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Environment and Heritage

Ecological Assessment
Illawarra Escarpment Mountain Bike Concept Plan
Planning and Assessment Services

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Document control

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Executive summary

Context

Niche Environment and Heritage Pty Ltd (Niche) was commissioned by NSW National Parks and Wildlife Service (NPWS) to undertake a terrestrial ecological assessment as part of a Review of Environmental Factors (REF) to develop a draft Concept Plan for the Illawarra Escarpment Mountain Bike Trail network. NPWS has engaged Synergy Trails, a mountain bike (MTB) trail design and construction firm, to develop a draft Concept Plan for the Illawarra Escarpment MTB network ('the Project'). The Project will consist of 67 trails over approximately 50 kilometres of trail, network links and supporting infrastructure and services in the O'Briens Drift to Mt Kembla precinct of the Illawarra Escarpment (study area).

Aim of assessment

The primary aim of this assessment was to assess potential ecological impacts associated with the proposed MTB trail design and construction methodologies, and provide advice to amend the Project footprint in order to avoid and mitigate impacts. Assessment of residual ecological impacts from the Project was then conducted as required under state and federal legislation.

Methods

Flora and fauna surveys were completed in June and July 2021, and February 2022. Flora survey plots were undertaken to confirm regional vegetation mapping and random meander searches were conducted along the proposed trails and helicopter drop zone locations for threatened flora previously recorded in the study area. Due to the timing of surveys and the nature of the proposed impacts, threatened fauna surveys were limited to habitat assessments along the proposed trails, and call playback for Red-crowned Toadlet (*Pseudophryne australis*).

Key results

Good condition native vegetation exists throughout the study area with minor areas of exotic species along previously cleared trails and fire trails. With reference to vegetation mapping of the study area (NSW Department of Planning Industry and Environment [DPIE] 2016), the majority of vegetation to be modified by the Project is *Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion* (2.8 hectares [ha]). An area of *Lilly Pilly - Sassafras - Stinging Tree subtropical/warm temperate rainforest on moist fertile lowlands, southern Sydney Basin Bioregion* occurs along several of the tracks surveyed; this vegetation type is considered part of the Threatened Ecological Community (TEC) Illawarra Subtropical Rainforest in the Sydney Basin Bioregion (ISR), which is listed as endangered under the NSW *Biodiversity Conservation Act 2016* (BC Act) and critically endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Two threatened fauna species (Grey-headed Flying-fox [*Pteropus poliocephalus*]) (EPBC and BC Acts) and Powerful Owl [*Ninox strenua*]) (BC Act) were recorded in the study area. Potential habitat exists for a number of species; however, those with the highest potential of being affected include Giant Burrowing Frog (*Heleioporus australiacus*) and Red-crowned Toadlet.

No threatened flora were recorded in the study area and none are likely to be impacted as a result of the project.

Impacts of the Project

The Project would result in unavoidable and direct impacts, namely, the removal of approximately 6.54 ha of native vegetation (from primary and secondary clearing), temporary impacts to 0.16 ha of native vegetation at helicopter drop zone locations, and the temporary modification to a small amount of habitat other than native vegetation (mostly ephemeral drainage lines).

Of the 6.54 ha to be removed, 0.45 ha consists of ISR (TEC).

Potential indirect impacts include sedimentation or erosion in adjacent bushland, weed invasion, potentially deleterious hydrological changes and increased human activity within or directly adjacent to sensitive habitat areas. These indirect impacts would be ameliorated by a series of mitigation measures and safeguards.

Assessment of impacts on threatened biodiversity

Formal assessments of significance (Test of Significance [ToS] under Section 7.3 of the BC Act and the EPBC Act's Significant Impact Criteria) have been conducted as part of this assessment to determine whether the Project will have a significant impact on threatened biodiversity. These assessments were conducted for the following threatened biodiversity:

- Threatened ecological communities:
  - Illawarra Subtropical Rainforest (ISR)
- Threatened fauna
  - Grey-headed Flying-fox (EPBC Act and BC Act)
  - Large-eared Pied Bat (*Chalinolobus dwyeri*) (EPBC Act and BC Act)
  - Little Bentwing-bat (*Miniopterus australis*) (BC Act)
  - Eastern Bentwing-bat (*Miniopterus orianae oceanensis*) (BC Act)
  - Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) (BC Act)
  - Eastern Freetail-bat (*Micronomus norfolcensis*) (BC Act)
  - Southern Myotis (*Myotis macropus*) (BC Act)
  - Greater Broad-nosed Bat (*Scoteanax rueppellii*) (BC Act)
  - Spotted-tailed Quoll (*Dasyurus maculatus maculatus*) (EPBC Act and BC Act)
  - Powerful Owl (BC Act)
  - Sooty Owl (*Tyto tenebricosa*) (BC Act)
  - Gang-gang Cockatoo (*Callocephalon fimbriatum*) (BC Act)
  - Rufous Fantail (*Rhipidura rufifrons*) (EPBC Act and BC Act)
  - Black-faced Monarch (*Monarcha melanopsis*) (EPBC Act and BC Act)
  - Olive Whistler (*Pachycephala olivacea*) (BC Act)
  - Pink Robin (*Petroica rodinogaster*) (BC Act)
  - Red-crowned Toadlet (BC Act)
  - Giant burrowing Frog (EPBC Act and BC Act)
  - Stuttering Frog (*Mixophyes balbus*) (EPBC Act and BC Act)
  - Rosenberg's Goanna (*Varanus rosenbergi*) (BC Act).

These assessments concluded that the above TEC and threatened fauna species are unlikely to be significantly affected by the Project.

Recommendations

Recommendations and safeguards designed to avoid and mitigate impacts of the Project include:

- Delineation of the project footprint
- Avoidance of canopy trees
- Erosion and sediment controls
- Preparation and implementation of a:
  - hygiene management plan
  - weed management plan.

Glossary and list of abbreviations

Term or abbreviation	Definition
AOBV	Areas of Outstanding Biodiversity Value
BAM	Biodiversity Assessment Method
BC Act	*Biodiversity Conservation Act 2016* (NSW)
BOS	Biodiversity Offsets Scheme
CEEC	Critically Endangered Ecological Community
DPE	NSW Department of Planning and Environment (previously DPIE)
DPI	NSW Department of Primary Industries
DPIE	NSW Department of Planning, Industry and Environment (previously OEH, DECCW, DECC, DEC)
EA	Ecological Assessment
EEC	Endangered Ecological Community
e.g.	For example
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
FAFT	Fire Access and Fire Trail
FM Act	*Fisheries Management Act 1994*
ha	Hectare/s
i.e.	the abbreviation for *id est* and means "in other words"
IBRA	Interim Biogeographic Regionalisation for Australia
IEMB network	Illawarra Escarpment Mountain Bike Trail Network
IESCA	Illawarra Escarpment State Conservation Area
ISR	Illawarra Subtropical Rainforest
KTPs	Key Threatening Processes
LGA	Local Government Area
Locality	The site and surrounds, nominally a 10 km radius from the site
m	Metre/s
m^2	Metres square
MNES	Matters of National Environmental Significance (from the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*).
Niche	Niche Environment and Heritage Pty Ltd
NPWS	National Parks and Wildlife Service
NSW	New South Wales
PCT	Plant Community Type
Project footprint	Area of direct impacts by the Project within the study area
REF	Review of Environmental Factors
Study area	Means the Project footprint and surrounding land where surveys were conducted.
TEC	Threatened Ecological Community
Threatened biodiversity	Threatened species, populations or ecological communities listed under the BC and/or EPBC Acts

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1. Project background

1.1 Introduction

Niche Environment and Heritage Pty Ltd (Niche) was commissioned by NSW National Parks and Wildlife Service (NPWS) to undertake a terrestrial ecological assessment as part of a Review of Environmental Factors (REF) to develop a draft Concept Plan for the Illawarra Escarpment Mountain Bike Trail Network (henceforth referred to as the "IEMB network") (Figure 1; Figure 2). Thorough details of the Project are included within the REF which this document accompanies. NPWS has engaged Synergy Trails, a mountain bike (MTB) trail design and construction firm, to develop a draft Concept Plan for the IEMB network. The IEMB network will consist of 67 trails over approximately 51 kilometres (km) of trail, network links and supporting infrastructure and services (the Project) in the O'Briens Drift to Mt Kembla precinct of the Illawarra Escarpment (study area) (Table 3). The study area occurs within the IESCA and encompasses the entire MTB network (Figure 1). The REF also defines approval pathways and end use planning, such as on-going monitoring of underground conditions where appropriate.

1.2 Project location

The proposed IEMB network is located along the Illawarra Escarpment, to the west of the Wollongong suburbs of Figtree and Cordeaux Heights and south-west of Wollongong and Mt Keira / Keiraville (Figure 2). The proposed IEMB network is approximately 50 km in total length, spanning multiple land tenures, including approximately 250 hectares (ha) of the Illawarra Escarpment State Conservation Area (IESCA), managed by NPWS. Other land tenures within the proposed IEMB network include:

- Wollongong City Council (WCC)
- Sydney Water
- South32 (Private landholder).

The 'locality' of the project is taken to be a 10 km buffer from the study area. Table 1 provides details of the landscape features of the Project.

Table 1: Landscape features

Landscape features	Description	Figure/ Section reference
Project footprint	The area within which direct impacts from the Project will occur during construction – 6.54 ha.	Figure 1 and Figure 8
Operational footprint	The area within which permanent and direct impacts from the Project will occur during the operational phase -	Figure 1 and Figure 8
Study area	The Project footprint and surrounding land where surveys were conducted.	Figure 1
IBRA bioregion/subregion	The Project is located mainly within the Illawarra and has smaller sections in the Sydney Cataract subregion which is within the Sydney Basin Interim Biogeographic Regionalisation for Australia (IBRA) bioregion.	Figure 2
NSW (Mitchell) Landscapes	The Project is mapped as mainly occurring within the Bulli Coastal Escarpment and flows into the Dapto-Wollongong Coastal Slopes and the Woronora Plateau Mitchell Landscapes (Mitchell 2002).	Figure 2
Rivers, streams and estuaries and Strahler stream order	Most drainage from the study area runs east and south into the creek catchment of the Southern Rivers – Northwest and one creek runs north into the Hawkesbury Nepean South catchment. There were three creek systems in the study area, the trails cross 1st, 2nd and 3rd Strahler order streams at various locations as outlined below: • 3rd order streams (Byarong Creek) - three times	Figure 1 and Figure 2 Section 2.3.3 and 3.4

Landscape features	Description	Figure/ Section reference
	• 2nd order streams (Brandy and Water Creek, and Byarong Creek) - 16 times • 1st order streams (unnamed) – 32 times.	
Wetlands within and adjacent to development	There are no wetlands within or adjacent to the study area.	Figure 2
Connectivity features	Vegetation within the study area is wholly connected to large patches of vegetation to the west, north and south across Mount Keira and Mount Kembla, and is a part of the IESCA. IESCA connects further with catchment lands and other conservation reserves that extend south to Macquarie Pass National Park and north to Royal National Park.	Figure 1 and Figure 2
Geological significance and soils	There are crevices and cliff sections in the locality but there were no karst, caves, crevices, cliffs or other areas of geological significance within the study area or Project footprint. There are no high hazard soil areas.	-
Areas of outstanding biodiversity value	The study area is not in an area of outstanding biodiversity value (AOBV) as per the NSW *Biodiversity Conservation Act* (BC Act).	Section 4.1.4

1.3 Description of the Project

The Project includes 28.61 km of entirely new trail. A number of existing unsanctioned trails (22.56 km in total length) have been incorporated into the IEMB network to minimise environmental impacts from creating new trails. The existing trails that have been incorporated into the IEMB network require modification to meet the IMBA trail standards. The success of the proposed IEMB network would allow unsanctioned trails on Mount Keira to be closed and rehabilitated by NPWS.

Multiple network entry points and dispersed parking areas provide ease of accessibility to the IEMB network, enabling riders to easily access the ride start point of their choice. Climbing trails enable riders to cycle into the network from surrounding suburbs including Mount Kembla and Mount Keira, Keiraville, Cordeaux Heights and Farmborough Heights.

The IEMB network also includes important non-trail features, such as parking, amenities, signage and predetermined shuttle pick up locations, to ensure functionality of the network and a pleasant experience for all users.

The proposed construction methodology would be based on the conditions of each section of trail. Different grades of trail would require different levels of construction. The establishment of the trails would generally require five stages. These stages have been detailed below.

1. **Ground truthing and detail design**
   - Ground truthing of a 20 metre (m) trail corridor, with NPWS staff, to optimise trail design and minimise ecological disturbance.
   - The trail would be marked with micro flags at approximately 2 m intervals along the trail centreline.
   - Confirm fallen trees marked for cutting/removal from the trail alignment are not habitat for birds or mammals.
2. **Clearing the trail alignment**
   - Hand clearing of the marked trail of vegetation with brush-cutters and chainsaws.
   - Cleared vegetation would be stockpiled off-trail for use as brush matting to remediate access areas and degraded illegal trails on completion.
   - All trail corridors (new and existing) would be cleared to a height of 2.4 m. The trail corridors would also be checked for overhanging branches. An arborist would be consulted about any trees of concern.

- Fallen trees would be cut back to between 0.5 - 1.0 m from the trail alignment.
- Any cut timber would be stockpiled for re-use in trail construction or habitat creation.
- Where required, rocks within the trail alignment would be relocated for use as Technical Trail Features and Filters (TTF).
- Organic material would be relocated for use in berms and other trail structures to encourage regrowth.

3. **Material deposition**
   - Material would be brought to the site by helicopter to designated laydown zones (referred to as helicopter drop zones).
   - If possible, materials would be brought to the laydown zones via access roads.
4. **Cutting the Trail in**
   - Excavation would commence at critical surface water movement points. Machinery and techniques used for the excavation would depend on the trail category (and construction method) (Table 2). Trail sections have been mapped as hand built or machine built.
   - TTFs would be located and built-in locations along the trail that assist with surface water management.
   - TTFs would also be located in relation to natural rock formations and other landscape features.
   - Soil and rocks would then be dug and relocated to build the base trail between features.
   - Once the alignment is complete, the trail would be compacted by hand (shovel, McCleod's) or plate compactor.
   - Construction on existing fire / access trails would be within the existing trail corridor.
5. **Finishing the trail**
   - Stockpiled organic material would be reinstated around the trail alignment.
   - Signage would be installed.
   - Trail would be test ridden, and adjustments to geometry made to optimise the experience and meet standards/levels/criteria. The alterations would be within the area surveyed, the impact area to remain the same (note: where any alterations to the proposed result in an increased impact area than assessed as part of this document or outside of the survey area, a reassessment will be required).

Table 2 details the proposed construction equipment required for the aforementioned workings. The potential impacts of using the equipment and mitigation strategies to reduce the severity of impact is also included in Table 2.

Table 2: Summary of proposed construction equipment and details of impact

Equipment	Description	Machine Built Trails	Hand Built Trails	Associated Trail Staff	Impact / Mitigation
Narrow Track Excavator	1.8 tonne mini excavator 1.2 m track width with overall width of 1.5 m	Yes	No	Licenced Operator Two trail crew on hand tools	Trail crew hand finishing and compacting soil with machine to minimise potential for soil erosion. Fuel Management – Spill kits will always be kept with machine, and trail staff fully trained in use. Machine will be thoroughly washed down prior to use on the site to avoid bringing in contaminants.
Power Carrier	Petrol Engine Payload capacity 500 kg Maximum incline 25º with 350 kg payload Overall dimensions 214 x 65 x 110 cm (LxWxH) Weight 200 kg	Yes	No	1 operator (no licence required)	Track tread minimises impact to ground surface. Spill kit and secure fuel storage nearby at all times.
Plate Compactor	Petrol Engine Weight 56 kg	Yes	Yes	1 operator (no licence required)	Spill kit and secure fuel storage nearby at all times.
Brush Cutter	Petrol Engine	Yes	Yes	1 operator (no licence required)	Stockpile cut vegetation off-trail for use as brush matting. Clear all trail corridors (new and existing) to a height of 2.4m. Stockpile or relocate cut timber for re-use in trail construction or habitat creation. Spill kit and secure fuel storage nearby at all times.
Chain Saw	Petrol Engine	Yes	Yes	1 operator (no licence required)	Stockpile cut vegetation off-trail for use as brush matting. Fallen trees will be cut back to between 0.5-1.0m from the trail alignment. Spill kit and secure fuel storage nearby at all times.
Portable Generator	Petrol Engine	Yes	Yes	1 operator (no licence required)	Spill kit and secure fuel storage nearby at all times.
Handheld Power tools	Hilti Electrical power tools including angle grinders, drills, hammers.	Yes	Yes	1 operator (no licence required)	Battery tools preferred. Overnight recharge avoids need for generator on trail.

Equipment	Description	Machine Built Trails	Hand Built Trails	Associated Trail Staff	Impact / Mitigation
	Run on generator power / battery				
Handheld Power tools	Electrical circular saw with vacuum collection attachment Run on generator power.	Yes	Yes	Trail Crew trained in safe and sustainable use.	Avoids spread of FRP dust while cutting.
Hand Tools	Shovels, McCleod's, mattocks, rock hammers, rakes, hand rock tools. (chisels, hammers and scutches)	Yes	Yes	Trail Crew trained in safe and sustainable use.	

Table 3 provides a list of the proposed trails to be created as part of the IEMB network.

Table 3: Proposed trails of the IEMB network

Trail Category	Name		Trail Length (m)
Fire/Access Trail	**Existing (sanctioned)**	Access Rd	161
		Memorial Road	355
		Stafford Farm Trail	1,800
		Water Tank Access Road	1,014
	Existing (sanctioned) Total		**3,331**
Fire/Access Trail Total			**3,331**
Black trails	**Existing**	Trail 17 (Lower)	265
		Trail 17 Upper	179
		Trail 19	498
		Trail 32	1,900
		Trail 34	1,104
		Trail 43	125
		Trail 44	260
	Existing Total		**4,332**
	Proposed	Trail 20	883
		Trail 21	1,065
		Trail 51	156
		Trail 6	342
		Trail 62 (Expresso)	297
		Trail 7	352
	Proposed Total		3,095
Black Trails Total			**7,427**
Blue Trails	**Existing**	Trail 16	972
		Trail 24	236
		Trail 25	974
		Trail 36	348
		Trail 38	353
		Trail 41	914
		Trail 42	281
		Trail 46	315
		Trail 47	230
		Trail 48	126
		Trail 58	461
		Trail 61 (Hotdog)	1,241
	Existing Total		**6,451**
	Proposed	Trail 14	1,086
		Trail 15	191
		Trail 16	257
		Trail 18	1,853
		Trail 25	463
		Trail 33	1,889
		Trail 36	746

Trail Category	Name		Trail Length (m)
		Trail 37	314
		Trail 38	53
		Trail 4	443
		Trail 42	744
		Trail 45	512
		Trail 47	224
		Trail 48	243
		Trail 5	315
		Trail 50	319
		Trail 54	526
		Trail 55	138
		Trail 61 (Hotdog)	293
		Trail 64	2,151
		Trail 65	342
		Trail 66	452
		Trail 67	688
	Proposed Total		**14,242**
Blue Trails Total			**2,0692**
Green Trails	**Existing**	Trail 10	788
		Trail 13	917
		Trail 28	71
		Trail 31	573
		Trail 8	96
		Trail 9	251
	Existing Total		2,696
	Proposed	Trail 11 ENTRY	63
		Trail 12	37
		Trail 13	205
		Trail 26	61
		Trail 28	783
		Trail 3	464
		Trail 30	63
		Trail 39	299
		Trail 40	185
		Trail 53	591
	Proposed Total		**2,752**
Green Trails Total			**5,447**
Red Trails (Ascending)	**Existing**	Trail 22	996
		Trail 23	189
		Trail 31	835
		Trail 56	112
		Trail 59	383
	Existing Total		**2,515**
	Proposed	Trail 1	1,183
		Trail 2	1,099

Trail Category	Name		Trail Length (m)
		Trail 22	339
		Trail 23	844
		Trail 29	225
		Trail 35	2,792
		Trail 40	228
		Trail 50	1,121
		Trail 52	187
		Trail 59	837
		Trail 63	2,229
	Proposed Total		**11,084**
Red Trails (Ascending) Total			**13,599**
Two-way Trails	**Existing**	Trail 60	101
	Existing Total		101
	Proposed	Trail 26	217
		Trail 27	179
		Trail 59	55
	Proposed Total		451
Two-way Trails Total			**552**
Grand Total			**51,050**

This table is based on an earlier iteration of the trail network. Please refer to the REF for the revised numbers.

Different trail widths are required for each construction type (hand vs machine-built), and the trail category. Two-way trails have been included in the design where an ascending and descending trail are located adjacent to each other. A summary of trail widths for each trail category, during both the construction and operational phases, is presented in Table 4.

Table 4 Summary table of trail widths for each trail category

Trail Category	Machine-built construction width (m)	Hand-built construction width (m)	Operational width (m)
Existing Bike Path	4.0	N/A	4.0
Fire/Access Trail	4.0	N/A	4.0
Black Trails	1.2	1.2	0.6
Blue Trails	1.2	1.2	0.9
Green Trails	1.2	1.2	0.9
Red Trails	1.2	1.2	0.9
Two-way Trails	2.5	n/a	2.0

1.4 Purpose of this report

The primary aim of this study was to assess ecological impacts associated with the proposed MTB trail design and construction methodologies and provide advice during refinement of the Project footprint in order to avoid and mitigate impacts. Assessment of residual ecological impacts from the Project was then conducted as required under state and federal legislation. The scope of works includes the preparation of an ecological assessment to inform the REF, under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

1.5 Investigation scope

The approach of this assessment includes the following:

- Undertake a background review of relevant literature, mapping and databases.
- Conduct a field survey using recognised methods to assess the ecological values of the site and address identified data gaps.
- Describe the ecological values of the site in regard to flora, fauna and vegetation communities.
- Describe the potential ecological impacts of the Project.
- Assess the significance of impacts on threatened biodiversity as listed under the BC Act and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- Provide advice on measures to avoid and mitigate impacts.

1.6 Limitations

This study was designed as a habitat-based level of assessment, with the methodology developed for the purposes of conducting an assessment in accordance with Section 1.7 of the EP&A Act and Part 7 of the BC Act. Targeted survey (such as spotlighting and/or call playback) for terrestrial fauna were conducted in areas of suitable habitat. Similarly, vegetation plot sampling techniques were used in accordance with the Biodiversity Assessment Method (BAM) to assist with identification of plant community types (PCTs) with regards to any threatened ecological community (TEC) and only to confirm regional mapping.

The timing of the field surveys for some threatened fauna species (particularly those assessed as having a moderate likelihood of occurrence) were outside suitable breeding seasons and the results of these surveys could not conclusively exclude any species presence or absence. As such, many species were assumed present based on the availability and quality of suitable habitat within the study area.

1.7 Approval and assessment process

1.7.1 NSW Biodiversity Conservation Act 2016

The BC Act establishes a framework for assessing and offsetting biodiversity impacts from proposed development. The purpose of the BC Act is to "maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development". It provides for:

- Threatened species and ecological communities
- AOBV (previously critical habitat under the *Threatened Species Conservation Act 1995*)
- Key Threatening Processes (KTPs)
- Private land conservation agreements
- The Biodiversity Offsets Scheme (BOS)
- Biodiversity assessment requirements
- Biodiversity certification of land.

1.7.2 NSW *Environmental Planning and Assessment Act 1979*

The EP&A Act provides an assessment framework for the consideration of threatened species, populations, ecological communities and their habitats. Due to the complexity and multi-tenure nature of the Project, the IEMB network is to be assessed under the EP&A Act in two separate components:

1. Trail construction on NPWS, South32 and Sydney Water land will be assessed under Part 5 of the EP&A Act.
2. Supporting infrastructure on WCC and South32 land will be assessed under Part 4 of the EP&A Act

NPWS and WCC are acting as co-proponents for the project.

Section 7.3 of the BC Act, the ToS, sets out the criteria for determining whether a proposal is likely to have a significant impact on threatened biodiversity.

For an activity under Part 4 of the EP& A Act an activity will be likely to significantly affect a threatened species if:

- There are impacts to land mapped on the Biodiversity Values Map
- Clearing of native vegetation exceeds the area threshold, or
- It is likely to significantly affect threatened species or ecological communities, or their habitats, according to the ToS (section 7.3 of the BC Act).

Under Part 4 of the EP&A Act, if it is determined that an activity is likely to significantly affect a threatened species or ecological community, a Biodiversity Development Assessment Report (BDAR) under the BOS must be prepared.

For an activity under Part 5 of the EP&A Act an activity will be likely to significantly affect a threatened species if:

- It is likely to significantly affect threatened species or ecological communities, or their habitats, according to the ToS (section 7.3 of the BC Act)
- It is carried out in a declared AOBV.

Under Part 5 of the EP&A Act, if it is determined that an activity is likely to significantly affect a threatened species or ecological community the preparation of a Species Impact Statement (SIS), or, if the proponent elects to participate in the BOS, a BDAR would be required.

1.7.3 NSW *National Parks and Wildlife Act 1974*

The objects of the *National Parks and Wildlife Act 1974* (NPW Act) are as follows—

a) the conservation of nature, including, but not limited to, the conservation of—
   i. habitat, ecosystems and ecosystem processes, and
   ii. biological diversity at the community, species and genetic levels, and
   iii. landforms of significance, including geological features and processes, and
   iv. landscapes and natural features of significance including wilderness and wild rivers,

b) the conservation of objects, places or features (including biological diversity) of cultural value within the landscape, including, but not limited to—
   i. places, objects and features of significance to Aboriginal people, and
   ii. places of social value to the people of New South Wales, and
   iii. places of historic, architectural or scientific significance,

c) fostering public appreciation, understanding and enjoyment of nature and cultural heritage and their conservation,

d) providing for the management of land reserved under this Act in accordance with the management principles applicable for each type of reservation.

The objects of this Act are to be achieved by applying the principles of ecologically sustainable development. The Project occurs within land reserved under the NPW Act, being IESCA.

1.7.4 NSW *Fisheries Management Act 1994*

One of the key objectives of the FM Act is to conserve 'key fish habitat' (addressed in Section 3.4). Under Part 7 of the FM Act a permit is to be obtained from the Department of Primary Industries (DPI) (Fisheries) for:

- Activities involving dredging and reclamation work.
- Activities temporarily or permanently obstructing fish passage.
- Harming marine vegetation.

1.7.5 Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

The EPBC Act is a Commonwealth Act for the protection of nationally significant natural or cultural values or the regulation of certain nationally significant activities. These values are known as Matters of National Environmental Significance (MNES) and the regulated activities are known as 'controlled actions' and include activities which may impact on:

- World Heritage properties
- National Heritage places
- Wetlands of international importance (including Ramsar wetlands)
- Commonwealth listed threatened species and ecological communities
- Commonwealth listed Migratory species
- Commonwealth marine or land areas
- Nuclear actions (including uranium mining)
- The Great Barrier Reef Marine Park
- A water resource in relation to coal seam gas development and large coal mining development.

Before any changes in land use or new developments can be approved, any potential negative impacts on MNES must be carefully considered. 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.

A 10 km buffer of the study area was examined on 23 June 2021 using the EPBC Act's Protected Matters Search Tool (DAWE 2022a).

1.7.6 NSW *Biosecurity Act 2015*

The broad objectives for biosecurity in NSW under the *Biosecurity Act 2015* are to manage biosecurity risks from animal and plant pests and diseases, weeds and contaminants by:

- Preventing their entry into NSW
- Quickly finding, containing and eradicating any new entries
- Effectively minimising the impacts of those pests, diseases, weeds and contaminants that cannot be eradicated through robust management arrangements.

Under the *Biosecurity Act 2015*, priority weeds are defined in the following categories:

- Weeds of National Significance
- National environmental Alert List Weeds
- Water weeds
- Native plants considered weeds.

In NSW all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any

biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable. Weeds identified under the *Biosecurity Act 2015* have been listed in Appendix 5.

1.7.7 Koala SEPP State Environmental Planning Policy (Biodiversity and Conservation) 2021

The State Environmental Planning Policy (SEPP) (Biodiversity and Conservation) 2021 was made and commenced on 1 March 2022. The Biodiversity and Conservation SEPP consolidates, transfers and repeals provisions of 11 SEPPs, including SEPP (Koala Habitat Protection) 2020 (Koala SEPP 2020) and SEPP (Koala Habitat Protection) 2021 (Koala SEPP 2021). Chapter 3 of the Biodiversity and Conservation SEPP, repeals Koala SEPP 2020 and applies to the RU1, RU2, RU3 land use zones. Chapter 4 of the Biodiversity and Conservation SEPP, repeals Koala SEPP 2021 and applies to all other land apart from land stipulated in section 4.4(3) of the SEPP, this including land use zones RU1, RU2 and RU3, and land dedicated or reserved under the *National Parks and Wildlife Act 1974*. The majority of land at the Project Site is zoned E1 (National Parks and Nature Reserves), E2 (Environmental Conservation) or E3 (Environmental Management).

Chapter 4 of the Biodiversity and Conservation SEPP does not apply to Part 5 activities; however, it does apply to Part 4 activities (i.e. South32 land). No trees with a diameter at breast height of more than 10 cm would be removed for the Project, and there are only seven Koala records within IESCA and immediate surrounds. The Koala is considered to be relatively uncommon in the study area, more frequently recorded further west on the top of the escarpment. As such, the Project is not considered to impact koala or koala habitat and further consideration of Chapter 4 of the Biodiversity and Conservation Koala SEPP within South32 land is not required

2. Methods

2.1 Literature review

Literature and data sources reviewed included:

- Illawarra PCT Vegetation Map (NSW Department of Planning, Industry and Environment [DPIE] 2016)
- DPIE Threatened Species Profiles Database (cited throughout document as Department of Planning and Environment [DPE] 2022a)
- DPE Bionet, Atlas of NSW Wildlife (search radius of 10 km applied to study area) (DPE 2022b)
- The EPBC Act Protected Matters Search Tool (10 km buffer) (DAWE 2022a).
- BAM-Calculator tool to identify candidate species known or predicated to occur within the IBRA subregion (DPE 2022c)
- DPI Fisheries spatial data portal (DPI 2022a)
- Review of any local biodiversity studies that may provide information on biodiversity of the sites (including, but not limited to, Attachments B, F, M, N, O of the Request for Tender).

2.2 Orientation

The study area was investigated over three days between 10 May to 14 May 2021 by Niche employees Freya Gordon (Senior ecologist), Sarah Hart (Ecologist) and Kai Whitaker (Environmental approvals) escorted by NPWS representative Jamie Erskine and Synergy trails representative Adrian Main. The orientation survey was aimed at traversing the entire network to gain an in-depth understanding of the scope of works and to refine the field survey effort. The information collected during these three days has been included in this report.

2.3 Field survey methodology

2.3.1 Vegetation communities, threatened ecological communities and threatened flora

The study area was investigated over seven days by Niche Ecologists Sarah Hart and Amy Legge between 28 June to 2 July 2021, Stephen Bloomfield and Nathan Browne on 1 February 2022, and Stephen Bloomfield and Amy Legge on 18 February 2022. The survey involved walking the proposed trails in the Project footprint, the positions of which had been previously uploaded to a handheld GPS. Ecological assessment included seven BAM plots to confirm regional vegetation mapping

Vegetation communities within the study area were determined using the most recent available vegetation mapping across the locality: Illawarra PCT Vegetation Map (DPIE 2016). Vegetation communities within the study area were then aligned to the State-wide system of PCTs using their descriptions provided in the BioNet Vegetation Classification database (DPE 2022d). One vegetation plot in accordance with the BAM was established within each of the PCTs and consisted of the following:

- One 20 x20 m floristic plot.
- One 50 x 20 metres (m) functional plot immediately adjacent to or spanning the proposed trails.

The following attributes were collected within the BAM plots:

- Composition:
  - native species richness (20 x 20 m plot)
- Structure:
  - native flora cover (% of the 20 x 20 m plot) divided into the growth forms:
    a) Tree

b) Shrub
c) Grass and grass like
d) Forb
e) Fern
f) Other

- exotic species cover
- high threat weed vegetation cover

- Function (within 50 x 20 m plot)
  - tree regeneration (size classes present)
  - number of trees with hollows
  - total length of fallen logs
  - number of large trees
  - tree stem size class
  - litter cover (sampled in 5 x 1 m quadrats).

The BAM plot location was marked using GPS coordinates (Appendix 5).

Fifteen Rapid Data Points (Appendix 6) and random meander searches for threatened flora along the proposed trails and helicopter drop zone locations was also conducted.

2.3.2 Fauna and fauna habitat

Targeted amphibian searches using a combination of both call playback for Red-crowned Toadlet (*Pseudophryne australis),* and spotlighting (tadpole searches) was conducted by ecologists Freya Gordon and David Wilkinson on the evenings of 22 and 23 of June 2021, and 13 and 15 July 2021. Due to seasonality constraints, this was the only species that could be surveyed for in winter. Two drainage lines within the study area were selected for these surveys, being Byarong Creek and American Creek; both are 3rd order streams within the study area. Byarong Creek itself did not provide optimal habitat due to fast flow, however tributaries leading to it were surveyed. The amphibian surveys were conducted over four nights. Call playback was conducted at select locations where the trails intersect the creek to detect any breeding individuals or pools of water, whereas spotlighting and tadpole searches were conducted along all accessible tributaries. Whilst there was no rain during the surveys, there was sufficient recent rainfall prior. Spotlighting was also conducted between Byarong Creek and Mount Keira Road whilst returning to the vehicle after each amphibian survey. All opportunistic observations of fauna were also recorded (Appendix 4).

Table 5: Fauna survey effort and conditions

Date	Survey	Temperature (min) °C	Temperature (max) °C	Wind (km/h) at 3pm	Rainfall (mm)	Person hours
22 June 2021	Call playback (amphibian) Spotlighting	12.7	17.7	4	0	2.6
23 June 2021	Call playback (amphibian) Spotlighting	13.0	19.6	13	0.8	2.8
13 July 2021	Call playback (amphibian) Spotlighting	11	21	15	0	3.3
14 July 2021	Call playback (amphibian) Spotlighting	13.8	18.8	17	0	2.7

A habitat assessment was conducted along the proposed trails in the study area. Habitat characteristics and parameters that were assessed included:

- Physical aspects such as climate (desktop), geology, soils, slope, elevation, drainage and aspect
- Presence and relative abundance of key habitat features;
  - Hollow-bearing trees (HBTs)
  - Large hollow logs
  - Rocky outcrops
  - Termite mounds
  - Nests
  - Scats
  - Chewed cones.

Whilst no targeted diurnal fauna surveys were conducted, opportunistic observations were recorded upon detection.

2.3.3 Aquatic/riparian areas

Qualitative aquatic assessments were conducted at the 3rd order crossings. Information recorded included, but was not limited to, a description of the following attributes:

- Dimensions of waterway and depth of water
- Ecosystem type (e.g. wetlands, floodplains, streams, estuaries, lakes)
- Habitat types (e.g. pools, riffles, billabongs)
- Flow characteristics and hydrological features of aquatic habitat
- Bed substrate (e.g. bedrock, boulder, gravel, sand, silt)
- Existing infrastructure and barriers to fish movement (natural or artificial)
- Width and species composition of riparian vegetation including the type of vegetation present (e.g. macrophytes, snags) and condition.

Any aquatic fauna present including likely presence of threatened fish was also recorded.

2.4 Threatened flora and fauna likelihood of occurrence

A list of subject threatened flora and fauna within the locality (10 km buffer from the study area) was compiled from database searches detailed in Section 2.1. The list of subject species is determined from consideration of this list.

In order to adequately determine the relevant level of assessment to apply to potentially impacted species (affected species), analysis of the likelihood of those species occurring within the study area was completed. Five categories for 'likelihood of occurrence' (Table 6) were attributed to each species after consideration of criteria such as known records, presence or absence of important habitat features in the study area, results of the field surveys and professional judgement.

Species considered further in formal assessments of significance (BC Act, EPBC Act) were those in the 'Known', 'High' or 'Moderate' categories and where impacts for the species could reasonably be expected to occur as a result of the Project. Species listed as a 'low' or 'no' likelihood of occurrence are those for which there is limited or no habitat present within the study area.

Table 6: Likelihood of occurrence criteria

Likelihood rating	Threatened flora criteria	Threatened and migratory fauna criteria
Known	The species was observed within the study area.	The species was observed within the study area.
High	It is likely that a species inhabits or utilises habitat within the study area.	It is likely that a species inhabits or utilises habitat within the study area.
Moderate	Potential habitat for a species occurs on the site. Adequate field survey would determine if there is a 'high' or 'low' likelihood of occurrence for the species within the study area.	Potential habitat for a species occurs on the site and the species may occasionally utilise that habitat. Species unlikely to be wholly dependent on the habitat present within the study area.
Low	It is unlikely that the species inhabits the study area.	It is unlikely that the species inhabits the study area. If present at the site the species would likely be a transient visitor. The study area contains only very common habitat for this species which the species would not rely on for its on-going local existence.
None	The habitat within the study area is unsuitable for the species.	The habitat within the study area is unsuitable for the species.

2.5 Helicopter drop zones site assessments

Targeted searches for threatened flora and habitat assessment for threatened fauna were conducted at proposed helicopter drop zone locations by Niche ecologists Nathan Browne and Amy Legge on the 6, 11, and 17 August 2021, and Stephen Bloomfield and Nathan Browne on 1 February 2022. In total, 60 drop zone sites were visited, with the remaining six drop zones assessed via desktop using 2 m resolution imagery.

3. Results

3.1 Flora and native vegetation

3.1.1 Vegetation types of the study area

Previous vegetation mapping (DPIE 2016) shows six vegetation communities occurring within the study area (Figure 3), corresponding to the PCTs outlined in Table 7.

Based on the outcome of the vegetation plots and field traverses, the vegetation mapping conducted for the region (DPIE 2016) is relatively accurate with the exception of some PCT boundary locations. The mapping is considered sufficient to carry out the level of biodiversity assessment required for the Project.

Table 7: Mapped vegetation communities (PCTs) in the Study Area

PCT Name	PCT #	TEC	Legislative listing*		Extent within Study Area (ha)
			BC Act	EPBC Act	
Gully Gum - Sydney Peppermint - Yellow Stringybark moist open forest of coastal escarpments, southern Sydney Basin Bioregion	878	N/A	-	-	78.25
Lilly Pilly - Coachwood warm temperate rainforest on moist sheltered slopes and gullies, Sydney Basin Bioregion and South East Corner Bioregion	905	N/A	-	-	92.11
Lilly Pilly - Sassafras - Stinging Tree subtropical/warm temperate rainforest on moist fertile lowlands, southern Sydney Basin Bioregion	906	Illawarra Subtropical Rainforest in the Sydney Basin Bioregion	E	CE	51.25
Silvertop Ash - Red Bloodwood - Sydney Peppermint heathy open forest on moist sandstone plateaux, southern Sydney Basin Bioregion	1156	N/A	-	-	6.12
Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion	1245	N/A	-	-	225.23
Whalebone Tree - Native Quince dry subtropical rainforest on dry fertile slopes, southern Sydney Basin Bioregion	1300	Illawarra Subtropical Rainforest in the Sydney Basin Bioregion	E	CE	0.05

*CE = E= Endangered, Critically Endangered

3.1.2 Threatened ecological communities

There are six PCTs that intersect with the study area, two of which comprise the TEC Illawarra Subtropical Rainforest in the Sydney Basin Bioregion (ISR) (PCT 906 and PCT 1300) (Table 7).

Fifteen trail sections intersect ISR (Figure 5) for an approximate total trail length of 4.03 km (Table 8). This TEC is listed as Endangered under the BC Act and forms part of the Illawarra-Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion under the EPBC Act, listed as Critically Endangered (hereafter, both TECs are referred to as ISR). PCT 906 which aligns with the both the State and Commonwealth listed TEC would be directly impacted as a result of the Project. TEC ISR also occurs within some of the helicopter drop zone locations which are discussed further in Section 2.5. A ToS under the BC Act (Appendix 2) and Assessment of Significance (AoS) under the EPBC Act (Appendix 3) have been undertaken for this TEC, a summary of which is provided in Section 4.2.

Table 8: Trails that intersect TECs

Threatened Ecological Community (TEC)	PCT Name	Extent within Study Area (ha)	Proposed Trails that intersect	Trail Length (m)
ISR (EEC-BC Act; CEEC-EPBC Act)	Lilly Pilly - Sassafras - Stinging Tree subtropical/warm temperate rainforest on moist fertile lowlands, southern Sydney Basin Bioregion (PCT 906)	44.74	Stafford Farm Trail	185.61
			Trail 28	306.89
			Trail 32	102.11
			Trail 33	186.31
			Trail 34	99.47
			Trail 35	236.84
			Trail 36	41.42
			Trail 42	304.83
			Trail 45	9.84
			Trail 50	421.72
			Trail 58	53.31
			Trail 59	296.04
			Trail 63	452.08
			Trail 64	1202.15
			Total	**4003.76**

3.1.3 Threatened flora

Literature review

A total of 35 threatened flora, as listed under the BC Act and/or EPBC Act, were considered in this assessment (refer to Appendix 1 and Figure 6). This list was derived from the database searches outlined in Section 2.1. Of the species listed in Appendix 1, three are considered to have a High or Moderate likelihood of occurrence in the study area (Table 17).

Field survey

During the field surveys no threatened flora were recorded in the study area. Subject threatened flora and their habitats are assessed in Section 4.3.

3.1.4 Weeds

A large proportion of the study area has an understory inundated with weed species, two of which are listed as priority weeds for the South East (NSW WeedWise) and Weeds of National Significance (WoNS). The following introduced flora species were observed during the field surveys:

- Lantana camara (Lantana) – Priority weed and WoNS
- *Anredera cordifolia* (Madeira vine) – Priority weed and WoNS
- *Ageratina adenophora* (Crofton weed)
- *Delairea ordorata* (Cape ivy)
- *Senna pendula* (Cassia)
- *Ipomoea indica* (Morning glory)
- *Ligustrum sinense* (Narrow-leaf privet)
- *Ligustrum lucidum* (Broad-leaf privet)
- *Erythrina crista-galli* (Cockspur coral tree)
- *Cirsium arvense* (Perennial thistle)
- *Solanum pseudocapsicum* (Jerusalem Cherry).

It is anticipated that the proposed works will increase the extent of the current disturbance regime, therefore the establishment of a weed management plan is highly recommended.

Of the aforementioned weeds, those of particular concern when undertaking construction works are *Lantana camara, Anredera cordifolia, Ligustrum sinense, Ligustrum lucidum* and *Erythrina crista-galli.* Extra caution is encouraged when working with these species, and it is advised that any cutting of these species be removed from the escarpment and disposed of according to NSW WeedWise control and biosecurity advice (DPI 2022b). This is due to their propensity to regenerate from small segments, thus the possibility of increasing their spread throughout the escarpment if particular care is not practised.

3.2 Terrestrial fauna and fauna habitat

3.2.1 Fauna

During the current field survey 23 terrestrial fauna species were recorded, two of which are threatened, and one is migratory (Section 3.2.3) (Appendix 4).

3.2.2 Fauna habitat

Woodland habitat (near the top of the escarpment)

Woodland habitat provides a wide range of food and shelter for vertebrate fauna. Trees from the family Myrtaceae (mostly *Eucalyptus* spp.) generally dominate the upper canopy in these areas and supply direct (foliage, nectar, exudates) and indirect food (arthropods) for a range of vertebrates, particularly birds and arboreal mammals.

Tree hollows (formed in dead trees [stags] and mature trees) provide nesting and roosting habitat for hollow-dwelling fauna and are important habitat components of native forests. A variety of tree hollows were seen throughout the study area generally at moderate to high densities. These are likely to provide suitable den and nesting habitat for a range of birds, arboreal mammals and microbats. Locally recorded threatened species that require tree hollows for roosting and/or breeding include the Powerful Owl (*Ninox strenua)* and Eastern Freetail Bat (*Micronomus norfolkensis*).

No hollow-bearing trees or mature trees would be impacted by the Project.

Rock outcrops

Sandstone outcrops were not very common throughout the study area, but where present included exfoliated surfaces and crevices. These habitat features may provide refuge for a range of reptile species, including the threatened Broad-headed Snake (*Hoplocephalus bungaroides*) and Rosenberg's Goanna (*Varanus rosenbergi*). These species rely on these habitats for over-wintering, thermoregulation, and shelter, and as a refuge for juveniles and prey species. Whilst outcropping rock was relatively common along some areas, exfoliating slabs of rock were mostly restricted to larger outcrops on the hilltops. Where possible, proposed trails have been situated away from rock outcrops.

Termite mounds

A small number of termite mounds were seen within the study area during the field survey, none of which are present along the proposed trails. Termite mounds are an important nesting resource for the Rosenberg's Goanna. Termite mounds would be avoided by the proposed works and therefore are unlikely to be impacted by the Project.

3.2.3 Threatened and migratory fauna

Literature review

A total of 89 subject threatened and migratory fauna have previously been recorded (DPE 2022b) or are predicted to have habitat (DAWE 2022a, DPE 2022c) within the locality (Appendix 1, Figure 7). This list was derived from the database searches outlined in Section 2.1. Of the species listed in Appendix 1, 17 species were considered to have a moderate to high likelihood of occurrence in the study area and three were confirmed present (Table 9).

Table 9: Threatened and migratory species with a moderate to high likelihood of occurrence within the study area

Common name	Scientific name	Likelihood of Occurrence	BC Act	EPBC Act
Giant Burrowing Frog	*Heleioporus australiacus*	Moderate	V	V
Red-crowned Toadlet	*Pseudophryne australis*	Moderate	V	-
Stuttering Frog	*Mixophyes balbus*	Moderate	E	V
Black-faced Monarch	***Monarcha melanopsis***	**Present**	**-**	**M**
Powerful Owl	***Ninox strenua***	**Present**	V	-
Gang-gang Cockatoo	*Callocephalon fimbriatum*	Moderate	V	-
Olive Whistler	*Coracina lineata*	Moderate	V	-
Pink Robin	*Petroica rodinogaster*	Moderate	V	-
Rufous Fantail	*Rhipidura rufifrons*	Moderate	-	M
Sooty Owl	*Tyto tenebricosa*	Moderate	V	-
Large-eared Pied Bat	*Chalinolobus dwyeri*	Moderate	V	V
Spotted-tailed Quoll	*Dasyurus maculatus*	Moderate	V	E
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	Moderate	V	-
Eastern Freetail-bat	*Micronomus norfolkensis*	Moderate	V	-
Little Bentwing-bat	*Miniopterus australis*	Moderate	V	-
Eastern Bentwing-bat	*Miniopterus orianae oceanensis*	Moderate	V	-
Southern Myotis	*Myotis macropus*	Moderate	V	-
Grey-headed Flying-fox	***Pteropus poliocephalus***	**Present**	**V**	**V**
Greater Broad-nosed Bat	*Scoteanax rueppellii*	Moderate	V	-
Rosenberg's Goanna	*Varanus rosenbergi*	Moderate	V	-

Field survey

The three threatened/migratory fauna species recorded during the current field survey were:

- Grey-headed Flying-fox
- Powerful Owl
- Black-faced Monarch.

The Grey-headed Flying-fox is listed as vulnerable under both the BC Act and EPBC Act. Greater than 10 individuals were recorded within the study area, roosting in the trees in the vicinity of American Creek (at the beginning of the Memorial Pathway in Kembla Grange, Figure 4). One individual was also recorded roosting at the edge of the transmission line easement near Mount Keira Road.

One Powerful Owl, listed as vulnerable under the BC Act, was heard whilst conducting amphibian surveys at American Creek, the call emanating from a significant distance to the north-west (Appendix 4).

The Black-faced Monarch is listed as Migratory under the EPBC Act. Two Black-faced Monarch individuals were heard calling in the vicinity of trail 39 and trail 40, south of Harry Graham Drive.

Affected threatened fauna and their habitats are assessed in Section 4.4.

3.3 Helicopter drop zone habitat assessment

A total of 60 drop zones were assessed for threatened flora and fauna habitat values (see Appendix 7). The drop zones span across five PCTs; 878, 905, 906 and 1245. Some of the proposed helicopter drop zones were located in areas where the vegetation generally consisted of an open canopy and weed inundated understory; however, where sites were found to be in moderately good condition and free from invasive flora species, it was advised that the drop zone location be moved to a nearby area with less habitat constraints (e.g. not within areas of TEC). Those which had potential for biodiversity impacts are highlighted below. The drop zones listed in Table 10 have been identified as those with habitat constraints rendering them unsuitable for a helicopter drop zone site. Alternate relocation options are proposed in the site notes. For drop zones where there are no viable relocation options, recommendations have been made to remove the drop zone location.

Table 10: Assessment of proposed helicopter drop zone locations with habitat constraints

Heli Drop Zone	PCT #	Site Notes	Habitat Constraints
6486HDZ17	878	Good previously cleared site at corner, some native ground cover. *Solanum pseudocapsicum* and Crofton weed moving into site. Still rainforest, post works regen best case scenario	Moderately good condition rainforest - **remove drop zone location**
6486HDZ39	1245	Canopy opening downslope from *Eucalyptus quadrangulata*	Good condition rainforest community, no weeds present. **Remove drop zone location**
6486HDZ40	905	On corner of trail 22 above steep descent. Not ideal location given size of sandpaper fig. Move drop location to HDZ33	Canopy intact, dense understorey. **Potential to relocate location** - perform multiple drops at HDZ33
6486HDZ44	905	Dense understorey on downhill corner of trail 34. Moderate clearing in canopy. Good condition besides single moth vine.	Single moth vine species, otherwise good habitat. Alternate *Rubus rosifolius* clearing further off track with larger canopy clearing - **move drop zone 10 m off track**
6486HDZ45	905	Near berm of trail 22, unsuitable site. Native understorey will need to be cleared - **Sassafras and Bolwarra.**	Sassafras and native ground cover will need to be cleared. Canopy closed in - **remove drop zone**

Heli Drop Zone	PCT #	Site Notes	Habitat Constraints
6486HDZ48	1245	Clearing on trail 16, canopy slightly closed	Small hollows in eucalyptus nearby, overstorey slightly inhibiting heli drop efficiency. **Relocate drop zone to more suitable 64865HDZ43**
6486HDZ60	1245	Steep slope on trail 1, not a highly suitable open clearing for a drop zone	Maidenhair fern groundcover, privet midstorey. Dense canopy cover. **Relocate drop zone to upslope, more suitable location 6486HDZ7**
6486HDZ61	906	Native fern ground cover and Sassafras, Bolwarra, Scented rosewood understorey	PCT 906 with dense understorey. No weeds present. Good quality habitat. **Remove drop zone location**
6486HDZ71	905	Southern uphill slope of trail 34. Weedy site, however, good canopy cover	*Acacia maidenii* canopy slight closure. **Move drop zone 40 m downslope** to coral tree opening, grassy clearing
6486HDZ81	878	On the eastern burn of existing track	Canopy cover high, potential to **relocate drop zone** slightly westward to uphill where canopy cover is reduced

3.4 Aquatic habitat

Major waterways (3rd order and above) in the catchment include Byarong Creek, American Creek, and Brandy and Water Creek. Several tributaries flow in all directions across the escarpment, flowing into the Southern Rivers Catchment and three 1st order tributaries of Kembla Creek flow into the Hawksbury-Nepean Catchment. A total of 51 waterway crossings requires consideration of erosion control and aquatic fauna habitat as part of the Project (Table 11, Figure 8).

The proposed trail crossings are located on mostly 1st and 2nd order watercourses, which provide either little aquatic habitat (consisting of shallow pools) or were mostly dry at the time of the survey. These ephemeral watercourses are suitable for erosion control measures and do not require bridges or culvert waterway crossings.

There are three locations where the proposed trails cross a 3rd order stream (tributaries of Byarong Creek) which are classed as key fish habitat and Class 2 -Moderate key fish habitat for fish passage. In accordance with DPI guidelines (DPI 2013), a suitable road crossing for these locations could include a bridge, arch structure or culvert (DPI 2013). The three crossings over Byarong Creek will require construction of a small wooden bridge to cross the creek (see Section 1.3 and REF for detailed construction notes).

All 3rd order sections of the creeks were flowing at the time of the survey; however, fish passage was limited as there were either sections with dry areas leading into smaller tributaries or the water was flowing rapidly and downhill.

3.4.1 Threatened aquatic fauna

There were no subject threatened aquatic fauna, as listed on the FM Act, to be considered in this assessment. This list was derived from the database searches outlined in Section 2.1. During the field survey no threatened aquatic fauna were recorded opportunistically in the study area.

Table 11: Creek crossings within the study area (51 crossings)

Hydroname	Strahler order	Latitude	Longitude	Trail name
American Creek	1st order	-34.42789309	150.817015	Memorial Road
	1st order	-34.42836842	150.817285	Memorial Road
Brandy and Water Creek	2nd order	-34.42044617	150.8119905	Trail 25
	2nd order	-34.41546952	150.8152967	Water Tank Access Road
	2nd order	-34.41555905	150.8152606	Water Tank Access Road
	2nd order	-34.41647292	150.8150312	Water Tank Access Road
	1st order	-34.41525392	150.8154067	Water Tank Access Road
	2nd order	-34.41737307	150.8137857	Access Road
	2nd order	-34.41739836	150.8137782	Access Road
	1st order	-34.4091361	150.8299713	Stafford Farm Trail
	1st order	-34.40845112	150.8258237	Stafford Farm Trail
	2nd order	-34.41782509	150.8136263	Trail 7
	2nd order	-34.41682518	150.8141008	Trail 8
	2nd order	-34.41898847	150.8129358	Trail 13
	1st order	-34.42277209	150.8102471	Trail 18
	1st order	-34.42280687	150.810189	Trail 18
	2nd order	-34.42258236	150.8090721	Trail 21
	1st order	-34.42056049	150.8078556	Trail 25
	1st order	-34.40559356	150.8323341	Trail 40
	1st order	-34.42060608	150.8113366	Trail 46
	1st order	-34.42047342	150.8098626	Trail 48
	1st order	-34.42060057	150.8111835	Trail 48
	1st order	-34.40897668	150.8300046	Trail 53
	1st order	-34.42376363	150.8089597	Trail 60
	1st order	-34.42062611	150.8114946	Trail 25
	1st order	-34.40895477	150.825095	Trail 28
	1st order	-34.408981	150.825032	Trail 28
	1st order	-34.40898322	150.8250267	Trail 28

Hydroname	Strahler order	Latitude	Longitude	Trail name
	1st order	-34.40920539	150.8244829	Trail 28
	1st order	-34.41038571	150.823015	Trail 28
	1st order	-34.40823282	150.8261019	Trail 36
	1st order	-34.40559519	150.83233439	Trail 50
	1st order	-34.40582072	150.83236299	Trail 50
	1st order	-34.40605373	150.83238063	Trail 50
	1st order	-34.40860584	150.8302117	Trail 66
	1st order	-34.4118584	150.8164367	Trail 45
	1st order	-34.41201288	150.8164541	Trail 45
	1st order	-34.41222201	150.8164709	Trail 27
	1st order	-34.40849101	150.83029012	Trail 50
	1st order	-34.40849101	150.83029012	Trail 50
Byarong Creek	3rd order – Key Fish Habitat	-34.40955217	150.8459426	Trail 59
	2nd order	-34.40949899	150.844855	Trail 42
	2nd order	-34.40970989	150.8447805	Trail 42
	2nd order	-34.40999851	150.8446007	Trail 42
	2nd order	-34.41028763	150.8444972	Trail 42
	2nd order	-34.4101252	150.8445247	Trail 59
	2nd order	-34.41024447	150.8445018	Trail 59
	3rd order – Key Fish Habitat	-34.4088427	150.8455797	Trail 42
	1st order	-34.41122683	150.8405019	Trail 33
	1st order	-34.41124691	150.8402305	Trail 34
	3rd order – Key Fish Habitat	-34.41067781	150.8448183	Trail 59

4. Impact Assessment

4.1 Impacts of the Project

An assessment of the potential impacts of the Project on biodiversity is provided in Table 15. Impacts are categorised as direct or indirect as described in DPIE (2018), which states:

> *"Direct impacts are those that directly affect habitat and individuals. They include, but are not limited to, death through predation, trampling, poisoning of the animal/plant itself and the removal of suitable habitat. When applying each factor, consideration must be given to all of the likely direct impacts of the proposed activity or development.*
>
> *Indirect impacts occur when project-related activities affect species, populations or ecological communities in a manner other than direct loss. Indirect impacts can include loss of individuals through starvation, exposure, predation by domestic and/or feral animals, loss of breeding opportunities, loss of shade/shelter, deleterious hydrological changes, increased soil salinity, erosion, inhibition of nitrogen fixation, weed invasion, fertiliser drift, or increased human activity within or directly adjacent to sensitive habitat areas. As with direct impacts, consideration must be given, when applying each factor, to all of the likely indirect impacts of the proposed activity or development."*

A likelihood rating of known, likely or unlikely has been assigned to each of the potential impacts listed in Table 15.

4.1.1 Direct impacts

The proposed works would involve the mix of handheld tools and machinery to prepare proposed trails (Table 12). Where possible, proposed trails have been located along previously cleared alignments. These areas require 'secondary clearing' and have been utilised to limit the impact on areas of mature native vegetation. Trails that require 'primary clearing' within mature native vegetation would generally require a construction clearing width of 1.2 m, depending on the trail category (see Table 4). Only Trail 59 (two-way) would require a 2.5 m clearing width for a length of 55 m. The canopy layer would not be removed, and only the immediate groundcover and mid-storey/ shrub-layer would be affected.

Table 12: Construction methods along proposed trails

Trail Category	Existing (machine built/no clearing required) (m)	Hand Built (m)	Machine Built (m)	Grand Total (m)
Proposed Black Trails	Nil	1,039	2,056	3,095
Proposed Blue Trails	Nil	5,246	8,996	14,242
Proposed Green Trails	Nil	90	2,662	2,752
Proposed Red Trails	Nil	3,842	7,242	11,084
Two-way	Nil	nil	451	451
Grand Total	**Nil**	**10,217**	**21,407**	**31,624**

Approximately 3,331 m of access trails will be machine built, however, will require no vegetation clearing.
This table is based on an earlier iteration of the trail network. Please refer to the REF for the revised numbers.

The Project would result in unavoidable and direct impacts, namely the removal of approximately 4.30 ha of native vegetation for primary clearing, 2.24 ha of native vegetation for secondary clearing, and 0.16 ha of temporary impacts to native vegetation at helicopter drop zones (Table 13). All areas disturbed temporarily would be regenerated post-works. The verges of the constructed trails would be regenerated to narrower operational widths (Table 4).

It is unlikely that death to threatened entities would occur through temporary trampling since construction will be bicycle or foot based. The proposed helicopter drop zone locations would temporarily disturb the vegetation in the immediate area of the zone via the process of trampling, whilst unpacking packaged cargo. Table 13 details the total area of each PCT that will be subject to temporary disturbance using a conservative estimate that every drop zone will require a 5 m x 5 m temporary footprint to drop and transport the track building equipment and materials. The majority of proposed drop zones are low to moderate quality habitat, mostly inundated with introduced flora species at the ground cover level.

Table 13: Summary of construction impacts to each PCT

PCT	Sum of primary clearing (new trails) for construction (ha)	Sum of Secondary Clearing (existing trails) for trail construction (ha)	Sum of temporary disturbance from Material Drop Zones (ha) number of zones in italics	Total impact area (ha)
878 Gully Gum - Sydney Peppermint - Yellow Stringybark moist open forest of coastal escarpments, southern Sydney Basin Bioregion	1.03	0.78	0.02 *(8 zones)*	1.82
905 Lilly Pilly - Coachwood warm temperate rainforest on moist sheltered slopes and gullies, Sydney Basin Bioregion and South East Corner Bioregion	0.97	0.49	0.05 *(18 zones)*	1.51
906 Lilly Pilly - Sassafras - Stinging Tree subtropical/warm temperate rainforest on moist fertile lowlands, southern Sydney Basin Bioregion	0.40	0.05	0.02 *(6 zones)*	0.47
1156 Silvertop Ash - Red Bloodwood - Sydney Peppermint heathy open forest on moist sandstone plateaux, southern Sydney Basin Bioregion	0.01	Nil	Nil	0.01
1245 Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion	1.89	0.91	0.08 *(32 zones)*	2.88
Total	**4.30**	**2.24**	**0.16**	**6.69**

Numbers have been rounded to two decimal points.

Post-construction, the nominal operational footprint will result in permanent impacts to a total of 4.02 ha of native vegetation (Table 14). Although this report has considered the construction footprint of 6.54 ha (comprised of 4.30 ha of primary clearing and 2.24 ha of secondary clearing) for impact assessment purposes.

4.1.2 Indirect impacts

With reference to Table 15 indirect impacts such as changes to hydrology, sedimentation and erosion, and weed invasion are considered unlikely due to the avoidance and mitigation measures that would be implemented on-site (refer to Section 4.5). Such measures include appropriate track construction techniques, quarantining of plant and machinery, the enforcement of strict exclusion zones and rapid rehabilitation of native vegetation.

Table 14: Summary of operational footprint per PCT within the study area

PCT	Operational footprint (ha)
878 Gully Gum - Sydney Peppermint - Yellow Stringybark moist open forest of coastal escarpments, southern Sydney Basin Bioregion	1.12
905 Lilly Pilly - Coachwood warm temperate rainforest on moist sheltered slopes and gullies, Sydney Basin Bioregion and South East Corner Bioregion	0.88
906 Lilly Pilly - Sassafras - Stinging Tree subtropical/warm temperate rainforest on moist fertile lowlands, southern Sydney Basin Bioregion	0.33
1156 Silvertop Ash - Red Bloodwood - Sydney Peppermint heathy open forest on moist sandstone plateaux, southern Sydney Basin Bioregion	0.003
1245 Sydney Blue Gum x Bangalay - Lilly Pilly moist forest in gullies and on sheltered slopes, southern Sydney Basin Bioregion	1.69
Native vegetation Total	**4.02**

4.1.3 Key threatening processes

The 39 Key Threatening Processes (KTPs) that are listed on the BC Act and/or EPBC Act as of October 2021 and are applicable to terrestrial environments, are shown in Table 16.

The only KTP that would occur as a result of the Project is the permanent removal of 6.54 ha of understorey native vegetation. Where possible, proposed trails have largely been located along previously cleared alignments. These areas require 'secondary clearing' and have been utilised to limit the impact on areas of mature native vegetation. Trails that require 'primary clearing' within mature native vegetation would be between 0.9 m and a maximum of 2 m wide, the canopy layer would not be removed, and only the immediate groundcover and mid-storey/ shrub-layer would be affected. Where required, vines (e.g. *Pandorea pandorana* and *Geitonoplesium cymosum)* would be tied back using suitable materials as to not harm the individual plants. These would also be monitored during maintenance inspections across the study area. Maintenance schedules will be determined by the lifespan of the materials.

Three KTPs would be avoided by the design features of the Project; bushrock removal, loss of hollow-bearing trees and the removal of dead wood and trees. Bushrock and hollow-bearing trees would be avoided in their entirety, while dead wood and dead trees would be temporarily moved and then replaced in a nearby suitable location or utilised within the track design upon completion of works. Therefore, there is no net negative impact on these KTPs. The operation of machinery would lead to a negligible increase of greenhouse gas emissions and therefore no effect on threatened biodiversity.

Ten KTPs relate to invasive ecological processes that have the potential to be transported by works plant and machinery during the construction stage, and persons and bikes during the operational stage. The proposed works would avoid all possible invasive processes by the quarantining and cleaning of plant and machinery prior to entry to the escarpment area. Once present within the study area, machinery would stay at site until the proposed works are completed. Of these 10 KTPs, the following two are of concern:

- Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis
- Infection of native plants by *Phytophthora cinnamomi*

Both KTPs should be managed in accordance with the Hygiene Guidelines prepared by DPIE (2020) and a hygiene management plan prepared as part of the Project.

Table 15: Direct and indirect impacts associated with the Project

Impact	Likelihood of impact as a result of the Project	Project Stage	
		Construction	Operational
Direct impacts			
Removal or modification of native vegetation	Permanent removal and temporary impacts to 6.54 ha of native understorey vegetation, leaving the canopy layer intact.	✓	
Loss of individuals of a threatened species	Unlikely (see Section 4.3 and 4.4).	✓	✓
Removal or modification of threatened species habitat other than native vegetation	Temporary modification and negligible in relation to ephemeral drainages. Largely avoided and/or mitigated with large rocks or additional sandstone from the area.	✓	
Death through trampling	Unlikely – all access will be on foot or bicycle to construct proposed trails.	✓	✓
Death through poisoning	Unlikely	n/a	n/a
Loss of individuals through starvation	Unlikely	n/a	n/a
Loss of individuals through exposure	Unlikely	n/a	n/a
Predation by domestic and/or feral animals	Unlikely (Mitigated) – Foxes and or cats are likely to use existing trails, therefore they may benefit from the Project. Mitigation measures should ensure that coordinated control of these species continues		✓
Loss of breeding opportunities	Unlikely – helicopter use will be dispersed throughout construction period with no intense period of helicopter work (around four drops per week).	✓	✓
Loss of shade/shelter	Unlikely – all canopy will remain as existing, only understory vegetation to be removed.	✓	
Indirect impacts			
Edge effects	Unlikely	n/a	n/a
Deleterious hydrological changes	Unlikely (mitigated) – bridges and crossings will be managed to avoid any permanent changes to watercourse and flow would be maintained.	✓	✓
Increased soil salinity	Unlikely	n/a	n/a
Sedimentation and erosion	Unlikely (mitigated) – the use of retaining wall and coir logs across areas of high erosion to avoid increased effects.	✓	✓

Impact	Likelihood of impact as a result of the Project	Project Stage	
		Construction	Operational
Inhibition of nitrogen fixation	Unlikely	n/a	n/a
Weed invasion	Likely (mitigated) - disturbance regime through escarpment will increase spread of invasive primary species, thus require ongoing regeneration efforts and implementation of a weed management plan.	✓	✓
Fertiliser drift	Unlikely	n/a	n/a
Increased human activity within or directly adjacent to sensitive habitat areas	Likely (mitigated) - increased foot (bicycle) traffic adjacent to critically endangered ISR and across escarpment within habitat utilised by threatened species, although most of the increased human activity will be temporary riders throughout the day along the proposed trails only. The trails have been designed to discourage creation of new trails by members of the public (e.g. inclusion of an adequate volume of advanced trails). ISR has been avoided where possible, giving consideration to other non-ecological constraints, such as cultural and landscape, identified during the initial field surveying and mapping of the proposed trail network.	✓	✓

Table 16: Key threatening processes

Key Threatening Process	BC Act	EPBC Act equivalent	Exacerbated due to Project
1. Aggressive exclusion of birds by noisy miners (*Manorina melanocephala*)	√	√	No
2. Alteration of habitat following subsidence due to longwall mining	√	x	N/A
3. Alteration to the natural flow regimes of rivers, streams, floodplains & wetlands.	√	x	No - (avoided through mitigation) The proposed works will not alter the natural flow of any watercourses.
4. Bushrock removal	√	x	No - (avoided through mitigation) integrated with trail design or place nearby in suitable habitat throughout study area.
5. Clearing of native vegetation	√	√	Yes - clearing of 6.54 ha (permanent and temporary)
6. Competition and grazing by the feral European rabbit	√	√	No
7. Competition and habitat degradation by feral goats	√	√	No
8. Competition from feral honey bees	√	X	No
9. Death or injury to marine species following capture in shark control programs on ocean beaches	√	x	No
10. Entanglement in, or ingestion of anthropogenic debris in marine and estuarine environments	√	√	No
11. Forest Eucalypt dieback associated with over-abundant psyllids and bell miners	√	x	No
12. Habitat degradation and loss by Feral Horses (brumbies, wild horses), *Equus caballus*	√	x	No
13. Herbivory and environmental degradation caused by feral deer	√	x	No – the Project will not increase the presence of deer throughout the study area. Current control measures will continue.
14. High frequency fire	√	x	No
15. Human-caused climate change	√	√	Negligible
16. Importation of red imported fire ants into NSW	√	√	No
17. Infection by *Psittacine circoviral* (beak & feather) disease affecting endangered psittacine species	√	√	No
18. Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis	√	√	No (avoided through mitigation)
19. Infection of native plants by *Phytophthora cinnamomi*	√	√	No (avoided through mitigation) The soil borne pathogen *Phytophthora cinnamomi* is present to the north of the IESCA and is a potential risk to the vegetation of the Illawarra escarpment. Hygiene protocols exist to minimise spread and prevent introduction of phytophthora (IESCA Plan of Management [NPWS 2018]). These will include wash down facilities for bikes during the operational phase.

Key Threatening Process	BC Act	EPBC Act equivalent	Exacerbated due to Project
20. Introduction and Establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae	√	x	No (avoided through mitigation)
21. Introduction of the large earth bumblebee (*Bombus terrestris*)	√	x	No
22. Invasion and establishment of exotic vines and scramblers	√	x	No (avoided through mitigation)
23. Invasion and establishment of Scotch broom	√	x	No
24. Invasion and establishment of the Cane Toad	√	√	No
25. Invasion by escaped garden plants, including aquatics	√	√	No (avoided through mitigation)
26. Invasion of native plant communities by African Olive (*Olea europaea* L. subsp. *cuspidata*)	√	x	No
27. Invasion of native plant communities by bitou bush & boneseed	√	x	No (avoided through mitigation)
28. Invasion of native plant communities by exotic perennial grasses	√	(only N. Aust)	No (avoided through mitigation)
29. Invasion of the yellow crazy ant (*Anoplolepis gracilipes*)	√	(only Christmas Island)	No
30. Invasion, establishment and spread of Lantana (*Lantana camara)*	√	x	No (avoided through mitigation)
31. Loss and/or degradation of sites used for hill-topping by butterflies	√	x	No
32. Loss of hollow-bearing trees	√	x	No (avoided throughout study area)
33. Novel biota and their impact on biodiversity	x	√	No (avoided through mitigation)
34. Predation and hybridisation of feral dogs	√	√	No
35. Predation by feral cats	√	√	No
36. Predation by the European Red Fox	√	√	No
37. Predation by the Plague Minnow (*Gambusia holbrooki*)	√	x	No
38. Predation, habitat degradation, competition and disease transmission by Feral Pigs (*Sus scrofa*)	√	√	No
39. Removal of dead wood and dead trees	√	x	No (avoided throughout study area)

Infection of frogs by amphibian chytrid fungus causing the disease chytridiomycosis

During construction, this KTP will be managed through the quarantining and cleaning of plant and machinery prior to entry to and exit from the escarpment area. Wet or muddy footwear of staff and contractors should be cleaned and dried before and between visiting sites within the escarpment area. Cleaning utensils and a disinfectant should be carried for use between sites.

No frogs ought to be handled during the construction or operation of the Project

All staff and contractors should be educated on the hygiene protocols and the importance of preventing the introduction and spread of chytrid fungus to those threatened frogs potentially present within the study area.

Once in operation, wash down facilities for bikes and boot scrubbing/cleaning stations should be implemented.

Signs and other forms of educative material should be available to all users of the trails.

Infection of native plants by Phytophthora cinnamomi

During construction, this KTP will be managed through the quarantining and cleaning of plant and machinery prior to entry to and exit from the escarpment area, the use of erosion and sedimentation controls and undertaking works when soil conditions are at their driest (in relation to the associated vegetation classes). All staff and contractors should be educated on the hygiene protocols and the importance of preventing the introduction and spread of *Phytophthora cinnamomi*.

Once in operation, wash down facilities for bikes and boot scrubbing stations will attempt to prevent introduction of the pathogen, however the effectiveness of this is still under assessment (DPE 2022e). Assuming the pathogen is present, or may come to be present, coir logs and/or retaining walls will assist in managing water flow that assists in its transportation.

Signs and other forms of educative material should be available to all users of the trails, and the use of the trails should be restricted during wet weather.

Monitoring of the site should be undertaken on annual basis and a phytosanitary protocol and guideline document for the management of *Phytophthora cinnamomi* should be developed.

Where *Phytophthora cinnamomi* is identified on site, the relevant trails would be temporarily closed and managed in accordance with the guideline document, which would aim to minimise the spread of *Phytophthora cinnamomi* in those infested areas and prevent its introduction into uninfested areas.

The remaining KTPs are not applicable or are unlikely to be exacerbated by the Project.

4.1.4 Areas of Outstanding Biodiversity Value (AOBV) and Critical habitat

Areas of Outstanding Biodiversity Value (AOBV) and Critical habitat are declared under both the BC Act and EPBC Act, respectively.

AOBV in NSW (BC Act) include:

- Gould's Petrel - critical habitat declaration
- Little penguin population in Sydney's North Harbour
- Mitchell's Rainforest Snail in Stotts Island Nature Reserve
- Wollemi Pine.

The following species are listed on the EPBC Act Register of Critical Habitat:

- Wandering Albatross (*Diomedea exulans*) - Macquarie Island
- Ginninderra peppercress *(Lepidium ginninderrense)* - Northwest corner Belconnen Naval Transmission Station, ACT
- Black-eared Miner (*Manorina melanotis*) - Gluepot Reserve, Taylorville Station and Calperum Station
- Shy Albatross (*Thalassarche cauta*) - Albatross Island, The Mewstone, Pedra Branca
- Grey-headed Albatross (*Thalassarche chrysostoma*) - Macquarie Island.

No AOBV or critical habitat relevant to the study area would be affected by the Project.

4.2 Affected threatened ecological communities (TECs)

The Project will result in the clearing (primary and secondary) of approximately 0.45 ha of ISR, a TEC listed under both state and Commonwealth legislation. The clearing of 0.45 ha equates to 0.01% of ISR present

within the study area and <0.01% in the locality. The canopy would remain intact and large shrubs along the tracks (regenerating Stinging Trees) would be avoided. An additional 0.003 ha of ISR at one helicopter drop zone has the potential to be temporarily impacted. It has been recommended that all other proposed drop zones which occur within areas of ISR are removed or relocated (Table 10).

No additional indirect impacts to TECs are likely under the Project. A ToS (BC Act) and AoS (EPBC Act) for ISR TEC were undertaken and are presented in Appendix 2 and Appendix 3, respectively. The assessments conclude that the Project is unlikely to have a significant impact on ISR due to the linear clearing of understorey vegetation only, which is unlikely to lead to fragmentation or isolation of the TEC. The Project is unlikely to place the ISR TEC at risk of extinction.

4.3 Subject threatened flora

The three subject threatened flora (Figure 6) listed in Section 3.1.3, are considered to have potential habitat within the study area (Table 17). Given that they can be detected at any time of year, it is considered unlikely that these species are present within the proposed trails; however, there is potential for them to occur in the broader study area.

Threatened flora are considered unlikely to be present in the impact area and, as such, are unlikely to be impacted by the Project. Therefore, a ToS (BC Act) and/or an AoS (EPBC Act) was not conducted for any threatened flora species.

Table 17: Subject threatened flora (state and Commonwealth)

Species	Likelihood of Occurrence	Potential to be affected by Project	BC Act	EPBC Act
Cynanchum elegans White-flowered Wax Plant	High	Low – not detected during surveys although suitable potential habitat associated with PCT 1300.	E	E
Daphnandra johnsonii Illawarra Socketwood	Moderate	Low – not detected during surveys although suitable potential habitat associated with PCTs 1300 and 906. No trees would be removed.	E	E
Rhodamnia rubescens Scrub Turpentine	High	Low – numerous previous records in the locality although none detected during field survey. Study area has suitable habitat associated with PCTs 905, 906, and 1245. No trees would be removed.	CE	-

4.4 Subject threatened and migratory fauna (terrestrial and aquatic)

The analysis of subject threatened and migratory fauna (Figure 7) resulted in 13 threatened fauna being rated as having a moderate likelihood of occurrence within the study area and three confirmed as present (Table 18).

Developments can impact fauna in a number of ways. The significance of an impact would be greatest if any of the following situations occur:

- Death or injury of individuals
- Loss or disturbance of limiting foraging resources
- Loss or disturbance of limiting breeding resources.

Limiting resources are those that are of particular importance for the survival of a species.

Table 18: Subject threatened fauna (state and Commonwealth)

Species	Likelihood of Occurrence	Potential to be affected by Project	BC Act	EPBC Act
Frogs				
Giant Burrowing Frog ***Heleioporus australiacus***	**Moderate**	**Moderate –temporary habitat disturbance during construction of bridges along creek crossings. ToS and AoS conducted (see Appendix 2 and Appendix 3).**	**V**	**V**
Red-crowned Toadlet ***Pseudophryne australis***	**Moderate**	**Moderate –temporary habitat disturbance during construction of bridges along creek crossings. ToS conducted (see Appendix 2 and Appendix 3).**	**V**	**-**
Stuttering Frog *Mixophyes balbus*	Moderate	Low – Brandy and Water Creek contain suitable habitat but will not be impacted by the Project. Further, BioNet records show nearest record is 20 km south-west of study area, recorded in 2005 (DPE 2022b).	E	V
Birds				
Black-faced Monarch *Monarcha melanopsis*	Present	Low – suitable foraging and sheltering habitat present. Minimal impacts to habitat.	-	M
Powerful Owl *Ninox strenua*	Present	Low – hollow-bearing trees would not be impacted. Minimal impacts to foraging habitat.	V	-
Gang-gang Cockatoo *Callocephalon fimbriatum*	Moderate	Low – although many hollow bearing trees present, none will be impacted	V	-
Olive Whistler *Coracina lineata*	Moderate	Low – suitable rainforest habitat present, although only occurring in small stands with no swamps nearby.	V	-
Pink Robin *Petroica rodinogaster*	Moderate	Low – unlikely to be found in rainforests in winter, no suitable habitat during warmer months across much of the study area in wet sclerophyll or dense canopy areas across the escarpment.	V	-
Mammals				
Large-eared Pied Bat *Chalinolobus dwyeri*	Moderate	Low – no suitable habitat across much of the study area no trees will be removed as part of the Project.	V	V
Spotted-tailed Quoll *Dasyurus maculatus*	Moderate	Low – very steep slopes and dense vegetation unlikely to be foraging through.	V	E
Eastern False Pipistrelle *Falsistrellus tasmaniensis*	Moderate	Low – no suitable habitat across much of the study area no trees will be removed as part of the Project.	V	-
Eastern Freetail-bat *Micronomus norfolkensis*	Moderate	Low – no suitable habitat across much of the study area no trees will be removed as part of the Project.	V	-
Little Bentwing-bat *Miniopterus australis*	Moderate	Low – no suitable habitat across much of the study area no trees will be removed as part of the Project.	V	-
Eastern Bentwing-bat *Miniopterus orianae oceanensis*	Moderate	Low – no suitable habitat across much of the study area no trees will be removed as part of the Project.	V	-
Southern Myotis *Myotis macropus*	Moderate	Low – no suitable habitat across much of the study area no trees will be removed as part of the Project.	V	-
Grey-headed Flying-fox *Pteropus poliocephalus*	Present	Low –no mature trees will be removed as part of the Project. Impacts to be mitigated around	V	V

Species	Likelihood of Occurrence	Potential to be affected by Project	BC Act	EPBC Act
		construction timing and in particular helicopter movements throughout the study area.		
Greater Broad-nosed Bat *Scoteanax rueppellii*	Moderate	Low – no suitable habitat across much of the study area no trees will be removed as part of the Project.	V	-
Reptiles				
Rosenberg's Goanna *Varanus rosenbergi*	Moderate	Low – Although a few termite mounds were found across the study area, none had markings or evidence of recent activity. None are likely to be impacted by the Project.	V	-

Status - V-Vulnerable, E- Endangered

All 16 threatened fauna species with potential or known occurrence in the study area may have potential foraging habitat within the study area; however, the extensive areas of vegetation immediately adjacent to the study area is likely to provide a variety of habitat features, such as hollow-bearing trees, stags, termite mounds, dense shrubs and mature trees. Furthermore, the current Project would not remove any hollow-bearing trees, stags, mature trees, bush rock or termite mounds and would be restricted to pre-existing trails or previously disturbed sites, where practical. It is therefore unlikely that the Project would result in a significant loss of critical habitat features or direct impacts to any threatened fauna species.

Indirect or operational impacts to threatened fauna are unlikely under the Project. A ToS (BC Act) and/or AoS (EPBC Act) for the species listed in Table 18 were undertaken and are presented in Appendix 2 and Appendix 3, respectively. Given the linear clearing of understorey vegetation only, which is unlikely to lead to fragmentation or isolation of habitat, the avoidance of high-quality habitat and minimal impacts to aquatic habitat through construction design, the assessments conclude that the Project is unlikely to have a significant impact on any of the species considered. The Project is unlikely to place a local population of any of these species at risk of extinction.

4.5 Avoid and minimise impacts

This section outlines the avoidance, management and mitigation measures that NPWS have incorporated into the Project design or will employ during construction, operation or completion of the Project to reduce impacts on biodiversity values.

4.5.1 Avoidance measures (pre-construction)

NPWS have aimed to avoid and minimise environmental impacts from the Project during the design process. After field surveys, the design of the Project aimed to avoid and mitigate impacts to the better condition areas of biodiversity with particular emphasis on avoiding areas of habitat for:

- Threatened ecological communities:
    - Illawarra Subtropical Rainforest in the Sydney Basin Bioregion (EEC-BC Act)
    - Illawarra-Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion (CEEC-EPBC Act).

NPWS have made efforts to avoid and minimise impacts through location and design of the Project as detailed below. Where possible, the Project has utilised existing mountain bike trails throughout the study area, whereby the Project design expands upon bike trail berms and corners, and creates trails of varying difficulty via construction of additional trail structures such as switchbacks; overall, creating safer and more sustainable trails for the mountain bike riders in the future.

There will be no clearing of any canopy/overstorey trees throughout the entire study area, allowing for

many of the direct impacts, such as loss of shade and shelter or breeding opportunities, to be avoided.

4.5.2 Mitigation measures (construction and post construction)

The following management and mitigation measures will be further developed and implemented during the construction and operational phases of the Project:

Construction stage

- Project boundary to be clearly defined with well-marked posts.
- All large trees and stags, including hollow-bearing trees, would be avoided. Temporary protective tree measure should be erected around such species. In addition, rock armouring will be placed around the roots of some of the trees for their protection.
- Disturbance would be restricted to the removal of shrubs and small trees (diameter at breast height <10 cm), with the root ball of plants to be left intact to aid in rehabilitation which would be made possible by utilisation of a "trittering" attachment on the excavator. The trittering attachment mulches the vegetation to ground level, rather than ripping or excavating vegetation out of the ground.
- No removal of mature shrubs or canopy trees would occur within areas of ISR TEC.
- Where required, vines (e.g. *Pandorea pandorana* and *Geitonoplesium cymosum)* would be tied back using suitable materials so as not to harm individual plants.
- Rock outcrops with potential habitat for the endangered Broad-headed Snake and its prey species (such as exfoliating sandstone or crevices) are to be avoided.
- Movement or disturbance of large hollow logs would be avoided wherever practical. Any bush-rock that are moved would be placed on the side of the track and used in the sites post-works rehabilitation.
- The Project would avoid removing bush-rock. Any bush-rock that is moved would be placed on the side of the track and used in the sites post-works rehabilitation.
- All creeks and drainage lines that contain flowing or still water are to have a bridge constructed over them to avoid any impacts on the stream channel. Impacts to small ephemeral drainage lines should also be avoided and/or minimised.
- Soil disturbance would seek to avoid areas prone to erosion or sediment run off, such as steep slopes. Other erosion controls would be incorporated where required (e.g. coir logs and retaining walls).
- Only locally sourced aggregates would be used in the construction of the access trails and would consist of weed-free sandstone. Non-local aggregates, such as blue metal have the potential to alter the environmental conditions in creeks and drainage lines. This recommendation applies to all material (chemical or physical) that may be necessary for the Project.
- The design of any bridge upgrade would also need to consider appropriate scour protection up and downstream of footings where flow or existing scour is predicted to increase , and designed to include relevant elements and construction recommendations outlined in water crossing guidelines (*Fish passage requirements for waterway crossings* (Fairfull & Witheridge 2003). Other guidelines which are recommended include *Controlled activities for water crossing on waterfront land* (DPI 2012) and, regarding erosion and sedimentation control for both road widening and water crossing works, *Managing Urban Stormwater: Soils and construction - Volume 2C - Unsealed roads* (NSW Department of Environment and Climate Change [DECC] 2003).
- Helicopter drop zones would only occur in areas with predominantly weedy understory and sufficient canopy opening. Where there is potential for impacts, helicopter drop zones have been removed or relocated.
- Helicopters are highly unlikely to incur a bird or bat strike during the proposed works. However, it is recommended that the flight times are:
  - During daylight hours to avoid dawn and dusk when bird and bat species are most active i.e. an hour after sunrise and an hour before sunset

  - Outside of the months of May-August, when the Powerful Owl may be utilising the study area for breeding purposes.
- Similarly, the use of loud plant and equipment should be subject to the same restrictions mentioned above for helicopter use
- An unexpected threatened species finds procedure should be developed in the case that threatened flora or fauna species are encountered during the Project. This should be part of the Construction Environmental Management Plan (CEMP) and should involve stopping works immediately and contacting a qualified ecologist to advise on avoidance measures and/or assess the potential impact the Project may have on the species.
- To prevent the spread of *Phytophthora cinnamomi* and Chytrid fungus a hygiene management plan should be prepared in accordance with the Hygiene Guidelines prepared by DPIE (2020). Measures in the hygiene management plan will include, but not be limited to:
  - Wash down facilities for plant and equipment, and boot scrubbing/cleaning stations for personnel during the construction of the Project
  - Boot and machinery sanitisation with an ethanol spray each day (DECC 2008).
- Any frogs observed should not be handled, while any dead frogs should be left alone and the Project ecologist called.
- A fauna monitoring plan should be prepared to gain further understanding of the Powerful Owl's use of the site.
- The exacerbation of introduced weed species through an increased area of the current bike track disturbance regime will be mitigated by the establishment of a weed management plan. The weed management plan is to be prepared to minimise and prevent the spread of high threat weeds across the escarpment, with a particular focus on those areas of ISR. Commonly occurring species near previously disturbed sections of the study area include *Lantana camara, Ageratina adenophora, Delairea ordorata, Senna pendula, Ipomoea indica, Ligustrum sinense, Ligustrum lucidum, Erythrina crista-galli, Cirsium arvense, Anredera cordifolia, Solanum pseudocapsicum.*
- All areas cleared of native vegetation, which are not required during the operational phase, would be rehabilitated post-construction.
- A monitoring plan should be developed to inspect materials, trail structure, and condition of PCTs along the IEMB network.
- Signage and other educative/informative material should be placed around the area to make users aware of the sensitive environment they are using, prescriptive actions, management activities and the consequence of non-compliance (i.e. track closure).

Operational stage

- Rock armouring will be placed around the roots of some of the larger trees for their protection.
- Implementation of the fauna monitoring plan which would include targeted surveys for the Powerful Owl during its breeding months (May-August) conducted on an annual basis. The purpose being to identify potential breeding habitat (suitable hollow-bearing trees) and whether it is being used by the species. Where identified, trails within 100 m of such habitat should be closed to riders during the months of May-August. Any adaptive management actions would be adopted as necessary.
- Regarding Powerful Owl use of the study area and safety of riders (i.e. to protect riders from swooping Owls), consideration should be given to closing tracks to night riding.
- Coordinated pest control measures targeting deer and foxes should continue.
- The hygiene management plan should be implemented in accordance with DPIE guidelines. Measures in the hygiene management plan will include, but not be limited to:
  - Wash down facilities for bikes and boot scrubbing/cleaning stations to be established at main entry points to the trail system.
- Monitoring and maintenance of erosion and sedimentation controls (e.g. coir logs and retaining walls) to be conducted annually or subsequent to a significant rainfall event.

- The weed management plan should be implemented.
- The rehabilitated areas should be monitored biannually and ameliorative measures adopted where necessary.
- A monitoring plan should be implemented to inspect materials, trail structure, and condition of PCTs along the IEMB network. Any issues will be highlighted in a monitoring report, with adaptative measures incorporated in consultation with NPWS. Issues to be considered include closure of the trail after periods of high rainfall. See Trail Maintenance Regime as part of the REF.
- Where cycling is observed to be having an unacceptable impact on the IESCA values or visitor safety, management may include temporary or permanent closure of trails, or temporarily or permanently diverting/re-routing cycling access
- Signage and other educative/informative material should be placed around the area to make users aware of the sensitive environment they are using, prescriptive actions, management activities and the consequence of non-compliance (i.e. track closure).
- Where illegal track building is observed, NPWS will apply community engagement and compliance mechanisms to address ongoing illegal track building and the risks associated with the use of unauthorised tracks.

5. Conclusion

This report assesses the ecological significance of threatened flora and fauna, and vegetation communities that occur, or have the potential to occur, within the area to be impacted by the Project, in accordance with the requirements of the EP&A Act, BC Act and EPBC Act.

The Project would result in the permanent removal of 6.54 ha of native vegetation, including 0.45 ha of ISR TEC (listed under both the BC Act and EPBC Act). A test of significance (BC Act) and assessment of significance (EPBC Act) for the ISR TEC were conducted. The assessments conclude that the proposal is unlikely to have a significant impact on the TEC.

Although suitable habitat is present in the study area, no threatened flora species were recorded during the field surveys. During the construction of the phase of the Project, a suitably qualified ecologist or NPWS personnel will be present during the trail alignment siting to ensure that protected flora species are avoided. As such, none are expected to be impacted by the Project.

Two threatened fauna species (Grey-headed Flying-fox and Powerful Owl) and one migratory fauna species (Black-faced Monarch) were recorded in the study area; potential habitat also exists for a number of other threatened fauna species. Assessments for the significance of impacts from the Project (ToS under the BC Act and AoS under the EPBC Act) were carried out on the following listed threatened fauna:

- Grey-headed Flying-fox (EPBC Act and BC Act)
- Large-eared Pied Bat (EPBC Act and BC Act)
- Little Bentwing-bat (BC Act)
- Eastern Bentwing-bat (BC Act)
- Eastern False Pipistrelle (BC Act)
- Eastern Freetail-bat (BC Act)
- Southern Myotis (BC Act)
- Greater Broad-nosed Bat (BC Act)
- Spotted-tailed Quoll (EPBC Act and BC Act)
- Powerful Owl (BC Act)
- Sooty Owl (BC Act)
- Gang-gang Cockatoo (BC Act)
- Rufous Fantail (EPBC Act and BC Act)
- Black-faced Monarch (EPBC Act)
- Olive Whistler (BC Act)
- Pink Robin (BC Act)
- Red-crowned Toadlet (BC Act)
- Giant burrowing Frog (EPBC Act and BC Act)
- Stuttering Frog (EPBC Act and BC Act)
- Rosenberg's Goanna (BC Act).

The assessments concluded that the Project is unlikely to have a significant impact on any of the threatened fauna species considered.

Through a combination of adjustments to the original design, as well as avoidance of overstorey vegetation, the Project is unlikely to have a significant impact on threatened biodiversity and their habitats. A SIS

(NSW) or an EPBC Act Referral (Commonwealth) is not considered necessary for any threatened biodiversity.

A number of measures have been recommended to avoid and mitigate potential impacts on native vegetation, flora and fauna occurring in the study area. These include a low impact trittering methodology (slashing strategy) and subsequent rapid rehabilitation of impact areas, on-site mitigation measures and environmental safeguards.

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Figures

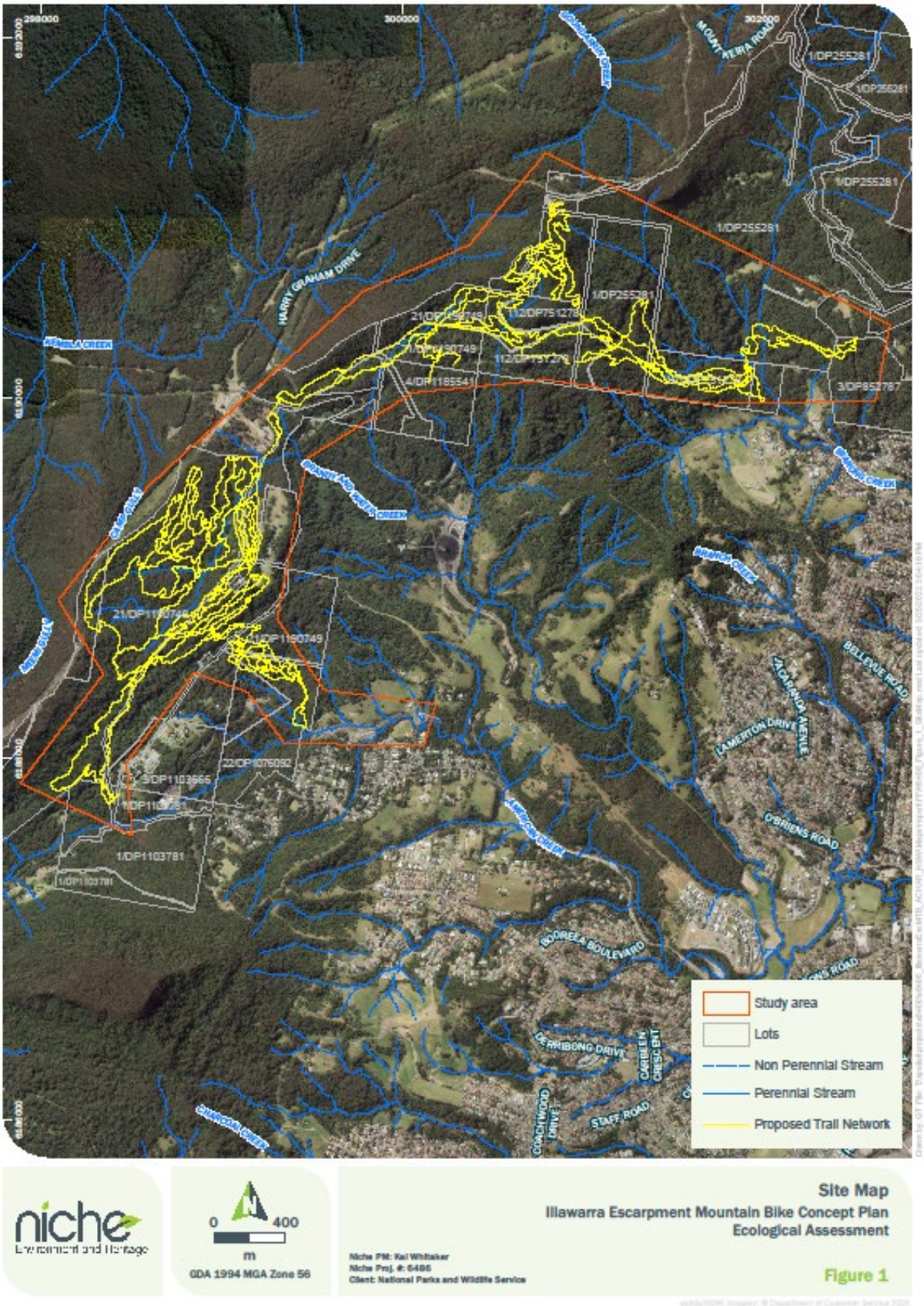

Figure 1: Site Map

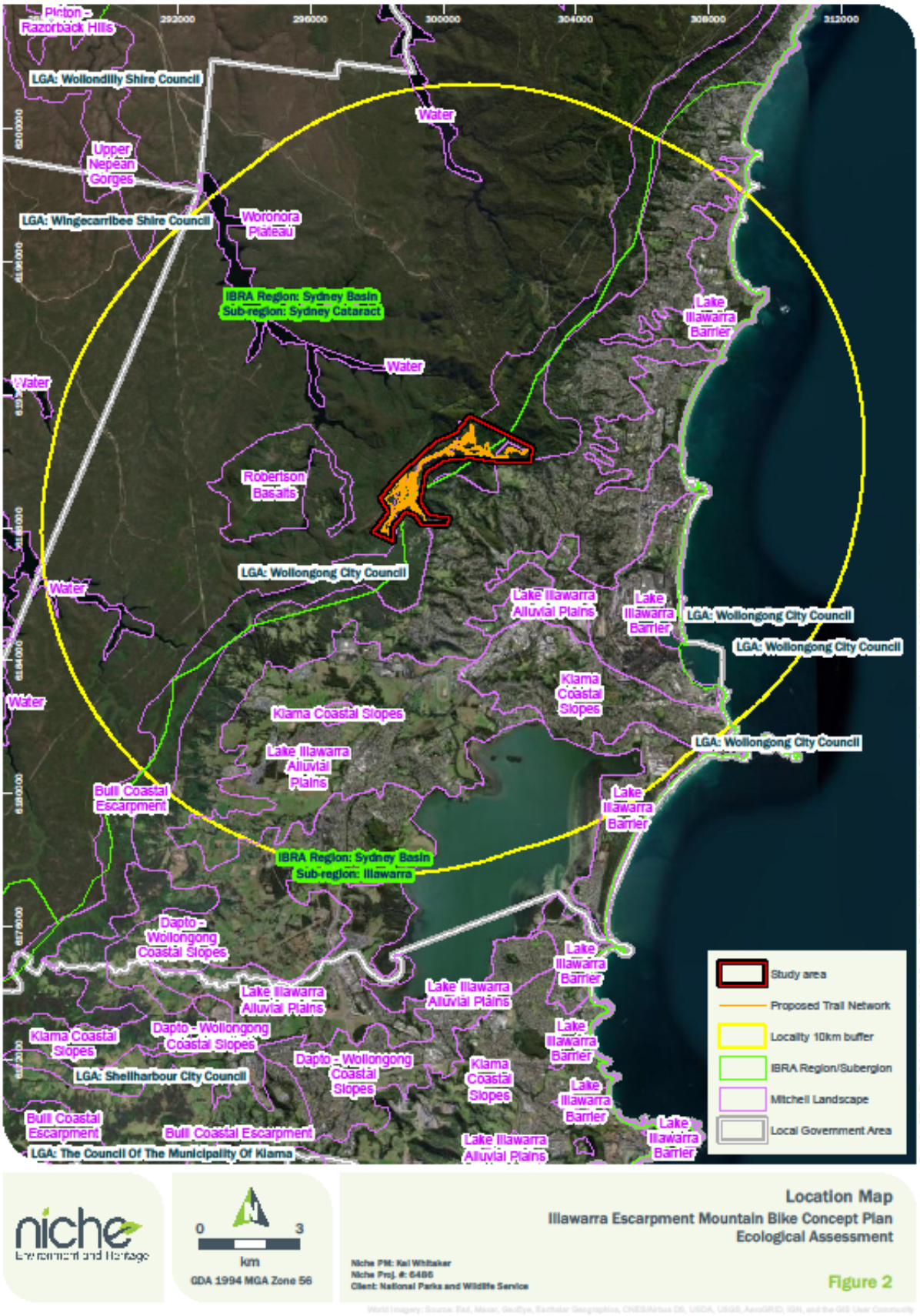

Figure 2: Location Map

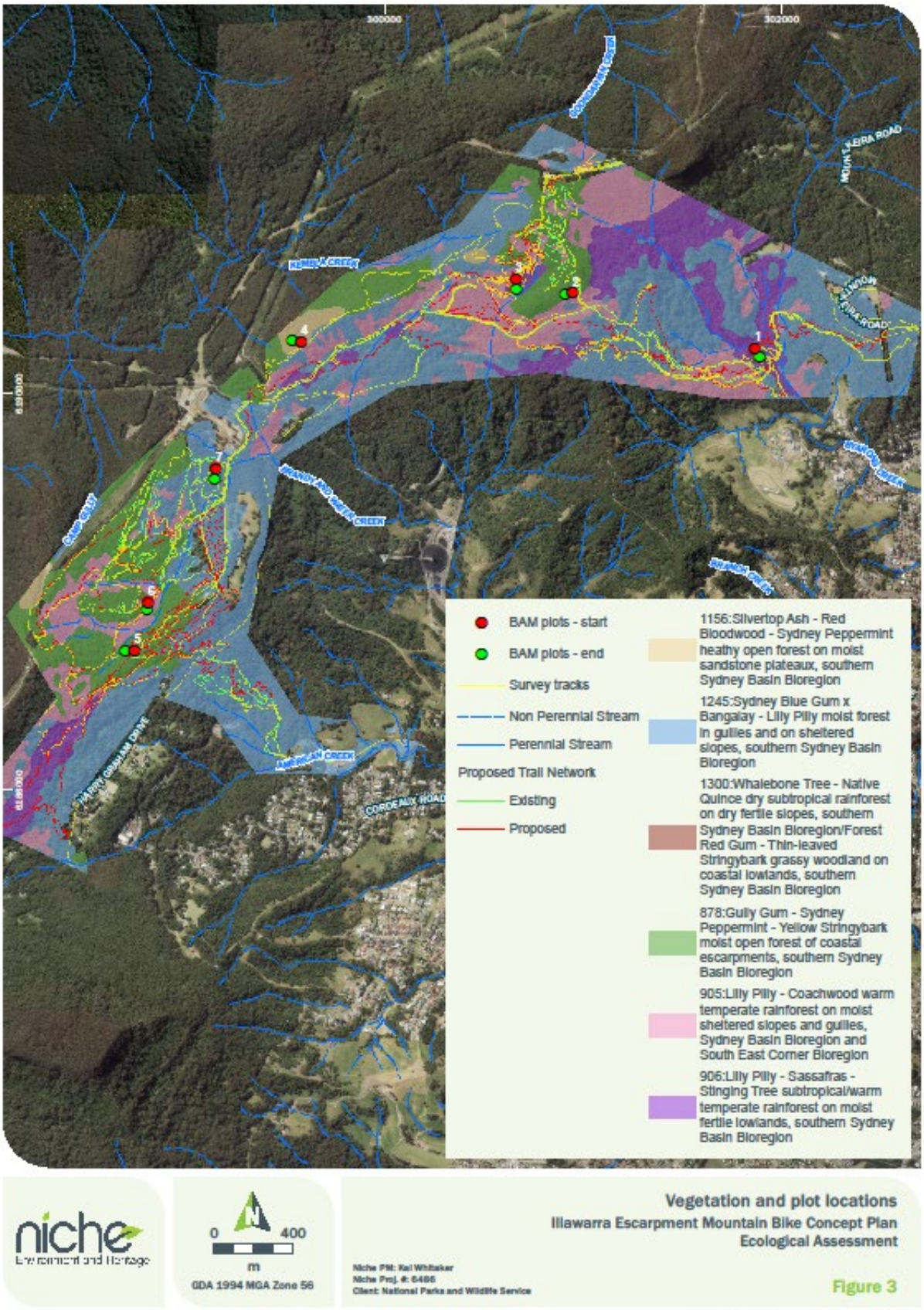

Figure 3: Vegetation and plot locations

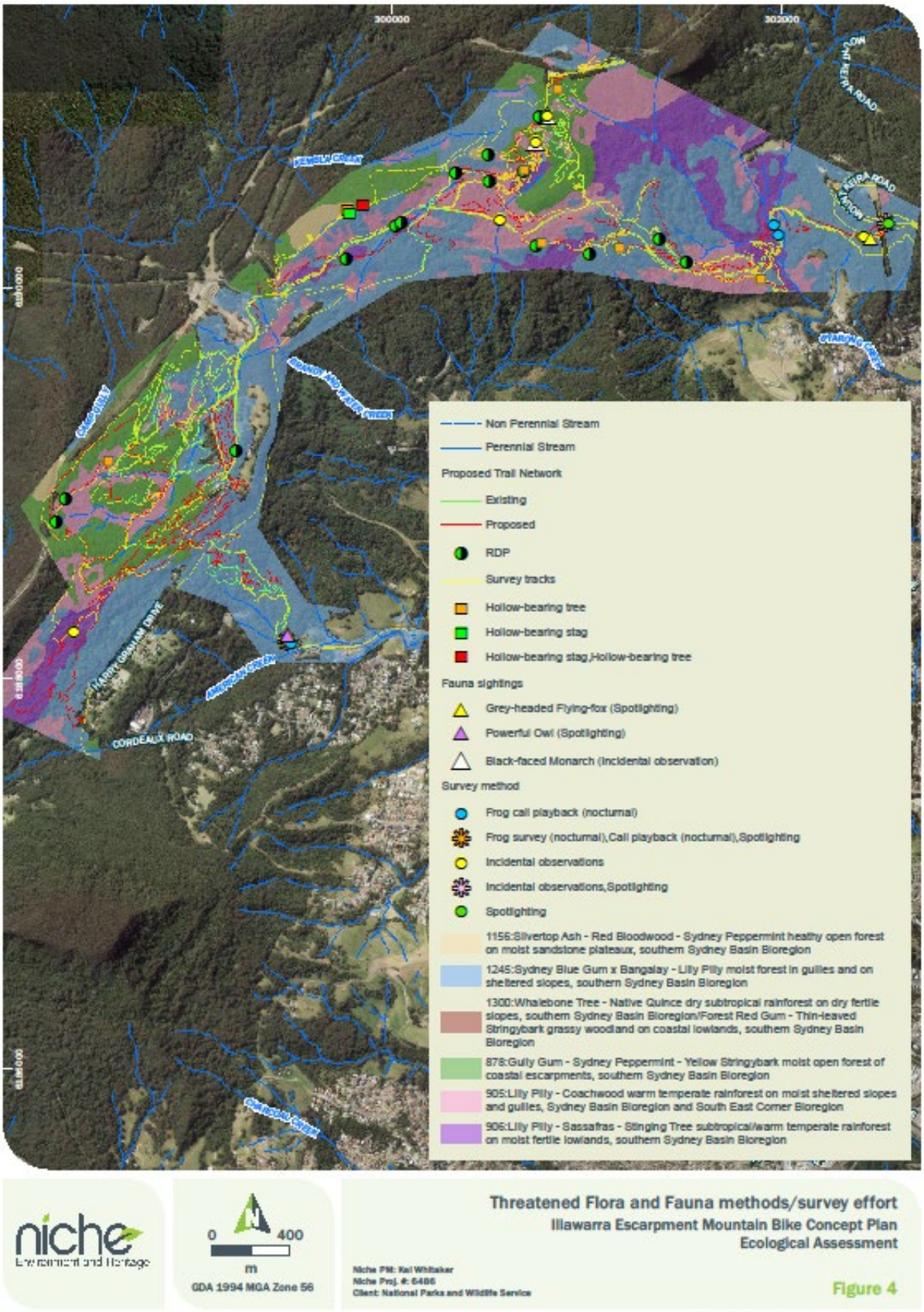

Figure 4: Threatened Flora and Fauna methods/ survey effort

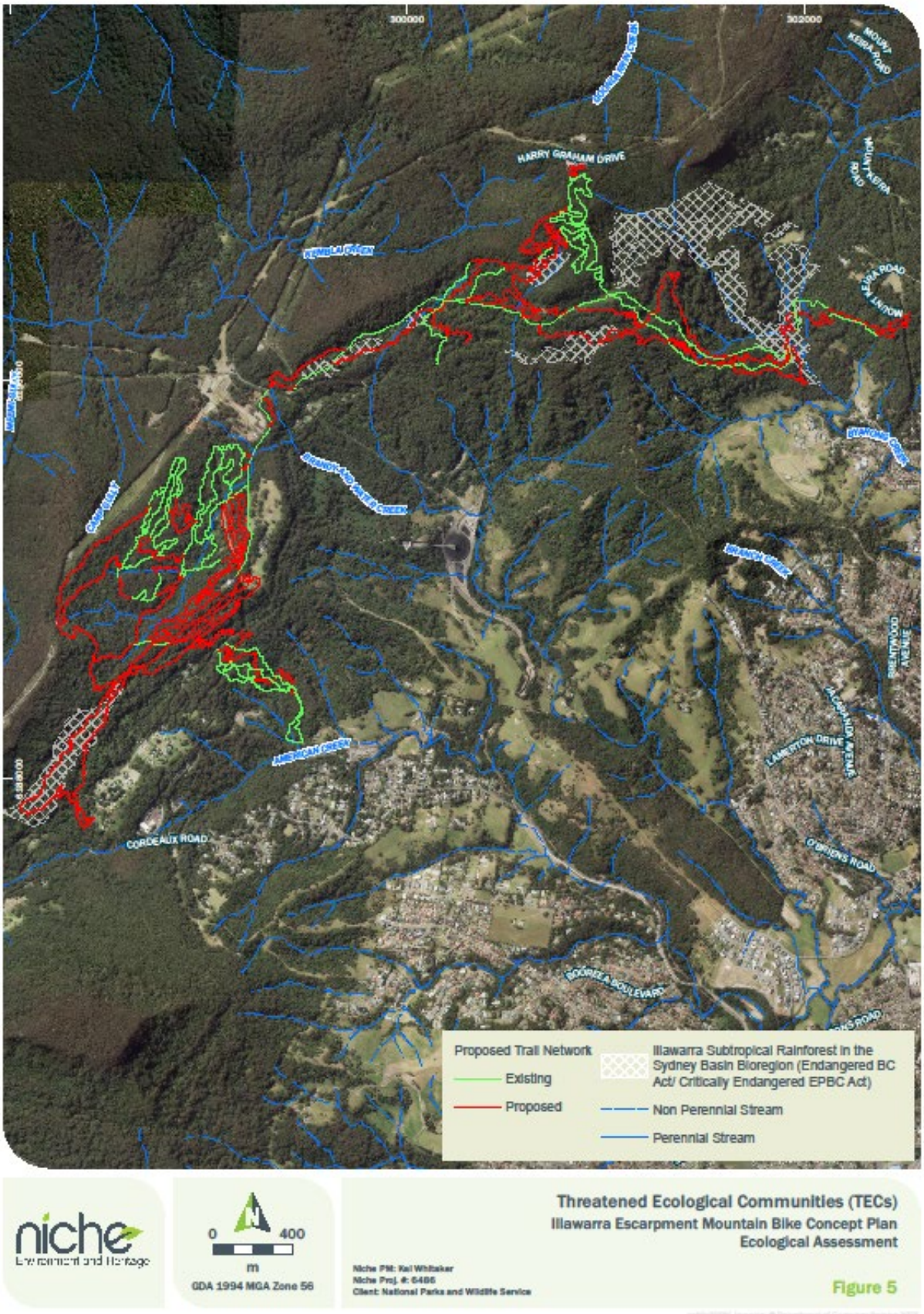

Figure 5: Threatened Ecological Communities (TECs)

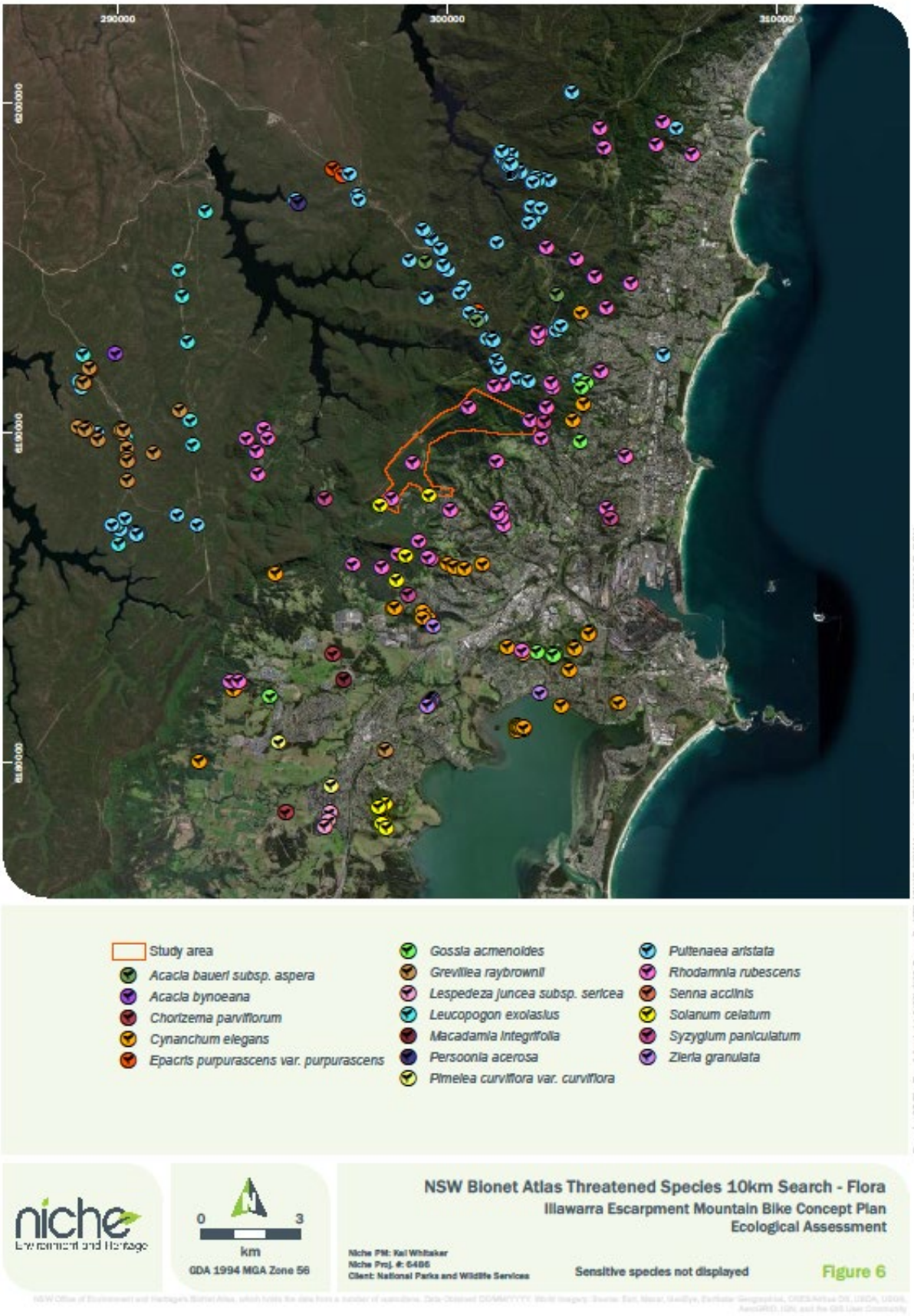

Figure 6: NSW Bionet Atlas Threatened Species 10km Search – Flora

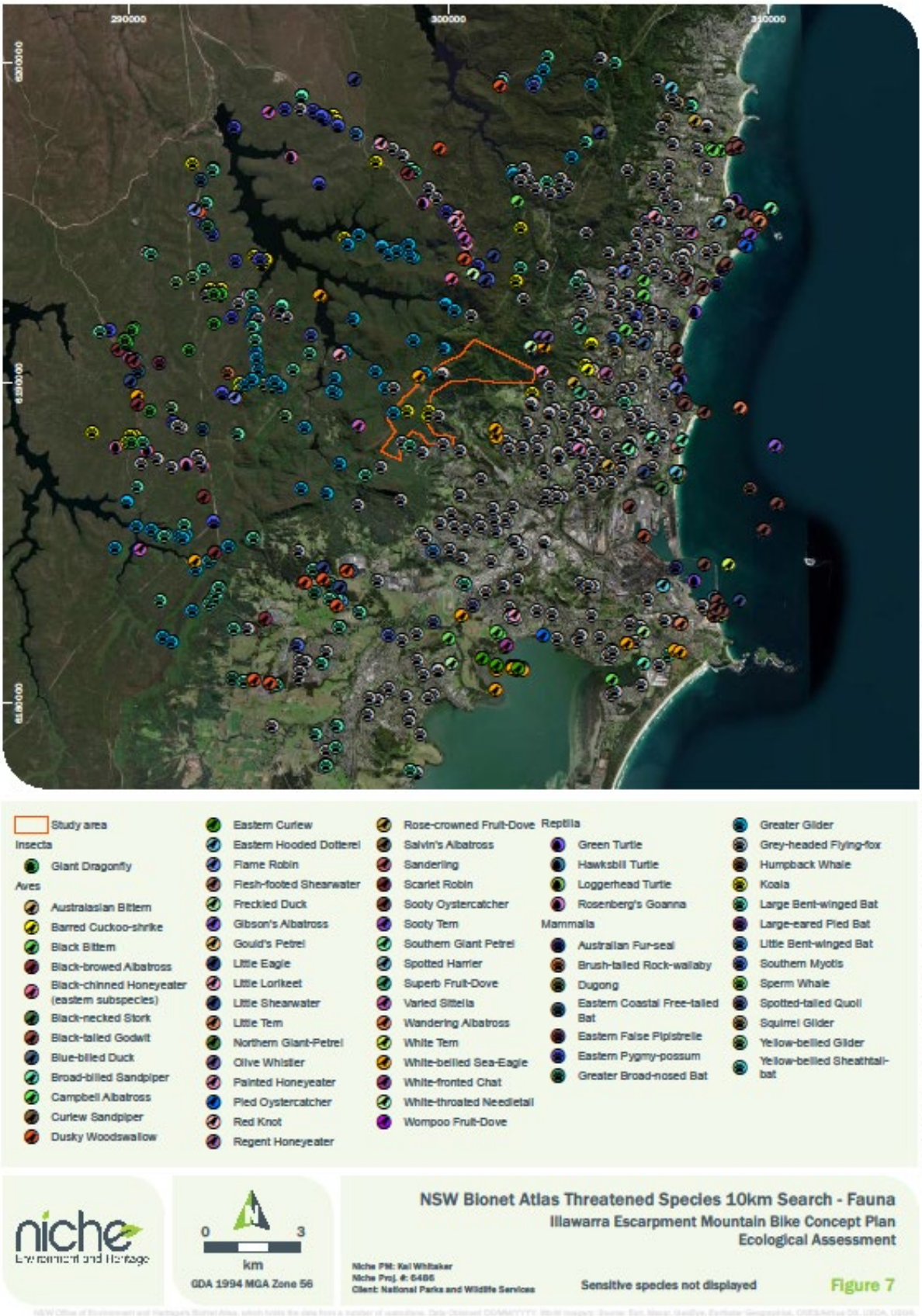

Figure 7: NSW Bionet Atlas Threatened Species 10km Search – Fauna

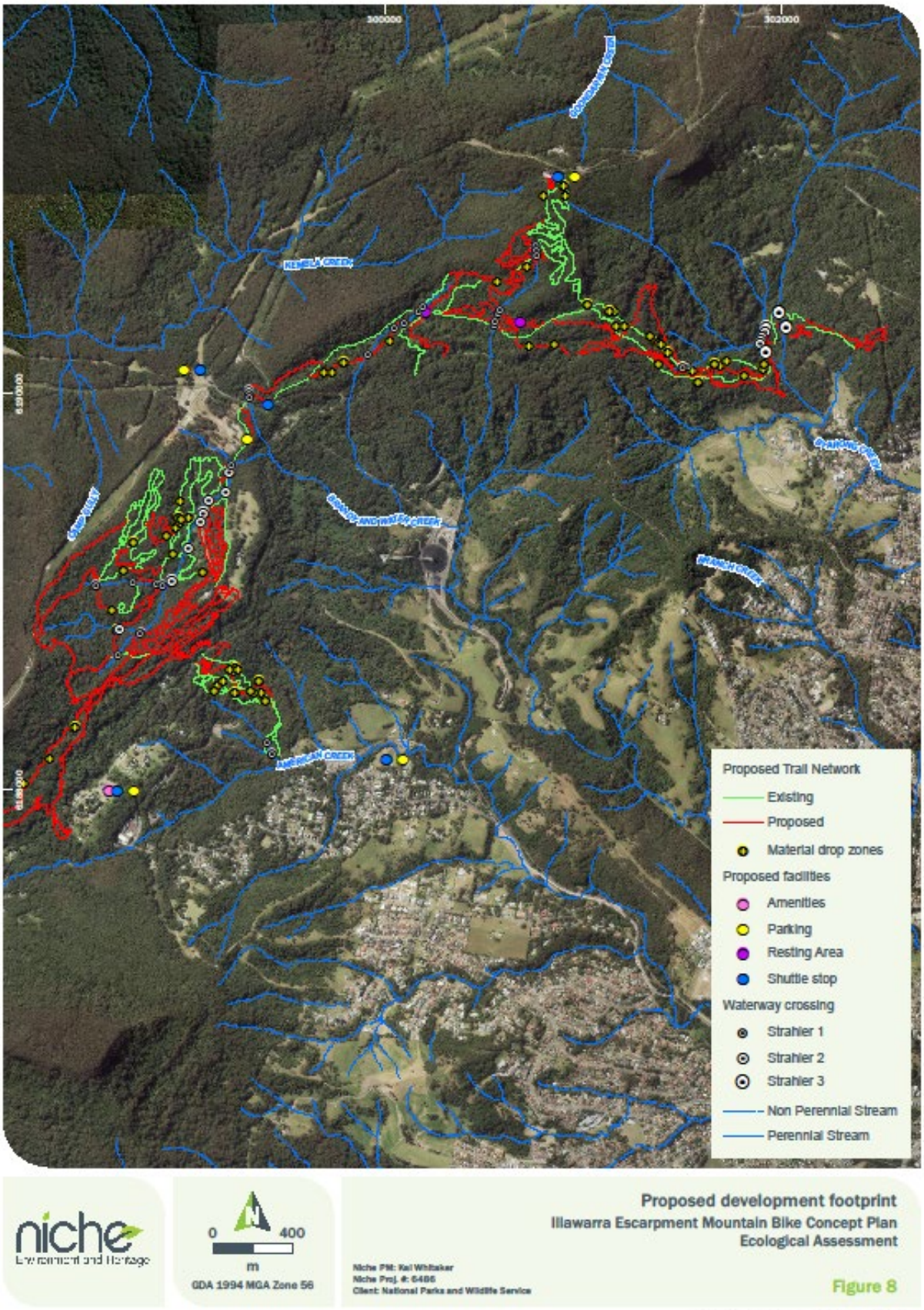

Figure 8: Project footprint

Appendix 1. Likelihood of occurrence table

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[1]	Potential for impact
Heleioporus australiacus	Giant Burrowing Frog	BAM-C, Bionet	V	V	The Giant Burrowing Frog has been recorded breeding in a range of water bodies associated with more sandy environments of the coast and adjacent ranges from the Sydney Basin south the eastern Victoria. It breeds in hanging swamps, perennial non-flooding creeks and occasionally permanent pools, but permanent water must be present to allow its large tadpoles time to reach metamorphosis.	Moderate - associated with PCTs 878, 905, 1156, 1245	Low – Brandy and Water Creek has suitable habitat but will not be impacted by the Project. AoS conducted (see Appendix 2 and Appendix 3).
Litoria aurea	Green and Golden Bell Frog	BAM-C, Bionet	E	V	Inhabits a very wide range of water bodies including marshes, dams and streams, particularly those containing emergent vegetation such as bullrushes or spikerushes. It also inhabits numerous types of man-made water bodies including quarries and sand extraction sites. Optimum habitat includes water-bodies that are un-shaded, free of predatory fish such as Plague Minnow, have a grassy area nearby and diurnal sheltering sites available.	Low	None - no habitat present within the study area, not near any open water or dams.
Litoria littlejohni	Littlejohn's Tree Frog	BAM-C, Bionet	V	V	Occurs in wet and dry sclerophyll forests and heathland associated with sandstone outcrops between 280 and 1000 m on the eastern slopes of the Great Dividing Range from the Central Coast down into Victoria. Individuals have been collected from a wide range of water bodies that includes semi-permanent dams, permanent ponds, temporary pools and permanent streams, with calling occurring from fringing vegetation or on the banks. Individuals have been observed sheltering under rocks on high exposed ridges during summer and within deep leaf litter adjacent to the breeding site. Breeds in the upper reaches of permanent streams and in perched swamps. Non-breeding habitat is heath based forests and	Low	Low – no permanent streams, or temporary pools sustaining water for enough time to allow tadpole growth present within PCT1156 (only associated PCT, as per TBDC, present in the study area). No suitable habitat within remainder of study

[1] Associated PCTs are those present within the study area that the species is known to be associated with according to the Threatened Biodiversity Data Collection (DPE 2022f). As such, none have been provided for the migratory species listed under the EPBC Act.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[1]	Potential for impact
					woodlands. Calling occurs in all months of the year, often in association with heavy rains. The tadpoles are distinctive, being large and very dark in colouration.		area. BioNet records show nearest record is 2.5 km north-west of study area in WaterNSW Catchment land and PCT 1250 Coastal sandstone gully forest (not present in the study area).
Mixophyes balbus	Stuttering Frog	BAM-C	E	V	Associated with streams in dry sclerophyll and wet sclerophyll forests and rainforests of more upland areas of the Great Dividing Range of NSW and down into Victoria. Breeding occurs along forest streams with permanent water where eggs are deposited within nests excavated in riffle zones by the females and the tadpoles swim free into the stream when large enough to do so. Outside of breeding, individuals range widely across the forest floor and can be found hundreds of metres from water.	Moderate – associated with PCTs 878, 905, 906, 1245, 1300	Low – Brandy and Water Creek contain suitable habitat but will not be impacted by the Project. Further, BioNet records show nearest record is 20 km south-west of study area, recorded in 2005.
Pseudophryne australis	Red-crowned Toadlet	BAM-C, Bionet	V	-	Occurs on wetter ridge tops and upper slopes of sandstone formations on which the predominant vegetation is dry open forests and heaths. This species typically breeds within small ephemeral creeks that feed into larger semi-perennial streams. After rain these creeks are characterised by a series of shallow pools lined by dense grasses, ferns and low shrubs and usually contain leaf litter for shelter. Eggs are terrestrial and laid under litter, vegetation or rocks where the tadpoles inside will reach a relatively late stage of development before waiting for flooding waters before hatching will occur.	Moderate – associated with PCTs 878, 905, 1245	Low – Brandy and Water Creek has suitable habitat but will not be impacted by the Project. AoS conducted (see Appendix 2).
Birds							
Anthochaera phrygia	Regent Honeyeater	Bionet	CE	E,M	The Regent Honeyeater mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. Birds are also found in drier coastal woodlands and forests in some years. The distribution of the species has contracted dramatically in the last 30 years to between north-eastern Victoria and south-eastern Queensland. There are only three known	Low	None - no habitat present within the study area, not near

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[1]	Potential for impact
					key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region. In NSW the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands. In some years flocks converge on flowering coastal woodlands and forests.		any open water or dams.
Ardenna carneipes	Flesh-footed shearwater	Bionet	V	MA, M	Ranges throughout the Pacific and Indian Oceans. There are two main breeding areas in the world: one in the South West Pacific includes Lord Howe Island and New Zealand; the other along the coast of Western Australia.	None	None - no habitat present within the study area, not near the ocean.
Artamus cyanopterus	Dusky Woodswallow	Bionet	V	-	Dusky woodswallows are widespread in eastern, southern and south western Australia. The species occurs throughout most of New South Wales, but is sparsely scattered in, or largely absent from, much of the upper western region. Most breeding activity occurs on the western slopes of the Great Dividing Range. Primarily inhabit dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris.	Low	Low – no suitable habitat within the study area.
Botaurus poiciloptilus	Australasian Bittern	Bionet	E	E	The Australasian Bitterns is widespread but uncommon over south-eastern Australia. In NSW they may be found over most of the state except for the far north-west. Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes and spikerushes.	Low	Low – no suitable habitat of permanent freshwater wetlands within the study area.
Calidris alba	Sanderling	Bionet	V	-	Found in coastal areas on low beaches of firm sand, near reefs and inlets, along tidal mudflats and bare open coastal lagoons; individuals are rarely recorded in near-coastal wetlands.	None	None - no habitat present within the study area, not near the ocean.
Calidris ferruginea	Curlew Sandpiper	Bionet	E	CE, M, MA, C, K, J	The Curlew Sandpiper is distributed around most of the coastline of Australia. It occurs along the entire coast of NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in the Murray-Darling Basin. It generally occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts. It also occurs in non-tidal swamps, lakes and lagoons on the coast and sometimes the inland	None	None - no habitat present within the study area, not near the ocean.
Callocephalon fimbriatum	Gang-gang Cockatoo	BAM-C, Bionet	V	-	In summer, occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. Also occur in subalpine snow gum woodland and occasionally in temperate or regenerating forest.	Moderate - associated with PCTs	Low – although many hollow bearing trees

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[1]	Potential for impact
					In winter, occurs at lower altitudes in drier, more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas. It requires tree hollows in which to breed.	878, 905, 906, 1156, 1245, 1300	present, none will be impacted
Calyptorhynchus lathami	Glossy Black-Cockatoo	BAM-C, Bionet	V	-	Inhabits forest with low nutrients, characteristically with key Allocasuarina spp. Tends to prefer drier forest types with a middle stratum of Allocasuarina below Eucalyptus or Angophora. Often confined to remnant patches in hills and gullies. Breed in hollows stumps or limbs, either living or dead. Endangered population in the Riverina.	Low - there was no large stands of feed trees in the study area	Low – although many hollow bearing trees present, none will be impacted, Further, there was no large stands of feed trees in the study area.
Circus assimilis	Spotted Harrier	Bionet	V	-	The Spotted Harrier occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania. Individuals disperse widely in NSW and comprise a single population. Occurs in grassy open woodland including acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.	Low – no suitable open grassland habitat in the study area on the escarpment	Low
Coracina lineata	Barred Cuckoo-shrike	Bionet	V	-	Rainforest, eucalypt forests and woodlands, clearings in secondary growth, swamp woodlands and timber along watercourses. They are usually seen in pairs or small flocks foraging among foliage of trees for insects and fruit. They are active birds, frequently moving from tree to tree.	Low – study area is outside species range	Low
Cuculus optatus	Oriental Cuckoo	PMST		M	Mainly inhabits coniferous, deciduous and mixed forests. Breeds in northern hemisphere. Brood parasite, laying eggs in nests of other birds.	Low – if present, likely a transient visitor	No – unlikely to impact any potential habitat
Daphoenositta chrysoptera	Varied Sittella	Bionet	V	-	Inhabits wide variety of dry eucalypt forests and woodlands, usually with either shrubby under storey or grassy ground cover or both, in all climatic zones of Australia. Usually in areas with rough-barked trees, such as Stringybarks or Ironbarks, but also in paperbarks or mature Eucalypts with hollows.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[1]	Potential for impact
Dasyornis brachypterus	Eastern Bristlebird	Bionet	E	E	The distribution of the Eastern Bristlebird has contracted to three disjunct areas of south-eastern Australia. There are three main populations: Northern - southern Queensland/northern NSW, Central - Barren Ground NR, Budderoo NR, Woronora Plateau, Jervis Bay NP, Booderee NP and Beecroft Peninsula and Southern - Nadgee NR and Croajingalong NP in the vicinity of the NSW/Victorian border. Habitat for central and southern populations is characterised by dense, low vegetation including heath and open woodland with a heathy understorey. In northern NSW the habitat occurs in open forest with dense tussocky grass understorey and sparse mid-storey near rainforest ecotone; all of these vegetation types are fire prone.	Low - no heathy understory in the study area	Low
Diomedea exulans	Wandering Albatross	Bionet	E	-	The Wandering Albatross is marine, pelagic and aerial.	None	None - no habitat present within the study area, not near the ocean
Diomedea exulans (sensu lato)	Wandering Albatross	Bionet		V, M, MA	The Wandering Albatross is marine, pelagic and aerial . It occurs where water surface temperatures range from -2° to 24°C . On breeding islands, it nests on coastal or inland ridges, slopes, plateaux and plains, often on marshy ground.	None	None - no habitat present within the study area, not near the ocean
Ephippiorhynchus asiaticus	Black-necked Stork	Bionet	E	-	Mainly found on shallow, permanent, freshwater terrestrial wetlands, and surrounding marginal vegetation, including swamps, floodplains, watercourses and billabongs, freshwater meadows, wet heathland, farm dams and shallow floodwaters, as well as extending into adjacent grasslands, paddocks and open savannah woodlands. They also forage within or around estuaries and along intertidal shorelines, such as saltmarshes, mudflats and sandflats, and mangrove vegetation.	None	None - no habitat present within the study area, not near the ocean
Epthianura albifrons	White-fronted Chat/ population in the Sydney Metropolitan Catchment Management Area	Bionet	V, EP	-	Low vegetation in salty coastal and inland areas and crops. Runs along ground and is found in local flocks in Winter.	None	None – study area on the escarpment not in coastal vegetation or crops

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[1]	Potential for impact
Esacus magnirostris	Beach Stone-curlew	Bionet	CE	-	n NSW, the species occurs regularly to about the Manning River, and the small population of north-eastern NSW is at the limit of the normal range of the species in Australia. Beach Stone-curlews are found exclusively along the coast, on a wide range of beaches, islands, reefs and in estuaries, and may often be seen at the edges of or near mangroves. They forage in the intertidal zone of beaches and estuaries, on islands, flats, banks and spits of sand, mud, gravel or rock, and among mangroves. Beach Stone-curlews breed above the littoral zone, at the backs of beaches, or on sandbanks and islands, among low vegetation of grass, scattered shrubs or low trees; also among open mangroves.	None	None - no habitat present within the study area, not near the ocean
Glossopsitta pusilla	Little Lorikeet	Bionet	V	-	Distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range in NSW, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. Mostly occur in dry, open eucalypt forests and woodlands. They feed primarily on nectar and pollen in the tree canopy. Nest hollows are located at heights of between 2 m and 15 m, mostly in living, smooth-barked eucalypts. Most breeding records come from the western slopes.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas
Grantiella picta	Painted Honeyeater	Bionet	V	V	Inhabits Boree/ Weeping Myall (*Acacia pendula*), Brigalow (*A. harpophylla*) and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus Amyema.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas
Haematopus fuliginosus	Sooty Oystercatcher	Bionet	V	-	In NSW the Sooty Oystercatcher occupies rocky headlands, reefs and offshore islands along the entire coast, apparently as a single continuous population.	None	None - no habitat present within the study area, not near the ocean
Haematopus longirostris	Pied Oystercatcher	Bionet	E	-	The Pied Oystercatcher inhabits marine littoral habitats, including islands. It occupies muddy, sandy, stony or rocky estuaries, inlets and beaches, particularly intertidal mudflats and sandbanks in large marine bays.	None	None - no habitat present within the study area, not near the ocean
Haliaeetus leucogaster	White-bellied Sea-Eagle	Bionet	-	M	Inhabits coastal and near coastal areas, building large stick nests, and feeding mostly on marine and estuarine fish and aquatic fauna.	Low	Low – no suitable habitat across much of the study area in

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[1]	Potential for impact
							wet sclerophyll or dense canopy areas
Hieraaetus morphnoides	Little Eagle	BAM-C, Bionet	V	-	Most abundant in lightly timbered areas with open areas nearby. Often recorded foraging in grasslands, crops, treeless dune fields, and recently logged areas. May nest in farmland, woodland and forest in tall trees.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas
Hirundapus caudacutus	White-throated Needletail	PMST		V, M	An aerial species found in feeding concentrations over cities, hilltops and timbered ranges.	Low – if present, likely a transient visitor	No – unlikely to impact any potential habitat
Ixobrychus flavicollis	Black Bittern	Bionet	V	-	Usually found on coastal plains below 200 m. Often found along timbered watercourses, in wetlands with fringing trees and shrub vegetation. The sites where they occur are characterized by dense waterside vegetation.	None	None - no habitat present within the study area, not near the ocean
Lathamus discolor	Swift Parrot	BAM-C, Bionet	E	E	The Swift Parrot occurs in woodlands and forests of NSW from May to August, where it feeds on eucalypt nectar, pollen and associated insects . The Swift Parrot is dependent on flowering resources across a wide range of habitats in its wintering grounds in NSW . This species is migratory, breeding in Tasmania and also nomadic, moving about in response to changing food availability.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas
Limicola falcinellus	Broad-billed Sandpiper	Bionet	V	-	Broad-billed Sandpipers favour sheltered parts of the coast such as estuarine sandflats and mudflats, harbours, embayments, lagoons, saltmarshes and reefs as feeding and roosting habitat. Occasionally, individuals may be recorded in sewage farms or within shallow freshwater lagoons. Broad-billed Sandpipers roost on banks on sheltered sand, shell or shingle beaches.	None	None - no habitat present within the study area, not near the ocean
Limosa	Black-tailed Godwit	Bionet	V	-	Primarily a coastal species. Usually found in sheltered bays, estuaries and lagoons with large intertidal mudflats and-or sandflats. Further inland, it can also be found on mudflats and in water less than 10 cm deep, around muddy lakes and swamps.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[1]	Potential for impact
Lophoictinia isura	Square-tailed Kite	Bionet	V	-	Typically inhabits coastal forested and wooded lands of tropical and temperate Australia. In NSW it is often associated with ridge and gully forests dominated by *Eucalyptus longifolia, Corymbia maculata, E. elata or E. smithii.* Individuals appear to occupy large hunting ranges of more than 100km^2. They require large living trees for breeding, particularly near water with surrounding woodland -forest close by for foraging habitat. Nest sites are generally located along or near watercourses, in a tree fork or on large horizontal limbs.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.
Macronectes giganteus	Southern Giant Petrel	Bionet	E	E	The Southern Giant Petrel has a circumpolar pelagic range from Antarctica to approximately 20 S and is a common visitor off the coast of NSW. Over summer, the species nests in small colonies amongst open vegetation on antarctic and subantarctic islands, including Macquarie and Heard Islands and in Australian Antarctic territory.	None	None - no habitat present within the study area, not near the ocean.
Macronectes halli	Northern Giant-petrel	Bionet	V	V	Breeding in Australian territory is limited to Macquarie Island and occurs during spring and summer.	None	None - no habitat present within the study area, not near the ocean.
Melithreptus gularis	Black-chinned Honeyeater (eastern subspecies)	Bionet	V	-	In NSW it is widespread, with records from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. It is rarely recorded east of the Great Dividing Range, although regularly observed from the Richmond and Clarence River areas. It has also been recorded at a few scattered sites in the Hunter, Central Coast and Illawarra regions, though it is very rare in the latter.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas
Monarcha melanopsis	Black-faced Monarch	PMST		M	Found along the coast of eastern Australia, becoming less common further south. Inhabits rainforests, eucalypt woodlands, coastal scrub and damp gullies. It may be found in more open woodland when migrating.	Present	Low – No breeding habitat to be removed as part of Project. Minimal impacts to foraging habitat
Monarcha trivirgatus	Spectacled Monarch	PMST		M	Coastal north-eastern and eastern Australia, including coastal islands, from Cape York, Queensland to Port Stephens, New South Wales. Prefers thick understorey in rainforests, wet gullies and waterside vegetation, as well as mangroves.	Low – outside known distribution	-

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[1]	Potential for impact
Motacilla flava	Yellow Wagtail	PMST		M	Northern hemisphere breeding. This species occupies a range of damp or wet habitats with low vegetation, from damp meadows, marshes, waterside pastures, sewage farms and bogs to damp steppe and grassy tundra.	Low - no habitat present within the study area	Low
Myiagra cyanoleuca	Satin Flycatcher	PMST		M	The Satin Flycatcher is found along the east coast of Australia from far northern Queensland to Tasmania, including south-eastern South Australia. Found in tall forests, preferring wetter habitats such as heavily forested gullies, but not rainforests.	Low – marginal habitat	Low
Neophema pulchella	Turquoise Parrot	Bionet	V	-	The Turquoise Parrot's range extends from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range. Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Nests in tree hollows, logs or posts, from August to December. It lays four or five white, rounded eggs on a nest of decayed wood dust.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.
Ninox connivens	Barking Owl	Bionet	V	-	Generally found in open forests, woodlands, swamp woodlands and dense scrub. Can also be found in the foothills and timber along watercourses in otherwise open country.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.
Ninox strenua	Powerful Owl	BAM-C, Bionet	V	-	Occupies wet and dry eucalypt forests and rainforests. Can occupy both un-logged and lightly logged forests as well as undisturbed forests where it usually roosts on the limbs of dense trees in gully areas. It is most commonly recorded within red turpentine in tall open forests and black she-oak within open forests. Large mature trees with hollows at least 0.5 m deep are required for nesting. Tree hollows are particularly important for the Powerful Owl because a large proportion of the diet is made up of hollow-dependent arboreal marsupials. Nest trees for this species are usually emergent with a diameter at breast height of at least 100 cm.	Present - associated with PCTs 878, 905, 906, 1156, 1245, 1300	Low – No breeding habitat to be removed as part of Project. Minimal impacts to foraging habitat.
Oxyura australis	Blue-billed Duck	Bionet	V	-	Widespread in NSW, but most common in the southern Murray-Darling Basin area. Birds disperse during the breeding season to deep swamps up to 300 km away. It is generally only during summer or in drier years that they are seen in coastal areas. The Blue-billed Duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation.	None	None - no habitat present within the study area, not near any open water or dams.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[1]	Potential for impact
Pachycephala olivacea	Olive Whistler	Bionet	V	-	Mostly inhabit wet forests above about 500m. During the winter months they may move to lower altitudes. Forage in trees and shrubs and on the ground, feeding on berries and insects. The Olive Whistler inhabits the wet forests on the ranges of the east coast. It has a disjunct distribution in NSW chiefly occupying the beech forests around Barrington Tops and the MacPherson Ranges in the north and wet forests from Illawarra south to Victoria. In the south it is found inland to the Snowy Mountains and the Brindabella Range.	Moderate - associated with PCTs 878, 905, 1156, 1245	Low –may occur in winter
Pandion cristatus	Eastern Osprey	Bionet	V	M, MA	Found right around the Australian coast line, except for Victoria and Tasmania. They are common around the northern coast, especially on rocky shorelines, islands and reefs. The species is uncommon to rare or absent from closely settled parts of south-eastern Australia. Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.
Petroica boodang	Scarlet Robin	Bionet	V	-	The Scarlet Robin is found from SE Queensland to SE South Australia and also in Tasmania and SW Western Australia. In NSW, it occurs from the coast to the inland slopes. The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.
Petroica phoenicea	Flame Robin	Bionet	V	-	Flame Robins are found in a broad coastal band from southern Queensland to just west of the South Australian border. The species is also found in Tasmania. The preferred habitat in summer includes eucalyptus forests and woodland, whilst in winter prefers open woodlands and farmlands. It is considered migratory. The Flame Robin breeds from about August to January.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.
Petroica rodinogaster	Pink Robin	BAM-C, Bionet	V	-	The Pink Robin is found in Tasmania and the uplands of eastern Victoria and far south-eastern NSW, almost as far north as Bombala. On the mainland, the species disperses north and west and into more open habitats in winter, regularly as far north as the ACT area, and sometimes being found as far north as the central coast of NSW. Inhabits rainforest and tall, open eucalypt forest, particularly in densely vegetated gullies.	Moderate - associated with PCT 878, 1245	Low –unlikely to be found in rainforests in winter, no suitable habitat during warmer months across much of the study area in wet sclerophyll or dense canopy areas

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[1]	Potential for impact
							across the escarpment.
Pezoporus wallicus	Eastern Ground Parrot	Bionet	V	-	Large populations occur on the NSW south coast, particularly Barren Grounds NR, Budderoo NP, the Jervis Bay area and Nadgee NR. Small numbers are recorded at Morton and Ben Boyd NP and other areas on the south coast. The Ground Parrot occurs in high rainfall coastal and near coastal low heathlands and sedgelands, generally below one metre in height and very dense (up to 90% projected foliage cover). These habitats provide a high abundance and diversity of food, adequate cover and suitable roosting and nesting opportunities for the Ground Parrot, which spends most of its time on or near the ground.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.
Phoebetria fusca	Sooty Albatross	Bionet	V	-	In Australian waters, this species is generally recorded in winter off the south coast from Tasmania to Western Australia, while there are occasional sightings off the NSW coast, north of Grafton. This pelagic or ocean-going species inhabits subantarctic and subtropical marine waters, spending the majority of its time at sea, and rarely occurs in continental shelf waters.	None	None - no habitat present within the study area, not near the ocean.
Polytelis swainsonii	Superb Parrot	Bionet	V	V	The Superb Parrot is found throughout eastern inland NSW. On the South-western Slopes their core breeding area is roughly bounded by Cowra and Yass in the east, and Grenfell, Cootamundra and Coolac in the west. Birds breeding in this region are mainly absent during winter, when they migrate north to the region of the upper Namoi and Gwydir Rivers. Inhabits box-gum, box-cypress-pine and boree woodlands and river red gum forest.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.
Pterodroma leucoptera	Gould's Petrel	Bionet		E	Pelagic marine species, spending much of its time foraging at sea and coming ashore only to breed. The Australian subspecies breeds and roosts on two islands off NSW, Cabbage Tree and Boondelbah Islands. They nest predominantly in natural rock crevices among the rock scree and also in hollow fallen palm trunks, under mats of fallen palm fronds and in cavities among the buttresses of fig trees.	None	None - no habitat present within the study area, not near the ocean.
Ptilinopus magnificus	Wompoo Fruit-dove	Bionet	V	-	Inhabits rainforest, monsoon forest, adjacent eucalypt forest and brush box forest. Occurs along the coast and coastal ranges from the Hunter River in NSW to Cape York Peninsula. It is rare south of Coffs Harbour. Three subspecies are recognised, with the most southerly in NSW and south-eastern Queensland. It used to occur in the Illawarra, though there are no recent records.	Low	Low – no recent records, more likely in the forests north of Coffs Harbour.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[1]	Potential for impact
Ptilinopus regina	Rose-crowned Fruit-dove	Bionet	V	-	Coast and ranges of eastern NSW and Queensland, from Newcastle to Cape York. Vagrants are occasionally found further south to Victoria. Rose-crowned Fruit-doves occur mainly in sub-tropical and dry rainforest and occasionally in moist eucalypt forest and swamp forest, where fruit is plentiful.	Low	Low – no recent records, more likely in the forests north of Newcastle.
Ptilinopus superbus	Superb Fruit-dove	Bionet	V	-	The Superb Fruit-dove occurs principally from north-eastern in Queensland to north-eastern NSW. It is much less common further south, where it is largely confined to pockets of suitable habitat as far south as Moruya. There are records of vagrants as far south as eastern Victoria and Tasmania. Inhabits rainforest and similar closed forests where it forages high in the canopy, eating the fruits of many tree species such as figs and palms. It may also forage in eucalypt or acacia woodland where there are fruit-bearing trees.	Low	Low – no recent records, more likely in the forests north of Lismore.
Puffinus assimilis	Little Shearwater	Bionet	V	-	A widespread species in the subtropical Atlantic, Pacific and Indian Oceans. Lord Howe Island has one of the larger breeding colonies in the Australian region.	None	None - no habitat present within the study area, not near the ocean.
Rhipidura rufifrons	Rufous Fantail	PMST		M	Found along the east coast of Australia from far northern Queensland to Tasmania, including south-eastern South Australia. Inhabits tall forests, preferring wetter habitats such as heavily forested gullies, but not rainforests.	Moderate	Low – a wide-ranging species unlikely to be impacted by the Project
Stictonetta naevosa	Freckled Duck	Bionet	V	-	The freckled duck breeds in permanent fresh swamps that are heavily vegetated. Found in fresh or salty permanent open lakes, especially during drought. Often seen in groups on fallen trees and sand spits.	None	None - no habitat present within the study area, not near any open water or dams.
Thalassarche cauta	Black-browed Albatross	Bionet	V	-	The Black-browed Albatross has a circumpolar range over the southern oceans, and are seen off the southern Australian coast mainly during winter. Inhabits antarctic, subantarctic, subtropical marine and coastal waters over upwellings and boundaries of currents.	None	None - no habitat present within the study area, not near the ocean.
Thalassarche cauta (sensu stricto)	Shy Albatross	Bionet		V, M, MA	Marine species occurring in subantarctic and subtropical waters. Birds have been noted in shelf-waters around breeding islands and over adjacent rises. Nests on rocky islands.	None	None - no habitat present within the study area, not near the ocean.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[1]	Potential for impact
Thalassarche cauta eremita	Chatham Albatross	Bionet		E, M, MA	Marine species that occurs in subantarctic and subtropical waters reaching the tropics. It appears to be largely pelagic and has been noted in shelf-waters around breeding islands, over continental shelves during the non-breeding season, and occurs inshore and offshore. It usually nests on rocky ledges and steep slopes.	None	None - no habitat present within the study area, not near the ocean.
Thalassarche cauta steadi	White-capped Albatross	Bionet		V, M, MA	Common off the coast of south-east Australia throughout the year. It has been observed that juveniles are rare in New Zealand waters, being more common off south-east Australia and South Africa. Breeding colonies occur on islands south of New Zealand.	None	None - no habitat present within the study area, not near the ocean.
Thalassarche melanophris	Black-bowed albatross	Bionet	V	V, M, MA	The Black-browed Albatross is a marine species that inhabits Antarctic, subantarctic and temperate waters and occasionally enters the tropics.	None	None - no habitat present within the study area, not near the ocean.
Tyto novaehollandiae	Masked Owl	BAM-C, Bionet	V	-	Inhabits a diverse range of wooded habitat that provide tall or dense mature trees with hollows suitable for nesting and roosting. Mostly recorded in open forest and woodlands adjacent to cleared lands. Nest in hollows, in trunks and in near vertical spouts or large trees, usually living but sometimes dead. Nest hollows are usually located within dense forests or woodlands. Masked owls prey upon hollow-dependent arboreal marsupials, but terrestrial mammals make up the largest proportion of the diet.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.
Tyto tenebricosa	Sooty Owl	Bionet	V	-	Often found in tall old-growth forests, including temperate and subtropical rainforests. In NSW mostly found on escarpments with a mean altitude less than 500 metres. Nests and roosts in hollows of tall emergent trees, mainly eucalypts often located in gullies. Nests have been located in trees 125 to 161 centimetres in diameter.	Moderate – associated with PCTs 878, 905, 906, 1245, 1300	Low – No breeding habitat would be impacted and minimal foraging habitat would be impacted
Flora							
Acacia baueri subsp. aspera		Bionet	V	-	Occurs in low, damp heathlands, often on exposed rocky outcrops over a wide range of climatic and topographical conditions. Appears to prefer open conditions; rarely observed where there is any shrub or tree canopy development; and many of the observations of this species have been made following fire, suggesting the species prefers early successional habitats. Restricted to the Sydney region, occurring on the Kings Tableland in the central Blue Mountains and with sporadic occurrences on the Woronora	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[1]	Potential for impact
					Plateau in the Royal National Park, Mt. Keira district and at Wedderburn. May also occur on the escarpment-Woronora Plateau in the Flat Rock Junction and Stanwell Tops area of the Illawarra.		
Acacia bynoeana	Bynoe's Wattle	Bionet	E	V	Grows mainly in heath and dry sclerophyll forest in sandy soils. Mainly south of Dora Creek-Morisset area to Berrima and the Illawarra region, west to the Blue Mountains, also recorded from near Kurri Kurri in the Hunter Valley and from Morton National Park.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.
Arthropteris palisotii	-	BAM-C, Bionet	E	-	North-eastern NSW and also in Queensland. This species may be extinct in NSW. Occurs in rainforest, mainly on tree trunks.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.
Astrotricha crassifolia	-	Bionet	V	V	Occurs near Patonga (Gosford Local Government Area [LGA]), and in Royal NP and on the Woronora Plateau (Sutherland and Campbelltown LGAs). There is also a record from near Glen Davis (Lithgow LGA). Also in Victoria. Occurs in dry sclerophyll woodland on sandstone.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.
Callistemon linearifolius	Netted Bottle Brush	Bionet	V	-	Recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW. Recorded in 2000 at Coalcliff in the northern Illawarra. For the Sydney area, recent records are limited to the Hornsby Plateau area near the Hawkesbury River. Grows in dry sclerophyll forest on the coast and adjacent ranges.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.
Callitris endlicheri	Black Cypress Pine, Woronora Plateau population	Bionet	EP	-	This population represents the coastal limit of the species' range and is disjunct from other known populations of the species. The Woronora Plateau population is restricted to a single outcrop of sandstone about 2 ha in area. The soils at this site are skeletal sandy loams and the heathlands on sandstone outcrops in the area are restricted and highly distinctive.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.
Calomnion complanatum		BAM-C	E	-	Has been recorded from only three locations in NSW: Cambewarra Mountain (near Nowra), Rocky Creek Canyon (Newnes Plateau), and two sites at Mount Wilson (Waterfall Reserve and Zircon Creek). Grows on the trunks of tree ferns, and occasionally on sandstone rock. Records are from moist, shaded gullies within closed forests in mountainous areas with relatively high rainfall. At both Mount Wilson and Cambewarra Mountain,	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[1]	Potential for impact
					the closed forests are associated with basalt soils, overlying shales and-or sandstone.		
Chorizema parviflorum	Chorizema parviflorum Benth. in the Wollongong and Shellharbour Local Government Areas	Bionet	EP	-	This endangered population has been recorded from between Austinmer and Albion Park in the local government areas of Wollongong and Shellharbour. All known sites (excluding the site at Austinmer) occupy woodland or forest dominated by *Eucalyptus tereticornis* and-or *E. longifolia*. At Austinmer, the species is recorded from a coastal headland.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.
Cryptostylis hunteriana	Leafless Tongue-orchid	Bionet	V	V	Does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland. The larger populations typically occur in woodland dominated by Scribbly Gum (*Eucalyptus sclerophylla*), Silvertop Ash (*E. sieberi*), Red Bloodwood (*Corymbia gummifera*) and Black Sheoak (*Allocasuarina littoralis*); appears to prefer open areas in the understorey of this community and is often found in association with the Large Tongue Orchid (*C. subulata*) and the Tartan Tongue Orchid (*C. erecta*).	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.
Cynanchum elegans	White-flowered Wax Plant	BAM-C, Bionet	E	E	Recorded from rainforest gullies scrub and scree slopes from the Gloucester district to the Wollongong area and inland to Mt Dangar.	High – associated with PCT 1300	Low – Low – previous records in the locality although none found during field survey. Study area has suitable habitat but will not be impacted by the Project.
Daphnandra johnsonii	Illawarra Socketwood	BAM-C, Bionet	E	E	Restricted to the Illawarra region where it has been recorded from the local government areas of Shoalhaven, Kiama, Shellharbour and Wollongong. Occupies the rocky hillsides and gullies of the Illawarra lowlands, occasionally extending onto the upper escarpment slopes. Associated vegetation includes rainforest and moist eucalypt forest.	Moderate – associated with PCTs 906, 1245, 1300	Low – previous records in the locality although none found during field survey. Study area has suitable habitat but will not be impacted by the Project.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[1]	Potential for impact
Epacris purpurascens var. purpurascens		Bionet	V	-	Recorded from Gosford in the north, to Narrabeen in the east, Silverdale in the west and Avon Dam vicinity in the South. Found in a range of habitat types, most of which have a strong shale soil influence.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.
Genoplesium baueri	Bauer's Midge Orchid	Bionet	E	E	Grows in dry sclerophyll forest and moss gardens over sandstone. Flowers February to March. Has been recorded between Ulladulla and Port Stephens. Currently the species is known from just over 200 plants across 13 sites. The species has been recorded in Berowra Valley Regional Park, Royal National Park and Lane Cove National Park and may also occur in the Woronora, O'Hares, Metropolitan and Warragamba Catchments.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.
Gossia acmenoides - endangered population		BAM-C			Known from Shellharbour, Wollongong and Kiama LGAs and encompasses all occurrences south of the Georges River. This population is the southern most occurrence of the species and is approximately 175 km from the nearest population to the north in the Hunter region of NSW.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.
Haloragis exalata subsp. exalata	Square Raspwort	BAM-C	V	V	Occurs in 4 widely scattered localities in eastern NSW. It is disjunctly distributed in the central coast, south coast and north-western slopes botanical subdivisions of NSW. The species appears to require protected and shaded damp situations in riparian habitats.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.
Irenepharsus trypherus		BAM-C, Bionet	E	E	Typically inhabits steep rocky slopes near cliff lines and ridge tops. The species is less typically found growing out of rock crevices or on narrow benches along cliff lines. Most sites are recorded from the upper slopes of the ridge systems that extend south and east of the Illawarra escarpment, although the species has also been recorded from the deep sandstone gorges of the Shoalhaven River. Associated vegetation includes moist sclerophyll forest, ironwood thicket, and rainforest.	Low	Low – no suitable habitat across much of the study area, steep slopes but no large rocky outcrops or cliff lines
Lastreopsis hispida	Bristly Shield Fern	BAM-C	E	-	Grows in moist humus-rich soils in wet forest and rainforest gullies. Is rare in NSW with the only recent confirmed records from Mt Wilson in the Blue Mountains. Also occurs in southern Victoria and Tasmania, and is common in New Zealand.	Low	Low - Study area east of recent records
Lespedeza juncea subsp. sericea	*Lespedeza juncea* subsp. *sericea* in	Bionet	EP	-	This endangered population occurs south of Dapto in the Wollongong local government area. The population is disjunct from the other (non-	Low	Low - Study area north of Dapto

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[1]	Potential for impact
	the Wollongong Local Government Area				endangered) populations of the species in NSW, which occur in western Sydney, the far South Coast and the Southern Tablelands. Known from just one roadside population of approximately 200 plants, located in a small strip of open forest dominated by *Eucalyptus tereticornis*, *E. longifolia* and *Melaleuca decora*, on Budgong Sandstone. Also originally recorded in *Pennisetum clandestinum* (Kikuyu) grassland directly across the road from this site. This grassland was subsequently cleared and the species has not regenerated.		
Leucopogon exolasius	Woronora Beard-heath	Bionet	V	V	Grows in woodland on sandstone. Restricted to the Woronora and Grose Rivers and Stokes Creek, Royal National Park.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.
Melaleuca deanei	Deane's Paperbark	Bionet	V	V	Grows in wet heath on sandstone in coastal districts from Berowra to Nowra.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.
Persoonia acerosa		Bionet	V	V	Occurs in dry sclerophyll forest, scrubby low-woodland and heath on low fertility soils. Recorded only on the central coast and in the Blue Mountains, from Mt Tomah in the north to as far south as Hill Top where it is now believed to be extinct. Mainly in the Katoomba, Wentworth Falls, Springwood area.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.
Persoonia hirsuta	Hairy Geebung	Bionet	E	E	Distributed from Singleton in the north, along the east coast to Bargo in the south and the Blue Mountains to the west. A large area of occurrence, but occurs in small populations, increasing the species' fragmentation in the landscape. Found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone. Usually present as isolated individuals or very small populations. Probably killed by fire (as other Persoonia spp. are) but will regenerate from seed.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.
Pimelea curviflora var. curviflora		Bionet	V	V	Confined to the coastal area of Sydney between northern Sydney in the south and Maroota in the north-west. Former range extended south to the Parramatta River and Port Jackson region including Five Dock, Bellevue Hill and Manly. Occurs on shaley-lateritic soils over sandstone and shale-	Low	Low – no suitable habitat across much of the study area in

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[1]	Potential for impact
					sandstone transition soils on ridgetops and upper slopes amongst woodlands.		wet sclerophyll or dense canopy areas.
Pomaderris adnata	Sublime Point Pomaderris	Bionet	E	-	Known only from one site at Sublime Point, north of Wollongong. Occurs near the edge of the plateau behind the Illawarra escarpment. Associated vegetation is silver-top ash - red bloodwood forest. Soil is a sandy loam over sandstone.	Low	Low – no associated PCTs within study area. Was not found during survey along proposed trails.
Prostanthera densa		Bionet	V	V	Villous Mintbush is generally grows in sclerophyll forest and shrubland on coastal headlands and near coastal ranges, chiefly on sandstone, and rocky slopes near the sea.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.
Pterostylis gibbosa		Bionet	E	E	Grows in open forest or woodland, on flat or gently sloping land with poor drainage. Known from a small number of populations in the Hunter region (Milbrodale), the Illawarra region (Albion Park and Yallah) and the Shoalhaven region (near Nowra).	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.
Pterostylis pulchella		BAM-C	V	V	Found on cliff faces close to waterfalls and creek banks and mossy rocks alongside running water.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.
Pultenaea aristata		Bionet	V	V	Grows in moist, dry sclerophyll woodland to heath on sandstone, specifically the drier areas of Upland Swamps. Restricted to the Woronora Plateau, a small area between Helensburgh, south of Sydney, and Mt Keira above Wollongong.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.
Rhizanthella slateri	Eastern Australian Underground Orchid	BAM-C	V	E	Habitat requirements are poorly understood and no particular vegetation type has been associated with the species, although it is known to occur in sclerophyll forest. Highly cryptic given that it grows almost completely below the soil surface, with flowers being the only part of the plant that can occur above ground. Therefore usually located only when the soil is disturbed. In NSW, currently known from fewer than 10 locations, including	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[1]	Potential for impact
					near Bulahdelah, the Watagan Mountains, the Blue Mountains, Wiseman's Ferry area, Agnes Banks and near Nowra.		
Rhodamnia rubescens	Scrub Turpentine	BAM-C, Bionet	CE	-	Occurs in coastal districts north from Batemans Bay in New South Wales, approximately 280 km south of Sydney, to areas inland of Bundaberg in Queensland. Populations of *R. rubescens* typically occur in coastal regions and occasionally extend inland onto escarpments up to 600 m a.s.l. in areas with rainfall of 1,000-1,600 mm. Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils.	High - associated with PCTs 905, 906, 1245, 1300	Low –previous records in the locality although none found during field survey. Study area has suitable habitat but species will not be impacted by the Project.
Senna acclinis		BAM-C, Bionet	E	-	Grows on the margins of subtropical, littoral and dry rainforests, north from the Wollongong area (Balgownie) on the Central Coast, north to Townsville in Queensland.	Moderate	Low - Study area south of Balgownie.
Solanum celatum	-	Bionet	E	-	Grows on hills and slopes in eucalypt woodland; commonly found after fire or disturbance. Restricted to an area from Wollongong to just south of Nowra, and west to Bungonia. Majority of records are prior to 1960 and the majority of populations are likely to have been lost to clearing.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.
Syzygium paniculatum	Magenta Lilly Pilly	Bionet	E	V	Found only in NSW, in a narrow, linear coastal strip from Bulahdelah to Conjola State forest. On the south coast the species occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral rainforest. On the central coast it occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.
Thelymitra kangaloonica	Kangaloon Sun Orchid	Bionet	CE	CE	Thelymitra sp. Kangaloon is only known to occur on the southern tablelands of NSW in the Moss Vale - Kangaloon - Fitzroy Falls area at 550-700 m above sea level. It is known to occur at three swamps that are above the Kangaloon Aquifer. It is found in swamps in sedgelands over grey silty grey loam soils	Low	Low - no habitat present, there was no swamp habitat within study area.
Zieria granulata		BAM-C, Bionet	E	E	Restricted to the Illawarra region where it is recorded from a number of sites. The species primarily occupies the coastal lowlands between Oak Flats and Toolijooa, in the local government areas of Shellharbour and Kiama. This is a range of approximately 22 kilometres.	Low	Low - No habitat present, there are no basalt soils present within the study area.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[1]	Potential for impact
Invertebrates							
Petalura gigantea	Giant Dragonfly	Bionet	E	-	The Giant Dragonfly is found along the east coast of NSW from the Victorian border to northern NSW. It is not found west of the Great Dividing Range. There are known occurrences in the Blue Mountains and Southern Highlands, in the Clarence River catchment, and on a few coastal swamps from north of Coffs Harbour to Nadgee in the south. Live in permanent swamps and bogs with some free water and open vegetation. Adults emerge from late October and are short-lived, surviving for one summer after emergence.	Low	Low – No suitable habitat of swamps or bogs present within the study area.
Mammals							
Cercartetus nanus	Eastern Pygmy-possum	BAM-C, Bionet	V	-	Inhabits rainforest through to sclerophyll forest and tree heath. Banksias and myrtaceous shrubs and trees are a favoured food source. Will often nest in tree hollows, but can also construct its own nest . Because of its small size it is able to utilise a range of hollow sizes including very small hollows. Individuals will use a number of different hollows and an individual has been recorded using up to 9 nest sites within a 0.5ha area over a 5 month period .	Low	Low – minimal impacts to potential habitat.
Chalinolobus dwyeri	Large-eared Pied Bat	BAM-C, Bionet	V	V	Located in a variety of drier habitats, including the dry sclerophyll forests and woodlands to the east and west of the Great Dividing Range. Can also be found on the edges of rainforests and in wet sclerophyll forests. This species roosts in caves and mines in groups of between 3 and 37 individuals.	Moderate - associated with PCTs 878, 905, 1156, 1245, 1300	Low – No impacts to breeding habitat. No suitable habitat across much of the study area and no canopy trees will be removed as part of the Project.
Dasyurus maculatus	Spotted-tailed Quoll	Bionet	V	E	Spotted-tailed Quoll are found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern Queensland. Only in Tasmania is it still considered common. Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline.	Moderate – associated with PCTs 878, 905, 906, 1156, 1245, 1300	Low – very steep slopes and dense vegetation unlikely to be foraging through.
Falsistrellus tasmaniensis	Eastern False Pipistrelle	Bionet	V	-	Inhabit sclerophyll forests, preferring wet habitats where trees are more than 20 m high. Two observations have been made of roosts in stem holes of living eucalypts. There is debate about whether or not this species moves to lower altitudes during winter, or whether they remain sedentary but	Moderate - associated with PCTs 878, 906,	Low – no suitable habitat across much of the study area no canopy trees will be

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[1]	Potential for impact
					enter torpor . This species also appears to be highly mobile and records showing movements of up to 12 km between roosting and foraging sites .	1156, 1245, 1300	removed as part of the Project.
Isoodon obesulus	Southern Brown Bandicoot (eastern)	Bionet	E	-	Prefers sandy soils with scrubby vegetation and-or areas with low ground cover that are burn from time to time. A mosaic of post fire vegetation is important for this species.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.
Micronomus norfolkensis	Eastern Freetail-bat	Bionet	V	-	Most records are from dry eucalypt forests and woodlands to the east of the Great Dividing Range. Appears to roost in trees, but little is known of this species' habits.	Moderate - associated with PCTs 878, 905, 1156, 1245, 1300	Low – no suitable habitat across much of the study area no canopy trees will be removed as part of the Project.
Miniopterus australis	Little Bentwing-bat	BAM-C, Bionet	V	-	Coastal north-eastern NSW and eastern Queensland. Little Bent-wing Bat is an insectivorous bat that roost in caves, in old mines, in tunnels, under bridges, or in similar structures. They breed in large aggregations in a small number of known caves and may travel 100s km from feeding home ranges to breeding sites. Little Bent-wing Bat has a preference for moist eucalypt forest, rainforest or dense coastal banksia scrub where it forages below the canopy for insects.	Moderate - associated with PCTs 878, 905, 906, 1245, 1300	Low – no breeding habitat would be impacted. Minimal impacts to foraging habitat.
Miniopterus orianae oceanensis	Eastern Bentwing-bat	BAM-C, Bionet	V	-	Eastern Bent-wing Bats occur along the east and north-west coasts of Australia. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young.	Moderate - associated with PCTs 878, 905, 1156, 1245, 1300	Low – no breeding habitat would be impacted. Minimal impacts to foraging habitat.
Myotis macropus	Southern Myotis	BAM-C, Bionet	V	-	The Large-footed Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage.	Moderate - associated with PCTs 905, 906, 1245, 1300	Low – no potential roosting habitat would be impacted. Minimal impacts to foraging habitat..
Petaurus australis	Yellow-bellied Glider	Bionet	V	-	Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal	Low	Low – no suitable habitat across much of the study area in

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[1]	Potential for impact
					gullies and creek flats to tall montane forests in the south. Found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria.		wet sclerophyll or dense canopy areas.
Petaurus norfolcensis	Squirrel Glider	BAM-C, Bionet	V	-	Generally occurs in dry sclerophyll forests and woodlands but is absent from dense coastal ranges in the southern part of its range . Requires abundant hollow bearing trees and a mix of eucalypts, banksias and acacias . There is only limited information available on den tree use by Squirrel gliders, but it has been observed using both living and dead trees as well as hollow stumps. Within a suitable vegetation community at least one species should flower heavily in winter and one species of eucalypt should be smooth barked. Endangered population in the Wagga Wagga LGA.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.
Petrogale penicillata	Brush-tailed Rock-wallaby	BAM-C, Bionet	E	V	Found in rocky areas in a wide variety of habitats including rainforest gullies, wet and dry sclerophyll forest, open woodland and rocky outcrops in semi-arid country. Commonly sites have a northerly aspect with numerous ledges, caves and crevices.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas.
Phascolarctos cinereus	Koala	BAM-C, Bionet	V	V	Inhabits eucalypt forests and woodlands. The suitability of these forests for habitation depends on the size and species of trees present, soil nutrients, climate and rainfall .	Low	Low – rare visitor to the study area. No impacts to trees with a dbh>10cm
Potorous tridactylus	Long-nosed Potoroo	BAM-C, Bionet	V	V	Inhabits coastal heath and wet and dry sclerophyll forests. Generally found in areas with rainfall greater than 760 mm. Requires relatively thick ground cover where the soil is light and sandy.	Low	Low – no suitable habitat across much of the study area in wet sclerophyll or dense canopy areas
Pteropus poliocephalus	Grey-headed Flying-fox	BAM-C	V	V	This species is a canopy-feeding frugivore and nectarivore of rainforests, open forests, woodlands, melaleuca swamps and banksia woodlands. Bats commute daily to foraging areas, usually within 15 km of the day roost although some individuals may travel up to 70 km.	Present - associated with PCTs 878, 905, 906, 1156, 1245, 1300	Low –no canopy trees or foraging trees will be removed as part of the Project
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	Bionet	V	-	Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more	Low	Low – no breeding habitat would be removed and minimal

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[1]	Potential for impact
					open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.		impacts to foraging habitat
Scoteanax rueppellii	Greater Broad-nosed Bat	Bionet	V	-	Prefer moist gullies in mature coastal forests and rainforests, between the Great Dividing Range and the coast. They are only found at low altitudes below 500 m. In dense environments they utilise natural and human-made opening in the forest for flight paths. Creeks and small rivers are favoured foraging habitat. This species roosts in hollow tree trunks and branches.	Moderate - associated with PCTs 878, 905, 906, 1245, 1300	Low – no breeding habitat would be removed and minimal impacts to foraging habitat
Reptiles							
Hoplocephalus bungaroides	Broad-headed Snake	BAM-C, Bionet	E	V	Occurs almost exclusively in association with communities occurring on Triassic sandstone within the Sydney Basin. Typically found among exposed sandstone outcrops with vegetation types ranging from woodland to heath. Within these habitats they spend most of the year sheltering in and under rock crevices and exfoliating rock. However, some individuals will migrate to tree hollows within 500m of escarpment to find shelter during hotter parts of summer.	Low	Low – no suitable exposed sandstone areas within the study area or to be impacted by the Project
Varanus rosenbergi	Rosenberg's Goanna	Bionet	V	-	This species is a Hawkesbury-Narrabeen sandstone outcrop specialist. Occurs in coastal heaths, humid woodlands and both wet and dry sclerophyll forests.	Moderate – associated with PCT 905	Low – Although some termite mounds found across the study area, none will be impacted by the Project and none had markings or evidence of recent activity

Appendix 2. Tests of Significance (BC Act)

A ToS is provided for the following BC Act listed threatened biodiversity in relation to the Project:

- Threatened Ecological Communities
    - Illawarra Subtropical Rainforest in the Sydney Basin Bioregion (ISR) (Endangered)
- Threatened Fauna:
    - Giant Burrowing Frog (Vulnerable)
    - Red-crowned Toadlet (Vulnerable)
    - Stuttering Frog (Endangered)
    - Grey-headed Flying-fox (Vulnerable)
    - Cave-dependant bats
        - Large-eared Pied Bat (Vulnerable)
        - Little Bent-winged Bat (Vulnerable)
        - Large Bent-winged Bat (Vulnerable).
    - Hollow-dependant bats
        - Eastern False Pipistrelle (Vulnerable)
        - Eastern Coastal Free-tailed Bat (Vulnerable)
        - Southern Myotis (Vulnerable)
        - Greater Broad-nosed Bat (Vulnerable).
    - Spotted-tailed Quoll (Vulnerable)
    - Large forest owls
        - Powerful Owl (Vulnerable)
        - Sooty Owl(Vulnerable).
    - Wet Forest Birds
        - Olive Whistler (Vulnerable)
        - Pink Robin (Vulnerable).
    - Gang-gang Cockatoo (Vulnerable)
    - Rosenberg's Goanna (Vulnerable).

Illawarra Subtropical Rainforest in the Sydney Basin Bioregion (ISR)	
Description: ISR is a rainforest community that occupies high nutrient soils in the Illawarra region, south of Sydney. Characteristic tree species include *Baloghia inophylla* (Brush Bloodwood), *Brachychiton acerifolius* (Flame Tree), *Dendrocnide excelsa* (Giant Stinging Tree), *Diploglottis australis* (Native Tamarind), Ficus spp., *Pennantia cunninghamii* (Brown Beech), and *Toona ciliata* (Red Cedar). Species of Eucalyptus, Syncarpia and Acacia may also be present as emergents or incorporated into the dense canopy. While rainforest canopies are generally closed, in highly disturbed stands the canopy of ISR may be irregular and open. The height of the canopy varies considerably, and structurally some stands of ISR are scrub. **Distribution:** Recorded from the LGAs of Wollongong, Shellharbour, Shoalhaven and Kiama, but may occur elsewhere in the Sydney Basin Bioregion. The main occurrences of ISR are located between Albion Park and Gerringong (referred to as the Illawarra Brush in Mills and Jakeman 1995) and on the Berkeley Hills north of Lake Illawarra (referred to as the Berkeley Brush in Mills and Jakeman 1995). Outlying occurrences extend south to the Shoalhaven River and west into the Kangaroo Valley. ISR is closely associated with sheltered sites with fertile (relatively high-nutrient) soils that have a high water-holding capacity. It therefore occupies a number of landscape positions, including the slopes of the escarpment, on rocky scree and in gully lines. **Summary of impacts and context of ISR for the Project:** The rainforest patches considered within this assessment and impacted by the Project constitute various pockets of rainforest throughout the study area. Twelve out of 71 proposed trails disrupt the extent of ISR, particularly the proposed Blue Trails in the northern portion of the Project footprint encompassing approximately 0.21 ha. While sampling was not conducted over all of the patches, those that were surveyed were considered to be a 'High Condition Category B' class patch based on at least 70% canopy cover (all canopy strata from sub-canopy to emergent layer), a minimum of 10 native plant species from Table A1, and likely to support at least two specialist birds from Table A2 (of Commonwealth Department of Environment and Energy [DoEE] 2019) per 0.04 ha sample plot on average for the patch and the patch being greater than 1 ha. The assessed patch is highly variable in condition, consisting of areas of good condition separated by significant areas of Lantana infestation due to previous clearing activities (powerline easements and access trails). The area of rainforest to be impacted by the Project has somewhat poor connectivity to the larger patch of ISR within the locality. Remnant patches that have not been cleared (corresponding with the best condition) have been largely avoided by the Project. A total of 0.45 ha (primary and secondary clearing) of ISR would be cleared as part of the Project.	
Assessment of significance: An action is likely to have a significant impact on a threatened ecological community if there is a real chance or possibility that it will:	
Criteria	**Address of Criteria**
a) in the case of a threatened species, whether the proposed development or activity 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	N/A
b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: i) is likely to have an adverse effect on the extent of the ecological community such that its local	The Project would involve the removal of 0.45 ha of ISR native vegetation. The extent of ISR is estimated to be 6500ha (DAWE 2022b), therefore the extent would be reduced by approximately <0.01%. The extent of occurrence of a community is considered as the area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected sites of present occurrence (as per IUCN criteria). The current extent of ISR includes areas of the community in all directions from the proposed clearing. Therefore, the current Project is considered unlikely to reduce the overall extent of occurrence of the community. The Project will only remove the understory, and smaller midstory vegetation, leaving intact the canopy and large shrubs typical of the ISR community, such as the Giant Stinging Tree.

Illawarra Subtropical Rainforest in the Sydney Basin Bioregion (ISR)	
occurrence is likely to be placed at risk of extinction, or ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,	
c) in relation to the habitat of a threatened species or ecological community: i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,	**Extent of impact on habitat:** The extent of ISR habitat to be removed as a result of the Project is 0.45 ha. This comprises only groundcover, understorey and midstorey species, avoiding all of the habitat trees with hollows. **Habitat fragmentation:** The area of habitat is unlikely to become fragmented or isolated from other areas of habitat as a result of the proposed activity. The trails and associated impacts will not be sufficiently wide enough to act as a barrier to movement for any seed dispersal. The increased fragmentation within the midstory and understory layers of the vegetation via the introduction of narrow mountain bike trails (generally 1.2 m wide) is unlikely to reduce seed dispersal and animal dispersal for those species that are currently able to move between pockets of ISR. **Importance of habitat to be impacted:** The Project will only remove the understory, and smaller midstory vegetation, leaving intact the canopy and large shrubs typical of the ISR community, such as the Giant Stinging Tree. The area of impact is considered minor when compared to the amount of ISR present in the locality. This reduces the overall importance of the potentially impacted habitat. Therefore, the negligible amount of habitat to be modified is of low importance to the long-term survival of ISR in the locality.
d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),	No AOBV are present within the areas to be cleared or potentially impacted by the Project.
e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.	Section 4.1.3 provides a full analysis of the potential operation of KTPs within the study area due to the proposed works. The only KTP that will be increased as a result of the Project is the clearing of native vegetation. In this case, the proposed trails equate to a permanent clearing of native vegetation structure (excluding canopy) within the study area of 6.54 ha, of which 0.45 ha is ISR.
Conclusion: The Project is unlikely to fragment this community or place ISR at risk of extinction, and is therefore unlikely to result in a significant impact on this TEC. It is recommended that NPWS adopt practices that minimise the potential for indirect impacts through management measures such as waste disposal and cleaning equipment before mobilisation on site, and monitoring of the TEC condition in close proximity to the IEMB network during operation.	

Red-crowned Toadlet	
Distribution: The Red-crowned Toadlet has a restricted distribution. It is confined to the Sydney Basin, from Pokolbin in the north, the Nowra area to the south, and west to Mt Victoria in the Blue Mountains. **Habitat requirements:** Occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones. Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings. Shelters under rocks and amongst masses of dense vegetation or thick piles of leaf litter. Breeding congregations occur in dense vegetation and debris beside ephemeral creeks and gutters. Red-crowned Toadlets have not been recorded breeding in waters that are even mildly polluted or with a pH outside the range 5.5 to 6.5. Eggs are laid in moist leaf litter, from where they are washed by heavy rain; a large proportion of the development of the tadpoles takes place in the egg. Disperses outside the breeding period, when they are found under rocks and logs on sandstone ridges and forage amongst leaf-litter. Red-crowned Toadlets are quite a localised species that appear to be largely restricted to the immediate vicinity of suitable breeding habitat. Red-crowned Toadlets are usually found as small colonies scattered along ridges coinciding with the positions of suitable refuges near breeding sites. Due to this tendency for discrete populations to concentrate at particular sites, a relatively small, localised disturbance may have a significant impact on a local population if it occurs on a favoured breeding or refuge site. **Impact summary:** The Project will require the primary clearing of up to 4.30 ha, secondary clearing of up to 2.24 ha, and temporary disturbance of up to 0.16 ha of native vegetation which may be utilised as habitat by these species, including moderate to highly connected forest and rainforest habitats. No canopy trees would be impacted by the Project.	
Assessment of significance: An action is likely to have a significant impact on a threatened species if there is a real chance or possibility that it will:	
Criteria	**Address of Criteria**
a) in the case of a threatened species, whether the proposed development or activity 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	Red-crowned Toadlet was not recorded within the study area during the current survey, however there are species' records in the locality (Figure 7) and it is likely to utilise the dense vegetation and debris beside ephemeral creeks within the Study Area. The Project (proposed activity) involves the minor modification of ephemeral drainage lines and impacts (from primary and secondary clearing) to 6.07 ha of native vegetation that is associated with this species (PCTs 1245, 905 and 878). Primary clearing (3.89 ha) of native vegetation involves the clearing of a narrow strip (generally 1.2 m wide) for a mountain bike trail and the construction of bridges above the creek channel. The Project is unlikely 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.
b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,	N/A

Red-crowned Toadlet	
c) in relation to the habitat of a threatened species or ecological community: i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,	**Extent of impact on habitat:** The extent of Red-crowned Toadlet habitat to be removed as a result of the Project is 6.07 ha. This comprises only groundcover, understorey and midstorey species, avoiding all overstorey species. **Habitat fragmentation:** The area of habitat is unlikely to become fragmented or isolated from other areas of habitat as a result of the proposed activity. The trails and associated impacts will not be sufficiently wide enough to act as a barrier to movement for the Red-crowned Toadlet. **Importance of habitat to be impacted:** Ephemeral creeks and associated habitat are important feature for Red-crowned Toadlet. However, the Project largely avoids such habitat. Further, the very small area of habitat impacted compared to the amount of habitat in the locality, significantly reduces the overall importance of potentially impacted habitat. Any potential impacts will be mitigated by a suite of measures, which will aid the rapid re-establishment of ephemeral drainages within the study area. Therefore, the negligible amount of habitat to be modified is of low importance to the long-term survival of the species in the locality.
d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),	No AOBV are present within the areas to be cleared or potentially impacted by the Project.
e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.	Section 4.3.3 provides a full analysis of the potential operation of KTPs within the study area due to the proposed works. The only KTP that will be impacting the Red-crowned Toadlet and increased as a result of the Project is the clearing of native vegetation. In this case, the proposed trails equate to a permanent clearing of native vegetation structure (excluding canopy) within the study area of 6.07 ha that will also have a temporary disturbance to the ephemeral creek crossings during construction. Mitigation measures will be in place to avoid that will also result in minor disturbance to the ephemeral creek crossings during construction. Mitigation measures will be in place to avoid any disturbance to the potential presence of RCT in the study area.
Conclusion: Given the avoidance of high quality habitat, and that surveys failed to detect this species, the Project is unlikely to result in a significant impact on the Red-crowned Toadlet. It is recommended that NPWS adopt practices that minimise the potential for indirect impacts through management measures such as waste disposal and cleaning equipment before mobilisation on site.	

Giant Burrowing Frog	
Distribution: The Giant Burrowing Frog is distributed in south eastern NSW and Victoria, and appears to exist as two distinct populations: a northern population largely confined to the sandstone geology of the Sydney Basin and extending as far south as Ulladulla, and a southern population occurring from north of Narooma through to Walhalla, Victoria. **Habitat requirements:** Found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based. Spends more than 95% of its time in non-breeding habitat in areas up to 300 m from breeding sites. Whilst in non-breeding habitat it burrows below the soil surface or in the leaf litter. Individual frogs occupy a series of burrow sites, some of which are used repeatedly. The home ranges of both sexes appear to be non-overlapping suggesting exclusivity of non-breeding habitat. Home ranges are approximately 0.04 ha in size. Individuals move into the breeding site either immediately before or following heavy rain and occupy these sites for up to 10 days. Most individuals will not attempt to breed every year. The Giant Burrowing Frog has a generalist diet and studies to date indicate that they eat mainly invertebrates including ants, beetles, cockroaches, spiders, centipedes and scorpions. When breeding, frogs will call from open spaces, under vegetation or rocks or from within burrows in the creek bank. Males show strong territoriality at breeding sites. This species breeds mainly in autumn, but has been recorded calling throughout the year. Egg masses are foamy with an average of approximately 500-800 eggs and are laid in burrows or under vegetation in small pools. After rains, tadpoles are washed into larger pools where they complete their development in ponds or ponded areas of the creekline. Tadpole development ranges from around 12 weeks duration to up to 12 months with late developing tadpoles overwintering and completing development when warmer temperatures return. Breeding habitat of this species is generally soaks or pools within first or second order streams. They are also commonly recorded from 'hanging swamp' seepage lines and where small pools form from the collected water. **Impact summary:** The Project will require the primary clearing of up to 4.30 ha, secondary clearing of up to 2.24 ha, and temporary disturbance of up to 0.16 ha of native vegetation which may be utilised as habitat by these species, including moderate to highly connected forest and rainforest habitats. No canopy trees would be impacted by the Project.	
Assessment of significance: An action is likely to have a significant impact on a threatened species if there is a real chance or possibility that it will:	
Criteria	**Address of Criteria**
a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The Project (proposed activity) involves impacts (from primary and secondary clearing) to 6.54 ha of native vegetation. Primary clearing (4.30 ha) of native vegetation involves the clearing of a narrow strip (up to 1.2 m wide) for a mountain bike trail and the construction of bridges above the creek channel. Giant Burrowing Frog was not recorded within the study area during the current survey, however the species is well known from the locality and immediate surrounds utilising the dense vegetation and surface soil beside ephemeral creeks (Figure 7). There is little doubt that a viable local population of the species exists nearby. The Project (proposed activity) is unlikely 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.
b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or ii) Is likely to substantially and adversely modify the composition of	N/A

Giant Burrowing Frog	
the ecological community such that its local occurrence is likely to be placed at risk of extinction,	
c) in relation to the habitat of a threatened species or ecological community: i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,	**Extent of impact on habitat:** The extent of Giant Burrowing Frog habitat to be impacted will be restricted to the understorey vegetation to allow mountain bike and foot access. The creek crossing would temporarily modify the tributary and habitats using a variety of erosion control measures during construction to allow water flow to continue along its natural pathway. Such structures may be removed once the bridge and infrastructures are completed, pending the natural flow and features at each site. **Habitat fragmentation:** The area of habitat is unlikely to become fragmented or isolated from other areas of habitat as a result of the proposed activity. The tracks and associated impacts would not be sufficiently wide enough to act as a barrier to movement for the Giant Burrowing Frog. **Importance of habitat to be impacted:** Ephemeral creeks and associated habitat are important features for Giant Burrowing Frogs, however, the Project largely avoids such habitat and the very small area of habitat to be impacted compared to the amount of habitat in the locality, significantly reduces the overall importance of potentially impacted habitat. Furthermore, any potential impacts would be mitigated by a suite of measures, which would aid the rapid re-establishment of ephemeral drainages within the study area. Therefore, the negligible amount of habitat to be modified is of low importance to the long-term survival of the species in the locality.
d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),	No AOBV are present within the areas to be cleared or potentially impacted by the Project.
e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.	Section 4.1.3 provides a full analysis of the potential operation of KTPs within the study area due to the proposed works. The only KTP that will be impacting the Giant Burrowing Frog and increased as a result of the Project is the clearing of native vegetation. In this case, the proposed trails equate to a permanent clearing of native vegetation structure (excluding canopy) within the study area of 5.39 ha (operational footprint) that will also have a temporary disturbance to the ephemeral creek crossings during construction. Mitigation measures will be in place to avoid any disturbance to the potential individuals of Giant Burrowing Frog in the study area.
Conclusion: Given the avoidance of high quality habitat and minimal impacts across the study area, the Project is unlikely to result in a significant impact on the Giant Burrowing Frog. It is recommended that NPWS adopt practices that minimise the potential for indirect impacts through management measures such as waste disposal and cleaning equipment before mobilisation on site.	

Stuttering Frog	
Distribution: The Stuttering Frog occurs along the east coast of Australia from southern Queensland to north-eastern Victoria. The species is considered to have disappeared from Victoria and to have undergone considerable range contraction in NSW, particularly in south-east NSW. It is the only Mixophyes species that occurs in south-east NSW and in recent surveys it has only been recorded at three locations south of Sydney. The Dorrigo region, in north-east NSW, appears to be a stronghold for this species. No targeted surveys for this species were conducted. **Habitat requirements:** The Stuttering Frog is found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range. The Stuttering Frog breeds in streams during summer after heavy rain where eggs are laid on rock shelves or shallow riffles in small, flowing streams. Outside of the breeding season individuals live in deep leaf litter and thick understorey vegetation on the forest floor. As the tadpoles grow they move to deep permanent pools and take approximately 12 months to metamorphose. **Impact summary:** The Project will require the primary clearing of up to 4.30 ha, secondary clearing of up to 2.24 ha, and temporary disturbance of up to 0.16 ha of native vegetation which may be utilised as habitat by these species, including moderate to highly connected forest and rainforest habitats. No canopy trees would be impacted by the Project.	
Assessment of significance: An action is likely to have a significant impact on a threatened species if there is a real chance or possibility that it will:	
Criteria	**Address of Criteria**
a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The Project (proposed activity) involves impacts (from primary and secondary clearing) to 6.54 ha of native vegetation. Primary clearing (4.30 ha) of native vegetation involves the clearing of a narrow strip (generally 1.2 m wide) for a mountain bike trail and the construction of bridges above the creek channel. While Brandy and Water Creek contain suitable habitat for this species, they are not considered to be impacted by the Project. BioNet records show the nearest Stuttering Frog record to be 20 km south-west of the study area (recorded in 2005) (DPE 2022b). The large intact patches of vegetation within the Illawarra Escarpment provide extensive areas of habitat facilitating fauna movement and provide habitat resources throughout the region and in the area immediately adjacent to the study area. Given the avoidance of impact to potential Stuttering Frog habitat within the study area, the Project is unlikely 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.
b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,	N/A

Stuttering Frog	
c) in relation to the habitat of a threatened species or ecological community: i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,	**Extent of impact on habitat:** The extent of Stuttering Frog habitat to be removed will be restricted to the understorey vegetation to allow mountain bike and foot access. The creek crossing would temporarily modify the tributary and habitats using a variety of erosion control measures during construction to allow water flow to continue along its natural pathway. Such structures may be removed once the bridge and infrastructures are completed, pending the natural flow and features at each site. **Habitat fragmentation:** The area of habitat is unlikely to become fragmented or isolated from other areas of habitat as a result of the proposed activity. The tracks and associated impacts would not be sufficiently wide enough to act as a barrier to movement for the Stuttering Frog. **Importance of habitat to be impacted:** While some of the creek lines provide potential habitat for the Stuttering Frog, the Project largely avoids such habitat. The very small area of habitat impacted compared to the amount of habitat in the locality, significantly reduces the overall importance of potentially impacted habitat. Furthermore, BioNet records show that the Stuttering Frog has not been recorded within 20 km of the study area for 17 years (the nearest record is from 2005, around 20 km south-west of the study area) (DPE 2022b).Therefore, the negligible amount of habitat to be modified is of low importance to the long-term survival of the species in the locality.
d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),	No AOBV are present within the areas to be cleared or potentially impacted by the Project.
e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.	Section 4.1.3 provides a full analysis of the potential operation of KTPs within the study area due to the proposed works. The only KTP that will be impacting the Stuttering Frog and increased as a result of the Project is the clearing of native vegetation. In this case, the proposed trails equate to a permanent clearing of 5.39 of ha of native vegetation (excluding canopy) from the study area (operational footprint). The Project will also have a temporary impact to the ephemeral creek crossings during construction.
Conclusion: Given the avoidance of high quality habitat and minimal impacts across the study area, the Project is unlikely to result in a significant impact on the Stuttering Frog. It is recommended that NPWS adopt practices that minimise the potential for indirect impacts through management measures, such as waste disposal and cleaning equipment prior to mobilisation on site.	

Grey-headed Flying-fox	
Distribution: Grey-headed Flying-foxes are generally found within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortages, they may be found in unusual locations. The Grey-headed Flying-fox was recorded during the field survey, however, no roosting/breeding camps were identified within the study area. **Life cycle, habitat:** Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young. Annual mating commences in January and conception occurs in April or May; single young is born in October or November. Site fidelity to camps is high; some camps have been used for over a century. The species can travel up to 50 km from the camp to forage; commuting distances are more often <20 km. They feed on the nectar and pollen of native trees, in particular *Eucalyptus, Melaleuca* and *Banksia*, and fruits of rainforest trees and vines. They also forage in cultivated gardens and fruit crops. **Impact summary:** The Project will require the primary clearing of up to 4.30 ha, secondary clearing of up to 2.24 ha, and temporary disturbance of up to 0.16 ha of native vegetation which may be utilised as habitat by these species, including moderate to highly connected forest and rainforest habitats. No canopy trees would be impacted by the Project.	
Assessment of significance: An action is likely to have a significant impact on a threatened species if there is a real chance or possibility that it will:	
Criteria	**Address of Criteria**
a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The Project will require the primary clearing of up to 4.30 ha, secondary clearing of up to 2.24 ha, and temporary disturbance of up to 0.16 ha of understorey native vegetation which is unlikely to be utilised as foraging habitat by the Grey-headed Flying-fox. No canopy trees will be removed as part of the Project. According to the National Flying-fox monitor, the nearest nationally important flying-fox camp is located around 12 km to the north-east of the study area, at Thirroul (DAWE 2022c). While this is the case, there is a known camp site at Figtree (around 2 km south-east of the study area [DAWE 2022c]). No Flying-fox camps/breeding/roosting habitats were identified, or are known to occur, within, or in close proximity to, the study area. The large intact patches of vegetation within the Illawarra Escarpment provide extensive areas of habitat facilitating fauna movement and providing foraging resources throughout the region and in the area immediately adjacent to the study area. Given the abundance of potential foraging habitat, and other areas of native vegetation within the locality, the proposed vegetation removal is considered unlikely to have an impact on important life-cycle stages of the Grey-headed Flying-fox such that a viable local population of the species would be placed at risk of extinction.
b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or ii) Is likely to substantially and adversely modify the composition of	N/A

Grey-headed Flying-fox	
the ecological community such that its local occurrence is likely to be placed at risk of extinction,	
c) in relation to the habitat of a threatened species or ecological community: i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,	**Extent of impact on habitat:** Primary clearing of up to 4.30 ha, secondary clearing of up to 2.24 ha, and temporary disturbance of up to 0.16 ha of native vegetation which may provide foraging habitat for the Grey-headed Flying-fox. The vegetation is in mostly moderate to good condition, with some existing disturbance from previous clearing activities and presence of weeds. No canopy trees will be removed as part of the Project. There will be no impacts to known roosting/breeding Flying-fox camps. **Habitat fragmentation:** The linear clearing of understorey vegetation only, is unlikely to lead to fragmentation or isolation from other areas of habitat as a result of the proposed activity. The narrow mountain bike trails (generally 1.2 m wide) and associated impacts will not be sufficiently wide enough to act as a barrier to the movement of this highly mobile species. **Importance of habitat to be impacted:** The habitat to be removed represents typical foraging habitat available within the region. Extensive foraging resources are present within the study area, and the adjacent and extensive bushland areas. There will be no impacts to known roosting/breeding Flying-fox camps. The species is unlikely to be dependent on the resources within the study area for its long-term survival in the locality.
d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),	No AOBV are present within the areas to be cleared or potentially impacted by the Project.
e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.	The following KTPs relevant to this species are known to exist or have the potential to be exacerbated by the Project: • Clearing of native vegetation. Section 4.1.3 provides a full analysis of the potential operation of KTPs within the study area due to the proposed works. The only KTP that will be impacting the Grey-headed Flying-fox and increased as a result of the Project is the clearing of native vegetation. In this case, the proposed trails equate to primary clearing of approximately 4.30 ha, secondary clearing of approximately 2.24 ha, and temporary disturbance of approximately 0.16 ha of native vegetation. No canopy trees will be removed as part of the Project. Habitat of some prey species may be impacted by the removal of understorey vegetation, however this impact is considered minimal due to the narrow and linear nature of the clearing and extensive surrounding vegetation. The Project is unlikely to significantly contribute to KTPs for the species.
Conclusion: The Project is considered unlikely to have a significant impact on the Grey-headed Flying-fox**.**	

Cave-dependant bats: Large-eared Pied Bat, Little Bent-winged Bat, Large Bent-winged Bat	
Large-eared Pied Bat **Distribution:** Found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. No targeted surveys for this species were conducted. **Life cycle, habitat:** Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Petrochelidon ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves and overhangs. They remain loyal to the same cave over many years. Forages for small, flying insects below the forest canopy. Likely to hibernate through the coolest months. **Little Bent-winged Bat** **Distribution:** East coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW. No targeted surveys for this species were conducted. **Life cycle, habitat:** Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. Little Bent-winged bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day. Forages for small insects beneath the canopy of densely vegetated habitats. Maternity colonies form in spring and birthing occurs in early summer. Males and juveniles disperse in summer. **Large Bent-winged Bat** **Distribution:** Large Bent-winged bats occur along the east and north-west coasts of Australia. No targeted surveys for this species were conducted. **Life cycle, habitat:** Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. At other times of the year, populations disperse within about 300 km range of maternity caves. Breeding or roosting colonies can number from 100 to 150,000 individuals. Hunt in forested areas, catching moths and other flying insects above the treetops. **Impact summary:** The Project will require the primary clearing of up to 4.30 ha, secondary clearing of up to 2.24 ha, and temporary disturbance of up to 0.16 ha of native vegetation which may be utilised as foraging habitat by these species, including moderate to highly connected forest and rainforest habitats. No canopy trees will be removed as part of the Project.	
Assessment of significance: An action is likely to have a significant impact on a threatened species if there is a real chance or possibility that it will:	
Criteria	**Address of Criteria**
a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The Project will require the primary clearing of up to 4.30 ha, secondary clearing of up to 2.24 ha, and temporary disturbance of up to 0.16 ha of native vegetation which may be utilised as foraging habitat by these species. No canopy trees will be removed as part of the Project. While no targeted acoustic bat surveys were conducted all three species are likely to utilise the study area for foraging purposes. However, it is unlikely that these species are limited to foraging within the area being impacted due to the presence of the surrounding vegetation. The large intact patches of vegetation within the Illawarra Escarpment provide extensive areas of habitat facilitating fauna movement and providing foraging resources throughout the region and in the area immediately adjacent to the study area. There is no breeding or roosting habitat available for these species in, or in close proximity to, the study area. The Project is unlikely to have an adverse effect on these cave-dependent bats, such that a viable local population of the species is likely to be placed at risk of extinction.
b) in the case of an endangered ecological community or critically endangered	N/A

Cave-dependant bats: Large-eared Pied Bat, Little Bent-winged Bat, Large Bent-winged Bat	
ecological community, whether the proposed development or activity: i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,	
c) in relation to the habitat of a threatened species or ecological community: i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,	**Extent of impact on habitat**: Primary clearing of up to 4.30 ha, secondary clearing of up to 2.24 ha, and temporary disturbance of up to 0.16 ha of native vegetation in mostly moderate to good condition, with some existing disturbance from previous clearing activities and presence of weeds. No canopy trees will be removed as part of the Project. . There will be no impacts to known or potential breeding habitat for these species. **Habitat fragmentation:** The linear clearing of understorey vegetation only, is unlikely to lead to fragmentation or isolation from other areas of habitat as a result of the proposed activity. The narrow mountain bike trails (generally 1.2 m wide) and associated impacts will not be sufficiently wide enough to act as a barrier to movement for highly mobile cave-dependant bats. **Importance of habitat to be impacted:** The habitat to be removed represents typical foraging habitat available within the region. Extensive foraging resources are present within the study area, and the adjacent and extensive bushland areas. There will be no impacts to known or potential breeding habitat for these species. The species is unlikely to be dependent on the resources within the study area for its long-term survival in the locality.
d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),	No AOBV are present within the areas to be cleared or potentially impacted by the Project.
e) whether the proposed development or activity is or is part of a key threatening	The following KTPs are known to exist or have the potential to be exacerbated by the Project: • Clearing of native vegetation.

Cave-dependant bats: Large-eared Pied Bat, Little Bent-winged Bat, Large Bent-winged Bat	
process or is likely to increase the impact of a key threatening process.	No suitable cave-dependant bat roosting habitat occurs within the study area. Section 4.1.3 provides a full analysis of the potential operation of KTPs within the study area due to the proposed works. The only KTP that will be impacting cave-dependant bats and increased as a result of the Project is the clearing of native vegetation. In this case, the proposed trails equate to primary clearing of up to 4.30 ha, secondary clearing of up to 2.24 ha, and temporary disturbance of up to 0.16 ha of native vegetation. No canopy trees will be removed as part of the Project.
Conclusion: The Project is considered unlikely to have a significant impact on the Large-eared Pied Bat, Little Bent-winged Bat and Large Bent-winged Bat.	

Hollow-dependant bats: Eastern False Pipistrelle, Eastern Coastal Free-tailed Bat, Southern Myotis, Greater Broad-nosed Bat	
Eastern False Pipistrelle **Distribution:** The Eastern False Pipistrelle is found on the south-east coast and ranges of Australia, from southern Queensland to Victoria and Tasmania. No targeted surveys for this species were conducted. **Life cycle, Habitat:** Prefers moist habitats, with trees taller than 20 m. Generally, roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings. Hunts beetles, moths, weevils and other flying insects above or just below the tree canopy. Hibernates in winter. Females are pregnant in late spring to early summer. **Eastern Coastal Free-tailed Bat** **Distribution:** The Eastern Coastal Free-tailed Bat is found along the east coast from south Queensland to southern NSW. No targeted surveys for this species were conducted. **Life cycle, habitat:** Occurs in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roosts mainly in tree hollows but will also roost under bark or in man-made structures. Usually solitary but also recorded roosting communally, probably insectivorous. **Southern Myotis** **Distribution:** Southern Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers. No targeted surveys for this species were conducted. **Life cycle, habitat:** Roosts in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. The species has highly specialised foraging characteristics, primarily foraging over streams and pools catching insects and small fish by raking their feet across the water surface. **Greater Broad-nosed Bat** **Distribution:** Greater Broad-nosed Bat is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. It extends to the coast over much of its range. In NSW it is widespread on the New England Tablelands, however, does not occur at altitudes above 500 m. No targeted surveys for this species were conducted. **Life cycle, habitat:** Roosts in tree hollows, but has also been found in buildings. Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 - 6 m. **Impact summary:** The Project will require the primary clearing of up to 4.30 ha, secondary clearing of up to 2.24 ha, and temporary disturbance of up to 0.16 ha of native vegetation which may be utilised as habitat by these species, including moderate to highly connected forest and rainforest habitats. No hollow-bearing trees or mature trees would be impacted by the Project.	
Assessment of significance: An action is likely to have a significant impact on a threatened species if there is a real chance or possibility that it will:	
Criteria	**Address of Criteria**
a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The Project will require the primary clearing of up to 4.30 ha, secondary clearing of up to 2.24 ha, and temporary disturbance of up to 0.16 ha of native vegetation which may be utilised as foraging habitat by these species, including moderate to highly connected forest and rainforest habitats. Three of the hollow-dependent bats forage in forest canopies, while the Southern Myotis forages over water. While no targeted acoustic bat surveys were conducted, BioNet Atlas records (DPE 2022b) indicate that all three species frequent the locality. Given no hollow-bearing trees or mature trees would be removed as part of the Project, no potential breeding resources for these species will be impacted. The amount of vegetation to be removed is considered negligible when compared to the large extensive and intact patches of vegetation that are present within the Illawarra Escarpment. This provides extensive areas of habitat facilitating fauna movement and providing foraging and roosting resources throughout the region for these three bats.

Hollow-dependant bats: Eastern False Pipistrelle, Eastern Coastal Free-tailed Bat, Southern Myotis, Greater Broad-nosed Bat	
	The Project is unlikely to have an adverse effect on these hollow-dependent bats, such that a viable local population of the species is likely to be placed at risk of extinction.
b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,	N/A
c) in relation to the habitat of a threatened species or ecological community: i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,	**Extent of impact on habitat:** Primary clearing of up to 4.30 ha, secondary clearing of up to 2.24 ha, and temporary disturbance of up to 0.16 ha of native vegetation in mostly moderate to good condition, with some existing disturbance from previous clearing activities and presence of weeds. Temporary disturbance during construction to those creek crossings that contain water, are of a suitable width and that may be utilised as foraging habitat by Southern Myotis will also occur, however, a variety of erosion control measures will be in place during construction to allow water flow to continue along its natural pathway. No hollow-bearing trees or mature trees would be impacted by the Project. Therefore, there will be no direct impacts to known or potential breeding habitat for these species. **Habitat fragmentation:** The linear clearing of understorey vegetation only, is unlikely to lead to fragmentation or isolation from other areas of habitat as a result of the proposed activity. The narrow mountain bike trails (generally 1.2 m wide) and associated impacts will not be sufficiently wide enough to act as a barrier to the movement of these highly mobile hollow-dependant bats. **Importance of habitat to be impacted:** The habitat to be removed represents typical foraging habitat available within the region. Extensive foraging resources are present within the study area, and the adjacent and extensive bushland areas. There will be no impacts to known or potential breeding habitat for these species. The species is unlikely to be dependent on the resources within the study area for its long-term survival in the locality.
d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding	No AOBV are present within the areas to be cleared or potentially impacted by the Project.

Hollow-dependant bats: Eastern False Pipistrelle, Eastern Coastal Free-tailed Bat, Southern Myotis, Greater Broad-nosed Bat	
biodiversity value (either directly or indirectly),	
e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.	The following KTPs are known to exist or have the potential to be exacerbated by the Project: • Clearing of native vegetation. Section 4.1.3 provides a full analysis of the potential operation of KTPs within the study area due to the proposed works. The only KTP that will be impacting hollow-dependant bats and increased as a result of the Project is the clearing of native vegetation. In this case, the proposed trails equate to primary clearing of up to 4.30 ha, secondary clearing of up to 2.24 ha, and temporary disturbance of up to 0.16 ha of native vegetation. No canopy trees or hollow-bearing trees will be removed as part of the Project.
Conclusion: The proposed action is considered unlikely to have a significant impact on the Eastern False Pipistrelle, Eastern Coastal Free-tailed Bat, Southern Myotis and Greater Broad-nosed Bat.	

Spotted-tailed Quoll	
Distribution: The range of the Spotted-tailed Quoll has contracted considerably since European settlement. It is now found in eastern NSW, eastern Victoria, south-east and north-eastern Queensland, and Tasmania. Only in Tasmania is it still considered relatively common. No targeted surveys for the Spotted-tailed Quoll were conducted; nor were any detected within the study area. **Life cycle, habitat:** Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Quolls use hollow-bearing trees, fallen logs, other animal burrows, small caves and rock outcrops as den sites. Mostly nocturnal, although will hunt during the day; spend most of the time on the ground, although also an excellent climber and will hunt possums and gliders in tree hollows and prey on roosting birds. A generalist predator with a preference for medium-sized (500 g-5 kg) mammals. Consumes a variety of prey, including gliders, possums, small wallabies, rats, birds, bandicoots, rabbits, reptiles and insects. Also eats carrion and takes domestic fowl. Females occupy home ranges of 200-500 ha, while males occupy very large home ranges from 500 to over 4,000 ha. Quolls are known to traverse their home ranges along densely vegetated creek lines. Average litter size is five; both sexes mature at about one year of age. Life expectancy in the wild is about 3-4 years. **Impact summary:** The Project will require the primary clearing of approximately 4.30 ha, secondary clearing of approximately 2.24 ha, and temporary disturbance of approximately 0.16 ha of native vegetation, which may be utilised as habitat by this species, including moderate to highly connected forest and rainforest habitats.	
Assessment of significance: An action is likely to have a significant impact on a threatened species if there is a real chance or possibility that it will:	
Criteria	**Address of Criteria**
a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The Project will require the primary clearing of approximately 4.30 ha, secondary clearing of approximately 2.24 ha, and temporary disturbance of approximately 0.16 ha of native vegetation, including moderate to highly connected forest and rainforest habitats. The Project is unlikely to have an adverse effect on the Spotted-tailed Quoll as no hollow-bearing trees or large woody debris will be removed as result of the Project; therefore no potential den habitat will be impacted. Habitat of some prey species may be impacted by the removal of understorey vegetation, however this impact is considered minimal due to the narrow and linear nature of the clearing and extensive surrounding vegetation. The Spotted-tailed Quoll has a relatively large home range (200-500 ha), and it is considered that the study area likely constitutes only a small part of this. The large intact patches of vegetation within the Illawarra Escarpment provide extensive areas of habitat facilitating fauna movement and providing foraging and den resources throughout the region. The Project is unlikely to have an adverse effect on the Spotted-tailed Quoll, such that a viable local population of either species is likely to be placed at risk of extinction.
b) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed: i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, orIs 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	N/A

Spotted-tailed Quoll	
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 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 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.	**Extent of impact on habitat:** Primary clearing of approximately 4.30 ha, secondary clearing of approximately 2.24 ha, and temporary disturbance of approximately 0.16 ha of native vegetation will occur as a result of the Project. This vegetation is in mostly moderate to good condition, with some existing disturbance from previous clearing activity and presence of weeds. No hollow-bearing trees or large woody debris would be impacted by the Project. Therefore, there is unlikely to be a direct impact to known or potential den habitat for these species. Habitat of some prey species may be impacted by the removal of understorey vegetation, however this impact is considered minimal due to the narrow and linear nature of the clearing and extensive surrounding vegetation. **Habitat fragmentation:** The linear clearing of understorey vegetation only, is unlikely to lead to fragmentation or isolation from other areas of habitat as a result of the proposed activity. The narrow mountain bike trails (generally 1.2 m wide) and associated impacts will not be sufficiently wide enough to act as a barrier to movement for Spotted-tailed Quoll. **Importance of habitat to be impacted:** The Spotted-tailed Quoll has a relatively large home range (200-500 ha), and it is considered that the study area likely constitutes only a small part of this. As such, the Spotted-tailed Quoll is unlikely to be dependent on the resources within the study area for its survival. Extensive foraging resources are present within the study area, and the adjacent and extensive bushland areas No hollow-bearing trees or large woody debris would be impacted by the Project. Therefore, there will be no direct impacts to known or potential den habitat for this species, which are of key importance for its survival.
d) Whether the action proposed is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly)	No AOBV are present within the areas to be cleared or potentially impacted by the Project.
e) Whether the action proposed constitutes or is part of a KTP or is likely to result in the operation of, or increase the impact of, a KTP	The following KTPs are known to exist or have the potential to be exacerbated by the Project: • Clearing of native vegetation Section 4.1.3 provides a full analysis of the potential operation of KTPs within the study area due to the proposed works. The only KTP that will be impacting the Spotted-tailed Quoll and increased as a result of the Project is the clearing of native vegetation. In this case, the proposed trails equate to primary clearing of approximately 4.30 ha, secondary clearing of approximately 2.24 ha, and temporary disturbance of approximately 0.16 ha of native vegetation. No canopy trees, hollow-bearing trees or large woody debris will be removed as part of the Project. Habitat of some prey species may be impacted by the removal of understorey vegetation, however this impact is considered minimal due to the narrow and linear nature of the clearing and extensive surrounding vegetation.
Conclusion: The Project is considered unlikely to have a significant impact on the Spotted-tailed Quoll.	

Large forest owls: Powerful Owl, Sooty Owl	
Powerful Owl **Distribution:** The Powerful Owl is endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria. In NSW, it is widely distributed throughout the eastern forests from the coast inland to the tablelands, with scattered records on the western slopes and plains suggesting occupancy prior to land clearing. It is now at low densities throughout most of its eastern range, rare along the Murray River and former inland populations may never recover. The Powerful Owl was recorded within the study area during field surveys. **Life cycle, habitat:** The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. Powerful Owl requires large tracts of forest or woodland habitat, but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine (*Syncarpia glomulifera*), Black She-oak (*Allocasuarina littoralis*), Blackwood (*Acacia melanoxylon*), Rough-barked (*Angophora floribunda*), and a number of eucalypt species. The main prey items are medium-sized arboreal marsupials, particularly the Greater Glider, Common Ringtail Possum (*Pseudocheirus peregrinus*) and Sugar Glider (*Petaurus breviceps*). There may be marked regional differences in the prey taken by Powerful Owls. For example, in southern NSW, Ringtail Possum make up the bulk of prey in the lowland or coastal habitat. At higher elevations, such as the tableland forests, the Greater Glider may constitute almost all of the prey for a pair of Powerful Owls. Flying foxes are important prey in some areas and birds comprise about 10-50% of the diet depending on the availability of preferred mammals. As most prey species require hollows and a shrub layer, these are important habitat components for the owl. Powerful Owl pairs have high fidelity to a large territorial range (between 400 to 4000 ha depending on habitat quality). Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old. While the female and young are in the nest hollow the male Powerful Owl roosts nearby (10-200 m) guarding them, often choosing a dense "grove" of trees that provide concealment from other birds that harass him. Nesting for this species typically occurs between May to July. **Sooty Owl** **Distribution:** The species Occupies the easternmost one-eighth of NSW, occurring on the coast, coastal escarpment and eastern tablelands. Territories are occupied permanently. The species was not detected within the study area during field surveys. **Life cycle, habitat:** The species is typically known to occur in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. Roosts by day in the hollow of a tall forest tree or in heavy vegetation; hunts by night for small ground mammals or tree-dwelling mammals such as the Common Ringtail Possum or Sugar Glider. Nests in very large tree-hollows. **Impact summary:** The Project will require the primary clearing of up to 4.30 ha, secondary clearing of up to 2.24 ha, and temporary disturbance of up to 0.16 ha of native vegetation which may be utilised as habitat by these species, including moderate to highly connected forest and rainforest habitats. No hollow-bearing trees or mature trees would be impacted by the Project.	
Assessment of significance: An action is likely to have a significant impact on a threatened species if there is a real chance or possibility that it will:	
Criteria	**Address of Criteria**
a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The Powerful Owl and Sooty Owl are considered to have potentially local viable populations due to recent records within the locality, including the detection of the Powerful Owl nearby during the survey. The Project will require the primary clearing of up to 4.30 ha, secondary clearing of up to 2.24 ha, and temporary disturbance of up to 0.16 ha of native vegetation which may be utilised as habitat by these species, including moderate to highly connected forest and rainforest habitats. The Project is unlikely to have an adverse effect on these large forest owls as no hollow-bearing trees or mature trees would be impacted by the Project and, therefore, it will not impact on any roosting/breeding habitat that has the potential to be used by these species. Habitat of some prey species may be impacted by the removal of understorey vegetation, however this impact is considered minimal due to the narrow and linear nature of the clearing and extensive surrounding vegetation.

Large forest owls: Powerful Owl, Sooty Owl	
	These species are highly mobile and wide-ranging, and the large intact patches of vegetation within the Illawarra Escarpment provide extensive areas of habitat facilitating fauna movement and providing foraging and roosting resources throughout the region.. It is considered unlikely that these species are limited/restricted to the study area. The Project is unlikely to have an adverse effect on the Powerful Owl or Sooty Owl, such that a viable local population of either species is likely to be placed at risk of extinction.
b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or ii) (ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction	N/A
c) in relation to the habitat of a threatened species or ecological community: i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,	**Extent of impact on habitat:** Primary clearing of up to 4.30 ha, secondary clearing of up to 2.24 ha, and temporary disturbance of up to 0.16 ha of native vegetation will occur as a result of the Project. This vegetation is in mostly moderate to good condition, with some existing disturbance from previous clearing activity and presence of weeds. No hollow-bearing trees or mature trees would be impacted by the Project. Therefore, there is unlikely to be a direct impact to known or potential breeding habitat for these species. Habitat of some prey species may be impacted by the removal of understorey vegetation, however this impact is considered minimal due to the narrow and linear nature of the clearing and extensive surrounding vegetation. **Habitat fragmentation:** The linear clearing of understorey vegetation only, is unlikely to lead to fragmentation or isolation from other areas of habitat as a result of the proposed activity. The narrow mountain bike trails (generally 1.2 m wide) and associated impacts will not be sufficiently wide enough to act as a barrier to movement for highly mobile forest owls. **Importance of habitat to be impacted:** The habitat to be removed represents typical foraging habitat available within the region. Extensive foraging resources are present within the study area, and the adjacent and extensive bushland areas. There will be no impacts to known or potential breeding habitat for these species. The species is unlikely to be dependent on the resources within the study area for its long-term survival in the locality.

Large forest owls: Powerful Owl, Sooty Owl	
d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),	No AOBV are present within the areas to be cleared or potentially impacted by the Project.
e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.	The following KTPs are known to exist or have the potential to be exacerbated by the Project: • Clearing of native vegetation Section 4.1.3 provides a full analysis of the potential operation of KTPs within the study area due to the proposed works. The only KTP that will be impacting large forest owls and increased as a result of the Project is the clearing of native vegetation. In this case, the proposed trails equate to primary clearing of approximately 4.30 ha, secondary clearing of approximately 2.24 ha, and temporary disturbance of approximately 0.16 ha of native vegetation. No canopy trees will be removed as part of the Project. Habitat of some prey species may be impacted by the removal of understorey vegetation, however this impact is considered minimal due to the narrow and linear nature of the clearing and extensive surrounding vegetation.
Conclusion: The long-term local occurrence of the Powerful Owl and Sooty Owl is unlikely to be significantly affected by the Project given their mobility, the relatively small proportion of foraging habitat that will be directly impacted in comparison with available habitat immediately adjacent to the study area, and the avoidance of potential breeding habitat.	

Olive Whistler, Pink Robin	
Olive Whistler **Distribution:** The Olive Whistler inhabits the wet forests on the ranges of the east coast. It has a disjunct distribution in NSW chiefly occupying the beech forests around Barrington Tops and the MacPherson Ranges in the north and wet forests from the Illawarra region south to Victoria. In the south it is found inland to the Snowy Mountains and the Brindabella Range. The species was not detected within the study area during field surveys. **Habitat:** Mostly inhabits wet forests above about 500 m. During the winter months they may move to lower altitudes. The Olive Whistler forages in trees and shrubs and on the ground, feeding on berries and insects, and nests in low forks of shrubs. **Pink Robin** **Distribution:** The Pink Robin is found in Tasmania and the uplands of eastern Victoria and far south-eastern NSW, almost as far north as Bombala. On the mainland, the species disperses north and west and into more open habitats in winter, regularly as far north as the ACT area, and sometimes being found as far north as the central coast of NSW. The species was not detected within the study area during field surveys. **Life cycle, habitat:** Inhabits rainforest and tall, open eucalypt forest, particularly in densely vegetated gullies. Catches prey by the perch-and-pounce method, foraging more on the ground than the more flycatcher-like Rose Robin. Insects and spiders are the main dietary items. The Pink Robin nests in an upright or oblique fork, from 30cm to 6m above the ground, in deep undergrowth. **Impact Summary:** The Project will require the primary clearing of approximately 4.30 ha, secondary clearing of approximately 2.24 ha, and temporary disturbance of approximately 0.16 ha of native vegetation which may be utilised as habitat by these species, including moderate to highly connected forest and rainforest habitats.	
Assessment of significance: An action is likely to have a significant impact on a threatened species if there is a real chance or possibility that it will:	
Criteria	**Address of Criteria**
a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The Project will require the primary clearing of approximately 4.30 ha, secondary clearing of approximately 2.24 ha, and temporary disturbance of approximately 0.16 ha of native vegetation which may be utilised as habitat by these species, including moderate to highly connected forest and rainforest habitats. No canopy trees will be removed as part of the Project. The Project has the potential to impact wet forest birds through removal of nesting/roosting sites and disturbance of foraging habitat. However, the amount of vegetation to be removed as a result of the Project and its linear nature (generally 1.2 m wide trail) is considered negligible when compared to the large extensive and intact patches of vegetation that is present within the Illawarra Escarpment. This provides extensive areas of habitat facilitating fauna movement and providing foraging and roosting resources throughout the region for the Olive Whistler and Pink Robin. The Project is unlikely to have an adverse effect on the Olive Whistler or Pink Robin, such that a viable local population of either species is likely to be placed at risk of extinction.
b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or	N/A

Olive Whistler, Pink Robin	
ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction	
c) in relation to the habitat of a threatened species or ecological community: i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,	**Extent of impact on habitat:** The primary clearing of approximately 4.30 ha, secondary clearing of approximately 2.24 ha, and temporary disturbance of approximately 0.16 ha native vegetation may reduce both potential nesting and shelter habitat for these species, as well as habitat for prey species (insects). However, the reduction of potential habitat is considered minimal due to the small with of the trail (1.5 m), highly mobile nature of these species, and the abundance of suitable habitat present in, and surrounding, the study area. No canopy trees will be removed as part of the Project. **Habitat fragmentation:** The linear clearing of understorey vegetation only, is unlikely to lead to fragmentation or isolation from other areas of habitat as a result of the proposed activity. The narrow mountain bike trails (generally 1.2 m wide) and associated impacts will not be sufficiently wide enough to act as a barrier to the movement of these highly mobile wet forest birds. **Importance of habitat to be impacted:** The habitat to be removed within the study area is unlikely to represent habitat of local importance for these species, and likely only forms a small part of the foraging and nesting habitat required and used by this species. As such, they are considered unlikely to be solely dependent on the habitat resources present within the study area for their survival. Extensive suitable foraging and nesting resources are present within the study area, and the adjacent and extensive bushland areas.
d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),	No AOBV are present within the areas to be cleared or potentially impacted by the Project.
e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.	The following KTPs are known to exist or have the potential to be exacerbated by the Project: • Clearing of native vegetation. Section 4.1.3 provides a full analysis of the potential operation of KTPs within the study area due to the proposed works. The only KTP that will be impacting wet forest birds and increased as a result of the Project is the clearing of native vegetation. In this case, the proposed trails equate to primary clearing of approximately 4.30 ha, secondary clearing of approximately 2.24 ha, and temporary disturbance of approximately 0.16 ha of native vegetation. No canopy trees will be removed as part of the Project. The Project may reduce both potential nesting and shelter habitat for these species, as well as habitat for prey species (insects), however this impact is considered minimal due to the narrow and linear nature of the clearing and extensive surrounding vegetation. As such, the Project is unlikely to significantly contribute to a KTP for these species.
Conclusion: The Project is considered unlikely to have a significant impact on wet forest birds.	

Gang-gang Cockatoo	
Gang-gang Cockatoo **Distribution:** The Gang-gang Cockatoo is a medium sized bird with a distribution spanning from southern Victoria to south and central eastern NSW. In NSW the species is distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes. It also occurs regularly in the Australian Capital Territory. **Life cycle, habitat:** The Gang-gang Cockatoo prefers different habitat types according to the season. In spring and summer, the species will inhabit tall mountain forests and woodlands including wet sclerophyll forests, while in autumn and winter, it will move to lower altitudes and occupy open dry sclerophyll forests and woodlands including box-gum and box-ironbark vegetation communities. The Gang-gang Cockatoo is known to occasionally inhabit sub-alpine Snow Gum (*Eucalyptus pauciflora*) woodland in addition to temperate rainforests. The preferred breeding habitat of the Gang-gang Cockatoo occurs in old growth forest and woodlands containing numerous hollows higher than 9 m above ground level and larger than 10 cm in diameter. The species nests in hollows in the trunks, limbs or dead spouts of tall living trees, especially Eucalyptus species, often near waterways or waterbodies. A clutch of up to two eggs is laid in spring to summer. Each pair has a single successful brood per year, though pairs may have a second attempt if the first attempt fails early in the season. The incubation period is approximately four weeks duration, the nesting period is seven to eight weeks long and the post fledgling dependence period lasts at least four to six weeks. **Impact summary:** The Project will require the primary clearing of up to 4.30 ha, secondary clearing of up to 2.24 ha, and temporary disturbance of up to 0.16 ha of native vegetation which may be utilised as habitat by these species, including moderate to highly connected forest and rainforest habitats. No hollow-bearing trees or mature trees would be impacted by the Project.	
Assessment of significance: An action is likely to have a significant impact on a threatened species if there is a real chance or possibility that it will:	
Criteria	**Address of Criteria**
a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The Project will require the primary clearing of up to 4.30 ha, secondary clearing of up to 2.24 ha, and temporary disturbance of up to 0.16 ha of native vegetation which may be utilised as habitat by these species, including moderate to highly connected forest and rainforest habitats. The Project is unlikely to have an adverse effect on the Gang-gang Cockatoo as no hollow-bearing trees or mature trees would be impacted by the Project and, therefore, it will not impact on any roosting/breeding habitat that has the potential to be used by this species. Habitat of some prey species may be impacted by the removal of understorey vegetation, however this impact is considered minimal due to the narrow and linear nature of the clearing and extensive surrounding vegetation. The Gang-gang Cockatoo is highly mobile and wide-ranging, and the large intact patches of vegetation within the Illawarra Escarpment provide extensive areas of habitat facilitating fauna movement and providing foraging and roosting resources throughout the region. It is considered unlikely that this species is limited/restricted to the study area. The Project is unlikely to have an adverse effect on the Gang-gang Cockatoo, such that a viable local population of this species is likely to be placed at risk of extinction.
b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or	N/A

Gang-gang Cockatoo	
ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction	
c) in relation to the habitat of a threatened species or ecological community: i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,	**Extent of impact on habitat:** Primary clearing of up to 4.30 ha, secondary clearing of up to 2.24 ha, and temporary disturbance of up to 0.16 ha of native vegetation will occur as a result of the Project. This vegetation is in mostly moderate to good condition, with some existing disturbance from previous clearing activity and presence of weeds. No hollow-bearing trees or mature trees would be impacted by the Project. Therefore, there is unlikely to be a direct impact to known or potential breeding habitat for these species. Habitat of some prey species may be impacted by the removal of understorey vegetation, however this impact is considered minimal due to the narrow and linear nature of the clearing and extensive surrounding vegetation. **Habitat fragmentation:** The linear clearing of understorey vegetation only, is unlikely to lead to fragmentation or isolation from other areas of habitat as a result of the proposed activity. The narrow mountain bike trails (generally 1.2 m wide) and associated impacts will not be sufficiently wide enough to act as a barrier to movement for highly mobile forest owls. **Importance of habitat to be impacted:** The habitat to be removed represents typical foraging habitat available within the region. Extensive foraging resources are present within the study area, and the adjacent and extensive bushland areas. There will be no impacts to known or potential breeding habitat for these species. The species is unlikely to be dependent on the resources within the study area for its long-term survival in the locality.
d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),	No AOBV are present within the areas to be cleared or potentially impacted by the Project.
e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.	The following KTPs are known to exist or have the potential to be exacerbated by the Project: • Clearing of native vegetation Section 4.1.3 provides a full analysis of the potential operation of KTPs within the study area due to the proposed works. The only KTP that will be impacting the Gang-gang Cockatoo and increased as a result of the Project is the clearing of native vegetation. In this case, the proposed trails equate to primary clearing of approximately 4.30 ha, secondary clearing of approximately 2.24 ha, and temporary disturbance of approximately 0.16 ha of native vegetation. No canopy trees or hollow-bearing trees will be removed as part of the Project. Habitat of some prey species may be impacted by the removal of understorey vegetation, however this impact is considered minimal due to the narrow and linear nature of the clearing and extensive surrounding vegetation.

Gang-gang Cockatoo
Conclusion: The long-term local occurrence of the Gang-gang Cockatoo is unlikely to be significantly affected by the Project given their mobility, the relatively small proportion of foraging habitat that will be directly impacted in comparison with available habitat immediately adjacent to the study area, and the avoidance of potential breeding habitat.

Rosenberg's Goanna	
Distribution: Rosenberg's Goanna occurs on Sydney Sandstone in Wollemi National Park to the north-west of Sydney, in the Goulburn and ACT regions and near Cooma in the south. There are records from the Southwest Slopes near Khancoban and Tooma River. Also occurs in South Australia and Western Australia. The species was not detected within the study area during field surveys. **Life cycle, habitat:** Found in heath, open forest, and woodland where it shelters in hollow logs, rock crevices and in burrows, which they may dig for themselves, or use those of other species, such as rabbit warrens. Associated with termites and the mounds of which this species nests in, termite mounds are a critical component of this species' habitat. The Rosenberg's Goanna lays up to 14 eggs in a termite mound which the hatchlings dig themselves out of. Individuals require large areas of habitat and feed on carrion, birds, eggs, reptiles and small mammals. **Impact summary:** The Project will require the primary clearing of 1.01 ha, secondary clearing of 0.86 ha, and temporary disturbance of 0.045 ha of native, including moderate to highly connected forest and rainforest habitats.	
Assessment of significance: An action is likely to have a significant impact on a threatened species if there is a real chance or possibility that it will:	
Criteria	**Address of Criteria**
a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	The Project will require the primary clearing of 1.01 ha, secondary clearing of 0.86 ha, and temporary disturbance of 0.045 ha of associated PCTs which may be utilised as habitat by this species, including moderate to highly connected rainforest habitat. A small number of termite mounds were seen within the study area during the field survey, none of which are present along the proposed trails. Termite mounds are an important nesting resource for the Rosenberg's Goanna. No large hollow woody debris, hollow-bearing trees or termite mounds would be impacted by the Project; therefore, direct impacts to potential Rosenberg's Goanna sheltering habitat or hollow-dependant prey species is unlikely. Habitat of some prey species may be indirectly impacted by the removal of understorey vegetation, however this impact is considered minimal due to the narrow and linear nature of the clearing and extensive surrounding vegetation. Due to the large area of similar habitat available within the surrounding area, it is considered unlikely that Rosenberg's Goanna are limited/restricted to the study area. The large intact patches of vegetation within the Illawarra Escarpment provide extensive areas of habitat facilitating fauna movement and providing foraging and den resources throughout the region. The Project is unlikely to have an adverse effect on the Rosenberg's Goanna, such that a viable local population of the species is likely to be placed at risk of extinction.
b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or ii) is likely to substantially and adversely modify the composition of the ecological community such that	N/A

Rosenberg's Goanna	
its local occurrence is likely to be placed at risk of extinction	
c) in relation to the habitat of a threatened species or ecological community: i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,	**Extent of impact on habitat:** Primary clearing of 1.01 ha, secondary clearing of 0.86 ha, and temporary disturbance of 0.045 ha of associated native vegetation in mostly moderate to good condition, with some existing disturbance from previous clearing activities and presence of weeds. No large hollow woody debris, hollow-bearing trees or termite mounds would be impacted by the Project; therefore, direct impacts to potential Rosenberg's Goanna sheltering habitat or hollow-dependant prey species is unlikely. Habitat of some prey species may be impacted by the removal of understorey vegetation, however this impact is considered minimal due to the narrow and linear nature of the clearing and extensive surrounding vegetation. Termite mounds do not occur along the proposed trail and will be avoided by the proposed works and therefore are unlikely to be impacted. **Habitat fragmentation:** The linear clearing of understorey vegetation only, is unlikely to lead to fragmentation or isolation from other areas of habitat as a result of the proposed activity. The narrow mountain bike trails (generally 1.2 m wide) and associated impacts will not be sufficiently wide enough to act as a barrier to the movement of the Rosenberg's Goanna. **Importance of habitat to be impacted:** The habitat to be removed represents typical foraging habitat available within the region. Extensive foraging resources are present within the study area, and the adjacent and extensive bushland areas. No hollow woody debris or termite mounds would be removed as part of the Project; therefore, there will be no direct impacts to known or potential sheltering or breeding habitat for the Rosenberg's Goanna. The species is unlikely to be dependent on the resources present within the study area for its long-term survival in the locality.
d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),	No AOBV are present within the areas to be cleared or potentially impacted by the Project.
e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.	The following KTPs are known to exist or have the potential to be exacerbated by the Project: • Clearing of native vegetation Section 4.1.3 provides a full analysis of the potential operation of KTPs within the study area due to the proposed works. The only KTP that will be impacting the Rosenberg's Goanna and increased as a result of the Project is the clearing of native vegetation. In this case, the proposed trails equate to primary clearing of 1.01 ha, secondary clearing of 0.86 ha, and temporary disturbance of 0.045 ha of native vegetation. No large hollow woody debris, hollow-bearing trees or termite mounds will be removed as part of the Project. The Project is unlikely to significantly contribute to KTPs for the sp
Conclusion: The Project is considered unlikely to have a significant impact on wet forest birds.	

Appendix 3. Assessments of Significance (EPBC Act)

An AoS is provided for the following EPBC Act listed threatened and migratory biodiversity in relation to the Project:

- Threatened Ecological Communities
  - Illawarra-Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion (ISR) (Critically Endangered)
- Threatened Fauna
  - Giant Burrowing Frog (Vulnerable)
  - Stuttering Frog (Vulnerable)
  - Grey-headed Flying-fox (Vulnerable)
  - Large-eared Pied Bat (Vulnerable)
  - Spotted-tailed Quoll (Endangered)
  - Rufous Fantail (Migratory)
  - Black-faced Monarch (Migratory).

Illawarra-Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion (ISR)		
Refer to ISR ToS above for information on description, distribution, and summary of impacts and context of ISR for the Project.		
An action is likely to have a significant impact on a threatened ecological community if there is a real chance or possibility that it will:		
Assessment of significance	**Response**	**Likelihood**
• reduce the extent of an ecological community	The Project would involve the removal of 0.45 ha of ISR native vegetation from both primary and secondary clearing. An additional 0.015 ha may be temporarily impacted through the use of a helicopter drop zone. The extent of ISR is estimated to be 6500ha (DAWE 2022b), therefore the extent would be reduced by approximately <0.01%. The extent of occurrence of a community is considered as the area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected sites of present occurrence (as per IUCN criteria). The current extent of ISR includes areas of the community in all directions from the Project footprint. Therefore, the current Project is considered unlikely to reduce the overall extent of occurrence of the community. The Project will only remove the understory, and smaller midstory vegetation, leaving intact the canopy and large shrubs typical of the ISR community, such as the Giant Stinging Tree.	Likely – small reduction extent (0.01% reduction). No reduction in overall extent of occurrence.
• fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	The Project would not result in an increase in the level of fragmentation for the existing remnant ISR patch. The increased fragmentation within the midstory and understory layers of the vegetation via the introduction of narrow mountain bike trails (generally 1.2 m wide) is unlikely to reduce seed dispersal and animal dispersal for some species that are currently able to move between patches of ISR.	Unlikely –small increase, no greater than an existing goat/ deer tracks.
• adversely affect habitat critical to the survival of an ecological community	The area considered critical to the survival of the ecological community includes all patches that meet the key diagnostic characteristics and at least the minimum condition thresholds (Moderate or High Condition classes) (DoEE 2019). From the plot data collected there are areas of ISR that meet High Condition class (Category B), 10 species from the flora list present. two of the specialist bird species and Although the removal of 0.45 ha of this community by the Project would not adversely affect habitat critical to the survival of ISR as the canopy and large shrubs will remain intact leaving the community to thrive with large *Ficus spp*. (Fig trees) and various vines (e.g. *Pandorea pandorana* and *Geitonoplesium cymosum*) across the study area being avoided.	Unlikely (mitigated) – only removal of mid and understory vegetation, avoiding large shrubs and canopy trees.
• 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	Some potential impacts arise from the Project within areas of ISR, such as along Byarong Creek. These proposed trails would require creek crossings and would likely experience some temporary level of reduced surface run-off resultant from downhill mountain bike trails and associated water channels, such that overall water availability would slightly decrease. Furthermore, increases in bicycle traffic on the proposed trails will increase soil compaction and nutrient availability in the immediate Project footprint. The overall magnitude of the impacts is considered to be low. There is also an increased risk of weed invasion from trail works and maintenance that will create a disturbance regime in which weeds can move into the study area. These impacts would be managed via rehabilitation efforts within ISR adjacent to the study area. Given the current high concentrations of weeds adjacent to large parts of the	Unlikely (mitigated) - ongoing maintenance of proposed trails to reduce any risk of erosion in the gullies and waterways nearby ISR.

Illawarra-Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion (ISR)		
	study area a management plan has been recommended to reduce the chances of encroachment of many exotic species throughout the higher quality ISR in the study area. The overall modification to the water and soil is temporary during construction, while the ongoing maintenance of the track will avoid any erosion to be increased in these sensitive areas.	
• 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 proposed trails will increase human traffic into the ISR although downhill mountain bikes would be expected to stay on the marked trails. Areas of ISR have been largely avoided and the study area is already used for mountain biking, therefore the Project is unlikely to change the species composition of the TEC.	Unlikely
• cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: – assisting invasive species, that are harmful to the listed ecological community, to become established, or – 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	Given the current low concentrations of weeds within areas to be impacted both directly and indirectly together with ongoing trail maintenance to control weeds and erosion in the study area, the composition of the community is unlikely to change substantially. With the implementation of a management plan for exotic species it is not expected that any new exotic species will become established. Any changes in plant composition are likely to be limited and localised. The fauna assemblage is unlikely to change substantially given the location and size of the impact area in the context of the larger ISR patch. There are no known risks of chemical or pollutant mobilisation from the Project.	Unlikely
• interfere with the recovery of an ecological community.	A recovery plan has not been prepared for ISR. The Conservation Advice provides sufficient guidance on the recovery of the ecological community and a decision to have a recovery plan is unlikely to lead to substantial additional conservation benefits given the resources required to develop a plan. The Project will impact on <0.01% of ISR in the locality of the study area (10 km). Areas of ISR that are proposed to be impacted by the Project are unlikely to be disturbed in the long-term with the implementation of a weed management plan, marking the trails out to reduce people getting lost and leaving the canopy and large shrubs intact.	Unlikely
Conclusion: The EPBC Act assessment concludes that the ISR habitat to be impacted is classed as habitat critical to the survival of the TEC. There will be a small impact in the extent of ISR from the Project (<0.01% in the locality) through primary and secondary clearing and the use of one helicopter drop zone. All other areas of ISR have been avoided, therefore based on EPBC Act guidelines, the Project is not likely to have a significant impact on ISR. Mitigation measures have been recommended which include leaving the canopy and any large shrubs intact and implementing a weed management plan .		

Giant Burrowing Frog		
Refer to Giant Burrowing Frog ToS above for information on distribution, habitat requirements and summary of impacts for the Project.		
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:		
Assessment of significance	**Response**	**Likelihood**
• lead to a long-term decrease in the size of an important population of a species	It is considered unlikely that the proposed action would lead to a long term decrease in the size of any Giant Burrowing Frog population, since measures to avoid key habitat for the species have been adopted and the Project involves only limited disturbance to potential habitat for the species. The proposed activity involves the clearing of a narrow strip (generally 1.2 m wide) of native vegetation for a mountain bike trail and the construction of bridges above the creek channel. Giant Burrowing Frog was not recorded within the study area during the current survey (noting that targeted surveys were not undertaken), however the species is well known from the locality and immediate surrounds, utilising the dense vegetation and surface soil beside ephemeral creeks (Figure 7). A viable local population of the species is likely to occur in the study area.	Unlikely
• reduce the area of occupancy of the species	The Project is not likely to reduce the area of occupancy of any population of the species.	Unlikely
• fragment an existing population into two or more populations	Whilst clearing would take place within potential habitat for the Giant Burrowing Frog, this would not cause fragmentation for the species as there would be no permanent barriers to movement of individuals.	Unlikely
• adversely affect habitat critical to the survival of a species	The Project is not likely to affect habitat critical to the survival of the species as the impacts are temporary in disturbed locations along Byarong Creek, and Brandy and Water Creek. The habitat in nearby ephemeral creeks would not be impacted by the Project and offer more adequate habitat for the species.	Unlikely
• disrupt the breeding cycle of an important population	The Project is not likely to significantly disrupt the breeding cycle of any population as it would only potentially impact a very small area of limited shelter, breeding or foraging habitat.	Unlikely
• modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The temporary modification of the ephemeral creeks and nearby vegetation is unlikely to have long-term negative consequences for the species. It is considered unlikely that the action would modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the Giant Burrowing Frog is likely to decline.	Unlikely
• result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	The Project would introduce tracks into some areas of relatively pristine habitat, which generally increases the potential for invasive predators to move into new areas. However, the proposed tracks are minor in nature (generally 1.2 m wide) and the tracks would be raised onto bridges and creek crossings to avoid any damage to the habitat of the creek channels. It is therefore unlikely that the Project would lead to the establishment of invasive species harmful to the Giant Burrowing Frog.	Unlikely
• introduce disease that may cause the species to decline	Whilst there is some potential for plant and machinery to transport and disperse soil pathogens throughout the study area during the works, this risk would be managed through the use of vehicle quarantining procedures. It is considered unlikely that the Project would introduce disease that may cause the Giant Burrowing Frog to decline.	Unlikely

Giant Burrowing Frog		
• interfere substantially with the recovery of the species.	There is no adopted or made recovery plan for this species (DAWE 2022d).	Unlikely
Conclusion: The proposed action will remove up to 7.96 ha of native vegetation through both primary and secondary clearing, some of which may provide habitat for the Giant Burrowing Frog. However, given that impacts are relatively minor, the study area is likely to continue to provide habitat for the species. The Project is considered unlikely to have a significant impact on the Giant Burrowing Frog.		

Stuttering Frog		
Refer to Stuttering Frog ToS above for information on distribution, habitat requirements and summary of impacts for the Project.		
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:		
Assessment of significance	**Response**	**Likelihood**
• lead to a long-term decrease in the size of an important population of a species	It is considered unlikely that the proposed action would lead to a long term decrease in the size of any Stuttering Frog population, since measures to avoid key habitat for the species have been adopted and the Project involves only limited disturbance to potential habitat for the species. The proposed activity involves the clearing of a narrow strip (generally 1.2 m wide) of native vegetation for a mountain bike trail and the construction of bridges above the creek channel. Stuttering Frog was not recorded within the study area during the current survey (noting that targeted surveys were not undertaken). BioNet records show the nearest Stuttering Frog record to be 20 km south-west of the study area (recorded in 2005) (DPE 2022b).	Unlikely
• reduce the area of occupancy of the species	The Project is not likely to reduce the area of occupancy of any population of the species.	Unlikely
• fragment an existing population into two or more populations	Whilst clearing would take place within potential habitat for the Stuttering Frog, this would not cause fragmentation for the species as there would be no permanent barriers to movement of individuals.	Unlikely
• adversely affect habitat critical to the survival of a species	The Project is not likely to affect habitat critical to the survival of the species as the impacts are temporary in disturbed locations along Byarong Creek, and Brandy and Water Creek. The habitat in nearby ephemeral creeks would not be impacted by the Project and offer more adequate habitat for the species.	Unlikely
• disrupt the breeding cycle of an important population	The Project is not likely to significantly disrupt the breeding cycle of any population as it would only potentially impact a very small area of limited shelter, breeding or foraging habitat.	Unlikely
• modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The temporary modification of the ephemeral creeks and nearby vegetation is unlikely to have long-term negative consequences for the species. It is considered unlikely that the action would modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the Stuttering Frog is likely to decline.	Unlikely
• result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	The Project would introduce tracks into some areas of relatively pristine habitat, which generally increases the potential for invasive predators to move into new areas. However, the proposed tracks are minor in nature (generally 1.2 m wide) and the tracks would be raised onto bridges and creek crossings to avoid any damage to the habitat of the creek channels. It is therefore unlikely that the Project would lead to the establishment of invasive species harmful to the Stuttering Frog.	Unlikely
• introduce disease that may cause the species to decline	Whilst there is some potential for plant and machinery to transport and disperse soil pathogens throughout the study area during the works, this risk would be managed through the use of vehicle quarantining procedures. It is considered unlikely that the Project would introduce disease that may cause the Stuttering Frog to decline.	Unlikely
• interfere substantially with the recovery of the species.	There is no adopted or made recovery plan for this species.	Unlikely

Stuttering Frog
Conclusion: The proposed action will remove up to 7.96 ha of native vegetation through both primary and secondary clearing, some of which may provide habitat for the Stuttering Frog. However, given that impacts are relatively minor, the study area is likely to continue to provide habitat for the species. The Project is considered unlikely to have a significant impact on the Stuttering Frog.

Grey-headed Flying-fox		
Refer to Grey-headed Flying-Fox ToS above for information on distribution, habitat requirements and summary of impacts for the Project.		
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:		
Criteria	**Address of Criteria**	**Likelihood**
• lead to a long-term decrease in the size of an important population of a species	According to the National Flying-fox monitor, the nearest nationally important flying-fox camp is located around 12 km to the north-east of the study area, at Thirroul (DAWE 2022c). While this is the case, there is a known camp site at Figtree (around 2 km south-east of the study area [DAWE 2022c]). Field surveys did not identify any established camps within the study area. There are numerous Grey-headed Flying-Fox records in the locality, and it is likely that the species may use the habitat within the study area on occasion as a foraging resource. Impacts of the Project would be restricted to the primary clearing of approximately 4.30 ha, secondary clearing of approximately 2.24 ha, and temporary disturbance of approximately 0.16 ha of native understorey vegetation. Given the abundance of potential foraging habitat, and other areas of native vegetation within the locality, the proposed vegetation removal is considered unlikely to have an impact on important life-cycle stages of the Grey-headed Flying-Fox, such that a viable local population of the species would be placed at risk of extinction. Therefore, the works are unlikely to lead to a long-term decrease in the size of an important population of the Grey-headed Flying-Fox.	Unlikely
• reduce the area of occupancy of an important population	The Project will result in the primary clearing of approximately 4.30 ha, secondary clearing of approximately 2.24 ha, and temporary disturbance of approximately 0.16 ha of native understorey vegetation. However, given the study area is connected to extensive areas of native vegetation in the surrounding locality and region that provide an abundance of foraging resources, and the narrow and linear nature of the area to be impacted, it is unlikely that the Project would adversely impact this highly mobile species. No Flying-fox camps/breeding/roosting habitats were identified, or are known to occur, within, or in close proximity to, the study area. As such, no suitable Flying-fox camps will be impacted by the Project. The Project is unlikely to result in a reduction in the area of occupancy of an important population of Grey-headed Flying-Fox.	Unlikely
• fragment an existing important population into two or more populations	According to the National Flying-fox monitor, there are no nationally important flying-fox camps known within, or close to, the study area (DAWE 2022c). The nearest nationally important flying-fox camp is located around 12 km to the north-east of the study area, at Thirroul. Due to the transient nature of the species, constant genetic exchange and movement, there is not one single breeding population. Given the high mobility of the species, the linear and narrow (generally 1.2 m wide) clearing of understorey vegetation only, the Project would be unlikely to increase fragmentation for this species.	Unlikely
• adversely affect habitat critical to the survival of a species	Critical habitat defined for the survival of the Grey-headed Flying-Fox includes (DAWE 2021): • Important winter and spring vegetation communities that contain *Eucalyptus tereticornis, E. albens, E. crebra, E. fibrosa, E. melliodora, E. paniculata, E. pilularis, E. robusta, E. seeana, E. sideroxylon, E. siderophloia, Banksia integrifolia, Castanospermum australe, Corymbia citriodora, C. eximia, C. maculata, Grevillea robusta, Melaleuca quinquenervia or Syncarpia glomulifera*	Unlikely

Grey-headed Flying-fox		
	• native species that are known to be productive as foraging habitat during the final weeks of gestation, and during the weeks of birth, lactation and conception (August to May) • native species (additional to the aforementioned species) used for foraging and that occur within 20 km of a nationally important camp as identified on the Department's interactive flying-fox web viewer, or • native and or exotic species used for roosting at the site of a nationally important Grey-Headed Flying-Fox camp as identified on the Department's interactive flying-fox web viewer. The study area supports vegetation that may provide suitable foraging habitat within 20 km of a nationally important camp (Thirroul) (DAWE 2022c), however, it does not support any of the tree species identified above as critical habitat. Foraging habitat loss is the primary threat for Grey-headed Flying-fox, however, given no mature or canopy trees will require clearing as part of the Project, the loss of foraging habitat is negligible. Further, no Flying-fox camps are present in the study area. The Grey-headed Flying-fox is unlikely to be dependent on the vegetation impacted within the study area for its long-term survival in the locality. Given the high mobility of this species, the vegetation clearing proposed is unlikely to adversely affect habitat critical to the survival of the species.	
• disrupt the breeding cycle of an important population	Due to the nomadic nature of species, constant genetic exchange and movement, there is not one single breeding population. Depending on the time of the project being implemented may potentially impact species aggregation for mating or female gestation and birth. However, given there are no significantly close camps/breeding/roosting habitats to the study area (the closest known nationally important flying-fox camp is located around 12 km to the north-east of the study area, at Thirroul [DAWE 2022c]) it is unlikely the Project will disrupt the breeding cycle of the species. Given the abundance of potential foraging habitat, and other areas of native vegetation within the locality, the removal of understorey vegetation is considered unlikely to have impacts on important life-cycle stages of the Grey-headed Flying-fox, such that a viable local population of the species would be placed at risk of extinction.	Unlikely
• modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The Project will result in the primary clearing of approximately 4.30 ha, secondary clearing of approximately 2.24 ha, and temporary disturbance of approximately 0.16 ha of native understorey vegetation. However, the area to be cleared is relatively small when compared to the large extensive and intact patches of vegetation that are present within the Illawarra Escarpment, these areas also providing an abundance of foraging resources. Therefore, the Project will not substantially modify or decrease the availability or quality of habitat of a known population of Grey-headed Flying-fox, such to the extent that the species is likely to decline.	Unlikely
• result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	The Project would introduce tracks into some areas of relatively pristine habitat, which generally increases the potential for invasive species to move into new areas. However, the proposed tracks are minor in nature (generally 1.2 m wide). A proposed management plan will aim to prevent the establishment of any exotic species. It is unlikely that the Project would lead to the establishment of invasive species that are harmful to the Grey-headed Flying-fox.	Unlikely
• introduce disease that may cause the species to decline, or	Incidence of Australian Bat Lyssavirus (ABL) is very low (<1%), little is known about Bat Paramyxovirus, and 25% of wild flying-fox carry antibodies to Menangle Pig Virus.	Unlikely

Grey-headed Flying-fox		
	In addition, whilst there is some potential for plant and machinery to transport and disperse soil pathogens throughout the study area during the works, this risk would be managed through the use of vehicle quarantining procedures. It is considered unlikely that the Project would introduce disease that may cause the Grey-headed Flying-fox to decline.	
• interfere substantially with the recovery of the species.	No Flying-fox camps have been recorded in the study area (DAWE 2022c, authors). With reference to the National Recovery Plan for the Grey-headed Flying-fox (DAWE 2021), the Project is unlikely to interfere substantially with the recovery of the Grey-headed Flying-fox.	Unlikely
Conclusion: Based on the above considerations, the Project is considered unlikely to have a significant impact on a population of the Grey-headed Flying-fox.		

Spotted-tailed Quoll		
Refer to Spotted-tailed Quoll ToS above for information on distribution, habitat requirements and summary of impacts for the Project.		
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:		
Criteria	**Address of Criteria**	**Likelihood**
• lead to a long-term decrease in the size of a population	The Project is unlikely to have an adverse effect on the Spotted-tailed Quoll as no hollow-bearing trees or large woody debris will be removed as result of the Project; therefore, no potential den habitat will be impacted. Habitat of some prey species may be impacted by the removal of understorey vegetation, however this impact is considered minimal due to the narrow and linear nature of the clearing and extensive surrounding vegetation. The Spotted-tailed Quoll has a relatively large home range (200-500 ha), and it is considered that the study area likely constitutes only a small part of this. The large intact patches of vegetation within the Illawarra Escarpment provide extensive areas of habitat facilitating fauna movement and providing foraging and den resources throughout the region. In addition, previous records within the locality (DPE 2022b) indicate that if Spotted-tailed Quolls were to use the study area, it would only do so on an occasional basis. Therefore, the Project is considered unlikely to lead to a long-term decrease in a potentially occurring Spotted-tailed Quoll population.	Unlikely
• reduce the area of occupancy of the species	The Project will require the primary clearing of 4.30 ha, secondary clearing of 2.24 ha, and temporary disturbance of 0.16 ha of native vegetation that may be utilised as habitat by this species. However, given the study area is connected to extensive areas of native vegetation in the surrounding locality and region that provide an abundance of foraging resources, and the narrow and linear nature of the area to be impacted, it is unlikely that the Project would adversely impact the Spotted-tailed Quoll.. No hollow-bearing trees or large woody debris would be impacted by the Project; therefore, no potential den habitat will be impacted. The Project is unlikely to result in a reduction in the area of occupancy of the Spotted-tailed Quoll.	Unlikely
• fragment an existing population into two or more populations	The linear clearing of understorey vegetation only, is unlikely to lead to fragmentation or isolation from other areas of habitat as a result of the proposed activity. The narrow mountain bike trails (generally 1.2 m wide) and associated impacts will not be sufficiently wide enough to act as a barrier to the movement of the Spotted-tailed Quoll.	Unlikely
• adversely affect habitat critical to the survival of a species	The Project will require the primary clearing of 4.30 ha, secondary clearing of 2.24 ha, and temporary disturbance of 0.16 ha of native vegetation which may be utilised as habitat by this species. However, given that the Project will not impact any den habitat, and that the surrounding habitat is highly connected with plentiful foraging resources, it is unlikely to adversely impact habitat critical to the survival of the species.	Unlikely
• disrupt the breeding cycle of a population	No hollow-bearing trees or large woody debris would be impacted by the Project; therefore, there will be no direct impacts to known or potential den habitat for this species, which are of key importance for its survival. As such, the Project is unlikely to disrupt the breeding cycle of any potentially occurring Spotted-tailed Quoll population.	Unlikely

Spotted-tailed Quoll		
• modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The Project will require the primary clearing of approximately 4.30 ha, secondary clearing of approximately 2.24 ha, and temporary disturbance of approximately 0.16 ha of native vegetation which may be utilised as habitat by the Spotted-tailed Quoll. This area constitutes a relatively small proportion of suitable habitat within the locality. No habitat will be isolated as a result of the Project as the bike trail will be very narrow (generally 1.2 m wide) and only understorey vegetation will be removed. It is unlikely, based on the relatively small proportion of potential habitat to be removed and abundance of adjacent suitable habitat, that the Project would result in an impact that will cause the Spotted-tailed Quol.to decline.	Unlikely
• result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	The Project would introduce tracks into some areas of relatively pristine habitat, which generally increases the potential for invasive species to move into new areas. However, the proposed tracks are minor in nature (generally 1.2 m wide). A proposed management plan will aim to prevent the establishment of any exotic species. It is unlikely that the Project would lead to the establishment of invasive species that are harmful to the Spotted-tailed Quoll.	Unlikely
• introduce disease that may cause the species to decline, or	Whilst there is some potential for plant and machinery to transport and disperse soil pathogens throughout the study area during the works, this risk would be managed through the use of vehicle quarantining procedures. It is considered unlikely that the Project would introduce disease that may cause the Spotted-tailed Quoll to decline.	Unlikely
• interfere with the recovery of the species.	The Project will not interfere with the recovery of the Spotted-tailed Quoll.	Unlikely
Conclusion: Based on the above considerations, the Project is considered unlikely to have a significant impact on a population of the Spotted-tailed Quoll.		

Large-eared Pied Bat		
Refer to Large-eared Pied Bat ToS above for information on distribution, habitat requirements and summary of impacts for the Project.		
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:		
Criteria	**Address of Criteria**	**Likelihood**
• lead to a long-term decrease in the size of an important population of a species	The largest known populations of the Large-eared Pied Bat occur in those areas dominated by sandstone escarpments. While there are crevices and cliff sections in the locality, there are no karst, caves, crevices, cliffs or other areas of geological significance within the study area. Given that the proposed bike trail is not in close proximity to any critical habitat (maternity sites or karst systems,) and will involve the clearing of a relatively small area of native vegetation within a well-connected landscape, it is highly unlikely that important populations that occupy the locality will be directly impacted by the Project. In addition, previous records within the locality indicate that if Large-eared Pied Bats were to use the study area, they would only do so on an occasional basis. Therefore, the works are unlikely to lead to a long-term decrease in the size of an important population of Large-eared Pied Bat.	Unlikely
• reduce the area of occupancy of an important population	The Project will result in the primary clearing of approximately 4.30 ha, secondary clearing of approximately 2.24 ha, and temporary disturbance of approximately 0.16 ha of native vegetation which may be utilised as foraging habitat by this species. However, given the study area is connected to extensive areas of native vegetation in the surrounding locality and region that provide an abundance of foraging resources, and the narrow and linear nature of the area to be impacted, it is unlikely that the Project would adversely impact this highly mobile species. There are crevices and cliff sections in the locality but there are no karst, caves, crevices, cliffs or other areas of geological significance within the study area. As such, no suitable roosting or breeding habitat for this species will be impacted by the Project. The Project is unlikely to result in a reduction in the area of occupancy of the Large-eared Pied Bat.	Unlikely
• fragment an existing important population into two or more populations	The linear clearing of understorey vegetation only, is unlikely to lead to fragmentation or isolation from other areas of habitat as a result of the proposed activity. The narrow mountain bike trails (generally 1.2 m wide) and associated impacts will not be sufficiently wide enough to act as a barrier to the movement of this highly mobile species.	Unlikely
• adversely affect habitat critical to the survival of a species	Large-eared Pied Bat is dependent on the presence of diurnal roosts for shelter. Roosts are utilised during the day and also at night when not feeding, as well as for the raising of young. This species has been known to roost in disused mine shafts, caves, overhangs and abandoned Fairy Martin (*Hirundo ariel*) nests. There are only a couple of maternity roosts known in NSW. Any maternity roosts must be considered habitat critical to the survival of the species. No suitable roosting/breeding habitat is present in the study area. Given that the Project will only impact potential foraging habitat , it is considered unlikely to adversely affect habitat critical to the survival of Large-eared Pied Bat.	Unlikely
• disrupt the breeding cycle of an important population	No suitable breeding habitat for this species occurs within the study area; therefore, the Project will not disrupt the breeding cycle of an important population.	Unlikely

Large-eared Pied Bat		
• modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The Project will result in the primary clearing of approximately 4.30 ha, secondary clearing of approximately 2.24 ha, and temporary disturbance of approximately 0.16 ha of native vegetation which may be utilised as foraging habitat by this species. However, the area to be cleared is relatively small when compared to the large extensive and intact patches of vegetation that are present within the Illawarra Escarpment, these areas also providing an abundance of foraging resources. Therefore, the Project will not substantially modify or decrease the availability or quality of habitat of a known population of Large-eared Pied Bat such to the extent that the species is likely to decline.	Unlikely
• result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	The Project would introduce tracks into some areas of relatively pristine habitat, which generally increases the potential for invasive species to move into new areas. However, the proposed tracks are minor in nature (generally 1.2 m wide). A proposed management plan will aim to prevent the establishment of any exotic species. It is unlikely that the Project would lead to the establishment of invasive species that are harmful to the Large-eared Pied Bat.	Unlikely
• introduce disease that may cause the species to decline, or	Whilst there is some potential for plant and machinery to transport and disperse soil pathogens throughout the study area during the works, this risk would be managed through the use of vehicle quarantining procedures. It is considered unlikely that the Project would introduce disease that may cause the Large-eared Pied Bat to decline.	Unlikely
• interfere substantially with the recovery of the species.	The Project will not interfere substantially with the recovery of the Large-eared Pied Bat.	Unlikely
Conclusion: Based on the above considerations, the Project is considered unlikely to have a significant impact on an important population of the Large-eared Pied Bat.		

Rufous Fantail		
Distribution: The Rufous Fantail occurs in coastal and near coastal districts of northern and eastern Australia. The Rufous Fantail has breeding populations occurring from about the South Australia-Victoria border, through south and central Victoria, on and east of the Great Divide in New South Wales (NSW), and north to about the NSW-Queensland border; and R. r. intermedia has breeding populations occurring on and east of the Great Divide, from about the NSW-Queensland border, north to the Cairns-Atherton region, Queensland. Both subspecies winter farther north from Cape York Peninsula in Queensland to Torres Strait and southern Papua New Guinea. The two subspecies intergrade in a zone between the Queensland-NSW border ranges and the Clarence-Orara rivers in NSW. There is no evidence for historical changes in the distribution of the Rufous Fantail in Australia, although populations around Nanango, south-east Queensland, are said to have declined since the 1940s. There is one historical record from Tasmania, in March 1945, but this was probably a vagrant. Estimates of population density vary from 0.02 birds/ha near Canberra to 2.66 birds/ha at Lower Bucca State Forest in north-east NSW. **Habitat:** The Rufous Fantail forages mainly in the low to middle strata of forests, sometimes in or below the canopy or on the ground. In east and south-east Australia, the Rufous Fantail mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts. They occasionally occur in secondary regrowth, following logging or disturbance in forests or rainforests. When on passage, they are sometimes recorded in drier sclerophyll forests and woodlands, often with a shrubby or heath understorey. They are also recorded from parks and gardens when on passage. The Rufous Fantail nests in a fork, from 0.5 m to 3 m (sometimes 7 m) above the ground, favouring creek banks. **Impact summary:** The Project will require the removal of approximately 4.30 ha of native vegetation for primary clearing, 2.24 ha of native vegetation for secondary clearing, and 0.16 ha of temporary impacts to native vegetation at helicopter drop zones. Clearing of native vegetation may reduce both potential nesting and shelter habitat for this species, as well as habitat for prey species (insects). However, the reduction of potential habitat is considered minimal due to the small width of the trail (1.5 m), highly mobile nature of these species, and the abundance of surrounding suitable habitat.		
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:		
Criteria	**Address of Criteria**	**Likelihood**
• substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	Given the lack of literature around the species population, it is difficult to identify whether the study area contains habitat that is important (in accordance with the definition provided by the Commonwealth Department of the Environment [2013]) for the Rufous Fantail; therefore, it is assumed that the habitat present is important habitat for the purpose of this assessment. It Is noted, however, that the study area is not at the limit of this species distribution range. The Project will require the primary clearing of up to 4.30 ha, secondary clearing of up to 2.24 ha, and temporary disturbance of up to 0.16 ha of native vegetation which may be utilised as foraging, shelter, and nesting habitat by this species. However, the habitat to be removed within the study area is unlikely to represent habitat of local importance for the Rufous Fantail, and is considered quite small, given the extensive area of suitable habitat within, and beyond the limits of, the study area. The study area likely represents only a small portion of this species foraging and nesting habitat. Similarly, the narrow mountain bike trails (generally 1.2 m wide) and associated impacts will not be sufficiently wide enough to act as a barrier to the movement of mobile species such as the Rufous Fantail. Therefore, it is unlikely that the clearing required as part of the Project will substantially modify, destroy or isolate an area of important habitat for the Rufous Fantail.	Unlikely
• result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species	The Project would introduce tracks into some areas of relatively pristine habitat, which generally increases the potential for invasive species to move into new areas. However, the proposed tracks are minor in nature (generally 1.2 m wide). A proposed management plan will aim to prevent the establishment of any exotic species. It is unlikely that the Project would lead to the establishment of invasive species that are harmful to the Rufous Fantail.	Unlikely

Rufous Fantail		
• seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	While the Project may result in a minor reduction in foraging, shelter, and nesting habitat, the area of habitat to be removed is relatively small compared to the abundant resources present in the adjacent well-connected landscape. As such, the Project is considered unlikely to disrupt the lifecycle of an ecologically significant proportion of the Rufous Fantail population.	Unlikely
Conclusion: Based on the above considerations, the Project is considered unlikely to have a significant impact on the Rufous Fantail.		

Black-faced Monarch		
Distribution: The Black-faced Monarch is widespread in eastern Australia and a vagrant to Western Australia. In Queensland, it is widespread from the islands of the Torres Strait and on Cape York Peninsula, south along the coasts (occasionally including offshore islands) and the eastern slopes of the Great Divide, to the NSW border. The species has been recorded with the following densities: 0.01 birds/ha near Armidale, 0.2 birds/ha at Moruya; 0.2—0.5 birds/ha near Eden, and 0.1—0.2 birds/ha near Bombala. **Life cycle, habitat:** The Black-faced Monarch forages at all vertical levels of the forest, though most often at low or middle levels, within 6 m of the ground. It breeds in rainforest habitat, generally nesting near the top of trees with large leaves, in the tops of small saplings, or in lower shrubs. The nests are usually secured in a three-pronged fork; less often on horizontal forks or on horizontal branches with thin lateral twigs or shoots. Tree and shrub species used as nest sites include: daisybushes (*Olearia spp.*), Lilly Pilly (*Acmena smithii*), Yellow Sassafras (*Doryphora sassafras*), wattles (*Acacia spp.*), Coachwood (*Ceratopetalum apetalum*), Grey Myrtle (*Backhousia myrtifolia*) and Turpentine (*Syncarpia glomulifera*). The Black-faced Monarch mainly occurs in rainforest ecosystems, including semi-deciduous vine-thickets, complex notophyll vine-forest, tropical (mesophyll) rainforest, subtropical (notophyll) rainforest, mesophyll (broadleaf) thicket/shrubland, warm temperate rainforest, dry (monsoon) rainforest and (occasionally) cool temperate rainforest. It occurs in gullies in mountain areas or coastal foothills. **Impact summary:** The Project will require the removal of approximately 4.30 ha of native vegetation for primary clearing, 2.24 ha of native vegetation for secondary clearing, and 0.16 ha of temporary impacts to native vegetation at helicopter drop zones. Clearing of native vegetation may reduce both potential nesting and shelter habitat for this species, as well as habitat for prey species (insects). However, the reduction of potential habitat is considered minimal due to the small width of the trail (1.5 m), highly mobile nature of these species, and the abundance of surrounding suitable habitat.		
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:		
Criteria	**Address of Criteria**	**Likelihood**
• substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species	Given the lack of literature around the species population, it is difficult to identify whether the study area contains habitat that is important (in accordance with the definition provided by DoE [2013]) for the Black-faced Monarch; therefore, it is assumed that the habitat present is important habitat for the purpose of this assessment. It Is noted, however, that the study area is not at the limit of this species distribution range. The Project will require the primary clearing of up to 4.30 ha, secondary clearing of up to 2.24 ha, and temporary disturbance of up to 0.16 ha of native vegetation which may be utilised as foraging, shelter, and nesting habitat by this species. However, the habitat to be removed within the study area is unlikely to represent habitat of local importance for the Black-faced Monarch, and is considered quite small, given the extensive area of suitable habitat within, and beyond the limits of, the study area. The study area likely represents only a small portion of this species foraging and nesting habitat. Similarly, the narrow mountain bike trails (generally 1.2 m wide) and associated impacts will not be sufficiently wide enough to act as a barrier to the movement of mobile species such as the Black-faced Monarch. Therefore, it is unlikely that the clearing required as part of the Project will substantially modify, destroy or isolate an area of important habitat for the Black-faced Monarch.	Unlikely
• result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species	The Project would introduce tracks into some areas of relatively pristine habitat, which generally increases the potential for invasive species to move into new areas. However, the proposed tracks are minor in nature (generally 1.2 m wide). A proposed management plan will aim to prevent the establishment of any exotic species. It is unlikely that the Project would lead to the establishment of invasive species that are harmful to the Black-faced Monarch.	Unlikely
• seriously disrupt the lifecycle (breeding, feeding, migration or	While the Project may result in a minor reduction in foraging, shelter, and nesting habitat, the area of habitat to be removed is relatively small compared to the abundant resources present in the adjacent well-connected landscape. As such,	Unlikely

Black-faced Monarch		
resting behaviour) of an ecologically significant proportion of the population of a migratory species.	the Project is considered unlikely to disrupt the lifecycle of an ecologically significant proportion of the Black-faced Monarch population.	
Conclusion: Based on the above considerations, the Project is considered unlikely to have a significant impact on the Black-faced Monarch.		

Appendix 4. Fauna list

Class	Common Name	Scientific Name	Observation Type	Total
Amphibia	Common Eastern Froglet	*Crinia signifera*	Heard call	10
Aves	Crimson Rosella	*Platycercus elegans*	Observed	5
	Lewin's Honeyeater	*Meliphaga lewinii*	Observed	2
	Eastern Whipbird	*Psophodes olivaceus*	Heard call	1
	Grey Fantail	*Rhipidura albiscapa*	Observed and Heard call	1
	White-browed Scrubwren	*Sericornis frontalis*	Observed	1
	Superb Lyrebird	*Menura novaehollandiae*	Observed and Heard call	5
	Green Catbird	*Ailuroedus crassirostris*	Heard call	1
	Cicada bird	*Coracina tenuirostris*	Observed and Heard call	1
	Black-faced Monarch	*Monarcha melanopsis*	Heard call	2
	Sulphur crested Cockatoo	*Cacatua galerita*	Observed and Heard call	15
	Crested Pigeon	*Ocyphaps lophotes*	Observed and Heard call	5
	Laughing Kookaburra	*Dacelo novaeguineae*	Observed and Heard call	3
	White-throated Treecreeper	*Cormobates leucophaea*	Observed and Heard call	3
	Topknot Pigeon	Lopholaimus antarcticus	Observed	1
	Wonga Pigeon	*Leucosarcia melanoleuca*	Observed and Heard call	2
	Powerful Owl	*Ninox strenua*	Heard call	1
	Southern Boobook	*Ninox novaeseelandiae*	Observed	1
Crustacean	Southern Hairy Crayfish	*Euastacus hirsutus*	Observed	>100
Fish	Short-Finned Eel	*Anguilla australis*	Observed at Byarong Creek, trail 35	1
	Flathead Gudgeon	*Philypnodon grandicepsed*	Observed (Mainly in Byarong Creek)	20
Mammalia	Goat*	*Capra hircus*	Scat/heard	1
	Common Brushtail Possum	*Trichosurus vulpecula*	Observed	1
	Common Ringtail Possum	*Pseudocheirus peregrinus*	Observed	6
	Swamp Wallaby	*Wallabia bicolor*	Observed	n/a
	Fallow deer*	*Dama*	Observed	5
	Grey-headed Flying-fox	*Pteropus poliocephalus*	Observed	>10

*non-native

Appendix 5. Flora list and plot data

A list of the BAM plot data conducted across the study area. Asterisk (*) denotes an exotic species.

Family		Common Name	6486sh01	6486sh02	6486sh03	6486sh04	6486sh05	6486sh06	6486sh07
Adiantaceae	*Adiantum formosum*	Giant Maidenhair	35		85		0.5		
Apocynaceae	*Araujia sericifera**	Moth Vine	0.1						
Apocynaceae	*Marsdenia rostrata*	Milk Vine		0.1				0.5	0.2
Apocynaceae	*Parsonsia straminea*	Common Silkpod	0.5						
Apocynaceae	*Tylophora barbata*	Bearded Tylophora					0.5		0.2
Araceae	*Gymnostachys anceps*	Settler's Twine					0.1	0.1	5
Arecaceae	*Livistona australis*	Cabbage Palm			1		2	5	1
Aspleniaceae	*Asplenium australasicum*	Bird's Nest Fern						0.1	
Asteraceae	*Ageratina adenophora**	Crofton Weed							0.2
Asteraceae	*Delairea odorata**	Cape Ivy	0.2						
Bignoniaceae	*Pandorea pandorana*	Wonga Vine					0.3	0.5	0.2
Blechnaceae	*Blechnum cartilagineum*	Gristle Fern		1					
Blechnaceae	*Blechnum patersonii*	Strap Water Fern	0.5						
Blechnaceae	*Blechnum spp.*							10	
Blechnaceae	*Doodia aspera*	Prickly Rasp Fern				0.2	5	2	0.5
Celastraceae	*Elaeodendron australe*			40	15		60	1	
Commelinaceae	*Commelina cyanea*	Native Wandering Jew	3						
Convolvulaceae	*Dichondra repens*	Kidney Weed				1	0.2		
Cunoniaceae	*Ceratopetalum apetalum*	Coachwood						3	
Cyperaceae	*Carex appressa*	Tall Sedge				0.5			
Dennstaedtiaceae	*Pteridium esculentum*	Bracken	0.5	10				20	
Dicksoniaceae	*Calochlaena dubia*	Rainbow Fern							5
Dilleniaceae	*Hibbertia scandens*	Climbing Guinea Flower							0.1
Ebenaceae	*Diospyros australis*	Black Plum	2						

Family		Common Name	6486sh01	6486sh02	6486sh03	6486sh04	6486sh05	6486sh06	6486sh07
Euphorbiaceae	*Claoxylon australe*	Brittlewood					0.1		
Fabaceae (Mimosoideae)	*Acacia melanoxylon*	Blackwood	40						
Fabaceae (Mimosoideae)	*Acacia spp.*	Wattle							0.1
Geraniaceae	*Geranium solanderi*	Native Geranium					0.1		
Haloragaceae	*Gonocarpus hirtus*					0.5			
Lamiaceae	*Clerodendrum tomentosum*	Hairy Clerodendrum							1
Lauraceae	*Cassytha glabella*								0.1
Lauraceae	*Cryptocarya glaucescens*	Jackwood							3
Lindsaeaceae	*Lindsaea linearis*	Screw Fern						1	
Lomandraceae	*Lomandra filiformis*	Wattle Matt-rush					0.1		
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush				10	25		0.5
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry	0.2	2	0.5		2	5	0.5
Luzuriagaceae	*Geitonoplesium cymosum*	Scrambling Lily	0.5	0.5		0.2	1	0.2	1
Meliaceae	*Melia azedarach*	White Cedar	1	0.2					
Meliaceae	*Synoum glandulosum subsp. glandulosum*	Scentless Rosewood							30
Menispermaceae	*Stephania japonica*	Snake vine					0.2	0.1	0.3
Monimiaceae	*Doryphora sassafras*	Sassafras		25	65				0.5
Moraceae	*Ficus coronata*	Creek Sandpaper Fig	10		0.5				
Moraceae	*Ficus rubiginosa*	Port Jackson Fig			25			30	
Moraceae	*Ficus watkinsiana*	Strangling Fig			10				
Moraceae	*Streblus brunonianus*	Whalebone Tree	1						
Myrsinaceae	*Myrsine howittiana*	Brush Muttonwood	2						
Myrtaceae	*Acmena smithii*	Lilly Pilly	3		10			70	40
Myrtaceae	*Backhousia myrtifolia*	Grey Myrtle				85		15	20
Myrtaceae	*Eucalyptus botryoides <--> saligna*								45
Myrtaceae	*Eucalyptus muelleriana*	Yellow Stringybark		35					
Myrtaceae	*Eucalyptus piperita*	Sydney Peppermint				40	10		5
Myrtaceae	*Eucalyptus smithii*	Ironbark Peppermint					45		

Family		Common Name	6486sh01	6486sh02	6486sh03	6486sh04	6486sh05	6486sh06	6486sh07
Myrtaceae	*Syzygium australe*	Brush Cherry		30					
Oleaceae	*Notelaea longifolia*	Large Mock-olive		5		1			
Oleaceae	*Notelaea venosa*	Veined Mock-olive					30	5	
Osmundaceae	*Todea barbara*	King Fern	2						
Phormiaceae	*Dianella spp.*					0.1			
Phyllanthaceae	*Glochidion ferdinandi*	Cheese Tree							1
Pittosporaceae	*Pittosporum multiflorum*	Orange Thorn	0.2		0.5		0.2	1	5
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum						3	2
Poaceae	*Cynodon dactylon*	Common Couch	0.1						
Poaceae	*Entolasia marginata*	Bordered Panic				0.2	0.5		
Poaceae	*Microlaena stipoides var. stipoides*	Weeping Grass					0.5		
Poaceae	*Oplismenus imbecillis*						2	1	2
Rubiaceae	*Opercularia hispida*	Hairy Stinkweed							5
Rutaceae	*Zieria smithii*	Sandfly Zieria					0.1		
Sapindaceae	*Diploglottis australis*	Native Tamarind	5						
Smilacaceae	*Smilax australis*	Lawyer Vine	1	0.1		0.1	1	0.5	5
Solanaceae	*Solanum spp.**		1			0.1			
Urticaceae	*Dendrocnide excelsa*	Giant Stinging Tree	20		5				
Urticaceae	*Urtica incisa*	Stinging Nettle	0.1						
Verbenaceae	*Lantana camara**	Lantana	0.2						
Violaceae	*Viola hederacea*	Ivy-leaved Violet							10

Site	Date	Time	Vegetation type	Vegetation condition	Bearing	Number of large trees	Tree stem class size	Number of hollow trees	Fallen logs	Mean litter
SH01	28/06/2021	10:08	906	High	155	1	5-10, 10—20, 20-30, 30-50, 50-80	0	1.0	79
SH02	29/06/2021	9:38	878	High	229	4	<5, 5-10, 10—20, 20-30, 30-50, 50-80	0	3.0	84
SH03	29/06/2021	11:25	906	High	146	6	<5, 5-10, 10—20, 20-30, 30-50, 50-80	0	21.0	74
SH04	29/06/2021	14:21	1156	High	274	9	<5, 5-10, 10—20, 20-30, 30-50, 50-80	0	32.0	81
SH05	01/07/2021	9:10	878	High	263	4	<5, 5-10, 10—20, 20-30, 30-50, 50-80	0	68.0	90
Sh06	01/07/2021	13:07	769	High	145	0	<5, 5-10, 10—20, 20-30, 30-50	0	16.0	88.4
SH07	2/07/2021	9:59	1245	High	196	1	<5, 5-10, 10—20, 20-30, 30-50, 50-80	0	35.0	72

Appendix 6. Rapid Data Point data - flora

Latitude	Longitude	Observer	RDP#	Date	Time	Informal RDP Name	Overstory species	Midstorey species	Understory species
-34.4108	150.8349	SH	1	28/06/2021	13:33	Blue gum Lilly pilly	*Eucalyptus botryoides <--> saligna, Doryanthes excelsa Livistona australis*	*Acmena smithii, Lantana camara, Pittosporum undulatum*	*Adiantum formosum, Pittosporum multiflorum*
-34.4061	150.8294	SH	2	29/06/2021	12:38	Seiberi peppermint, heathy open forest	*Eucalyptus piperita, Backhousia myrtifolia*	*Pomaderris elliptica subsp. elliptica, Lomandra longifolia, Xylomelum pyriforme*	*Adiantum aethiopicum, Oplismenus imbecillis, Entolasia marginata*
-34.4195	150.815	SH	3	2/07/2021	14:43	Exotic species, running list		*Ageratina Adenophora, Delairea odorata, Lantana camara, Senna pendula Ipomoea indica Ligustrum sinense Ligustrum lucidum Verbena spp., Erythrina crista-galli, Cirsium arvense, Anredera cordifolia Solanum pseudocapsicum*	
-34.4044	150.8323		4	1/02/2022	9:47	Bangalay wet understorey			
-34.4069	150.8313		5	1/02/2022	10:45	ISR			
-34.4073	150.8295		6	1/02/2022	11:34	Open disturbed	*Acacia maidenii*		
-34.4069	150.8276		7	1/02/2022	12:19	Weedy			*Calochlaena dubia, Solanum pseudocapsicum*
-34.4104	150.832		8	1/02/2022	13:08	Coast white box woodland	*Eucalyptus botryoides <--> saligna*	*Cyathea spp.*	

Latitude	Longitude	Observer	RDP#	Date	Time	Informal RDP Name	Overstory species	Midstorey species	Understory species
-34.4102	150.8389		9	1/02/2022	14:09	Red cedar woodland	*Toona ciliata*, *Dendrocnide excelsa*, *Cryptocarya spp*.		
-34.4113	150.8403		10	1/02/2022	14:23	White cedar red cedar stinging tree	*Dendrocnide excelsa*, *Toona ciliata*	*Melia azedarach var. australasica*	
-34.4226	150.8049		11	18/02/2022	11:21	Gully gum wet forest	*Eucalyptus smithii*, *Eucalyptus botryoides <--> saligna*	*Notelaea spp*.	*Livistona australis*, *Melicope micrococca*
-34.4216	150.8054		12	18/02/2022	11:34	Lilly pilly forest		*Doryphora sassafras*, *Asplenium australasicum*	
-34.4108	150.8214		13	18/02/2022	12:53	Sassafrass forest		*Doryphora sassafras*, *Ficus coronata*, *Cyathea spp*.	
-34.4093	150.8242		14	18/02/2022	13:06	Coral tree thicket	*Erythrina sykesii*		
-34.4092	150.8245		15	18/02/2022	13:13	Rainforest	*Pennantia cunninghamii*, *Toona ciliata*, *Eupomatia laurina*		*Blechnum patersonii*, *Microsorum scandens*

Appendix 7. Helicopter Drop Zones

Helicopter Drop Zone	PCT #	Site Notes	Habitat Constraints
6486HDZ1	905	Restricted to groundcover vegetation removal. *Melicope micrococca*, *Trochocarpa laurina*. No threatened plants.	None
6486HDZ2	905	Cleared track.	None
6486HDZ3	905	Predominantly weedy	None
6486HDZ4	905	Predominantly weedy	None
6486HDZ7	1245	Good site for drop zone adjacent to bike jump. Native groundcover with some *Solanum pseudocapsicum*, coral tree overstorey	None
6486HDZ9	906	Mostly weedy understory – Perennial thistle/*Solanum pseudocapsicum*	Stinging tree PCT - kurrajong, doughwood, syzigium - fringe of rainforest
6486HDZ10	1245	Open clearing downhill from big jump. Illegal clearing previously undertaken	None
6486HDZ13	906	Opening in canopy along trail 34, PCT needs to change	
6486HDZ14	878	Moderate canopy cover	None
6486HDZ17	878	Good previously cleared site at corner, some native ground cover. *Solanum pseudocapsicum* and Crofton weed moving into site. Still rainforest, post works regen be best case scenario	Moderately good condition rainforest - remove drop zone location
6486HDZ19	878	Cleared site with minimal canopy. Only species impacted would be *Pittosporum multiflorum*	None
6486HDZ24	1245	Native ground cover, no threatened spp. Privet creeping into site	None
6486HDZ26	905	*Solanum pseudocapsicum*, lantana bracken fern at site - degraded. Upslope of track more suitable location - better site for helicopter drop zone	None
6486HDZ27	878	Corner of trail 46 adjacent to two cabbage palms most suitable drop zone. Turkey rhubarb present at drop site. Partially degraded habitat.	None
6486HDZ27	1245	Southern side of trail 34	Thick Bracken fern ground cover
6486HDZ30	1245	Coral tree forest with *Solanum pseudocapsicum* understorey. Some unscented rosewood and sassafras present. Largely weed inundated site. Low quality. Ficus macrophylla mature tree adjacent to habitat	None
6486HDZ33	905	*Solanum pseudocapsicum* inundated site with minimal canopy	None
6486HDZ33	1245	Suitable drop location at crest of downhill descent with open canopy.	None
6486HDZ34	1245	Open canopy, steep slope. Coral tree, pittosporum mature trees	None
6486HDZ36	1245	*Solanum pseudocapsicum*, maidenhair fern groundcover. No *Eucalyptus saligna x botryoides* to be seen in entire area. Just weedy/unmapped PCT with broad leaf privet canopy	None

Helicopter Drop Zone	PCT #	Site Notes	Habitat Constraints
6486HDZ39	1245	Canopy opening downslope from *Eucalyptus quadrangulata*	Good condition rainforest community, no weeds present. Remove drop zone location.
6486HDZ40	905	On corner of trail 22 above steep descent. Not ideal location given size of sandpaper fig. Move drop location to HDZ33	Canopy intact, dense understorey. Potential to replace location - perform multiple drops at HDZ33.
6486HDZ41	1245	Crofton weed field - Perfect for helicopter drop zone	None
6486HDZ43	1245	Privet overstorey	None
6486HDZ44	905	Dense understorey on downhill corner of trail 34. Moderate clearing in canopy. Good condition besides single moth vine.	Single moth vine species, otherwise good habitat. Alternate *Rubus rosifolius* clearing further off track with larger canopy clearing - move site 10m off track.
6486HDZ45	905	Near berm of trail 22, unsuitable site. Native understorey will need to be cleared - Sassafras and Bolwarra.	Sassafras and native ground cover will need to be cleared. Canopy closed in - remove drop zone.
6486HDZ47	905	Drop zone on track, canopy cover high. Move drop zone south side of trail to more open, weedy clearing	None
6486HDZ48	1245	Above trail 19, trail 1 intersection cleared area	None
6486HDZ48	1245	Clearing on trail 16, canopy slightly closed	Small hollows in eucalyptus nearby, overstorey slightly inhibiting heli drop efficiency. Move to more suitable 64865HDZ43.
6486HDZ52	905	Good open canopy clearing for drop zone. Move upslope drop zone with red ash canopy down here.	None
6468HDZ58	905	Grassy opening before steep descent with existing trails. If drop zones downslope can be avoided, this drop zone would be suitable for multiple drops.	Site would benefit from regeneration efforts to stop weed spread into downslope trails.
6486HDZ58	905	Weedy understory, intact red ash canopy.	Mature acacia and red ash trees.
6486HDZ60	1245	Steep slope on trail 1, not a super open clearing for a drop zone.	Maidenhair fern groundcover, privet midstorey. Dense canopy cover. Move drop zone to upslope, more suitable location 6486HDZ7.
6486HDZ61	906	Native fern ground cover and Sassafras, Bolwarra, scented rosewood understorey.	TEC with dense understorey. No weeds present. Good quality habitat. Remove drop zone location.
6486HDZ62	878	Good condition rainforest, some moth vine present. Suitable clearing for helicopter drop.	Habitat more resembles rainforest than mapped gully gum PCT.
6486HDZ62	906	Mainly a cleared field of *Solanum pseudocapsicum*. Mature tree can be avoided.	None
6486HDZ63	906	Cleared grassy area with *Solanum pseudocapsicum* and bracken fern .	None
6486HDZ64	906	Lantana prolific, poor quality site.	None
6468HDZ67	1245	Degraded habitat - Turkey rhubarb and Crofton weed moving in.	None
6486HDZ71	905	Southern uphill slope of trail 34. Weedy site, however, good canopy cover.	Acacia maidenii canopy slight closure. Move site 40m downslope to coral tree opening, grassy clearing.
6486HDZ72	1245	Degraded precleared habitat. Perfect for drop zone.	Sassafras and whalebone tree on site margins.

Helicopter Drop Zone	PCT #	Site Notes	Habitat Constraints
6486HDZ73	878	Suitable site for helicopter drop.	Mostly native ground cover moderate quality site, dense *Eucalyptus saligna x botryoides* canopy.
6486HDZ74	1245	Some *Rubus rosifolius, Hibbertia scandens* and *Syzigium australe* may be impacted.	None
6486HDZ75	1245	Northern side of downhill slope seedier and more appropriate.	None
6486HDZ77	905	Weed inundated groundcover.	Some white cedar present on site.
6468HDZ80	1245	Weedy/unmapped PCT. *Solanum pseudocapsicum* / moth vine.	None
6486HDZ81	878	On the eastern burn of existing track.	Canopy cover high, potential to move point slightly westward to uphill where canopy cover is reduced.
6486HDZ81	905	Moderate canopy cover, small opening - sufficient for drop zone.	None
6468HDZ83	1245	South side of trail 1 downhill slope.	None
6468HDZ86	878	Intercept of two trails. Canopy opening sufficient for heli drop. Habitat more resembles blue gum x bangalay PCT.	None
6486HDZ87	1245	Weedy site, minimal canopy.	None
6468HDZ88	1245	Fulcrum point taken downhill - only canopy opening below a *Eucalyptus quadrangulata*.	None
6486HDZ92	878	On the western side of berm with deep track marks. Sassafras understorey may pose minor issues.	None
6486HDZ98	1245	Drop zone on berm of trail 34.	None
6486HDZ101	1245	Uphill slope of trail 34, seats at site.	None
6486HDZ103	1245	Weedy understory north side of trail 32, sufficient canopy opening for heli drop.	None
6486HDZ113	1245	Western side/ uphill of trail 34 most open, appropriate drop zone.	None
6486HDZ117	1245	Intersection of trail 16 and 19. Native groundcover, privet overstorey. *Eucalyptus saligna* x *botryoides* down slope, PCT1245 starts here.	None
6486HDZ126	905	Grassy area, opening in canopy. Good site for drop zone.	None
6486HDZ152	905	Grassy area north of trail 32, canopy opening slim but sufficient.	None

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