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Ecological Assessment
Balgownie Mountain Bike Track Network

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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 Balgownie 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 Balgownie MTB network ('the Project'). The Project will consist of 57 trails over approximately 27 kilometres of trail and network links in the Balgownie precinct of the Illawarra Escarpment (Subject Area).

Aim of assessment

The primary aim of this assessment was to assess potential ecological impacts associated with the proposed trail design and construction methodologies, and provide advice to amend the Project footprint in order to avoid and mitigate ecological impacts. A number of changes to the original trail network plan were made in order to avoid impacting threatened biodiversity. Following those changes, an assessment of ecological impacts of the Project was conducted as required under state and federal legislation.

Methods

Flora surveys were completed between September and December 2022. Random meander searches were conducted along the proposed trails and helicopter drop zone locations for threatened flora previously recorded in the Subject Area. Due to the timing of surveys and the nature of the proposed impacts, threatened fauna surveys were not conducted and instead, where suitable habitat was identified an assessment was undertaken and presence was assumed (where necessary).

Key results

Good condition native vegetation exists throughout the Subject Area. The condition of native vegetation is compromised in some areas due to the presence of exotic species and invasive weeds, particularly along previously cleared trails and fire trails, as well as where large gaps occur in the canopy. With reference to vegetation mapping of the Subject Area (NSW Department of Planning and Environment [DPE] 2023a), the majority of vegetation to be modified by the Project is Illawarra Escarpment Bangalay x Blue Gum Wet Forest (3.12 hectares [ha]), Illawarra Subtropical Rainforest in the Sydney Basin Bioregion (ISR) (0.26 ha), South Coast Warm Temperate-Subtropical Rainforest (ISR) (0.03 ha), Illawarra Escarpment Warm Temperate Rainforest (0.05 ha), Illawarra North-Pittwater Bangalay Moist Forest (0.003 ha) and some areas of already cleared vegetation (0.15 ha). There is one Threatened Ecological Community (TEC) Illawarra Subtropical Rainforest in the Sydney Basin Bioregion (ISR) represented by two Plant Community Types 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). This TEC has been avoided where possible; the final trail network requiring the clearing of up to 0.29 ha Vegetation clearing assessed for this Project includes groundcovers, shrubs and small trees up to 10 cm DBH as all larger and mature trees will be avoided as part of the trail siting.

Two threatened fauna species Black-faced Monarch (*Monarcha melanopsis*) and Rufous Fantail (*Rhipidura rufifrons*) (listed as Migratory under the EPBC Act) were recorded in the Subject Area. Potential habitat exists for a number of threatened fauna species; however, those with the highest potential of being affected include Giant Burrowing Frog (*Heleioporus australiacus*) and the Green and Golden Bell Frog (*Litoria aurea*).

No threatened flora were recorded in the Subject 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 associated with construction (includes the operational footprint), namely, the removal of approximately 3.5 ha of native vegetation including the temporary impacts to 0.0125 ha of native vegetation at helicopter drop zone locations.

The proposed clearing will be restricted to groundcovers, shrubs, some small rocks and trees up to 10 cm DBH. Large trees, canopy trees, hollow-bearing trees and bushrock will not be removed as part of the Project.

Of the 3.5 ha to be removed as part of the Project's construction, 0.29 ha consists of ISR (TEC). This represents 0.79% of ISR within the Subject Area. This is considered to be an overestimate as a result of restricted vegetation clearing proposed.

Potential indirect ecological impacts include sedimentation and/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) (EPBC Act and BC Act)
- Threatened fauna
  - Giant burrowing Frog (EPBC Act and BC Act)
  - Green and Golden Bell Frog (EPBC Act and BC Act)

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

While the Subject Area provides a potential foraging resource for many other threatened fauna species (e.g. birds, bats), the nature and scale of the Project is not considered to adversely impact the lifecycle requirements (i.e. potential breeding habitat or specific habitat requirements) of these potentially occurring species such that they would be placed at risk of extinction. No legislative assessments were considered necessary in regard to such species.

Recommendations

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

- Delineation of the project footprint on site prior to commencement of construction
- Avoidance of removing large shrubs, midstorey and canopy trees over 10 cm DBH
- Avoidance of removing Allocasuarina species where possible
- Avoidance of contributing to erosion through suitable design for different creek crossings and associated River Style

- Erosion and sediment controls
- Fibre-reinforced Plastic (FRP) to be used, where feasible
- 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
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DECC	Department of Environment and Climate Change
DPE	NSW Department of Planning and Environment (previously DPIE, DECC)
DPI	NSW Department of Primary Industries
DPIE	NSW Department of Planning, Industry and Environment
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)
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
BMBT network	Balgownie 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 Subject area
REF	Review of Environmental Factors
Subject 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 Balgownie Mountain Bike Trail Network (henceforth referred to as the "BMBT network") (Figure 1; Figure 2). The aim of the ecological assessment was to assess the direct and indirect impacts of the construction and operation of the BMBT network. 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 BMBT network. The BMBT network will consist of 57 trails over approximately 27 kilometres (km) of trail (the Project) in the Balgownie precinct of the Illawarra Escarpment (Subject Area). 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 BMBT network is located along the Illawarra Escarpment, to the west of the Wollongong suburbs of Corrimal and Tarrawanna, and north of Balgownie (Figure 2). The proposed mountain bike trail network is approximately 27 km in total length. The majority of trails are located on NPWS land within the Illawarra Escarpment SCA, managed by NPWS. The trail network also traverses Crown Land managed by Wollongong City Council.

Table 1 provides details of the landscape features of the Project.

Table 1: Landscape features

Landscape features	Description	Figure Ref
Project footprint	The area within which direct impacts from the Project will occur during construction – 3.5 ha.	Figure 1 and Figure 2
Subject Area	The Project footprint and surrounding land where surveys were conducted.	Figure 1
IBRA bioregion/subregion	The Project is located within the Sydney Cataract and Illawarra subregions which are 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 the Dapto-Wollongong Coastal Slopes (Mitchell 2002).	Figure 2
Rivers, streams and estuaries and Strahler stream order	The watershed from the Subject Area runs east into the Towradgi Creek catchment which enters the ocean at Corrimal Beach. The Towradgi Creek system occurs in the Subject Area as first and second order streams. The trails will cross 1st order streams 16 times and 2nd order streams two times.	Figure 1 and Figure 2
Wetlands within and adjacent to development	There are two artificial wetlands in the Subject Area.	Figure 2
Connectivity features	Vegetation within the Subject Area is wholly connected to large patches of vegetation to the west, north and south and is part of the IESCA.	Figure 1 and Figure 2
Geological significance and soils	There are crevices and cliffs in the locality but there are no karst, caves, crevices, cliffs or other areas of geological significance within the Subject Area or Project footprint. The proposal is supported by a geotechnical assessment which includes systematic identification of landslide and rockfall hazards, and assessment of risks. The proposed trail network has been designed to prioritise safety with regards to landslides and rockfalls.	-

Landscape features	Description	Figure Ref
Areas of outstanding biodiversity value	The Subject Area is not in an area of outstanding biodiversity value (AOBV) as per the NSW *Biodiversity Conservation Act* (BC Act).	-

1.3 Description of the Project

The Project includes 10.3 km of new trail. A further 16.63 km of existing unsanctioned tracks will be upgraded to minimise environmental impacts from creating new trails. The existing trails that have been incorporated into the network require modification to meet the International Mountain Bike Association (IMBA) trail standards as set out in the *Australian mountain bike trail guidelines* (MTBA 2019).

The proposed trail network is structured in three distinct interconnected tiers. Each of the tiers can be ridden individually or as an interconnected network. The network is designed to enable a large variety of riding options and routes, with the possibility of creating unique loops that suit an individual rider's ability and/or preference. The trail network includes a range of trail categories to provide for differing rider abilities. The categories include existing roads/fire trails (all riders), black trails (advanced riders), blue trails (intermediate riders), light blue trails (beginner and intermediate riders), green trails (beginner riders), red climbing trails (intermediate to advanced riders) and two-way trails (all riders).

The proposed upgrades would result in improved drainage and erosion control, safety and reduced edge impacts to native vegetation and habitats. The success of the proposed trail network would allow unsanctioned trails within the Subject Area, that do not form part of the proposed network, to be closed and rehabilitated by NPWS.

The proposed network would also address significant safety issues from unsanctioned jumps associated with the possum trails.

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 initial trail design**
   - A preliminary assessment of the proposed trail network was conducted by NPWS (NPWS 2020). Existing unsanctioned mountain bike trails within the Subject Area were initially mapped by NPWS, using the NPWS published trail GIS data (including Strava, Trail Forks and All Trails) and through correspondence with Illawarra Mountain Bike Alliance.
   - A desktop constraints assessment (NPWS 2020) was used to evaluate the Subject Area for trail suitability and to inform field investigations. Approximately 29 km of existing and new trails were identified as being suitable. This included 44 trails (28 existing trails and 16 new trails) which included 17 creek crossings.
   - Ground truthing of a 20 metre (m) trail corridor, with NPWS staff and Synergy Trails, to optimise trail design and minimise ecological disturbance. Ecological input was provided during this stage to consider impacts on threatened species, threatened communities, wetlands and creeks, creek health and any other environmental issues.
   - The trail would be marked with flags at approximately 10 m intervals along the trail centreline.

2. **Confirm final trail design incorporating environmental principles**
   - The initial trail design identified 29 km of trail as being suitable for the Project.
   - The proposed trail locations were assessed for presence of threatened ecological communities (TECs), threatened flora species, threatened fauna habitat features, such as rocky outcrops and hollow-bearing trees and wetlands. Riparian health was assessed and any erosion issues noted. The initial proposal would impact on two threatened ecological communities: Plant Community Type (PCT) 3013 "Illawarra Lowland Subtropical Rainforest" with proposed construction impact of 0.26 ha and PCT 3036 "South Coast Warm Temperate-Subtropical Rainforest" with proposed construction impact of 0.03 ha.

- The final trail design incorporated a number of environmental principles to mitigate impacts. These principles include utilising existing trail corridors where feasible, restricting clearing to ground and lower stratum species, avoiding sensitive environments (ISR) where feasible, and reducing the overall length of the network from 29 km to 27 km.

  The original trail design consisted of 44 trails but was increased to 57 trails as a final plan to avoid the clearing of native vegetation (including ISR). The final design uses more existing trails (39 compared to 28 in the original design), and also reduces the number of trails that intersect ISR (from 22 to 20) (Appendix 1), locating the majority of the trails within vegetation that is abundant in the region.

3. Clearing the trail alignment

- Mechanical clearing of the marked trail of vegetation with a small excavator, brush-cutters and chainsaws.
- In areas that are free of weeds, cleared vegetation would be stockpiled off-trail within material laydown areas for use as brush matting to remediate access areas and degraded unsanctioned trails on completion. Where weeds are present, cleared vegetation will be bagged and removed from the site to be disposed of at a licensed facility.
- 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. Overhanging vines that encroach on the trail corridor would be tied back (rather than trimmed).
- 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.

4. Material deposition

- Where suitable, trail construction materials would be brought to the site by helicopter to designated material laydown areas (shown on Figure 2).
- Where practicable, construction materials would be brought to the laydown areas via access roads.
- Material laydown areas will be located in existing cleared areas.

5. 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).
- Machine excavation will start at the beginning of the trail and the critical surface water movement points will be marked. The excavator will be a zero-swing type, allowing for machinery excavation works to be confined within the marked trail corridor.
- TTFs would be located at 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.

6. Finishing the trail

- Stockpiled organic material would be reinstated around the trail alignment.

- Signage would be installed at the entrance, exit and at each trail junction. Specifications and requirements for signage will be governed by a signage management plan to be developed by NPWS.
- Trails 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).
- There are sections within the trail network that have a relatively high proportion of weeds. Construction in these areas would require careful handling of weed material and may require revegetation. Such works will be in accordance with the Construction Environmental Management Plan (CEMP).

It is noted that the trail design includes different types of engineered crossings to prevent sedimentation, erosion and impacts on water quality, including:

Small Bridges

Small 1-3 m fibre-reinforced plastic (FRP) bridge with no side rails. Hardened rock entry and exits. Used to cross small creeks, gullies or other obstructions.

Medium & Large Bridges

Small 2-6 m bridge with galvanised steel structure and FRP mesh surface, safety mesh to sides on galvanised steel posts. Hardened rock entry and exits. Used to cross creeks, gullies or other obstructions.

Large Two-Way Bridges (2 sizes)

Two way Bridge with galvanised steel structure and FRP mesh surface, safety mesh to sides on galvanised steel posts. Hardened rock entry and exits. Used to cross creeks, gullies or other obstructions where bikes are required to travel in two directions.

Hybrid Bridge and rock armoured river crossing

Bridge section to have galvanised steel structure (bolted directly to large existing river rocks) and FRP mesh surface, hardened rock entry and exits. Used to cross creeks & small rivers, where there is substantial flood risk, and high likelihood of trail features being washed out. Located in riffle sections. In the event of substantial flooding, the FRP panel is considered sacrificial. The connections between the FRP and the galvanised steel joists should be designed to fail before the connection of the steel subframe to the large river rocks.

Bridge & Hardened River Crossings

FRP feature that ends with a drop to an inclined landing ramp. Rock Armouring to entry and exits of FRP. Feature may require import of soil for a landing ramp. Landing ramp may need to be rock hardened. Located where existing features that can be used are absent and trail is straight and sloped enough to allow for a suitable landing ramp.

Table 2 details the proposed construction equipment required for the aforementioned works. 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 1.5 m trail width	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 25° 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 (weed-free) 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 (weed-free) 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. Run on generator power / battery	Yes	Yes	1 operator (no licence required)	Battery tools preferred. Overnight recharge avoids need for generator on site.

Equipment	Description	Machine Built Trails	Hand Built Trails	Associated Trail Staff	Impact / Mitigation
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.	n/a

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

Table 3: Proposed trails of the BMBT network

Trail Category	Name		Trail Length (m)
Fire/Access Trails	**Existing trails**	Lower Access Road	307
		Mid Access Road	761
		Old Access Trail	564
		Short Road	23
		Upper Access Road	1,700
	Existing trails total		**3,355**
	New trails	Dirt Jump Corridor	188
	New trails total		**188**
Fire/Access Trails Total			**3,543**
Black trails	**Existing trails**	Trail 9	453
		Trail 20	413
		Trail 27	338
		Trail 29	104
		Trail 30	669
		Trail 35	505
	Existing trails total		**2,482**
	New trails	Trail 20	233
		Trail 35	925
	New trails total		**1,158**
Black Trails Total			**3,640**
Blue Trails	**Existing trails**	Trail 8	395
		Trail 28	1,076
		Trail 33	470
		Trail 36	232
	Existing trails total		**2,173**
	New trails	Trail 8	267
		Trail 33	643
		Trail 34	343
	New trails total		**1,253**
Blue Trails Total			**3,426**
Green Trails	**Existing trails**	Trail 1	786
		Trail 2	176
		Trail 5	666
		Trail 6	105
		Trail 13	581
		Trail 14	151
		Trail 24	45
		Trail 31	313
	Existing trails total		**2,823**
	New trails	Trail 4	636
		Trail 24	900
		Trail 31	313

Trail Category	Name		Trail Length (m)
	New trails total		**1,849**
Green Trails Total			**4,672**
Light Blue Trails	**Existing trails**	Trail 7	484
		Trail 10	631
		Trail 11	31
		Trail 16	359
		Trail 17	250
		Trail 18	1,049
		Trail 26	587
		Trail 37	447
	Existing trails total		**3,838**
	New trails	Trail 16	522
		Trail 25a	421
		Trail 25b	520
	New trails total		**1,463**
Light Blue Trails Total			**5,301**
Climbing Trails	**Existing trails**	Trail 3	801
		Trail 12	576
		Trail 21	336
	Existing trails total		**1,713**
	New trails	Trail 3	935
		Trail 32	2,139
	New trails total		**3,074**
Climbing Trails Total			**4,787**
Linking Trails	**Existing trails**	Trail 15	151
		Trail 19	7
		Trail 29/30	24
		Trail 33/35	52
	Existing trails total		**234**
	New trails	Trail 19	27
		Trail 23	611
	New trails total		**638**
Linking Trails Total			**872**
Grand Total			**26,943**

Different trail widths are required for each construction type 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)	Operational width (m)
Climbing trails	1.5	1.5
Fire/Access Trail	None	4.0
Black Trails	1.5	1.5
Blue Trails	1.5	1.5
Green Trails	1.5	1.5
Light Blue Trails	1.5	1.5
Two-way linking trails	2.5	2.5

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 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, vegetation communities and riparian health.
- Describe the potential ecological impacts of the Project.
- Provide advice to the client throughout the design stage of the Project on sensitive ecological areas to avoid.
- Assess the significance of impacts on threatened biodiversity for the final trail design as listed under the BC Act and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- Provide measures to avoid and mitigate impacts of the Project.

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 surveys (such as spotlighting and/or call playback) for terrestrial fauna were not conducted and formal vegetation plot data was not obtained.

Survey results are not definitive as more species would be recorded during a longer survey over various seasons and weather conditions. Many species can only be identified when they are flowering or fruiting. Not all fauna species that use a site will be recorded during ecological survey work due to their mobility, cryptic nature and unpredictable movement throughout their habitat. The detection of migratory species in the Subject Area is dependent on the season of survey.

Instead, habitat presence or absence was used as a tool to measure if threatened species were likely to utilise the site or not. Any threatened species (flora or fauna) considered to have potential habitat within the site was considered in this assessment of environmental significance. This process ensured that all

threatened species with potential to use the site were considered in the impact assessment, rather than only those that were recorded during the field surveys.

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
- 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. The Project is to be assessed under Part 5 of the EP&A Act.

Section 7.3 of the BC Act (the Test of Significance [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 5 of the EP&A Act, the development 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
- 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 Biodiversity Development Assessment Report (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 the IESCA, reserved and managed in accordance with Section 30G of the NPW Act. The management purposes and principles for IESCA are to (NPWS 2023):

- Conserve biodiversity, maintain ecosystem function, protect natural phenomena and maintain natural landscapes
- Conserve places, objects and features of cultural value
- Provide for the undertaking of uses permitted under other provisions of the NPW Act (including uses permitted under section 47J, such as mineral exploration and mining), having regard to the conservation of the natural and cultural values of the state conservation area
- Provide for sustainable visitor use and enjoyment that is compatible with the conservation of the area's natural and cultural values
- Provide for the sustainable use (including adaptive re-use) of any buildings or structures or modified natural areas having regard to the conservation of the state conservation area's natural and cultural values
- Provide for appropriate research and monitoring.

The Project is considered to meet the management principles of the IESCA Plan of Management.

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 Subject Area was examined on the 5th November 2022 using the EPBC Act's Protected Matters Search Tool (Department of Climate Change, Energy, the Environment and Water [DCCEEW] 2023a).

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.

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. Wollongong Council Land). No trees with a diameter at breast height of more than 10 cm would be removed for the Project, and there are only nine Koala historical records within 10 km of the Project site. There are no Koala records for the immediate Balgownie area. The Koala is considered to be relatively uncommon in the Subject 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 Wollongong Council Land is not required.

2. Methods

2.1 Literature review

Literature and data sources reviewed included:

- NSW State Vegetation Type Map (NSW Department of Planning and Environment [DPE] 2023a)
- DPE Threatened Species Profiles Database (DPE 2023b)
- DPE Bionet, Atlas of NSW Wildlife (search radius of 10 km applied to Subject Area) (DPE 2023c)
- The EPBC Act Protected Matters Search Tool (10 km buffer) (DCCEEW 2023a).
- DPI Fisheries spatial data portal (DPI 2023a)
- River Styles Mapping (DPI 2023)
- Review of any local biodiversity studies that may provide information on biodiversity of the sites.

2.2 Field investigations

The Subject Area was investigated on foot over four days between August and November 2022 by Niche employees Stephen Bloomfield (Senior Ecologist), Kayla McGregor (Senior Ecologist), Prue Bartlett (Ecologist) and Amy Legge (Ecologist) escorted by NPWS representative Ben McNamara and Synergy trails representative Adrian Main. The surveys were conducted over different time periods by different team members (Table 5) and were aimed at traversing as much of the trail network as possible to gain an in-depth understanding of the scope of works proposed and to sample a representation of all vegetation and habitat types present.

Table 5: Field investigation details

Date	Team Member(s)	Survey Effort (hrs)
22/08/2022	Kayla McGregor	6
28/09/2022	Stephen Bloomfield Prue Bartlett	12
18/10/2022	Stephen Bloomfield Prue Bartlett	12
30/11/2022	Amy Legge Stephen Bloomfield	12
	Total	**42**

A corridor width of 20 m (10 m either side of the trails) was assessed when conducting the field investigation.

2.3 Field survey methodology

2.3.1 Vegetation communities, threatened ecological communities and threatened flora

The survey involved walking the proposed trails in the Project footprint, the positions of which had been previously uploaded to a handheld GPS. In some locations, the proposed new trails were marked with flagging tape. The ecological assessment included:

- Confirming the PCT mapping of the Subject Area through the collection of Rapid Data Points (Appendix 2, Figure 3) and random meander searches for changes in vegetation along the existing and proposed trails and helicopter drop zone locations. Key diagnostic species of each strata were compared to mapped PCTs for the Subject Area. Formal Biodiversity Assessment Method (BAM) plots were not collected.

- Threatened flora searches via random meander searches along the existing and proposed trails and helicopter drop zone locations (Figure 3).
- Data was collected on the presence and extent of weed species,
- Specific vegetation relating to threatened species e.g. Allocasuarina species for the Glossy Black Cockatoo, and general vegetation condition.

2.3.2 Fauna and fauna habitat

No targeted fauna surveys were conducted. Instead, a habitat assessment of the Subject Area was conducted to identify habitat features suitable for threatened fauna. 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
  - Dreys
  - Specific feed trees

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

2.3.3 Riparian assessment

The trail design includes 18 creek crossings consisting of different types of engineered crossings to prevent sedimentation, erosion and impacts on water quality (refer to Section 1.3). As part of the riparian assessment, each proposed creek crossing was recorded. 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)
- River Style (geomorphological classification)
- 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.

River Style Classification

In NSW, rivers and creeks are mapped for their River Style – an integrated river management classification system that is based on understanding the existing natural geomorphic condition on the river, its inherent fragility (sensitivity to change) and likelihood of recovery (Brierley & Fryirs 2005). River Styles mapping is available for most waterways in NSW and then confirmed in the field by assessing the valley setting,

presence or absence of floodplain and geomorphic features. The River Styles classification for each watercourse was recorded as part of the riparian assessment.

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 Subject 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 Subject 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 Subject 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 Subject Area.

Table 6: Likelihood of occurrence criteria

Likelihood rating	Threatened flora criteria	Threatened and migratory fauna criteria
Known	The species was observed within the Subject Area.	The species was observed within the Subject Area.
High	It is likely that a species inhabits or utilises habitat within the Subject Area.	It is likely that a species inhabits or utilises habitat within the Subject 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 Subject 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 Subject Area.
Low	It is unlikely that the species inhabits the Subject Area.	It is unlikely that the species inhabits the Subject Area. If present at the site the species would likely be a transient visitor. The Subject 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 Subject Area is unsuitable for the species.	The habitat within the Subject 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 six proposed helicopter drop zone locations by Niche ecologists. The six sites were selected due to their already cleared and disturbed condition and absent canopy.

3. Results

3.1 Flora and native vegetation

3.1.1 Vegetation types of the Subject Area

Current vegetation mapping (DPE 2023a) shows six native vegetation communities occurring within, or in close proximity to, the trail network that are likely to be directly impacted by the Project:

- PCT 3013 Illawarra Lowland Subtropical Rainforest
- PCT 3028 Illawarra Escarpment Warm Temperate Rainforest
- PCT 3036 South Coast Warm Temperate-Subtropical Rainforest
- PCT 3153 Illawarra Escarpment Bangalay x Blue Gum Wet Forest
- PCT 3155 Illawarra North-Pittwater Bangalay Moist Forest
- PCT 3327 Illawarra Lowland Red Gum Grassy Forest.

'Non-native' vegetation is also mapped.

Based on the outcome of the RDPs and field traverses, the vegetation mapping conducted for the region (DPE 2023a) is relatively accurate with the exception of some PCT boundary adjustments, and the erroneous mapping of PCT 3327. As such, Niche has revised the PCT mapping layer for the Subject Area in order to carry out the level of biodiversity assessment required for the Project (Figure 4). Five PCTs, and two non-PCTs, are present within, and close to, the project's footprint (Table 7). The extent of each of the five PCTs within the Subject Area has also been provided Table 7.

Table 7: Mapped vegetation communities in the Subject Area

PCT Name	PCT #	TEC	Legislative listing*		Extent within Subject Area (ha)
			BC Act	EPBC Act	
Illawarra Lowland Subtropical Rainforest	3013	Illawarra Subtropical Rainforest in the Sydney Basin Bioregion	E	CE	36.4
Illawarra Escarpment Warm Temperate Rainforest	3028	n/a	-	-	28.4
South Coast Warm Temperate-Subtropical Rainforest	3036	Illawarra Subtropical Rainforest in the Sydney Basin Bioregion	E	CE	0.4
Illawarra Escarpment Bangalay x Blue Gum Wet Forest	3153	n/a	-	-	161.3
Illawarra North-Pittwater Bangalay Moist Forest	3155	n/a			7.7
Total (PCT assigned)					**234.2 (ha)**
Non-native vegetation					7.5
Native planted vegetation					3.2
Total (non PCT assigned)					**10.7 (ha)**

*CE - Critically Endangered, E - Endangered

3.1.2 Threatened ecological communities

There are five PCTs that occur within, or in close proximity to, the Project's footprint, two of which comprise the TEC Illawarra Subtropical Rainforest in the Sydney Basin Bioregion (ISR) (PCT 3013 and PCT 3036) (Table 7). This TEC is listed as Endangered under the BC Act and forms part of the Illawarra Subtropical Rainforest of the Sydney Basin Bioregion under the EPBC Act, listed as Critically Endangered.

The original trail network design consisted of 22 trail sections that intersected ISR (Figure 5) for an approximate total trail length of 3.3 km (Appendix 1). Based on the ecological advice provided, the final trail network design now includes 20 trail sections that intersect ISR for an approximate total trail length of 2.5 km (Appendix 1).

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 3) and Assessment of Significance (AoS) under the EPBC Act (Appendix 4) have been undertaken for this TEC, a summary of which is provided in Section 4.2.

3.1.3 Threatened flora

Literature review

A total of 29 threatened flora, as listed under the BC Act and/or EPBC Act, were considered in this assessment (refer to Appendix 5, Figure 6). This list was derived from the database searches outlined in Section 2.1. Out of the species listed in Appendix 5, three are considered to have a High or Moderate likelihood of occurrence in the Subject Area (Table 8). These species are:

- *Cynanchum elegans* (White-flowered Wax Plant)
- *Rhodamnia rubescens* (Scrub Turpentine)
- *Senna acclinis* (Rainforest Cassia).

Field survey

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

3.1.4 Weeds

Some areas of the Subject Area have an understorey 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)
- *Tradescantia fluminensis* (Wandering Trad).

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 2023b). This is due to their propensity to regenerate from small segments, thus there is the possibility of increasing their spread throughout the escarpment if particular care is not exercised.

3.2 Terrestrial fauna and fauna habitat

3.2.1 Fauna

No targeted fauna surveys were conducted as part of this assessment. During field work, however, 25 fauna species were opportunistically recorded, two of which are listed as migratory under the EPBC Act (Section 3.2.3) (Appendix 6).

3.2.2 Fauna habitat

Forest habitat

Forest 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 across the Subject Area and supply direct food (foliage, nectar, exudates) and indirect food (arthropods) for a range of vertebrates, particularly birds and arboreal mammals.

In wetter, more protected sites, both TECs include forest habitat that is dominated by rainforest canopy species such as *Schizomeria ovata* and *Doryphora sassafras*. Understorey species include *Diospyros australis*, *Pittosporum multiflorum*, *Cryptocarya glaucescens* and *Livistona australis*. These rainforest areas provide a range of flower, fruit and nectar feeding opportunities for a range of species and have a greater diversity of flora species including ferns, vines, forbs and epiphytes.

In some drier areas of Eucalypt forest, particularly along small ridges or spurs, Black She-oak (*Allocasuarina littoralis*) occurs as a dominant understorey species. Allocasuarina species are a preferred feeding resource for the threatened State and Commonwealth (vulnerable) listed Glossy Black Cockatoo. The proposed trail network is not expected to result in the removal of any Black She-oak trees.

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 Subject Area generally at a moderate density. 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.

The creeks and two artificial wetlands provide habitat for aquatic species such as frogs, some macroinvertebrates and waterbirds. The wetlands provide suitable foraging habitat for the State (vulnerable) listed Southern Myotis (*Myotis macropus*), which forages over streams and pools catching insects and small fish by raking their feet across the water surface (DPE 2023b).

Termite mounds

One termite mound was observed within the Subject Area during the field survey; adjacent to Trail 27 near its junction with Trail 28. Termite mounds are an important nesting resource for the Rosenberg's Goanna. The termite mound would be avoided by the proposed works and therefore is unlikely to be impacted by the Project.

3.2.3 Threatened and migratory fauna

Literature review

A total of 137 subject threatened and migratory fauna have previously been recorded (DPE 2023c) or are predicted to have habitat (DCCEEW 2023a) within the locality (Appendix 5, Figure 7). This list was derived from the database searches outlined in Section 2.1. Of the species listed in Appendix 5, 17 species were considered to have a moderate to high likelihood of occurrence in the Subject Area and three were confirmed present (Table 8).

Table 8: Threatened and migratory species with a moderate to high likelihood of occurrence within the Subject Area.

Common name	Scientific name	Likelihood of Occurrence	BC Act	EPBC Act
Giant Burrowing Frog	*Heleioporus australiacus*	Moderate	V	V
Green and Golden Bell Frog	*Pseudophryne australis*	Moderate	V	-
Stuttering Frog	*Mixophyes balbus*	Moderate	E	V
Black Bittern	*Ixobrychus flavicollis*	Moderate	V	-
Black-faced Monarch	***Monarcha melanopsis***	**Present**	**-**	**M**
Gang-gang Cockatoo	*Callocephalon fimbriatum*	High	V	-
Glossy Black Cockatoo	*Calyptorhynchus lathami*	High	V	-
Olive Whistler	*Coracina lineata*	Moderate	V	-
Powerful Owl	*Ninox strenua*	High	V	-
Sooty Owl	*Tyto tenebricosa*	Moderate	V	-
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	Moderate	V	-
Eastern Pygmy-possum	*Cercartetus nanus*	Moderate	V	V
Greater Broad-nosed Bat	*Scoteanax rueppellii*	Moderate	V	-
Greater Glider	*Petauroides volans*	Moderate	E	E
Grey-headed Flying-fox	*Pteropus poliocephalus*	High	V	V
Southern Myotis	*Myotis macropus*	Moderate	V	-
Yellow-bellied Glider	*Petaurus australis*	Moderate	V	V

Field survey

The two migratory fauna species recorded during the current field survey were (Figure 8):

- Black-faced Monarch (*Monarcha melanopsis*)
- Rufous Fantail (*Rhipidura rufifrons*).

Both the Black-faced Monarch and Rufous Fantail are both listed as Migratory under the EPBC Act. One Black-faced Monarch individual was heard calling in the vicinity of Trail 18, while one Rufous Fantail individual was heard calling in the vicinity of the upper access road/Trail 25a.

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

3.3 Helicopter drop zone habitat assessment

A total of five drop zones were assessed for threatened flora and fauna habitat values (see Appendix 7). The drop zones span across one PCT – 3153. All of the sites are already disturbed, consisting of an open canopy and weed inundated understorey. No threatened species were observed at any of the sites. The drop zones listed in Table 9 have been identified as those with minimal impact and are suitable for a helicopter drop zone site.

Table 9: Assessment of proposed helicopter drop zone locations with site notes

Heli Drop Zone	PCT ID/Name	Site Notes	Area of Impact (ha)
Site 1 E 304600 N 6194627	3153 Illawarra Escarpment Bangalay x Blue Gum Wet Forest	Generally cleared of canopy. Weedy. No threatened plants and limited habitat value.	0.0025
Site 2 E 304117 N 6194045	3153 Illawarra Escarpment Bangalay x Blue Gum Wet Forest	Very steep. Substantial earthwork required. Proposed retaining/rock wall.	0.0025
Site 3 E 304094 N 6193931	3153 Illawarra Escarpment Bangalay x Blue Gum Wet Forest	Ideal location. Cleared canopy. Weedy. No threatened plants and limited habitat value.	0.0025
Site 4 E 305327 N 6194985	3153 Illawarra Escarpment Bangalay x Blue Gum Wet Forest	Generally cleared of canopy. Weedy. No threatened plants and limited habitat value.	0.0025
Site 5 E 304692 N 619413	3153 Illawarra Escarpment Bangalay x Blue Gum Wet Forest	Proposed Possums site, cleared ground and open canopy. No threatened plants and limited habitat value.	0.0025
		Total area of Impact	**0.0125 (ha)**

3.4 Aquatic habitat

The watershed from the Subject Area runs east into the Towradgi Creek catchment which enters the ocean at Corrimal Beach.

The Towradgi Creek system occurs in the Subject Area as first and second order streams. The trails will cross 1st order streams 16 times and 2nd order streams two times. A total of 18 waterway crossings require consideration of erosion control and aquatic fauna habitat as part of the Project (Table 10, Figure 2).The first order streams provide little aquatic habitat (consisting of shallow pools) but were flowing during the time of the survey. These ephemeral watercourses are suitable for bed level bike crossings and small hardened creek crossings.

The first order streams are geomorphologically classified as 'Headwater' River Styles. A 'Headwater' River Style is a stable River Style with bedrock at the base and on the margins which limits vertical and horizontal erosion.

One of the second order streams is mapped, and was confirmed in the field as, 'Low Sinuosity Fine Grained' River Style. This River Style has no valley margin controls and is laterally unconfined. During large flow events, the banks can erode if the hydrology has been altered and riparian vegetation cleared. Some sections of Towradgi Creek have been subject to rehabilitation efforts to address bank collapse (rip rap and rock groins).

There are two locations where the proposed trails cross a 2nd order stream (both Towradgi Creek); Towradgi Creek is not classed as key fish habitat for fish passage. The two crossings over Towradgi Creek

will require construction of a medium or large bridge to cross the creek (see Section 1.3 and REF for detailed construction notes).

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. The EPBC Protected Matters Search Tool identified eight threatened fish species as potentially having habitat within the Subject Area, however, there is no suitable habitat present (e.g. unsuitable width of waterway). During the field survey no threatened aquatic fauna were recorded opportunistically in the Subject Area.

Table 10: Creek crossings (18) within the Subject Area

Hydroname	Strahler order	Trail name	Easting	Northing
Towradgi Creek	1st order	Dirt Jump corridor	304908	6193730
Towradgi Creek	1st order	Lower Access Road	304600	6193604
Towradgi Creek	1st order	Mid Access Road	304506	6193610
Towradgi Creek	1st order	Old Access Trail	304866	6193794
Towradgi Creek	1st order	Trail 18	304524	6193963
Towradgi Creek	1st order	Trail 3	304849	6194129
Towradgi Creek	1st order	Trail 30	305152	6194335
Towradgi Creek	1st order	Trail 31	305064	6194168
Towradgi Creek	1st order	Trail 32	305073	6194704
Towradgi Creek	1st order	Trail 33	305100	6194649
Towradgi Creek	1st order	Trail 35	305317	6195024
Towradgi Creek	1st order	Trail 35	305355	6194572
Towradgi Creek	1st order	Trail 37	304601	6193674
Towradgi Creek	1st order	Trail 5 / Adaptive	304953	6193599
Towradgi Creek	1st order	Trail 5 / Adaptive	304914	6193718
Towradgi Creek	1st order	Trail 6	304957	6193619
Towradgi Creek	2nd order	Trail 1 / Adaptive	305053	6193520
Towradgi Creek	2nd order	Trail 31	305373	6194192

4. Impact Assessment

4.1 Impacts of the Project

An assessment of the potential impacts of the Project on biodiversity is provided in Table 11. Impacts are categorised as direct or indirect as described by the NSW Department of Planning, Industry and Environment (DPIE) (2018):

> *"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 11.

4.1.1 Direct impacts

The proposed works would involve a mix of machinery and some hand tool construction impacts to prepare proposed trails. Where possible, proposed trails have been located along previously cleared alignments and where trails already exist. Existing trails 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 1.5 m, depending on the trail category (see Table 4). The number of existing trails used for the final trail network was adjusted from 28 trails to 39 trails so impacts on native vegetation and habitat would be minimised. Six two-way trails would require a 2.5 m clearing width and two of these are new trails (length of 638 m). The canopy layer would not be removed, and only the immediate groundcover and understorey vegetation would be affected where any clearing takes place.

The Project would result in unavoidable and direct impacts, namely the removal of approximately 3.5 ha of native vegetation clearing (both existing and new tracks) and 0.0125 ha of temporary impacts to native vegetation and exotic vegetation at helicopter drop zones (Table 12). All areas disturbed temporarily would be regenerated post-works. It is unlikely that death to threatened entities would occur through temporary trampling. 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 12 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 quality habitat, mostly inundated with introduced flora species at the ground cover level.

Table 11: 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 3.5 ha of native understorey vegetation, leaving the canopy layer intact. The original trail network design was adjusted to minimise direct impacts on native vegetation by using more existing tracks, reducing track length and avoiding some areas of TEC.	✓	
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 operations er week).	✓	✓
Loss of shade/shelter	Unlikely – all canopy will remain as existing, only minor 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. Bed level crossings are suitable designs for 'Headwater' River Styles and bridges with bank erosion control designs are suitable for 'Low sinuosity fine grained' River Style.	✓	✓
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 through the site 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 endangered TEC vegetation 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). TEC vegetation 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 12: Summary of construction impacts to the Subject Area's vegetation

Plant community type	Primary clearing (new trails) for construction (ha)	Secondary clearing (existing trails) for construction (ha)	Temporary disturbance for laydown areas (ha) (Number of zones)	Total impact area (ha)
Illawarra Lowland Subtropical Rainforest (PCT 3013) (TEC)	0.214	0.0434	nil	0.260
Illawarra Escarpment Warm Temperate Rainforest (PCT 3028)	0.044	0.00731	nil	0.0513
South Coast Warm Temperate-Subtropical Rainforest (PCT 3036) (TEC)	0.0294	0.00115	nil	0.0305
Illawarra Escarpment Bangalay x Blue Gum Wet Forest (PCT 3153)	1.26	1.85	0.0125 (5 sites)	3.12
Illawarra North-Pittwater Bangalay Moist Forest (PCT 3155)	nil	0.00335	n/a	0.00335
Native vegetation (PCT) sub-total	**1.55**	**1.90**	**0.0125**	**3.46**
Non-native vegetation	0.0342	0.0598	nil	0.0940
Native Vegetation planted	nil	0.0540	nil	0.0540
Non-PCT subtotal	**0.0342**	**0.114**	**nil**	**0.148**
Grand total	**1.58**	**2.02**	**0.0125**	**3.61**

4.1.2 Indirect impacts

With reference to Table 11 indirect impacts, such as changes to hydrology, sedimentation, erosion and weed invasion, are considered unlikely due to the avoidance and mitigation measures that would be implemented on-site. Such measures include appropriate track construction techniques, quarantining of plant and machinery, the enforcement of strict exclusion zones and rapid rehabilitation of native vegetation.

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 February 2023 and are applicable to terrestrial environments, are shown in Table 13.

The only KTP that would occur as a result of the Project is the permanent removal of 3.5 ha of understorey native vegetation. 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 Subject 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 Subject 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 13: 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 placed nearby in suitable habitat throughout Subject Area.
5. Clearing of native vegetation	√	√	Yes Clearing of 3.5 ha
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 Subject 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)

Key Threatening Process	BC Act	EPBC Act equivalent	Exacerbated due to Project
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.
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 Subject 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 Subject 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 Subject Area. Wet or muddy footwear of staff and contractors should be cleaned and dried before and between visiting sites. 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 Subject 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 Subject 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 2022d). 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 Subject Area would be affected by the Project.

4.2 Affected threatened ecological communities (TECs)

The Project will result in the clearing of approximately 0.29 ha of ISR, a TEC listed under both state and Commonwealth legislation. The clearing of 0.29 ha equates to 0.79% of ISR present within the Subject Area.

ISR is 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 and on the Berkeley Hills north of Lake Illawarra. 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.

The ISR considered within this assessment and impacted by the Project consists of one large continuous patch and a smaller patch in the north of the Subject Area. The original design for the Project included 22 trails over 3.3 km impacting on ISR. To minimise ecological impacts on ISR, the design was amended to include 20 trails over 2.5 km within the TEC.

The ISR is variable in condition, consisting of areas of mostly high condition separated by some 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 is connected to a larger patch of ISR within the locality. Remnant patches that have not been cleared or disturbed by unsanctioned trails (corresponding with the best condition) have been largely avoided by the Project.

No additional indirect impacts to TECs are likely under the Project. A ToS (BC Act) and AoS (EPBC Act) for the ISR TEC were undertaken and are presented in Appendix 3 and Appendix 4, respectively. Based on the small area of linear impact within ISR, the limited amount of vegetation to be removed from this TEC (i.e. clearing restricted to groundcovers, shrubs and small trees (diameter at breast height <10 cm), and the retention of canopy trees and large understorey and midstorey species avoided, the Project is not considered to lead to fragmentation or isolation of the ISR TEC, or compromise its integrity, such that its long-term survival would be at risk. As such, the assessments conclude that the Project is unlikely to have a significant impact on ISR. 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 Subject Area (Table 14). Given that they can be detected at any time of year, it is considered unlikely that these species are present within, or close to, the proposed trails; however, there is potential for them to occur in the broader Subject 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 14: 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	Moderate	Low. No local records. Species not detected during surveys although suitable potential habitat associated with PCTs 3013, 3028, 3036 and 3153.	E	E
Senna acclinis Rainforest Cassia	Moderate	Low. 2 local records Species not detected during surveys although suitable potential habitat associated with PCTs 3153 and 3155.	E	-
Rhodamnia rubescens Scrub Turpentine	High	Low. 24 local records. Species not detected during surveys although suitable potential habitat associated with PCTs 3013, 3028, 3036, 3153 and 3155.	E	CE

4.4 Subject threatened and migratory fauna (terrestrial and aquatic)

The analysis of subject threatened and migratory fauna (Figure 7) resulted in 17 threatened fauna being rated as having a moderate or high likelihood of occurrence within the Subject Area and two confirmed as present (Table 15).

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 15: 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. Associated with PCT 3028 & 3036.**	**Low. Creek crossings will be managed sensitively with bridges crossing vegetation. ToS and AoS conducted (see Appendix 3 and Appendix 4).**	**V**	**V**
Green & Golden Bell Frog *Litoria aurea*	**Moderate. Associated with PCT 3153 & 3013.**	**Low. Only one area where 3 artificial freshwater dams provide habitat and these won't be disturbed. ToS and AoS conducted (see Appendix 3 and Appendix 4).**	**E**	**V**
Stuttering Frog *Mixophyes balbus*	Moderate. Associated with PCT 3013, 3153, 3028 & 3036.	Low. Most creeks on site are not permanently flowing and provide limited habitat. No local records. The creek crossings will be managed sensitively.	E	V
Birds				

Species	Likelihood of Occurrence	Potential to be affected by Project	BC Act	EPBC Act
Black Bittern *Ixobrychus flavicollis*	Moderate. Associated with PCTs 3013, 3153 & 3036.	Low. Habitat is present in the form of two wetlands. The project will minimise impacts close to the wetlands.	V	-
Black-faced Monarch *Monarcha melanopsis*	**Present**	**Low. No breeding habitat to be removed as part of Project. Minimal impacts to foraging habitat.**	**-**	**M**
Rufous Fantail *Rhipidura rufifrons*	**Present**	**Low. No breeding habitat to be removed as part of Project. Minimal impacts to foraging habitat.**	**-**	**M**
Gang-gang Cockatoo *Callocephalon fimbriatum*	High. Associated with all PCTs for this site.	Low. 52 local records and suitable habitat but no canopy trees will be removed for this project.	V	E
Glossy Black Cockatoo *Calyptorhynchus lathami*	High. Associated with all PCTs for this site.	Low. 2 local records and some suitable habitat. Allocasuarina will be avoided where possible.	V	-
Olive Whistler *Coracina lineata*	Moderate. Associated with all PCTs for this site.	Low. 2 local records and suitable habitat but no canopy trees will be removed for this project.	V	-
Powerful Owl *Ninox strenua*	High. Associated with all PCTs for this site.	Low. 61 local records. No roost trees observed or signs of prey. No canopy trees will be removed for this project.	V	-
Sooty Owl *Tyto tenebricosa*	Moderate. Associated with all PCTs for this site.	Low. 12 local records, limited suitable habitat and no canopy trees will be removed for this project.	V	-
Mammals				
Eastern Pygmy-possum *Cercartetus nanus*	Moderate. Associated with all PCTs for this site.	Low. 9 local records but limited suitable habitat.	V	-
Eastern False Pipistrelle *Falsistrellus tasmaniensis*	Moderate. Associated with all PCTs for this site.	Low. Suitable habitat exists but no canopy trees will be removed for this project.	V	-
Southern Myotis *Myotis macropus*	High. Associated with all PCTs for this site.	Low. Only one area where 3 artificial freshwater dams provide feeding habitat and these will be managed sensitively. No canopy trees will be removed for this project.	V	-
Greater Glider *Petauroides volans*	Moderate. Associated with all PCTs for this site.	Low. Suitable feeding and denning habitat does exist but no canopy trees will be removed for this project.	E	E
Yellow-bellied Glider *Petaurus australis*	Moderate. Associated with PCT 3153.	Low. 5 local records and suitable habitat. No canopy trees will be removed for this project.	V	V
Grey-headed Flying-fox *Pteropus poliocephalus*	High. Associated	Low. Abundant local records and lots of feed trees. However there are no formalised	V	V

Species	Likelihood of Occurrence	Potential to be affected by Project	BC Act	EPBC Act
	with PCTs 3028, 3013 and 3153.	'camps' where this species congregates on the site and no canopy trees will be removed for this project.		
Greater Broad-nosed Bat *Scoteanax rueppellii*	Moderate. Associated with 3153 & 3036.	Low. No canopy trees will be removed for this project.	V	-

Status - V-Vulnerable, E- Endangered

All 18 threatened fauna species with potential or known occurrence in the Subject Area may have potential foraging habitat within the Subject Area; however, the extensive areas of vegetation immediately adjacent to the Subject 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, *Allocasuarina sp.* (where possible), 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 impacts to some threatened fauna are likely under the Project. A ToS (BC Act) and/or AoS (EPBC Act) for four species listed in Table 15 were undertaken and are presented in Appendix 3 and Appendix 4, respectively. The species are Black-faced Monarch (recorded), Rufous Fantail (recorded), Giant Burrowing Frog (*Heleioporus australiacus*) (potentially present) and Green and Golden Bell Frog (*Litoria aurea*) (potentially present). The Giant Burrowing Frog and Green and Golden Bell Frog were considered given their direct reliance on watercourses, small home ranges, the number of local records confirming their presence in the locality and the bike trail network including 18 creek crossings (riparian habitat). The other 15 threatened fauna species are considered likely to move across the site but their habitat needs, home ranges and mobility means they will be less impacted by the construction and operations of the bike trail network. 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 mitigated 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. Where possible, the Project has utilised existing mountain bike trails throughout the Subject Area. Subsequent to the field surveys, the design of the Project aimed to avoid and mitigate impacts to the better condition areas of biodiversity with particular emphasis on areas of habitat for:

- ISR TEC – ecologist to inspect these areas to confirm micro-siting to minimise impacts
- Hollow-dependent native fauna - micro-siting of the alignment to avoid mature trees and trees with hollows

- Glossy Black-cockatoo - micro-siting of the alignment to avoid Allocasuarina species, regardless of size (where possible)

Other pre-construction avoidance measures include:

- Site compound/storage areas to be located outside of native vegetation areas
- Micro-siting of the alignment to avoid all overstorey species and middle-storey species with a DBH greater than 10 cm
- Development of a CEMP.

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

- Implementation of the CEMP, weekly compliance site inspections and random audits
- Project boundary and sensitive vegetation areas to be clearly defined with well-marked posts.
- All large trees and stags, including hollow-bearing trees, would be avoided. Ecologist to nominate large mature and hollow-bearing trees for temporary protective measures as part of the micro-siting of the final trail alignment. 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.
- 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 reptiles are to be avoided.
- Movement or disturbance of large hollow logs would be avoided wherever practical. Any large hollow logs that are to be moved would be placed on the side of the track and used in the sites post-works rehabilitation.
- The Project would minimise 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.
- Bridges constructed in the River Style 'Low Sinuosity Fine Grained' will include bank stability works.
- 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). There is one large active head cut located on the headwater of an unnamed creek (location - 34.370708, 150.879404) which should be repaired to prevent further erosion. The site is unstable and will continue to lose soil upstream of the headcut where a proposed trail will run. The headcut requires a 'Rock Chute' or 'Rock Ramp' design incorporating large rock, geofabric and revegetation.
- 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.
- 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 Subject 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 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.
- 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 Subject 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 trail 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.
- 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 head cut should be monitored for stability following large rain events.
- All creek lines should be monitored for the start of fresh active erosion sites (head cuts) so these can be treated quickly to prevent potential damage to nearby bike trails.
- 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 trail 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 biodiversity 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 3.5 ha of native vegetation, including 0.29 ha of ISR TEC (listed under both the BC Act and EPBC Act). It is noted that the 0.29 ha of ISR TEC to be removed is restricted to groundcovers, shrubs and small trees (diameter at breast height <10 cm). Canopy trees and large understorey and midstorey species will be avoided.

Although suitable habitat is present in the Subject Area for several threatened flora species, no threatened flora were recorded during the field surveys. As such, none are expected to be impacted by the Project.

Two migratory fauna species (Black-faced Monarch and Rufous Fantail) were recorded in the Subject Area; however, potential habitat exists for a number of species given the range of ecological niches. Assessments of 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 biodiversity:

- Illawarra Lowland Subtropical Rainforest (EPBC Act and BC Act)
- Black-faced Monarch (EPBC Act)
- Rufous Fantail (EPBC Act)
- Giant burrowing Frog (EPBC Act and BC Act)
- Stuttering Frog (EPBC Act and BC Act).

Through a combination of adjustments to the original design, as well as avoidance of clearing all overstorey vegetation, the Project is unlikely to have a significant impact on threatened biodiversity and their habitats. A SIS / BDAR (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 Subject Area. These include a low impact vegetation slashing methodology (slashing strategy) and subsequent rapid rehabilitation of impact areas, on-site mitigation measures and environmental safeguards.

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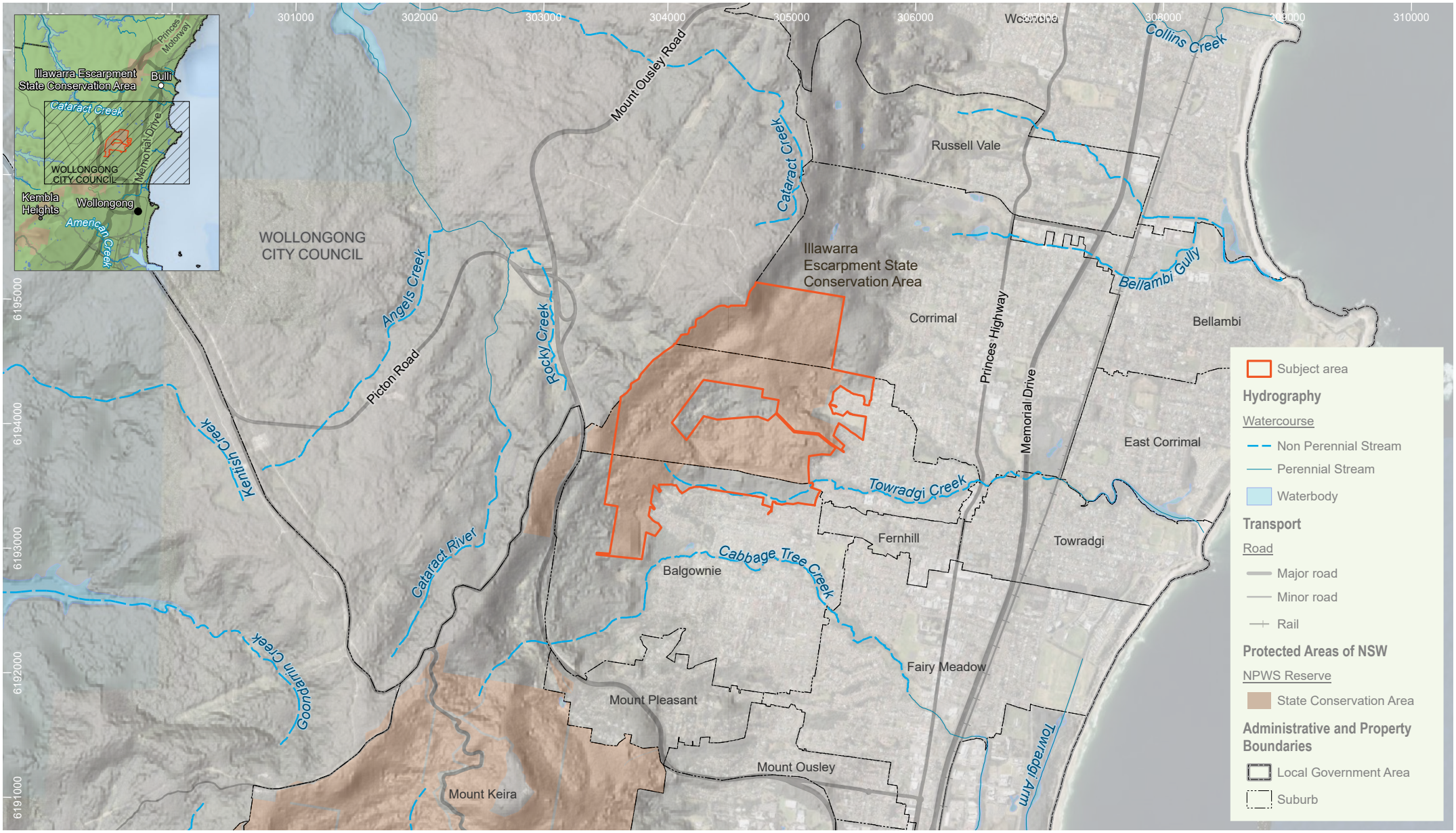
Figures

Figure 1: Site Map



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Niche PM: Kai Whitaker
Niche Proj. #: 7262
Client: NPWS

Location Map
Balgownie Mountain Bike Trail Network REF

Figure 1

Figure 2: Location Map

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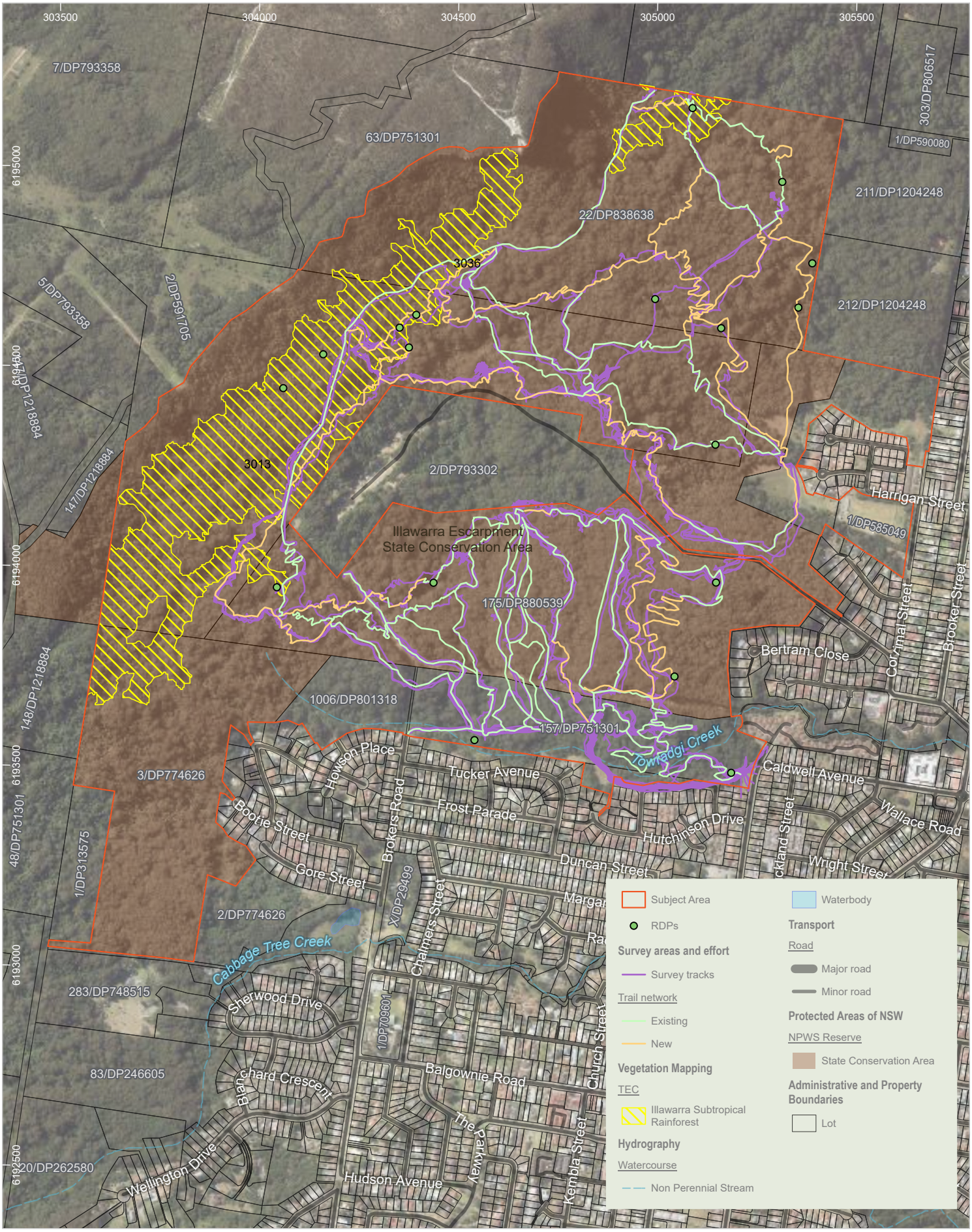
Site map

Balgownie Mountain Bike Project REF

Niche PM: Kai Whitaker
Niche Proj. #: 7262
Client: NPWS

Figure 2

Figure 3: Survey effort



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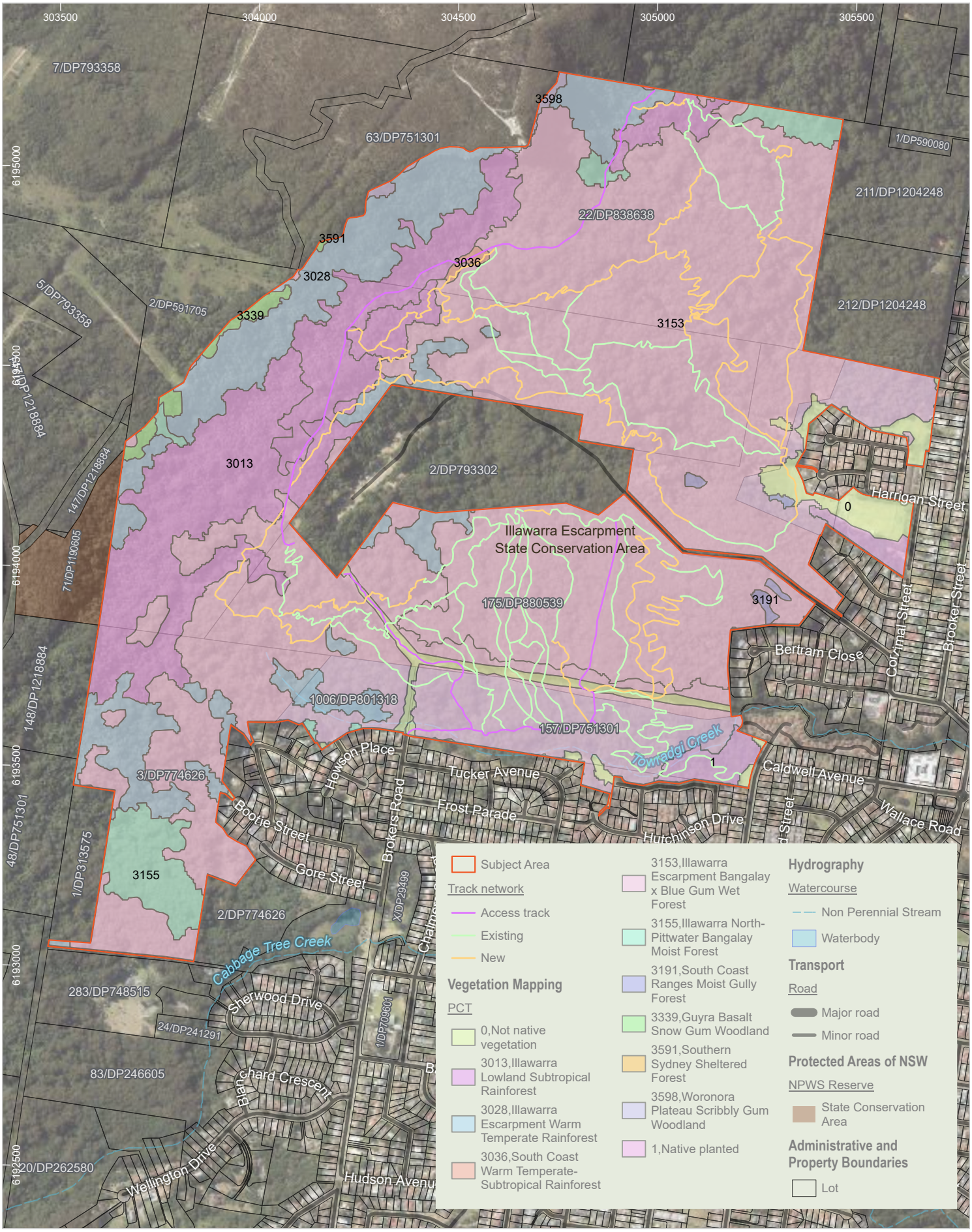
Niche PM: Kai Whitaker
Niche Proj. #: 7262
Client: NPWS

Survey effort
Balgownie Mountain Bike Trail Network REF

Figure 3

Figure 4: Vegetation communities



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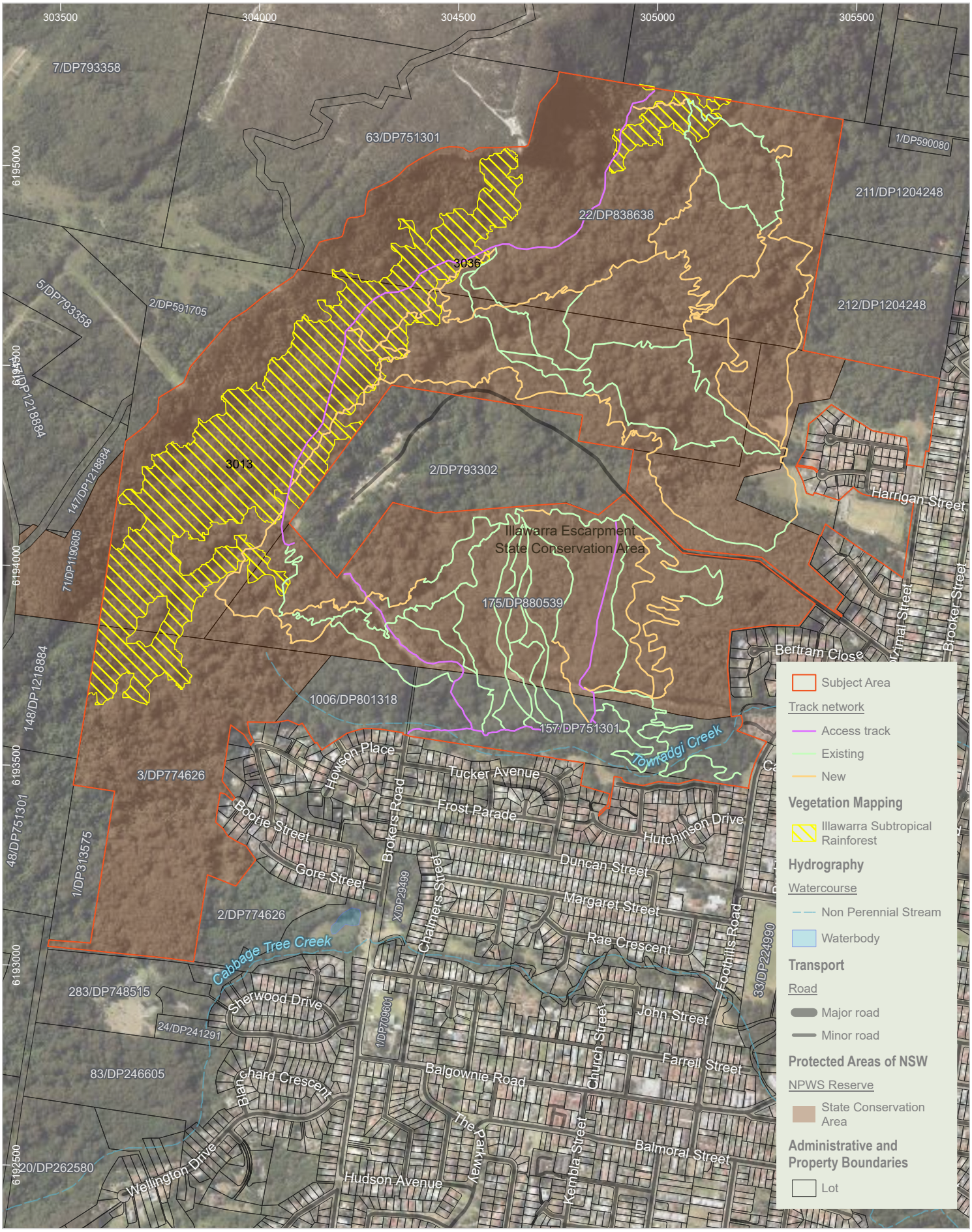
PCTs
Balgownie Mountain Bike Project REF

Niche PM: Kai Whitaker
Niche Proj. #: 7262
Client: NPWS

Figure 4

Figure 5: Threatened Ecological Communities (TECs) & trail



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TEC and trail network map

Balgownie Mountain Bike Project REF

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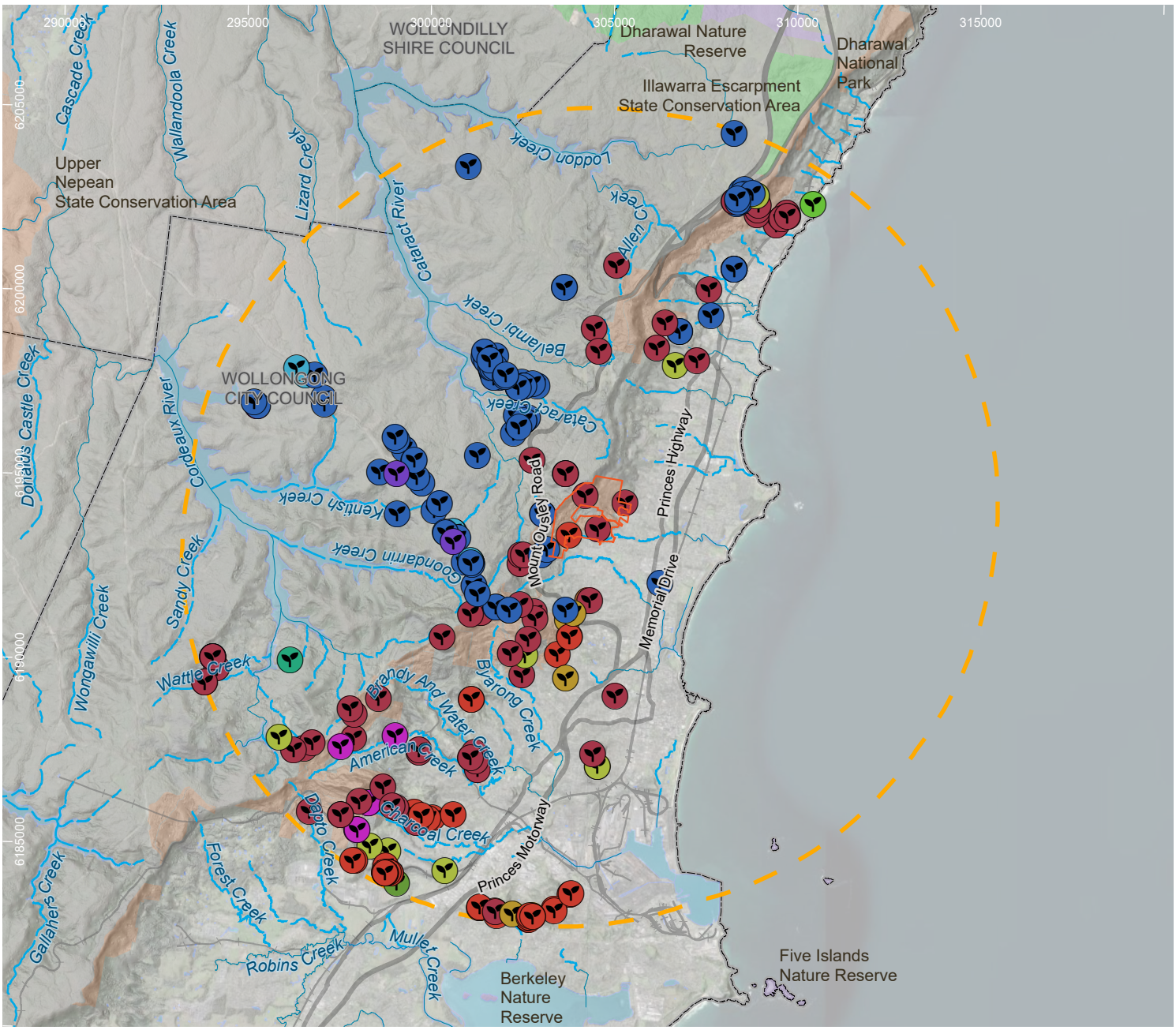
Niche Proj. #: 7262
Client: NPWS

Figure 5

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



Subject Area

10km buffer

Hydrography

Watercourse

- Non Perennial Stream
- Perennial Stream

Waterbody

Transport

Road

- Major road
- Rail

Protected Areas of NSW

NPWS Reserve

- National Park
- Nature Reserve
- State Conservation Area

Administrative and Property Boundaries

- Local Government Area

Threatened Flora/Fauna

Flora

- *Acacia baueri* subsp. *aspera*
- *Chorizema parviflorum*
- *Cynanchum elegans*
- *Epacris purpurascens* var. *purpurascens*
- *Gossia acmenoides*
- *Persoonia acerosa*
- *Persoonia glaucescens*
- *Pultenaea aristata*
- *Rhodamnia rubescens*
- *Senna acclinis*
- *Solanum celatum*
- *Syzygium paniculatum*
- *Zieria granulata*

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WGS 1984 Web Mercator

Threatened Flora recorded within 10km of the study area

Balgownie Mountain Bike Trail Network REF

*Sensitive species not displayed

Niche PM: Kai Whitaker
Niche Proj. #: 7262
Client: NPWS

Figure 6

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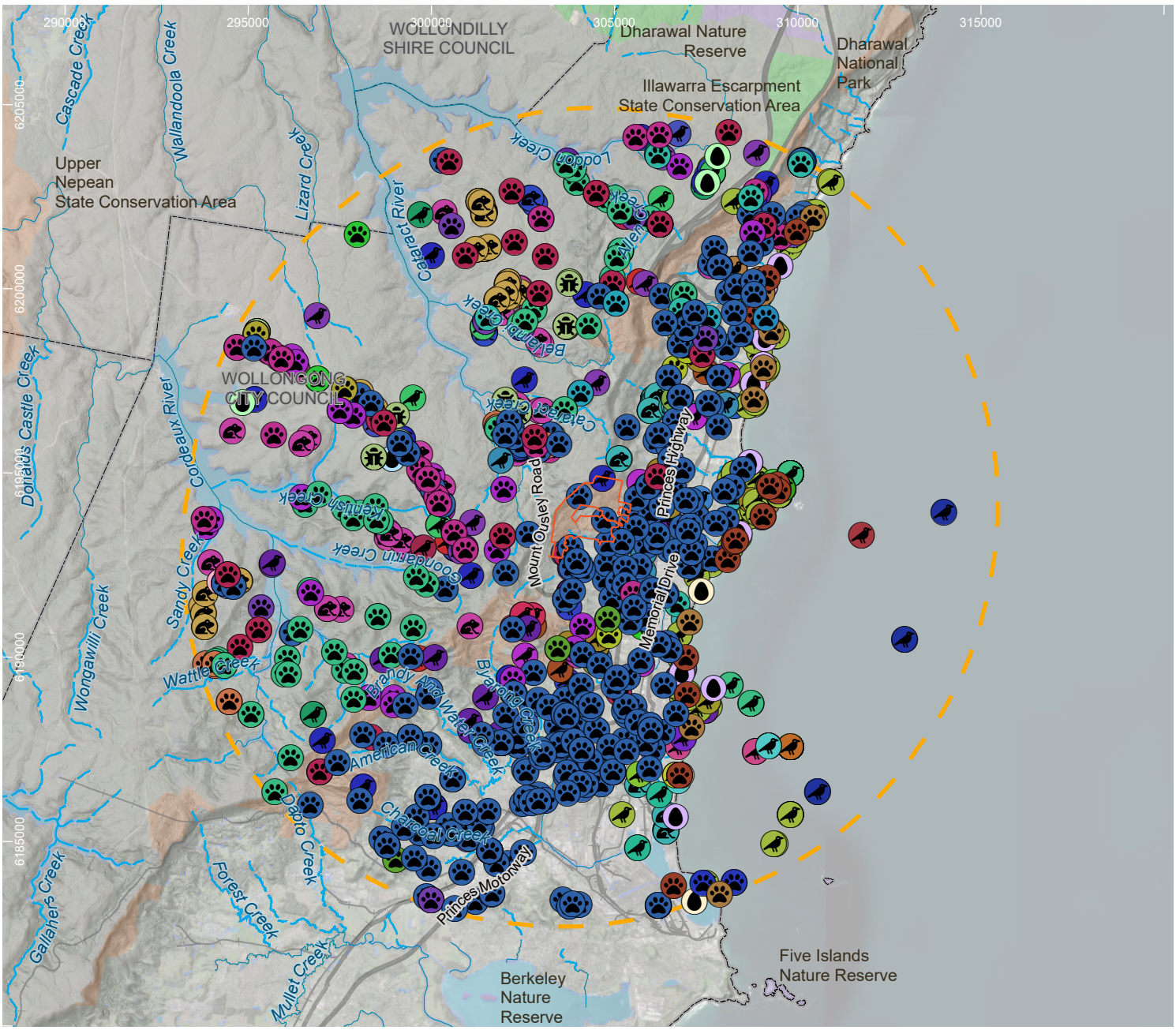
Figure 7: NSW Bionet Atlas Threatened Species 10 km Search – Fauna



Subject Area
10km buffer

Hydrography

Watercourse
- Non Perennial Stream
- Perennial Stream

Waterbody

Transport

Road
- Major road
- Rail

Protected Areas of NSW

NPWS Reserve
- National Park
- Nature Reserve
- State Conservation Area

Administrative and Property Boundaries

Local Government Area

Threatened Flora/Fauna

Mammalia
- Australian Fur-seal
- Dugong
- Eastern Coastal Free-tailed Bat
- Eastern False Pipistrelle
- Eastern Pygmy-possum
- Greater Broad-nosed Bat
- Greater Glider
- Grey-headed Flying-fox
- Koala
- Large Bent-winged Bat
- Little Bent-winged Bat
- New Zealand Fur-seal
- Southern Myotis
- Southern Right Whale
- Sperm Whale
- Spotted-tailed Quoll
- Squirrel Glider
- Yellow-bellied Glider

Insecta
- Giant Dragonfly

Reptilia
- DPIE Default Sightings
- Elements Marine Data
- Illawarra Fauna Survey
- Woronora Plateau Offset Project
- Woronora Post Fire Survey

Aves
- Australasian Bittern
- Barred Cuckoo-shrike
- Beach Stone-curlew
- Black Bittern
- Black-browed Albatross
- Black-chinned Honeyeater (eastern subspecies)
- Black-necked Stork
- Black-tailed Godwit
- Blue-billed Duck
- Broad-billed Sandpiper
- Buller's Albatross
- Campbell Albatross
- Dusky Woodswallow
- Eastern Hooded Dotterel
- Flame Robin
- Flesh-footed Shearwater
- Gibson's Albatross
- Gould's Petrel
- Great Knot
- Little Eagle
- Little Lorikeet
- Little Shearwater
- Little Tern
- Northern Giant-Petrel
- Olive Whistler
- Painted Honeyeater
- Pied Oystercatcher
- Pilotbird
- Pink Robin
- Regent Honeyeater
- Rose-crowned Fruit-Dove
- Salvin's Albatross
- Sanderling
- Scarlet Robin
- Shy Albatross
- Sooty Albatross
- Sooty Oystercatcher
- Sooty Tern
- Southern Giant Petrel
- Spotted Harrier
- Superb Fruit-Dove
- Swift Parrot
- Varied Sittella
- Wandering Albatross
- White Tern
- White-bellied Sea-Eagle
- White-throated Needletail
- Wompoo Fruit-Dove

Amphibia
- Giant Burrowing Frog
- Green and Golden Bell Frog
- Littlejohn's Tree Frog
- Red-crowned Toadlet

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Threatened Fauna recorded within 10km of the study area

Balgownie Mountain Bike Trail Network REF

*Sensitive species not displayed

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Niche Proj. #: 7262
Client: NPWS

Figure 7

Figure 8: Project footprint including habitat features, wetlands and threatened species location.

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Project footprint (habitat features, wetland location and threatened species location)

Balgownie Mountain Bike Trail Network REF

Niche PM: Kai Whitaker
Niche Proj. #: 7262
Client: NPWS

Figure 8

Appendix 1. Trail redesign in ISR

TEC	Original trail design		Final trail design	
	Trail no.	Impact length (m)	Trail no.	Impact length (m)
ISR (PCT 3013)	21	45.14	21	44.81
	22	131.94	23	18.44
	22	594.73	23	393.06
	23	14.99	24	0.22
	23	396.38	24	45.74
	24	11.78	24	150.06
	24	91.97	33	98.60
	33	202.50	33	96.14
	35	146.08	35	145.50
	25a	48.29	25a	57.79
	25a	108.84	25a	75.14
	25a	144.47	25a	208.99
	25a	210.40	25b	109.14
	25b	107.35	Upper access road	30.37
	Upper access road	50.56	Upper access road	45.76
	Upper access road	30.27	Upper access road	151.47
	Upper access road	1.60	Upper access road	636.98
	Upper access road	632.24	n/a	n/a
	Upper access road	151.45	n/a	n/a
Subtotal		**3,121**		**2,308**
ISR (PCT 3036)	23	105.29	23	117.41
	26	3.43	26	7.66
	Upper access road	75.31	Upper access road	73.11
Subtotal		**184**		**198**
Totals		**3,305**		**2,506**

Appendix 2. Rapid Data Point data – flora & habitat

Latitude	Longitude	Observer	RDP#	Date	Time	Informal RDP Name	Overstory species	Midstorey species	Understory species	Groundcover species
-34.38068299	150.8744928	SB	1	28/09/2022	10:37	Acacia woodland	*Acacia melanoxylon*			
-34.37723649	150.8690947	SB	2	28/09/2022	11:58	Weeds				*Ageratina riparia, Ageratina adenophora, Delairea odorata, Commelina cyanea, Carex spp.*
-34.37274532	150.8692703	SB	3	28/09/2022	13:32	Disturbed ISR			*Dendrocnide excelsa*	*Adiantum aethiopicum, Pteridium esculentum Calochlaena dubia, Urtica incisa, Gymnostachys anceps*
-34.371982	150.8703623	SB	4	28/09/2022	13:45	Disturbed ISR			*Doryphora sassafras*	*Rubus rosifolius, Calochlaena dubia, Gymnostachys anceps, Hydrocotyle laxiflora, Pteridium esculentum, Carex spp.*
-34.36809411	150.8829001	SB	5	28/09/2022	14:58	Disturbed				*Rubus rosifolius, Dichondra repens, Commelina cyanea*
-34.36993069	150.8837196	SB	5	28/09/2022	15:21	ISR				
-34.37092945	150.8833388	SB	6	28/09/2022	15:35	*Degraded Blackbutt and blue gum*				
-34.37924952	150.8799557	SB	10	18/10/2022	9:18	PCT 694	*Eucalyptus pilularis, Syncarpia glomulifera, Eucalyptus botryoides*	*Livistona australis*	*Synoum glandulosum subsp. glandulosum, Pittosporum multiflorum, Allocasuarina littoralis*	*Adiantum aethiopicum, Geitonoplesium cymosum, Gymnostachys anceps, Doodia aspera*

Latitude	Longitude	Observer	RDP#	Date	Time	Informal RDP Name	Overstory species	Midstorey species	Understory species	Groundcover species
-34.3771308	150.8810894	SB	11	18/10/2022	10:01	694	*Eucalyptus pilularis*	*Acacia melanoxylon,Allocasuarina littoralis*	*Synoum glandulosum subsp. glandulosum*	*Lomandra longifolia, Dianella caerulea, Eustrephus latifolius, Entolasia marginata, Marsdenia rostrata, Calochlaena dubia*
-34.37713472	150.8733735	SB	11	18/10/2022	11:43	Exotic			*Lantana camara, Delairea odorata, Rubus rosifolius*	*Hydrocotyle laxiflora*
-34.37182893	150.8727036	SB	12	18/10/2022	13:40	ISR				
-34.37138115	150.8724476	SB	13	18/10/2022	13:57	ISR	*Baloghia inophylla, Dendrocnide excelsa*		*Livistona australis*	*Gymnostachys anceps, Pteris tremula*
-34.37109212	150.8729035	SB	14	18/10/2022	14:00	Helipad			*Livistona australis, Diploglottis australis*	*Adiantum formosum, Pteris tremula*
-34.37073671	150.8794278	SB	15	18/10/2022	15:14	694	*Eucalyptus pilularis, Toona ciliata, Dendrocnide excelsa*		*Calochlaena dubia, Lantana camara, Rubus rosifolius, Delairea odorata, Cyathea australis*	
-34.37139359	150.8812305	SB	16	18/10/2022	15:31	?	*Eucalyptus botryoides <--> saligna*		*Pittosporum multiflorum, Cryptocarya glaucescens, Diospyros australis*	*Pellaea falcata, Doodia aspera, Gymnostachys anceps, Geitonoplesium cymosum, Pandorea pandorana*
-34.37402174	150.8810734	SB	17	18/10/2022	16:07	694 open disturbed			*Solanum chenopodioides, Lantana camara*	*Delairea odorata, Rubus rosifolius*

Latitude	Longitude	Observer	RDP#	Date	Time	Informal RDP Name	Overstory species	Midstorey species	Understory species	Groundcover species
-34.36642865	150.8804502	SB	18	30/11/2022	12:04	ISR	*Schizomeria ovata, Endiandra sieberi*	*Doryphora sassafras, Planchonella australis, Dendrocnide excelsa*	*Legnephora moorei, Pittosporum multiflorum, Diploglottis australis, Livistona australis, Gymnostachys anceps, Wilkiea huegeliana, Pyrrosia rupestris, Cryptocarya glaucescens, Homalanthus populifolius*	*Calochlaena dubia, Marsdenia flavescens, Adiantum aethiopicum, Doodia aspera*
-34.3814218	150.8815023	SB	19	30/11/2022	14:35	Planted	*Brachychiton acerifolius, Eucalyptus botryoides <--> saligna, Syncarpia glomulifera subsp. glomulifera, Glochidion ferdinandi, Acacia melanoxylon, Eucalyptus microcorys, Eucalyptus saligna*		*Pittosporum multiflorum, Ficus coronata, Archontophoenix cunninghamiana, Livistona australis, Dendrocnide excelsa, Morinda jasminoides, Melia azedarach, Toona ciliata*	*Tradescantia albiflora, Pandorea pandorana, Oplismenus spp., Stephania japonica, Adiantum aethiopicum, Ehrharta erecta*

Latitude	Longitude	Habitat feature	Notes	Date	Time
-34.37070774	150.8794036	Eroding creek with exposed coal seam - major head cut	Active headcut on Headwater River Style. The proposed trail is upstream from the headcut. Headcut requires rock ramp or rock chute rehabilitation to control.	2022-10-18	15:14
-34.37718233	150.8732586	Hollow-bearing stag	Dead stag in clearing	2022-10-18	11:46
-34.37567282	150.8767924	Hollow-bearing stag	Red track	2022-10-18	10:46
-34.36932294	150.8835644	Hollow-bearing stag	Track 35 - 2 large hollows	2022-09-28	15:14
-34.36939212	150.8829176	Hollow-bearing stag	Crown snapped off - 3 obvious hollows	2022-09-28	15:10
-34.37626584	150.8795524	Hollow-bearing tree	Proposed red track. *Eucalyptus saligna* species.	2022-10-18	10:14
-34.377166	150.8792661	Hollow-bearing tree	*Eucalyptus saligna* with hollows x 3.	2022-10-18	09:43
-34.36623222	150.8797717	Hollow-bearing tree	One large hollow in a *Eucalyptus pilularis*.	2022-09-28	14:44
-34.36988306	150.8740211	Hollow-bearing tree	Very large mature tree - unknown species.	2022-09-28	14:02
-34.38124248	150.8787796	Hollow-bearing tree	*Eucalyptus saligna* with hollows - riparian location.	2022-09-12	10:02
-34.36774632	150.8839332	Hollow-bearing tree	*Eucalyptus pilularis*	2022-11-30	13:56
-34.36702833	150.8827069	Hollow-bearing tree	*Eucalyptus pilularis*	2022-11-30	13:50
-34.36840256	150.8815109	Hollow-bearing tree	*Eucalyptus saligna*	2022-11-30	11:33
-34.36844515	150.881558	Hollow-bearing stag		2022-11-30	11:29
-34.37175187	150.8723752	ISR vegetation track 25a	TEC confirmed	2022-10-18	13:44
-34.37150558	150.8760696	Large freshwater ponds	Artificial ponds from mining era. Really good frog habitat. Potential habitat for green and golden bell frogs.	2022-10-18	14:55
-34.381044	150.8796305	Large remnant tree	DBH 2m	2022-09-28	09:52
-34.3717123	150.8723748	Remnant red cedars	*Toona ciliata*	2022-10-18	13:42
-34.36995778	150.883271	Remnant red cedars	*Toona ciliata*	2022-09-28	15:24
-34.38094558	150.8795488	Remnant tee	*Syncarpia glomulifera*	2022-09-28	10:16
-34.37791721	150.8724724	Remnant tree	*Eucalyptus pilularis*	2022-09-28	11:11
-34.36988804	150.8740311	Remnant tree	*Eucalyptus pilularis*	2022-09-28	14:08
-34.37000427	150.883683	Stand of red cedars	Small stand 3 -5 trees	2022-09-28	15:21
-34.37189215	150.876219	Termite nest	*Toona ciliata*	2022-10-18	14:58
-34.37761446	150.8705723	Vegetation	Trail 16 - proposed. Uncleared track. Really good quality vegetation.	2022-09-28	11:23

Appendix 3. 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)
  - Stuttering Frog (Endangered).

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 ISR considered within this assessment and impacted by the Project consists of one large continuous patch and a smaller patch in the north of the Subject Area. The extent of ISR in the Subject Area is 36.8 ha. The original design for the Project included 22 bike trails over 3.3 km impacting on ISR. To avoid ecological impacts, the final design consists of 20 bike trails over 2.5 km within ISR. Of the 36.8 ha of ISR in the Subject Area, 0.79% will be impacted by the Project. The ISR is variable in condition, consisting of areas of mostly high condition separated by some areas of Lantana infestation due to previous clearing activities (powerline easements and access trails). The area of rainforest to be impacted by the Project is connected to a larger patch of ISR within the locality. Remnant patches that have not been cleared or disturbed by unsanctioned trails (corresponding with the best condition) have been largely avoided by the Project. The majority of the ISR surveyed is 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[1]. The variable condition relates to the helicopter drop zone areas, and other areas that have been subject to past clearing and disturbance i.e. powerline easements and access trails. A total of 0.29 ha 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 occurrence is likely to be placed at risk of extinction, or	The Project would involve the removal of 0.29 ha of ISR native vegetation, this consisting of groundcover and understorey species only, from a narrow (1.5 m wide) linear footprint. The total extent of ISR is estimated to be 6,500 ha (DoEE 2019), therefore the extent would be reduced by approximately 0.004%. The 0.29 ha and the percentages calculated above are conservative. Based on the retention of large understorey and midstorey species, as well as canopy trees, the actual amount of vegetation clearing is considered to be a small proportion of the calculated extent reductions above. While a very small proportion of the ISR within the Subject Area will be adversely impacted (0.79%), it is unlikely that it would be such that its local occurrence is likely to be placed at risk of extinction.

[1] It is noted that no vegetation survey plots were conducted as part of this assessment.

Illawarra Subtropical Rainforest in the Sydney Basin Bioregion (ISR)	
ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,	The 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 groundcover and understory vegetation, leaving the canopy and large shrubs typical of the ISR community, such as the Giant Stinging Tree, intact.
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 0.29 ha. This comprises only groundcover, understorey and midstorey species; all of the mature trees and habitat trees with hollows will be avoided. **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 clearing of the groundcover, understory and midstory layers of the vegetation via the introduction of narrow mountain bike trails (generally 1.5 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 groundcover and vegetation, leaving the canopy and large shrubs typical of the ISR community, such as the Giant Stinging Tree, intact. 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 Subject 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 Subject Area of 3.5 ha, of which 0.29 ha is ISR.
Conclusion: The Project is unlikely to fragment ISR or place it 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 trail network during operation.	

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 vegetation clearing of 3.5 ha 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 to 3.5 ha of native vegetation. Clearing of native vegetation involves the clearing of a narrow strip (up to 1.5 m wide) for a mountain bike trail and the construction of bridges above the creek channel. Giant Burrowing Frog was not recorded within the Subject 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. BioNet records show the nearest record to be 3 km north and of the Subject Area (recorded in 2014 and 2020) (DPE 2022c). There are 55 records of this species within 10 km recorded in BioNet. 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	N/A

Giant Burrowing Frog	
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 Giant Burrowing Frog habitat to be impacted will be restricted to the understorey vegetation to allow mountain bike and foot access. The creek crossings 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 the movement of 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 Subject 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 Subject Area due to the proposed works. The only KTP that may impact 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 Subject Area of 3.5 ha 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 Subject Area.
Conclusion: Given the avoidance of high quality habitat and minimal impacts across the Subject 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.	

Green and Golden Bell Frog

Distribution: Since 1990, there have been approximately 50 recorded populations locations in NSW, most of which are small, coastal or near coastal populations. They were formerly distributed from the NSW north coast near Brunswick Heads, southwards along the NSW coast to Victoria where it extends into east Gippsland. No targeted surveys were conducted for this species were conducted.

Habitat requirements: The Green and Golden Bell Frog is found in a range of habitats in and around water bodies such as wetlands, lakes and dams, and often on sites which humans have disturbed such as abandoned quarries. Their preferred habitats always contain plenty of vegetation in and around water. Their diet typically consists of beetles, ants, spiders, crickets and smaller frogs, including the young of their own species. The green and golden bell frog can colonise, use and survive in a wide range of habitats, including highly modified sites such as disused industrial areas. The frog requires different habitat during different parts of its life cycle, including habitat for breeding, foraging, refuge and movement. Constructed water bodies such as stormwater detention basins, farm dams, areas bunded by earthworks and by road or rail structures, drains, ditches and other excavated areas that can capture water such as quarries and brick pits have been used as breeding habitat. Smaller or less obvious structures have also been used, such as water tanks, bunded safety areas surrounding industrial chemical storage areas, wells, irrigation pits, water troughs, laundry tubs and old bath tubs. Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (Gambusia holbrooki), have a grassy area nearby and diurnal sheltering sites available.

Impact summary: The Project will require the clearing of 3.5 ha of native vegetation, including riparian areas, which may be utilised as habitat by these species. 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 to 3.5 ha of native vegetation, including a marginal area of riparian vegetation. Clearing of native vegetation involves the clearing of a narrow strip (generally 1.5 m wide) for a mountain bike trail and the construction of bridges above the creek channel. BioNet records show the nearest record to be 1 km north of the Subject Area (recorded in 1997) (DPE 2022c). There are 79 records of this species within 10 km recorded in BioNet. The large intact patches of vegetation and riparian areas within the Subject Area provide extensive areas of habitat facilitating fauna movement and provide habitat resources throughout the region and in the area immediately adjacent to the Subject Area. Given the avoidance of impact to potential Green and Golden Bell Frog habitat within the Subject 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

Green and Golden Bell 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 Green and Golden Bell Frog habitat to be removed will be restricted to the understorey vegetation across riparian areas and adjacent to the wetlands. The creek crossings 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 this species. **Importance of habitat to be impacted:** While some of the creek lines and wetlands provide potential habitat, the Project largely avoids such habitat. The very small area of habitat impacted compared to the amount of habitat present in the locality, significantly reduces the overall importance of potentially impacted habitat.
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 Subject Area due to the proposed works. The only KTP that may impact the Green and Golden Bell Frog is the clearing of native vegetation. In this case, the proposed trails equate to a permanent clearing of 3.5 of ha of native vegetation (excluding canopy) from the Subject Area. 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 Subject Area, the Project is unlikely to result in a significant impact on the Green and Golden Bell 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.	

Appendix 4. 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)
  - Green and Golden Bell Frog (Vulnerable)

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 0.29 ha of ISR native clearing. The extent of ISR is estimated to be 6,500 ha (DoEE 2019), therefore the extent would be reduced by approximately 0.004%. The clearing of 0.29 ha equates to a 0.79% reduction of ISR from the Subject Area, however, as the clearing is restricted to groundcover and understory vegetation only, this reduction is overly conservative. 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 ground and understory vegetation, leaving the canopy and large shrubs typical of the ISR community, such as the Giant Stinging Tree, intact.	Likely – small reduction in extent (0.004% 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 1.5 m wide) is unlikely to reduce seed dispersal and animal dispersal for those species that are currently able to move between patches of ISR.	Unlikely –small increase, no greater than 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). It is considered that most the ISR present within the Subject Area meets High Condition class (Category B), with 10 species from the flora list present. The removal of 0.29 ha of this community by the Project would not adversely affect habitat critical to the survival of ISR as the canopy, large shrubs and various vines across the Subject Area will be avoided. The structural integrity and function of ISR is unlikely to be compromised as a result of the Project.	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 waterways. 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 Subject Area. These impacts would be managed via rehabilitation efforts within ISR adjacent to the Subject Area. Given the current high concentration of weeds in parts of the Subject Area, a management plan has been recommended to reduce the chances of encroachment of many exotic species throughout the higher quality ISR.	Unlikely (mitigated) - ongoing maintenance of proposed trails to reduce any risk of erosion in the gullies and waterways within and near to ISR.

Illawarra-Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion (ISR)		
	The overall modification to the water and soil is temporary during construction, while the ongoing maintenance of the track will prevent increased erosion in 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 Subject 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 Subject 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 0.79% of ISR in the Subject Area. 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 on the extent of ISR as a result of the Project (0.79% in the locality) through partial vegetation clearing and the use of one helicopter drop zone. All other areas of ISR have been avoided, therefore based on EPBC Act significant impact 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 1.5 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 Subject 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 Subject Area. BioNet records indicate there are 55 records of this species within 10 km of the Subject Area, the nearest record being 3 km to the north (recorded in 2014 and 2020) (DPE 2023c).	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 Towradgi Creek. More adequate habitat for the species is present in the nearby ephemeral creeks which would not be impacted by the Project.	Unlikely
• disrupt the breeding cycle of an important population	The Project is not likely to significantly disrupt the breeding cycle of any Giant Burrowing Frog 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 1.5 m wide) and the tracks would be raised onto bridges above 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

Giant Burrowing Frog		
• 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 Subject 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
• interfere substantially with the recovery of the species.	There is no adopted or made recovery plan for this species (DCCEEW 2023c).	Unlikely
Conclusion: The proposed action will remove up to 3.5 ha of native vegetation, some of which may provide habitat for the Giant Burrowing Frog. However, given that impacts are relatively minor, the Subject 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.		

Green and Golden Bell Frog		
Refer to the Green and Golden Bell 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 Green and Golden Bell 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 1.5 m wide) of native vegetation for a mountain bike trail and the construction of bridges above the creek channel. BioNet records indicate that there are 79 records of this species within 10 km of the Subject Area, the nearest record being 1 km to the north (recorded in 1997) (DPE 2023c).	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 this species, 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 riparian areas. More adequate habitat for the species is present in nearby ephemeral creeks which would not be impacted by the Project. The wetlands will not be disturbed and there is only one trail in their vicinity.	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 Green and Golden Bell 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 good habitat, which generally increases the potential for invasive predators to move into new areas. However, the proposed tracks are minor in nature (generally 1.5 m wide) and the tracks would be raised onto bridges above 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 Green and Golden Bell 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 Subject 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 Green and Golden Bell Frog to decline.	Unlikely

Green and Golden Bell Frog		
• interfere substantially with the recovery of the species.	There is no adopted or made recovery plan for this species.	Unlikely
Conclusion: The proposed action will remove up to 3.5 ha of native vegetation through clearing, some of which may provide habitat for the Green and Golden Bell Frog. However, given that impacts are relatively minor, the Subject Area is likely to continue to provide habitat for the species. The Project is considered unlikely to have a significant impact on the Green and Golden Bell Frog.		

Appendix 5. Likelihood of occurrence table

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
AMPHIBIANS							
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. Breeding habitat of this species is generally soaks or pools within first or second order streams. 55 local records.	Moderate. Associated with PCT 3028 & 3036.	Low. Creek crossings will be managed sensitively with bridges crossing vegetation. ToS & AoS conducted (see Appendix 2 & Appendix 3).

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
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. 79 local records.	Moderate. Associated with PCT 3153 & 3013.	Low. Only one area where 3 artificial freshwater dams provide habitat and these won't be disturbed. ToS & conducted (Appendix 2 & Appendix 3).
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	Low. Associated with PCT 3036.	Low. No suitable habitat and no local records.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					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 woodlands. Calling occurs in all months of the year, often in association with heavy rains. The tadpoles are distinctive, being large and very dark		

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					in colouration. No local records.		
Litoria watsoni	Watson's Tree Frog	PMT	-	E	A recent taxonomic revision divided Litoria littlejohn into two species (*L. littlejohn* and *L. watsoni*). This species is very similar to L. littlejohn physically. This species prefers shallow streams with rocky or sandy bases with pools that are separate to other water bodies. These pools have low salinity, are slightly acidic and contain high levels of leaf litter. They also lack fish and contain little algae. Not known to occur where there is clearing, forestry or farmland. No suitable habitat. No local records.	Low. Not associated with any PCTs mapped for the site.	Low. No suitable habitat and no local records.
Mixophyes balbus	Stuttering Frog	PMT	-	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	Moderate. Associated with PCT 3013, 3153, 3028 & 3036.	Low. Most creeks on site are not permanently flowing and provide limited habitat. No local records. The creek crossings will be managed sensitively.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					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. No local records.		
Pseudophryne australis	Red-crowned Toadlet	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	Low. Associated with PCT 3028.	Low. Minimal suitable habitat. The creek crossings will be managed sensitively.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					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.		
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	Low. Not associated with any PCTs for this site.	Low. 2 local records and some suitable habitat but no canopy trees will be removed for this project.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					are only three known 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. 2 local records.		
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	Low. Associated with all PCTs for this site.	Low. 1 local record and some suitable habitat but no canopy trees will be removed for this project.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					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. 1 local record.		
Botaurus poiciloptilus	Australasian Bittern	Bionet	E	E	The Australasian Bittern 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. 2 local records.	Low. Not associated with any PCTs for this site.	Low. 2 local records and two wetlands are present but won't be impacted by the project.
Calidris alba	Sanderling	Bionet	V	C	Found in coastal areas on low beaches of firm	None	None. Only uses coastal habitat.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					sand, near reefs and inlets, along tidal mudflats and bare open coastal lagoons; individuals are rarely recorded in near-coastal wetlands. 3 local records.		
Calidris canutus	Red Knot	PMT	-	E, M	During the non-breeding season in Australasia, the red knot mainly inhabit intertidal mudflats, sandflats and sandy beaches of sheltered coasts and sometimes on sandy ocean beaches or shallow pools on exposed rock platforms. They are occasionally seen on terrestrial saline wetlands near the coast and on sewage ponds and saltworks. No local records.	None	None. Only uses coastal habitat.
Calidris ferruginea	Curlew Sandpiper	Bionet	E	CE, M	In Australia, curlew sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps,	None	None. Only uses coastal habitat.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					lakes and lagoons near the coast, and ponds in saltworks and sewage farms. No local records.		
Callocephalon fimbriatum	Gang-gang Cockatoo	BAM-C, Bionet	V	E	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. 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. 52 local records.	High. Associated with all PCTs for this site.	Low. 52 local records and suitable habitat but no canopy trees will be removed for this project.
Calyptorhynchus lathami	Glossy Black-Cockatoo	BAM-C, Bionet	V	-	Inhabits forest with low nutrients, characteristically with key Allocasuarina spp. Tends to prefer drier	High. Associated with all PCTs for this site.	Low. 2 local records and some suitable habitat. Allocasuarina will be avoided where possible.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					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. 2 local records.		
Charadrius leschenaultii	Greater Sand Plover	PMT	-	V	In the non-breeding grounds in Australasia, the species is almost entirely coastal, inhabiting littoral and estuarine habitats. They mainly occur on sheltered sandy, shelly or muddy beaches, large intertidal mudflats, sandbanks, salt-marshes, estuaries, coral reefs, rocky islands rock platforms, tidal lagoons and dunes near the coast	None	None. Only uses coastal habitat.
Circus assimilis	Spotted Harrier	Bionet	V	-	The Spotted Harrier occurs throughout the Australian mainland, except in densely forested or	Low. Not associated with any PCTs for this site.	Low. 1 local record but no suitable habitat.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					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. 1 local record.		
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.	Low. Associated with PCT 3153.	Low. 2 local records and some suitable habitat but no canopy trees will be removed for this project.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					They are active birds, frequently moving from tree to tree. 1 local record.		
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. 1 local record.	Low. Associated with all PCTs for this site.	Low. 1 local record and some suitable habitat but no canopy trees will be removed for this project.
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,	Low. Associated with all PCTs for this site.	Low. 9 local records but suitable habitat is limited on the site.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					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. 9 local records.		
Diomedea antipodensis	Antipodean Albatross	PMT	-	V, M	At sea Antipodean albatrosses range across the South Pacific from Australia to as far as Chile, from the Tropic of Capricorn south. They breed on the Auckland Islands,	None	None. Only uses coastal habitat.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					Antipodes Islands and Campbell Island. No local records.		
Diomedea epomophora	Southern Royal Albatross	PMT	-	V, M	Most of the royal albatross population is found between 30° S and 45° S. The majority of the world's population of southern royal albatrosses nest on the rat-free subantarctic Campbell Island, around 8,200 to 8,600 pairs. No local records.	None	None. Only uses coastal habitat.
Diomedea exulans (sensu lato)	Wandering Albatross	Bionet		V, M	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. No local records.	None	None. Only uses coastal habitat.
Diomedea sanfordi	Northern Royal Albatross	PMT	-	E, M	Northern royal albatrosses nest on the Chatham Islands (Forty-fours Island, Big Sister Island, and Little	None	None. Only uses coastal habitat.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					Sister Island), Enderby Island in the Auckland Islands, and at Taiaroa Head on the Otago Peninsula of New Zealand. When they are not breeding, northern royal albatrosses undertake circumpolar flights in the southern oceans. No local records.		
Falco hypoleucos	Grey Falcon	PMT	E	V	The species occurs in arid and semi-arid Australia, including the Murray-Darling Basin, Eyre Basin, central Australia and Western Australia. The species frequents timbered lowland plains, particularly acacia shrublands that are crossed by tree-lined water courses. No local records.	Low. Not associated with any PCTs for this site.	Low. No suitable habitat.
Fregetta grallaria	White-bellied Storm-Petrel	PMT	-	V	The white-bellied storm petrel has a widespread range throughout the oceans of the Southern Hemisphere	None	None. Only uses coastal habitat.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					including the Pacific, Atlantic and Indian Oceans. No breeding colonies in NSW. No local records.		
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. 12 local records.	Low. Associated with PCTs 3013, 3028 & 3153.	Low. 12 local records, limited suitable habitat and no canopy trees will be removed for this project.
Grantiella picta	Painted Honeyeater	Bionet	V	V	Inhabits Boree/ Weeping Myall (*Acacia pendula*), Brigalow (*A. harpophylla*) and	Low. Not associated with any PCTs for this site.	Low. No local records and no suitable habitat.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					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. No local records.		
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. 53 local records.	None	None. Only uses coastal habitat.
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. 1 local record.	None	None. Only uses coastal habitat.
Haliaeetus leucogaster	White-bellied Sea-Eagle	Bionet	-	M	Inhabits coastal and near coastal areas,	None	None. Only uses coastal habitat.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					building large stick nests, and feeding mostly on marine and estuarine fish and aquatic fauna. 14 local records.		
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. 6 local records.	Low. Associated with all PCTs for this site.	Low. 6 local records, some suitable habitat but no canopy trees removed for this project.
Hirundapus caudacutus	White-throated Needletail	PMT	-	V, M	An aerial species found in feeding concentrations over cities, hilltops and timbered ranges. 2 local records.	Low. Associated with all PCTs for this site.	Low. This species migrates down the east coast and doesn't breed in Australia. No canopy trees will be removed for this project.
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.	Moderate. Associated with PCTs 3013, 3153 & 3036.	Low. Habitat is provided as two wetlands. The project will minimise impacts close to the wetlands.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					The sites where they occur are characterized by dense waterside vegetation. 6 local records.		
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. 18 local records.	Low. Not associated with any PCTs for this site.	Low. Unsuitable habitat and no canopy trees will be removed for this project.
Limicola falcinellus	Broad-billed Sandpiper	Bionet	V	C	Broad-billed Sandpipers favour sheltered parts of the coast such as estuarine sandflats and mudflats, harbours, embayments, lagoons, saltmarshes	None	None. Only uses coastal habitat.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					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. 1 local record.		
Limosa lapponica baueri	Nunivak Bar-tailed Godwit	Bionet	-	V	It is found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. Less frequently it occurs in salt lakes and brackish wetlands, sandy ocean beaches and rock platforms. No local records.	None	None. Only uses coastal habitat.
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,*	Low. Associated with all PCTs for this site.	Low. 8 local records, suitable habitat but no canopy trees will be removed for this project.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					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. 8 local records.		
Macronectes giganteus	Southern Giant Petrel	Bionet	E	E, M	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	None	None. Only uses coastal habitat.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					and in Australian Antarctic territory. 4 local records.		
Macronectes halli	Northern Giant-petrel	Bionet	V	V, M	Breeding in Australian territory is limited to Macquarie Island and occurs during spring and summer. No local records.	None	None. Only uses coastal habitat.
Monarcha melanopsis	Black-faced Monarch	PMT	-	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. No local records.	Present	Low. No breeding habitat to be removed as part of Project. Minimal impacts to foraging habitat. AoS conducted (see Appendix 3).
Neophema chrysogaster	Orange-bellied Parrot	PMT	CE	CE	The Orange-bellied Parrot breeds in the south-west of Tasmania and migrates in autumn to spend the winter on the mainland coast of south-eastern South Australia and southern Victoria. On the mainland, the Orange-bellied	None	None. Only uses coastal habitat.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					Parrot spends winter mostly within 3 km of the coast in sheltered coastal habitats including bays, lagoons, estuaries, coastal dunes and saltmarshes. The species also inhabits small islands and peninsulas and occasionally saltworks and golf courses. Birds forage in low samphire herbland or taller coastal shrubland. No local records.		
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	Low. Not associated with any PCTs for this site.	Low. No suitable habitat.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					to December. It lays four or five white, rounded eggs on a nest of decayed wood dust. 1 local record.		
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. 3 local records.	Low. Associated with all PCTs for this site.	Low. 3 local records, suitable habitat but no canopy trees will be removed for this project.
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	High. Associated with all PCTs for this site.	Low. 61 local records. No roost trees observed or signs of prey. No canopy trees will be removed for this project.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					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. 61 local records.		
Numenius madagascariensis	Eastern Curlew	PMT	-	CE, M	During the non-breeding season in Australia, the eastern curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass (Zosteraceae). No local records.	None	None. Only uses coastal habitat.
Onychoprion fuscata	Sooty Tern	Bionet	V	-	The Sooty Tern is found over tropical and sub-tropical seas and on associated	None	None. Only uses coastal habitat.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					islands and cays around Northern Australia. In NSW only known to breed at Lord Howe Island. Occasionally seen along coastal NSW, especially after cyclones. 1 local record.		
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. 2 local records.	Low. Associated with all PCTs for this site.	Low. 2 local records and suitable habitat but no canopy trees will be removed for this project.
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	Moderate. Associated with all PCTs for this site.	Low. 2 local records and suitable habitat but no canopy trees will be removed for this project.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					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. 2 local records.		
Pachyptila turtur subantarctica	Fairy Prion	PMT	-	V	The species as a whole has a circumpolar distribution, and probably frequents subtropical waters during the non-breeding period. It has been recorded breeding on subantarctic and cool temperate islands in the Southern	None	None. Only uses coastal habitat.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					Hemisphere (New Zealand offshore islands, Iles Crozet, Bird Island, South Georgia, the Falkland Islands and Ile St Paul). No local records.		
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. 1 local record.	None	None. Only uses coastal habitat.
Petroica phoenicea	Flame Robin	Bionet	V	-	Flame Robins are found in a broad coastal band from southern Queensland to just west of the South	Low. Associated with PCTs 3028, 3153 & 3036.	Low. 2 local records, some suitable habitat but no canopy trees will be removed for this project.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					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. 2 local records.		
Phoebetria fusca	Sooty Albatross	Bionet	V	V, M	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	None	None. Only uses coastal habitat.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					shelf waters. 1 local record.		
Polytelis anthopeplus monarchoides	Regent Parrot (eastern subspecies)	Bionet	E	V	The species nests within River Red Gum forests along the Murray, Wakool and lower Murrumbidgee Rivers, and possibly the Darling River downstream of Pooncarie. Typical nest trees are large, mature healthy trees with many spouts (though dead trees are used) and are usually located close to a watercourse. 1 local record.	Low. Not associated with any PCTs for this site.	Low. No suitable habitat.
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	None	None. Only uses coastal habitat.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					hollow fallen palm trunks, under mats of fallen palm fronds and in cavities among the buttresses of fig trees. No local records.		
Pterodroma neglecta neglecta	Kermadec Petrel (western)	PMT	-	V	Ranges over subtropical and tropical waters of the South Pacific. Breeds on islands across the South Pacific. In Australia it breeds on Ball's Pyramid and Phillip Island (near Norfolk Island). No local records.	None	None. Only uses coastal habitat.
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-	Low. Not associated with any PCTs for this site.	Low. 1 local record, some suitable habitat but no canopy trees will be removed for this project.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					eastern Queensland. 1 local record.		
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.3 local records.	Low. Associated with PCTs 3028, 3013, 3153 & 3036.	Low. 3 local records, suitable habitat but no canopy trees will be removed for this project.
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	Low. Associated with PCTs 3028, 3013, 3153 & 3036.	Low. No local records, suitable habitat but no canopy trees will be removed for this project.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					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. No local records.		
Pycnoptilus floccosus	Pilotbird	PMT	-	V	Habitat critical to the survival of the Pilotbird includes wet sclerophyll forests in temperate zones in moist gullies with dense undergrowth and dry sclerophyll forests and woodlands occupying dry slopes and ridges. 6 local records.	Low. Not associated with any PCTs for this site.	Low. 6 local records, some suitable habitat but no canopy trees removed for this project.
Rostratula australis	Australian Painted Snipe	PMT	-	E	Most records are from the south east, particularly the Murray Darling Basin, with scattered records across northern Australia and historical records from around the Perth region in	Low. Not associated with any PCTs for this site.	Low. No local records and no suitable habitat.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					Western Australia. In NSW many records are from the Murray-Darling Basin including the Paroo wetlands, Lake Cowal, Macquarie Marshes, Fivebough Swamp and more recently, swamps near Balldale and Wanganella. No local records.		
Sternula albifrons	Little Tern	Bionet	E	-	Migratory seabird. Almost exclusively coastal, preferring sheltered environments; however may occur several kilometres from the sea in harbours, inlets and rivers (with occasional offshore islands or coral cay records). 3 local records.	None	None. Only uses coastal habitat.
Sternula nereis	Australian Fairy Tern	PMT	-	V	The Fairy Tern (Australian) nests on sheltered sandy beaches, spits and banks above the high tide line and below vegetation. No local records.	None	None. Only uses coastal habitat.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
Thalassarche bulleri	Buller's Albatross	PMT	-	V	Migratory seabird. Occurs in both inshore and offshore waters, including the continental shelf break and pelagic waters. This albatross only nests on islands off New Zealand. No local records.	None	None. Only uses coastal habitat.
Thalassarche carteri	Indian Yellow-nosed Albatross	PMT	-	V	Migratory seabird. It breeds on Prince Edward Islands, the Crozet Islands, Kerguelen Island, Amsterdam Island (on the Falaises d'Entrecasteaux) and St Paul Islands in the Indian Ocean. No local records.	None	None. Only uses coastal habitat.
Thalassarche cauta	Shy Albatross	Bionet	V	V	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. 1 local record.	None	None. Only uses coastal habitat.
Thalassarche eremita	Chatham Albatross	PMT	-	E	Marine species that occurs in subantarctic and	None	None. Only uses coastal habitat.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					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. No local records.		
Thalassarche melanophris	Black-browed Albatross	Bionet	V	V	The Black-browed Albatross is a marine species that inhabits Antarctic, subantarctic and temperate waters and occasionally enters the tropics. 4 local records.	None	None. Only uses coastal habitat.
Thalassarche steadi	White-capped Albatross	PMT		V	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	None	None. Only uses coastal habitat.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					colonies occur on islands south of New Zealand. No local records.		
Thinornis cucullatus	Australian Hooded Plover	Bionet	CE	V	In south-eastern Australia Hooded Plovers prefer sandy ocean beaches, especially those that are broad and flat, with a wide wave-wash zone for feeding, much beachcast seaweed, and backed by sparsely vegetated sand-dunes for shelter and nesting. Occasionally Hooded Plovers are found on tidal bays and estuaries, rock platforms and rocky or sand-covered reefs near sandy beaches, and small beaches in lines of cliffs. They regularly use near-coastal saline and freshwater lakes and lagoons, often with saltmarsh. 2 local records.	None	None. Only uses coastal habitat.
Tyto novaehollandiae	Masked Owl	Bionet	V	-	Inhabits a diverse range of wooded habitat that provide	Low. Associated with all PCTs for this site.	Low. 4 local records, suitable habitat but no canopy trees will

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					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. 4 local records.		be removed for this project.
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,	Moderate. Associated with all PCTs for this site.	Low. 12 local records, limited suitable habitat and no canopy trees will be removed for this project.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					mainly eucalypts often located in gullies. Nests have been located in trees 125 to 161 centimetres in diameter. 12 local records.		
FLORA							
Acacia baueri subsp. aspera	null	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. Not associated with any PCTs for this site.	Low. No suitable habitat.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	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. 2 local records.		
Acacia bynoeana	Bynoe's Wattle, Tiny Wattle	PMT	-	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. No local records.	Low. Not associated with any PCTs for this site.	Low. No suitable habitat.
Allocasuarina glareicola	null	PMT	-	E	Allocasuarina glareicola occurs within the Hawkesbury–Nepean and Sydney Metro (NSW) natural resource regions and is found primarily in the Castlereagh and	Low. Not associated with any PCTs for this site.	Low. No suitable habitat.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					Londonderry vicinity. It is found in woodland communities. No local records.		
Arthropteris palisotii	Lesser Creeping Fern	Bionet	E	-	The Lesser Creeping Fern grows on trees. Its creeping stem is branched and wiry and covered with dark scales. The shiny green fronds are up 30 cm long with thinly leathery leaflets. Spores are borne on the underside of the leaflets in circular clumps. 1 local record.	Moderate. Associated with PCTs 3013, 3028 and 3153.	Low. 1 local record and suitable habitat. Impacts minimised for creek crossings.
Caladenia tessellata	Thick-lipped Spider-orchid, Daddy Long-legs	Bionet	E	V	Generally found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil. No local records.	Low. Not associated with any PCTs for this site.	Low. No suitable habitat.
Calochilus pulchellus	Pretty Beard Orchid, Pretty Beard-orchid	Bionet	E	-	Calochilus pulchellus is endemic to New South Wales. It is known from the Sydney Basin	Low. Not associated with any PCTs for this site.	Low. No suitable habitat.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					Bioregion, where a total of less than 30 adult plants have been recorded in three sites over a range of 40 km on the South Coast of NSW, at altitudes from 20-560 m above sea level. All currently known sites are within the Shoalhaven Local Government Area. Soils need to be sandy loam and vegetation is usually woodland or heath. No local records.		
Cryptostylis hunteriana	Leafless Tongue-orchid	PMT	-	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	Low. Not associated with any PCTs for this site.	Low. No suitable habitat.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					(*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*). No local records.		
Cynanchum elegans	White-flowered Wax Plant	Bionet	E	E	Recorded from dry rainforest gullies scrub and scree slopes from the Gloucester district to the Wollongong area and inland to Mt Dangar. The White-flowered Wax Plant usually occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; Coastal Tea-tree Leptospermum laevigatum – Coastal Banksia integrifolia subsp. integrifolia	Moderate. Associated with PCTs 3153, 3028 and 3013.	Low. No plants found during surveys.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					coastal scrub; Forest Red Gum Eucalyptus tereticornis aligned open forest and woodland; Spotted Gum Corymbia maculata aligned open forest and woodland; and Bracelet Honeymyrtle Melaleuca armillaris scrub to open scrub. No local records.		
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. 3 local records.	Low. Not associated with any PCTs for this site.	Low. No plants found during surveys.
Genoplesium baueri	Yellow Gnat-orchid, Bauer's Midge Orchid, Brittle 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	Low. Not associated with any PCTs for this site.	Low. No suitable habitat.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					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. No local records.		
Gossia acmenoides	Gossia acmenoides population in the Sydney Basin Bioregion south of the Georges River	Bionet	E	-	Known from Shellharbour, Wollongong and Kiama LGAs and encompasses all occurrences south of the Georges River. This population is the southernmost occurrence of the species and is approximately 175 km from the nearest population to the north in the Hunter region of NSW. 3 local records.	Low. Not associated with any PCTs for this site.	Low. No suitable habitat.
Grevillea raybrownii	null	Bionet	V	-	This species occurs in open Eucalypt forest and woodland with a shrubby understorey on sandy, gravelly loam	Low. Not associated with any PCTs for this site.	Low. No suitable habitat.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					soils derived from sandstone that are low in nutrients. No local records.		
Haloragis exalata subsp. exalata	Wingless Raspwort, Square Raspwort	Bionet	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. No local records.	Low. Associated with PCT 3013.	Low. No plants found during surveys.
Melaleuca biconvexa	Biconvex Paperbark	Bionet	V	V	Biconvex Paperbark is a shrub or small tree, usually up to 10 m tall, though occasionally as high as 20 m. The bark is that of a typical paperbark. Biconvex Paperbark generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects. No local records.	Low. Not associated with any PCTs for this site.	Low. No local records and no plants found during surveys.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
Melaleuca deanei	Deane's Melaleuca	Bionet	V	V	Grows in wet heath on sandstone in coastal districts from Berowra to Nowra. The species occurs mostly in ridgetop woodland, with only 5% of sites in heath on sandstone. No local records.	Low. Not associated with any PCTs for this site.	Low. No local records and no plants found during surveys.
Persicaria elatior	Tall Knotweed	Bionet	V	V	Prefers damp areas and will utilise disturbed sites and man-made water bodies. No local records.	Low. Not associated with any PCTs for this site.	Low. No local records and no plants found during surveys.
Persoonia bargoensis	Bargo Geebung	Bionet	E	V	The Bargo Geebung occurs in woodland or dry sclerophyll forest on sandstone and on heavier, well drained, loamy, gravelly soils of the Wianamatta Shale and .Hawkesbury Sandstone. It favours interface soil landscapes such as between the Blacktown Soil Landscape and the complex Mittagong Formation soils (Lucas Heights Soil Landscape) with the underlying sandstone	Low. Not associated with any PCTs for this site.	Low. No suitable habitat.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					(Hawkesbury Soil Landscape and Gymea Soil Landscape). Some of the vegetation the species occurs within would be recognised as the Shale/Sandstone Transition Forest, a listed community. No local records.		
Persoonia hirsuta	Hairy Geebung, Hairy Persoonia	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. No local records.	Low. Not associated with any PCTs for this site.	Low. No suitable habitat.
Persoonia nutans	Nodding Geebung	Bionet	E	E	Restricted to the Cumberland Plain in western Sydney, between Richmond in the north and	Low. Not associated with any PCTs for this site.	Low. No suitable habitat.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					Macquarie Fields in the south. The species has a disjunct distribution, with the majority of populations (and 99% of individuals) occurring in the north of the species range in the Agnes Banks, Londonderry, Castlereagh, Berkshire Park and Windsor Downs areas. No local records.		
Pimelea spicata	Spiked Rice-flower	Bionet	E	E	Once widespread on the Cumberland Plain, the Spiked Rice-flower occurs in two disjunct areas; the Cumberland Plain (Marayong and Prospect Reservoir south to Narellan and Douglas Park) and the Illawarra (Landsdowne to Shellharbour to northern Kiama). No local records.	Low. Not associated with any PCTs for this site.	Low. No suitable habitat.
Pterostylis gibbosa	Illawarra Greenhood	Bionet	E	E	Grows in open forest or woodland, on flat or gently sloping land with poor drainage. Known from a small number	Low. Not associated with any PCTs for this site.	Low. No suitable habitat.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					of populations in the Hunter region (Milbrodale), the Illawarra region (Albion Park and Yallah) and the Shoalhaven region (near Nowra).		
Pterostylis saxicola	Sydney Plains Greenhood	Bionet	E	E	Restricted to western Sydney between Freemans Reach in the north and Picton in the south. There are very few known populations and they are all very small and isolated. Two populations occur within a conservation reserve (Georges River National Park; Scheyville NP). Most commonly found growing in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines. The vegetation communities above the shelves where Pterostylis saxicola occurs are sclerophyll forest or woodland on	Low. Not associated with any PCTs for this site.	Low. No suitable habitat.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					shale/sandstone transition soils or shale soils. No local records.		
Pultenaea aristata	Prickly Bush-pea	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. 89 local records.	Low. Not associated with any PCTs for this site.	Low. 89 local records with 4 to the west of the site. No records for the site itself. No plants found in surveys.
Rhizanthella slateri	Eastern Underground Orchid	Bionet	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	Low. Associated with PCT 3028.	Low. No suitable habitat.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					when the soil is disturbed. In NSW, currently known from fewer than 10 locations, including near Bulahdelah, the Watagan Mountains, the Blue Mountains, Wiseman's Ferry area, Agnes Banks and near Nowra. No local records.		
Rhodamnia rubescens	Scrub Turpentine	Bionet	E	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 above sea level in areas with rainfall of 1,000-1,600 mm. Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest	High. Associated with PCTs 3153, 3028, 3013 & 3036.	Low. 24 local recordings and habitat is suitable. Not found during surveys.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					usually on volcanic and sedimentary soils. 24 local records.		
Senna acclinis	Rainforest Cassia	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. 2 local records.	Moderate.	Low. 2 local records and habitat is suitable. Not found during surveys.
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. 2 local records.	Low. Associated with PCT 3036.	Low. 2 local records and habitat is suitable. Not found during surveys.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
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. No local records.	Low. Not associated with any PCTs for this site.	Low. No suitable habitat.
Xerochrysum palustre	Swamp Everlasting	PMT	-	V	Grows in swamps and bogs which are often dominated by heaths. Also grows at the edges of bog margins on peaty soils with a cover of shrubs or grasses. No local records.	Low. Not associated with any PCTs for this site.	Low. No suitable habitat.
MAMMALS							
Arctocephalus pusillus doriferus	Australian Fur-seal	Bionet	V	-	The Australian Fur Seal can be found in coastal waters and oceans. They prefer rocky islands, boulder and pebble beaches and rocky ledges for resting	None	None. No marine habitat present.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					and breeding. 3 local records.		
Balaenoptera musculus	Blue Whale	PMT	-	E	Blue whales are found in all oceans except the Arctic. They generally migrate seasonally between summer feeding grounds and winter breeding grounds, but some evidence suggests that individuals in certain areas might not migrate at all. Information about distribution and movement varies with location, and migratory routes are not well known. In general, distribution is driven largely by food availability—they occur in waters where krill are concentrated. No local records.	None.	None. No marine habitat present.
Cercartetus nanus	Eastern Pygmy-possum	Bionet	V	-	Inhabits rainforest through to sclerophyll forest and tree heath. Banksias and myrtaceous shrubs and trees are a favoured food source. Will often	Moderate. Associated with all PCTs for this site.	Low. 9 local records but limited suitable habitat.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					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. 9 local records.		
Chalinolobus dwyeri	Large-eared Pied Bat, Large Pied Bat	PMT	-	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. No local records.	Low. Associated with all PCTs for this site.	Low. No local records and no canopy trees will be removed for this project.
Dasyurus maculatus	Spotted-tailed Quoll	Bionet	V	E	Spotted-tailed Quoll are found on the	Low. Associated with all PCTs for this site.	Low. Only 1 local record and minimal

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					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. 1 local record.		habitat will be removed for this project.
Eubalaena australis	Southern Right Whale	PMT	-	E	The Southern Right Whale inhabits the southern and sub-antarctic oceans except during the winter breeding season. During this breeding season the whales migrate to warmer temperate waters around the southern parts of the African, South American and Australian land masses. No local records.	None	None. No marine habitat present.
Falsistrellus tasmaniensis	Eastern False Pipistrelle	Bionet	V	-	Inhabit sclerophyll forests, preferring wet habitats where	Moderate. Associated with all PCTs for this site.	Low. Suitable habitat exists but no canopy trees will be

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					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 enter torpor. This species also appears to be highly mobile and records showing movements of up to 12 km between roosting and foraging sites. 2 local records.		removed for this project.
Isoodon obesulus obesulus	Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (south-eastern)	PMT	-	E	Prefers sandy soils with scrubby vegetation and-or areas with low ground cover that are burnt from time to time. A mosaic of post fire vegetation is important for this species. No local records.	Low. Associated with PCT 3153 & 3036.	Low. Some bandicoot diggings observed but likely to be *Perameles nasuta* (Long-nosed Bandicoot). Unsuitable habitat exists and no local records.
Miniopterus australis	Little Bent-winged Bat	Bionet	V	-	Little Bent-wing Bat is an insectivorous bat that roost in	Low. Associated with PCT 3153.	Low. Suitable feeding habitat exists but no canopy

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					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. 4 local records.		trees will be removed for this project.
Miniopterus orianae oceanensis	Large Bent-winged Bat	Bionet	V	-	This species is an insectivorous bat that roosts in caves, derelict mines, stormwater tunnels, buildings and other man-made structures. The caves needs specific temperature and humidity requirements for the birth and rearing of young. This species will travel up to 300km away from	Low. Associated with all PCTs for this site.	Low. 9 local records and suitable feeding habitat exists. No caves or suitable habitat for roosting and breeding.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					maternity caves in forested area, catching moths and other flying insects above the tree tops. 9 local records.		
Myotis macropus	Southern Myotis	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. 2 local records.	High. Associated with all PCTs for this site.	Low. Only one area where 3 artificial freshwater dams provide feeding habitat and these will be avoided. No canopy trees will be removed for this project.
Notamacropus parma	Parma Wallaby	PMT	-	V	Preferred habitat is moist eucalypt forest with thick, shrubby understorey, often with nearby grassy areas, rainforest margins and occasionally drier eucalypt forest. No local records.	Low. Not associated with any PCTs for this site.	Low. No local records.
Petauroides volans	Greater Glider	PMT	E	E	Predominantly found in mature forests with abundant large	Moderate. Associated with all PCTs for this site.	Low. Suitable feeding and denning habitat exists but no

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					hollows in a small home range of 1ha. Specialist mainly leaf feeder, having preferred eucalypt feed trees. 3 local records.		canopy trees will be removed for this project.
Petaurus australis	Yellow-bellied Glider	Bionet	V	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 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. Can live in urban forested areas if there are enough mature trees with hollows and unfragmented vegetation. 5 local records.	Moderate. Associated with PCT 3153.	Low. 5 local records and suitable habitat. No canopy trees will be removed for this project.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
Petaurus norfolcensis	Squirrel Glider	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. 3 local records.	Low. Associated with PCTs 3028 & 3153.	Low. 3 local records and some minor areas of suitable habitat. No canopy trees will be removed for this project.
Petrogale penicillate	Brush-tailed Rock-wallaby	Bionet	E	V	Found in rocky areas in a wide variety of habitats including rainforest gullies, wet and dry sclerophyll forest,	Low. Associated with PCTs 3028, 3153 and 3013.	Low. No suitable rocky habitats for this species.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					open woodland and rocky outcrops in semi-arid country. Commonly sites have a northerly aspect with numerous ledges, caves and crevices. No local records.		
Phascolarctos cinereus	Koala	Bionet	E	E	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. 9 local records.	Low. Associated with PCT 3153 & 3036.	Low. 9 local records and suitable feed trees across the site. Impact on this species will be low given that no canopy trees will be removed.
Potorous tridactylus trisulcatus	Long-nosed Potoroo (southern mainland)	PMT	-	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. No local records.	Moderate. Associated with PCT 3036.	Low. No local records and no suitable habitat.
Pseudomys novaehollandiae	New Holland Mouse, Pookila	PMT	-	V	Very distinct populations with less than 10,000 individuals known.	Low. Not associated with any PCTs for this site.	Low. No local records and no suitable habitat.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					Occupies heathland understorey. No local records.		
Pteropus poliocephalus	Grey-headed Flying-fox	Bionet	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. 235 local records.	High. Associated with PCTs 3028, 3013 and 3153.	Low. Abundant local records and lots of feed trees. However there are no formalised 'camps' where this species congregates on the site and no canopy trees will be removed for this project.
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	Moderate. Associated with 3153 & 3036.	Low. No canopy trees will be removed for this project.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					species roosts in hollow tree trunks and branches. 2 local records.		
REPTILES							
Caretta caretta	Loggerhead Turtle	Bionet	E	E	The loggerhead turtle has a worldwide distribution in coastal tropical and subtropical waters. In Australia, loggerheads occur in coral reefs, bays and estuaries in tropical and warm temperate waters off the coast of Queensland, Northern Territory, Western Australia and New South Wales. 1 local record.	None	None. No marine habitat present.
Chelonia mydas	Green Turtle	Bionet	V	V	The green turtle is one of the largest sea turtles and the only herbivore among the different species. Like other sea turtles, they migrate long distances between feeding grounds and the beaches from where they hatched. Classified as	None	None. No marine habitat present.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					endangered, green turtles are threatened by overharvesting of their eggs, hunting of adults, being caught in fishing gear and loss of nesting beach sites. 3 local records.		
Dermochelys coriacea	Leatherback Turtle	PMT	-	E	This species is a large sea turtle with leather-like shell. They migrate across large areas for feeding on jellyfish and need nesting beaches for breeding. No local records.	None	None. No marine habitat present.
Eretmochelys imbricata	Hawksbill Turtle	PMT	-	V	Hawksbills are named for their narrow, pointed beak. Hawksbills are found mainly throughout the world's tropical oceans, predominantly in coral reefs. They feed mainly on sponges by using their narrow pointed beaks to extract them from crevices on the reef, but also eat sea anemones	None	None. No marine habitat present.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					and jellyfish. No local records.		
Hoplocephalus bungaroides	Broad-headed Snake	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. 1 local record.	Low	Low. No suitable exposed sandstone areas within the Subject Area to be impacted.
Natator depressus	Flatback Turtle	PMT	-	V	All known breeding sites of the flatback turtle occur in tropical Australia, on beaches and islands in Queensland, the Northern Territory	None	None. No marine habitat present.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					and Western Australia. They feed in the northern coastal regions of Australia, ranging as far south as the Tropic of Capricorn. Their feeding grounds also extend to the Indonesian archipelago and the Papua New Guinea coast. No local records.		
INSECTS							
Petalura gigantea	Giant Dragonfly	Bionet	E	-	This species has been recorded from permanent wetlands, both coastal and upland, from Moss Vale northwards to southern Queensland, but has not been recorded in most areas for many years. 18 local records.	Low. Not associated with any PCTs for this site.	Low. Area with two wetlands will be managed sensitively.
FISH							
Scientific Name	**Common Name**	**Source**	**FM Act**	**EPBC Act**	**Habitat**	**Likelihood**	**Potential for impact**
Bidyanus bidyanus	Silver Perch	PMT	V	CE	Silver perch are endemic to the Murray-Darling system (including all	None	None. No habitat present.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					states and sub-basins).		
Epinephelus daemelii	Black Rockcod	PMT	V	V	Black cod generally inhabit near-shore rocky and offshore coral reefs at depths down to 50 m along the NSW coast. In coastal waters adult black cod are found in rock caves, rock gutters and on rock reefs.	None	None. No habitat present.
Hippocampus whitei	White's Seahorse	PMT	E	E	H. whitei is known to occur in estuaries from St Georges Basin, NSW to Hervey Bay, QLD.	None	None. No habitat present.
Maccullochella peelii	Murray Cod	PMT		V	The Murray Cod occurs naturally in the waterways of the Murray-Darling Basin (ACT, SA, NSW and V ic) and is known to live in a wide range of warm water habitats that range from clear, rocky streams to slow flowing turbid rivers and billabongs.	None	None. No habitat present.
Macquaria australasica	Macquarie Perch	PMT	E	E	In the Murray-Darling Basin, the species was once typically found in the cool, upper reaches	None	None. No habitat present.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					of drainage systems located in southern NSW, the ACT and northern Victoria. In east coast drainage systems, the species has been recorded naturally occurring in the Hawkesbury/Nepean, Georges and Shoalhaven rivers in NSW.		
Prototroctes maraena	Australian Grayling	PMT	E	V	The Australian Grayling Prototroctes maraena is a small to medium-sized, slender, silvery fish with soft-rayed fins lacking any spines. It is endemic to south-eastern Australia, including Victoria, Tasmania and New South Wales, and is a migratory species that inhabits estuarine waters and coastal seas as larvae/juveniles, and freshwater rivers and streams as adults.	None	None. No habitat present.
Seriolella brama	Blue Warehou	PMT		CD	Blue Warehou mostly occur in offshore waters, although juveniles	None	None. No habitat present.

Scientific Name	Common Name	Source	BC Act	EPBC Act	Habitat	Likelihood[2]	Potential for impact
					may be found in bays, estuaries and coastal waters.		
Thunnus maccoyii	Southern Bluefin Tuna	PMT	E	CD	SBT is a highly migratory species that occurs globally in waters between 30°S and 50°S, though is mainly found in the eastern Indian Ocean and in the south western Pacific Ocean.	None	None. No habitat present.

Appendix 6. Fauna list

Class	Common Name	Scientific Name	Observation Type
Amphibia	Common Eastern Froglet	*Crinia signifera*	Heard call
	Striped Marsh Frog	*Limnodynastes peronii*	Heard call
Aves	Black-faced Monarch	*Monarcha melanopsis*	Heard call
	Brown Treecreeper	*Climacteris picumnus*	Observed
	Cicada bird	*Coracina tenuirostris*	Observed and Heard call
	Crested Pigeon	*Ocyphaps lophotes*	Observed and Heard call
	Crimson Rosella	*Platycercus elegans*	Observed
	Eastern Whipbird	*Psophodes olivaceus*	Heard call
	Green Catbird	*Ailuroedus crassirostris*	Heard call
	Grey Butcher Bird	*Cracticus torquatus*	Observed
	Grey Fantail	*Rhipidura albiscapa*	Observed and Heard call
	Indian Myna*	*Acridotheres tristis*	Observed
	Laughing Kookaburra	*Dacelo novaeguineae*	Observed and Heard call
	Lewin's Honeyeater	*Meliphaga lewinii*	Observed
	Noisy Miner	*Manorina melanocephala*	Observed and Heard call
	Rainbow Lorikeet	*Trichoglossus moluccanus*	Observed
	Rufous Fantail	*Rhipidura rufifrons*	Heard call
	Sulphur crested Cockatoo	*Cacatua galerita*	Observed and Heard call
	Superb Lyrebird	*Menura novaehollandiae*	Observed and Heard call
	Topknot Pigeon	Lopholaimus antarcticus	Observed
	White-browed Scrubwren	*Sericornis frontalis*	Observed
	White-throated Treecreeper	*Cormobates leucophaea*	Observed and Heard call
	Wonga Pigeon	*Leucosarcia melanoleuca*	Heard call
Mammalia	Fallow deer*	*Dama*	Scat/tracks
	Swamp Wallaby	*Wallabia bicolor*	Observed

*non-native

Appendix 7. Helicopter Drop Zones

Helicopter Drop Zone	PCT Name	Site Notes	Habitat Constraints
1	Illawarra Escarpment Bangalay x Blue Gum Wet Forest	Generally cleared of canopy. Weedy. No threatened plants and limited habitat value.	None
2	Illawarra Escarpment Bangalay x Blue Gum Wet Forest	Very steep. Substantial earthwork required. Proposed retaining/rock wall.	None
3	Illawarra Escarpment Bangalay x Blue Gum Wet Forest	Ideal location. Cleared canopy. Weedy. No threatened plants and limited habitat value.	None
4	Illawarra Escarpment Bangalay x Blue Gum Wet Forest	Generally cleared of canopy. Weedy. No threatened plants and limited habitat value.	None
5	Illawarra Escarpment Bangalay x Blue Gum Wet Forest	Proposed Possums site, cleared ground and open canopy. No threatened plants and limited habitat value.	None

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Impact assessments
Development and activity approvals
Rehabilitation
Stakeholder consultation and facilitation
Project management

Environmental offsetting
Offset strategy and assessment (NSW, QLD, Commonwealth)
Accredited BAM assessors (NSW)
Biodiversity Stewardship Site Agreements (NSW)
Offset site establishment and management
Offset brokerage
Advanced Offset establishment (QLD)