservation within site (ha)
Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest	CEEC listed under TSC Act and EPBC Act (Shale Sandstone Transition Forest)	Moderate/good	1.21	0.17	0.35
Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest	EEC listed under the TSC Act Act (Shale Sandstone Transition Forest)	Moderate / good_poor	0.34	0.20	0.15
Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest	EEC listed under the TSC Act Act (Shale Sandstone Transition Forest)	Low	0.30	0.24	0.03
Grey Box - Forest Red Gum grassy woodland on hills	CEEC listed under the TSC Act and EPBC Act (Cumberland Plain Woodland)	Moderate / good	1.48	0.33	0.09

Vegetation Type (OEH, 2013a)	Conservation Significance	Condition[1]	Site area (ha)	Full vegetation removal within site (ha)	Partial conservation within site (ha)
Grey Box - Forest Red Gum grassy woodland on hills	CEEC listed under the TSC Act (Cumberland Plain Woodland)	Moderate / good _poor	0.19	-	-
Forest Red Gum - Grey Box shrubby woodland	EEC listed under the TSC Act (Moist Shale Woodland in the Sydney Basin Bioregion) and CEEC listed under the EPBC Act (Western Sydney Dry Rainforest and Moist Woodland on Shale)	Moderate / good	1.54	0.05	0.19
Forest Red Gum - Grey Box shrubby woodland	EEC listed under the TSC Act (Moist Shale Woodland in the Sydney Basin Bioregion)	Moderate / good_poor	0.62	0.17	0.22
Forest Red Gum - Grey Box shrubby woodland	EEC listed under the TSC Act (Moist Shale Woodland in the Sydney Basin Bioregion)	Low	0.85	0.52	0.19
		Total area	**6.53**	**1.68**	**1.21**

[1]Condition classes have been recorded in accordance with the BBAM. Note that moderate/good_poor condition reflects vegetation in generally poor condition. Low condition vegetation has an overstorey less than 25% of the lower Benchmark value for percentage foliage cover and less than 50% native ground cover or more than 90% ground cover vegetation is cleared. Low condition vegetation is in worse condition than vegetation classified as moderate/good_poor.

Up to 0.33 hectares of Cumberland Plain Woodland would be removed for the proposal. This accounts for 0.79% of the total estimated area of that vegetation community in the biobank sites within Fernhill Estate (around 41.84 ha) that have been set aside for conservation. A further 0.09 hectares will be modified. Section 1.1 and Appendix C provide a detailed assessment of significance of impacts on Cumberland Plain Woodland. Up to 1.25 hectares of Cumberland Woodland will be retained on the site and includes better condition vegetation that is comensurate with the EPBC Act-listed form of the community.

Up to 0.75 hectares of Moist Shale Woodland would be removed for the proposal. The majority of this vegetation is in moderate/good_poor or low condition. The vegetation to be cleared is approximately 5.47 % of the total estimated area of that vegetation community in the biobanks

within the Fernhill Estate (around 13.71 ha) that would be set aside for conservation. A further 0.60 hectares will be modified. Section 1.1 and Appendix C provide a detailed assessment of significance of impacts on Moist Shale Woodland.

The proposal would remove 0.60 hectares of Shale Sandstone Transition Forest. This is approximately 0.64 % of the total estimated area of that EEC in the biobanks within the Fernhill Estate (around 94.98 ha) that would be set aside for conservation. A further 0.53 hectares would be modified for the proposal. Section 1.1 and Appendix C provide a detailed assessment of significance of impacts on Shale Sandstone Transition Forest.

The removal of 1.68 hectares of native vegetation would involve clearing of a moderately diverse range of non-threatened native plants, including a small number of mature trees. Mature trees have value within plant populations as sources of pollen and seed. There are extensive areas of these vegetation communities and species in the locality. The total area of native vegetation to be removed (1.68 hectares) is around 0.01 % of the estimated area of native vegetation in the locality (around 13,714 hectares, based on Tozer (2010)). This minor reduction in the extent of native vegetation would not threaten the persistence of local populations of native plants. Flora populations would persist within adjoining areas of alternative habitat beyond the study area, particularly within the large tracts of intact native vegetation set aside for conservation within the Fernhill Estate in biobanks.

The majority of the site is disturbed, with cleared grassland areas adjacent to Mayfair Road where indicative house pads have been located, exotic mid-storey vegetation on the mid slopes and also regrowth vegetation downslope.These areas contain little native vegetation cover and have limited habitat value for native plants. Any vegetation clearing required in these areas would remove a small number of individuals of non-threatened native plants and noxious and environmental weeds. Provided the weed management measures proposed in Section 6 are adopted, the proposal may result in positive impacts on retained native vegetation within the site and also within the adjacent Fernhill East Biobank by reducing the area of weeds in the study area. This would remove a source of weed propagules that are currently threatening adjoining areas of intact native vegetation.

The vegetation that would be removed provides limited habitat resources for native fauna species, including threatened species of fauna such as the Cumberland Plain Land Snail. This species was not recorded on the site nor was any wooden debri or rubbish observed which may provide habitat for this species. While the site may contain some foraging substrate for this species, the proposal would remove a negligible portion of resources in the locality.

The clearing of 1.68 hectares of native woodland and forest would include the potential removal of a few mature trees. Mature trees have value for fauna populations as sources of foraging resources such as leaves, nectar, sap or seed and substrate for invertebrate prey. The proposal would remove a very small proportion of available foraging resources for local populations of native fauna. No hollow-bearing trees would be removed for the proposal.

5.1.2 Habitat fragmentation and connectivity

The site occurs on a disturbed edge of native vegetation adjoining Mayfair Road. The site has a low perimeter to edge ratio which has lower ecological value for a variety of fauna. In contrast, more extensive areas of undisturbed habitat including the Fernhill East Biobank and also the Blue Mountains National Park occur adjacent to the site. The removal of habitat resources within the site is likely to have a relatively minor impact on local populations of threatened biota. The proposal is unlikely to fragment habitat or reduce connectivity to existing patches of intact vegetation.

5.1.3 Aquatic habitats

There are no wetlands, riparian or aquatic habitats in the site.

5.1.4 Fauna injury and mortality

Tthe site and study area provides habitat resources for native fauna species, including threatened fauna. More mobile native fauna such as birds, microbats, terrestrial and arboreal mammals are highly unlikely to be affected by the proposal. Construction may result in the injury or mortality of small terrestrial fauna that may be sheltering in vegetation within the site, such as the Cumberland Land Snail. The frog and reptile species that are known or likely to occur in the site are widespread and abundant in the study area and locality and so the potential injury or mortality of individuals within a maximum of 2.89 hectares of habitat is highly unlikely to affect an ecologically significant proportion of any local frog or reptile populations.

The Cumberland Land Snail is small, sedentary and closely affiliated with native vegetation communities within the site and so specific mitigation measures will be required to reduce the risk of injury or mortality of this endangered species. Targeted pre-clearing surveys and relocation of individuals and habitat resources are likely to reduce the risk of harm to acceptable levels (see Section 6.2). Even allowing for the possibility that these mitigation measures may not be effective the proposal would be highly unlikely to result in harm to an ecologically significant proportion of the local population of the species. The site contains 2.89 hectares of Cumberland Land Snail habitat and this species has been detected in the study area (in the Fernhill East Biobank). The absence of habitat resouces such as litter and wooden debris in the site suggests that this species is unlikely to inhabit the site or be impacted by the proposal.

Nesting birds and roosting microbats may be vulnerable to injury or mortality if present during clearing of trees within the site. There was no evidence of occupation by nesting birds or roosting microbats during fauna surveys. Pre-clearing fauna surveys will be undertaken as part of the Construction Environmental Management Plan (CEMP) to reduce the potential risk of injury or mortality to native fauna. Pre-clearing surveys will involve the inspection of trees for resident fauna as a precautionary measure prior to felling. The CEMP will also contain protocols for the felling of habitat trees and measures for the safe management of native fauna if detected in trees or on site generally during construction (see Section 6).

The proposal would increase the extent of developed land in the study area and locality and may result in a minor increase in the volume of traffic. This would have a negligible effect on the risk of vehicle collisions with native fauna given the existing volume of traffic on Mayfair Road and because the site is at the terminal end of a vegetated corridor (see Section 4.3.2 and Figure 3).

5.2 Indirect impacts

5.2.1 Habitat fragmentation

The site is at the terminal end of a vegetated corridor (see Section 4.3.2 and Figure 3). The proposal would involve widening an existing gap in habitat and so vegetation clearing for the proposal will not directly isolate or fragment any areas of habitat.

Vegetation in the Blue Mountains National Park and the Nepean River riparian strip to the west of the site is an important habitat corridor as described in Section 4.3.2. The site is located at the terminal end of this patch of habitat and does not, in itself, comprise an important connecting linkage. A significant proportion (17.6%) of the site is low condition, exotic vegetation that would have very little value as fauna movement habitat. Fauna movement, pollination and seed fall of plants and other ecological processes would occur around, rather than through, the site.

The proposal involves construction of structures that may obstruct movement of fauna attempting to travel through the study area, such as fences and buildings. These barriers would be parallel to existing, equivalent barriers, including Mayfair Road to the north, and would not significantly increase the degree to which fauna movement is disrupted. Fauna movement and ecological processes would continue to function around the site via the vegetated riparian corridor to the north.

In this context, the proposal would not have an adverse effect on fauna movement or habitat connectivity.

5.2.2 Erosion, sedimentation or contamination

There are potential sensitive receptors for indirect impacts on aquatic habitats in the wider study area including a large dam to the south of the site. Potential impacts that could cause the decline in aquatic habitat value include:

- Alterations to riparian and floodplain geomorphology
- Alterations to catchment hydrology
- Reduced water quality through hydrocarbon contamination or through increased nutrient or sediment inputs.

The hydrology and water quality of the study area is already substantially modified by clearing, damming of the drainage line to the south of the site and livestock access. The proposal would result in a minor increase in the proportion of hardstand surfaces in the study area and may also modify drainage through drains and other engineered structures. Given the extent of existing modifications to the local catchment the proposal would comprise a minor change to hydrology and would be highly unlikely to adversely affect any aquatic habitats.

The potential for hydrocarbon contamination or increased nutrient or sediment inputs can be avoided or minimised through the implementation of appropriate mitigation measures as outlined in Section 6.

5.2.3 Weed invasion and edge effects

'Edge effects' refers to changed environmental conditions at the interface of intact vegetation and cleared areas. Edge effects may result in impacts such as changes to vegetation type and structure, increased growth of exotic plants, increased predation of native fauna or avoidance of habitat by native fauna. Edge effects would result from clearing of vegetation within the site and then continue to affect vegetation and habitats adjoining the site for the life of the proposal.

Construction may increase the degree of weed infestation through dispersal of weed propagules (seeds, stems and flowers) into areas of native vegetation via erosion (wind and water) and via workers shoes and clothing and through construction vehicles. The risk of introduction of weeds would continue during operation of the propsal through wind or water transmisiion of propagules from gardens and/or as property owners or their pets may enter adjoining vegetation.

Within the majority of the study area the severity of impacts arising from edge effects and weed invasion would be limited by the presence of existing disturbance. The northern boundary of vegetation within the site adjoins cleared land dominated by exotic plants. Areas vulnerable to novel edge effects include along the southern edge of the site where it adjoins native woodland and forest.

A Vegetation Management Plan is recommended for the proposal, which would contain measures to avoid direct and indirect impacts on native vegetation adjoining the site (refer Section 6). Given these mitigation measures and the extent of existing weed infestation and

disturbance in the study area the proposal would result in a minor increase in weed infestation and other edge effects.

5.2.4 Pests and pathogens

Construction activities within the site have the potential to introduce or spread pathogens such as Phytophthora (*Phytophthora cinnamomi*), Myrtle Rust (*Uredo rangelii*) and Chytrid fungus (*Batrachochytrium dendrobatidis*) throughout the study area through vegetation disturbance and increased visitation. There is little available information about the distribution of these pathogens within the locality, and no evidence of these pathogens was observed during surveys. Phytophthora and Myrtle Rust may result in the dieback or modification of native vegetation and damage to fauna habitats. Chytrid fungus affects both tadpoles and adult frogs and can wipe out entire populations once introduced into an area.

The potential for impacts associated with these pathogens is low, given the disturbed nature of the site, and limited intact native vegetation. As a precautionary measure a 'clean on entry, clean on exit' policy should be implemented during construction activities as outlined under the CEMP (detailed further in Section 6) to prevent the introduction or spread of these pathogens.

5.3 Operational impacts

5.3.1 Noise, light and vibration

The site is located directly adjacent to a quiet regional road (Mayfair Road) with relatively low traffic volumes and adjoins Mulgoa Road approximately 700 metres away. Habitats adjacent to the site therefore already experience some noise, light and vibration disturbance. The proposal may increase traffic flow to Mayfair Road due to the additional dwellings, though this is likely to be minor given the current population and volume of through traffic. There would be a minor increase in light spill associated with the proposed dwellings. Light spill is likely to be low intensity and restricted to human waking hours. This would not be a novel impact and is likely to have a minor effect on native fauna in habitat adjoining the site.

5.4 Cumulative impacts

Cumulative impacts would occur from the subdivision of land within the Mulgoa precinct for rural residential dwellings.The majority of the indicative dwelling footprint within the site contains grazed exotic grassland with minimal habitat resources for native fauna and negligible value as a movement corridor. Impacts on native flora and fauna are substantially less than would be associated with an undisturbed 'green field' site. The proposal would remove and/or modify 2.89 hectares of vegetation and so would contribute to cumulative impacts on native biota in the locality.

Potential cumulative impacts arising from the proposal include:

- An increase in the degree of vegetation clearing in the study area.
- An increase in the magnitude of edge effects on remnant native vegetation and the imposition of novel edge effects on some areas of vegetation.
- A minor increase in noise and light disturbance and the risk of predation of native fauna by domestic pets.
- A minor increase in the risk of vehicle collisions due to increased vehicle traffic.

Mitigation measures proposed to ameliorate f these potential impacts are included in Section 6.

The site is located at the terminal end of a vegetated corridor, on the edge of Mayfair Road and would comprise a relatively minor increase in the degree of habitat fragmentation or indirect effects. The proposal would not sever any import vegetated links or isolate any areas of habitat.

Cumulative impacts arising from the proposal are unlikely to cross any critical threshold for impacts that would have a significant adverse affect on local populations of any native biota.

5.5 Key threatening processes

A key threatening process (KTP) is defined in the TSC Act (OEH 2011) as an action, activity or proposal that:

- Adversely affects two or more threatened species, populations or ecological communities.
- Could cause species, populations or ecological communities that are not currently threatened to become threatened.

KTPs are listed under the TSC Act, the FM Act and also under the EPBC Act. A number of KTPs are listed under more than one Act. Those potentially relevant to this proposal are discussed in Table 6 below. Mitigation measures to limit the impacts of these KTPs are discussed in Section 6.

Table 6 Key threatening processes

KTP	Status	Likely impact
Clearing of native vegetation	TSC Act; EPBC Act	The proposal would result in the removal of 1.68 hectares of native and introduced vegetation. An additional 1.21 hecatres may be modified for the development and maintence of APZs. Most of the vegetation to be removed or modified is on moderate to low condition due to weed infestation and other edge effects. The clearing of this vegetation is not likely to significantly affect any threatened biota. The proposal would result in a minor increase in the operation of this KTP.
Removal of dead wood and dead trees	TSC Act	There are small quantities of dead wood that would provide habitat resources for native fauna. The CEMP would include measures for the salvage and reinstatement of woody debris which would partially mitigate against the operation of this KTP. The proposal would result in a minor increase in the operation of this KTP.
Invasion of plant communities by perennial exotic grasses	TSC Act	The site features moderate infestation with perennial exotic grasses. There is the potential for perennial exotic grasses to further invade native vegetation through disturbance during construction of the proposal and a shift of the disturbed edge south into intact native vegetation. A Vegetation Management Plan is recommended, which would include measures to limit the spread of weeds. These mitigation measures are likely to effectively limit the operation of this KTP.
Infection of native plants by Phytophthora cinnamomi	TSC Act; EPBC Act	Construction activities have the potential to introduce the root-rot fungus *Phytophthora cinnamomi* into the study area, which could lead to dieback of vegetation. The implementation of a Vegetation Management Plan is recommended to limit impacts on native vegetation including prevention of introduction of this fungus during construction. The proposal is unlikely to increase the operation of this

KTP	Status	Likely impact
		KTP.
Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae	TSC Act	Construction activities have the potential to introduce Myrtle Rust to the study area. The implementation of a Vegetation Management Plan is recommended to limit impacts on native vegetation. The proposal is unlikely to increase the operation of this KTP.

6. Mitigation measures

The proposal would result in direct impacts on native biota and their habitats within the site. There is potential for direct and indirect impacts on habitat in the study area. Specific mitigation measures are recommended to minimise such impacts on the natural environment.

The following sections detail the avoidance of impacts, mitigation measures and offset contributions recommended for the proposal.

6.1 Avoidance of impacts

The proposal is the construction of five dwellings and associated APZs adjacent to Mayfair Road. The majority of the site falls within land which is extensively modified or cleared by previous activities. The site is located at the terminal end of a vegetated corridor adjacent to the Fernhill East Biobank and would comprise a relatively minor increase in the degree of habitat fragmentation or indirect effects. The proposal would not sever any important vegetated links or isolate any areas of habitat. Impacts on native flora and fauna are substantially less than would be associated with an undisturbed 'green field' site. In addition, 3.64 hectares of native vegetation would be fully retained within the site with another 1.21 hectares to be partially conserved through Asset Protection Zones for the ongoing maintenance of this area.

Impacts have been further avoided through the preliminary design phase including:

- Placement of indicative dwelling footprints in areas of the lowest habitat and conservation value where possible.
- Partial clearing within Asset Protection Zones such as clearing to achieve only a discontinuous canopy.

6.2 Mitigation of impacts

6.2.1 Pre-construction phase

During the pre-construction phase, impacts of the proposal on areas with moderate-high biodiversity values will be minimised where possible by:

- Documentation and communication of environmental values and constraints in the study area
- Temporary fencing of areas where no impacts are to occur, to minimise the chance of inadvertent impacts during construction.

Pre-clearance surveys

Pre-clearance surveys should be undertaken by a qualified ecologist. Surveys should include:

- Clear marking/erection of exclusion fencing around protected vegetation areas and delineation of 'no-go' areas
- Targeted pre-clearing surveys in accordance with the Cumberland Plain Land Snail as per the fauna management plan. Pre-clearing surveys would include targeted searches of the site for snails and salvage and relocation of any snails and/or suitable shelter sites that are detected. Snails and/or suitable shelter sites would be relocated to appropriate Cumberland Plain Land Snail habitat in the study area, to the north and west of the site. Snail collection and relocation would need to be conducted by appropriately experienced ecologists under a Licence obtained under Section 91 of the TSC Act.

- Inspections of native vegetation for other resident fauna and/or nests or other signs of fauna occupancy
- Capture and relocation or captive rearing of less mobile fauna (such as roosting microbats, nestling birds or any injured fauna) by a trained fauna handler and with assistance from Wildlife Information Rescue and Education Service (WIRES) as required

6.2.2 Construction phase

The following principals should be followed throughout the construction phase:

- Wildlife should not be handled wherever possible. Construction staff should only handle wildlife in an emergency situation. Uninjured wildlife should be gently encouraged to leave the site by the ecologist/ wildlife specialist. Injured wildlife would be taken to a local WIRES carer or veterinarian for treatment and care if necessary
- All fuel and chemical storages should be bunded.

7. Assessments of Significance

7.1 Identification of affected threatened biota

The desktop assessment, field surveys and habitat assessments have been used to identify threatened biota that may be affected by the proposal, through either direct or indirect impacts. If threatened biota is potentially affected by a proposal then the significance of impacts must be assessed through Section 5A of the EPA Act (the seven part test) and/or the *Matters of National Environmental Significance – Assessment of significance guidelines* (DEWHA 2009).

The DECC (2007) *Threatened species assessment guidelines - the assessment of significance and* DEWHA (2009) guidelines require proponents to compile a list of threatened biota which may be affected by the proposal and which require an assessment of significance.

The suite of threatened biota potentially relevant to this assessment is presented in Appendix A, along with the nature of any previous records in the locality and an assessment of the likelihood of occurrence in the site or being affected by the proposal. Based on the targeted surveys and habitat assessments undertaken, a number of the threatened biota are not likely to occur in the study area. Given the limited scale and magnitude of impacts arising from the proposal and impact mitigation and environmental management measures described in Section 6, no additional threatened biota outside of the study area are likely to be affected by the proposal.

Table 7 lists the threatened ecological communities and species that are known or likely to be present in the study area and are considered affected threatened biota for the proposal and which require specific assessments of significance of impacts. The results of the assessments of significance for guilds of affected threatened biota are described below.

Table 7 Threatened biota that are known or likely to occur in the study area that may be affected by the proposal

Common Name	Scientific name	TSC Act	EPBC Act
Shale Sandstone Transition Forest	Shale Sandstone Transition Forest in the Sydney Basin Bioregions	CEEC	CEEC
Cumberland Plain Woodland	'Cumberland Plain Woodland in the Sydney Basin Bioregion'(TSC Act) and 'Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest' (EPBC Act)	CEEC	CEEC
Moist Shale Woodland	Moist Shale Woodland in the Sydney Basin Bioregion	EEC	CEEC
Spiked Rice-flower	*Pimelea spicata*	E	E
Cumberland Plain Land Snail	*Meridacium correcvirens*	E	Not listed

7.2 Threatened ecological communities recorded on site

Assessments of significance of impacts on on the local occurrences of Cumberland Plain Woodland, Shale Sandstone Transition Forest and Moist Shale Woodland have been prepared

pursuant to s.5A of the EPA Act (see Appendix C). The outcome of these assessments is that the proposal would not have a significant effect on these TECs, given:

- Removal of 1.68 hectares of these TECs would occur primarily in areas of moderate/good_poor, or low condition.
- Partial modification of 1.21 hectares of these TECs for operation and maintenance of APZs would occur primarily in areas of moderate/good_poor, or low condition.
- The proposal would not threaten the viability or persistence of these TECs in the locality or the region, given the condition of the sites' vegetation and its insignificance as edge habitat within a large tract of native vegetation.

7.3 Threatened flora species that may potentially occur

7.3.1 Spiked Rice-flower

An assessment of significance of impacts on the Spiked Rice-flower has been prepared pursuant to s.5A of the EPA Act (see Appendix C). The outcome of this assessment is that the proposal would not have a significant effect on the Spiked Rice-flower, given:

- Potential impacts of the proposal on the life cycle of the species would be restricted to the removal of individual plants (if present) within vegetation in the site (which is unlikely).
- There is around 1,480 hectares of potential habitat for the Spiked Rice-flower in shale woodlands in the locality (based on Tozer 2010 vegetation mapping). The minor magnitude of impacts on any individual plants that may occur in the site or on potential habitat would not threaten the viability or persistence of the species in the locality or the region.
- The proposal would not result in a significant increase in the operation of any KTPs nor have any effects that would substantially interfere with the maintenance or recovery of the species.

7.4 Threatened fauna that may potentially occur

7.4.1 Cumberland Plain Land Snail

An assessment of significance of impacts on the Cumberland Plain Land Snail has been prepared pursuant to s.5A of the EPA Act (see Appendix C). The outcome of this assessment is that the proposal would not have a significant impact, given:

- Potential impacts of the proposal on the life cycle of the species would be restricted to the removal of potential habitat and potentially snails (if present) within the 2.89 hectares of potential habitat for the species in the site.
- The proposal would affect around 2.65 percent of the total estimated area of potential habitat for the species in equivalent habitat types within the existing Fernhill estate Biobanks (East and Central West) set aside for conservation. The minor magnitude of impacts on any individual snails that may occur in the site or on potential habitat would not threaten the viability or persistence of the species in the locality or the region.
- The proposal would not isolate or fragment any significant areas of habitat.
- The proposed construction would include a pre-clearing survey including salvage of any snails or woody debris in construction footprints and placement in adjacent areas of retained vegetation. This would partially mitigate impacts on local populations.

- The proposal would not result in a significant increase in the operation of any KTPs nor have any effects that would substantially interfere with the maintenance or recovery of the Cumberland Plain Land Snail.

7.5 Migratory fauna

Migratory fauna have not been recorded within the site. The Cattle Egret (*Ardea ibis*) has been recorded south east of the study area in a large dam but is unlikely to occur in the site. A range of migratory and nomadic species (excluding waterfowl and waders may utilise habitats within the study area on occasion).

The EPBC Act requires an assessment of the significance of potential impacts of a proposal on migratory species with reference to the criteria specified in the *Matters of National Environmental Significance –Assessment of significance guidelines* (DEWHA 2009).

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will (DEWHA 2009):

- *Substantially modify, destroy or isolate an area of important habitat for a migratory species*

  An area of 'important habitat' for a migratory species is: habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, and/or; habitat that is of critical importance to the species at particular life-cycle stages, and/or; habitat utilised by a migratory species which is at the limit of the species range, and/or; habitat within an area where the species is declining (DEWHA 2009).

  The site would have little value for migratory species and does not comprise 'important habitat'. Impacts would be restricted to the site and its immediate vicinity and so the proposal would not substantially modify any important habitat.

- *Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or*

  As described above the site does not comprise 'important habitat'. Impacts would be restricted to the site and its immediate vicinity and so the proposal would not result in an invasive species becoming established in important habitat.

- *Seriously disrupt the lifecycle of an ecologically significant proportion of the population of a migratory species.*

  Given the limited scale of the proposal and quality of habitat for migratory species only a small number of individuals of the Cattle Egret or any other migratory species would ever occupy habitat within the area potentially subject to impacts. The risk of injury or mortality of any of these individuals is very slight. The site contains a small proportion of the habitat resources available for migratory species in the study area and the locality. As described in Section 5.2.1, the proposal would not significantly increase the degree of fragmentation or isolation of habitat in the locality. Therefore the proposal would not seriously disrupt the lifecycle of an ecologically significant proportion of the population of any migratory species.

Based on the consideration of the criteria contained in the *Matters of National Environmental Significance –Assessment of significance guidelines* (DEWHA 2009), the proposal would not be likely to have a significant impact on any migratory species.

7.6 MNES

General consideration of significant impacts on the local occurrence of Cumberland Plain Woodland, Western Sydney Dry Rainforest and Moist Shale Woodland and Spike Rice-flower has been given subject to the DEWHA (2009) guidelines (see Appendix C). These MNES have been included in Section 5A assessments of significance in Appendix C of this report. The outcome of these assessments is that the proposal would not have a significant effect on these MNES.

'The Greater Blue Mountains Area' is listed as a declared World Heritage Property and a National Heritage Place under the EPBC Act. The Greater Blue Mountains Area is located about six kilometres west of the study area and is separated from the site by native vegetation. Impacts of the proposal would be restricted to the site and immediately adjoining areas. Given the location, scale and magnitude of impacts arising from the proposal there is no risk of direct or indirect impacts of the proposal on the Greater Blue Mountains Area.

8. Conclusions

The site is dominated by cleared land and introduced grassland but also contains intact and regrowth native vegetation including TECs and habitat for threatened species. Native vegetation and habitat within the site is primarily in moderate/good_poor or low condition adjacent to Mayfair Road and is already exposed to edge effects. Moderate/good condition vegetation is present on the site adjacent to the Fernhill East Biobank. Away from these disturbed areas the native vegetation in the broader study area is generally in good condition and is connected to extensive areas of habitat via vegetated corridors.

Based on the desktop assessment, field surveys and habitat assessments undertaken the following affected threatened biota was identified:

- Shale Sandstone Transition Forest EEC, which is present in the site.
- Moist Shale Woodland EEC, which is present in the site.
- Cumberland Plain Woodland CEEC, which is present in the site.
- The Spiked Rice-flower, which may be present in potential habitat in the the site.
- The Cumberland Plain Land Snail, which was recorded in the broader Fernhill Estate and locality.

Assessments of significance for threatened biota have been prepared pursuant to s.5A of the EPA Act and conclude that the proposal is not likely to have a significant effect on the local populations of any threatened biota given:

- Vegetation within the development footprint is in generally low condition, forms edge habitat and is unlikely to be optimal habitat for threatened biota.
- The proposal would not threaten the viability or persistence of threatened biota in the locality or the region.
- Potential impacts of the proposal on the life cycle of threatened biota would be restricted to the removal of 1.68 hectares of native and introduced vegetation.
- There are extensive areas of habitat for threatened biota in the locality. The minor magnitude of impacts associated with the proposal would not threaten the viability or persistence of the species in the locality or the region.
- Mitigation measures in accordance with an CEMP are proposed to ameliorate potential indirect impacts.
- The proposal would not result in a significant increase in the operation of any KTPs nor have any effects that would substantially interfere with the maintenance or recovery of any threatened biota.

A Species Impact Statement is not required for the proposal.

The subject contains a number of MNES and/or their habitats. Based on the impact assessments and assessments of significance included in this report the proposal is not likely to have a significant impact on any MNES. A referral is not required.

9. Disclaimer

This report has been prepared by GHD for INC Angas Securities Ltd and may only be used and relied on by INC Angas Securities Ltd for the purpose agreed between GHD and the INC Angas Securities Ltd as set out in Section 1.4 of this report.

GHD otherwise disclaims responsibility to any person other than INC Angas Securities Ltd arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by INC Angas Securities Ltd and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

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Appendices

Appendix A - Threatened biota assessment

Threatened ecological communities known or predicted from the locality, habitat association and suitable habitat present at the site.

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat association	Nature of record	Likelihood of occurrence in site
Agnes Banks Woodland in the Sydney Basin Bioregion	Agnes Banks Woodland in the Sydney Basin Bioregion	EEC		Most remnants occur near Agnes Banks in Penrith LGA, on eastern bank of the Hawkesbury River. Occurs on aeolian sands overlaying Tertiary alluviums. Structure varies from low woodland on higher ridges to sedgeland in low-lying depressions. Characteristic species include *Eucalyptus sclerophylla, Angophora bakeri* and *Banksia serrata*.	Known within 10km (OEH 2015a)	Not present
Blue Gum High Forest in the Sydney Basin Bioregion	Blue Gum High Forest in the Sydney Basin Bioregion	CEEC	CEEC	Occurs on the Hornsby Plateau, north eastern edge of the Cumberland Plain with most remnants in Hornsby, Ku-ring-gai and Baulkham Hills LGAs. Typically occurs in high rainfall areas on fertile soils derived from Wianamatta shale. Grades into Sydney Turpentine-Ironbark Forest at lower rainfall areas. Moist, tall open forest characterised by Eucalyptus saligna and E. pilularis. Usually has small tree layer of *Pittosporum undulatum, Elaeocarpus reticulatus and Alloxasuarina torulosa* over a low, open shrub layer and an understorey of grasses, herbs and ferns.	Known within 10km (OEH 2015a)	Not present
Blue Mountains Shale Cap Forest in the Sydney Basin Bioregion	Blue Mountains Shale Cap Forest in the Sydney Basin Bioregion	EEC	CEEC	Found on deep fertile soils formed on Wianamatta Shale, on moist sheltered sites at lower to middle altitudes of the Blue Mountains and Wollemi areas. Extensive occurrences of shale are at Springwood, Berambing to Kurrajong Heights, Mountain Lagoon and Colo Heights. Characteristic tree species of this ecological community are *Eucalyptus oreades, E. cypellocarpa* and *Syncarpia glomulifera*. The structure of the community was originally tall open forest to open forest, depending on site conditions and history, but as a result of partial clearance may now exist as woodland or as groups of remnant trees.	Known within 10km (OEH 2015a)	Not present

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat association	Nature of record	Likelihood of occurrence in site
Blue Mountains Swamps in the Sydney Basin Bioregion	Blue Mountains Swamps in the Sydney Basin Bioregion	VEEC	EEC	Occurs on the Hornsby Plateau, north eastern edge of the Cumberland Plain with most remnants in Hornsby, Ku-ring-gai and Baulkham Hills LGAs. Typically occurs in high rainfall areas on fertile soils derived from Wianamatta shale. Grades into Sydney Turpentine-Ironbark Forest at lower rainfall areas. Moist, tall open forest characterised by Eucalyptus saligna and E. pilularis. Usually has small tree layer of *Pittosporum undulatum, Elaeocarpus reticulatus and Allocasuarina torulosa* over a low, open shrub layer and an understorey of grasses, herbs and ferns.	Known within 10km (OEH 2015a)	Not present
Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion	Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion	VEEC		Occurs almost exclusively on soils derived from Tertiary alluvium, or on sites located on adjoining shale or Holocene alluvium, with known occurrences in the Bankstown, Blacktown, Campbelltown, Hawkesbury, Liverpool and Penrith LGAs. Typically on sandy soils and on slightly higher ground than Castlereagh Ironbark Forest or Shale Gravel Transition Forest (Tozer 2003). Dominated by *Eucalyptus parramattensis subsp. parramattensis, Angophora bakeri and E. sclerophylla*. A small tree stratum of Melaleuca decora is sometimes present, generally in areas with poorer drainage. It has a well-developed sclerophyllous shrub stratum over a diverse range of forbs.	Known within 10km (OEH 2015a)	Not present
Castlereagh Swamp Woodland Community	Castlereagh Swamp Woodland Community	EEC		Occurs in the Castlereagh and Holsworthy areas on the Cumberland Plain on alluvial soils, often in poorly drained depressions. Low woodland characterised by dense stands of *Melaleuca decora* along with other canopy trees, such as *Eucalyptus parramattensis ssp parramattensis*. Poorly developed shrub layer of juvenile melaleucas over waterlogging tolerant groundcover species such as *Centella asiatica,*	Known within 10km (OEH 2015a)	Not present

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat association	Nature of record	Likelihood of occurrence in site
				Juncus usitatus and Goodenia paniculata.		
Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion	Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion	EEC		Occurs on the Cumberland Plain with the most extensive stands in Castlereagh and Holsworthy areas. Smaller remnants in Kemps Creek area and eastern section of the Cumberland Plain. Ranges from open forest to low woodland, with a canopy dominated by *Eucalyptus fibrosa and Melaleuca decora* along with other species of eucalypt. Dense shrubby understorey of *Melaleuca nodosa, Lissanthe strigosa and Fabaceae sp* over sparse ground layer of grasses and herbs.	Known within 10km (OEH 2015a)	Not present
Cumberland Plain Shale Woodlands and Shale Gravel Transition Forest (federal listing)		Component EECs listed separately	CEEC	Grassy woodlands and forests of the shale hills and plains of the Cumberland Plain and associated transitional communities on shale-gravel soils. Canopy typically dominated *by Eucalyptus moluccana, E. tereticornis and/or E. fibrosa*. Sparse small tree stratum of young eucalypts and Acacia species and/or shrub layer dominated by *Bursaria spinosa* may be present. Understorey comprises perennial native grasses, grasslike and non-woody plants.	Known within 10km (OEH 2015a); Community likely to occur within area (DOTE 2015)	Present
Cumberland Plain Woodland in the Sydney Basin Bioregion	Cumberland Plain Woodland in the Sydney Basin Bioregion	EEC	May qualify as CEEC	Grassy woodland/forest endemic to the hills and plains of the Cumberland Plain. Canopy typically dominated by *Eucalyptus moluccana and E. tereticornis, with E. crebra, Corymbia maculata and E. eugenioides* occurring less frequently. Shrub layer dominated by *Bursaria spinosa*, and grasses such as *Themeda australis* and *Microlaena stipoides var*	Known within 10km (OEH 2015a)	Present

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat association	Nature of record	Likelihood of occurrence in site
				stipoides.		
Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC		Occurs in coastal areas subject to periodic flooding with standing fresh water for at least part of the year. Typically on silts, muds or humic loams below 20 m elevation in low-lying parts of floodplains, alluvial flats, depressions, drainage lines, backswamps, lagoons and lakes. Structure and composition varies spatially and temporally depending on the water regime, though is usually dominated by herbaceous plants and has few woody species.	Known within 10km (OEH 2015a)	Not present
Moist Shale Woodland in the Sydney Basin Bioregion	Moist Shale Woodland in the Sydney Basin Bioregion	EEC	May qualify as CEEC	Occurs on clay soils from Wianamatta Shale in the southern half of the Cumberland Plain, and is intermediate between Cumberland Plain Woodland and Western Sydney Dry Rainforest. Similar to Cumberland Plain Woodland but with more mesic shrub understorey. Dominant canopy trees include Forest Red Gum Eucalyptus tereticornis, Grey Box E. moluccana, Narrow-leaved Ironbark E. crebra and Spotted Gum *Corymbia maculata*. Small trees, such as Hickory Wattle Acacia implexa and Sydney Green Wattle *A. parramattensis* ssp parramattensis are also common. The shrub layer includes *Breynia oblongifolia*, *Hairy Cyperaceae Cyperaceae tomentosum* and Indian Weed *Siegesbeckia orientalis ssp orientalis*.	Known within 10km (OEH 2015a)	Present

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat association	Nature of record	Likelihood of occurrence in site
Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions	Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions	EEC	EEC	Occurs above 4-500m asl on undulating tablelands and plateaus, typically on basic volcanic , fine grained sedimentary substrates or occasionally granite. Associated with accumulations of peaty or organic mineral sediments on poorly drained flats in stream headwaters. Dense, open or sparse layer of shrubs with soft-leaved sedges, grasses and forbs. Only type of wetland that may contain more than trace amounts of mosses (*Sphagnum spp.*). Small trees may be absent, or present as scattered emergent.	Known within 10km (OEH 2015a)	Not present
Mount Gibraltar Forest in the Sydney Basin Bioregion	Mount Gibraltar Forest in the Sydney Basin Bioregion	EEC	EEC	Confined to a small number of pockets in the Southern Highlands region mainly near Bowral and Mittagong. Occurs in the Wingecarribee LGA, but may occur elsewhere in the Sydney Basin Bioregion. Restricted to clay soils on microsyenite intrusions in the central parts of the Southern Highlands. Occurs on gentle to steep slopes with correspondingly deep and shallow soils respectively; combined with aspect, these factors contribute to the variability evident in the floral composition of this community (OEH 2013).	Known within 10km (OEH 2015a)	Not present

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat association	Nature of record	Likelihood of occurrence in site
Newnes Plateau Shrub Swamp in the Sydney Basin Bioregion	Newnes Plateau Shrub Swamp in the Sydney Basin Bioregion	EEC	EEC	Recorded from the local government areas of Lithgow and Blue Mountains City. The community is characteristically dominated by shrubs, with a variable cover of sedges. Shrubs have a dense to open cover, and include Baeckea linifolia, Grevillea acanthifolia subsp. acanthifolia, Epacris paludosa and Leptospermum species. The cover of sedges varies inversely with shrub cover. Floristic composition varies locally in relation to soil moisture gradients within the swamps. With decreasing altitude, Newnes Plateau Shrub Swamp grades into Blue Mountains sedge swamp communities. The transition occurs around Bell and Clarence at approximately 850-950 m above sea level. Blue Mountains sedge swamps typically have less cover of shrubs and a greater cover of sedges (particularly Gymnoschoenus sphaerocephalus) than Newnes Plateau Shrub Swamp. Occurrences on peat may be included in the EPBC Act listed Temperate highland Peat Swamps on Sandstone EEC.	Known within 10km (OEH 2015a)	Not present
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC		Occurs on flats, drainage lines and river terraces of coastal floodplains where flooding is periodic and soils generally rich in silt, lack deep humic layers and have little or no saline (salt) influence. Occurs south from Port Stephens in the NSW North Coast, Sydney Basin and South East Corner bioregions. Characterised by a tall open canopy layer of eucalypts with variable species composition.	Known within 10km (OEH 2015a)	Not present

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat association	Nature of record	Likelihood of occurrence in site
Robertson Basalt Tall Open-forest in the Sydney Basin Bioregion	Robertson Basalt Tall Open-forest in the Sydney Basin Bioregion	EEC	EEC	Typically restricted to occurrences of Robertson Basalt in the southern highlands, also on Cambewarra range to the south. Grows on highly fertile soils derived from basalt, on the slopes of rolling hills in areas of 1000-1600 mm annual rainfall. Open forest or woodland to 30 m tall with a sparse to moderately dense shrub layer and a dense herbaceous ground layer. Dominant tree species include *Eucalyptus fastigata, E. viminalis, E. radiata and E. cypellocarpa. Acacia melanoxylon* is a common small tree species in this community.	Known within 10km (OEH 2015a)	Not present
Shale gravel Transition Forest in the Sydney Basin Bioregion	Shale gravel Transition Forest in the Sydney Basin Bioregion	EEC	CEEC	"Primarily in the northern section of the Cumberland Plain, also found in Liverpool/Holsworthy, Bankstown, Yennora, Villawood and Kemps Creek areas. Occurs primarily where shallow deposits from ancient river systems overlay shale soils, but also associated with localised concentrations of iron-hardened gravel. Open forest with canopy dominated by Eucalyptus fibrosa, E. moluccana and E. tereticornis, often with small tree layer of Melaleuca decora over a sparse shrub layer. Grades into Cumberland Plain Woodland where the influence of gravel soil declines, and into Cooks River/Castlereagh Ironbark Forest or Castlereagh Scribbly Gum Woodland where gravel deposits are thick.	Known within 10km (OEH 2015a)	Not present
Shale/Sandstone Transition Forest	Shale/Sandstone Transition Forest	EEC	EEC	Primarily in the northern section of the Cumberland Plain, also found in Liverpool/Holsworthy, Bankstown, Yennora, Villawood and Kemps Creek areas. Occurs primarily where shallow deposits from ancient river systems overlay shale soils, but also associated with localised concentrations of iron-hardened gravel. Open forest with canopy dominated by Eucalyptus fibrosa, E. moluccana and E. tereticornis, often with small tree layer of Melaleuca	Known within 10km (OEH 2015a); Community likely to occur within area (DOTE 2015)	Present

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat association	Nature of record	Likelihood of occurrence in site
				decora over a sparse shrub layer. Grades into Cumberland Plain Woodland where the influence of gravel soil declines, and into Cooks River/Castlereagh Ironbark Forest or Castlereagh Scribbly Gum Woodland where gravel deposits are thick.		
Southern Highlands Shale Woodlands in the Sydney Basin Bioregion	Southern Highlands Shale Woodlands in the Sydney Basin Bioregion	EEC		Confined to a small area in the Wingecarribee LGA, between the Illawarra Escarpment in the east, Burrawang and Bundanoon in the south, Canyonleigh in the west and Berrima and Colo Vale in the north. Occurs on clay soils on Wianamatta Shale, between approx. 60-800 m asl. Typically woodland but also tall open forest, grassy woodland and scrub. Dominant canopy species vary across the range. Shrub layer generally open although may have dense patches and groundlayer typically comprises diverse native grasses and herbs.	Known within 10km (OEH 2015a)	Not present
Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion	Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion	EEC		Restricted to sheltered heads and upper slopes of gullies on transitional zones where sandstone outcrops may exist, but where soils are influenced by lateral movement of moisture, nutrients and sediment from more fertile substrates in an area bounded by Hurstville, Carss Park, Bundeena, Otford, Stanwell Tops, Darkes Forest, Punchbowl Creek and Menai. Open forest dominated by Angophora costata, Eucalyptus piperita and occasional E. *pilularis* over scattered subcanopy trees, a diverse shrub layer and well-developed groundcover of ferns, forbs, grasses and graminoids. Variable species composition.	Known within 10km (OEH 2015a)	Not present

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat association	Nature of record	Likelihood of occurrence in site
Sun Valley Cabbage Gum Forest in the Sydney Basin Bioregion	Sun Valley Cabbage Gum Forest in the Sydney Basin Bioregion	EEC		Occurs in the Sun Valley in the Blue Mountains City Council local government area; within about 15 hectares. Occurs on soils formed from diatremes (pipes of volcanic material) at Sun Valley. Other diatreme substrates in the area support different dominant tree species and do not have Eucalyptus amplifolia (OEH 2013).	Known within 10km (OEH 2015a)	Not present
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC		Typically occurs below 20m asl on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes on coastal floodplains of NSW. Associated with grey-black clay-loams and sandy loams, saline or sub-saline groundwater. Structure variable from open forests to scrubs or reedlands with scattered trees. Canopy dominated by Casuarina glauca (north of Bermagui) or Melaleuca ericifolia (south of Bermagui). Understorey characterised by frequent occurrences of vines, a sparse cover of shrubs, and a continuous groundcover of forbs, sedges, grasses and leaf litter.	Known within 10km (OEH 2015a)	Not present
Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions	Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions	EEC		Occurs on plateaus and tablelands between 600-900m asl with loam or clay soils derived primarily from basalt, but may also be derived from mudstones, granites, alluvium and other substrates. Known from Bathurst Regional, Goulburn Mulwaree, Oberon, Palerang, Shoalhaven, Upper Lachlan and Wingecarribee LGAs. Open, variable canopy which may include Ribbon Gum, Narrow-leaved Peppermint, Mountain Gum and Snow Gum, over a sparse shrub layer and dense groundcover of herbs and grass. Community also includes derived native grasslands where trees have been removed.	Known within 10km (OEH 2015a)	Not present

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat association	Nature of record	Likelihood of occurrence in site
Temperate Highland Peat Swamps on Sandstone	Temperate Highland Peat Swamps on Sandstone		EEC	Occurs on sandstone in temperate highland regions from around 600–1100 m above sea level. Known from the Blue Mountains, Lithgow, Southern Highlands, and Bombala regions. Swamps occurring across a range of locations in the landscape, from hanging swamps to depressions in the landscape, or along watercourses. Wetter parts are occupied by sphagnum bogs and fens, with sedge and shrub associations in the drier parts.	Community known to occur within locality (DOTE 2015)	Not present
Upland Basalt Sydney Eucalypt Forests of the Sydney Basin Bioregion			EEC	Generally confined to the Sydney Basin IBRA Bioregion although some occurrences may extend outside the Sydney Basin Bioregion boundary, e.g. the southern extent at Sassafras, east of Nerriga NSW, and patches on the Boyd Plateau and Mt Werong. Generally tall open eucalypt forests found on igneous rock (predominately Tertiary basalt and microsyenite) in, or adjacent to, the Sydney Basin Bioregion.	Community likely to occur within locality (DOTE 2015)	Not present
Western Sydney Dry Rainforest and Moist Woodland on Shale	Western Sydney Dry Rainforest and Moist Woodland on Shale	Component EECs listed separately	CEEC	Occurs is generally gullies, sheltered slopes and rugged terrain in isolated patches, largely on the edges of the Cumberland Plain in NSW, with some patches on undulating terrain in the central parts of the Cumberland Plain (DOTE 2015).The dry rainforest occupies the lower slopes and gullies where conditions are more favourable for the development of a rainforest canopy layer. The ecological community grades into the moist woodland form, generally on the upper slopes, also extending onto more gently, undulating terrain. The ecological community may be associated with riparian vegetation (e.g. at Little Wheeny Creek and Redbank creek near Kurrajong and Grose Vale) and creeks	Community likely to occur within locality (DOTE 2015)	Present

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat association	Nature of record	Likelihood of occurrence in site
				and/or drainage lines may cut through the ecological community.		
Western Sydney Dry Rainforest in the Sydney Basin Bioregion	Western Sydney Dry Rainforest in the Sydney Basin Bioregion	EEC	Components may qualify as CEEC	Restricted to hilly country where it occurs on clay soils derived from Wianamatta shale on sheltered lower slopes and gullies. Very restricted and occurs mostly in the Razorback Range near Picton. Outlying occurrences at Grose Vale and Cattai. Canopy trees include Melaleuca styphelioides, Acacia implexa and Alectryon subcinereus. Shrub layer includes rainforest species Notolaea longifolia, Clerodendrum tomentosum and Pittosporum revolutum. The shrub layer combines with vines to form dense thickets in sheltered locations.	Known within 10km (OEH 2015a)	Not present
White Box Yellow Box Blakely's Red Gum Woodland	White Box Yellow Box Blakely's Red Gum Woodland	EEC	CEEC	Occurs on the tablelands and western slopes of NSW, on moderate to highly fertile soils. Found in areas with annual rainfall between 400 - 1200 mm, at altitudes between 170 - 1200 m asl. Open woodland/forest, characterised by Eucalyptus albens, E. melliodora and E. blakelyi. Intact sites are rare, but contain a high species diversity of trees, shrubs, climbers, grasses and particularly herbs. The NSW listing includes sites with/without canopy layer and areas with predominately exotic groundlayer, whereas to meet the federal listing criteria areas must	Predicted within 10km (DOTE 2015)	Not present

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat association	Nature of record	Likelihood of occurrence in site
				have either intact tree layer and predominately native groundlayer, or an intact ground layer with high species diversity but no remaining tree layer.		

Threatened flora known or predicted from the locality, habitat association and likelihood of occurring at the site.

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat association	Nature of record	Likelihood of occurrence in site	Notes
Acacia bynoeana	Bynoe's Wattle	E	V	This species is endemic to central eastern NSW, and is currently known from only 34 locations, many of which are only 1-5 plants. This species occurs mainly in heath and dry sclerophyll forest on sandy soils, seeming to prefer open, sometimes slightly disturbed sites such as trail margins, road edges, and in recently burnt open patches. This species flowers from September to March, and fruit matures in November.	Predicted to occur within 10km (DOTE 2015)	Unlikely	Suitable soil types and geomorphology not present.
Acacia gordonii		E	E	Disjunct populations in the lower Blue Mountains and the South Maroota/Glenorie areas, within the Hawkesbury, The Hills and Blue Mountains LGAs. Grows in dry sclerophyll forest and heathlands amongst or within rock platforms on sandstone outcrops.	Predicted to occur within 10km (DOTE 2015)	Unlikely	Suitable soil types and geomorphology not present.
Allocasuarina glareicola		E	E	Primarily restricted to small populations in and around Castlereagh NR (NW Cumberland Plain), but with an outlier population at Voyager Point, Liverpool. Also reported from Holsworthy Military Area. Grows on tertiary alluvial gravels, with yellow clayey subsoil and lateritic soil. Occurs in Castlereagh open woodland.	Predicted to occur within 10km (DOTE 2015)	Unlikely	Suitable soil types and geomorphology not present.

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat association	Nature of record	Likelihood of occurrence in site	Notes
Asterolasia elegans		E	E	Occurs north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby LGAs, may also occur in the western part of Gosford LGA. 7 known populations. Occurs on Hawkesbury sandstone, commonly amongst rocky outcrops and boulders in sheltered forests on mid- to lower slopes and valleys.	Predicted to occur within 10km (DOTE 2015)	Unlikely	Suitable soil types and geomorphology not present.
Cryptostylis hunteriana	Leafless Tongue Orchid	V	V	Occurs in coastal areas from East Gippsland to southern Queensland. Habitat preferences not well defined. Grows mostly in coastal heathlands, margins of coastal swamps and sedgelands, coastal forest, dry woodland, and lowland forest. Prefers open areas in the understorey and is often found in association with Cryptostylis subulata and the Cryptostylis erecta. Soils include moist sands, moist to dry clay loam and occasionally in accumulated eucalypt leaves. Flowers November-February.	Predicted to occur within 10km (DOTE 2015)	Unlikely	Suitable soil types and geomorphology not present.
Cynanchum elegans	White-flowered Wax Plant	E	E	Occurs from Gerroa (Illawarra) to Brunswick Heads and west to Merriwa in the upper Hunter. Most common near Kempsey. Usually occurs on the edge of dry rainforest or littoral rainforest, but also occurs in Coastal Banksia Scrub, open forest and woodland, and Melaleuca scrub. Soil and geology types are not	Predicted to occur within 10km (DOTE 2015)	Unlikely	Typical vegetation associations not present and not previosuly recorded in the locality.

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat association	Nature of record	Likelihood of occurrence in site	Notes
				limiting.			
Diuris tenuifolia		V	V	Occurs in western Sydney, predominately the Cumberland Plain as well as the Lower Blue Mountains and north to Yengo. Grows in scrubby/dry heath areas of Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays, and associated transitional communities including Castlereagh Scribbly Gum Woodland.	5 records within 10km (OEH 2015a)	Unlikely	Suitable soil types and geomorphology not present.
Eucalyptus benthamii	Camden White Gum	V	V	Occurs on the alluvial flats of the Nepean River and its tributaries. Known distribution from The Oaks (south) to Grose Wold (north) and Kedumba Valley (west). 2 major subpopulations: in Kedumba Valley and Bents Basin State Recreation Area. Occurs in wet open forest on alluvial flats, in well drained alluvial sands and gravels to 1 m deep.	4 records within 10km (OEH 2015a); Predicted within 10km (DOTE 2015)	Unlikely	Broadly suitable habitat present, but a large and readily detectable species that may be reliably excluded based on survey effort conducted.

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat association	Nature of record	Likelihood of occurrence in site	Notes
Grevillea juniperina subsp. juniperina	Juniper-leaved Grevillea	V		Occurs only within western Sydney in an area bounded by Blacktown, Erskine Park, Londonderry and Windsor. Outlier populations also at Kemps Creek and Pitt Town. Grows on reddish clay to sandy soils derived from Wianamatta Shale and Tertiary alluvium, typically containing lateritic gravels. Occurs in association with Cumberland Plain Woodland, Castlereagh Ironbark Woodland, Castlereagh Scribbly Gum Woodland and Shale/Gravel Transition Forests.	10 records within 10km (OEH 2015a) including a substantial population in the western precinct of the Fernhill estate (EcoLogical, 2010).	Unlikely	Suitable habitat present, but a large and readily detectable species that may be reliably excluded based on survey effort.
Marsdenia viridiflora subsp. viridiflora	Marsdenia viridiflora R. Br. subsp. viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	EP		Recent records are from Prospect, Bankstown, Smithfield, Cabramatta Creek and St Marys. Previously known north from Razorback Range. A climber that grows in vine thickets and open shale woodland.	17 records within 10km (OEH 2015a)	Unlikely	Suitable habitat present, but a large and readily detectable species that may be reliably excluded based on survey effort conducted.

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat association	Nature of record	Likelihood of occurrence in site	Notes
Melaleuca deanei	Deane's Paperbark	V	V	Occurs from Nowra- St Albans and west to the Blue Mountains, with most records in Ku-ring-gai / Berowra and Holsworthy/Wedderburn areas. Mostly grows on broad flat ridgetops, dry ridges and slopes and strongly associated with low nutrient sandy loam soils, sometimes with ironstone. Grows in heath- open forest, often in sandstone ridgetop woodland communities.	1 records within 10kmOEH 2015a, last recorded 2012 (OEH 2015a); Predicted within 10km (DOTE 2015)	Unlikely	Suitable soil types and geomorphology not present.
Micromyrtus minutiflora		E	V	Occurs in Richmond and Penrith areas in western Sydney. Grows in open forest on sandy clay or gravelly soils from Tertiary alluvium. Associated with Castlereagh Scribbly Gum Woodland, Ironbark Forest, Shale/Gravel Transition Forest, and other open forest types.	1 record within 10km, last recorded 2014 (OEH 2015a)	Unlikely	Suitable soil types and geomorphology not present.
Pelargonium sp. Striatellum (G.W.Carr 10345)	Omeo Stork's-bill	E	E	Omeo Storksbill Pelargonium sp. (G.W. Carr 10345), syn. P. striatellum, is a tufted perennial forb known from only 3 locations in NSW, with two on lake-beds on the basalt plains of the Monaro and one at Lake Bathurst. It has a narrow habitat that is usually just above the high-water level of irregularly inundated or ephemeral lakes, in the transition zone between surrounding grasslands or pasture and the wetland or aquatic communities.	Predicted to occur within 10km (DOTE 2015)	Nil	Suitable soil types and geomorphology not present and outside of known range.

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat association	Nature of record	Likelihood of occurrence in site	Notes
Persoonia acerosa	Needle Geebung	V	V	Recorded on central coast and in Blue Mountains, from Mt Tomah to Hill Top (though now believed extinct in Hill Top). Mainly in Katoomba, Wentworth Falls and Springwood areas. Inhabits dry sclerophyll forest, scrubby low woodland and heath on sandstone. Occurs in well-drained soils including sands, laterite and gravels between 550- 1000m asl. May occur in disturbed areas eg roadsides.	Predicted to occur within 10km (DOTE 2015)	Unlikely	Suitable soil types and geomorphology not present.
Persoonia hirsuta	Hairy Geebung	E	E	Occurs within the Blue Mountains, Southern Highlands and Sydney coastal regions from Hilltop to Glen Davis and Royal NP to Gosford. Population within the Hills Shire particularly important due to high density of plants. Grows on sandy soils in dry sclerophyll open forest, woodland and heath on sandstone up to 600m above sea level.	2 records within 10km (OEH 2015a); Predicted within 10km (DOTE 2015)	Unlikely	Suitable soil types and geomorphology not present.
Pimelea curviflora var. curviflora		V	V	Confined to area between north Sydney in the south and Maroota in the north-west. Former range extended to Parramatta River including Five Dock, Bellevue Hill and Manly. Grows on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands. Often grows amongst dense grasses and sedges. Flowers October to May.	Predicted to occur within 10km (DOTE 2015)	Unlikely	Suitable soil types and geomorphology not present.

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat association	Nature of record	Likelihood of occurrence in site	Notes
Pimelea spicata	Spiked Rice-flower	E	E	Disjunct populations within the Cumberland Plain (from Mount Annan and Narellan Vale to Freemans Reach and Penrith to Georges Hall) and Illawarra (from Mt Warrigal to Gerroa) (DEC 2005). In the Cumberland Plain region, restricted to areas which support or historically supported Cumberland Plain Woodland. Grows on well-structured clay soils derived from Wianamatta Shale. In the Illawarra, grows on variable soils in close proximity to the coast on hills or coastal headlands. Inhabits coastal woodland or grassland with emergent shrubs (OEH 2013).	1 record within 10km, last recorded 2005 (OEH 2015a); Predicted within 10km (DOTE 2015).	Possible	Suitable habitat present and a small, cryptic species that may not have been detected in field surveys
Pomaderris brunnea	Rufous Pomaderris	V	V	Mainly occurs in SW Sydney (Wollondilly and Camden LGAs), with other populations in the Hawkesbury-Wollemi region, near Walcha in the New England tablelands and Gippsland in VIC. In NSW, grows in moist woodland or open forest on clay and alluvial soils on flood plains and creek lines. Near Sydney occurs in open woodland dominated by E. amplifolia with Allocasuarina sp. and Bursaria sp. understorey, or on alluvial flats with eucalypts including E. elata, E. piperita and E. punctata (Sutter 2011).	Predicted to occur within 10km (DOTE 2015)	Unlikely	Suitable habitat present, but a large and readily detectable species that may be reliably excluded based on survey effort conducted.

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat association	Nature of record	Likelihood of occurrence in site	Notes
Pterostylis saxicola	Sydney Plains Greenhood	E	E	Occurs in western Sydney between Picton and Freemans Reach. Grows in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines. Associated vegetation above these rock shelves is sclerophyll forest or woodland on shale or shale/sandstone transition soils.	Predicted to occur within 10km (DOTE 2015)	Unlikely	Suitable soil types and geomorphology not present.
Pultenaea glabra	Smooth Bush-pea, Swamp Bush-pea	V	V	In NSW restricted to higher Blue Mountains in the Katoomba-Hazelbrook and Mt Victoria areas. Unconfirmed sightings in Mt Wilson and Mt Irvine areas. Grows in swamp margins, hillslopes, gullies and creekbanks and occurs within dry sclerophyll forest and tall damp heath on sandstone.	Predicted to occur within 10km (DOTE 2015)	Unlikely	Suitable soil types and geomorphology not present and outside of known range.
Pultenaea parviflora		E	V	Occurs on the Cumberland Plain, with core distribution from Windsor to Penrith and east to Dean Park, and outliers in Kemps Creek and Wilberforce. Grows in dry sclerophyll woodlands, forest or in grasslands on Wianamatta Shale, laterite or Tertiary alluvium, on infertile sandy to clay soils. Associated communities include Castlereagh Ironbark Forest, Shale Gravel transition Forest and intergrade with Castlereagh Scribbly Gum Woodland.	2 records within 10km (OEH 2015a); Predicted within 10km (DOTE 2015).	Unlikely	Suitable soil types and geomorphology not present.

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat association	Nature of record	Likelihood of occurrence in site	Notes
Rhizanthella slateri	Eastern Underground Orchid	V	E	The species grows in eucalypt forest but no informative assessment of the likely preferred habitat for the species is available (OEH 2013). Currently known only from 10 locations, including near Bulahdelah, the Watagan Mountains, the Blue Mountains, Wiseman's Ferry area, Agnes Banks and near Nowra. Flowers during October and November (Harden 1993).	Predicted to occur within 10km (DOTE 2015)	Possible	Suitable habitat present and a small, cryptic species that may not have been detected in field surveys
Streblus pendulinus	Siah's Backbone, Sia's Backbone, Isaac Wood		E	On the Australian mainland, Siah's Backbone is found in warmer rainforests, chiefly along watercourses. The altitudinal range is from near sea level to 800 m above sea level. The species grows in well-developed rainforest, gallery forest and drier, more seasonal rainforest (ATRP 2010).On Norfolk Island, the species is found in a variety of forest types, though it is rare (DNP 2010).	Predicted to occur within 10km (DOTE 2015)	Unlikely	Suitable soil types and geomorphology not present.
Tetratheca glandulosa	Glandular Pink-bell	V	V	Restricted to The Hills, Gosford, Hawkesbury, Hornsby, Ku-ring-gai, Pittwater, Ryde, Warringah, and Wyong LGAs. Associated with shale-sandstone transition habitat (shale-cappings over sandstone). Occupies ridgetops, upper-slopes and to a lesser extent mid-slope sandstone benches. Soils generally shallow, yellow, clayey/sandy loam, commonly with lateritic fragments. Vegetation varies from heath to open forest and is broadly equivalent to Sydney Sandstone Ridgetop Woodland	Predicted to occur within 10km (DOTE 2015)	Unlikely	Suitable soil types and geomorphology not present.

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat association	Nature of record	Likelihood of occurrence in site	Notes
				community.			
Thelymitra sp. Kangaroo (C.L.Jones 1610)	Kangaloon Sun-orchid		CE	Only known from three locations near Robertson in the Southern Highlands. Grows in seasonally swampy sedgeland on grey silty clay loam at 600–700 m above sea level. Flowers in late October and early November.	Predicted to occur within 10km (DOTE 2015)	Unlikely	Suitable soil types and geomorphology not present and outside of known range.

All information in this table is taken from NSW OEH and Commonwealth DOTE Threatened Species profiles (OEH, 2015a; DOTE 2015) unless otherwise stated. The codes used in this table are: CE – Critically Endangered; E – Endangered; V – Vulnerable; EP – Endangered Population; CEEC – Critically Endangered Ecological Community; EEC – Endangered Ecological Community.

Threatened fauna known or predicted from the locality, habitat association and likelihood of occurring at the site.

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat sssociation	Nature of record	Likelihood of occurrence in site	Notes
Birds							
Anthochaera phrygia	Regent Honeyeater	CE	E	In NSW confined to two known breeding areas: the Capertee Valley and Bundarra-Barraba region. Non-breeding flocks occasionally seen in coastal areas foraging in flowering Spotted Gum and Swamp Mahogany forests, presumably in response to drought. Inhabits dry open forest and woodlands, particularly Box-Ironbark woodland and riparian forests of River Sheoak, with an abundance of mature trees, high canopy cover and abundance of mistletoes.	3 records within 10km (OEH 2015a); Predicted within 10km (DOTE 2015)	Unlikley	Suitable habitat present within the Fernhill estate but not the site.
Botaurus poiciloptilus	Australasian Bittern	E	E	Widespread but uncommon over most NSW except the northwest. Favours permanent freshwater wetlands with tall dense reedbeds particularly Typha spp.and Eleocharis spp., with adjacent shallow, open water for foraging. Roosts during the day amongst dense reeds or rushes and feeds mainly at night on frogs, fish, yabbies, spiders, insects and snails.	1 record within 10km (OEH 2015a); Predicted within 10km (DOTE 2015)	Unlikely	Suitable habitat present within the Fernhill estate but not the site
Burhinus grallarius	Bush Stone-curlew	E		Scattered distribution across NSW. Inhabits lowland grassy woodland and open forest and, in coastal areas, Casuarina and Melaleuca woodlands, saltmarsh and mangroves. Requires a low, sparse groundcover, some fallen timber and leaf litter, and a general lack of a shrubby understory (OEH 2013).	1 records within 10km, last recorded 1996 (OEH 2015a)	Unlikely	Suitable habitat present within the Fernhill estate but not the site

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat sssociation	Nature of record	Likelihood of occurrence in site	Notes
Calocephalon fimbriatum	Gang-gang Cockatoo	V		This species is nomadic, spending summer in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests and winter at lower altitudes in drier more open eucalypt forest and woodlands, particularly in coastal areas. This species nests in hollow-bearing trees close to water with breeding taking place between October and January. Breeding usually occurs in tall mature sclerophyll forests that have a dense understorey, and occasionally in coastal forests.	10 records within 10km (OEH 2015a)	Unlikely	Suitable habitat present within the Fernhill estate but not the site
Chthonicola sagittata	Speckled Warbler	V		Within NSW most frequently reported from the hills and tablelands of the Great Dividing Range, rarely from the coast. Inhabits a wide range of Eucalyptus-dominated communities with a grassy understorey, a sparse shrub layer, often on rocky ridges or in gullies. Sedentary and requires large, relatively undisturbed remnants to persist in an area. Forages on the ground for seeds and insects, and nests in a slight hollow in the ground or at the base of a low dense plant.	5 records within 10km (OEH 2015a)	Unlikely	Suitable habitat present within the Fernhill estate but not the site
Daphoenositta chrysoptera	Varied Sittella	V		Sedentary, occurs across NSW from the coast to the far west. Inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Sensitive to habitat isolation and loss of structural complexity, and adversely affected by dominance of Noisy Miners. Cleared agricultural land is potentially a barrier to movement. Builds a cup-	10 records within 10km (OEH 2015a)	Unlikely	Suitable habitat present within the Fernhill estate but not the site

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat sssociation	Nature of record	Likelihood of occurrence in site	Notes
				shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.			
Ephippiorhynchus asiaticus	Black-necked Stork	E		In NSW, becomes increasingly uncommon south of the Northern Rivers region, and rarely occurs south of Sydney. Breeding recorded as far south as Buladelah, though most breeding in NSW occurs in the north-east. Primarily inhabits permanent freshwater wetlands and surrounding vegetation including swamps, floodplains, watercourses and billabongs, freshwater meadows, wet heathland, farm dams and shallow floodwaters. Will also forage in inter-tidal shorelines, mangrove margins and estuaries. Feeds in shallow, still water. Breeds during summer, nesting in or near a freshwater swamp.	1 record within 10km (OEH 2015a), last recorded 1994	Unlikely	Infrequently occurs in the Sydney region.
Erythrotriorchis radiatus	Red Goshawk	CE	V	Typically occurs in coastal and subcoastal areas, with 90% of recent records in NSW confined to the Northern Rivers and Northern Tablelands regions, north of the Clarence River. Formerly occurred south to Port Stephens. Prefer woodlands and forests with a mosaic of vegetation types that are open enough for fast manoeuvring flight, avoiding very open or very dense habitats. In NSW inhabits mixed subtropical rainforest, Melaleuca swamp forest and open	Predicted within 10km (DOTE 2015)	Unlikely	Infrequently occurs in the Sydney region.

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat sssociation	Nature of record	Likelihood of occurrence in site	Notes
				eucalypt forest along coastal rivers. Nests built within 1km of a permanent freshwater body in a large, tall tree(>20m) within a remnant stand. Home ranges large (120-200km2).			
Glossopsitta pusilla	Little Lorikeet	V		Occurs from coast to western slopes of the Great Dividing Range. Inhabits dry, open eucalypt forests and woodlands. Occurrence is positively associated with patch size, and with components of habitat complexity including canopy cover, shrub cover, ground cover, logs, fallen branches and litter. Feed primarily on profusely-flowering eucalypts and a variety of other species including melaleucas and mistletoes. On the western slopes and tablelands Eucalyptus albens and E. melliodora are particularly important food sources for pollen and nectar respectively. Mostly nests in small (opening approx. 3cm) hollows in living, smooth-barked eucalypts, especially Eucalyptus viminalis, E. blakelyi and E. dealbata. Most breeding records are from the western slopes.	1 record within 10km, last recorded 2005 (OEH 2015a)	Unlikely	Suitable habitat present within the Fernhill estate but not the site

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat sssociation	Nature of record	Likelihood of occurrence in site	Notes
Ixobrychus flavicollis	Black Bittern	V		Occurs from southern NSW to Cape York and the Kimberley, and southwest WA. Inhabits terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. May occur in flooded grassland, forest, woodland, rainforest and mangroves as long as there is permanent water. Roosts by day in trees or within reeds on the ground. Nests in branches overhanging water and breeds from December to March.	1 record within 10km, last recorded 1995 (OEH 2015a)	Unlikely	Suitable habitat present within the Fernhill estate but not the site
Lathamus discolor	Swift Parrot	E	E	Migratory, travelling to the mainland from March to October. Breeds in Tasmania from September to January. On the mainland, it mostly occurs in the southeast foraging on winter flowering eucalypts and lerps, with records of the species between Adelaide and Brisbane. Principal over-winter habitat is box-ironbark communities on the inland slopes and plains. Eucalyptus robusta, Corymbia maculata and C. gummifera dominated coastal forests are also important habitat.	10 records within 10km (OEH 2015a); Predicted within 10km(DOTE 2015)	Unlikely	Suitable habitat present within the Fernhill estate but not the site
Limosa limosa	Black-tailed Godwit	V	M; C,J,K	The Black-tailed Godwit is a migratory wading bird that breeds in Mongolia and Eastern Siberia and flies to Australia for the southern summer, arriving in August and leaving in March. In NSW, it is most frequently recorded at Kooragang Island (Hunter River estuary), with occasional records elsewhere along the north and south coast, and inland. Records in western NSW indicate that a regular inland passage is used by the species, as it may occur around any of the large	1 record within 10km, last recorded 1982 (OEH 2015a)	Unlikely	Suitable habitat present within the Fernhill estate but not the site

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat sssociation	Nature of record	Likelihood of occurrence in site	Notes
				lakes in the western areas during summer, when the muddy shores are exposed. It is usually found in sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats. It has also been found around muddy lakes and swamps, wet fields and sewerage treatment works.			
Lophoictinia isura	Square-tailed Kite	V		Occurs across NSW, resident in North, northeast and along west-flowing rivers. Summer breeding migrant to southeast of state. Inhabits a variety of habitats including woodlands and open forests, with preference for timbered watercourses. Favours productive forests on the coastal plain, box-ironbark-gum woodlands on the inland slopes, and Coolibah/River Red Gum on the inland plains. In Sydney area nests in mature living trees within 100m of ephemeral/permanent watercourse. Large home range > 100 km2.	5 records within 10km (OEH 2015a)	Unlikely	Suitable habitat present within the Fernhill estate but not the site
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	V		Considered a sedentary species, but local seasonal movements are possible. Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Occurrence is positively associated with patch size, and with components of habitat complexity including canopy cover, shrub cover, ground cover, logs, fallen branches and litter. Nests on low, live or dead forks or branches of trees or stumps, or	1 record within 10km (OEH 2015a)	Unlikely	Suitable habitat present within the Fernhill estate but not the site

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat sssociation	Nature of record	Likelihood of occurrence in site	Notes
				occasionally on fallen trees or limbs.			
Neophema pulchella	Turquoise Parrot	V		Occurs from coast to inland slopes. In coastal area, most common between Hunter and Northern Rivers, and further south in S Coast. Inhabits open eucalypt woodlands and forests, typically with a grassy understorey. Favours edges of woodlands adjoining grasslands or timbered creek lines and ridges. Feeds on the seeds of native and introduced grasses and other herbs. Grasslands and open areas provide important foraging habitat for this species while woodlands provide important roosting and breeding habitat. Nests in tree hollows, logs or posts from August to December.	1 record within 10km, last recorded 1982 (OEH 2015a)	Unlikely	Suitable habitat present within the Fernhill estate but not the site
Ninox connivens	Barking Owl	V		Occurs from coast to inland slopes and plains, though is rare in dense, wet forests east of the Great Dividing Range and sparse in higher parts of the tablelands and in the arid zone. Inhabits eucalypt woodlands, open forest, swamp woodlands, and, especially in inland areas, timber along watercourses. Roosts along creek lines in dense, tall understorey foliage (e.g. in Acacia and Casuarina), or dense eucalypt canopy. Nests in hollows of large, old eucalypts including Eucalyptus camaldulensis,	1 record within 10km, last recorded 2002 (OEH 2015a)	Unlikely	Suitable foraging and breeding habitat in the Fernhill estatesite but no breeding habitat and limited foraging habitat in the site.

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat sssociation	Nature of record	Likelihood of occurrence in site	Notes
				Eucalyptus albens, Eucalyptus polyanthemos and Eucalyptus blakelyi. Birds and mammals important prey during breeding. Territories range from 30 to 200 hectares.			
Ninox strenua	Powerful Owl	V		Occurs from the coast to the western slopes. Solitary and sedentary species. Inhabits a range of habitats from woodland and open sclerophyll forest to tall open wet forest and rainforest. Prefers large tracts of vegetation. Nests in large tree hollows (> 0.5 m deep), in large eucalypts (dbh 80-240 cm) that are at least 150 years old. Pairs have high fidelity to a small number of hollow-bearing nest trees and defend a large home range of 400 - 1,450 ha. Forages within open and closed woodlands as well as open areas.	13 records within 10km (OEH 2015a)	Unlikely	Suitable foraging and breeding habitat in the Fernhill estatesite but no breeding habitat and limited foraging habitat in the site.
Petroica boodang	Scarlet Robin	V		In NSW occurs from coast to inland slopes. Breeds in drier eucalypt forests and temperate woodlands, often on ridges and slopes, within open understorey of shrubs and grasses and sometimes in open areas. In autumn and winter it migrates to more open habitats such as grassy open woodland or paddocks with scattered trees. Abundant logs and coarse woody debris are important habitat components.	1 record within 10km, last recorded 1998 (OEH 2015a)	Unlikely	Suitable habitat present within the Fernhill estate but not the site (absence of wooden debris)

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat sssociation	Nature of record	Likelihood of occurrence in site	Notes
Petrcica phcenicea	Flame Robin	V		Breeds in upland moist eucalypt forests and woodlands, often on ridges and slopes, in areas of open understorey. Migrates in winter to more open lowland habitats such as grassland with scattered trees and open woodland on the inland slopes and plains. Forages from low perches, feeding on invertebrates taken from the ground, tree trunks, logs and other coarse woody debris. Fallen logs and coarse woody debris are important habitat components. Open cup nest of plant fibres and cobweb is often built near the ground in a sheltered niche, ledge or shallow cavity in a tree, stump or bank.	3 records within 10km (OEH 2015a)	Unlikely	Suitable habitat present within the Fernhill estate but not the site (absence of wooden debris)
Rcstratula australis	Australian Painted Snipe	E	V,M	Normally found in permanent or ephemeral shallow inland wetlands, either freshwater or brackish. Nests on the ground amongst tall reed-like vegetation near water. Feeds on mudflats and the water's edge taking insects, worm and seeds. Prefers fringes of swamps, dams and nearby marshy areas with cover of grasses, lignum, low scrub or open timber.	Predicted within 10km (DOTE 2015)	Unlikely	Suitable habitat present within the Fernhill estate but limited habitat in the site.
Stagcncpleura guttata	Diamond Firetail	V		Typically found west of the Great Dividing Range, but populations also occur in drier coastal areas including W Sydney, Hunter, Clarence and Snowy River valleys. Occurs in grassy eucalypt woodlands including Box Gum and Snow Gum communities, as well as open forest, mallee and natural and derived grasslands. Often found in riparian areas and occasionally in lightly wooded farmland. Nests in shrubby	1 record within 10km, last recorded 1990 (OEH 2015a)	Unlikely	Suitable habitat present within the Fernhill estate but not the site

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat sssociation	Nature of record	Likelihood of occurrence in site	Notes
				understorey or higher up under nests of other species.			
Stictonetta naevosa	Freckled Duck	V		Breeds in large, ephemeral swamps in the Murray-Darling, particularly along the Paroo and Lachlan Rivers and other Riverina rivers. In drier times moves to more permanent waters. Disperses during extensive inland droughts and may be found in coastal areas during such times. Prefers freshwater swamps/creeks with dense Cumbungi, Lignum or tea-tree. Nests in dense vegetation at or near water level.	2 records within 10km (OEH 2015a)	Unlikley	No breeding or foraging habitat in the site (absence of creeks,dams or swamps)
Tyto novaehollandiae	Masked Owl	V		Occurs across NSW except NW corner. Most common on the coast. Inhabits dry eucalypt woodlands from sea level to 1100 m. Roosts and breeds in large (>40cm) hollows and sometime caves in moist eucalypt forested gullies. Hunts along the edges of forests and roadsides. Home range between 500 ha and 1000 ha. Prey mostly terrestrial mammals but arboreal species may also be taken.	12 records within 10km (OEH 2015a)	Unlikely	Suitable foraging and breeding habitat in the Fernhill estatesite but no breeding habitat and limited foraging habitat in the site.

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat sssociation	Nature of record	Likelihood of occurrence in site	Notes
Tyto tenebricosa	Sooty Owl	V		Occurs in the coastal, escarpment and tablelands regions of NSW. More common in the north and absent from the western tablelands and further west. Inhabits tall, moist eucalypt forests and rainforests, and are strongly associated with sheltered gullies, particularly those with tall rainforest understorey. Roosts in tree hollows, amongst dense foliage in gullies or in caves, recesses or ledges of cliffs or banks. Nest in large (>40cm wide, 100cm deep) tree hollows in unlogged/unburnt gullies within 100m of streams or in caves.	1 record within 10km (OEH 2015a)	Unlikely	Suitable foraging and breeding habitat in the Fernhill estatesite but no breeding habitat and limited foraging habitat in the site.
Mammals							
Cercartetus nanus	Eastern Pygmy-possum	V		Occurs along the east coast of NSW, and inland to the Pillaga, Dubbo, Parkes and Wagga Wagga. Inhabits range of habitats from coastal heath and woodland though open and closed forests, subalpine heath and rainforest (Tulloch and Dickman 1995). Inhabits rainforest, sclerophyll forests and heath. Banksia spp. and myrtaceous shrubs and trees are favoured food sources and nesting sites in drier habitats. Diet mostly pollen and nectar from Banksia spp., Eucalyptus spp., Callistemon spp. and insects (Ward and Turner 2008). Nests in hollows in trees, under the bark of Eucalypts, forks of tea-trees, abandoned bird nests and Xanthorrhoea bases (Ward and Turner 2008, Tulloch and Dickman 2006).	1 record within 10km, last recorded 2004 (OEH 2015a)	Unlikley	There is no suitable foraging habitat in the site

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat sssociation	Nature of record	Likelihood of occurrence in site	Notes
Chalinolobus gouldii	Large-eared Pied Bat	V	V	Occurs from the coast to the western slopes of the divide. Largest numbers of records from sandstone escarpment country in the Sydney Basin and Hunter Valley (Hoye and Schulz 2008). Roosts in caves and mines and most commonly recorded from dry sclerophyll forests and woodlands. An insectivorous species that flies over the canopy or along creek beds (Churchill 2008). In southern Sydney appears to be largely restricted to the interface between sandstone escarpments and fertile valleys.	4 records within 10km (OEH 2015a); Predicted within 10km (DOTE 2015)	Unlikely	Suitable foraging habitat in the study area but habitat is limited in the site
Dasyurus maculatus	Spotted-tailed Quoll	V	E	Inhabits a range of environments including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Den sites are in hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces. Females occupy home ranges of up to 750 ha and males up to 3,500 ha, usually traversed along densely vegetated creek lines.	13 records within 10km (OEH 2015a); Predicted within 10km (DOTE 2015)	Unlikely	Suitable foraging habitat in the study area but habitat is limited in the site
Miniopterus australis	Little Bentwing-bat	V		Occurs from Cape York to Sydney. Inhabits rainforests, wet and dry sclerophyll forests, paperbark swamps and vine thickets. Only one maternity cave known in NSW, shared with Eastern Bentwing-bats at Willi Willi, near Kempsey. Outside breeding season roosts in caves, tunnels and mines and has been recorded in a tree hollow on one occasion. Forages for insects beneath the canopy of well-timbered habitats (Churchill 2008, Hoye and Hall	1 record within 10km, last recorded 2012 (OEH 2015a)	Unlikely	Suitable foraging habitat in the study area but habitat is limited in the site

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat sssociation	Nature of record	Likelihood of occurrence in site	Notes
				2008).			
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V		Generally occurs east of the Great Dividing Range along NSW coast (Churchill 2008). Inhabits various habitats from open grasslands to woodlands, wet and dry sclerophyll forests and rainforest. Essentially a cave bat but may also roost in road culverts, stormwater tunnels and other man-made structures. Only 4 known maternity caves in NSW, near Wee Jasper, Bungonia, Kempsey and Texas. Females may travel hundreds of kilometres to the nearest maternal colony (Churchill 2008).	15 records within 10km (OEH 2015a)	Unlikely	Suitable foraging habitat in the study area but habitat is limited in the site
Mormopterus norfolkensis	Eastern Freetail-bat	V		Occurs in dry sclerophyll forest and woodland east of the Great Dividing Range. Forages in natural and artificial openings in vegetation, typically within a few kilometres of its roost. Roosts primarily in tree hollows but also recorded from man-made structures or under bark (Churchill 2008).	8 records within 10km (OEH 2015a)	Unlikely	Suitable foraging habitat and potential roost sites in the Fernhill Estate but there is no breeding habitat and roosting habitat is limited in the site

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat sssociation	Nature of record	Likelihood of occurrence in site	Notes
Myctis macrcpus	Southern Myotis	V		Mainly coastal but may occur inland along large river systems. Usually associated with permanent waterways at low elevations in flat/undulating country, usually in vegetated areas. Forages over streams and watercourses feeding on fish and insects from the water surface. Roosts in a variety of habitats including caves, mine shafts, hollow-bearing trees, stormwater channels, buildings, under bridges and in dense foliage, typically in close proximity to water (Campbell 2011). Breeds November or December (Churchill 2008)	11 records within 10km (OEH 2015a)	Unlikely	Suitable foraging habitat and potential roost sites in the Fernhill Estate but there is no breeding or foraging habitat, and roosting habitat is limited in the site
Petaurus australis	Yellow-bellied Glider	V		Occurs along the east coast to the western slopes of the Great Dividing Range. Inhabits a variety of forest types but prefers tall mature eucalypt forest with high rainfall and rich soils. Relies on large hollow-bearing trees for shelter and nesting, with family groups of 2-6 typically denning together. In southern NSW its preferred habitat at low altitudes is moist gullies and creek flats in mature coastal forests. Mostly feeds on sap, nectar and honeydew.	6 records within 10km (OEH 2015a)	Unlikley	Preferred tall, moist forest foraging habitat not present and probably too few hollow-bearing trees to maintain a local population.
Petrcgale penicillata	Brush-tailed Rock-wallaby	E	V	Occurs from the Shoalhaven north to the Queensland border. Now mostly extinct west of the Great Dividing Range, except in the Warrumbungles and Mt Kaputar. Occurs on rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges facing north. Diet consists of vegetation in adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees.	1 record within 10km, last recorded 1994 (OEH 2015a); Predicted within 10km (DOTE 2015)	Unlikely	No suitable rocky escarpment habitat

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat sssociation	Nature of record	Likelihood of occurrence in site	Notes
Phascolarctcs cinereus	Koala	V	V	Occurs from coast to inland slopes and plains. Restricted to areas of preferred feed trees in eucalypt woodlands and forests. Home range varies depending on habitat quality, from < 2 to several hundred hectares.	19 records within 10km (OEH 2015a); Predicted within 10km (DOTE 2015)	Unlikely	Suitable foraging habitat in the study area but limited habitat in the site
Pctcrcus trioactylus trioactylus	Long-nosed Potoroo (SE mainland)	V	V	Restricted to east of the Great Dividing Range, with annual rainfall >760 mm. Inhabits coastal heath and dry and wet sclerophyll forests. Requires relatively thick ground cover and appears restricted to areas of light and sandy soil (Johnston 2008). Feeds on fungi, roots, tubers, insects and their larvae, and other soft-bodied animals in the soil.	Predicted within 10km (DOTE 2015)	Unlikely	No suitable coastal forest with sandy soils
Pseudomys novaehollandiae	New Holland Mouse, Pookila		V	Restricted to east of the Great Dividing Range, with annual rainfall >760 mm. Inhabits coastal heath and dry and wet sclerophyll forests. Requires relatively thick ground cover and appears restricted to areas of light and sandy soil (Johnston 2008). Feeds on fungi, roots, tubers, insects and their larvae, and other soft-bodied animals in the soil.	Predicted within 10km (DOTE 2015)	Unlikley	Preferred forest on sandy soils with thick groundcover are not present
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Roosts in camps within 20 km of a regular food source, typically in gullies, close to water and in vegetation with a dense canopy. Forages in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths, swamps and street trees, particularly in eucalypts, melaleucas and banksias. Highly mobile with movements largely determined by food availability (Eby and Law 2008). Will also forage in	15 records within 10km (OEH 2015a); Predicted within 10km (DOTE 2015)	Unlikely	Suitable foraging habitat in the study area but limited habitat in the site.

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat sssociation	Nature of record	Likelihood of occurrence in site	Notes
				urban gardens and cultivated fruit crops.			
Scotorax rueppellii	Greater Broad-nosed Bat	V		Occurs on the east coast and Great Dividing Range. Inhabits a variety of habitats from woodland to wet and dry sclerophyll forests and rainforest, also remnant paddock trees and timber-lined creeks, typically below 500m asl. Forages in relatively uncluttered areas, using natural or man-made openings in denser habitats. Usually roosts in tree hollows or fissures but also under exfoliating bark or in the roofs of old buildings. Females congregate in maternal roosts in suitable hollow trees (Hoye and Richards 2008, Churchill 2008).	4 records within 10km (OEH 2015a)	Unlikely	Suitable foraging habitat and potential roost sites in the study area but no roosting habitat and limited foraging habitat in the site.
Reptiles							
Hoplocephalus bungaroides	Broad-headed Snake	E	V	Nocturnal, sheltering in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter, and spring, moving to shelters in hollows of large trees within 200m of escarpments in summer. Feeds mostly on geckos and small skinks, and occasionally on frogs and small mammals.	OEH 2015aPredicted within 10km (DOTE 2015)	Unlikely	Preferred rocky escarpment habitat not present.

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat sssociation	Nature of record	Likelihood of occurrence in site	Notes
Frogs							
Heleioporus australiacus	Giant Burrowing Frog	V	V	Occurs along the coast and eastern slopes of the Great Dividing Range south from Wollemi National Park. Appears to exist as 2 populations with a 100km gap in records between Jervis Bay and Eden. Northern population occurs on sandy soils supporting heath, woodland or open forest. Breeds in ephemeral to intermittent streams with persistent pools. Only infrequently moves to breeding sites, most commonly found on ridges away from creeks, several hundred metres from water.	OEH 2015aPredicted within 10km (DOTE 2015)	Unlikley	Preferred ridgetop habitats on sandy soils not present
Litoria aurea	Green and Golden Bell Frog	E	V	Formerly occurred from Brunswick Heads to victoria, but >80% populations now extinct. Inhabits marshes, natural and artificial freshwater to brackish wetlands, dams and in stream wetlands. Prefers sites containing cumbungi (Typha spp.) or spike rushes (Eleocharis spp.), which are unshaded and have a grassy area and/or rubble as shelter/refuge habitat nearby. Gambusia holbrooki is a key threat as they feed on green and Golden Bell Frog eggs and tadpoles.	1 record within 10km (OEH 2015a); Predicted within 10km (DOTE 2015)	Unlikely	Suitable foraging habitat and potential breeding habitat absent in the study area

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat sssociation	Nature of record	Likelihood of occurrence in site	Notes
Litoria littlejohni	Littlejohn's Tree Frog, Heath Frog	V	V	Occurs on plateaus and eastern slopes of the Great Dividing Range south from Watagan State Forest. Occurs along permanent rocky streams with thick fringing vegetation associated with eucalypt woodlands and heaths among sandstone outcrops, hunting either in shrubs or on the ground.	Predicted within 10km (DOTE 2015)	Unlikley	Preferred rocky stream habitats on slopes and plateaus not present
Mixophyes balbus	Stuttering Frog, Southern Barred Frog (in Victoria)	E	V	Occurs along the east coast of Australia. Has undergone a massive range reduction particularly in the south of its range: within the Sydney Basin, White (2008a) located only 3 populations south of Sydney (Macquarie Pass and Mt Werong) and Daly et al. (2002, in White 2008a) found only 2 extant populations between Macquarie Pass and Victoria. Inhabits rainforest and wet, tall, open forest. Shelter in deep leaf litter and thick understorey vegetation on the forest floor. Feeds on insects and smaller frogs, breeding in streams during summer after heavy rain. The species does not occur in areas where the riparian vegetation has been disturbed or where there have been significant upstream human impacts (Mahony et al 1997).	Predicted within 10km (DOTE 2015)	Unlikley	Preferred rocky stream habitats in rainforest not present
Mixophyes iteratus	Giant Barred Frog, Southern Barred Frog	E	E	Occurs on the coast and ranges from south-eastern QLD to the Hawkesbury River in NSW, particularly in Coffs Harbour - Dorrigo area. Forage and live amongst deep, damp leaf litter in rainforest, moist eucalypt forest and nearby dry eucalypt forest. Breed in shallow, flowing rocky streams. Within Sydney Basin, confined to small	Predicted within 10km (DOTE 2015)	Unlikley	Preferred rocky stream habitats in rainforest not present

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat sssociation	Nature of record	Likelihood of occurrence in site	Notes
				populations in tall, wet forest in the Watagan Mountains north of the Hawkesbury and the lower Blue Mountains (White 2008b).			
Pseudophryne australis	Red-crowned Toadlet	V		Restricted to Sydney Basin, from Nowra to Pokolbin and west to Mt Victoria. Inhabits heathland and open woodland on Hawkesbury and Narrabeen Sandstones, within 100m of ridgelines. Breeds in ephemeral feeder creeks or flooded depressions, requiring unpolluted water between 5.5 and 6.5 pH. Shelters under rocks, amongst masses of dense vegetation or leaf litter. Populations restricted to immediate vicinity of breeding areas.	29 records within 10km (OEH 2015a)	Unlikley	Preferred ridgetop habitats on sandy soils not present
Fish							
Macquaria australasica	Macquarie Perch	V (FM Act)	E	Occurs in the upper reaches of the Lachlan, Murrumbidgee and Murray Rivers, and in parts of the Hawkesbury and Shoalhaven catchment areas.Inhabits river and lake habitats, especially the upper reaches of rivers and their tributaries. Requires clear water with deep, rocky holes and abundant cover (including aquatic vegetation, woody debris, large boulders and overhanging banks). Spawning occurs in spring and summer in shallow upland streams or flowing sections of river systems.	Predicted within 10km (DOTE 2015); Found in the Hawkesbury/ Nepean CMA	Unlikley	Preferred clear, deep, rocky streams are not present

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat sssociation	Nature of record	Likelihood of occurrence in site	Notes
Prototroctes maraena	Australian Grayling		V,M	Occurs in coastal rivers and streams south from the Shoalhaven River. Inhabits estuarine waters and coastal seas as larvae/juveniles, and freshwater rivers and streams as adults. Most of their lives are spent in freshwater rivers and streams in cool, clear waters with a gravel substrate and alternating pool and riffle zones, however can also occur in turbid water. The species can penetrate well inland, being recorded over 100 km inland from the sea. (Backhouse et al 2008).	Predicted within 10km (DOTE 2015)	Unlikley	Preferred clear, rocky streams are not present
Invertebrates							
Archaeophya adamsi	Adam's emerald dragonfly	E (FM Act)		The species is only known from a few sites in the greater Sydney region. Larvae have been found in small creeks with gravel or sandy bottoms, in narrow, shaded riffle zones with moss and rich riparian vegetation. Adult dragonflies generally fly away from the water to mature before returning to breed. Males congregate at breeding sites and often guard a territory. Females probably lay their eggs into the water.	Found in the Hawkesbury/ Nepean CMA (DPI 2015)	Unlikley	Preferred shady, gravel streams are not present
Austrocordulia leonardi	Sydney Hawk Dragonfly	E (FM Act)		The Sydney hawk dragonfly has a very restricted distribution. The known distribution of the species includes three locations in a small area south of Sydney, from Audley to Picton. The species is known from the Hawkesbury-Nepean, Georges River, Port Hacking and Karuah drainages. The Sydney hawk dragonfly has specific habitat requirements, and has only ever been	Found in the Hawkesbury/ Nepean CMA (DPI 2015)	Unlikley	Preferred deep, clear streams are not present

Scientific name	Common name	TSC Act status	EPBC Act status	Habitat sssociation	Nature of record	Likelihood of occurrence in site	Notes
				collected from deep and shady riverine pools with cooler water. Larvae are found under rocks where they co-exist with Austrocordulia refracta.			
Meridacium connecvirens	Cumberland Plain Land Snail	E		Occurs within a small area of the Cumberland Plain, from Richmond and Windsor to Picton. Found primarily under litter of bark, leaves and logs, or in loose soil around grass clumps within Cumberland Plain Woodland. Has also been found under rubbish. Feeds on fungus. During periods of drought can burrow into the soil to escape the dry conditions.	66 records within 10km (OEH 2015a)	Possible	Up to 45 live individuals or shells recorded in the Fernhill Estate. Potential lower quality habitat in the site.

Notes:

Marine and littoral threatened species (particularly shorebirds) which are restricted to coastal or estuarine environments were excluded from the threatened biota table.

Wildlife Atlas records: only records from 1980 or later were considered. The date of the last record is included for any species which have not been recorded within the last 20 years.

A search of the DPI online records viewer (DPI 2015a) and OEH Environet websites revealed no records of threatened fish species within the Sydney Metropolitan catchment.

All information in this table is taken from NSW OEH and Commonwealth DOTE Threatened Species profiles (OEH, 2015a; DOTE 2015) unless otherwise stated. The codes used in this table are: CE – Critically Endangered; E – Endangered; V – Vulnerable; EP – Endangered Population; CEEC – Critically Endangered Ecological Community; EEC – Endangered Ecological Community.

Appendix B – Survey results

Table 1 and 2 below illustrates the flora species recorded in the adjacent East Biobank within the same vegetation types as recorded in the site.

Appendix Table 1 Fernhill East biobank plant species recorded in plots (1 of 2)

Family	Scientific Name	Common Name	Exotic	Plot_1	Plot_11	Plot_12	Plot_16	Plot_17	Plot_18	Plot_20
Acanthaceae	*Brunchiella australis*	Blue Trumpet		1	1	2		1	1	2
Adiantaceae	*Cheilanthes sieberi subsp. sieberi*	Rock Fern		2	1	1	2	2	2	2
Amaranthaceae	*Alternanthera denticulata*	Lesser Joyweed				1				
Anthericaceae	*Laxmannia gracilis*	Slender Wire Lily							1	
Apiaceae	*Centella asiatica*	Indian Pennywort		1						
Apiaceae	*Platysace lanceolata*	Shrubby Platysace							2	
Apocynaceae	*Parsonsia straminea*	Common Silkpod			1					
Asteraceae	*Bidens pilosa*	Cobbler's Pegs	*	2			2	2		1
Asteraceae	*Calotis dentex*	Burr-daisy		2	2			2		2
Asteraceae	*Cirsium vulgare*	Spear Thistle	*				1			
Asteraceae	*Conyza bonariensis*	Flaxleaf Fleabane	*			1	1			
Asteraceae	*Euchiton sphaericus*	Star Cudweed				1				
Asteraceae	*Lagenophora stipitata*	Common Lagenophora							2	
Asteraceae	*Olearia microphylla*	White Dogwood				1	2			2
Asteraceae	*Senecio glastifolius*						1			
Asteraceae	*Senecio hispidulus*	Hill Fireweed						1		
Asteraceae	*Senecio madagascariensis*	Fireweed	*	2	2	2		1		2
Asteraceae	*Sigesbeckia orientalis subsp. orientalis*	Indian Weed				2	2			
Asteraceae	*Taraxacum officinale*	Dandelion	*	1		2	1			
Asteraceae	*Vernonia cinerea*			2		2	1	2	1	2
Cactaceae	*Opuntia stricta*	Common Prickly Pear	*				1			
Clusiaceae	*Hypericum gramineum*	Small St John's Wort								1
Convolvulaceae	*Dichondra repens*	Kidney Weed		2	2	2	2	2	1	1
Cyperaceae	*Cyperus sanguinolentus*						2	2		

Family	Scientific Name	Common Name	Exotic	Plot_1	Plot_11	Plot_12	Plot_16	Plot_17	Plot_18	Plot_20
Cyperaceae	*Gahnia aspera*	Rough Saw-sedge		2	2				1	2
Cyperaceae	*Lepidosperma gunnii*								1	
Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge			1				2	
Dilleniaceae	*Hibbertia aspera*	Rough Guinea Flower							2	
Dilleniaceae	*Hibbertia diffusa*	Wedge Guinea Flower			1			1	1	
Fabaceae (Faboideae)	*Desmodium brachypodum*	Large Tick-trefoil					1	1		
Fabaceae (Faboideae)	*Desmodium rhytidophyllum*			2						
Fabaceae (Faboideae)	*Desmodium varians*	Slender Tick-trefoil				1	2	2		1
Fabaceae (Faboideae)	*Glycine clandestina*	Twining glycine							1	
Fabaceae (Faboideae)	*Glycine microphylla*	Small-leaf Glycine		2	1	1	2			1
Fabaceae (Faboideae)	*Glycine tabacina*	Variable Glycine		2		1	2		2	2
Fabaceae (Faboideae)	*Hardenbergia violacea*	False Sarsaparilla		1			1	2	1	1
Fabaceae (Faboideae)	*Indigofera australis*	Australian Indigo		1			1			
Fabaceae (Faboideae)	*Jacksonia scoparia*	Dogwood			1					
Fabaceae (Mimosoideae)	*Acacia buxifolia*	Box-leaved Wattle		3	4			1	1	
Fabaceae (Mimosoideae)	*Acacia decurrens*	Black Wattle					3	3		
Fabaceae (Mimosoideae)	*Acacia implexa*	Hickory Wattle				2		2		
Fabaceae (Mimosoideae)	*Acacia parramattensis*	Parramatta Wattle		2	3	3	2		3	4
Geraniaceae	*Geranium homeanum*					1				
Geraniaceae	*Geranium sanguineum*	Native Geranium				1				
Goodeniaceae	*Goodenia hederacea*	Ivy Goodenia			1	1				
Lamiaceae	*Clerodendrum tomentosum*	Hairy Clerodendrum			2		3	3		
Lamiaceae	*Plectranthus parviflorus*							3		
Lobeliaceae	*Pratia purpurascens*	Whiteroot		2	2			3	2	2
Lomandraceae	*Lomandra confertifolia subsp. rubiginosa*								1	
Lomandraceae	*Lomandra gracilis*							1	1	2

Family	Scientific Name	Common Name	Exotic	Plot_1	Plot_11	Plot_12	Plot_16	Plot_17	Plot_18	Plot_20
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush							1	
Lomandraceae	*Lomandra multiflora subsp. multiflora*	Many-flowered Mat-rush							2	
Luzuriagaceae	*Geitonoplesium cymosum*	Scrambling Lily			1		2			
Malvaceae	*Sida rhombifolia*	Paddy's Lucerne	*	2		2	2			1
Meliaceae	*Melia azedarach*	White Cedar					1			
Myoporaceae	*Eremophila debilis*	Amulla				1				
Myrtaceae	*Angophora floribunda*	Rough-barked Apple					3	3		
Myrtaceae	*Eucalyptus crebra*	Narrow-leaved Ironbark			3			3	3	
Myrtaceae	*Eucalyptus eugenioides*	Thin-leaved Stringybark		2	4					
Myrtaceae	*Eucalyptus fibrosa*	Red Ironbark		3	3	1			3	3
Myrtaceae	*Eucalyptus punctata*	Grey Gum		2					4	
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum		2		4	4	3		4
Orchidaceae	*Pterostylis sp.*	Greenhood							2	
Oxalidaceae	*Oxalis perennans*					2		1		
Passifloraceae	*Passiflora herbertiana*				1		1			
Phormiaceae	*Dianella caerulea var. producta*				1				2	
Phormiaceae	*Dianella revoluta*	Blueberry Lily							1	
Phyllanthaceae	*Breynia oblongifolia*	Coffee Bush			2			2		
Pittosporaceae	*Billardiera scandens*	Hairy Apple Berry			2				2	
Pittosporaceae	*Bursaria spinosa*	Native Blackthorn		2	2	2	2			2
Plantaginaceae	*Plantago gaudichaudii*	Narrow Plantain						1		
Plantaginaceae	*Plantago lanceolata*	Lamb's Tongues	*	1		1	2			
Plantaginaceae	*Veronica plebeia*	Trailing Speedwell		2	2		2	2		
Poaceae	*Andropogon virginicus*	Whisky Grass	*	2						
Poaceae	*Aristida ramosa*	Purple Wiregrass		3	2			1	2	2
Poaceae	*Aristida vagans*	Threeawn Speargrass		3			1		1	

Family	Scientific Name	Common Name	Exotic	Plot_1	Plot_11	Plot_12	Plot_16	Plot_17	Plot_18	Plot_20
Poaceae	*Chloris gayana*	Rhodes Grass	*			2	1			
Poaceae	*Chloris sp.*		*	2						
Poaceae	*Cymbopogon refractus*	Barbed Wire Grass		2	2	2				
Poaceae	*Dichelachne micrantha*	Shorthair Plumegrass						2		1
Poaceae	*Digitaria ischaemum*		*	1						
Poaceae	*Digitaria parviflora*	Small-flowered Finger Grass			1		1	2		2
Poaceae	*Digitaria ramularis*	Finger Panic Grass		2						
Poaceae	*Echinopogon caespitosus*	Bushy Hedgehog-grass		3	2	2	1		2	2
Poaceae	*Entolasia marginata*	Bordered Panic					2	2		
Poaceae	*Entolasia stricta*	Wiry Panic		3	2	2		3	2	
Poaceae	*Eragrostis brownii*	Brown's Lovegrass							1	
Poaceae	*Eragrostis curvula*	African Lovegrass	*				1	1		
Poaceae	*Eragrostis leptostachya*	Paddock Lovegrass			2	2	1	1		1
Poaceae	*Imperata cylindrica*	Blady Grass				2				
Poaceae	*Microlaena stipoides*	Weeping Grass		4	3	3	3	2	2	3
Poaceae	*Oplismenus aemulus*				1	2	2	2		
Poaceae	*Oplismenus imbecillis*							2		
Poaceae	*Panicum effusum*	Hairy Panic						1		
Poaceae	*Panicum simile*	Two-colour Panic			1					
Poaceae	*Paspalum dilatatum*	Paspalum	*	1						
Poaceae	*Setaria parviflora*		*	2			1	1		1
Poaceae	*Setaria pumila*	Pale Pigeon Grass	*			2				
Poaceae	*Sporobolus creber*	Slender Rat's Tail Grass						1		
Poaceae	*Sporobolus elongatus*	Slender Rat's Tail Grass		1						
Poaceae	*Themeda australis*	Kangaroo Grass				2	3	3		5
Proteaceae	*Persoonia linearis*	Narrow-leaved Geebung							3	

Family	Scientific Name	Common Name	Exotic	Plot_1	Plot_11	Plot_12	Plot_16	Plot_17	Plot_18	Plot_20
Ranunculaceae	*Clematis aristata*	Old Man's Beard			1					
Rhamnaceae	*Pomaderris ferruginea*				1					
Rosaceae	*Rubus fruticosus sp. agg.*	Blackberry complex	*	1		2				
Rubiaceae	*Pomax umbellata*	Pomax			1				1	
Santalaceae	*Exocarpos cupressiformis*	Cherry Ballart					1		1	1
Sapindaceae	*Dodonaea triquetra*	Large-leaf Hop-bush							3	
Solanaceae	*Solanum campanulatum*								1	
Solanaceae	*Solanum prinophyllum*	Forest Nightshade			1			1	1	
Verbenaceae	*Lantana camara*	Lantana	*	3	3	3	4	4	1	2
Verbenaceae	*Verbena bonariensis*	Purpletop	*	2		2	2			1
Violaceae	*Viola hederacea*	Ivy-leaved Violet		1		1				1
Vitaceae	*Cayratia clematidea*	Native Grape					2			

*** = Exotic**

1 = Vegetation Zones:

2 = Cover Abundance:

1. Less than 5% and rare; 2. Less than 5% and common; 3. 6 – 15%; 4. 16 – 25%; 5. 26 – 50%; 6. 51 – 75%; 7. 76 – 100%.

Appendix Table 2 Fernhill East biobank plant species recorded in plots (2 of 2)

Family	Scientific Name	Common Name	Exotic	Plot_25	Plot_27	Plot_28	Plot_29	Plot_30	Plot_31
Acanthaceae	*Brunoniella australis*	Blue Trumpet		1		2	2	2	
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower			1				
Adiantaceae	*Adiantum aethiopicum*	Common Maidenhair					2		1
Adiantaceae	*Cheilanthes sieberi subsp. sieberi*	Rock Fern		2	2	2	1		
Apiaceae	*Centella asiatica*	Indian Pennywort					2		
Apiaceae	*Platysace lanceolata*	Shrubby Platysace			1				
Apocynaceae	*Araujia sericifera*	Moth Vine	*						2
Asteraceae	*Bidens pilosa*	Cobbler's Pegs	*			2	2	2	2
Asteraceae	*Calotis dentex*	Burr-daisy		2	2		2	2	
Asteraceae	*Conyza bonariensis*	Flaxleaf Fleabane	*			1			
Asteraceae	*Ozothamnus diosmifolius*	White Dogwood						1	
Asteraceae	*Senecio hispidulus*	Hill Fireweed							
Asteraceae	*Senecio madagascariensis*	Fireweed	*			2			
Asteraceae	*Taraxacum officinale*	Dandelion	*	1		1			
Asteraceae	*Vernonia cinerea*					2			
Bignoniaceae	*Jacaranda mimosifolia*	Jacaranda	*	1					
Chenopodiaceae	*Einadia hastata*	Berry Saltbush				3			2
Commelinaceae	*Commelina cyanea*	Native Wandering Jew				2			
Convolvulaceae	*Dichondra repens*	Kidney Weed		1		2	2	1	2
Cyperaceae	*Cyperus sp.*								1
Cyperaceae	*Gahnia aspera*	Rough Saw-sedge		3	1	1	2	1	1
Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge			2				
Fabaceae (Faboideae)	*Daviesia ulicifolia*	Gorse Bitter Pea			1				

Family	Scientific Name	Common Name	Exotic	Plot_25	Plot_27	Plot_28	Plot_29	Plot_30	Plot_31
Fabaceae (Faboideae)	*Glycine clandestina*	Twining glycine			2	2	2		
Fabaceae (Faboideae)	*Glycine microphylla*	Small-leaf Glycine		1			2	1	2
Fabaceae (Faboideae)	*Glycine tabacina*	Variable Glycine				1			
Fabaceae (Faboideae)	*Hardenbergia violacea*	False Sarsaparilla		1					
Fabaceae (Faboideae)	*Indigofera australis*	Australian Indigo					1	1	
Fabaceae (Faboideae)	*Podolobium ilicifolium*	Prickly Shaggy Pea			1				
Fabaceae (Mimosoideae)	*Acacia buxifolia*	Box-leaved Wattle		4		4	2		
Fabaceae (Mimosoideae)	*Acacia decurrens*	Black Wattle							2
Fabaceae (Mimosoideae)	*Acacia implexa*	Hickory Wattle					2		3
Fabaceae (Mimosoideae)	*Acacia parramattensis*	Parramatta Wattle		2	4	1	3	4	4
Geraniaceae	*Geranium homeanum*						1		
Goodeniaceae	*Scaevola albida*	Pale Fan-flower					2	1	
Lamiaceae	*Clerodendrum tomentosum*	Hairy Clerodendrum		2				2	2
Lamiaceae	*Plectranthus parviflorus*								2
Lobeliaceae	*Pratia purpurascens*	Whiteroot			1	1			
Lomandraceae	*Lomandra confertifolia subsp. rubiginosa*				3				
Lomandraceae	*Lomandra gracilis*					2			
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush			2	1			
Lomandraceae	*Lomandra multiflora subsp. multiflora*	Many-flowered Mat-rush			1	2			
Luzuriagaceae	*Geitonoplesium cymosum*	Scrambling Lily				2	2		2
Malvaceae	*Sida rhombifolia*	Paddy's Lucerne	*	2					
Myrtaceae	*Angophora subvelutina*	Broad-leaved Apple							3
Myrtaceae	*Corymbia eximia*	Yellow Bloodwood				1			
Myrtaceae	*Eucalyptus crebra*	Narrow-leaved Ironbark			4	4	4	3	3
Myrtaceae	*Eucalyptus eugenioides*	Thin-leaved Stringybark		3	3				
Myrtaceae	*Eucalyptus moluccana*	Grey Box				1			

Family	Scientific Name	Common Name	Exotic	Plot_25	Plot_27	Plot_28	Plot_29	Plot_30	Plot_31
Myrtaceae	*Eucalyptus punctata*	Grey Gum		2	3	3	1	3	
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum							4
Oleaceae	*Notelaea longifolia*	Large Mock-olive			1				
Oxalidaceae	*Oxalis perennans*					2	1		
Passifloraceae	*Passiflora herbertiana*				1	2	2	1	2
Phormiaceae	*Dianella caerulea var. producta*			1					
Phyllanthaceae	*Breynia oblongifolia*	Coffee Bush		2		1			1
Pittosporaceae	*Billardiera scandens*	Hairy Apple Berry			2				
Pittosporaceae	*Bursaria spinosa*	Native Blackthorn		1		2	1		
Plantaginaceae	*Plantago lanceolata*	Lamb's Tongues	*	1					
Plantaginaceae	*Veronica plebeia*	Trailing Speedwell		1		1	2		
Poaceae	*Andropogon virginicus*	Whisky Grass	*	2					
Poaceae	*Aristida vagans*	Threeawn Speargrass		4	3				
Poaceae	*Chloris gayana*	Rhodes Grass	*	2		1			1
Poaceae	*Chloris sp.*		*		1				
Poaceae	*Dichelachne micrantha*	Shorthair Plumegrass		2		2			
Poaceae	*Digitaria sp.*	A Finger Grass	*	3					
Poaceae	*Echinopogon caespitosus*	Bushy Hedgehog-grass		3	3				
Poaceae	*Enneapogon avenaceus*	Bottle Washers			3				
Poaceae	*Entolasia marginata*	Bordered Panic					2	1	
Poaceae	*Entolasia stricta*	Wiry Panic		3	2	2	4	3	2
Poaceae	*Eragrostis curvula*	African Lovegrass	*			1			
Poaceae	*Eragrostis leptostachya*	Paddock Lovegrass		3					
Poaceae	*Microlaena stipoides*	Weeping Grass		2		4	4	3	3
Poaceae	*Oplismenus aemulus*					2	3	2	4
Poaceae	*Panicum simile*	Two-colour Panic		3		2			

Family	Scientific Name	Common Name	Exotic	Plot_25	Plot_27	Plot_28	Plot_29	Plot_30	Plot_31
Poaceae	*Setaria sp.*		*	1					
Poaceae	*Themeda australis*	Kangaroo Grass			1	2			
Proteaceae	*Persoonia linearis*	Narrow-leaved Geebung		2	2				
Ranunculaceae	*Clematis aristata*	Old Man's Beard							1
Rhamnaceae	*Alphitonia excelsa*	Red Ash					2		
Rubiaceae	*Pomax umbellata*	Pomax			1				
Santalaceae	*Exocarpos cupressiformis*	Cherry Ballart				2			
Santalaceae	*Exocarpos strictus*	Dwarf Cherry			2				
Sapindaceae	*Dodonaea triquetra*	Large-leaf Hop-bush		3	3				
Solanaceae	*Solanum prinophyllum*	Forest Nightshade					1	1	2
Stackhousiaceae	*Stackhousia viminea*	Slender Stackhousia				1			
Ulmaceae	*Trema tomentosa var. aspera*	Native Peach							3
Verbenaceae	*Lantana camara*	Lantana	*	3	1	5	5	5	4
Verbenaceae	*Verbena bonariensis*	Purpletop	*	1					
Vitaceae	*Cayratia clematidea*	Native Grape					2		2

Note:

- Plot numbers listed are a subset of those collected for the adjacent Fernhill East Biobank
- * = Exotic
- Cover Abundance:

1. Less than 5% and rare
2. Less than 5% and common
3. 6 – 15%
4. 16 – 25%
5. 26 – 50%

6. 51 – 75%
7. 76 – 100%

Appendix Table 3 Fernhill East Biobank opportunistic fauna observations

Table 3 lists fauna species recorded in the adjacent Fernhill East Biobank including those where habitat is present within the site.

Class	Family	Exotic	Scientific Name	Common Name	TSC Status	EPBC Status	Presence of habitat in site
Amphibia	Hylidae		*Litoria verreauxii verreauxii*	Verreaux's Tree Frog (subsp)			Yes
Amphibia	Myobatrachidae		*Limnodynastes peronii*	Brown-striped Frog			No
Amphibia	Myobatrachidae		*Crinia signifera*	Common Eastern Froglet			No
Aves	Acanthizidae		*Acanthiza pusilla*	Brown Thornbill			Yes
Aves	Acanthizidae		*Acanthiza lineata*	Striated Thornbill			Yes
Aves	Acanthizidae		*Smicrornis brevirostris*	Weebill			Yes
Aves	Acanthizidae		*Sericornis frontalis*	White-browed Scrubwren			Yes
Aves	Acanthizidae		*Acanthiza nana*	Yellow Thornbill			Yes
Aves	Accipitridae		*Accipiter fasciatus*	Brown Goshawk			Yes
Aves	Accipitridae		*Accipiter cirrocephalus*	Collared Sparrowhawk			Yes
Aves	Alcedinidae		*Ceyx azureus*	Azure Kingfisher			No
Aves	Alcedinidae		*Dacelo novaeguineae*	Laughing Kookaburra			Yes
Aves	Anatidae		*Cygnus atratus*	Black Swan			No
Aves	Anatidae		*Aythya australis*	Hardhead			No
Aves	Anatidae		*Anas superciliosa*	Pacific Black Duck			No
Aves	Ardeidae		*Ardea ibis*	Cattle Egret			Yes
Aves	Ardeidae		*Ardea pacifica*	White-necked Heron			No
Aves	Artamidae		*Cracticus tibicen*	Australian Magpie			Yes
Aves	Artamidae		*Cracticus torquatus*	Grey Butcherbird			Yes
Aves	Artamidae		*Strepera graculina*	Pied Currawong			Yes
Aves	Cacatuidae		*Eolophus roseicapillus*	Galah			Yes
Aves	Cacatuidae		*^Calyptorhynchus lathami*	Glossy Black-Cockatoo	V		Yes
Aves	Cacatuidae		*Cacatua sanguinea*	Little Corella			Yes

Class	Family	Exotic	Scientific Name	Common Name	TSC Status	EPBC Status	Presence of habitat in site
Aves	Cacatuidae		*Cacatua galerita*	Sulphur-crested Cockatoo			Yes
Aves	Cacatuidae		*Calyptorhynchus funereus*	Yellow-tailed Black-cockatoo			Yes
Aves	Charadriidae		*Vanellus miles*	Masked Lapwing			Yes
Aves	Climacteridae		*Cormobates leucophaea*	White-throated Treecreeper			Yes
Aves	Columbidae		*Geopelia humeralis*	Bar-shouldered Dove			Yes
Aves	Columbidae		*Macropygia amboinensis*	Brown Cuckoo-dove			Yes
Aves	Columbidae		*Leucosarcia picata*	Wonga Pigeon			No
Aves	Corvidae		*Corvus coronoides*	Australian Raven			Yes
Aves	Cuculidae		*Cacomantis flabelliformis*	Fan-tailed Cuckoo			Yes
Aves	Estrildidae		*Taeniopygia bichenovii*	Double-barred Finch			Yes
Aves	Estrildidae		*Neochmia temporalis*	Red-browed Finch			Yes
Aves	Hirundinidae		*Hirundo neoxena*	Welcome Swallow			Yes
Aves	Maluridae		*Malurus cyaneus*	Superb Fairy-wren			Yes
Aves	Meliphagidae		*Manorina melanophrys*	Bell Miner			Yes
Aves	Meliphagidae		*Acanthorhynchus tenuirostris*	Eastern Spinebill			Yes
Aves	Meliphagidae		*Meliphaga lewinii*	Lewin's Honeyeater			Yes
Aves	Meliphagidae		*Manorina melanocephala*	Noisy Miner			Yes
Aves	Meliphagidae		*Anthochaera carunculata*	Red Wattlebird			Yes
Aves	Meliphagidae		*Melithreptus lunatus*	White-naped Honeyeater			Yes
Aves	Meliphagidae		*Lichenostomus penicillatus*	White-plumed Honeyeater			Yes
Aves	Meliphagidae		*Lichenostomus chrysops*	Yellow-faced Honeyeater			Yes
Aves	Monarchidae		*Myiagra rubecula*	Leaden Flycatcher			Yes
Aves	Monarchidae		*Grallina cyanoleuca*	Magpie-lark			Yes
Aves	Monarchidae		*Myiagra inquieta*	Restless Flycatcher			Yes

Class	Family	Exotic	Scientific Name	Common Name	TSC Status	EPBC Status	Presence of habitat in site
Aves	Neosittidae		*Daphoenositta chrysoptera*	Varied Sittella	V		Yes
Aves	Oriolidae		*Oriolus sagittatus*	Olive-backed Oriole			Yes
Aves	Pachycephalidae		*Pachycephala pectoralis*	Golden Whistler			Yes
Aves	Pachycephalidae		*Colluricincla harmonica*	Grey Shrike-thrush			Yes
Aves	Pardalotidae		*Pardalotus punctatus*	Spotted Pardalote			Yes
Aves	Pardalotidae		*Pardalotus striatus*	Striated Pardalote			Yes
Aves	Petroicidae		*Eopsaltria australis*	Eastern Yellow Robin			Yes
Aves	Petroicidae		*Microeca fascinans*	Jacky Winter			Yes
Aves	Petroicidae		*Petroica rosea*	Rose Robin			Yes
Aves	Phalacrocoracidae		*Microcarbo melanoleucos*	Little Pied Cormorant			Yes
Aves	Phasianidae		*Coturnix ypsilophora*	Brown Quail			Yes
Aves	Podicipedidae		*Tachybaptus novaehollandiae*	Australasian Grebe			No
Aves	Psittacidae		*Alisterus scapularis*	Australian King-Parrot			Yes
Aves	Psittacidae		*Platycercus elegans*	Crimson Rosella			Yes
Aves	Psittacidae		*Platycercus eximius*	Eastern Rosella			Yes
Aves	Psittacidae		*Trichoglossus haematodus*	Rainbow Lorikeet			Yes
Aves	Psittacidae		*Psephotus haematonotus*	Red-rumped Parrot			Yes
Aves	Psophodidae		*Psophodes olivaceus*	Eastern Whipbird			Yes
Aves	Ptilonorhynchidae		*Ptilonorhynchus violaceus*	Satin Bowerbird			Yes
Aves	Rallidae		*Gallinula tenebrosa*	Dusky Moorhen			No
Aves	Rallidae		*Fulica atra*	Eurasian Coot			No
Aves	Rallidae		*Porphyrio porphyrio*	Purple Swamphen			No
Aves	Rhipiduridae		*Rhipidura albiscapa*	Grey Fantail			Yes

Class	Family	Exotic	Scientific Name	Common Name	TSC Status	EPBC Status	Presence of habitat in site
Aves	Rhipiduridae		*Rhipidura leucophrys*	Willie wagtail			Yes
Aves	Threskiornithidae		*Threskiornis spinicollis*	Straw-necked Ibis			No
Aves	Threskiornithidae		*Platalea flavipes*	Yellow-billed Spoonbill			No
Aves	Timaliidae		*Zosterops lateralis*	Silvereye			Yes
Aves	Turdidae	*	*Turdus merula*	Eurasian Blackbird			Yes
Gastropoda	Camaenidae		*Meridolum corneovirens*	Cumberland Plain Land Snail	E		Yes
Mammalia	Bovidae	*	*Bos taurus*	European cattle			Yes
Mammalia	Bovidae	*	*Capra hircus*	Goat			Yes
Mammalia	Cervidae	*	*Cervus timorensis*	Rusa deer			Yes
Mammalia	Macropodidae		*Macropus giganteus*	Eastern Grey Kangaroo			Yes
Mammalia	Macropodidae		*Macropus rufogriseus*	Red-necked wallaby			Yes
Mammalia	Molossidae		*Mormopterus "Species 2"*	Undescribed Freetail Bat			Yes
Mammalia	Phalangeridae		*Trichosurus vulpecula*	Common Brushtail Possum			Yes
Mammalia	Rhinolophidae		*Rhinolophus megaphyllus*	Eastern Horseshoe-bat			Yes
Reptilia	Scincidae		*Lampropholis delicata*	Dark-flecked Garden Sunskink			Yes
Reptilia	Scincidae		*Eulamprus quoyii*	Eastern Water-skink			Yes

Key: E – endangered, V – vulnerable.

Appendix C – Assessments of Significance

Overview

Assessments of the likely significance of impacts of the proposal on these threatened biota have been prepared pursuant to Section 5A of the EPA Act (the seven part test). Consideration has also been given to the *Matters of National Environmental Significance Assessment of significance guidelines* when assessing those species that are also listed under the EPBC Act (DoE, 2015).

Assessments of significance for the following affected threatened biota have been prepared:

- Threatened flora species
  - Spiked Rice flower (*Pimelea spicata*)
- Threatened ecological communities
  - Cumberland Plain Woodland
  - Shale Sandstone Transition Forest
  - Moist Shale Woodland
- Threatened fauna species
  - Cumberland Plain Land Snail (*Meridolum corneovirens*)

Given the limited scale of impacts arising from the proposal and impact mitigation and environmental management measures described in Section 6, no additional threatened biota outside of the proposal site are likely to be affected by off-site impacts of the proposal.

Assessment of Significance for Cumberland Plain Woodland (CEEC under the TSC and EPBC Act)
a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,
Not applicable to this CEEC.
b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,
Not applicable to this CEEC.
c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
The proposal would require the removal of 0.33 hectares of this CEEC and the modification of a further 0.09 hectares within the site for APZ operation and maintenance. The removal of 0.33 hectares of Cumberland Plan Woodland is approximately 0.79 % of the total estimated area of that vegetation community in the biobanks within the Fernhill Estate (around 41.84 ha) that would be set aside for conservation. This minor reduction in extent would not threaten the viability or persistence of the CEEC in the locality or the region. A CEMP is recommended for the proposal, which would contain measures to avoid direct and indirect impacts on native vegetation adjoining the site, including this CEEC. The likely magnitude of edge effects or other indirect effects would not be sufficient to further reduce the extent of the ecological community.
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,
The proposal would require the removal of 0.33 hectares of Cumberland Plain Woodland which is approximately 0.79 % of the total estimated area of that vegetation community in the biobanks within the Fernhill Estate (around 41.84 ha) that would be set aside for conservation. The local occurrence of this community extends from the site and includes the biobank sites within the Fernhill Estate and potentially further into the locality. This small area would contain a very minor proportion of the individuals or their habitats within the populations of the species that collectively comprise Cumberland Plain Woodland in the locality. Removal of a small proportion of this CEEC in the site would not alter the composition of the local occurrence of the community such that the local occurrence would be placed at risk of extinction. The vegetation of this community within the site is a small proportion of the local occurrence of this community. The extensive areas of floristically similar vegetation in the study area and locality are likely to be sufficient to maintain viable local occurence of the community. site
d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
The proposal would require the removal of 0.33 hectares of Cumberland Plain Woodland within the site. The proposal would also require the modification of a further 0.09 hectares of Cumberland Plain

Assessment of Significance for Cumberland Plain Woodland (CEEC under the TSC and EPBC Act)
Woodland.
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
The proposal will remove 0.33 hectares of Cumberland Plain Woodland and modify a further 0.09 hectares. Cumberland Plain Woodland occurs in close proximity to Mayfair Road in the east portion of the site and 22% of this community within the site will be removed by the proposal. The proposal involves construction of structures that may obstruct movement of fauna attempting to travel through the study area, such as fences and residential dwellings. These barriers would be parallel to existing, equivalent barriers, including stock fences and existing buildings within Mayfair Road and would not significantly increase the degree to which fauna movement is disrupted. Fauna movement and ecological processes would at continue to function around the site via vegetated riparian corridors to the north, south and west. Vegetation in the Blue Mountains National Park and the Nepean River riparian strip to the west of the site is likely to be an important habitat corridor. The site is located at the edge of this patch of habitat and does not, in itself, comprise an important connecting linkage. Fauna movement, pollination and seed fall of plants and other ecological processes would occur around, rather than through, the site. In this context, the proposal would not have an adverse effect on fauna movement or habitat connectivity.
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,
The 0.33 hectares of good condition Cumberland Plain Woodland vegetation to be removed by the proposal, is approximately 0.79 % of the total estimated area of Cumberland Plain Woodland in the biobanks within the Fernhill Estate (around 41.84 ha) that have been set aside for conservation under a biobanking agreement. In addition, the proposal would retain up to 1.25 hectares of Cumberland Plain Woodland within the same patch of vegetation and would directly join connective vegetation of the East Biobank. The disturbance footprint is within a narrow, fragmented patch of edge habitat with less value than equivalent habitat in more extensive patches of native vegetation, that are remote from cleared or developed land. There are extensive areas of such undisturbed habitat in the locality, particularly to the west of the study area in the central west portion of the Fernhill Estate. As such, the vegetation to be removed is unlikely to be important to the long term survival of this community.
e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),
There is no critical habitat listed for this CEEC.
f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,
There is no recovery plan for this CEEC. OEH identifies a number of priority actions intended to abate threats to this CEEC and ensure its long term conservation (OEH, 2011b), including the protection of habitat by minimising further clearing of the community. The proposal would not involve any clearing or otherwise affect this CEEC and so is consistent with these priority actions.
g) whether the action proposed constitutes or is part of a key threatening process or is likely to

Assessment of Significance for Cumberland Plain Woodland (CEEC under the TSC and EPBC Act)
result in the operation of, or increase the impact of, a key threatening process.
The proposal constitutes part of a Key Threatening Process (KTP) 'Clearing of native vegetation'. The proposal involves the removal of 0.33 hectares and the modification of a further 0.09 hectares of Cumberland Plain Woodland which would comprise a negligible increase in the operation of this KTP. The proposal would not directly contribute to the operation of any other KTPs of relevance to Cumberland Plain Woodland. The proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation (refer Section 6). These measures would mitigate against the operation of any KTPs.
Conclusion of Assessment of Significance
Based on consideration of the above criteria, the proposal is unlikely to have a significant effect on the local occurrence of Cumberland Plain Woodland as: • Up to 0.33 hectares of Cumberland Plain Woodland would be removed • Up to 0.09 hectares of Cumberland Plain Woodland would be modified • Up to 1. 25 hectares of Cumberland Plain Woodland would be retained • Up to 41.84 hectares of Cumberland Plain Woodland has been set aside for conservation within the Fernhill Estate under Biobanking Agreemeents • Vegetation to be removed is edge habitat which is unlikely to be important in the locality and ajoins an existing road. The MNES significance impact criteria have also been considered for Cumberland Plain Woodland and in the light of the above findings similarly conclude that the proposal is unlikely to have a significant impact on this community.

Assessment of Significance for Moist Shale Woodland (EEC under the TSC Act, CEEC under the EPBC Act)
a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.
Not applicable to EECs.
b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.
Not applicable to EECs.
c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
The proposal would remove a maximum of 0.75 hectares of Moist Shale Woodland and an additional 0.60 hectares would be modified for APZ operation and maintenance. The removal of Moist Shale Woodland is approximately 5.47 % of the total estimated area of that vegetation community in the biobanks within the Fernhill Estate (around 13.71 ha) that would be set aside for conservation. This minor reduction in extent would not threaten the viability or persistence of the EEC in the locality or the region. A CEMP is recommended for the proposal, which would contain measures to avoid direct and indirect impacts on native vegetation adjoining the site, including this CEEC. The likely magnitude of edge effects or other indirect effects would not be sufficient to further reduce the extent of the ecological community.
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,
The proposal would require the removal of 0.75 hectares of Moist Shale Woodland which is approximately 5.47 % of the total estimated area of that vegetation community in the biobanks within the Fernhill Estate (around 13.71 ha) that would be set aside for conservation. Up to 0.60 hectares would be modified, while a further 1.66 hectares would be retained by the proposal in the site. The local occurrence of this community extend from the site and includes the biobank sites and potentially further into the locality. This small area would contain a very minor proportion of the individuals within the populations of the species that collectively comprise Moist Shale Woodland in the locality. Removal of a small proportion of this EEC in the site would not alter the composition of the local occurrence of this community such that its local occurrence would be placed at risk of extinction. The vegetation of this community is a small proportion of the local occurrence of this community. The extensive areas of floristically similar vegetation in the study area and locality are likely to be sufficient to maintain viable local populations of the species that comprise the EEC.
d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
The proposal would require the removal of 0.75 hectares and modification of a further 0.60 hectares of

Assessment of Significance for Moist Shale Woodland (EEC under the TSC Act, CEEC under the EPBC Act)
Moist Shale Woodland respectively.
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
Vegetation removal of 0.75 hectares of this TEC within the site is approximately 26% of the total amount of vegetation to be removed or modified by the proposal. Removal of the Moist Shale Woodland TEC will occur in the central portion of the site. Up to 1.66 hectares of Moist Shale Woodland would be retained within the site. The proposal involves construction of structures that may obstruct movement of fauna attempting to travel through the study area, such as fences and residential dwellings within Mayfair Road. These barriers would be parallel to existing, equivalent barriers, including stock fences and a road and would not significantly increase the degree to which fauna movement is disrupted. Fauna movement and ecological processes would at continue to function around the site via vegetated riparian corridors to the north, south and west. Vegetation in the Blue Mountains National Park and the Nepean River riparian strip to the west of the site is likely to be an important habitat corridor. The site is located at the edge of this patch of habitat and does not, in itself, comprise an important connecting linkage. Fauna movement, pollination and seed fall of plants and other ecological processes would occur around, rather than through, the site. In this context, the proposal would not have an adverse effect on fauna movement or habitat connectivity.
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,
The 0.75 hectares of primarily moderate/good_poor, and low condition Moist Shale Woodland to be cleared by the proposal, is approximately 5.47 % of the total estimated area of that vegetation community in the biobanks within the Fernhill Estate (around 13.71 ha) that would be set aside for conservation. The disturbance footprint is within a narrow, fragmented patch of edge habitat with less value than equivalent habitat in more extensive patches of native vegetation, that are remote from cleared or developed land. There are extensive areas of such undisturbed habitat in the locality, particularly to the west of the study area in the central portion of the Fernhill Estate and in the Blue Mountains National Park.
e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)
There is no critical habitat listed for this CEEC.
f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.
There is no recovery plan for this CEEC. OEH identifies a number of priority actions intended to abate threats to this CEEC and ensure its long term conservation (OEH, 2011b), including the protection of habitat by minimising further clearing of the community. The proposal would not involve any clearing or otherwise affect this EEC and so is consistent with these priority actions
g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process
The Key Threatening Process (KTP) 'Clearing of native vegetation' has occurred historically within and around the study area. The proposal involves the removal of 0.75 hectares and the modification of a

Assessment of Significance for Moist Shale Woodland (EEC under the TSC Act, CEEC under the EPBC Act)
further 0.60 hectares of Moist Shale Woodland which would comprise a negligible increase in the operation of this KTP. The proposal would not directly contribute to the operation of any other KTPs of relevance to Moist Shale Woodland. The proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation (refer Section 6). These measures would mitigate against the operation of any KTPs.
Conclusion of Assessment of Significance
Based on consideration of the above criteria, the proposal is unlikely to have a significant effect on the local occurrence of Moist Shale Woodland as: • Up to 1.66 hectares of Moist Shale Woodland will be retained • Up to 0.75 hectares of Moist Shale Woodland will be removed. • Up to 0.60 hectares of Moist Shale Woodland would be modified. • Vegetation to be removed is edge habitat which is unlikely to be important in the locality. • This vegetation type has been conserved in the locality within biobanks within the Fernhill estate (13.71 hectares) and its removal only accounts for 5.47% of the vegetation within these biobanks. The MNES significance impact criteria have also been considered for Moist Shale Woodland and in the light of the above findings similarly conclude that the proposal is unlikely to have a significant impact on this community.

Assessment of Significance for Shale Sandstone Transition Forest (CEEC under the TSC and EPBC Acts)
a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.
Not applicable to EECs.
b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.
Not applicable to EECs.
c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
The proposal would remove 0.60 hectares of Shale Sandstone Transition Forest. This is approximately 0.64 % of the total estimated area of that vegetation community in the biobanks within the Fernhill Estate (around 94.98 ha) that have already been set aside for conservation under a biobanking agreement. This minor reduction in extent would not threaten the viability or persistence of the CEEC in the locality or the region. A CEMP is recommended for the proposal, which would contain measures to avoid direct and indirect impacts on native vegetation adjoining the site, including this CEEC. The likely magnitude of edge effects or other indirect effects would not be sufficient to further reduce the extent of the ecological community.
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,
The proposal would require the removal of 0.60 hectares of Shale Sandstone Transition Forest which is approximately 0.64 % of the total estimated area of that vegetation community in the biobanks within the Fernhill Estate (around 94.98 ha) that have already been set aside for conservation under a biobanking agreement. The proposal will further modify 0.53 hectares of Shale Sandstone transition Forest within the site while retaining a further 0.72 hectares. This proposal would contain a very minor proportion of the individuals within the populations of the species that collectively comprise Shale Sandstone Transition Forest in the locality. Removal of a small proportion of this EEC in the site would not tangibly alter the composition of the local occurrence of the community. The individual plants within the site would not be an ecologically significant proportion of any of the individual species that make up the Shale Sandstone Transition Forest ecological community. The proposal is not likely to remove, modify or fragment a significant proportion of the habitat for this CEEC in the locality (refer part d). The extensive areas of floristically similar vegetation in the study area and locality are likely to be sufficient to maintain viable local populations of the species that comprise the CEEC. Given the scale and context of the proposal it is unlikely to modify the composition of any Shale Sandstone Transition Forest beyond the site and immediately adjoining areas. As such, the proposal is not likely to modify the composition of the CEEC in the locality such that any component species would become locally extinct.
d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

Assessment of Significance for Shale Sandstone Transition Forest (CEEC under the TSC and EPBC Acts)
and
The proposal would require the full removal of 0.60 hectares of Shale Sandstone Transition Forest respectively. Up to 0.53 hectares would be modified by the proposal.
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
The removal 0.60 hectares of Shale Sandstone Transition Forest within the site is approximately 20.76% of the total amount of vegetation to be removed by the proposal. Removal of the Shale Sandstone Transition Forest TEC will only occur in the western portion of the site. The proposal involves construction of structures that may obstruct movement of fauna attempting to travel through the study area, such as fences and residential dwellings. These barriers would be parallel to existing, equivalent barriers, including stock fences and a road and would not significantly increase the degree to which fauna movement is disrupted. Fauna movement and ecological processes would at continue to function around the site via vegetated riparian corridors to the north, south and west. Vegetation in the Blue Mountains National Park and the Nepean River riparian strip to the west of the site is likely to be an important habitat corridor. The site is located at the edge of this patch of habitat and does not, in itself, comprise an important connecting linkage. Fauna movement, pollination and seed fall of plants and other ecological processes would occur around, rather than through, the site. In this context, the proposal would not have an adverse effect on fauna movement or habitat connectivity.
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,
The 0.60 hectares of primarily poor and low condition vegetation to be cleared by the proposal, is approximately 0.64 % of the total estimated area of that vegetation community in the biobanks within the Fernhill Estate (around 94.98 ha) that would be set aside for conservation. The disturbance footprint is within a narrow, fragmented patch of habitat with less value than equivalent habitat in more extensive patches of native vegetation, that are remote from cleared or developed land. There are extensive areas of such undisturbed habitat in the locality, particularly to the west of the study area in the central portion of the Fernhill Estate and in the Blue Mountains National Park.
e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)
There is no critical habitat listed for this CEEC.
f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.
There is no recovery plan for this CEEC. OEH identifies a number of priority actions intended to abate threats to this CEEC and ensure its long term conservation (OEH, 2011b), including the protection of habitat by minimising further clearing of the community. The proposal would not involve any clearing or otherwise affect this EEC and so is consistent with these priority actions
g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process
The Key Threatening Process (KTP) 'Clearing of native vegetation' has occurred historically within and

Assessment of Significance for Shale Sandstone Transition Forest (CEEC under the TSC and EPBC Acts)
around the study area. The proposal involves the removal of 0.60 hectares and modification of a further 0.53 hectares of Shale Sandstone Transition Forest. The proposal would comprise a negligible increase in the operation of this KTP. The proposal would not directly contribute to the operation of any other KTPs of relevance to Shale Sandstone Transition Forest. The proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation (refer Section 6). These measures would mitigate against the operation of any KTPs.
Conclusion of Assessment of Significance
Based on consideration of the above criteria, the proposal is unlikely to have a significant effect on the local occurrence of Shale Sandstone Transition Forest. • Up to 0.60 hectares will be removed • Up to 0.72 hectares will be retained • Up to 0.53 hectares will be modified • It comprises the edge of a larger tract of vegetation and will not be fragmented • A large proportion of vegetation to be completely removed is in poor or low condition which is unlikely to be important in the locality • Approximately 94.98 hectares of Shale Sandstone Transition Forest has been set aside for conservation under Biobanking Agreeements within the Fenrhill Estate. The MNES significance impact criteria have also been considered for Shale Sandstone Transition Forest and in the light of the above findings similarly conclude that the proposal is unlikely to have a significant impact on this community.

Assessment of Significance for Spiked Rice-flower (*Pimelea spicata*) (endangered species)
a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,
There is one previous record of the Spiked Rice-flower in the locality (OEH, 2015b). However, given the cryptic nature of the species and the extent of suitable shale woodland habitat in the locality it is likely that the local population of the species is more widespread. This may include seeds or plants that were not detected in surveys conducted in the site. Hence, for the purposes of this assessment, it is assumed that the study area supports a local population (at least in part) of this species. Whilst, this species has not been recorded within the site, the proposal will involve the removal of 1.08 hectares of habitat for the Spiked Rice-flower in Cumberland Plain Woodland and Moist Shale Woodland which is 3.42% of the total estimated area of those vegetation communites in the biobanks within the Fernhill Estate (around 31.57 ha) that would be set aside for conservation. Potential impacts of the proposal on the life cycle of the species would be restricted to the removal of individual plants (if present) within exotic grassland in the site (which is unlikely). There is around 1480 hectares of potential habitat for the Spiked Rice-flower in shale woodlands in the locality (based on Tozer 2010 vegetation mapping). The minor magnitude of impacts on any individual plants that may occur in the site or on potential, lower quality habitat would not threaten the viability or persistence of the species in the locality or the region. An CEMP is recommended for the proposal, which would contain measures to avoid direct and indirect impacts on native vegetation adjoining the site, including potential habitat for the Spiked Rice-flower. Given these mitigation measures and the extent of existing weed infestation and disturbance in the study area, the proposal would result in a minor increase in weed infestation and other edge effects. Overall, given the limited extent of impacts and the mitigation measures proposed, the proposal is not likely to have an adverse effect on the life cycle of the species such that a local population is likely to be placed at risk of extinction.
b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,
Not applicable to threatened species.
c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
Not applicable to threatened species.
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,
Not applicable to threatened species.
d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed,

Assessment of Significance for Spiked Rice-flower (*Pimelea spicata*) (endangered species)
and
The proposal will involve the removal of 1.08 hectares of habitat for the Spiked Rice-flower in Cumberland Plain Woodland and Moist Shale Woodland which is 3.42% of the total estimated area of that vegetation community in the biobanks within the Fernhill Estate (around 31.57 ha) that is currently set aside for conservation under a biobanking agreement. The proposal would not directly affect any known habitat for the Spiked Rice-flower. The proposal would result mostly in impacts on some native plants within areas of exotic grassland, which may potentially comprise low quality habitat for the species. All of these impacts would be temporary and associated with infrequent events and would not permanently remove or modify any of this low quality habitat. An CEMP is recommended for the proposal, which would contain measures to avoid direct and indirect impacts on native vegetation adjoining the site, including habitat for the Spiked Rice-flower .
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
The removal 1.08 hectares of habitat for the Spiked Rice-flower is approximately 64% of the total amount of vegetation to be removed by the proposal. Removal of Spiked Rice-flower habitat will occur in the central and eastern portion of the site. Up to 2.92 hectares of Spiked Rice-flower habitat will be retained by the proposal. Pollination and other ecological processes would continue across this minor gap in habitat. In the context of the partially cleared and developed land in the locality this would comprise a very minor increase in the degree of habitat fragmentation. The proposal involves construction of temporary structures that would not impede ecological processes for plants. These ecological processes would at continue to function around the site via vegetated riparian corridors to the north, south and west. In this context, the proposal would not fragment or isolate any habitat.
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,
The 1.08 hectares of vegetation to be cleared by the proposal, is approximately 3.42% of the total estimated area of that vegetation community in the biobanks within the Fernhill Estate (around 31.57 ha) that would be set aside for conservation.The disturbance footprint is within a narrow, fragmented patch of edge habitat with less value than equivalent habitat in more extensive patches of native vegetation, that are remote from cleared or developed land such as undisturbed habitat in the locality to the west of the study area in the central portion of the Fernhill Estate and in the Blue Mountains National Park. In this context, the habitat to be removed is not important for the survival of the species. In addition, the modification of a further 0.69 hectares of Spiked Rice-flower habitat is similarly not important for this species as it is in predominantly in low to poor condition consists of edge habitat and is unlikely to comprise this species.
e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

Assessment of Significance for Spiked Rice-flower (*Pimelea spicata*) (endangered species)
There is no critical habitat listed or nominated for the Spiked Rice-flower.
f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,
There recovery plan for the Spiked Rice-flower identifies a number of priority actions intended to ensure the long term conservation of the species in the wild (including to: "conserve P. spicata using land-use and conservation planning mechanisms" (DEC, 2005). The proposal includes this ecology assessment and assessment of significance and so has included due consideration of NSW, conservation planning mechanisms however the proposal and would result in the removal of any known habitat for the species. The proposal is consistent with the recovery plan for the Spiked rice-flower .
g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process
The KTP 'Clearing of native vegetation' has occurred historically within and around the study area. The proposal involves the clearing of around 0.90 hectares of native vegetation which could potentially comprise Spiked Rice-flower habitat but would comprise a negligible increase in the operation of this KTP. The proposal would not directly contribute to the operation of any other KTPs of relevance to the Spiked Rice-flower. The proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation (refer Section 6). These measures would mitigate against the operation of any KTPs.
Conclusion of Assessment of Significance
Based on consideration of the above criteria, the proposal is unlikely to have a significant effect on the local population of the Spiked Rice-flower. • Up to 0.90 hectares of Spiked Riceflower habitat will be removed • The species was not recorded in the site • Up to 2.92 hectares will be retained (excluding the partial conservation of 0.69 hectares) • It comprises the edge of a larger tract of vegetation and will not be fragmented • A large proportion of vegetation to be completely removed is in poor or low condition which is unlikely to be important in the locality

Assessment of Significance for Cumberland Plain Land Snail (*Meridolum corneovirens*) (endangered species)
a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.
The study area is likely to contain a local population of the Cumberland Plain Land Snail based on direct observations of live snails and shells during the GHD site surveys of the Fernhill estate (see Figure 4). OEH (2015b) provides the following information about the biology and life history of the Cumberland Land Snail. It is hermaphroditic and lays clutches of eggs in moist and dark areas such as under logs. The species probably reproduces year round, where conditions are suitable. It is a fungal feeder and is generally active at night. Nothing is currently known about rates of fecundity, length of life span, dispersal patterns and over what distances individuals can move. Based on the above, potential risks to the life cycle of a local population of the species include: removal, modification or fragmentation of important areas of habitat; injury or mortality to an ecological significant proportion of the local population; or removal of suitable shelter sites. Up to 45 live individuals or shells have been recorded in Fernhill Estate (see Figure 4). These areas contained good quantities of habitat resources such as woody debris and leaf litter. There are 66 previous records of the species in the locality (OEH, 2015a) and around 2100 hectares of suitable habitat in shale woodlands or forest based on Tozer (2010) mapping. The proposal would require the removal of approximately 1.68 hectares of habitat for the Cumberland Plain Land Snail which is approximately 1.54% the total estimated area of habitat in the biobanks within the Fernhill Estate (around 108.98 ha) that would be set aside for conservation. Potential impacts of the proposal on the life cycle of the species would be restricted to the removal of individual snails (if present) within exotic grassland in the site (which is unlikely). There is around 1480 hectares of potential habitat for the Cumberland Plain Land Snail in shale woodlands in the locality (based on Tozer 2010 vegetation mapping). The minor magnitude of impacts on any individual snails that may occur in the site or on potential, lower quality habitat would not threaten the viability or persistence of the species in the locality or the region. An CEMP is recommended for the proposal, which would contain measures to avoid direct and indirect impacts on native vegetation adjoining the site, including potential habitat for the Cumberland Plain Land Snail. Given these mitigation measures and the extent of existing weed infestation and disturbance in the study area, the proposal would result in a minor increase in weed infestation and other edge effects. Therefore the proposed action is unlikely to have adverse effect on the life cycle of local population of the Cumberland Plain Land Snail.
b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.
Not applicable to this threatened species.
d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
The proposal would require the full and partial removal of approximately 2.79 hectares of habitat for the Cumberland Plain Land Snail which is approximately 1.54% the total estimated area of habitat in the

Assessment of Significance for Cumberland Plain Land Snail (*Meridolum corneovirens*) (endangered species)
biobanks within the Fernhill Estate (around 108.98 ha) that have been set aside for conservation under a biobanking agreement. The proposal would not directly affect any known habitat for the Cumberland Plain Land Snail and none have been recorded in the site. The proposal would result in impacts on some native plants, wooden debris within areas of disturbed woodland and exotic grassland, which may potentially comprise low quality habitat for the species. An CEMP is recommended for the proposal, which would contain measures to avoid direct and indirect impacts on native vegetation adjoining the site, including habitat for the Cumberland Plain Land Snail.
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
The removal of 1.68 hectares of habitat for the Cumberland Plain Land Snail is approximately 58% of the total amount of vegetation to be removed by the proposal. Removal of the Cumberland Plain Land Snail habitat will occur in the central and eastern portion of the site. Snail movement and other ecological processes would continue across this minor gap in habitat. In the context of the partially cleared and developed land in the locality this would comprise a very minor increase in the degree of habitat fragmentation. The proposal would not directly isolate or fragment any areas of habitat for the Cumberland Plain Land Snail. Shale woodland to the north and south of the site is likely to be an important habitat corridor for the Cumberland Plain Land Snail. The site is located at the edge of this patch of habitat and does not, in itself, comprise an important connecting linkage. Fauna movement and other ecological processes would occur around, rather than through, the site. The proposal involves construction of structures that may obstruct movement of fauna attempting to travel through the study area, such as fences and residential dwellings. These barriers would be parallel to existing, equivalent barriers, including stock fences, existing buildings and would not significantly increase the degree to which fauna movement is disrupted. Fauna movement and ecological processes would at continue to function around the site via vegetated riparian corridors to the north, south and west. In this context, the proposal would not fragment or isolate any habitat.
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,
The proposal would require the removal and modification of approximately 2.89 hectares of habitat for the Cumberland Plain Land Snail which is approximately 1.54% the total estimated area of habitat in the biobanks within the Fernhill Estate (around 108.98 ha) that have been set aside for conservation under a biobanking agreement. The disturbance footprint is within a narrow, fragmented patch of habitat with less value than equivalent habitat in more extensive patches of native vegetation, that are remote from cleared or developed land. In addition, the propsal will remove areas of habitat which are poor in habitat resources for this species such as wooden debris and leaf litter. There are extensive areas of such undisturbed habitat in the locality, particularly to the west of the study area in the central portion of the Fernhill Estate.

Assessment of Significance for Cumberland Plain Land Snail (*Meridolum corneovirens*) (endangered species)
d) in relation to the habitat of a threatened species, population or ecological community:
e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)
There is no recommended or declared critical habitat of relevance to this species (OEH, 2015b).
f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.
There is no recovery plan for the Cumberland Land Snail. OEH (2013b) identifies a total of 8 strategies and associated priority actions to help recover this threatened species. These strategies involve community consultation, research and habitat management. The proposal is broadly consistent with these strategies or else unrelated.
g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process
The Key Threatening Process (KTP) 'Clearing of native vegetation' has occurred historically within and around the study area. The proposal involves the full removal of 1.68 hectares of habitat for this species which would comprise a negligible increase in the operation of this KTP. The proposal would not directly contribute to the operation of any other KTPs of relevance to the Cumberland Plain Land Snail. The proposal would include environmental management measures including specific consideration of potential impacts on soil, water and native vegetation (refer Section 6). These measures would mitigate against the operation of any KTPs.
Conclusion of Assessment of Significance
Based on the consideration of the above factors, the proposal is not likely to have a significant effect on the local population of the Cumberland Plain Land Snail as: • Up to be 1.68 hectares of Cumberland Plain Land Snail would be cleared • Up to 3.64 hectares of Cumberland Plain Land Snail would be retained (excluding 1.21 hectares of partial conservation) • This species was not recorded in the site • The vegetation to be cleared is predominantly low to poor condition vegetation which is unlikely to contain this species.

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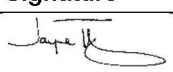
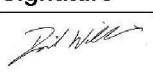
0.	B Harrington/M Weerakoon	J Tipping		Dan Williams		26/06/2015

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