Toughmudder

Fernhill Endurance Event Spring 2013

Ecological Assessment

August 2013

Table of contents

Table index

Figure index

Appendices

1. Introduction

1.1 Background

GHD Pty Ltd (GHD) has been engaged by Tough Mudder to complete an Ecology Assessment to support the Development Application (DA) for the proposed Spring 2013 Endurance Event (Tough Mudder) at the Fernhill Estate located on Mulgoa Road, Mulgoa (Figure 1). The DA will be submitted to Penrith City Council ('Council') for approval under Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EPA Act). This Ecology Assessment is a specialist appendix for inclusion in the DA. It assesses the potential for impacts of the proposed Tough Mudder event on biodiversity 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 *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Two events are proposed to be held each year. The first event was held on 13 and 14 April 2013 and the second is proposed for 30 November and 1 October 2013. The course for the second event is different from the course for the first event.

Other parts of the property are proposed for subdivision, and field surveys and assessments have been undertaken for these proposals (GHD 2013a; GHD 2013b). In addition, work is currently underway assessing a proposed biobank (the Fernhill East Biobank) within the property (GHD, in prep). This will be located in the north-eastern and south-eastern portions of the site.

1.2 Proposal description

The current proposal involves:

- Marking of track boundaries with fencing or bunting.
- The installation of temporary obstacles (these are removed after each event).
- The installation of temporary rest/drinks stations. (these are removed after each event).
- The installation of temporary marquees and tents (these are removed after each event).
- The running of the two day event.

The proposed Tough Mudder track is indicated on Figure 1

1.3 Terms and Definitions

The following area definitions are used in this report:

Subject site: the area to be directly affected by the proposal, comprising the track and associated temporary facilities.

Study area: the subject site (defined above) and any additional areas with the potential to be affected by the proposal, either directly or indirectly. In this study, this comprises the subject site and adjoining vegetation within 30 metres of the track and temporary facilities.

Fernhill property: the entire property, of which the event course covers part.

Locality: the area within a 10 km radius of the subject site.

Temporary modification: refers to the temporary impact area from obstacles and rest/drinking stations that are removed after each event.

Vegetation Zones

- Cleared land / exotic grassland/waterbodies
- 1 - Grey Box - Forest Red Gum grassy woodland on hills (HN529)
- 2 - Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest (HN556)
- 3 - Forest Red Gum - Rough-barked Apple grassy woodland (HN526)
- 4 - Turpentine - Smooth-barked Apple moist shrubby forest (HN606)
- 5 - Grey Box - Forest Red Gum grassy woodland on flats (HN528)
- 6 - Forest Red Gum - Grey Box shrubby woodland (HN524)
- 7 - Red Bloodwood - Grey Gum woodland (HN564)
- 8 - Grey Myrtle dry rainforest (HN538)
- 9 - Red Bloodwood - scribbly gum heathy woodland (HN566)
- 10 - Narrow-leaved Ironbark - Broad leaved Ironbark - Grey Gum open forest (HN556 low)
- 11 - Hard-leaved Scribbly Gum - Parramatta Red Gum heathy woodland (HN542 medium)
- 12 - Hard-leaved Scribbly Gum - Parramatta Red Gum heathy woodland (HN542 poor)
- Regrowth Grey Box - Forest Red Gum grassy woodland on flats (HN528)
- Varied Sitella
- Glossy Black-cockatoo
- Cumberland Plain Land Snail
- Grevillea juniperina
- Micromyrtus minutiflora
- Sydney Tough Mudder Course

Hold Your Wood
Mud Pit #2
Trench Warfare
Warrior Carry
Water Station #3
Mud Mile #1
Mud Pit #3
Water Station #4
Water Station #2
Berlin Walls
Shallow excavation
Pump water from pond
Stock Paddock (No Access)
Water logged
Just the Tip
Hill Climb
Wall Crossing
Water Station #1
Fence Cut
Mud Pit #1
Glory Blades
Kiss of Mud
Electric Eel
Artic Enema
Dirty Ballerina
Wall Crossing
Start Base
Electroshock Therapy
Funkey Monkey
Everest
Balls to the Wall
Walk the Plank
Cage Crawl
Water Station #5
Boa Constrictor
Mud Mile #2

DRAFT

Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community

1:15,000 (at A3)

0 55 110 220 330 440 550
Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

N

LEGEND

- Fernhill East biobank site boundary
- Fernhill Site Boundary
- Contour

Fernhill
Biobanking Assessment

Job Number	22-16689
Revision	B
Date	09 Aug 2013

Vegetation, threatened biota and proposed footprint

Figure 1

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2. Legislative Context

2.1 NSW legislation

2.1.1 Environmental Planning and Assessment Act 1979 (EP&A Act)

The EP&A 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 EP&A Act and EP&A Regulation 2000.

In addition, Section 111(4) of the Act states that the determining authority must consider the effect of an activity on:

- 'critical habitat' (as defined under the TSC Act and FM Act)
- species, populations or ecological communities, or their habitats (as listed under the TSC Act and FM Act) and whether there is likely to be a 'significant effect' on those species, populations or ecological communities.
- other protected fauna or protected native plants listed under the *National Parks and Wildlife Act 1974*.

Section 5A of the EP&A 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. Section 5A of the EP&A Act was addressed as part of the current assessment and 7-part tests were completed for relevant threatened species and ecological communities that are likely to be affected by the proposal (see Section x).

2.1.2 Threatened Species Conservation Act 1995 (TSC Act)

The *Threatened Species Conservation Act 1995* (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 provides for:

- The listing of 'threatened species, populations and ecological communities', with endangered species, populations and communities listed under Schedule 1, 'critically endangered' species and communities listed under Schedule 1A, vulnerable species and communities listed under Schedule 2.
- The listing of 'Key Threatening Processes' (under Schedule 3).
- The preparation and implementation of Recovery Plans and Threat Abatement Plans.
- Requirements or otherwise for the preparation of Species Impact Statement (SIS).

The TSC Act has been addressed in the current assessment through:

- Desktop review to determine the threatened species, populations or ecological communities that have been previously recorded within the locality of the site and hence could occur subject to the habitats present.
- Targeted field surveys for threatened species listed under the Act.
- Identification, assessment and mapping of EECs listed under the Act.

- Identification of suitable impact mitigation and environmental management measures for threatened species, where required.
- Assessment of potential impacts on threatened ecological communities and species.

2.1.3 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 EP&A 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 would not impact any threatened marine vegetation or biota listed under the Act.

The FM Act has been addressed in the current assessment through undertaking:

- A desktop review to determine the threatened species, populations or ecological communities listed under the FM Act that have been previously recorded within the locality of the site and hence could occur subject to the habitats present.
- Assessment of aquatic habitats during terrestrial field surveys.
- Assessment of potential impacts on aquatic habitats.

2.1.4 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.

Noxious weeds present in the study area were identified during field surveys, and appropriate control classes noted.

2.2 Commonwealth legislation

2.2.1 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 Sustainability, Environment, Water, Populations and Communities (the 'Minister').

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).

Potential impacts on any MNES must be subject to assessments of significance pursuant to the DSEWPaC Significant Impact Guidelines (DEWHA 2009). If a significant impact is considered likely, a referral under the EPBC Act must be submitted to the Commonwealth Environment Minister.

The EPBC Act has been addressed in the current assessment through:

- Desktop review to determine the threatened species or ecological communities and migratory species listed under the EPBC Act that have been previously recorded within the locality of the site and hence could occur subject to the habitats present.
- Targeted field surveys for MNES listed under the Act.
- Identification, assessment and mapping of EECs listed under the Act.
- Identification of suitable impact mitigation and environmental management measures for MNES, where required.
- Assessment of potential impacts on MNES.

3. Methods

3.1 Desktop review

The following databases and information were reviewed to generate a list of threatened ecological communities (TECs), populations and species listed under the EPBC Act, TSC Act and/or FM Act and other matters of national environmental significance (MNES) listed under the EPBC Act which have previously been recorded or are predicted to occur within the locality of the site:

- NSW Wildlife Atlas database for records of threatened species listed under the TSC Act (Office of Environment and Heritage (OEH) 2013a; data supplied by OEH on 31 July 2012).
- Protected Matters Online Search Tool for MNES listed under the EPBC Act predicted to occur in the locality (DSEWPaC 2013a; database queried on 21 June 2013).
- Department of Primary Industries Threatened Species Records Viewer (DPI 2013a; database queried 21 June 2013) for threatened species listed under the FM Act recorded within the Wollondilly Local Government Area.

A review of literature was also undertaken, particularly in the context of the occurrence of Endangered and Critically Endangered Ecological Communities (EEC and CEEC respectively) as listed under the TSC and EPBC Acts. The following resources were reviewed:

- Broad-scale mapping of Soil Landscape Groups mapped as occurring within the locality (Hazelton and Tille 1990).
- Broad-scale mapping of the vegetation of the Cumberland Plain (NSW NPWS 2002).
- Fernhill Athletic Endurance Track Preliminary Ecological Assessment (GHD 2012).
- Biobanking assessment (GHD 2013).
- Owston Estate (Fernhill) Ecological Assessment of Proposed Rezoning (Ecological Australia 2010).

3.2 Field Surveys

GHD have completed a number of site surveys in the last 12 months over the broader Fernhill Estate that have contributed to the understanding of the existing environment for this assessment (Table 1).

Table 1 Survey timing and effort

Stage	Date	Survey Technique	Study area
Rezoning proposal (Ecological Australia 2010)	2.5 days in March 2010	A survey for *Grevillea juniperina* subsp. *juniperina* within the Western Precinct.	Whole property
'Tough Mudder' DA preliminary survey (GHD, 2012)	11 December 2012	Broad-scale vegetation survey, vegetation mapping, opportunistic fauna and threatened flora observations across the study area for the first Tough Mudder course	Autumn 2013 Tough Mudder event track
'Tough Mudder' pre-event ecology site visit	21 March 2013	Ecological constraints assessment, opportunistic fauna and threatened flora observations.	Autumn 2013 Tough Mudder event track

Stage	Date	Survey Technique	Study area
(GHD 2013)			
Eastern Precinct Subdivision - preliminary survey (GHD, 2013)	30 May 2013	Broad-scale vegetation survey, vegetation mapping, opportunistic fauna and threatened flora observations.	Eastern precinct
Eastern Precinct Subdivision – ecology assessment (GHD 2013) survey	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 within the subject site, habitat assessments, opportunistic fauna observations.	Eastern precinct
Eastern Precinct Subdivision – supplementary Cumberland Plain Land Snail survey (GHD 2013)	29 June 2013	8 hours of active searches for Cumberland Plain Land Snail within the study area and other areas of snail habitat in the Fernhill estate, habitat assessments, opportunistic fauna observations.	Eastern precinct
BioBanking ecosystem survey (GHD in prep)	28-30 May, 6 - 7 June and 10 July 2013	Fine-scale vegetation survey and vegetation mapping, 20 20 m x 50 m BioBanking plot / transects, random meander searches for threatened plants, habitat assessments, opportunistic fauna observations.	Fernhill East Biobank
Supplementary Cumberland Plain Land Snail survey (GHD, in prep)	20 June 2013	Active searches for Cumberland Plain Land Snail within snail habitat in the Fernhill East biobank, habitat assessments and opportunistic fauna observations.	Fernhill East Biobank
'Tough Mudder' DA flora and fauna survey (this assessment)	30 July 2013	Ground-truthing of vegetation mapping, opportunistic fauna and flora observations across the study area for the new Tough Mudder course. Targeted searches along the northern section of the track, where there were likely occurrences of *Grevillea juniperina* subsp. *juniperina* and *Micromyrtus minutiflora*	Spring 2013 Tough Mudder event track

4. Existing Environment

4.1 The subject site and landscape context

4.1.1 Location

The subject site falls within the Hawkesbury Nepean Catchment Management Authority (CMA), and within the Sydney Basin Bioregion. The site is contained within the Cumberland Plain Mitchell Landscape (DECC, 2008a). This landscape is noted to be approximately 30 – 120 m ASL, and comprises 'low rolling hills and valleys in a rain shadow area between the Blue Mountains and the coast' (DECC 2008), with vegetation characterised by woodlands and open forest.

The subject site traverses a large proportion of the Fernhill property. The property includes the State Heritage Register listed Fernhill Estate, which contains significant European Heritage values. Fernhill Estate itself is considered to be one of the most significant private estates in New South Wales (Ecological Australia 2010). The estate includes a single-storey sandstone mansion built in 1842 in the Greek Revival-style. It also includes an equestrian facility specialising in showjumping coaching, training, boarding and agistment. Facilities include stables, outbuildings and a race track.

The property is located to the north of Mulgoa township. The entrance is located on Mulgoa Road and the western boundary is located on a rise above the Nepean River. Sections of Blue Mountains National Park adjoin the western and north-western portions of the property. Fairlight Road, which extends in an east-west direction to the south of the property, curves north and forms the western boundary. Mayfair Road, extends in an east-west direction to the north of the property and forms a northern boundary at the junction of the property and Blue Mountains National Park. A tributary of Jerrys Creek flows across the property, then beneath Mulgoa Road towards Chain of Ponds.

4.1.2 Soils and Topography

Large-scale mapping by Bannerman and Hazelton (1990) indicates the occurrence of soils derived from the Blacktown Soil Landscape Group in the central and western portions of the event track, and from the Gymea Soil Landscape Group below the residence, extending to the property boundary on Mulgoa Road in the eastern portion.

Topography is level to gently undulating in the eastern portion, before rising steeply in some locations in the centre and north, with many small gullies intersecting the hill. One gully runs in an east-west direction in the centre of the property. In the west, the landscape is again lvel to gently undulating. Beyond the western property boundary the topography drops steeply to the Nepean River..

4.1.3 Hydrology

Littlefield Creek flows through the south-eastern portion of the study area. There is an un-named tributary of Mulgoa Creek in the north, which in turn drains to the Nepean River, which lies to the west of the property. Various first and second order drainage lines cross the study area which have been dammed at multiple points to create water storage for livestock. All drainage lines and water bodies contained water at the time of the site visits, and supported varying degrees of in stream and riparian vegetation. The extent of such vegetation is limited to the area directly around the water bodies, which are all clearly artificial, and so were not discriminated from the surrounding vegetation communities.

4.2 Desktop review results

The desktop assessment highlighted the following threatened biota listed under the TSC Act and/or FM and/or EPBC Acts which have been previously recorded or are predicted to occur within the locality (see Appendix A):

- 23 threatened ecological communities (23 listed under the TSC Act, 6 under the EPBC Act).
- 31 threatened flora species (18 TSC Act, 22 EPBC Act).
- Two endangered flora populations (TSC Act).
- 59 threatened fauna species (53 TSC Act, one FM Act, 16 EPBC Act).
- 12 migratory species (listed under the EPBC Act).
- One World Heritage Property and National Heritage Place (Greater Blue Mountains World Heritage Area) listed under the EPBC Act.

No other MNES listed under the EPBC Act (Wetlands of International Significance (Ramsar sites) or Commonwealth Marine Areas) were indicated as occurring within the locality.

The likelihood of occurrence in the study area of threatened biota and MNES identified as occurring or likely to occur in the locality was assessed following field surveys and based on previous records and presence of suitable habitat. This assessment is provided in Appendix A. Those communities and species assessed as likely to occur, or that have been recorded on site, are discussed further in sections 4.3, 4.4 and 4.5.

4.3 Flora and Vegetation

4.3.1 Flora species

A total of 347 flora species have been recorded in the study area during surveys in the last 12 months. Of these, 265 species are native and 82 species are introduced or not endemic to the area (e.g planted natives). Two threatened flora have previously been recorded at the Fernhill property (Ecological Australia 2010):

- *Micromyrtus minutiflora*
- *Grevillea juniperina* subsp. *juniperina*.

The locations of populations of these species in the study area are indicated on Figure 1 and the species are discussed in more detail in Section 4.5.

4.3.2 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 Fernhill property contains at least six species declared as noxious weeds in the Penrith LGA, as shown in Table 2 below. These noxious species occurred in low densities in woodland and forest throughout the Fernhill property and as moderate to severe infestations along drainage lines in the southwest and north of the Fernhill property. Notably there is moderate to severe Lantana infestation throughout the Forest Red Gum - Rough-barked Apple grassy woodland and Forest Red Gum - Grey Box shrubby woodland vegetation zones. The Fernhill property also contains the weed Tree of Heaven (*Ailanthus altissima*), which is not listed as noxious in Penrith LGA but is a highly invasive species.

The distribution of noxious and environmental weeds in the Fernhill property is closely tied to disturbance, with the concentration of weeds greater where native vegetation adjoins cleared paddocks dominated by exotic plant species. Surface water and nutrient flows would also be contributing to the observed weed infestation with forest adjacent to drainage lines featuring heavier infestation with exotic species than drier woodland upslope.

Wetlands and water bodies in the Fernhill property appeared to be free of aquatic noxious weeds such as Alligator weed (*Alternanthera philoxeroides*) and Water Hyacinth (*Eichhornia crassipes*).

Table 2 Declared noxious weeds recorded in the study area

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

4.3.3 Vegetation

Field surveys undertaken by GHD over the last 12 months confirmed the presence and distribution of 12 NSW vegetation types within the Fernhill property. These vegetation types are shown on Figure 2, summarised in Table 3 and described below. Five of the vegetation types comprise local occurrences of threatened ecological communities (TECs) listed under the EPBC Act and/or TSC Act (see Table 3).

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 and in drainage lines.

Much of the Fernhill property has been grazed, and canopy vegetation is thought to have been at least partially cleared or thinned historically. Canopy vegetation has since re-established across parts of the Fernhill property. There are mature hollow-bearing trees at moderate densities in the more intact vegetation areas.

Table 3 Vegetation

Vegetation Zone	Vegetation Type (OEH, 2013a)	Veg Type ID	Description	Condition	Conservation Significance	Within the event footprint?
1	Grey Box - Forest Red Gum grassy woodland on hills	HN529	Grey Box - Forest Red Gum grassy woodland on hills occurs on mid slopes in the central portion of the study area, often as remnant patches adjoining cleared grassland. It features an open canopy ranging up to approximately 20 m 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 and very sparse Kurrajong (*Brachychiton populneus*) and occasional patches of Lantana. Groundcover species include Kangaroo Grass, Weeping Meadow, 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. Exotic species are frequently present within this vegetation zone and include exotic pasture grasses as well as noxious and environmental weeds such as Lantana, Paddys Lucerne, Rhodes Grass, Fireweed (*Senecio madagascariensis*), Paspalum, Catsear (*Hypochaeris radicata*) and Lamb's Tongues.	Moderate/ good	Commensurate with Cumberland Plain Woodland Critically Endangered Ecological Community listed under the TSC Act and EPBC Act	Yes
2	Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest	HN556	Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest occurs on mid and upper slopes. It has an open forest structure with a canopy ranging up to approximately 25 m in height, dominated by Narrow-leaved Ironbark (*Eucalyptus crebra*), Broad-leaved Ironbark (*E. fibrosa*), Grey Gum (*E. punctata*), Thin-leaved Stringybark and Forest Red Gum. There is moderately dense mid-storey containing Fringed Wattle (*Acacia fimbriata*), Thin-leaved Geebung (*Persoonia linearis*), Black Thorn, Black Wattle and scattered patches of Lantana. The groundcover is dominated by grasses and herbs at lower elevations in the central portions and by shrubs in the west and north-west. 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	Moderate/ good	Commensurate with Shale Sandstone Transitional Forest Endangered Ecological Community listed under TSC Act and EPBC Act	Yes

Vegetation Zone	Vegetation Type (OEH, 2013a)	Veg Type ID	Description	Condition	Conservation Significance	Within the event footprint?
			(*Echinopogon caespitosus*), Weeping Meadow Grass and Bordered Panic. Characteristic herb and forbs include Burr-daisy (*Calotis dentex*), *Lomandra obliqua*, *Glycine clandestina*, and Indian Pennywort (*Centella asiatica*). Exotic species are occasionally present within the community and include environmental weeds such as the above mentioned Lantana, Rhodes Grass, Cobbler's Pegs (*Bidens pilosa*) and Small-leaved Privet (*Ligustrum sinense*).			
3	Forest Red Gum - Rough-barked Apple grassy woodland	HN526	Forest Red Gum - Rough-barked Apple grassy woodland has an open canopy approximately 15 – 20 m in height, dominated by Rough-barked Apple (*Angophora floribunda*), Forest Red Gum and Cabbage Gum (*Eucalyptus amplifolia*). There is a dense mid-storey of Parramatta Wattle (*Acacia parramattensis*), Black Wattle, Black Thorn and Prickly-leaved Tea Tree (*Melaleuca styphelioides*) along with some dense patches of Lantana. The groundcover is dominated by grasses, herbs and ferns, including Weeping Meadow Grass, Australian Basket Grass (*Oplismenus aemulus*), Kidney Weed, Indian Weed (*Sigesbeckia orientalis* subsp. *orientalis*), Rainbow Fern (*Calochlaena dubia*), *Stellaria flaccida*, Blue Trumpet (*Brunoniella australis*) and Indian Pennywort. Exotic species are widespread and abundant within this vegetation zone, including localised very severe infestations of Lantana and the invasive weed Tree of Heaven (*Ailanthus altissima*). Other weed species include Common Chickweed (*Stellaria media*), Bridal Creeper (*Asparagus asparagoides*), Sharp Rush (*Juncus acutus*), Paspalum (*Paspalum dilatatum*), Blackberry Nightshade (*Solanum nigrum*), Wild Tobacco Bush (*Solanum mauritianum*) and Kikuyu (*Pennisetum clandestinum*).	Moderate/ good	Commensurate with River-Flat Eucalypt Forest Endangered Ecological Community listed under the TSC Act	No
4	Turpentine - Smooth-barked Apple moist shrubby forest	HN606	Turpentine - Smooth-barked Apple moist shrubby forest occurs on gully sides west of the historical precinct. It has an open forest structure with a canopy ranging up to approximately 25 m in height, dominated by Smooth-barked Apple (*Angophora costata*), Grey Gum and Turpentine (*Syncarpia glomulifera*). There is an open mid-storey of Thin-leaved Geebung, Blueberry Ash	Moderate/ good	Not listed as a threatened ecological community under the TSC or EPBC Acts	Yes

Vegetation Zone	Vegetation Type (OEH, 2013a)	Veg Type ID	Description	Condition	Conservation Significance	Within the event footprint?
			(*Elaeocarpus reticulatus*) and Forest Oak (*Allocasuarina torulosa*). The groundcover is a patchy, variable mix of shrubs, grasses and forbs. Shrub species include Large-leaf Hop-bush, Prickly Shaggy Pea (*Podolobium ilicifolium*), Slender Rice Flower (*Pimelea linifolia*) and Hairy Clerodendrum. Native grasses include Purple Wiregrass (*Aristida ramosa*), Bushy Hedgehog-grass (*Echinopogon caespitosus*), Weeping Meadow Grass. Characteristic herbs, sedges and forbs include Variable Sword-sedge (*Lepidosperma laterale*), *Dianella caerulea* var. *producta*, and *Lomandra obliqua*. Climbers and scramblers are abundant, including Wonga Wonga Vine (*Pandorea pandorana*), Dusky Coral Pea (*Kennedia rubicunda*) and Wombat Berry (Eustrephus latifolius). Exotic species are only very occasionally present within this vegetation type. Exotic plants include occasional isolated Lantana and windborne environmental weeds such as Fleabane, Paspalum (*Paspalum dilatatum*) and *Setaria parviflora*.			
5	Grey Box - Forest Red Gum grassy woodland on flats	HN528	Grey Box - Forest Red Gum grassy woodland occurs on mid slopes in the eastern portion of the property, often as remnant patches adjoining cleared grassland. It has a grassy woodland structure with an open canopy ranging up to approximately 20 m in height, dominated by Forest Red Gum (*Eucalyptus tereticornis*), Grey Box (*Eucalyptus moluccana*) and Thin-leaved Stringybark (*Eucalyptus eugenioides*). The sparse, open mid-storey contains occasional Black Thorn (*Bursaria spinosa*), Black Wattle (*Acacia decurrens*) and scattered patches of Lantana (*Lantana camara*). Mid-storey vegetation appears to have been at least partially suppressed by grazing in most areas. The groundcover is dominated by grasses and herbs. Native groundcover consists of native grasses such Kangaroo Grass (*Themeda australis*), Weeping Meadow Grass (*Microlaena stipoides*), and Bordered Panic (*Entolasia marginata*) and herb or forbs such as Kidney Weed (*Dichondra repens*), Commelina (*Commelina cyanea*), *Lomandra gracilis*, *Glycine clandestina*, and Indian Pennywort (*Centella asiatica*).	Moderate/ good	Commensurate with Cumberland Plain Woodland Critically Endangered Ecological Community listed under the TSC Act and EPBC Act	Yes

Vegetation Zone	Vegetation Type (OEH, 2013a)	Veg Type ID	Description	Condition	Conservation Significance	Within the event footprint?
			Exotic species are frequently present within the community and include exotic pasture grasses as well as noxious and environmental weeds such as the above mentioned Lantana, Paddys Lucerne (*Sida rhombifolia*), Rhodes Grass (*Chloris gayana*), Fireweed (*Senecio madagascariensis*), African Lovegrass (*Eragrostis curvula*) and Lamb's Tongues (*Plantago lanceolata*).			
6	Forest Red Gum - Grey Box shrubby woodland	HN524	Forest Red Gum - Grey Box shrubby woodland occurs north of Lake Jessica and has a closed canopy approximately 20 m 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 (*Brachychiton populneus*) and the exotic 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 frequent 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 (*Cyathamnus axillaris*), Wiry Panic (*Entolasia stricta*), Weeping Meadow Grass, *Senecio diaschides, Vernonia cinerea, Cyperus sanguinolentus, Plectranthus parviflorus* and Maidenhair Fern (*Adiantum aethiopicum*).. Exotic species are widespread and abundant within this vegetation zone, including very severe infestation with Lantana. Other environmental weeds present include Rhodes Grass, Cobblers Pegs, Wild Tobacco Bush (*Solanum mauritianum*) and Moth Vine (*Araujia sericifera*).	Moderate/ good	Commensurate with Moist Shale Woodland in the Sydney Basin Bioregion Endangered Ecological Community listed under the TSC Act	No
7	Red Bloodwood – Grey Gum woodland	HN564	Red Bloodwood – Grey Gum Woodland occurs on the crest and upper slopes of the hill in the centre of the property. Tree species composition and structure vary, according to aspect to some extent, but also according to previous disturbance. For example, in the western portion of this vegetation type, it is apparent that most of the vegetation had been cleared approximately 60 years		Not listed as a threatened ecological community under the TSC or EPBC Acts	Yes

Vegetation Zone	Vegetation Type (OEH, 2013a)	Veg Type ID	Description	Condition	Conservation Significance	Within the event footprint?
			ago, then allowed to regrow. Common tree species include Red Bloodwood (*Corymbia gummifera*), Thin-leaved Stringybark (*Eucalyptus eugenioides*) and Grey Gum (*E. punctata*), although Forest Red Gum (*E. tereticornis*) occurs on the lower sections and Yellow Bloodwood (*Corymbia eximia*) is a regular occurrence throughout the patch. Mid-storey shrubs form dense thickets in some sections, but are sparse in other, more rocky sites. Shrub species include Woody Pear (*Xylomelum pyriforme*), Green Spider Flower (*Grevillea mucronulata*), Narrow-leaved Geebung (*Persoonia linearis*), Fringed Wattle (*Acacia fimbriata*), Gorse Bitter Pea (*Daviesia ulicifolia*) and Silky hakea (*Hakea sericea*). Grasses form a sparse ground cover. Species include *Themeda australis, Eragrostis brownii* and *Cymbopogon refractus*. *Pomax umbellata* forms dense mats.			
8	Grey Myrtle dry rainforest	HN538	Grey Myrtle dry rainforest occurs in a deep, incised gully sides to the west of Lake Jessica. It has closed forest structure with a canopy ranging up to approximately 20 m in height, dominated by Rusty Fig (*Ficus rubiginosa*) and Grey Myrtle (*Backhousia myrtifolia*) with occasional Lilly Pilly (*Acmena smithii*). There is a diverse open mid-storey of small trees such as Veiny Wilkiea (*Wilkiea huegeliana*), Kanooka (*Tristaniopsis laurina*) and Large Mock-olive (*Notelaea longifolia*). The groundcover is dominated by ferns and mosses along with a patchy, variable mix of shrubs, grasses, sedges and forbs. Characteristic fern species include Prickly Rasp Fern (*Doodia aspera*), Necklace Fern (*Asplenium flabellifolium*), Common Maidenhair and Giant Maidenhair (*Adiantum formosum*). Shrub species include Rough-fruited Pittosporum and Hairy Clerodendrum. Native grasses include *Oplismenus aemulus* and Weeping Meadow Grass. Herbs, sedges and forbs include Pastel Flower (*Pseuderanthemum variabile*), Variable Sword-sedge, *Dianella caerulea* var. *producta* and *Stellaria flaccida*. Climbers and scramblers are abundant, including Wonga Wonga Vine, Scrambling Lily and Wombat Berry. Exotic species are occasionally present within this vegetation	Moderate/ good	Commensurate with Western Sydney Dry Rainforest Endangered Ecological Community listed under the TSC Act	No

Vegetation Zone	Vegetation Type (OEH, 2013a)	Veg Type ID	Description	Condition	Conservation Significance	Within the event footprint?
			zone. Exotic plants include occasional patches of Lantana and other bird-borne environmental weeds such as Small-leaved Privet (*Ligustrum sinense*).			
9	Red Bloodwood – scribbly gum heathy woodland	HN566	Red Bloodwood – Scribbly Gum Heathy Woodland occurs in the north-western portion of the property. Much of the mid-storey is absent, possibly as an artefact of the most recent bushfires, although there are patches of recently established shrubs. The most common canopy species are Red Bloodwood (*Corymbia gummifera*) and Scribbly Gum (*Eucalyptus racemosa* subsp. *racemosa*), with occasional occurrences of ironbark species, especially Narrow-leaved Ironbark (*Eucalyptus crebra*). Further upslope, Yellow Bloodwood (*Corymbia eximia*) occurs with Red Bloodwood. The mid-storey mainly consists of small patches of recently established shrub species, especially *Grevillea sericea, G. mucronulata, Leptospermum trinervium, Pultenaea* spp. and *Hakea sericea*. Ground cover species mainly occur as scattered individuals or clumps, emerging from dense leaf mould. Species include Wallaby Grass *Rytidosperma tenuis, Lomandra* spp and *Stylidium productum*. Weed species are rare and mainly occur along the edge of access track. The most common weed occurrence is Whisky Grass (*Andropogon virginicus*).	Low	Not listed as a threatened ecological community under the TSC or EPBC Acts	Yes
10	Hard-leaved Scribbly Gum – Parramatta Red Gum heathy woodland	HN542	This vegetation type occurs on low-lying, level areas at the north-western end of the property. The area has been extensively disturbed in the past, although a reasonable number of mature trees had been retained. The most common regrowth tree species is Narrow-leaved Apple (*Angophora bakeri*). Mature tree species include Hard-leaved Scribbly Gum (*Eucalyptus racemosa* subsp. *racemosa*), Parramatta Red Gum (*Eucalyptus parramattensis* subsp. *parramattensis*) and, where the vegetation intergrades, Narrow-leaved Ironbark (*Eucalyptus crebra*), White Stringybark (*Eucalyptus globoidea*) and Forest Red Gum (*Eucalyptus tereticornis*). In some patches there is a complete, continuous canopy cover with no shrub canopy. Where trees are scattered, there are dense patches of shrubs, especially *Leptospermum*	Medium	Commensurate with Castlereagh Scribbly Gum Woodland Vulnerable Ecological Community listed under the TSC Act	Yes

Vegetation Zone	Vegetation Type (OEH, 2013a)	Veg Type ID	Description	Condition	Conservation Significance	Within the event footprint?
			polygalifolium, Hakea sericea, Melaleuca thymifolia and *Callistemon linearis*. *Themeda australis* forms a dense ground cover.			
12	Hard-leaved Scribbly Gum – Parramatta Red Gum heathy woodland	HN542	The poor patches of this vegetation type are most likely an artefact of previous clearing, where nearly all trees and shrubs have been removed. In these patches, Narrow-leaved Apple (*Angophora bakeri*) is the most common tree species. The other tree species, Hard-leaved Scribbly Gum (*Eucalyptus racemosa* subsp. *racemosa*), Parramatta Red Gum (*Eucalyptus parramattensis* subsp. *parramattensis*), White Stringybark (*Eucalyptus globoidea*) and Narrow-leaved Ironbark (*Eucalyptus crebra*) occur as scattered individuals. Ground cover mainly consists of *Themeda australis, Cymbopogon refractus* and *Imperata cylindrica*. In some patches, it is evident that *Macrozamia spiralis* and *Xanthorrhoea media* were common, although most individuals of these species are still in the process of recovering	Poor	Commensurate with Castlereagh Scribbly Gum Woodland Vulnerable Ecological Community listed under the TSC Act	Yes
	Regrowth Grey Box – Forest Red Gum grassy woodland on flats	HN528	This vegetation type consists of sparsely scattered trees, or thickets of juveniles. The most common species are Narrow-leaved Ironbark (*Eucalyptus crebra*) and Thin-leaved Stringybark (*Eucalyptus eugenioides*), although Forest Red Gum (*Eucalyptus tereticornis*) and Grey Box (*Eucalyptus moluccana*) also occur. In some patches the juvenile thickets are surrounded by Bursaria spinosa. The groundcover is variable, although native grass species, especially *Bothriochloa macra, Panicum simile* and *Poa sieberiana* are common, growing in association with exotic grass species.	Poor	Commensurate with Shale Sandstone Transitional Forest Endangered Ecological Community listed under TSC Act and EPBC Act	No

4.4 Fauna and fauna habitats

4.4.1 Fauna species

During field surveys by GHD over the last 12 months, a total of 99 fauna species have been recorded at the Fernhill Estate, including 82 bird species, 10 mammal species, two reptile species, four frog species and one invertebrate species (Appendix A).

Four threatened fauna species have been recorded at the Fernhill Estate:

- Glossy Black-cockatoo (*Calyptorhynchus lathami*), listed as vulnerable under the TSC Act
- Black-chinned Honeyeater (*Melthreptus gularis*), listed as vulnerable under the TSC Act
- Varied Sittella (*Daphoenositta chrysoptera*), listed as vulnerable under the TSC Act
- Cumberland Plain Land Snail (*Meridolum corneovirens*), listed as endangered under the TSC Act.

Five introduced species were recorded; three introduced birds, the European Red Fox (*Vulpes vulpes*) and the European Rabbit (*Oryctolagus cuniculus*).

4.4.2 Fauna habitats

Habitat features and resources are described in terms of the native fauna they may support with specific reference to threatened species potentially present or known to occur in the study area. The study area generally has good fauna habitat values, due to moderate habitat complexity, allowing for a moderate diversity of fauna species. The habitat assessment identified the following main habitat types across the site:

- Forested areas
- Open grassy woodland
- Farm dams.
- Cleared land.

Forested areas

Forested areas are present within the central parts of the study area, forming a north-south wildlife corridor. Vegetation types include Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest (HN 556), Red Bloodwood – Grey Gum Woodland (HN 564) and Forest Red Gum – Grey Box shrubby woodland (HN 524). The structural diversity of the vegetation is high with a complete mature upper canopy layer of eucalypts up to 25 metres tall over a diverse shrub and ground layer. Only occasional hollow-bearing trees and shrubs occur, likely due to clearing over 50 years previously. A range of myrtaceous tree species are present, and these species would provide foraging resources for a range of birds, including cockatoos, parrots and honeyeaters, arboreal mammals and flying-foxes. Understory species include a range of acacia and banksia species, which may provide foraging habitats for gliders and small possums. Occasional *Allocausarina littorais* (Black She-oak) are present, which are a preferred feed tree of the threatened Glossy Black-cockatoo, which has been recorded at the Fernhill Estate. Good quantities of leaf litter are present throughout these habitat areas. Rock outcrops with crevices and overhangs are present along gullies running through these forest areas. These could provide habitat for snakes, and potentially the threatened Spotted-tailed Quoll (*Dasyurus maculatus*) and Large-eared Pied Bat (*Chalinolobus dwyeri*). Common frogs were heard calling from creeklines. Threatened species such as Red-crowned Toadlets may also occur.

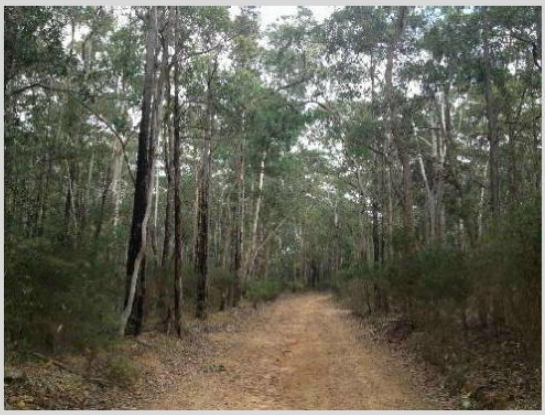

Photo 1: track through shrubby woodland

Photo 2: Track through open grassland woodland

Photo 3: Track through dam

Photo 4: Track through cleared area

Open woodland

Open woodland and forest with a grassy understory occurs in the eastern and western portions of the study area. In the waster portions, these woodland tend to occur as small patches within larger cleared areas. Vegetation types include Grey Box – Forest Red Gum grassy woodland on flats (HN528) and Grey Box – Forest Red Gum grassy woodland on hills (HN529) in the east, and Narrow-leaved Ironbark – Broad-leaved Ironbark – Grey Gum open forest (HN 556), Forest Red Gum – Grey Box shrubby woodland (HN 524) and Hard-leaved Scribbly Gum – Parramatta Red Gum heathy woodland (HN542) in the west. Occasional hollow-bearing trees are present, with some fallen logs, particularly in the eastern patches. The lack of fallen timber in some locations may be due to 'tidying up' activities undertaken by land managers in the past. Leaf litter is minimal in the western areas, while good quantities occur in the eastern patches.

The Varied Sittella (*Daphoenositta chrysoptera*) was recorded in Grey Box – Forest Red Gum grassy woodland on flats (HN528) in the south-east of the study area during previous surveys. Good quantities of leaf litter are present throughout this vegetation type. Cumberland Plain Land Snails (*Meridolum corneovirens*) were also recorded during previous surveys in the same area.

Farm dams

A number of farm dams and artificial lakes are present in the study area. These have emergent vegetation present including a range of sedges and reeds. Common frogs were heard calling from many of these dams. Waterbirds such as herons, egrets, cormorants and moorhens were observed. Snakes such as Red-bellied Black-snakes are likely to occur. Dams with good cover of emergent vegetation may provide foraging habitats for migratory waders such as Latham's

Snipe and the Australian Painted Snipe. Threatened microbats are likely to regularly forage for insects over the dams.

Cleared areas

Land within the eastern portion of the study area has been previously cleared for agricultural purposes and dwellings and farm buildings. These areas include stock paddocks and a racetrack. Common birds such as the Australian Magpies (*Cracticus tibicen*) and Red-rumped Parrots (*Psephotus haematonotus*) were observed in these areas.

4.5 Conservation Significance

Six threatened ecological communities were recorded at the Fernhill Estate (Table 3). Of these, the event track will pass through patches of the following:

- Cumberland Plain Woodland
- Shale – Sandstone Transition Forest
- Castlereagh Scribbly Gum Woodland.

Given much of the track is existing or is located in highly modified areas, impacts on threatened ecological communities are likely to be minimal. A detailed discussion of impacts is provided in section 5.

Two threatened flora species have been recorded at the Fernhill Estate:

- *Micromytrus minutiflora*, listed as endangered under the TSC Act and vulnerable under the EPBC Act
- *Grevillea juniperina* subsp. *juniperina,* listed as endangered under the TSC Act

A range of additional threatened flora species also have the potential to occur. These are detailed in Appendix A. Given much of the track is existing or is located in highly modified areas, impact on threatened flora are likely to be minimal. In particular, the track will not traverse the population of *Grevillea juniperina* subsp. *juniperina*. An existing track is already located within the area where *Micromytrus minutiflora* is known to occur, and thus further impacts are unlikely (see section 5 for further discussion on impacts on threatened flora).

Three threatened fauna species have been recorded at the Fernhill property during previous surveys:

- Glossy Black-cockatoo
- Varied Sittella
- Cumberland Plain Land Snail.

A range of additional threatened fauna species are also likely to occur, including Grey-headed Flying-foxes (*Pteropus poliocephalus*), microbats, woodland birds and frogs. These are detailed in Appendix A. The track will not traverse known habitat for the Cumberland Plain Land Snail. As no vegetation will be removed for the proposal, impacts on the two threatened birds known to occur at the property and any other species that may potentially occur would be minimal. A detailed discussion of potential impacts is provided in section 5.

Three migratory species have been recorded at the Fernhill Estate:

- Cattle Egret
- Eastern Great Egret
- Rainbow Bee-eater.

A range of additional migratory species are also likely to occur. These are detailed in Appendix A. Impacts on migratory species would be negligible. A detailed discussion of potential impacts is provided in section 5.

The western and north-western boundaries of Fernhill Estate are adjacent to the Blue Mountains World Heritage area. There would be no direct impacts on the Blue Mountains World Heritage area.

5. Impacts

5.1 Description of potential impacts

Impacts of the proposal are anticipated to be minor as the intended track alignment will extend through existing gaps in the vegetation and along existing tracks where possible. There will be no entry of participants into areas that are to be set aside for biobanking. No mature native trees would be removed for the proposal. There will be no trimming or slashing of vegetation, and no grading of tracks. Likely impacts of specific event components are discussed below:

- **Track:**
  - The intended track has been aligned specifically to avoid the proposed eastern biobank areas on the property, and through existing gaps in vegetation to minimise impacts on native vegetation and known populations of threatened plants. As noted above, there will be no removal of trees, or slashing or trimming of vegetation. Temporary marking of tracks (e.g. bunting) will be installed to demarcate the track and also prevent entry of participants into adjacent vegetation. These will be removed following the event.
- **Location of infrastructure**:
  - Erection of tents and establishment of temporary vehicle parks will be located in mainly cleared areas. There may be temporary compaction to sections of some trees' Structural Root Zones, or mechanical damage to leaders and lower branches.
  - Obstacles will be located in cleared areas as far as possible. There will be some trampling of groundcover. The obstacles will be removed immediately following the event and groundcover will likely recover quickly.
- The event
  - The event will be conducted over two days, over which time many participants will be present at the site. During this time noise is likely to temporarily disturb some fauna species.
  - There is likely to be some damage to groundcover as a result of people running along the course. Following the event and groundcover will likely recover quickly.
  - Where mud mile obstacles are located there may be some runoff of mud into adjacent vegetation.
  - There would be temporary disturbance at three small dams, where participants will either run around the perimeter or wade through the water (mud pits). These are artificial farm dams, and minimal habitat for native fauna is present. There may be some disturbance of common frogs, reptiles and waterbirds. No breeding habitat for any threatened or migratory waterbirds would be impacted.

These impacts are likely to be minor, given the temporary nature of the proposal and the fact that no vegetation would be cleared or substantially modified for the proposal. The proposal would be located in cleared areas as far as possible. Mitigation measures are provided in section 6 to further minimise potential impacts on native vegetation and habitats..

Further discussion of potential impacts on threatened ecological communities, threatened species and MNES is provided in section 5.3. In surveys following the previous event (autumn 2013), it was noted that there was no discernible adverse impacts along the majority of the event track. The location of one obstacle, a mud mile, was evident by some bare ground with only some recovery of groundcover. Recommended mitigation measures include assisted regeneration if there is disturbance of groundcover (see section 6).

5.2 Key threatening processes

A key threatening process (KTP) is defined under the TSC Act (OEH 2013c) 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.

There are currently 36 KTPs listed under the TSC Act, seven listed under the FM Act and 19 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 4. Mitigation measures to limit the impacts of KTPs of relevance are discussed in Section 6.

Table 4 Key threatening processes

Listed Key Threatening Process	Status	Would the proposal increase threat?
Habitat loss or change		
Clearing of native vegetation	TSC Act	No. There will be no clearing of native vegetation. Some disturbance of native groundcovers is likely. Mitigation measures are proposed in Section 6 to minimise disturbance of groundcover.
Loss of hollow-bearing trees	TSC Act	No. No hollow-bearing trees would be removed.
Removal of dead wood and dead trees	TSC Act	No. No stags would be removed. Clearing for tracks may disturb fallen timber but none would be removed from site. Mitigation measures are proposed in Section 6 to minimise disturbance of fallen timber.
The degradation of native riparian vegetation along NSW water courses	FM Act	Possible. The event could result in erosion and disturbance of riparian vegetation where the track passes over minor creeklines. Mitigation measures are proposed in Section 6 to minimise disturbance of riparian areas.
Weeds		
Invasion, establishment and spread of *Lantana camara**	TSC Act	Unlikely. Lantana was recorded within the study area. The proposal is unlikely to lead to the further invasion of this weed provided appropriate mitigation measures are developed and implemented as described in Section 6.
Invasion of plant communities by perennial exotic grasses	TSC Act	Unlikely. Parts of the study area are within cleared agricultural land, with the ground layer dominated by perennial exotic grasses. The proposal is unlikely to lead to the further invasion of these grasses provided appropriate mitigation measures and developed and implemented as described in Section 6.
Pest species		
Competition and grazing by the feral European Rabbit	TSC Act EPBC Act	Unlikely. The proposal is unlikely to increase this threat any more than that currently occurring in the study area.
Predation by the European Red Fox	TSC Act EPBC Act	Unlikely. The proposal is unlikely to increase this threat any more than that currently occurring in the study area.
Diseases		

Listed Key Threatening Process	Status	Would the proposal increase threat?
Infection of native plants by *Phytophthora cinnamomi*	TSC Act EPBC Act	Possible. The proposal could potentially introduce phytophthora into the study area. Mitigation measures are proposed in Section 7 to minimise the likelihood of this occurring.
Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae	TSC Act	Possible. The proposal could potentially introduce exotic rust fungi into the study area. Mitigation measures are proposed in Section 7 to minimise the likelihood of this occurring.
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis	TSC Act; EPBC Act	Likely. Event activities have the potential to introduce amphibian chytrid to the study area, which could lead to death of local frogs. Mitigation measures are proposed in Section 7 to minimise the likelihood of this occurring.

5.3 Impacts on threatened biota and MNES

5.3.1 Threatened ecological communities

Cumberland Plain Woodland occurs in the eastern portion of the study area, generally as small patches within or adjacent to cleared areas. In some locations the track comprises an existing roadway through the community (e.g near the stables and near the stock paddocks north of the racetrack). The proposal would have minimal impact on the adjacent community at these locations. There will be no clearing of trees, and no slashing or trimming of vegetation. The track will traverse patches of Cumberland Plain Woodland that occur within the stock paddocks. The ground layer in these locations is already disturbed by grazing. There would be minimal impact on the community in these locations, and the proposal would only temporarily impact the already disturbed ground layer. Similarly, the track will pass through a stand of this community near the main entrance. Again, the groundlayer in this location is subject to grazing, and the track and event would have minimal impact. There may be some ground disturbance within these patches from the installation of temporary protective fencing, and compaction of soil from participants. There is also the possibility of erosion leading to sediments entering adjacent areas. Assessments of significance pursuant to Section 5A of the EP&A Act and the EPBC Act significant impact guidelines (DEWHA 2009) are provided for this community. The conclusion of these assessments is that the proposal is unlikely to result in a significant impact.

Shale Sandstone Transition Forest occurs on east-facing slopes of the central portion of the Fernhill property, and in the western portion of the Fernhill property. In the central portion, the event will occur along existing tracks through the vegetation, and fencing will be installed to prevent entry of participants into these areas of native vegetation. There will be no clearing of trees, and no slashing or trimming of vegetation. There is the potential for indirect impacts from installation of fencing, and from erosion of the track during the event. In the western portion of the study area this vegetation type is characterised by scattered trees over a grassy understory. The proposal will involve the disturbance of the groundlayer in these areas through installation and removal of event features (e.g. mud mile #1). Assessments of significance pursuant to Section 5A of the EP&A Act and the EPBC Act significant impact guidelines (DEWHA 2009) are provided for this community. The conclusion of these assessments is that the proposal is unlikely to result in a significant impact..

Castlereagh Scribbly Gum Woodland occurs in the north-west portion of the Fernhill property. As with the above communities, there will be no clearing of trees, and no slashing or trimming of vegetation. Impacts will be restricted to temporary disturbance of groundlayer as a result of temporary fencing and participants running along the course. Impacts on this community will be

minimal. Note that as Castlereagh Scribbly Gum Woodland is listed as a vulnerable community under the TSC Act, no assessment of significance is required.

5.3.2 Threatened flora

No threatened flora species were recorded along the proposed event track, although threatened species are known to occur in the wider study area. Given that most of the track is located on existing tracks or within cleared areas, impacts on threatened flora are unlikely. There is potential for impacts in the regenerating woodland in the western portion of the study area, where the event track is not formed. In this area, there is the risk of damage to individual threatened plants if present, however none were observed. Assessments of significance pursuant to Section 5A of the EP&A Act and the EPBC Act significant impact guidelines (DEWHA 2009) have been provided for relevant species. The conclusion of these assessments is that the proposal is unlikely to result in a significant impact on threatened flora species.

5.3.3 Threatened fauna

Many threatened fauna species are likely to occur in the study area, either temporarily or as residents, however the proposal is highly unlikely to impact these species. Much of the event track is located on already formed tracks within areas of native vegetation. There will be no removal of trees, including no removal of hollow-bearing trees. Fauna would be subject to noise disturbance over the two day event however this is a temporary disturbance only. The proposal would result in a minor disturbance of groundcover in areas where no formed tracks exist (particularly in the western section and in the east where is passes through small stands of vegetation). No known habitat for the Cumberland Plain Land Snail would be impacted. Where the groundlayer would be impacted this species is unlikely to occur given the lack of potential habitat as a result of grazing. As such, impacts on woodland birds, arboreal mammals, bats, frogs and the Cumberland Plain Land Snail are likely to be negligible. No assessments of significance have been prepared for these species.

The proposal will involve participants crossing through two small dams in the west of the course (mud pits #2 and #3). These dams have minimal emergent vegetation and no overhanging trees. These dams do not represent potential breeding habitat for threatened or migratory water birds. These species could forage on occasion. The temporary nature of the disturbance would have a negligible impact on these species. Resident common frogs and turtles may be temporarily disturbed as a result of the two day event at these dams. No threatened frogs or reptiles are likely to occur, A large area of better quality habitat is present in the nearby Top Lake which would not be impacted by the proposal. The proposal would temporarily disturb potential foraging and breeding habitat. As such, impacts on woodland birds, frogs and reptiles are likely to be negligible. No assessments of significance have been prepared for these species.

5.3.4 Migratory species

Three migratory species were recorded in the study area: the Cattle Egret, Eastern Great Egret and Rainbow Bee-eater. No individual assessments of significance pursuant to the EPBC Act Significant Impact Guidelines (DEWHA 2009) have been prepared for these species as:

- The habitats recorded within the study area do not qualify as 'important habitat' for migratory species as defined under the guidelines;
- There is no real chance or possibility that the proposal will substantially modify, destroy or isolate an area of important habitat for migratory species;
- The proposal would not result in an invasive species (that is harmful to the migratory species) becoming established in an area of important habitat for migratory species; and

- The proposal is not likely to seriously disrupt the lifecycle of an ecologically significant proportion of the population of a migratory species.

Based on the above considerations the proposal is unlikely to impose "a significant effect" on any of the listed migratory fauna species predicted to occur within the locality.

5.3.5 Other MNES

The Blue Mountains World Heritage Area is adjacent to the western and north-western boundaries of Fernhill Property. The event passes alongside the boundary for about 150 metres prior to 'Hold Your Wood'. It also passes within about 50 metres of the boundary about 400 – 800 metres east of this location. Impacts on the Blue Mountains World Heritage Area are highly unlikely due to the limited impacts associated with the proposal, the presence of a boundary fence preventing entry in the World Heritage Area, and the distance between the track and the World Heritage Area for most of the course.

6. Impact Mitigation

6.1 Avoidance of impacts

Direct impacts on native vegetation and flora and fauna habitats have been avoided to a large extent by choosing a course alignment that avoids any clearing of vegetation, including avoiding slashing and trimming as far as is practicable. The following measures have been taken into account in the design of the track:

- Existing tracks will be used as far as possible for the course.
- The track will cross riparian vegetation through existing gaps.
- Temporary facilities, such as the obstacles and drinking stations, shall be located in areas already disturbed and/or cleared.
- The track will avoid entering the proposed Fernhill East Biobank.

6.2 Mitigation of impacts

Where impacts cannot be avoided, the following mitigation measures will need to be implemented to avoid or minimise direct and indirect impacts on EECs and threatened biota:

- The final alignment of the track should be designed with the aim of minimising the need to disturb topsoil and ground-cover growing along existing track edges. Temporary fencing should be installed to delineate the track and restrict access into areas of native vegetation and to protect the vegetation edge, including the Structural Root Zones (SRZ) of retained, mature trees. Where tents are to be installed close to patches of EEC, temporary fencing should be installed prior to and during the event. The fencing should be located by a qualified ecologist and/or arborist.
- An ecologist should be present on site during installation of track fencing to ensure no damage to threatened ecological communities or threatened flora.
- *Micromyrtus minutiflora* plants should be fenced to ensure no damage during the event.
- A clean on entry, clean on exit policy should be in place for all vehicles and plant, in order to avoid the potential spread of weeds as well as other pathogens such as *Phytophthora cinnamomi* or Myrtle Rust into the retained vegetation.
- All work staff, if working in or near water bodies, should be aware of the protocols for limiting the spread of Chytrid fungus to frog species.
- Appropriate erosion and sediment controls should be installed where necessary to minimise any indirect impacts on downslope vegetation and water bodies.
- A site induction should be held for all staff and participants, and include information on the sensitive nature of the vegetation, the adjacent World Heritage area, and the need to stay within marked areas.
- Following removal of event obstacles, damage to the groundlayer should be rectified with assisted regeneration if required.

Establishment of the Fernhill East biobank is proposed to offset impacts relating to clearing of vegetation on the property relating to a proposed Eastern Precinct subdivision. An assessment of the proposed biobank is currently being prepared, with the view to a biobanking agreement being made with OEH (GHD in prep). The biobank areas will conserve areas of Cumberland Plain Woodland and Shale Sandstone Transition Forest, communities that will be temporarily

disturbed by the Tough Mudder Event. No areas proposed for the Fernhill East biobank will be impacted by the Tough Mudder event.

7. Conclusion

Impacts of the Tough Mudder Endurance Event are anticipated to be minor as the intended track alignment will follow existing tracks where possible, and otherwise will extend through existing gaps in the vegetation. There will be no clearing of trees, and no slashing or trimming of vegetation for establishment of the tracks. Temporary fencing will be established along existing tracks to prevent entry of participants into adjacent native vegetation, in particular to protect threatened ecological communities. The track has been designed to avoid entry into areas that are to be set aside for the Fernhill East biobank. Some groundcover will be impacted where no existing tracks are present. This impact will be temporary, and following the event the groundcover is likely to recover quickly.

There is the potential for threatened flora species to be impacted. The event trackn avoids the area where the population of *Grevillea juniperina* subsp. *juniperina* is known to occur, and passes across a very narrow area of potential habitat for *Micrcmyrtus minutifclia*, however individual plants are unlikely to be impacted. These plants will be denced to ensure there is no damage. Impacts on these threatened species are therefore likely to be minimal.

There will be negligible impacts on fauna species given that no vegetation would be cleared. There would be no impact on hollow-bearing trees. Noise may temporarily disturb resident fauna during the two-day event. There would be temporary disturbance at three small farm dams, where the event track either passes through or around the dams. Common frogs, reptiles and waterbirds would be temporarily disturbed during the event. No impacts on threatened fauna species listed under the TSC or EPBC Acts are anticipated as a result of the proposed event.

Assessments of significance have been prepared for the two threatened ecological communities through which the event will pass and for the two threatened flora species that occur at the Fernhill Property. The outcome of the assessments is that the proposal is unlikely to have a significant impact on any threatened biota.

Measures to minimise impacts of the event have been identified according to the hierarchy of avoid and mitigate. As noted above, potential impacts have been largely avoided through the use of existing tracks where possible, the avoidance of the proposed biobank conservation area and given that no native vegetation would be cleared. Potnetial impacts on native vegetation and fauna habitats will be further minimised by adopting a range of specific mitigation measures, including fencing of native vegetation to prevent entry by participants, a clean on entry/clean on exit policy for vehicles, appropriate fencing and sediment control, and a site induction for all staff and participants.

8. References

Bannerman, S. M. and Hazelton, P.A. (1990) *Soil Landscapes of the Penrith 1:100 000 Sheet and Map.* Soil Conservation Service of NSW, Sydney.

Benson, D., Howell, J. and McDougall, L. (1996) Mountain Devil to Mangrove. A Guide to the Natural Vegetation in the Hawkesbury –Nepean Catchment. NSW Royal Botanic Gardens, Sydney.

Benson, D. and Howell, J (1990) *Taken for Granted. The Bushland of Sydney and its Suburbs.* Kangaroo Press and . NSW Royal Botanic Gardens, Sydney.

Commonwealth of Australia (2010) Cumberland Shale Woodlands and Shale-Gravel Transition Forest. Policy Statement 3.31. Canberra.

Department of Environment and Conservation (2005). Threatened Species Profile Database – *Cumberland Plain Woodland in the Sydney Basin Bioregion* – Profile. DEC website http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/profile.aspx?id=10191

Department of Environment, Climate Change and Water. (2010) Approved Cumberland Plain Recovery Plan. DECCW NSW, Sydney, NSW.

Department of Environment, Climate Change and Water (2010b) Threatened Species Profile – *Grevillea juniperina* subsp. *juniperina*. DECCW online: www.threatenedspecies.environment.nsw.gov.au/tsprofile.aspx?id=10367

Department of Environment, Climate Change and Water (2010c) Threatened Species Profile – *Micromyrtus minutiflora*. DECCW online: www.threatenedspecies.environment.nsw.gov.au/tsprofile.aspx?id=10529

EcoLogical Australia (2007) Fernhill Ecological Assessment.Report prepared for Warren Anderson.

Ecological Australia (2010). Owston Estate (Fernhill) Ecological Assessment of Proposed Rezoning. Report prepared for Owston Nominees.

Department of the Environment, Water, Heritage and the Arts (2009) Significant Impact Guidelines 1.1: Matters of National Environmental Significance. http://www.environment.gov.au/epbc/publications/pubs/nes-guidelines.pdf Department of the Environment, Water, Heritage and the Arts.

Department of Primary Industries (2013) Threatened and protected species records viewer. Available from: http://www.dpi.nsw.gov.au/fisheries/species-protection/records accessed February 2012

Department of Sustainability, Environment, Water, Population and Communities (2013a) EPBC Online Protected Matters Search Tool. Online resource http://www.environment.gov.au/erin/ert/epbc/index.html , queried July 2013.

Department of Sustainability, Environment, Water, Population and Communities. (2013b) Species Profile and Threats Database (SPRAT) database. Online resource http://www.environment.gov.au/cgi-bin/sprat/public/sprat.p accessed July 2013.

Fairley, A. (2004) *Seldom Seen. Rare Plants of Greater Sydney*. Reed New Holland, Sydney.

GHD (2012). Fernhill Athletic Endurance Track Preliminary Ecological Assessment. Report prepared for Tough Mudder.

GHD (2013). Fernhill Eastern Precinct Subdivision Ecology Assessment. Report prepared for Fernhill.

GHD (2013). Fernhill Central Precinct Ecology Assessment. Report prepared for Fernhill.

James, T., McDougall, L. and Benson, D. (1999) *Rare Bushland Plants of Western Sydney*. NSW Royal Botanic Gardens, Sydney.

Klaphake, V. (2010) *Eucalypts of the Sydney Region*. Van Klaphake, Byabarra.

NSW NPWS (2002a) Interpretation Guidelines for the Native Vegetation Map of the Cumberland Plain, Western Sydney. Threatened Species Unit, Hurstville.

NSW NPWS (2002b) Environmental Impact Assessment Guidelines for *Grevillea juniperina* subsp. *juniperina*. NSW NPWS, Hurstville.

NSW NPWS (2008) Mulgoa Nature Reserve. Plan of Management.

NSW Scientific Committee (2009). Cumberland Plain Woodland in the Sydney Basin Bioregion - critically endangered ecological community listing. Website http://www.environment.nsw.gov.au/determinations/cumberlandwoodlandsFD.htm

Office of Environment and Heritage (2013a). NSW National Parks and Wildlife Service NSW Wildlife Atlas Database. Office of Environment and Heritage NSW. Data supplied by OEH, July 2013.

Office of Environment and Heritage (2013b) Threatened Species profiles website http://www.threatenedspecies.environment.nsw.gov.au/tsprofile/index.aspx Office of Environment and Heritage NSW, accessed July 2013.

9. Disclaimer

This report has been prepared by GHD for Toughmudder and may only be used and relied on by Toughmudder for the purpose agreed between GHD and the Toughmudder as set out in section 1 of this report.

GHD otherwise disclaims responsibility to any person other than Toughmudder 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.

Appendices

Appendix A – Threatened biota likely to occur

Threatened ecological communities

Community	TSC Act	EPBC Act	Habitat Association	Details of record	Presence in the study area
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*.	Predicted to occur within 10km (OEH 2013)	Possible – one disturbed area in the north of the site contains components of this vegetation type
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 deanei, 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.	Predicted to occur within 10km (OEH 2013) Predicted to occur within 10km (DSEWPaC 2013)	Nil – no appropriate suite of canopy species present on site
Blue Mountains Swamps in the Sydney Basin Bioregion	VEEC	EEC	Occurs between 500-900m asl, on soils varying from damp yellow-grey sandy loams to black mineral peats. Typically associated with stream headwaters on sandstone plateaux of the Blue Mountains in poorly drained areas. Structure ranges from closed heath/scrub to open heath, closed sedgeland or fernland. Characterised by dense mixture shrubs and sedges, with shrub stratum typically 0.5 m to over 2.0 m tall and highly variable in cover. Ground stratum of sclerophyllous sedges and grasses to 1 m tall.	Predicted to occur within 10km (OEH 2013)	Nil – no appropriate soil types present on site
Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion	VEC		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.	Predicted to occur within 10km (OEH 2013)	Likely – one disturbed area in the north of the site contains components of this vegetation type
Castlereagh Swamp Woodland Community	EEC		Occurs 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, Juncus usitatus* and *Goodenia paniculata*.		Likely – one disturbed area in the north of the site contains components of this vegetation type

Community	TSC Act	EPBC Act	Habitat Association	Details of record	Presence in the study area
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 spp over sparse ground layer of grasses and herbs.	Predicted to occur within 10km (OEH 2013)	Possible – one disturbed area in the north of the site contains components of this vegetation type
Cumberland Plain Woodland in the Sydney Basin Bioregion	CEEC	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.	Predicted to occur within 10km (OEH 2013) Predicted to occur within 10km (DSEWPaC 2013)	This CEEC occurs on the site
Elderslie Banksia Scrub Forest	EEC		Occurs only in the Elderslie area, near Camden, in Sydney's south-west (15 ha in total). Unique as includes plants, such as coastal Banksia and other sandstone region species, which do not occur in the surrounding Cumberland Plain communities. Occurs only on sand deposits on the old terraces deposited by ancient river systems of what is now the Nepean River, and requires deep sand soil to fully regenerate.	Predicted to occur within 10km (OEH 2013)	Nil – no appropriate soil types or suite of species present on site
Freshwater Wetlands on Coastal Floodplains of the NSW 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.	Predicted to occur within 10km (OEH 2013)	Unlikely, because of extensive disturbances. Most wetland areas have either been created or modified.
Moist Shale Woodland in the Sydney Basin Bioregion	EEC		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 Clerodendrum Clerodendrum *tomentosum* and Indian Weed *Siegesteckia orientalis* ssp *orientalis*.	Predicted to occur within 10km (OEH 2013)	Present.

Community	TSC Act	EPBC Act	Habitat Association	Details of record	Presence in the study area
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.	Predicted to occur within 10km (OEH 2013) Predicted to occur within 10km (DSEWPaC 2013)	Nil – no appropriate soil types or suite of species present on site
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 2012).	Predicted to occur within 10km (OEH 2013)	Nil – no appropriate soil types or suite of species present on site
Newnes Plateau Shrub Swamp in the Sydney Basin Bioregion	EEC	EEC		Predicted to occur within 10km (OEH 2013)	Nil – no appropriate soil types or suite of species present on site. This EEC restricted to Newnes Plateau
River-Flat Eucalypt Forest on Coastal Floodplains of the NSW 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.	Predicted to occur within 10km (OEH 2013)	This EEC occurs on the site
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.	Predicted to occur within 10km (OEH 2013)	Nil – no appropriate soil types or suite of species present on site
Shale Gravel Transition Forest in the Sydney Basin Bioregion	EEC	CEEC (under CPW)	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,*	Predicted to occur within 10km (OEH 2013) Predicted to occur within 10km (DSEWPaC 2013)	Possible – one disturbed area in the north of the site contains components of this vegetation type

Community	TSC Act	EPBC Act	Habitat Association	Details of record	Presence in the study area
			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.		
Shale/Sandstone Transition Forest	EEC	EEC	Occurs on the edges of the Cumberland Plain where clay soils on shale intergrade with sandstone soils, or where shale caps overlay sandstone. Species composition variable depending on soil influences. Dominant tree species include *Eucalyptus tereticornis, E. punctata, E. globoidea, E. eugenioides, E. fibrosa* and *E. crebra*. Areas with a low sandstone influence have an understorey closer to Cumberland Plain Woodland.	Predicted to occur within 10km (OEH 2013) Predicted to occur within 10km (DSEWPaC 2013)	This EEC occurs on the site
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.	Predicted to occur within 10km (OEH 2013)	Nil – no appropriate soil types or suite of species present on site
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.	Predicted to occur within 10km (OEH 2013)	Nil – no appropriate soil types or suite of species present on site
Sun Valley Cabbage Gum Forest in the Sydney Basin Bioregion	CEEC		This vegetation type occurs in the Blue Mountains on diatreme soils. *Eucalyptus amplifolia* and *Eucalyptus eugenioides* are common canopy species.	Predicted to occur within 10km (OEH 2013)	Nil – inappropriate soils and location

Community	TSC Act	EPBC Act	Habitat Association	Details of record	Presence in the study area
Swamp Oak Floodplain forest of the NSW 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.	Predicted to occur within 10km (OEH 2013)	Nil – no appropriate canopy species; inappropriate location.
Sydney Turpentine-Ironbark Forest	EEC	CEEC	Occurs on the Cumberland Plain , with most remnants in Baulkham Hills, Hawkesbury, Hornsby, Ku-ring-gai, Parramatta, Ryde, Sutherland and Wollondilly LGAs. Open forest characterised by *Syncarpia glomulifera*, *Eucalyptus punctata, Eucalyptus pancuiata* and *E. eugenoides*. In areas of high rainfall (over 1050 mm per annum) *E. saligna* is more dominant. Sparse shrub stratum of *Pittosporum undulatum* and *Polyscias samtucifolia*.	Predicted to occur within 10km (DSEWPaC 2013)	Nil – no appropriate canopy species; inappropriate location.
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.	Predicted to occur within 10km (OEH 2013) Predicted to occur within 10km (DSEWPaC 2013)	Nil – no appropriate soil types or suite of species present on site
Western Sydney Dry Rainforest in the Sydney Basin Bioregion	EEC		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.	Predicted to occur within 10km (OEH 2013) Predicted to occur within 10km (DSEWPaC 2013)	Present.

Threatened flora species and populations

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence
Acacia bynoeana	Bynoe's Wattle	E	V	Endemic to central eastern NSW, currently known from only 34 locations, many of only 1-5 plants. Grows mainly in heath/ dry sclerophyll forest on sandy soils, prefers open, sometimes slightly disturbed sites such as trail margins, road edges, and in recently burnt open patches. Flowers September to March, and fruit matures in November.	**29 records** within 10km (OEH 2013) Predicted to occur within 10km (DSEWPaC 2013)	Possible – not recorded during this or previous surveys
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 (DSEWPaC 2013)	Unlikely - not recorded during this or previous surveys
Acacia pubescens	Downy Wattle	V	V	Occurs mainly in Bankstown-Fairfield-Rookwood and Pitt Town areas, with outliers at Barden Ridge, Oakdale and Mountain Lagoon. Grows on alluviums, shales and shale/sandstone intergrades. Soils characteristically gravely, often with ironstone. Occurs in open woodland and forest, in communities including Cooks River/ Castlereagh Ironbark Forest, Shale/ Gravel Transition Forest and Cumberland Plain Woodland. Flowers August to October.	**3 records** within 10km (OEH 2013)	Possible – not recorded during this or previous surveys
Acrophyllum australe		V	V	Restricted, from Faulconbridge to Lawson, South of Bilpin and near Kings Tableland, in the Blue Mountains area. Grows in sheltered gullies beneath waterfalls and drip zones of rock overhangs and cliff faces, usually with a south-east to south-west aspect	**18 records** within 10km (OEH 2013)	Unlikely – inappropriate habitat and location
Allocasuarina glareicola			E	Primarily found in Richmond district; although outlier populations exist in Voyager Point, Liverspool (OEH 2012). Found in open woodland on castlereagh woodland on lateritic soil; associated with these species: calyptus parramattensis, Eucalyptus fibrosa, Angophora bakeri, Eucalyptus sclerophylla and Melaleuca decora. Common associated understorey species include Melaleuca nodosa, Hakea dactyloides, Hakea sericea, Dillwynia tenuifolia, Micromyrtus minutiflora, Acacia elongata, Acacia brownei, Themeda australis and Xanthorrhoea minor	**30 records** within 10km (OEH 2013) Predicted to occur within 10km (DSEWPaC 2013)	Possible – not recorded during this or previous surveys
Ancistrachne maidenii		V	-	Restricted to 2 disjunct areas: N Sydney within the St Albans, Mt White to Berowra area and in the Shannon Creek area near Grafton, with only 7 known populations. Occurs in dry sclerophyll forest on sandstone derived soils at the transition between Hawkesbury and Watagan soil landscapes.	**1 record** within 10km (OEH 2013)	Unlikely – inappropriate soil type, habitat and location
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	Predicted to occur within 10km (DSEWPaC 2013)	Unlikely – inappropriate soil type, habitat and location

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence
				outcrops and boulders in sheltered forests on mid- to lower slopes and valleys.		
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 (DSEWPaC 2013)	Possible – no indicator species recorded during this or previous surveys
Cynanchum elegans	White-flowering 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 limiting.	8 records within 10km (OEH 2013) Predicted to occur within 10km (DSEWPaC 2013)	Unlikely, inappropriate habitat and location
Diuris tenuifolia		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.	**101 records** within 10km (OEH 2013)	Possible – not recorded during this or previous surveys
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.	**17 records** within 10km (OEH 2013)	Possible – not recorded during this or previous surveys
Eucalyptus nicholii	Narrow-leaved Black Peppermint	V	V	Naturally occurs only in New England Tablelands from Nundle to north of Tenterfield. Widely planted as urban street tree. Grows in dry grassy woodland, on shallow and infertile soils, mainly on granite.	Predicted to occur within 10km (DSEWPaC 2013)	Nil- no planted specimens recorded
Grevillea juniperina subsp. *juniperina*		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.	**275 records** within 10km (OEH 2013)	This species occurs on the site

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence
Hypsela sessiliflora		E	Ex	Currently known from a single location less than 10x15m on the Cumberland Plain in western Sydney. Known to grow in damp places, on the Cumberland Plain, including freshwater wetland, grassland/alluvial woodland and an alluvial woodland/shale plains woodland (Cumberland Plain Woodland) ecotone. May be an early successional species that benefits from some disturbance. Possibly out competed when overgrown by some species such as *Cynodon dactylon*.	**7 records** within 10km (OEH 2013)	Possible – not recorded during this or previous surveys
Leucopogon fletcheri subsp. *fletcheri*		V	V	Restricted to NW Sydney between St Albans and Annangrove, within the Hawkesbury, The Hills and Blue Mountains LGAs. Occurs in dry eucalypt woodland or shrubland on clayey lateritic soils, generally on flat to gently sloping terrain along ridges and spurs. Flowers August to September.	**168 records** within 10km (OEH 2013)	Nil- inappropriate soil and location
Marsdenia viridiflora R. Br. subsp. *viridiflora* population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas		E2		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.	**16 records** within 10km (OEH 2013)	Possible – not recorded during this or previous surveys
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.	**8 records** within 10km (OEH 2013) Predicted to occur within 10km (DSEWPaC 2013)	Nil- inappropriate soil and location
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.	**34 records** within 10km (OEH 2013)	This species occurs on the site
Pelargonium sp *Striatellum*	Omeo's Storkbill	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 (DSEWPaC 2013)	Nil- inappropriate soil and location
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	**6 records** within 10km (OEH 2013) Predicted to occur within 10km	Nil- inappropriate soil and location

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence
				areas eg roadsides.	(DSEWPaC 2013)	
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.	**4 records** within 10km (OEH 2013) Predicted to occur within 10km (DSEWPaC 2013)	Possible – not recorded during this or previous surveys
Persoonia nutans	Nodding Geebung	E	E	Occurs from Richmond to Macquarie Fields on the Cumberland Plain. Grows only on aeolian and alluvial sediments in sclerophyll forest and woodland vegetation communities. Largest populations occur in Agnes Banks Woodland or Castlereagh Scribbly Gum Woodland.	**133 records** within 10km (OEH 2013)	Possible – not recorded during this or previous surveys
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 (DSEWPaC 2013)	Possible – not recorded during this or previous surveys
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 (DEC 2005).	**8 records** within 10km (OEH 2013) Predicted to occur within 10km (DSEWPaC 2013)	Possible – not recorded during this or previous 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 (DSEWPaC 2013)	Possible – not recorded during this or previous surveys

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence
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 (DSEWPaC 2013)	Possible – not recorded during this or previous surveys
Pultenaea glabra	Smooth 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.	**10 records** within 10km (OEH 2013) Predicted to occur within 10km (DSEWPaC 2013)	Nil – inappropriate location and soil type
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.	**120 records** within 10km (OEH 2013) Predicted to occur within 10km (DSEWPaC 2013)	Possible – not recorded during this or previous surveys
Pultenaea villifera Sieber ex DC. population in the Blue Mountains local government area					**300 records** within 10km (OEH 2013)	Unlikely – no appropriate soil types or suite of species present on site; site not located within Blue Mountains LGA
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 (DECC 2005b; c). 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 (DSEWPaC 2013)	Possible – not recorded during this or previous surveys (and difficult to detect)
Streblus pendulinus	Siah's backbone		E	Siah's Backbone occurs from Cape York Peninsula to Milton, south-east New South Wales (NSW), as well as Norfolk Island (ATRP 2010; Jessup 2003; The Royal Botanic Gardens and Domain Trust 2011). Siah's Backbone is found in warmer rainforests, chiefly along watercourses. The species grows in well developed rainforest, gallery forest and drier, more seasonal rainforest (ATRP 2010).	Predicted to occur within 10km (DSEWPaC 2013)	Possible, although the patches of rainforest are mostly narrow and disturbed.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence
Tetratheca glandulosa		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 community.	Predicted to occur within 10km (DSEWPaC 2013	Possible – not recorded during this or previous surveys
Thelymitra sp. *Kangaroon*	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 (DSEWPaC 2013)	Unlikely – no appropriate soil types or suite of species present on site; location probably insufficiently high ASL.

Threatened fauna species

Scientific Name	Common Name	TSC/ FM Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence
Birds						
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 2013) Predicted to occur within 10km (DSEWPaC 2013)	Likely. May occur at dams with dense reedbeds
Rostratula 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 to occur within 10km (DSEWPaC 2013)	Possible. May occur at dams with dense reedbeds
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, Eucalyptus albens, Eucalyptus polyanthemos and Eucalyptus blakelyi. Birds and mammals important prey during breeding. Territories range from 30 to 200 hectares.	**3 records** within 10km (OEH 2013)	Likely. Potential habitat present within woodland areas.
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 (OEH 2013)	Likely. May occur at dams with dense reedbeds
Falco subniger	Black Falcon	V		The Black Falcon is widely, but sparsely, distributed in New South Wales, mostly occurring in inland regions. Some reports of 'Black Falcons' on the tablelands and coast of New South Wales are likely to be referable to the Brown Falcon. Occurs in plains, grasslands, foothills, timbered watercourses, wetland environs, crops, and	**1 record** within 10km (OEH 2013)	Likely. May forage above the study area on occasion.

Scientific Name	Common Name	TSC/ FM Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence
				occasionally over towns and cities. Breeding occurs along timbered waterways in in land areas.		
Meliphreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V		Widespread in NSW, but rarely recorded east of Great Dividing Range except in Richmond and Clarence River areas and scattered sites in the Hunter, Central Coast and Illawarra regions. Mostly in upper levels of drier open forests /woodlands dominated by box and ironbark eucalypts, or less commonly smooth-barked gums, stringybarks and tea-treas. Forage over home range of >5 ha. Tend to occur within largest woodland patches in the landscape. They forage for insects, nectar and honeydew. The nest is hidden by foliage high in the crown of a tree.	**3 records** within 10km (OEH 2013)	Present. Recorded in the study area.
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.	**2 records** within 10km (OEH 2013)	Likely. May occur at dams with dense reedbeds
Limosa limosa	Black-tailed Godwit	V	M	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 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.	**1 record** within 10km (OEH 2013)	Possible. May occur at dams with dense reedbeds
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V		Occurs from Corowa, Wagga Wagga, Temora, Forbes, Dubbo and Inverell to the east coast, in areas such as the Snowy River Valley, Cumberland Plain, Hunter Valley and parts of the Richmond and Clarence Valleys. Most common on the inland slopes and plains. Inhabits eucalypt woodlands and dry open forest, usually dominated by stringybarks or rough-barked species with open grassy understorey. Fallen timber is important foraging habitat. Nests in	**1 record** within 10km (OEH 2013)	Likely. May forage and breed in the study area.

Scientific Name	Common Name	TSC/ FM Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence
				hollows in standing trees or stumps.		
Burhinus grallarius	Bush Stone-curlew	E		Scattered distribution across NSW. The nearest known populations to the site are near Nowra and Pittwater (DEC 2006) although there is a record near Bargo from 1991 (OEH 2013a). 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 (DEC 2006).	**2 records** within 10km (OEH 2013)	Likely. May forage and breed in the study area.
Stagonopleura 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 understorey or higher up under nests of other species.	**4 records** within 10km (OEH 2013)	Likely. May forage and breed in the study area.
Petroica phoenicea	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.	**5 records** within 10km (OEH 2013)	Likely. May forage and breed in the study area.
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 2013)	Possible. May occur at farm dams on occasion, but not preferred habitat.
Callocephalon fimbriatum	Gang-gang Cockatoo	V		SParsely distributed in areas of less than 500mm rainfall, north from north-western NSW.Inhabits a range of inland habitats, especially along timbered watercourses which is the preferred breeding habitat. Also hunts over grasslands and sparsely timbered w	**44 records** within 10km (OEH 2013)	Likely. May forage and breed in the study area.
Calyptorhynchus lathami	Glossy Black-Cockatoo	V		Widespread but uncommon from coast to southern tablelands and central western plains. Feeds almost exclusively on the seeds of Allocasuarina species. Prefers woodland and open forests, rarely	**31 records** within 10km (OEH 2013)	Likely. May forage and breed in the

Scientific Name	Common Name	TSC/ FM Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence
				away from Allocasuarina. Roost in leafy canopy trees, preferably eucalypts, usually <1km from feeding site. Nests in large (approx. 20cm) hollows in trees, stumps or limbs, usually in Eucalypts (Higgins 1999).		study area.
Melanodryas cucullata cucullata	Hooded Robin	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 occasionally on fallen trees or limbs. The Hooded Robin occurs throughout much of NSW, but is absent from coastal areas south of Sydney. Its distribution overlaps the northern portion of the study area, and is not likely to occur within the Sydney Metropolitan Special Area.	**2 records** within 10km (OEH 2013)	Likely. May forage and breed in the study area.
Hieraaetus morphnoides	Little Eagle			Occurs throughout NSW except most densely forested parts of the Dividing Range escarpment. Occupies habitats rich in prey within open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used. For nest sites it requires a tall living tree within a remnant patch, where pairs build a large stick nest in winter and lay in early spring.	**2 records** within 10km (OEH 2013)	Likely. May forage and breed in the study area.
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.	**7 records** within 10km (OEH 2013)	Likely. May forage and breed in the study area.
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 2013)	Likely. May forage and breed in the study area.

Scientific Name	Common Name	TSC/ FM Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence
Grantiella picta	Painted Honeyeater	V	-	Nomadic, occurring in low densities across most of NSW. Highest concentrations and almost all breeding occur on inland slopes of the Great Dividing Range. Inhabits Boree, Brigalow and Box Gum woodlands and Box-Ironbark forests. Specialist forager on the fruits of mistletoes, preferably of the Amyema genus. Nests in outer tree canopy.	**1 record** within 10km (OEH 2013)	Likely. May forage and breed in the study area.
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.	**27 records** within 10km (OEH 2013)	Likely. May forage and breed in the study area.
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 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).	Predicted to occur within 10km (DSEWPaC 2013)	Possible. May forage and breed in the study area.
Xanthomyza phrygia	Regent Honeyeater	E	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.	**10 records** within 10km (OEH 2013) Predicted to occur within 10km (DSEWPaC 2013)	Likely. May forage in the study area on occasion.
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.	**10 records** within 10km (OEH 2013)	Likely. May forage and breed in the study area.

Scientific Name	Common Name	TSC/ FM Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence
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.	**6 records** within 10km (OEH 2013)	Likely. May forage and breed in the study area.
Pyrrholaemus sagittatus	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.	**16 records** within 10km (OEH 2013)	Likely. May forage and breed in the study area.
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.	**8 records** within 10km (OEH 2013)	Likely. May forage and breed in the study area.
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.	**20 records** within 10km (OEH 2013) Predicted to occur within 10km (DSEWPaC 2013)	Likely. May forage in the study area on occasion.
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.	**2 records** within 10km (OEH 2013)	Likely. May forage and breed in the study area.

Scientific Name	Common Name	TSC/ FM Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence
Lophoenositta 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-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.	**14 records** within 10km (OEH 2013)	Present. Likely to forage and breed in the study area.
Epthianura albifrons	White-fronted Chat	V	-	This species occurs from southern Queensland to Western Australia and down to Tasmania, mostly in temperate to arid climates and very rarely in sub-tropical areas. It is found in damp open habitats, particularly wetlands containing saltmarsh areas that are bordered by open grasslands. Along the coast they are found in estuarine and marshy habitats with vegetation <1m tall, and in open grasslands and areas bordering wetlands. Inland, they are often observed in grassy plains, saltlakes and saltpans along waterway margins.	**1 record** within 10km (OEH 2013)	Likely. May occur at dams with dense reedbeds
Mammals						
Petrogale 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 records** within 10km (OEH 2013) Predicted to occur within 10km (DSEWPaC 2013)	Nil.
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, storm water 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).	**66 records** within 10km (OEH 2013)	Likely. May forage in the study area.

Scientific Name	Common Name	TSC/ FM Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V		Occurs on southeast coast and ranges. Prefers tall (>20m) and wet forest with dense understorey. Absent from small remnants, preferring continuous forest but can move through cleared landscapes and may forage in open areas. Roosts in hollow trunks of Eucalypts, underneath bark or in buildings. Forages in gaps and spaces within forest, with large foraging range (12km foraging movements recorded) (Churchill 2008, Law et al 2008).	**8 records** within 10km (OEH 2013)	Likely. May forage and breed in the study area.
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).	**29 records** within 10km (OEH 2013)	Likely. May forage and breed in the study area.
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 subject 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).	**2 records** within 10km (OEH 2013)	Likely. May forage and breed in the study area.
Scoteanax 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).	**18 records** within 10km (OEH 2013)	Likely. May forage and breed in the study area.
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	**35 records** within 10km (OEH 2013) Predicted to occur within 10km (DSEWPaC 2013)	Likely. May forage in the study area.

Scientific Name	Common Name	TSC/ FM Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence
				2008). Will also forage in urban gardens and cultivated fruit crops.		
Phascolarctos 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.	**36 records** within 10km (OEH 2013) Predicted to occur within 10km (DSEWPaC 2013)	Likely. May forage and breed in the study area.
Chalinolobus dwyeri	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.	**7 records** within 10km (OEH 2013) Predicted to occur within 10km (DSEWPaC 2013)	Likely. May forage and breed in the study area.
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 2008).	**3 records** within 10km (OEH 2013)	Likely. May forage in the study area.
Potorous tridactylus	Long-Nosed Potoroo	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 to occur within 10km (DSEWPaC 2013)	Possible. May forage and breed in the study area.
Pseudomys novaehollandiae	New Holland Mouse		V	Occurs in disjunct, coastal populations from Tasmania to Queensland. In NSW inhabits a variety of coastal habitats including heathland, woodland, dry sclerophyll forest with a dense shrub layer and vegetated sand dunes (Wilson and Bradtke 1999). Populations may recolonise/ increase in size in regenerating native vegetation after wildfire, clearing and sandmining. Presence strongly correlated with understorey vegetation density, and high floristic diversity in regenerating heath (Lock and Wilson 1999).	Predicted to occur within 10km (DSEWPaC 2013)	Possible. May forage and breed in the study area.

Scientific Name	Common Name	TSC/ FM Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence
Myotis macropus	Large-footed 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)	**21 records** within 10km (OEH 2013)	Likely. May forage and breed in the study area.
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.	**65 records** within 10km (OEH 2013) Predicted to occur within 10km (DSEWPaC 2013)	Likely. May forage and breed in the study area.
Petaurus norfolcensis	Squirrel Glider	V		Occurs along the drier inland slopes as well as coastal habitats. Inhabits woodland and open forest with a Eucalyptus, Corymbia or Angophora overstorey and a shrubby understorey of Acacia or Banksia. Key habitat components include reliable winter and early-spring flowering Eucalypts, Banksia or other nectar sources, and hollow-bearing trees for roost and nest sites (van der Ree and Suckling 2008, Quin et al 2004), with social groups moving between multiple hollows. Social groups include one or two adult males and females with offspring, and have home ranges of 5-10ha within NSW (van der Ree and Suckling 2008, Kavanagh 2004).	**2 record** within 10km (OEH 2013)	Likely. May forage and breed in the study area.
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.	**12 records** within 10km (OEH 2013)	Likely. May forage and breed in the study area.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	Migrates from tropics to SE Aus in summer. Forages across a range of habitats including those with and without trees, from wet and dry sclerophyll forest, open woodland, Acacia shrubland, mallee, grasslands and desert. Roosts communally in large tree hollows and buildings (Churchill 2008).	**1 record** within 10km (OEH 2013)	Likely. May forage and breed in the study area.
Reptiles						

Scientific Name	Common Name	TSC/ FM Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence
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.	**5 records** within 10km (OEH 2013) Predicted to occur within 10km (DSEWPaC 2013)	Possible. Some rock crevices present, however these are well shaded and may not be suitable.
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.	**7 records** within 10km (OEH 2013) Predicted to occur within 10km (DSEWPaC 2013)	Likely. May forage and breed in the study area.
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.	**106 records** within 10km (OEH 2013)	Likely. May forage and breed in the study area.
Mixophyes iteratus	Giant 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 populations in tall, wet forest in the Watagan Mountains north of the Hawkesbury and the lower Blue Mountains (White 2008b).	Predicted to occur within 10km (DSEWPaC 2013)	Nil. No suitable habitat.
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.	**3 records** within 10km (OEH 2013) Predicted to occur within 10km (DSEWPaC 2013)	Unlikely. No known extant populations in the locality.

Scientific Name	Common Name	TSC/ FM Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence
Litoria littlejohni	Littlejohn's Tree 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 to occur within 10km (DSEWPaC 2013)	Nil. No suitable habitat.
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 to occur within 10km (DSEWPaC 2013)	Nil. No suitable habitat.
Fish						
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 to occur within 10km (DSEWPaC 2013)	Nil. No suitable habitat.
Macquaria australasica	Macquarie Perch	E	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 to occur within 10km (DSEWPaC 2013) Recorded in locality (DPI 2013)	Nil. No suitable habitat.
Invertebrates						

Scientific Name	Common Name	TSC/ FM Act	EPBC Act	Habitat Association	Details of record	Likelihood of occurrence
Meridolum corneovirens	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.	**122 records** within 10km (OEH 2013)	Present. Recorded in Cumberland Plain Woodland and River-flat Eucalypt forest on the site.
Petalura gigantea	Giant Dragonfly	V (TSC Act)		The Giant Dragonfly is found along the east coast of NSW from the Victorian border to northern NSW. There are known occurrences in the Blue Mountains and Southern Highlands. They live in permanent swamps and bogs with some free water and open vegetation. Adults spend most of their time settled on low vegetation on or adjacent to the swamp hunting for flying insects. Females lay eggs into moss or other soft vegetation bordering swamps. Larvae dig long branching burrows under the swamp leaving their burrows at night to feed on insects and other invertebrates on the surface and also use underwater entrances to hunt for food in the aquatic vegetation.	**4 records** within 10km (OEH 2013)	Nil. No suitable habitat.

Migratory species

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Recorded/ Predicted to Occur within 10 km	Liklihood of occurrence
Birds						
Rostratula australis	Australian Painted Snipe	E	V, Migratory Wetlands	Refer to threatened biota table above.	Predicted to occur within 10km (DSEWPaC 2013)	Possible. May occur at dams with dense reedbeds
Monarcha melanopsis	Black-faced Monarch	-	Migratory Terrestrial	This species of bird usually inhabits dense gullies of rainforest, sclerophyll forests and eucalypt woodlands along the coastal regions from Victoria to Cape York and is migratory over much of its range (Slater et al. 1989).	Predicted to occur within 10km (DSEWPaC 2013)	Possible May forage and breed in gullies in the property
Ardea ibis	Cattle Egret	-	Migratory Marine, Wetlands	This species of Migratory bird occurs in grasslands, woodlands, wetlands and pasture areas often seen with cattle and other animals. It makes shallow platform nests in wetland areas in surrounding trees and shrubs. They feed on grasshoppers and other invertebrates, frogs, lizards, and small mammals.	14 records within 10 km (OEH 2013) Predicted to occur within 10km (DSEWPaC 2013)	Present.
Apus pacificus	Fork-tailed Swift	-	Migratory Marine	In NSW, the Fork-tailed Swift is recorded in all regions. It is almost exclusively aerial, flying from less then 1 m to at least 300 m above ground and probably much higher. In Australia, they mostly occur over inland plains but sometimes above foothills or in coastal areas, over cliffs and beaches and also over islands and sometimes well out to sea. They mostly occur over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh but are also found over treeless grassland and sandplains covered with spinifex, open farmland and inland and coastal sand-dunes and sometimes occur above rainforests, wet sclerophyll forest or open forest or plantations of pines. They probably roost aerially, but are occasionally observed to land. The Fork-tailed Swift is an aerial eater, foraging along the edge of low pressure systems for insects.	Predicted to occur within 10km (DSEWPaC 2013)	Possible. May forage high above the poperty
Ardea alba	Great Egret	-	Migratory Marine, Wetlands	This species of wetland bird occurs in a variety of habitats including marshes, swamps, river margins, lake shorelines, flooded grasslands, sea-grass flats, mangrove swamps, coastal lagoons, and offshore coral reefs. Feeds in shallow to moderately deep water, on shore next to the water, or on dry ground primarily on fish, insects and shrimp. Other foods include frogs, lizards, snakes, small mammals, and small	Predicted to occur within 10km (DSEWPaC 2013)	Present.

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Recorded/ Predicted to Occur within 10 km	Likihood of occurrence
				birds. Breeding occurs in early spring and summer, nesting in trees, bushes, bamboo, reeds and other plants near water and on islands.		
Gallinago hardwickii	Latham's Snipe	-	Migratory Wetlands	This species of medium sized wading bird occurs in permanent and ephemeral wetlands up to 2000 m above sea-level, usually inhabiting open, freshwater wetlands with nearby low, dense vegetation such as swamps, flooded grasslands or heathlands, around bogs and other water bodies. This species can also occur in habitats with saline or brackish water and in modified or artificial habitats. It feeds in mud, either exposed or in very shallow water with low, dense vegetation. Roosting occurs on the ground near or in foraging areas beside or under clumps of vegetation, among dense tea-tree, in forests, in drainage ditches or plough marks, among boulders, or in shallow water if cover is unavailable. They feed on a variety of seeds, plant material, and insects.	Predicted to occur within 10km (DSEWPaC 2013)	Possible. May occur at dams with dense reedbeds
Merops ornatus	Rainbow Bee-eater	-	Migratory Terrestrial	This species of small bird occurs in a variety of habitat but seems to prefer lightly timbered forests and woodlands, and various cleared or semi-cleared habitats, including farmland and areas of human habitation often located close to permanent water. It also occurs in inland and coastal sand dune systems, and in mangroves in northern Australia, and has been recorded in heathland, sedgeland, vine forest and vine thicket, and on beaches. Breeding occurs from August to January, nesting in enlarged chambers at the end of long burrow or tunnel excavated by both sexes in flat or sloping ground, in the banks of rivers, creeks or dams, in roadside cuttings, in the walls of gravel pits or quarries, in mounds of gravel, or in cliff-faces. Nest sites are often re-used. This species primarily feeds on insects including bees, wasps, beetles, moths, butterflies, damselflies, dragonflies, flies, ants and bugs, and will occasionally eat earthworms, spiders and tadpoles. This species migrates north for the winter months within Australia after breeding has occurred.	2 records within 10 km (OEH 2013) Predicted to occur within 10km (DSEWPaC 2013)	Present.
Xanthomyza phrygia	Regent Honeyeater	CE	E, Migratory Terrestrial	Refer to threatened biota table above.	**10 records** within 10km (OEH 2013) Predicted to occur within 10km (DSEWPaC 2013)	Likely. May forage in the study area on occasion.
Rhipidura rufifrons	Rufous Fantail	-	Migratory Terrestrial	This species is a breeding migrant to southeast Australia during July to December, wintering in Papua New Guinea. It prefers wetter eucalypt forests, gullies, coastal scrub, watercourses, and rainforests	Predicted to occur within 10km (DSEWPaC 2013)	Possible May forage and breed in

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Association	Recorded/ Predicted to Occur within 10 km	Likihood of occurrence
				where it feeds of insects. Occasional reports have this species utilising parks and gardens during migration (Pizzey & Knight 1998).		woodland at the property
Myiagra cyanoleuca	Satin Flycatcher	-	Migratory Terrestrial	This is a migratory species which breeds around the Calliope Ranges in QLD southward to Tasmania during September / October to January / February before migrating north to southern and eastern Papua New Guinea and adjacent islands over winter (Readers Digest 1993). It prefers heavily vegetated gullies in forests, tall woodlands and during migration, coastal forests, woodlands, mangroves, trees in open country, and even gardens (Pizzey & Knight 1998).	Predicted to occur within 10km (DSEWPaC 2013)	Possible May forage and breed in woodland at the property
Haliaeetus leucogaster	White-bellied Sea-Eagle	-	Migratory Terrestrial	This species of large bird occurs along the coastline of Australia and also range inland over large rivers and wetlands, favouring forested coasts and forested margins of inland waterways. Nests are usually near water, in tall live or dead trees or on remote coastal cliffs. River Red Gum (*Eucalyptus camaldulensis*), Forest Red Gum (*E. tereticornis*) and Southern Mahogany (*E. botryoides*) are commonly used as nest trees (Emison & Bilney 1982). On islands free of predators, nests may be close to the ground in shrubs or rocky platforms (Marchant & Higgins 1993).	5 records within 10 km (OEH 2013) Predicted to occur within 10km (DSEWPaC 2013)	Likely. Mayforage over larger dams on occasion.
Hirundapus caudacutus	White-throated Needletail	-	Migratory Terrestrial	This species of migratory bird migrates from breeding grounds in Siberia, the Himalayas, and Japan to Australia in Summer, arriving mid-October and departing mid-April. It is known to inhabit a variety if habitats including forests, woodlands, farmlands, plains, lakes, costs and towns (Pizzey and Knight 1999). Feeds on insects during flight, chiefly ahead of weather changes. In Australia, this species is nomadic, responding to local weather changes (Readers Digest 1993).	4 records within 10 km (OEH 2013) Predicted to occur within 10km (DSEWPaC 2013)	Possible. May forage high above the poperty

Appendix B – Species Lists

Flora species

Family	Botanical Name	TSC Act Status	EPBC Act Status	July survey	Quadrats 1,3, 5,6	2, 10	4,8	7,9	11, 12
Adiantaceae	*Adiantum aethiopicum*						o		
	Adiantum formosum						o		
	Cheilanthes sieberi			u	u	u	u	u	
	Pellaea falcata				u	u	o		
Aspleniaceae	*Asplenium flabellifolium*					u	u		
Blechnaceae	*Doodia aspera*				u	u	u	u	
	Doodia caudata					u	u		
Dennstaedtiaceae	*Hypolepis muelleri*			u					
	Pteridium esculentum			o	u		u		
Dicksoniaceae	*Calochlaena dubia*			o	u		u		
Polypodiaceae	*Pyrrosia rupestris*			u	u	u	u		
Cycadopsida									
Zamiaceae	*Macrozamia spiralis*								u
Coniferopsida									
Cupressaceae	**Cupressus sempervirens*			u					
	**X Cupressocyparis leylandii*			o					
Pinaceae	**Pinus sylvestris*			u					
Liliidae									
Anthericacae	*Caesia parviflora var. parviflora*					u			
	Laxmannia gracilis					u			
Araceae	**Zantedeschia aethiopica*						u		
Asparagaceae	**Asparagus asparagoides*			u		u	u		
Commelinaceae	*Commelina cyanea*			u		u	u		
	Tradescantia fluminensis			u		u	u		
Cyperaceae	*Carex appressa*			o	o	u			
	Cyathochaeta diandra					u	u	u	
	**Cyperus eragrostis*			u					
	Cyperus imbecilis			u	u		u		
	Cyperus polystachyos			u					
	Cyperus sanguinolentus			u	u				
	Eleocharis acuta			o					
	Fimbristylis dichotoma			u					
	Gahnia aspera				u	u	u		
	Lepidosperma gunnii					u	u		
	Lepidosperma laterale					u	u	u	
	Schoenus apogon			u		u			
Iridaceae	*Patersonia sericea*					u	u	u	
	**Romulea rosea var. australis*			u					
Juncaceae	**Juncus acutus*			u					
	Juncus continuus					u			
	Juncus usitatus			u	u	u	u		
Juncaginacae	*Triglochin procera*			o					
Lomandraceae	*Lomandra confertifolia subsp. rubiginosa*					u	u	u	
	Lomandra cylindrica					u	u		
	Lomandra filiformis subsp. filiformis					u	u		
	Lomandra glauca					u		u	
	Lomandra longifolia				u	u		u	
	Lomandra multiflora subsp. multiflora				u				

Family	Botanical Name	TSC Act Status	EPBC Act Status	July survey	Quadrats				
					1,3, 5,6	2, 10	4,8	7,9	11, 12
Luzuriagaceae	*Eustrephus latifolius*					u	u		
	Geitonoplesium cymosum						u		
Nymphaeaceae	**Nymphaea caerulea*			o					
Philydraceae	*Philydrum lanuginosum*			o					
Phormiaceae	*Dianella caerulea var. producta*					u	u		
	Dianella longifolia var. longifolia					u	u	u	
	Dianella revoluta var. revoluta				u	u	u		
Poaceae	**Andropogon virginicus*			o		u		u	u
	Aristida caput-medusae				u	u			
	Aristida ramosa				o	u	u		
	Aristida vagans			u	o	u	u		
	Austrostipa pubescens			u	u		u	u	
	Bothriochloa macra			o	o	u			
	**Briza subaristata*			u					
	**Bromus catharticus*			o					
	**Chloris gayana*			o	u				
	Chloris ventricosa			u	o				
	Cymbopogon refractus				u	u	u	u	
	Cynodon dactylon			o	o	u			
	**Dactylis glomerata*			u					
	Eccoilopus cotulifer						u	u	
	**Digitaria ischaemum*			o					
	Digitaria parviflora				u				
	Digitaria ramularis						u	u	
	Echinopogon caespitosus			u	o	u	u		
	Echinopogon ovatus				u	u			
	Entolasia marginata			u	u	u	u	u	
	Entolasia stricta				u	u		u	
	**Eragrostis curvula*			o					
	Eragrostis benthamii				u		u		
	Eragrostis brownii				o	o			
	Eragrostis leptostachya				u		u	u	
	Imperata cylindrica var. major			u	o	u	u	u	
	**Lolium perenne*			c					
	Microlaena stipoides var. stipoides			u	o	o	o	u	
	Cyperus gemmatus			u		u	u		
	Cyperus imbecillis					u		u	
	Panicum effusum				u	u		u	
	Panicum simile			u	u	u	u	u	
	Paspalidium distans				u				
	Phragmites australis			u					
	**Paspalum dilatatum*			o					
	**Pennisetum clandestinum*			c					
	**Poa annua*			o					
	Poa labillardieri				u		u	u	
	Poa sieberiana var. sieberiana				o	u	u		
	Rytidosperma tenuius				o	u	u	u	
	**Setaria gracilis*			o					
	**Setaria pumila*								
	**Sporobolus africanus*								
	Sporobolus creber				u				
	Sporobolus elongatus			u	u				
	**Sporobolus fertilis*			u					
	Themeda australis			o	c	c	o	o	

Family	Botanical Name	TSC Act Status	EPBC Act Status	July survey	Quadrats				
					1,3, 5,6	2, 10	4,8	7,9	11, 12
Typhaceae	*Typha orientalis*			o					
Xanthorrhoeaceae	*Xanthorrhoea media*					u	u	u	
Magnoliopsida									
Acanthaceae	*Brunoniella australis*				o	u	u	u	
	Brunoniella pumilio			u	o		u		
	Pseuderanthemum variabile			u		u	u	u	
Amaranthaceae	*Alternanthera denticulata*			u	u	u			
Anacardiacae	**Schinus areira*			u					
Apiaceae	*Centella asiatica*			o	u	u		u	
	Hydrocotyle laxiflora				u	u		u	
	Platysace lanceolata					u	u	u	
Apocynaceae	**Araujia sericifera*			u					
	**Gomphocarpus fruticosus*			u					
	Parsonsia straminea					u	u		
Asclepiadaceae	*Marsdenia suaveolens*						u		
	Tylophora barbata				u	u	u		
Asteraceae	*Bidens pilosa*			u					
	Cirsus vulgare					u		u	
	**Cirsum vulgare*			u					
	**Conyza bonariensis*			u					
	**Conyza sumatrensis*			u					
	Cymbonotus lawsonianus					u		u	
	Euchiton involucratus				u	u		u	
	Euchiton sphaericus				u	u			
	**Gamochaeta purpurea*			u					
	**Hypochaeris radicata*			o					
	Lagenifera stipitata				u	u		u	
	Cleana emptica					u			
	Cotthamnus axillaris				o	o	u	u	
	Senecio diaschides				u	u	u	u	
	Senecio hispidulus					u	u		
	**Senecio madagascariensis*			o					
	Sigesbeckia orientalis				u				
	**Soliva sessilis*			o					
	**Sonchus oleraceus*			o					
	**Tagetes minuta*			u					
	Vernonia cinerea				u	u		u	
	**Xanthium occidentale*			u					
Basellaceae	**Anredera cordifolia*			u					
Bignoniaceae	**Jacaranda mimosifolia*			o					
	Pandorea pandorana						u		
Brassicaceae	**Hirschfeldia incana*			u					
Cactaceae	**Opuntia stricta*						u		
Campanulaceae	*Wahlenbergia communis*			u	u	u			
	Wahlenbergia gracilis				u	u			
	Wahlenbergia stricta var. stricta				u		u	u	
	**Petrorhagia nanteuilii*			u					
Caprifoliaceae	**Lonicera japonica*			u					
Caryophyllaceae	*Stellaria flaccida*						u		
	Stellaria pungens						u		
Casuarinaceae	*Allocasuarina littoralis*				o	o	o	u	
	Allocasuarina torulosa					o	o	u	
	Casuarina cunninghamiana			o	o				
	Casuarina glauca			o	c				

Family	Botanical Name	TSC Act Status	EPBC Act Status	July survey	Quadrats				
					1,3, 5,6	2, 10	4,8	7,9	11, 12
Chenopodiaceae	*Einadia hastata*				u	u			
	Einadia trigonos				u				
Clusiaceae	*Hypericum gramineum*			u	o	u			
Convolvulaceae	*Dichondra repens*			o	o	u			
Crassulaceae	*Crassula sieberiana*				u	u	u	u	
Cunoniaceae	*Ceratopetalum gummiferum*						o	u	
Dilleniaceae	*Hibbertia aspera subsp. aspera*					u	u	u	
	Hibbertia diffusa					u	u	u	
Elaeocarpaceae	*Elaeocarpus reticulatus*					u	u		
Ericaceae s. lat.	*Brachyloma daphnoides*					u	u	u	
	Epacris obtusifolia								o
	Leucopogon lanceolatus var. lanceolatus					u	u		
	Lissanthe strigosa				u	u		u	
	Melichrus urceolatus					u	u	u	
Euphorbiaceae	*Micrantheum hexandrum*					u	u	u	
Fabaceae Faboideae	*Bossiaea heterophylla*						o	u	
	Bossiaea rhombifolia					u		u	
	Daviesia ulicifolia					o	o	u	
	Desmodium brachypodum					u		u	
	Desmodium rhytidophyllum				u	u			
	Dillwynia sieberi				u	u			
	Glycine clandestina				o	u		u	
	Glycine microphylla				u	u			
	Glycine tabacina				o	u	u	u	
	Gompholobium glabratum							u	
	Gompholobium grandiflorum					u	u	u	
	Hardenbergia violacea			u	u	u	u	u	
	Hovea longifolia					o	o	o	
	Kunzea ambigua					u	u	u	
	Jacksonia scoparia					o	u	u	
	Kennedia rubicunda					u	u	u	
	**Medicago polymorpha*			u					
	Phyllota phylicoides							u	
	Podolobium ilicifolium					o	o	o	
	Pultenaea flexilis						o	o	
	Pultenaea linophylla								
	**Trifolium repens*			o					
	**Vicia sativa*			u					
Fabaceae Mimosoideae									
	Acacia decurrens			u	o	o	u		
	Acacia implexa			o	o	o	o		
	Acacia fimbriata					o	u	u	
	Acacia hispidula						u	u	
	Acacia linifolia					u	u	u	
	Acacia obtusifolia				u		u	o	
	Acacia parramattensis			o	o	o	u		
	Acacia parvipinnula					u		u	
	Acacia terminalis subsp. angustifolia					u	u	u	
	Acacia ulicifolia					u		u	
Geraniaceae	*Geranium homeanum*				u			u	
	Geranium sessiliflorum					u	u		
Goodeniaceae	*Goodenia hederacea subsp.*					u		u	

Family	Botanical Name	TSC Act Status	EPBC Act Status	July survey	Quadrats 1,3, 5,6	2, 10	4,8	7,9	11, 12
	Hederacea								
	Goodenia heterophylla					u		u	
	Scaevola albida					u	u	u	
Haloragaceae	*Gonocarpus teucrioides*				u		u		
Lamiaceae	*Clerodendrum tomentosum*						o		
	Plectranthus parviflorus					u	u	u	
Laureaceae	**Cinnamomum camphora*			u					
Lobeliaceae	*Pratia purpurascens*			o	o	u			
Loranthaceae	*Amyema pendulum*			u	o	u		u	
Malvaceae s. lat.	*Brachychiton populneus subsp. populneus*			u	u	u			
	Lasiopetalum ferrugineum var. ferrugineum					u		u	
	**Modiola caroliniana*			u					
	**Sida rhombifolia*			o					
Meliaceae	*Melia azedarach*			u	u		u		
Monimiaceae	*Wilkiea huegeliana*						u		
Moraceae	**Ficus pumila*			u					
	Ficus rubiginosa			u			u		
Myoporaceae	*Eremophila debilis*					u	u		
Myrsinaceae	**Anagallis arvensis*			u					
	Myrsine variabilis						u		
Myrtaceae	*Angophora bakeri*							o	o
	Angophora costata					u	o		
	Angophora floribunda				o				
	Angophora subvelutina			o	o				
	Backhousia myrtifolia						c		
	Callistemon citrinus								u
	Callistemon linearis			o					o
	Callistemon sanguineus			u	u				
	Corymbia eximia					o	o	u	
	Corymbia gummifera					u		o	
	Eucalyptus amplifolia			o	o				
	Eucalyptus (?) beyeriana				u	u			
	Eucalyptus crebra			o	o	o		u	u
	Eucalyptus elata			o					
	Eucalyptus eugenioides			u	o	u			u
	Eucalyptus fibrosa			u	u	u			
	Eucalyptus globoidea			u	u				
	**Eucalyptus gracilis*			u					
	**Eucalyptus microcorys*			o					
	Eucalyptus moluccana			o	c				
	Eucalyptus pancuiata subsp. pancuiata			o	o	o	u		
	Eucalyptus parramattensis subsp. parramattensis								u
	Eucalyptus pilularis						o		
	Eucalyptus piperita					u	u	u	
	Eucalyptus punctata					o	o	o	u
	Eucalyptus racemosa subsp. racemosa							c	c
	**Eucalyptus sclerophylla*	V		u					
	Eucalyptus sideroxylon			o					
	Eucalyptus sparsifolia				u	u			
	Eucalyptus squamosa								u
	Eucalyptus tereticornis			o	c	u			u
	Kunzea ambigua					u	u	u	

Family	Botanical Name	TSC Act Status	EPBC Act Status	July survey	Quadrats				
					1,3, 5,6	2, 10	4,8	7,9	11, 12
	Leptospermum juniperinum			u					o
	Leptospermum polygalifolium subsp. polygalifolium			o		u	u	u	c
	Leptospermum trinervium					u	u	u	
	**Lophostemon confertus*			u					
	Melaleuca decora				u				
	Melaleuca linariifolia			o	o				u
	Melaleuca stypheloides			o	o				u
	Melaleuca thymifolia								o
	Micromyrtus minutiflora	E	V						u
	Tristaniopsis laurina						o		
	Syncarpia glomulifera					u	o	u	
	Syzygium (syn. Acmena) smithii			u			u		
Nyctaginaceae	**Bougainvillea cv.*			u					
Oleaceae	**Ligustrum lucidum*			o		u			
	**Ligustrum sinense*			o					
	Notelaea ligustrina forma longifolia						o		
	**Olea europaea subsp. cuspidata*			o	u				
Oxalidaceae	*Oxalis perennans*			u			u		
Passifloraceae	*Passiflora herbertiana*						u		
Phyllanthacae	*Breynia oblongifolia*					u	o		u
	Glochidion ferdinandi var. ferdinandi						o		u
	Phyllanthus gasstricemii						u		
	Phyllanthus hirtellus					u	u		
	Poranthera microphylla					o			
Phytolaccaceae	**Phytolacca octandra*			u					
Pittosporaceae	*Billardiera scandens*					u	u	u	u
	Bursaria spinosa subsp. spinosa				o	u			
	Pittosporum revolutum						u		
	Pittosporum undulatum						u		
Plantaginaceae	*Plantago gaudichaudii*				u				
	**Plantago lanceolata*			o	u				
Polygonaceae	*Rumex brownii*			u					u
	**Rumex conglomeratus*			u					u
	**Rumex crispus*			u					
Proteaceae	*Banksia oblongifolia*							u	u
	Banksia serrata						u		
	Banksia spinulosa var. spinulosa					u	u	u	
	Grevillea juniperina subsp. juniperina	V							u
	Grevillea mucronulata					u	u	u	
	**Grevillea robusta*			u					
	Grevillea sericea subsp. sericea					u		o	
	Hakea sericea					u	u	u	
	Lambertia formosa					u	u		
	Persoonia lanceolata					u	u	u	u
	Persoonia levis					u	u		
	Persoonia linearis					o	u	u	u
	Stenocarpus sinuatus						u		
	Xylomelum pyriforme					o	u		
Ranunculaceae	*Clematis aristata*				u		u		

Family	Botanical Name	TSC Act Status	EPBC Act Status	July survey	Quadrats				
					1,3, 5,6	2, 10	4,8	7,9	11, 12
	Clematis glycinoides				u		u		
	Ranunculus lappaceus			o	u				u
Rhamnaceae	*Alphitonia excelsa*						u	u	
	Pomaderris ferruginea					u	u		
Rosaceae sens. lat.	**Rosa rubiginosa*			u					u
	**Rubus fruticosus sp. aggregate*			o	u				
	Rubus parvifolius					u	u		
	Rubus rosifolius						u		
Rosaceae sf Malacae	**Cotoneaster pannosus*			u					
Rubiaceae	*Asperula conferta*				u	u	u		
	Galium propinquum					u	u		
	Morinda jasminoides						u		
	Opercularia diphylla				u	u			
	Pomax umbellata				o	o			
Rutaceae	*Phiotheca myoporoides subsp. myoporoides*					u	u		
	Ziera smithii					u	u		
Salicaceae	*Populus sp.*			u					
	**Salix sp.*			u					
Santalaceae	*Exocarpos cupressiformis*				u	u	u	u	u
	Leptomeria acida					u		u	
Sapindaceae	*Dodonaea triquetra*				o	o	u	u	u
	Dodonaea viscosa subsp. angustifolia				o	u			
Scrophulariaceae	*Veronica plebeia*				u	u			u
Simaroubacae	**Ailanthus altissima*			u					
Solanaceae	**Cestrum parqui*			u					
	**Datura stramonium*			u					
	**Physalis peruviana*			u					
	**Solanum americanum*			u					
	**Solanum linnaeum*			u					
	**Solanum mauritianum*			u		u		u	u
	**Solanum nigrum*			u	u	u	u		
	Solanum prinophyllum				u	u			
	**Solanum pseudocapsicum*			u	u		u		
	Solanum pungetium				u	u			
Stylidiaceae	*Stylidium productum*					u			
Thymelaeaceae	*Pimelea linifolia subsp. linifolia*					u	u		
Ulmaceae	*Trema tomentosa var. viridis*						o		u
	**Ulmus parvifolia*			u					
	**Ulmus procera*			u					
Verbenaceae	**Lantana camara*			o	u	u			
	**Verbena bonariensis*			o	u	u			
	**Verbena rigida*			o		u			
Violaceae	*Viola hederacea*					u			
Vitaceae	*Cayratia clematidea*					u	u		

Key: C: common; O: occasional; U: uncommon; *: introduced

V: Vulnerable species E: Endangered species

Fauna species recorded

Family	Exotic	Scientific Name	Common Name	TSC Status	EPBC Status	Recorded in previous surveys	July survey
BIRDS							
Acanthizidae		*Acanthiza pusilla*	Brown Thornbill			OW	
Acanthizidae		*Acanthiza lineata*	Striated Thornbill			OW	
Acanthizidae		*Smicrornis brevirostris*	Weebill			OW	
Acanthizidae		*Sericornis frontalis*	White-browed Scrubwren				O
Acanthizidae		*Sericornis frontalis*	White-browed Scrubwren			O	
Acanthizidae		*Acanthiza nana*	Yellow Thornbill			O	O
Accipitridae		*Accipiter fasciatus*	Brown Goshawk			O	
Accipitridae		*Accipiter cirrocephalus*	Collared Sparrowhawk			O	
Accipitridae		*Aquila audax*	Wedge-tailed Eagle				O
Accipitridae		*Haliastur sphenurus*	Whistling Kite				O
Acrocephalidae		*Acrocephalus australis*	Australian Reed-Warbler				OW
Alcedinidae		*Ceyx azureus*	Azure Kingfisher			O	
Alcedinidae		*Dacelo novaeguineae*	Laughing Kookaburra				O
Alcedinidae		*Dacelo novaeguineae*	Laughing Kookaburra			O	
Anatidae		*Cygnus atratus*	Black Swan			O	
Anatidae		*Aythya australis*	Hardhead			O	
Anatidae		*Anas superciliosa*	Pacific Black Duck			O	
Ardeidae		*Ardea ibis*	Cattle Egret			O	
Ardeidae		*Ardea modesta*	Eastern Great Egret				O
Ardeidae		*Egretta novaehollandiae*	White-faced Heron				O
Ardeidae		*Ardea pacifica*	White-necked Heron			O	
Artamidae		*Cracticus tibicen*	Australian Magpie			OW	
Artamidae		*Cracticus torquatus*	Grey Butcherbird			O	OW
Artamidae		*Strepera graculina*	Pied Currawong			O	
Cacatuidae		*Eolophus roseicapillus*	Galah			O	
Cacatuidae		*^Calyptorhynchus lathami*	Glossy Black-cockatoo	V		O	
Cacatuidae		*Cacatua sanguinea*	Little Corella			O	O
Cacatuidae		*Cacatua galerita*	Sulphur-crested Cockatoo			W	W
Cacatuidae		*Calyptorhynchus funereus*	Yellow-tailed Black-cockatoo			O	
Charadriidae		*Vanellus miles*	Masked Lapwing			W	
Climacteridae		*Cormobates leucophaea*	White-throated Treecreeper			W	OW
Columbidae		*Geopelia humeralis*	Bar-shouldered Dove			O	
Columbidae		*Macropygia amboinensis*	Brown Cuckoo-dove			O	
Columbidae		*Leucosarcia picata*	Wonga Pigeon			O	
Corvidae		*Corvus coronoides*	Australian Raven			W	O
Cuculidae		*Cacomantis flabelliformis*	Fan-tailed Cuckoo			O	
Cuculidae		*Chalcites lucidus*	Shining Bronze-cuckoo				W
Estrildidae		*Taeniopygia bichenovii*	Double-barred Finch			O	
Estrildidae		*Neochmia temporalis*	Red-browed Finch			OW	
Hirundinidae		*Hirundo neoxena*	Welcome Swallow			O	O
Maluridae		*Malurus cyaneus*	Superb Fairy-wren			OW	O

Family	Exotic	Scientific Name	Common Name	TSC Status	EPBC Status	Recorded in previous surveys	July survey
Meliphagidae		*Manorina melanophrys*	Bell Miner			OW	W
Meliphagidae		*Acanthorhynchus tenuirostris*	Eastern Spinebill			O	
Meliphagidae		*Meliphaga lewinii*	Lewin's Honeyeater			O	
Meliphagidae		*Philemon corniculatus*	Noisy Friarbird			O	W
Meliphagidae		*Manorina melanocephala*	Noisy Miner			W	O
Meliphagidae		*Anthochaera carunculata*	Red Wattlebird			OW	
Meliphagidae		*Melithreptes lunatus*	White-naped Honeyeater			W	
Meliphagidae		*Lichenostomus penicillatus*	White-plumed Honeyeater			OW	
Meliphagidae		*Lichenostomus chrysops*	Yellow-faced Honeyeater			OW	OW
Monarchidae		*Myiagra rubecula*	Leaden Flycatcher			W	
Monarchidae		*Grallina cyanoleuca*	Magpie-lark			W	O
Monarchidae		*Myiagra inquieta*	Restless Flycatcher			W	
Neosittidae		*Daphoenositta chrysoptera*	Varied Sittella	V		O	
Oriolidae		*Oriolus sagittatus*	Olive-backed Oriole			OW	
Pachycephalidae		*Pachycephala pectoralis*	Golden Whistler			OW	O
Pachycephalidae		*Colluricincla harmonica*	Grey Shrike-thrush			W	O
Pardalotidae		*Pardalotus punctatus*	Spotted Pardalote			W	OW
Pardalotidae		*Pardalotus striatus*	Striated Pardalote			W	
Petroicidae		*Eopsaltria australis*	Eastern Yellow Robin			O	
Petroicidae		*Microeca fascinans*	Jacky Winter			O	
Petroicidae		*Petroica rosea*	Rose Robin			O	
Phalacrocoracidae		*Microcarbo melanoleucos*	Little Pied Cormorant			O	O
Phasianidae		*Coturnix pectoralis*	Brown Quail			O	
Podicipedidae		*Tachybaptus novaehollandiae*	Australasian Grebe			O	
Psittacidae		*Alisterus scapularis*	Australian King-Parrot			O	
Psittacidae		*Platycercus elegans*	Crimson Rosella			OW	
Psittacidae		*Platycercus eximius*	Eastern Rosella				O
Psittacidae		*Platycercus eximius*	Eastern Rosella			O	
Psittacidae		*Trichoglossus haematodus*	Rainbow Lorikeet			W	
Psittacidae		*Psephotus haematonotus*	Red-rumped Parrot			OW	O
Psophodidae		*Psophodes olivaceus*	Eastern Whipbird			W	W
Ptilonorhynchidae		*Ptilonorhynchus violaceus*	Satin Bowerbird			O	O
Rallidae		*Gallinula tenebrosa*	Dusky Moorhen			O	O
Rallidae		*Fulica atra*	Eurasian Coot			W	
Rallidae		*Porphyrio porphyrio*	Purple Swamphen			W	
Rhipiduridae		*Rhipidura albiscapa*	Grey Fantail			W	O
Rhipiduridae		*Rhipidura leucophrys*	Willie Wagtail			O	
Threskiornithidae		*Threskiornis spinicollis*	Straw-necked Ibis			O	
Threskiornithidae		*Platalea flavipes*	Yellow-billed Spoonbill			O	
Timaliidae		*Zosterops lateralis*	Silvereye			OW	O
Turdidae	*	*Turdus merula*	Eurasian Blackbird			O	
MAMMALS							
Bovidae	*	*Capra hircus*	Goat			O	

Family	Exotic	Scientific Name	Common Name	TSC Status	EPBC Status	Recorded in previous surveys	July survey
Canidae	*	*Vulpes vulpes*	Fox			F	
Cervidae	*	*Cervus timorensis*	Rusa deer			O	
Leporidae	*	*Oryctolagus cuniculus*	Rabbit				O
Macropodidae		*Macropus robustus*	Common Wallaroo				O
Macropodidae		*Macropus giganteus*	Eastern Grey Kangaroo			O	O
Macropodidae		*Wallabia bicolor*	Swamp Wallaby			O	
Molossidae		*Mormopterus ^Species 2^*				AD	
Phalangeridae		*Trichosurus vulpecula*	Common Brushtail Possum			O	
Rhinolophidae		*Rhinolophus megaphyllus*	Eastern Horseshoe-bat			AD	
REPTILES							
Scincidae		*Lampropholis delicata*	Dark-flecked Garden Sunskink			O	
Scincidae		*Eulamprus quoyii*	Eastern Water-skink			O	
FROGS							
Hylidae		*Litoria verreauxii*	Verreaux's Frog			W	
Myobatrachidae		*Limnodynastes peronii*	Brown-striped Frog			W	
Myobatrachidae		*Crinia signifera*	Common Eastern Froglet			W	W
Myobatrachidae		*Uperoleia laevigata*	Smooth Toadlet				W
GASTROPODS							
Camaenidae		*Meridolum corneovirens*	Cumberland Plain Land Snail	E1		O	

Key: *: introduced; AD: Anabat definite; V: Vulnerable; E1: endangered; M: Migratory; O: observed; W: heard; AD: Anabat definite

Appendix C - Assessments of Significance – TSC Act

Section 5A of the EP&A Act lists seven factors that must be taken into account in the determination of the significance of potential impacts of an activity on 'threatened species, populations or ecological communities (or their habitats)' listed under the TSC Act and FM Act. The '7 part test' is used to determine whether an activity is 'likely' to impose 'a significant effect' on threatened biota and thus whether a species impact statement (SIS) is required. Should the 7 part test conclude that a significant effect is likely, an SIS must be prepared. As discussed in Section 5 of this report, assessments of significance have been prepared for threatened biota known to occur as well as those species likely to occur in the subject site and in the case of fauna species, have potential habitat that is likely to be impacted by the proposal. Assessments of significance have therefore been prepared for the following species:

- Cumberland Plain Woodland CEEC
- Shale Sandstone Transition Forest EEC
- Threatened flora species:
  - *Micromyrtus minutiflora*
  - *Grevillea parviflora* subsp *parviflora*

Cumberland Plain Woodland in the Sydney Basin Bioregion

Cumberland Plain Woodland is a critically endangered open woodland ecological community. This TEC occurs in the eastern portion of the study area, especially in the south-eastern and north-eastern corners. The proposed track will generally skirt these patches, although there are some small patches where the track may pass within existing regenerating stands. The proposed tent areas are also located near the patches in this central section, although it would be possible to 'fine-tune' these locations in order to minimise disturbance to over-mature trees.

TSC Act Assessment of significance	Cumberland Plain Woodland
(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 relevant to an EEC.	
(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 relevant to an EEC	
(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:	
(i) It 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 Threatened Species Assessment Guidelines (DECC 2007) define "local occurrence" as the study area. The local occurrence of CPW in this assessment therefore comprises the areas mapped as CPW within the subject site and on adjoining land that may be affected either directly or indirectly by the proposed development. The area of Cumberland Plain Woodland (CPW) to be disturbed as part of the proposal represents a very small proportion of the total area of the community within the property. In some locations the track comprises an existing roadway through the community (e.g near the stables and near the stock paddocks north of the racetrack). The proposal would have minimal	

impact on the adjacent community at these locations. There will be no clearing of trees, and no slashing or trimming of vegetation. The track will traverse patches of Cumberland Plain Woodland that occur within the stock paddocks. The ground layer in these locations is already disturbed by grazing. There would be minimal impact on the community in these locations, and the proposal would only temporarily impact the already disturbed ground layer. Similarly, the track will pass through a stand of this community near the main entrance. Again, the groundlayer in this location is subject to grazing, and the track and event would have minimal impact. There may be some ground disturbance within these patches from the installation of temporary protective fencing, and compaction of soil from participants.

Given the above points, the impacts on the community will be minimal and temporary and will not 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. The event track has been designed to avoid the intended biobank area.

(ii) It 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,

A very small proportion of this TEC on the subject site would be affected as part of the proposed preparations for the event. A small amount of groundcover damage may occur during the event, therefore the proposed action is unlikely to substantially and adversely modify the composition of this community.

(c) 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

There will be no clearing of trees, and no slashing or trimming of vegetation within stands of CPW. As noted above, the groundlayer where the track is located would be temporarily disturbed, but would recover following the event.

(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

A large proportion of the land surrounding the subject site has been disturbed by previous agricultural activities and, more recently, residential development, reducing its suitability as habitat for the original vegetation type. There are large patches of this vegetation type in the north-east and south-east of this portion of the subject site, and the patches in the central portion, which will be affected by the proposed event constitute small regenerating patches. As the tree canopy will not be affected the proposal will not further fragment or isolate any stands of CPW from other areas of 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 area of CPW to be temporarily modified as part of the proposed development is relatively small in the context of the remaining CPW within the study area. There will be no clearing of trees, and no slashing or trimming of vegetation. The groundcover that would be temporarily disturbed is already disturbed by grazing and is not important to the long-term survival of the community in the locality.

TSC Act Assessment of significance	Cumberland Plain Woodland
(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),	
No critical habitat has been listed for this TEC.	
(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,	
The Approved Cumberland Plain Recovery Plan (DECCW, 2010) has been prepared to guide the long-term protection and survival of threatened biodiversity on the Cumberland Plain. The temporary disturbance of the groundlayer from installation of fencing and running of the event would not interfere with the recovery of the community.The proposal will not enter areas that are proposed to be set aside for biobanking (Fernhill East Biobank).	
(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.	
Three key threatening processes including 'Invasion of native plant communities by exotic perennial grasses', 'Infection of native plants by *Phytophthora cinnamomi*', and 'Introduction and establishment of Exotic Rust Fungi' have the potential to result from the proposal; however, recommendations in section 5 will be implemented to prevent and mitigate these threatening processes.	
Conclusion	
Impacts on CPW as a result of the event will be minimal and temporary. There will be no clearing of trees, and no slashing or trimming of vegetation. As such, the proposal is unlikely to have a significant effect on CPW.	

Shale/Sandstone Transition Forest

Shale/Sandstone Transition Forest occurs at the edges of the Cumberland Plain, on sites where shale caps overlie sandstone or on escarpments where shale soils intergrade with sandstone-derived soils. The suite of species will vary, according to the extent of sandstone influence. Vegetation with high and low sandstone influence can be identified in patches on the subject site.

This vegetation type occurs in complete, continuous form on the southern slopes of the hill, and in various stages of regeneration along the lower hill slopes. The only proposed disturbance to this vegetation involves some clearing and possibly some earthworks along existing track edges which already extend through these patches.

TSC Act Assessment of significance	Shale-Sandstone Transition Forest
(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 relevant to an EEC.	
(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	

TSC Act Assessment of significance	Shale-Sandstone Transition Forest
such that a viable local population of the species is likely to be placed at risk of extinction,	
Not relevant to an EEC	
(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:	
(i) It 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 Threatened Species Assessment Guidelines (DECC 2007) define "local occurrence" as the *study area*. The local occurrence of Shale/Sandstone Transition Forest in this assessment therefore comprises the areas mapped as Shale/Sandstone Transition Forest within the subject site and on adjoining land that may be affected either directly or indirectly by the proposed development. Shale/Sandstone Transition Forest (SSTF) occurs over large areas in the central and western portion of the property. In the central portion, the event will occur along existing tracks through the vegetation, and fencing will be installed to prevent entry of participants into these areas of native vegetation. There will be no clearing of trees, and no slashing or trimming of vegetation. There is the potential for indirect impacts from installation of fencing, and from erosion of the track during the event. In the western portion of the study area this vegetation type is characterised by scattered trees over a grassy understory. The proposal will involve the disturbance of the groundlayer in these areas through installation and removal of event features (e.g. mud mile #1). Groundlayer will be able to recover following the event. Given the above points, the impacts on the community will be minimal and temporary and will not 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. The event route has been designed to avoid the intended biobank area.	
(ii) It 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,	
A very small proportion of this TEC on the subject site would be affected as part of the proposed preparations for the event. A small amount of groundcover damage may occur during the event, which would be able to recover following the event. Therfore, the proposed action is unlikely to substantially and adversely modify the composition of this community.	
(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	
There will be no clearing of trees, and no slashing or trimming of vegetation within stands of SSTF. As noted above, the groundlayer where the event track is located would be temporarily disturbed, but would recover following the event.	
(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	
As the tree canopy will not be affected the proposal will not further fragment or isolate any	

TSC Act Assessment of significance	Shale-Sandstone Transition Forest
stands of SSTF from other areas of 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 area of SSTF to be temporarily modified as part of the proposed development is relatively small in the context of the remaining SSTF within the study area. There will be no clearing of trees, and no slashing or trimming of vegetation. The groundcover would be temporarily disturbed along the event track, and would be left to recover following the event.	
(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),	
No critical habitat has been listed for this TEC.	
(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,	
The Approved Cumberland Plain Recovery Plan (DECCW, 2010) has been prepared to guide the long-term protection and survival of threatened biodiversity on the Cumberland Plain. The temporary disturbance of the groundlayer from installation of fencing and running of the event would not interfere with the recovery of the community. The proposal will not enter areas that are proposed to be set aside for biobanking (Fernhill East Biobank).	
(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.	
Three key threatening processes including 'Invasion of native plant communities by exotic perennial grasses', 'Infection of native plants by *Phytophthora cinnamomi*', and 'Introduction and establishment of Exotic Rust Fungi' have the potential to result from the proposal; however, recommendations in section 5 will be implemented to prevent and mitigate these threatening processes.	
Conclusion	
Impacts on SSTF as a result of the event will be minimal and temporary. There will be no clearing of trees, and no slashing or trimming of vegetation. As such, the proposal is unlikely to have a significant effect on SSTF.	

Grevillea juniperina subsp. *juniperina*

Juniper-leaved Grevillea *Grevillea juniperina* subsp. *juniperina* is one of seven recognised subspecies of *Grevillea juniperina*. This subspecies is endemic to the Western Suburbs of Sydney, mainly occurring in an area between Blacktown, Erskine Park, Londonderry and Windsor, with outlying populations at Kemps Creek and Pitt Town (Fairley 2004). *Grevillea juniperina* subsp. *juniperina* occurs on clay to sandy soils derived from Wianamatta Shales or tertiary alluvium, typically containing ironstone particles in Cumberland Plain Woodland, Castlereagh Ironbark Woodland, Castlereagh Scribbly Gum Woodland and Shale/Gravel Transition Forest (DECCW 2010). It is possible that disturbance of topsoil facilitates seed germination.

Scattered individuals of *Grevillea juniperina* subsp. *juniperina* occur in the north-west, previously disturbed portion of the site, in vegetation described in this study as Community 12: Hard-leaved Scribbly Gum – Parramatta Red Gum heathy woodland (poor). The floristics of this vegetation type approximate the description of canopy and ground cover species of the vulnerable ecological community Castlereagh Scribbly Gum Woodland, listed under the TSC Act.

The proposed running track extends across this patch of vegetation, although all recorded individuals occur further to the south.

TSC Act Assessment of significance	*Grevillea juniperina subsp. juniperina*
(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,	
Five individuals of *Grevillea juniperina* subsp. *juniperina* were recorded in a previous environmental assessment (EcoLogical Australia 2007) in the south-western, previously disturbed section of the property. This area is located away from the proposed event track. No individuals of *Grevillea juniperina* subsp. *juniperina* were recorded along the proposed track alignment, and the existing population on the site will not be disturbed. No clearing of vegetation is required for the proposal. No adverse effects on the life cycle of this species are therefore likely.	
(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,	
The regrowth specimens of *Grevillea juniperina* subsp. *juniperina* on the site do not constitute an endangered population. There are no records of any endangered populations within or near the subject site.	
(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:	
(i) It 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.	
(ii) It 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.

(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

A very small (comparatively) portion of native vegetation would be disturbed as part of the proposed development, and mainly consists of installation of obstacles and participants running along the track. The alignment of the track is north of the *Grevillea juniperina* subsp. *juniperina* population, and no individuals were observed along the track. The proposal is unlikely to remove or modify any habitat for this species.

(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

There will be no clearing of trees, and no slashing or trimming of vegetation. The alignment of the track is north of the *Grevillea juniperina* subsp. *juniperina* population, and no individuals were observed along the track. The proposed event will not further fragment or isolate this small population from other areas of 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 alignment of the track is north of the *Grevillea juniperina* subsp. *juniperina* population, and no individuals were observed along the track. The event track will extend across grassland, avoiding trees and shrubs, further to the north of the known population. The temporary disturbance of this area does not represent a significant reduction in important habitat for this plant species such that its long-term survival in the locality is compromised.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),

No critical habitat of this species has been identified by the Director-General of the NPWS on the Register of Critical Habitats.

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

The Approved Cumberland Plain Recovery Plan (DECCW, 2010) has been prepared to guide the long-term protection and survival of threatened biodiversity on the Cumberland Plain. The Plan includes a number of threatened plant species, including *Grevillea juniperina* subsp. *juniperina*. The proposed event will not require the removal or disturbance of any of the individuals of *Grevillea juniperina* subsp. *juniperina* on site, and limited disturbance of potential habitat, therefore the proposed development is not inconsistent with the objectives of this plan.

(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.

Three key threatening processes including 'Invasion of native plant communities by exotic perennial grasses', 'Infection of native plants by *Phytophthora cinnamomi*', and 'Introduction and establishment of Exotic Rust Fungi' have the potential to result from the proposal; however, recommendations in section 5 will be implemented to prevent and mitigate these threatening processes.

Conclusion
No impacts on *Grevillea juniperina* subsp. *juniperina*are anticipated. There will be no clearing of trees, and no slashing or trimming of vegetation. The alignment of the track is north of the known *Grevillea juniperina* subsp. *juniperina* population, and no individuals were observed along the track. As such, the proposal is unlikely to have a significant effect on *Grevillea juniperina* subsp. *juniperina*.

Micromyrtus minutifolia

Micromyrtus minutiflora is endemic to the Castlereagh-Richmond area, occurring on tertiary alluvium with clay and gravel elements, in Castlereagh Woodlands of the floodplain (Fairley 2004).

One individual of *Micromyrtus minutiflora* was recorded in the north-west, previously disturbed portion of the site, in vegetation described in this study as Community 12: Hard-leaved Scribbly Gum – Parramatta Red Gum heathy woodland (poor). A number of seedlings which were also tentatively identified as *Micromyrtus minutiflora* were recorded growing within several scribbly gum clumps downslope of this occurrence. These seedlings could not be positively confirmed, because of an absence of flowers or fruit. The floristics of this vegetation type approximates the description of canopy and ground cover species of Castlereagh Scribbly Gum Woodland.

The proposed running track extends across this patch of vegetation, although the recorded individual occurs further to the south, moreover, the individual occurs within the junction of two fencelines where it is afforded protection from accidental damage by vehicles.

TSC Act Assessment of significance	*Micromyrtus minutifolia*
(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,	
One individual of *Micromyrtus minutiflora* was recorded in a previous environmental assessment (EcoLogical Australia 2007) in the north-western, previously disturbed section of the site. The individual occurs within the junction of two fencelines, where it is afforded protection from accidental damage by vehicles. The proposed development would have a temporary impact on groundcover within the area of potential habitat for this species. This includes marking of the running track and temporary disturbance of the groundlayer by participants during running of the event. No individuals of *Micromyrtus minutiflora* were recorded along the proposed track alignment, therefore the existing population on the property will not be disturbed. Known and tentatively identified plants will be fenced to ensure there is no damage. No adverse effects on the life cycle of this species are therefore likely.	
(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,	
The individual of *Micromyrtus minutiflora* on the site does not constitute an endangered population.	
(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:	

TSC Act Assessment of significance	*Micromyrtus minutiflia*
(i) It 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 relevant to a threatened species.	
(ii) It 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 relevant to a threatened species.	
(a) 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	
No clearing of vegetation is required for the proposal. The proposed event would have a temporary impact on groundcover within the area of potential habitat for this species. This includes marking of the running track and temporary disturbance of the groundlayer by participants during running of the event. No individuals of *Micromyrtus minutiflora* were recorded along the proposed track alignment and the existing population on the property will not be disturbed.	
(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	
There will be no clearing of trees, and no slashing or trimming of vegetation. The proposed development would have a temporary impact on groundcover within the area of potential habitat for this species. As the existing regenerating tree and shrub canopy will not be affected, the proposed event will not further fragment or isolate this small population from other areas of 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,	
No disturbance or shrub removal will be required in the north-west portion of the site, where *Micromyrtus minutiflora* occurs. The event track will extend across grassland, avoiding trees and shrubs, further to the north. The temporary disturbance of this area does not represent a significant reduction in important habitat for this plant species such that its long-term survival in the locality is compromised.	
(c) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),	
No critical habitat of this species has been identified by the Director-General of the NPWS on the Register of Critical Habitats.	
(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,	
The Approved Cumberland Plain Recovery Plan (DECCW, 2010) has been prepared to guide the long-term protection and survival of threatened biodiversity on the Cumberland Plain. The Plan includes a number of threatened plant species, as well as *Micromyrtus minutiflora*. The	

TSC Act Assessment of significance	*Micromyrtus minutiflia*
proposed event track will not require the removal of the individuals of *Micromyrtus minutiflora*, therefore the proposed development is not inconsistent with the objectives of this plan.	
(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.	
Three key threatening processes including 'Invasion of native plant communities by exotic perennial grasses', 'Infection of native plants by *Phytophthora cinnamomi*', and 'Introduction and establishment of Exotic Rust Fungi' have the potential to result from the proposal; however, recommendations in section 5 will be implemented to prevent and mitigate these threatening processes.	
Conclusion	
The proposal is unlikely to impact *Micromyrtus minutiflora*. There will be no clearing of trees, and no slashing or trimming of vegetation. The proposed event track will not require the removal of the individuals of *Micromyrtus minutiflora*. As such, the proposal is unlikely to have a significant effect on *Micromyrtus minutiflora*.	

Appendix D - Assessments of Significance – EPBC Act

Under the EPBC Act an action will require approval from the minister if the action has, will have, or is likely to have, a significant impact on a MNES. Assessments of significance have been prepared pursuant to the significant impact guidelines (DEWHA 2009) for the EPBC Act. Assessments of significance have been provided for the following MNES:

- Threatened ecological communities:
  - Cumberland Plain Woodland
  - Shale/Sandstone Transition Forest
- Threatened flora species:
  - *Micromyrtus minutiflora*.

Cumberland Shale Plain Woodland and Shale/Gravel Forest.

This assessment of significance has been prepared with reference to *Significant Impact Guidelines* (DEWHA 2009). The vegetation will be referred to as Cumberland Plain Woodland in this assessment.

EPBC Act Assessment of Significance	Cumberland Plain Woodland
An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will: reduce the extent of an ecological community	
The area of Cumberland Plain Woodland (CPW) to be disturbed as part of the proposal represents a very small proportion of the total area of the community within the property. In some locations the track comprises an existing roadway through the community (e.g near the stables and near the stock paddocks north of the racetrack). The proposal would have minimal impact on the adjacent community at these locations. There will be no clearing of trees, and no slashing or trimming of vegetation. The track will traverse patches of Cumberland Plain Woodland that occur within the stock paddocks. The ground layer in these locations is already disturbed by grazing. There would be minimal impact on the community in these locations, and the proposal would only temporarily impact the already disturbed ground layer. Similarly, the track will pass through a stand of this community near the main entrance. Again, the groundlayer in this location is subject to grazing, and the track and event would have minimal impact. There may be some ground disturbance within these patches from the installation of temporary protective fencing, and compaction of soil from participants. Given the above points, the impacts on the community will be minimal and temporary and will not reduce the extent of the ecological community. The event track has been designed to avoid the intended biobank area.	
fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	
A large proportion of the land surrounding the subject site has been disturbed by previous agricultural activities and, more recently, residential development, reducing its suitability as habitat for the original vegetation type. There are large patches of this vegetation type in the north-east and south-east of this portion of the subject site, and the patches in the central portion, which will be affected by the proposed event constitute small regenerating patches. As the tree canopy will not be affected the proposal will not fragment or increase fragmentation of the ecological community.	

EPBC Act Assessment of Significance	Cumberland Plain Woodland
adversely affect habitat critical to the survival of an ecological community	
No habitats considered critical to Cumberland Plain Woodland have been recorded as occurring within, or in close proximity to the subject site. The integrity of the habitat within the proposed track and tent areas is limited due to long term disturbances discussed previously. The main habitat value consists of the presence of some hollow-bearing trees. These trees will not be affected by the proposed activities. The proposal will temporarily impact disturbed groundlayer areas only.	
modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	
The abiotic factors of the subject site have been previously modified from their natural state, by clearing and levelling, possibly by draining, followed by the introduction of exotic pasture grasses and possibly the occasional application of fertiliser, irrigation and other agricultural practices. These actions would have altered soil nutrient loads, soil moisture levels and possibly to the soil profile's structural integrity. Local hydrology has probably been altered by past land uses. It is not anticipated that the proposed event would further modify these abiotic factors, particularly soil conditions and local hydrological patterns.	
cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting	
The area of CPW to be temporarily modified as part of the proposed development is relatively small in the context of the remaining CPW within the study area. There will be no clearing of trees, and no slashing or trimming of vegetation. The groundcover that would temporarily disturbed is already disturbed by grazing. As such, there would be no substantial change in the species composition of CPW in the study area.	
cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to	
These patches are simplified, both structurally and floristically, due to the long term agricultural disturbances and practices. There will be no clearing of trees, and no slashing or trimming of vegetation. The groundcover that would temporarily disturbed is already disturbed by grazing..	
assisting invasive species, that are harmful to the listed ecological community, to become established, or	
The vegetation patches have been degraded by the presence of introduced pasture species and invasive weeds. It is unlikely that the proposed activity would result in an increase of such introduced species into adjacent patches of CPW, provided that appropriate machinery hygiene is adhered to (i.e. cleaning prior to working in or adjacent to any native vegetation communities) as well as the other mitigation measures outlined above.	
causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or	
Due to the previous and existing agricultural and residential land usage, fertiliser and herbicide	

influences are expected to already be impacting upon the CPW patches. No fertilisers or herbicides are likely to be used for the proposed event..
interfere with the recovery of an ecological community
The Approved Cumberland Plain Recovery Plan (DECCW, 2010) has been prepared to guide the long-term protection and survival of threatened biodiversity on the Cumberland Plain. The temporary disturbance of the groundlayer from installation of fencing and running of the event would not interfere with the recovery of the community.
Conclusion of assessment of significance
Impacts on CPW as a result of the event will be minimal and temporary. There will be no clearing of trees, and no slashing or trimming of vegetation. As such, the proposal is unlikely to have a significant effect on CPW.

Shale/Sandstone Transition Forest

This assessment of significance has been prepared with reference to *Significant Impact Guidelines* (DEWHA 2009).

EPBC Act Assessment of Significance	Shale-Sandstone Transition Forest
An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:	
reduce the extent of an ecological community	
Shale/Sandstone Transition Forest (SSTF) occurs over large areas in the central and western portion of the property. In the central portion, the event will occur along existing tracks through the vegetation, and fencing will be installed to prevent entry of participants into these areas of native vegetation. There will be no clearing of trees, and no slashing or trimming of vegetation. There is the potential for indirect impacts from installation of fencing, and from erosion of the track during the event. In the western portion of the study area this vegetation type is characterised by scattered trees over a grassy understory. The proposal will involve the disturbance of the groundlayer in these areas through installation and removal of event features (e.g. mud mile #1). Groundlayer will be able to recover following the event. Given the above points, the impacts on the community will be minimal and temporary and will not 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. The event track has been designed to avoid the intended biobank area.	
fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	
The event has been designed to use existing tracks through the SSTF that is located on the hill, and no vegetation would require removal for the track in the western occurrence of SSTF. As the tree canopy will not be affected the proposal will not fragment or increase fragmentation of the ecological community.	
adversely affect habitat critical to the survival of an ecological community	
No habitats considered critical to SSTF have been recorded as occurring within, or in close proximity to the subject site. The integrity of the habitat within the proposed track and tent areas is limited due to long term disturbances discussed previously. The main habitat value consists of the presence of some hollow-bearing trees. These trees will not be affected by the proposed activities. The proposal will temporarily impact disturbed groundlayer areas only.	
modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	
There is some potential for minor disturbance to topsoil and associated debris during installation and removal of obstacles, and participants running along the track. Erosion and sediment control measures are recommended where necessary.	
cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting	
The area of SSTF to be temporarily modified as part of the proposed development is relatively	

EPBC Act Assessment of Significance	Shale-Sandstone Transition Forest
small in the context of the remaining SSTF within the study area. There will be no clearing of trees, and no slashing or trimming of vegetation. The groundcover that would temporarily disturbed is already disturbed by grazing. As such, there would be no substantial change in the species composition of SSTF in the study area.	
cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to	
These patches are simplified, both structurally and floristically, due to the long term agricultural disturbances and practices. There will be no clearing of trees, and no slashing or trimming of vegetation. The groundcover that would temporarily disturbed is already disturbed by grazing. In addition, it is proposed that a biobank will be established on the property which will conserve and manage stands of SSTF in perpetuity. .	
assisting invasive species, that are harmful to the listed ecological community, to become established, or	
The vegetation patches have been degraded by the presence of introduced pasture species and invasive weeds. It is unlikely that the proposed activity would result in an increase of such introduced species into adjacent patches of SSTF, provided that appropriate machinery hygiene is adhered to (i.e. cleaning prior to working in or adjacent to any native vegetation communities) as well as the other mitigation measures outlined above.	
causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or	
Previous uses of the site are not known, although it is apparent that logging and clearing has taken place at various times. It is possible that previous uses in the western occurrence may have involved the application of fertilisers or herbicides. No fertilisers or herbicides are likely to be used for the proposed event.	
interfere with the recovery of an ecological community	
The Approved Cumberland Plain Recovery Plan (DECCW, 2010) has been prepared to guide the long-term protection and survival of threatened biodiversity on the Cumberland Plain. The temporary disturbance of the groundlayer from installation of fencing and running of the event would not interfere with the recovery of the community.	
Conclusion of assessment of significance	
Impacts on SSTF as a result of the event will be minimal and temporary. There will be no clearing of trees, and no slashing or trimming of vegetation. As such, the proposal is unlikely to have a significant effect on SSTF.	

EPBC Act Assessment of Significance	*Micromyrtus minutiflora*
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	
Lead to a long-term decrease in the size of an important population of a species	
The proposed development would have a temporary impact on groundcover within the area of potential habitat for this species. This includes marking of the running track and temporary disturbance of the groundlayer by participants during running of the event. No individuals of *Micromyrtus minutiflora* were recorded along the proposed track alignment. The temporary and short-term nature of the track development is not likely to lead to a long-term decrease in the size of an important population of a species.	
Reduce the area of occupancy of an important population	
The occurrence, both positively and tentatively confirmed of this species will not be directly affected by the proposed track development, as the mature individual is located within the junction of two fences, where it is protected from damage by vehicles, and the juveniles occur within tree and shrub thickets which will not be cleared for the track development. Therefore, the existing area of population will not be reduced.	
Fragment an existing important population into two or more populations	
There will be no clearing of trees, and no slashing or trimming of vegetation. The proposed development would have a temporary impact on groundcover within the area of potential habitat for this species. As the existing regenerating tree and shrub canopy will not be affected, the proposed event track will not fragment the existing important population into two or more populations.	
Adversely affect habitat critical to the survival of a species	
No shrub removal will be required in the north-west portion of the site, where *Micromyrtus minutiflora* occurs. The running track will extend across grassland, avoiding trees and shrubs, further to the north. The temporary disturbance area is not likely to adversely affect any critical habitat for the species. The individuals will be fenced to ensure the proposal does not damage them.	
Disrupt the breeding cycle of a population	
One individual of *Micromyrtus minutiflora* was recorded in a previous environmental assessment (EcoLogical Australia 2007) in the north-western, previously disturbed section of the site. The individual occurs within the junction of two fencelines, where it is afforded protection from accidental damage by vehicles. The juveniles occur within tree and shrub thickets which will not be cleared for the track development. The proposed development would have a temporary impact on groundcover within the area of potential habitat for this species. This includes marking of the running track and temporary disturbance of the groundlayer by participants during running of the event. No individuals of *Micromyrtus minutiflora* were recorded along the proposed track alignment, therefore the existing population on the property will not be disturbed. The proposal is therefore unlikely to disrupt the breeding cycle of the population.	
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	

EPBC Act Assessment of Significance	*Micromyrtus minutiflora*
No disturbance or shrub removal will be required in the north-west portion of the site, where *Micromyrtus minutiflora* occurs. The event track will extend across grassland, avoiding trees and shrubs, further to the north. As such, the proposal is not likely to cause the species to decline.	
Result in invasive species that are harmful to an endangered species becoming established in the endangered species' habitat	
There are several invasive grass species which already occur on the site, and it is possible that, without post-development care, some invasive grass species may establish in the event track areas. Mitigation measures including appropriate machinery hygiene are recommended to minimise spread and introduction of weeds.	
Introduce disease that may cause the species to decline, or	
Phytophthora cinnamomi and Exotic Rust Fungi have the potential to be introduced by the proposal; however, recommendations in this report will be implemented to prevent and mitigate these diseases.	
Interfere substantially with the recovery of the species	
The Approved Cumberland Plain Recovery Plan (DECCW, 2010) has been prepared to guide the long-term protection and survival of threatened biodiversity on the Cumberland Plain. The Plan includes a number of threatened plant species, as well as *Micromyrtus minutiflora*. The proposed event track will not require the removal of the individuals of *Micromyrtus minutiflora*, therefore the proposed development is not inconsistent with the objectives of this plan.	
Conclusion of assessment of significance	
The proposal is unlikely to impact *Micromyrtus minutiflora*. There will be no clearing of trees, and no slashing or trimming of vegetation. The proposed event track will not require the removal of the individual of *Micromyrtus minutiflora*. As such, the proposal is unlikely to have a significant effect on *Micromyrtus minutiflora*.	

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Document Status

Rev No.	Author	Reviewer		Approved for Issue		
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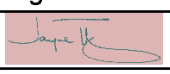
0.	G Leonard K Crosby	J Tipping		D Williams	*D Williams*	28/08/2013

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