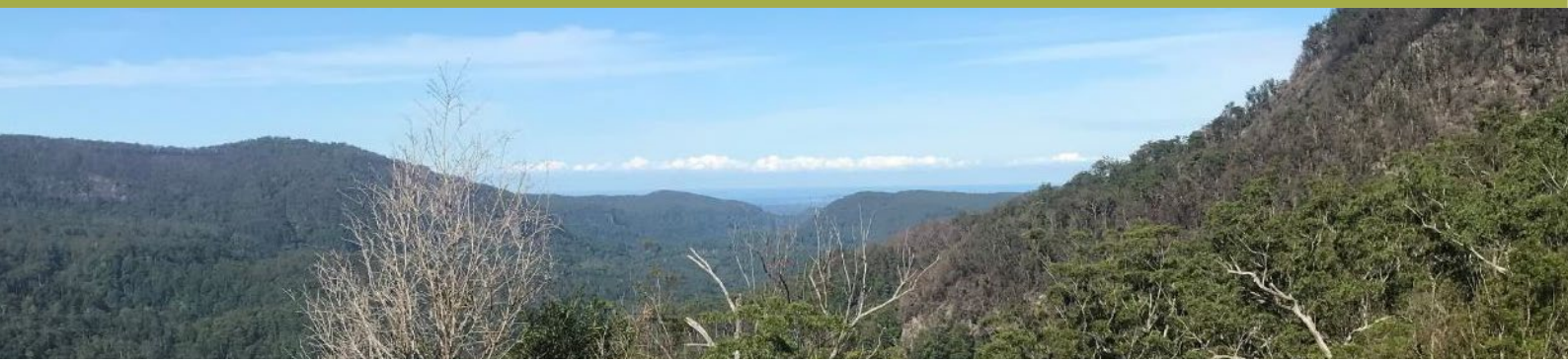
Natural Heritage Values Assessment

Tweed Byron Hinterland Walk



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Executive Summary

This Assessment has been completed to assess the natural heritage values associated with the proposed Tweed Byron Hinterland Trails (TBHT), which is proposed within conservation reserves administered by NSW National Parks and Wildlife Service (NPWS). This includes Whian Whian State Conservation Area (SCA), Nightcap National Park (NP) and Mount Jerusalem NP.

The TBHT includes the construction of a multi-day walk consisting of 47.74 km of walking tracks (to class 4 hiking track standard) and three camps connecting the Manns Road trail head (near Unicorn Falls) to the Minyon Falls day-use area. The main walking track is 35.55 km in length, made up of 8.25 km of new track and 27.30 km of existing tracks, roads and trails. The project will also incorporate a total of 12.18 km of side-tracks, embarking from the main route. Upgrades to existing roads will also be required for the construction and ongoing maintenance of the proposed facilities. The walk includes three camps which will include toilets, camping platforms and general infrastructure (tables, water tanks etc). The majority of the TBHT utilises existing vehicle tracks, firebreaks and old logging roads and snig tracks, however track construction is planned for some areas of undisturbed vegetation.

All three reserves are known as biodiversity 'hotspots' with numerous records of threatened flora and fauna (including several endemic species) and extensive areas of subtropical and warm-temperate rainforest, some of which occur within the 'Gondwana Rainforests of Australia' World Heritage Area (WHA). Approximately 5 km of the TBHT traverses the WHA. However, the route of the TBHT largely avoids rainforest habitats and occurs within disturbed eucalypt forest.

Field assessment of the TBHT recorded:

- Thirteen broad vegetation communities.
- Fifteen threatened flora species (Corokia (*Corokia whiteana*), Rusty Rose Walnut (*Endiandra hayesii)*, Green-leaved Rose Walnut (*Endiandra muelleri* subsp. *Bracteate)*, Narrow-leaf Finger Fern (*Grammitis stenophylla)*, Red Boppel Nut (*Hicksbeachia pinnatifolia)*, Rough-shelled Bush Nut (*Macadamia tetraphylla)*, Rusty Plum (*Niemeyera whitei)*, Onion Cedar (*Owenia cepiodora)*, Scrub Turpentine (*Rhodamnia rubescens)*, Rainforest Senna (*Senna acclinis)*, Small-leaved Hazelwood (*Symplocos baeuerlenii*), Red Lilly Pilly (*Syzygium hodgkinsoniae*), Arrow-head Vine (*Tinospora tinosporoides*), Peach Myrtle (*Uromyrtus australis)*, Tree Guinea Flower (*Hibbertia hexandra)*).
- One threatened ecological community (lowland rainforest).
- Nine threatened fauna species Pouched Frog (*Assa darlingtonia)*, Glossy Black-Cockatoo (*Calyptorhynchus lathami)*, White-eared Monarch (*Carterornis leucotis)*, Albert's Lyrebird (*Menura alberti)*, Loveridge's Frog (*Philoria loveridgei*), Koala (*Phascolarctos cinereus*), Wompoo Fruit-Dove (*Ptilinopus magnificus*), Sooty Owl (*Tyto tenebricosa*), Pale-vented Bush-hen (*Amaurornis moluccana)*).

Approximately 10.59 km of track will be constructed within undisturbed vegetation (the greatest impact of the TBHT), with lesser impacts from track construction along abandoned logging roads and snig tracks where selective clearing of regrowth would be required. The balance of the TBHT utilises formed roads or existing walking tracks (eg Historic Nightcap Track, management trails, previous forestry trails) where impacts would be low to nil. By avoiding and minimising impacts and limiting disturbance from construction, the TBHT would be unlikely to result in any significant biodiversity impacts within the context of the three reserves.

A full range of biodiversity impacts from the construction and operational phases of the TBHT have been considered and a range of mitigation measures proposed. A risk assessment of the TBHT

indicates that biodiversity impacts would be relatively low and can be managed with a high degree of confidence to minimise environmental risks. Review of the likely impacts of the TBHT indicate that biodiversity values of the 'Gondwana Rainforests of Australia' WHA and areas of High Conservation Value Old Growth Forest listed on the State Heritage Register would not be significantly affected.

Statutory assessment was completed for the proposal with regard to the:

- NSW *Biodiversity Conservation Act 2016* (BC Act)
- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Statutory assessments determined that a Species Impact Statement (SIS) is not required under NSW legislation (BC Act), and referral to the Australian Government Minister for the Environment is not required.

A range of mitigation measures have been recommended to minimise biodiversity impacts from the construction and operational stages of the project.

1. Introduction and Background

1.1 Introduction

GeoLINK has been engaged by NSW National Parks & Wildlife Service (NPWS) to prepare a Natural Heritage Values Assessment for the proposed Tweed Byron Hinterland Trail (TBHT), a multi-day walk covering approximately 47.74 km. This Assessment supports a Review of Environmental Factors (REF) prepared in accordance with the requirements of Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

1.2 Background

The TBHT is proposed to deliver world class recreational facilities in the Tweed, Byron and Lismore region and to boost both the NSW visitor economy and community wellbeing. The creation of the TBHT aims to create additional and compelling nature-based experiences in the hinterland to increase dispersal of visitors from the coast.

The TBHT will be a multi-day walking track route linking the Manns Road trail head in Mount Jerusalem National Park (NP) to the visitor area at Minyon Falls in Nightcap NP. New walking tracks and track linkages are proposed, building on the existing network of walking tracks, management trails and roads to create a multi-day walking track route that will also expand day walk opportunities. The majority of the multi-day walking track network will meet Class 4 standard (Australian Walking Track Grading System). Class 4 tracks are hiking tracks suited to self-reliant bushwalkers with only basic directional signage provided. Track surfaces will be largely natural except where prevailing environmental conditions necessitate improvements.

As part of overall improvements, visitor facilities at existing visitor areas will also be improved at Minyon Falls and a new trail head at Manns Road (near Unicorn Falls) is proposed in Mount Jerusalem National Park. These improvements have been addressed in separate REFs/ Master Plans for each of these precincts.

A Master Plan for the TBHT project has been prepared consistent with the REF. The Master Plan will be publicly exhibited and once finalised will guide preparation of necessary environmental impact, cultural heritage, safety, social, financial and engineering assessments.

1.3 Aims

The aims of this assessment are to:

- Identify any biodiversity constraints to the proposal (eg. habitat for threatened species or communities listed in the *Biodiversity Conservation Act 2016* (BC Act) or *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
- Identify trees/ native vegetation/ habitat which may require removal for the proposal;
- Identify opportunities for amending concept designs to avoid biodiversity impacts (ie. adoption of the 'avoid and minimise' approach); and
- Demonstrate that any anticipated impacts of the proposal comply with relevant statutory requirements.

2. The Site

2.1 The Site

The TBHT occurs within conservation reserves administered by NPWS and includes Whian Whian State Conservation Area (SCA), Nightcap National Park (NP) and Mount Jerusalem NP. A small section of the TBHT is outside NPWS estate and partly occurs within an easement on private land linking Nightcap and Mount Jerusalem NPs (refer to **Illustration 2.1**). The western portion of Nightcap NP (approximately 61% of the park) also forms part of the 'Gondwana Rainforests of Australia' World Heritage Area'. Approximately 5 km of the TBHT occurs within this area (refer to **Illustration 2.2**).

Nightcap NP and Whian Whian SCA (in which the southern portion of the TBHT occurs) are situated within the Nightcap Range and collectively cover approximately 10,463 ha. Mount Jerusalem NP (in which the northern portion of the TBHT occurs) covers approximately 5,160 ha.

In combination, these reserves provide core areas of high quality habitat and corridors, which facilitate the movement of animals and a range of specific habitat niches such as ecotones or boundary areas between forest types. Native vegetation on adjoining lands augment this habitat and provides important ecological links between remnant areas of forest (NPWS 2004). The TBHT also traverses areas of High Conservation Value Old Growth Forest (HCVOGF) listed on the state heritage register (refer to **Illustration 2.2**). Approximately 13.3 km of the track occurs within areas of identified candidate old growth forest.

The TBHT lies within three Local Government Areas (LGAs) – Tweed, Byron and Lismore. All NPWS land is zoned E1 National Parks and Nature Reserves. An easement over private property between the two national parks ('Doon Doon saddle') is located in Tweed Shire and is zoned RU2 (rural landscape). The easement conditions allow the public to traverse private property where the TBHT occurs.

The TBHT crosses a number of minor un-named ephemeral watercourses, with the only named watercourse within the TBHT 'footprint' being Rowlands Creek within Mt Jerusalem NP. A substantial watercourse occurs at the end of Whiskey Creek Trail (Mt Jerusalem NP), and while unnamed on topographic maps, is referred to as 'Whiskey Creek' in this report.

Large areas of all three conservation reserves are mapped as containing land of biodiversity value (as per the Biodiversity Values Map and Threshold Tool) under the BC Act. However, as the project is a part 5 assessment under the *Environmental Planning & Assessment Act 1979* (EP&A Act), this trigger to enter the Biodiversity Offsets Scheme (BOS) in the BC Act does not apply and a Biodiversity Development Assessment Report (BDAR) is not required.

2.2 Landscape

The TBHT occurs within the Scenic Rim subregion (SEQ10) of the South Eastern Queensland Bioregion as per the Interim Biogeographic Regionalisation for Australia (IBRA), Version 7. At a localised level, the TBHT typically traverses the 'Mount Warning Exhumed Slopes' and 'Nimbin Ridges' Mitchell Landscapes (DECC 2008).

Soil landscapes (eSPADE) along the TBHT (from north to south) include:

Frogs Hollow (fu)

- Landscape: steep hills on the Chillingham Volcanics.
- Geology: Chillingham Volcanics (Triassic): rhyolite, rhyolitic tuff, claystone.
- Soils: moderately deep to deep (100–200 cm), moderately well-drained Brown Podzolic Soils and Brown Earths on ridges and upper slopes. Deep (>200 cm), moderately well-drained Red Podzolic Soils and Red Clays elsewhere.
- Limitations: very steep slopes and mass movement hazard with localised rock outcrop and shallow soils. Strongly acid, highly erodible soils with high aluminium toxicity potential.

Kunghur (ku)

- Landscape: undulating and rolling hills on Bundamba Group sediments.
- Geology: Bundamba Group (Triassic–Jurassic)—sandstone, siltstone, claystone, conglomerate.
- Soils: shallow to deep (50–>150 cm), well-drained Yellow Podzolic Soils on ridges and upper slopes. Deep (>100 cm), moderately well-drained Yellow Podzolic Soils, Red Podzolic Soils and Red Earths on slopes. Moderately deep (100–150 cm), poorly drained Gleyed Podzolic Soils and Yellow Podzolic Soils on lower slopes and poorly drained areas.
- Limitations: steep slopes, localised rock outcrop and mass movement hazard. Hardsetting, erodible, moderately dispersive and highly acid soils that are occasionally shallow and non-cohesive with localised waterlogging.

Nimbin Rocks (nr)

- Landscape: cliffs and scarps of Nimbin Rhyolite overlying moderately inclined to very steep cliff-footslopes and talus of Nimbin Rhyolite and Lismore Basalts.
- Geology: Cliffs and colluvial cliff-footslopes within the Border-Nightcap Range and associated with the Nimbin Rhyolites.
- Soils: moderately well-drained Brown Podzolic Soils and Grey-brown Podzolic Soils of variable depth on cliff-footslopes, talus.
- Limitations: extreme rock fall and debris avalanche hazard, rock outcrop, steep slopes.

Minyon (mi)

- Landscape: plateau tops of low rolling hills on Nimbin Rhyolites.
- Geology: Lamington Volcanics: Nimbin Rhyolites—rhyolite, obsidian, pitchstone, tuff, agglomerate.
- Soils: deep (100–200 cm), moderately well-drained Red Podzolic Soils, Brown Podzolic Soils and Red Podzolic Soil/Krasnozem intergrades throughout plateaux. Deep (100–150 cm), poorly to moderately well-drained Red Podzolic Soils associated with pitchstone/obsidian outcrops. Shallow (50–100 cm), poorly drained Grey Leached Earths on plateau margins.
- Limitations: moderate to highly erodible soils of low fertility with localised stony, shallow occurrences. Localised steep slopes and rock outcrop.

2.3 History

All three reserves have provided resources and shelter for Aboriginal people for many thousands of years. A brief, post-European history of each reserve is provided below.

Whian Whian SCA (~ 2433 ha)

- Formerly Whian Whian State Forest which supported a timber industry for many years, following the commencement of logging in the 1830s (principally Red Cedar *Toona ciliata*).
- In 1871 surveyors identified a track over the Nightcap Range to link Lismore with Murwillumbah that allowed cedar getters access to previously isolated forest.
- What is now the Rummery Park campground was originally a forestry camp with use dating back to the 1930s.
- Gazetted as SCA in 2003 (following the addition of large areas of Whian Whian State Forest to Nightcap NP).
- Existing facilities include roads, walking tracks and Rummery Park campground.
- Mountain bike and horse riding are permitted on fire trails as per the SCA plan of management.

Nightcap NP (~ 8100 ha)

- As for Whian Whian SCA, the NP has a history of forestry ranging from early cedar cutting (1840s to 1890s), through to the introduction of modern silvicultural practices.
- Nightcap NP was reserved in 1983 over part of the former Goonimbar State Forest, with an addition made over a further part of the Whian Whian State Forest in 1999.
- Existing facilities include roads, walking tracks, a horse trailer area, Minyon Falls and Minyon Grass picnic areas. A communications transmission tower and associated infrastructure occurs at Mount Nardi.
- Mountain bike and horse riding are permitted on fire trails as per the park plan of management.
- The Historic Nightcap Track (walking track) connects Minyon Falls to Mt Nardi and utilises part of the first bridle track and telegraph line between the Richmond and Tweed valleys in 1871 and 1874 respectively.

Mt Jerusalem NP (~ 5081 ha)

- Mt Jerusalem NP has a history of forestry practices and was reserved in 1995 over part of the former Nullum State Forest with the balance reserved in 1999.
- No formal facilities occur and road access is limited.

Substantial parts of the reserves were burnt in severe bushfires in late 2019, with an estimated 5055 ha affected (refer to **Illustration 2.3**). These areas are now in recovery and monitoring of vegetation and threatened species habitat is in progress at several locations. The TBHT passes through approximately 19 km of forest burnt in the 2019 fires.

2.4 Management

All three reserves have approved plans of management adopted under the NPW Act as follows:

Whian Whian SCA

Plan of management adopted in 2010, with amendments specific to the TBHT adopted in 2019.

Nightcap and Mt Jerusalem NPs

Both reserves are included within the *Parks & Reserves of the Tweed Caldera Plan of Management* (NPWS 2004). This Plan has since had two amendments:

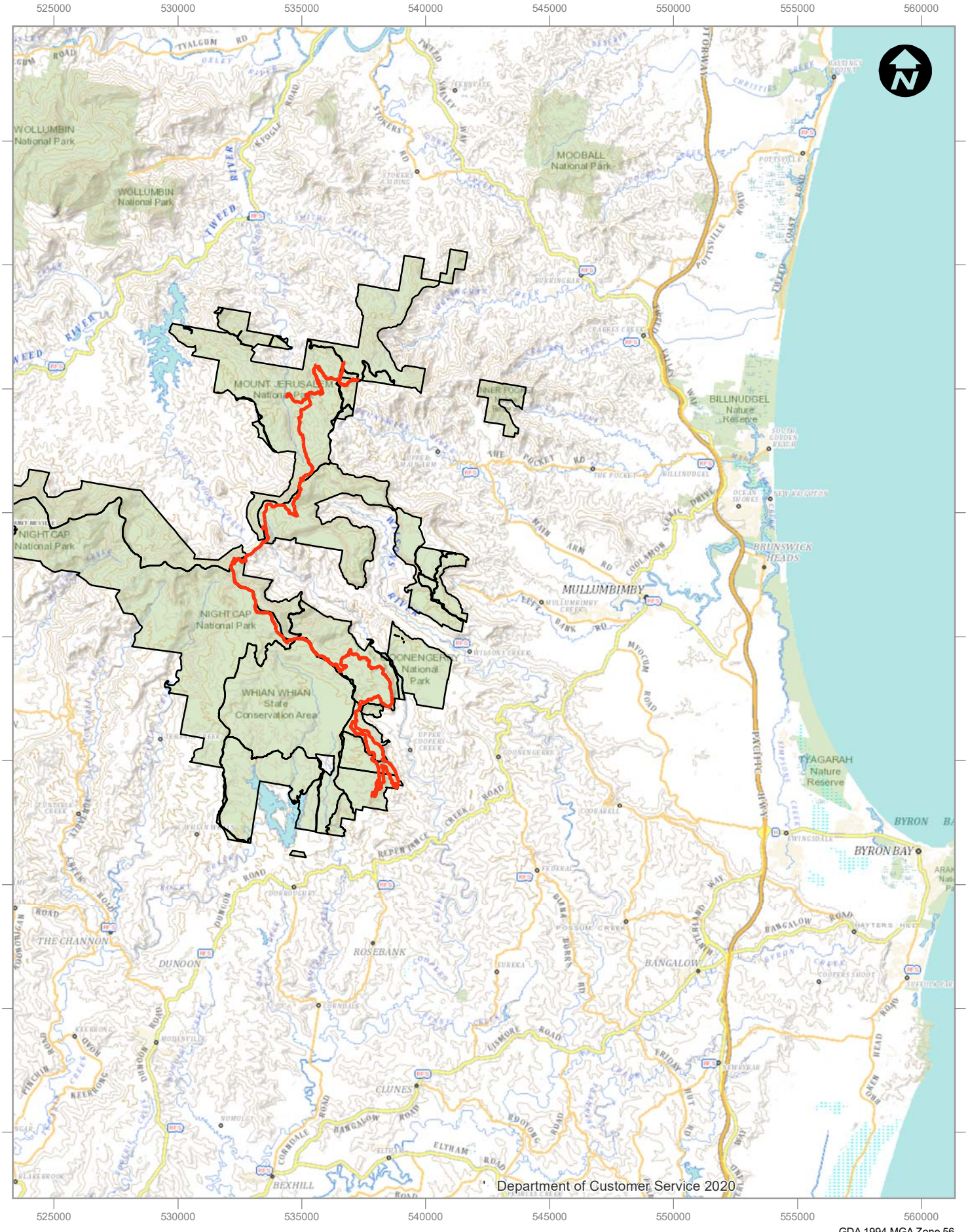
1. Amendments specific to Nightcap NP (to clarify details on walking/management trails, horse riding, recognition of Whian Whian SCA and other minor editorials (NPWS 2010).

2. Amendments specific to the TBHT (NPWS 2019).

2.5 Disturbance History

The majority of the TBHT utilises existing vehicle trails, firebreaks and old forestry trails. These assets have a varying history of maintenance and usage ranging from current fire trails (eg. the Eastern Boundary Trail) where a minimum 4 m cleared track exists, to rarely used vehicle trails with minor regrowth/ encroachment and abandoned trails where regrowth is common in the old road formation and vegetation comprises thickets of vines, Lantana and small trees. Fallen trees and woody debris (including from recent bushfires) are common on tracks and trails not subject to regular maintenance.

The TBHT traverses undisturbed vegetation in several areas (refer to **Section 5.2**). Further discussion of the disturbance required to achieve the TBHT (inclusive of the three proposed camps is detailed in **Section 5.2.1** and **Section 7**).



GDA 1994 MGA Zone 56

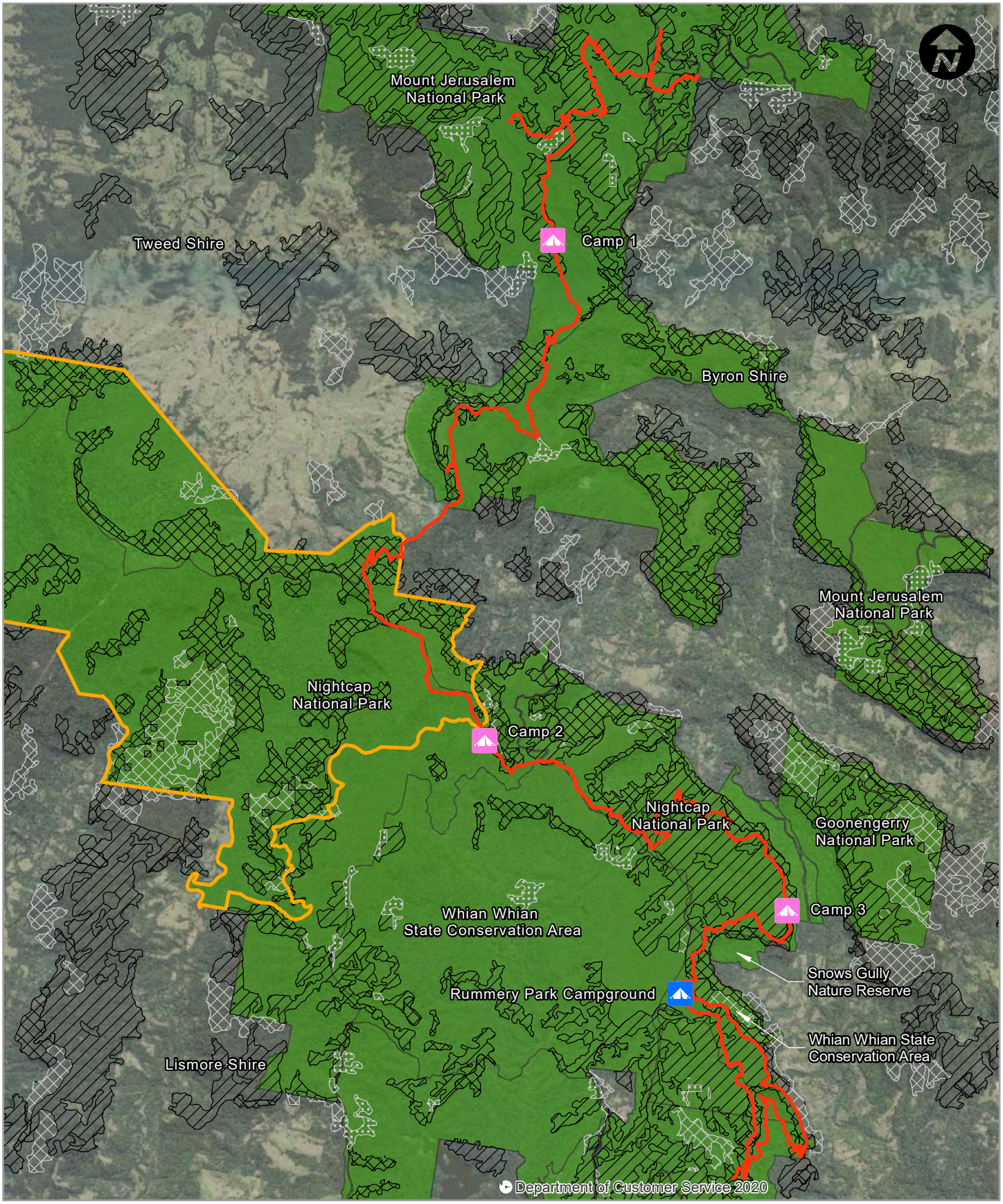
LEGEND

The Tweed-Byron Hinterland Trail

National Park reserve

0 4 Km

Locality Plan - Illustration 2.1



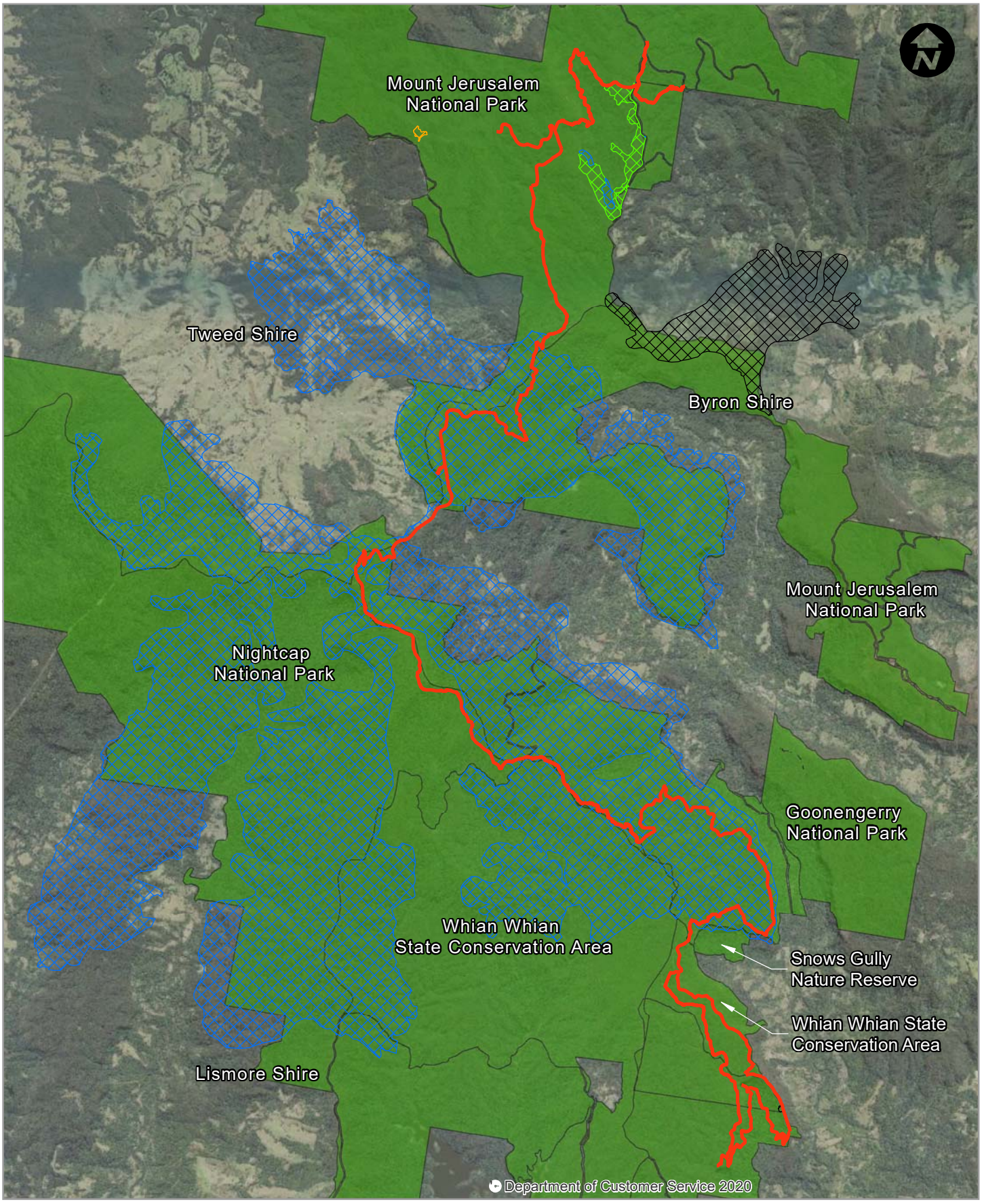
LEGEND

- The Tweed-Byron Hinterland Trails
- Gondwana Rainforests of Australia (World Heritage)
- National Park reserve
- Candidate Old Growth
- Disturbed Mature Forest
- Disturbed Old Growth
- Mature Forest
- Existing campground
- Proposed walk-in campground

0 1.5 Km

World Heritage and Old Growth Forests - Illustration 3.1

Information shown is for illustrative purposes only
Drawn by: AB Reviewed by: RE
Source of base data: DFSI and Environment NSW
Date: 24/08/2022
Revision: C



LEGEND

- The Tweed-Byron Hinterland Trail
- National Park reserve

Burnt Area

- 2017-18 Wildfire
- 2018-19 Wildfire
- 2019-20 Prescribed Burn
- 2019-20 Wildfire

0 1.5 Km

Bushfire Mapping - Illustration 2.3

Information shown is for illustrative purposes only
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Source of base data: DFSI
Date: 25/07/2022
Revision: C

3. The TBHT

3.1 Overview

The TBHT includes the construction of a multi-day class 4 walking track consisting of 47.74 km of walking trails and three camps connecting the Manns Road trail head to the Minyon Falls day-use area (refer to **Illustration 3.1**). The main walking track is 35.55 km in length, made up of 8.25 km of new track and 27.30 km of existing trails and roads. The project will also incorporate a total of 12.18 km of side-track, embarking from the main route. Upgrades to existing roads will also be required for the construction and ongoing maintenance of the proposed facilities.

The walk includes three camps which will include camping platforms, toilets and general infrastructure (tables, water tanks etc). Fireplaces will not be provided as open fires will not be permitted on the TBHT. The three new camps (from north to south) are referred to as Camps 1, 2 and 3 in this report ('official' names will be assigned to the camps later in the project).

The TBHT is intended to be walked from north (Manns Road trail head) to south, terminating at Minyon Falls and also includes several side tracks which diverge from the main walking track to areas of scenic interest. These include (north to south):

- Rowlands Creek (~ 1.49 km): an existing vehicle trail.
- Jerusalem Cliffs lookout (~ 0.23 km): an existing vehicle trail and walking track.
- Minyon Grass Loop trail (~ 1.24 km): a new track to be constructed as part of the TBHT, connecting Minyon Grass back to Minyon Falls and including the existing side branch to Quandong Falls.
- Minyon Falls pool track (~ 0.13 km): a short side branch from the existing Minyon Loop to formalise the existing rough pathway with stone tread steps and stone paving.
- Eastern Boundary Trail: an existing vehicular fire trail that will be part of a half-day walk from Minyon Falls to Rummery Park campground (which will loop back to Minyon Falls along the existing Boggy Creek walk).

For ease of reference in this report, the TBHT is referred to in five sections as follows:

- Section 1: Manns Road trail head to Camp 1.
- Section 2: Camp 1 to Camp 2.
- Section 3: Camp 2 to Camp 3.
- Section 4: Camp 3 to Minyon Falls.
- Section 5: Minyon Falls to Minyon Grass, Eastern Boundary Trail walk and existing Minyon Loop walk.

Sections 1-4 comprises the TBHT in full, with Section 5 including walking tracks associated with Minyon Falls and/or Rummery Park campground. Any side tracks are referred to by name (eg. Rowlands Creek Track [from Camp 1], Jerusalem Cliffs lookout); refer to **Illustration 3.1**.

Photographs of various locations along the TBHT are provided at **Appendix A**; the Master Plan is provided at **Appendix B**.

3.2 Interaction with Existing or Proposed Facilities

The TBHT intercepts with existing or proposed infrastructure at several locations:

- Manns Road: a trail head and carpark will be established in a disturbed area near the junction of South Chowan Road (leading to Unicorn Falls). A separate REF and assessment process has been completed for this facility.
- Section 3 of the TBHT utilises part of the existing Historic Nightcap Track, a formalised and intermittently maintained walking track which connects from Mount Nardi to Gibbergunyah Range Road.
- Section 4 takes walkers to the existing Rummery Park campground facilities (day use area, toilets, shelter). An existing walking track ('Boggy Creek walk') links Rummery Park campground to Minyon Falls.
- The TBHT terminates at Minyon Falls, which has undergone a major upgrade to improve facilities since late 2020. The Minyon Falls Master Plan has been addressed under a separate REF.
- Minyon Loop: the existing loop walk from Minyon Falls to the base of the falls and up to Minyon Grass will undergo minor improvements (step replacement and replacement of star pickets and wire with handrails).
- Rummery Park campground: The Eastern Boundary Trail walk will direct walkers to the existing camping and day use facilities at Rummery Park and utilise the existing Boggy Creek walk to return to Minyon Falls.

3.3 Construction Elements

3.3.1 Introduction

Construction/ installation of the TBHT will include the following components:

- Repairs to a section of Middle Ridge Fire Trail.
- Repairs to a section of Clay Pot Road.
- Repairs to a section of Eastern Fire Break.
- Tree removal for construction of the three camps.
- Construction of three camps, including provision of toilets, shelters, water tanks, camping platforms and bespoke furniture at each site.
- Fabrication, delivery and installation of all signs, posts, and trail markers.
- Trail construction - Manns Road trail head to Clay Pot Road.
- Trail construction - Camp 1 to Camp 2: helicopter for delivery of stone steps.
- Repairs to the vehicle bridge on Sand Ridge Road.
- Repairs to Sand Ridge Road.
- Repairs to Mount Jerusalem Road.
- Trail construction - Camp 2 to Camp 3.
- Repairs to trail to Tea Tree Lookout.
- Trail construction.
- New trail construction – Minyon Grass to Minyon Precinct.
- Access trail to the base of Minyon Falls (from the existing Minyon Loop) with stone tread steps and stone paving option using local rock.
- Upgrade of the existing Minyon Loop walk by replacing all concrete, mortar bag, and timber steps along the entire trail with stone steps and replacing all existing star-picket and plain wire fall-height barriers with an approved fall-height barrier design from the *Parks Facilities Manual*. Note: this component of the Activity is not funded as part of the initial construction works and will be completed in the future as funding permits.

- Installation of shoe cleaning stations.
- Installation of at-grade lookouts and seating.

3.3.2 Walking Tracks

Walking tracks in undisturbed areas will be built to a 600 mm width and require a disturbance footprint of approximately two metres for laying down and moving equipment, establishing sediment controls etc. There may be a need for passing bays or wider sections of track (> 600 mm) to be included if required. Construction methodology may include track building machines or hand tools (mattocks/ crowbars) depending on site sensitivities and shrubs and groundcovers will be removed or cut back as required. No mature trees or trees >100 mm dbh would require removal.

Rock will be required for steeper sections of the TBHT for step building and edging and will be flown in by helicopter where required.

Minimal amounts of 'bush rock' will be used in construction at several locations where it has previously been disturbed (eg. old snig tracks) or will be disturbed via earthworks or has fallen from the cliff face at Minyon Falls. Bush rock use will form a negligible part of the track works, as estimated below:

Section 1:

- 1.36 km - Rock for 4 steps recovered from snig track.
- 1.37 km - Rock for 5 stepping stones recovered from snig track.
- 1.38 km - Rock for 3 steps recovered from snig track.

Section 2:

- 2.34 km - Rock for paving across a steep gully from rock uncovered during excavation to bench the track.

Section 3:

- 3.25 km - Stone edging 6 m from rock uncovered during excavation to bench the track.
- 3.33 km - 7 stepping stones over ephemeral creek from local rock uncovered during excavation to bench the track.

Section 4:

- 4.3 km - Rock for 8 stepping stones from rock uncovered during excavation to bench the track.
- Reroute 4 - Rock for 15 steps (use local rock).

Minyon Loop:

- 9 m link near the base of Minyon Falls to use local rock.
- 70 m link to the base of Minyon Falls to use local rock.

NOTE: While Bushrock removal is listed as a key threatening process (KTP) in the *Biodiversity Conservation Act 2016*, the final determination listing notes that: *"Bushrock Removal…does not include: the removal of rock from approved mining or quarrying activities; the salvage of rock where the removal of the rock is necessary for carrying out a development or activity with an existing approval under the Environmental Planning and Assessment Act…"*. As the works would be completed under an REF determined under the EP&A Act, this KTP does not apply.

The stages in construction of new walking tracks are as follows:

- The exact alignment of the track will be marked with flagging tape on pegs in the ground.
- Vegetation removed along the alignment with hand tools and large fallen logs cut with chainsaws, all cut vegetation dispersed among the adjoining forest out of sight of the track.
- Mattocks, crowbars, shovels, rake-hoes and rakes will be used to dig the soil to build a new track, all soil will be dispersed among the adjoining forest out of sight of the track. Small machines will be used where conditions are appropriate.
- Helicopter or power carriers will be used to transport rock to site to build steps or stepping-stones, depending on access requirements.
- Helicopter or power carriers will be used to transport posts and signage to install along the track, depending on access requirements.
- A helicopter will be used to deliver a 1.5 tonne excavator to Mount Jerusalem Road in three parts, with the excavator used to regrade, re-instate 5% cross-slope, and re-instate roll-overs.

A side-by-side utility vehicle (refer **Figure 3.1**) will be utilised for improved access for fire management, pest and weed management and enforcement work within more remote parts of the TBHT. A side-by-side would require a 2 m wide track with greater width needed at corners for turning. Track improvements along the section of the Historic Nightcap Track between Doon Doon Saddle and Gibbergunyah Range Road would be required to allow the passage of a side-by-side. Earthworks were completed along this section of the trail in the past (using a bulldozer), however the trail width has reduced through lack of use, lack of maintenance, soil creep, bank collapse and revegetation.

Where the walking track occurs on tracks trafficable by vehicles from within NPWS estate, allowance must be provided for access by firefighting vehicles in accordance with bushfire requirements (4 m width, 4 m vertical clearance and provision for a turning area) as per *Planning for Bushfire Protection 2019* (NSW RFS 2019).

Figure 3.1 Example of 'side-by-side' utility vehicle

3.3.3 Lookouts and Seating

The TBHT includes informal lookouts which occur on the existing track or on side tracks. No additional works are proposed at any existing lookouts, other than the installation of signage to warn walkers of fall risk.

New lookouts are proposed (refer to **Illustration 3.1**) with each lookout to be built at grade with minor disturbance and installation of a single seat. Names for the new lookouts are being decided in consultation with local Aboriginal people.

Approximately 17 seats will be installed along the TBHT, with a single simple seat installed at each site. No other facilities/infrastructure are proposed at the seating locations.

3.3.4 Camps

Each camp has two areas, with an independent walkers camp and a tour camp (each with its own shelter), with a shared toilet. All camps have a relatively small footprint of less than 0.3 ha in area. Camps will require small scale disturbance for the installation of footings for the tent platforms, shelters, furniture, and excavation for the composing unit for the toilets. Some minor removal of regrowth vegetation may be required, in addition to the removal and relocation of fallen timber.

3.3.5 Watercourse Crossings

The proposed tracks include several crossings of minor watercourse which are subject to ephemeral flows. These crossing points will be constructed by using stepping stones, with the size of the stepping stone defined by the size of existing rock within the creek itself. Stepping stones will be of sufficient size to ensure they cannot be displaced by high rainfall events, and where necessary, will be dyna bolted into the bedrock. Repositioned natural (onsite) rock and rock brought in from local quarries will be used.

3.3.6 Bridge Repairs

Structural repairs are required to three bridges so they can accommodate vehicles or to make them safe for walker passage:

- Bridge in Section 1 (Sand Ridge Road) near Hell Hole: repair works will be completed so vehicles can cross the creek during camp and track construction work and for use by walkers and service vehicles after track construction work is complete. Existing soil on the bridge surface will be removed with a 1.5 tonne excavator and packed onto the existing road surface. Once the existing surface is free from soil, bearers will be replaced as required and new decking surface and handrails will be installed.

A number of other bridges along the Eastern Fire Break (Section 4) will also be upgraded for passage by vehicles and walkers, however these works are being completed under separate REFs under the Fire Access and Fire Trails (FAFT) scheme.

3.3.7 Plant and Equipment

Plant and equipment will include a small excavator (1.5 tonne), truck for delivery of stone (10 tonne) in addition to personnel completing much of the works by hand, using an arrangement of hand tools (mattock, crowbar, shovels, rake-hoes, rakes) and power tools (auger, concrete mixer, generator, drill, angle grinder, chainsaw, angle grinder, power barrow etc). A side-by-side will be utilised where possible to transport equipment and supplies from laydown areas and small track building machinery will be used in suitable locations. Helicopters will be used to access remote areas for the delivery of rock for step construction (refer below).

3.3.8 Helicopter Operations

A Jet Ranger helicopter (load capacity of 800 kg) will be deployed during construction at remote areas and step building operations up to Mount Jerusalem. Helicopters will be used to ferry in construction materials but will not land (ie. no formal landing area is required). Rather, all materials will be lowered to the ground in slings.

3.3.9 Staging, Timing and Duration

General hours of operation for the construction contractors will be 6am - 5pm Monday to Friday. Work may occur on weekends where required. No works would occur on public holidays or when the Fire Danger Rating is Extreme or Catastrophic. A timetable for construction staging is below and is subject to variation with regard to weather, contractor availability, availability of helicopter services etc.

Asset	Construction Commences	Construction Complete
Fire Trails	2022	2023
Camps	2022	2023
Walking Track	2022	2023

3.4 Operational Elements

Once operational, the TBHT would require periodic inspection of the track and built facilities at camps to ensure they remain to the required standard. Maintenance of assets will be required to ensure that they operate to the standards expected. Maintenance activities will include the removal of toilet waste and transportation to a wastewater treatment plant, cleaning toilet cubicles, stocking toilet paper in cubicles, cleaning leaves from gutters from shelters and the toilet, cleaning soil from drains and water bars along the track, weed control etc.

Trucks will be used to remove toilet dry waste from each camp.

In the event of walkers becoming injured in remote sections of the walk, a location near Jerusalem Cliffs lookout will be used for the retrieval of injured walkers through a winching and rappelling operation. Helicopters would not need to land in either of these circumstances.

3.5 Disturbance of Natural Values

As much of the TBHT utilises existing roads, trails and tracks, construction impacts to these areas would be relatively low. Several roads on which the walk is situated are formalised fire trails, with recent improvements to many roads completed in late 2019. Other abandoned or poorly maintained trails will require low levels of disturbance to remove fallen trees/ timber and remove vegetation regrowth. Environmental disturbance for the construction of the TBHT will be greatest where the TBHT traverses areas of undisturbed vegetation:

- Section 1, between Manns Road trail head and the formalised track along Whiskey Creek Trail. The TBHT will meander through a mix of sclerophyll forest communities.
- Section 1, where the track leaves Whiskey Creek Trail and crosses a rainforest/Flooded gum gully.
- Section 2, on the ascent to Mt Jerusalem and east of Mt Jerusalem, where the track leaves escarpment New England Blackbutt forest and descends into undisturbed warm temperate rainforest.
- Section 3, where a new track will be constructed parallel to Peates Mountain Road between North Rocks Road and the Eastern Fire Break (this area was almost entirely burnt in the 2019 bushfires and has experienced past logging disturbance).
- Section 4, south of Camp 3, where the track leaves an existing fire trail and passes through two gullies and disturbed sclerophyll forest.

In these areas, construction will require vegetation removal and disturbance. Matters such as soil erosion and sedimentation require consideration and mitigation to protect watercourses and the habitat values they provide.

Based on the construction requirements, the TBHT will result in physical disturbance to sections of the track as follows:

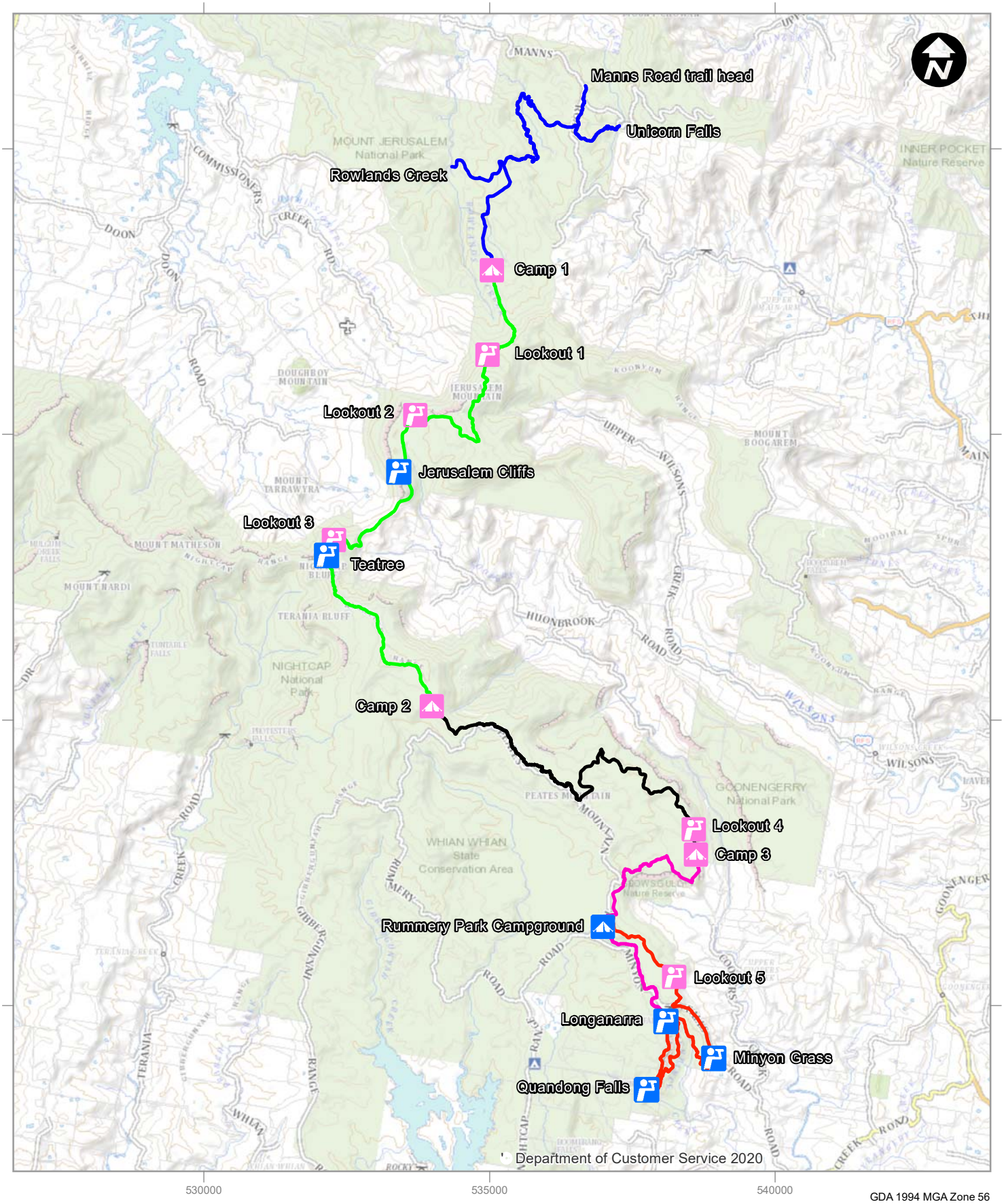
- Tree and shrub removal/ thinning at each of the three camps.
- Removal of regrowth along abandoned former vehicle trails and snig tracks.
- Select vegetation disturbance and removal for the installation of steps and stepping stones (watercourse crossings).
- Select vegetation disturbance and removal for drainage works.
- Minor earthworks to accommodate all of the above.

Additionally, disturbance to the amenity of all forest environments would occur during the construction period from human presence, noise from plant and vehicles (including a helicopter), emissions etc. In addition, the construction process also risks introducing weeds, pests and pathogens to the site such as Cinnamon Fungus (*Phytophthora cinnamomi*), Myrtle Rust (*Austropuccinia psidii*) and Yellow Crazy Ants (*Anoplolepis gracilipes*).

The potential impacts of the TBHT on biodiversity values are examined in detail in **Section 7**.

3.6 Infrastructure

Permanent infrastructure which would result from the TBHT is essentially limited to the three camps where camping platforms, shelters, water tanks, toilets, bespoke furniture, seats and lookouts would be constructed. Toilet waste would be directed to composting tanks, with camps 1 and 3 having a small absorption trench for excess liquids and camp 2 will have all liquids removed due to proximity to existing ephemeral watercourse. Removal from all camps will be as required by service vehicles and transported off site.



GDA 1994 MGA Zone 56

LEGEND

- Section 1 Manns Road day use area to Campsite 1
- Section 2 Campsite 1 to Campsite 2
- Section 3 Campsite 2 to Campsite 3
- Section 4 Campsite 3 to Minyon Falls
- Section 5 Minyon Loop and Boggy Creek Track

- Existing campground
- Proposed walk-in campground
- Existing lookout
- Proposed lookout

Information shown is for illustrative purposes only
Drawn by: AB Checked by: RE Reviewed by: ILC
Source of base data: DFSI
Date: 24/08/2022
Revision: D

4. Methodology

4.1 Desktop Review

Prior to field assessment, extensive desktop analysis was completed including:

- Review of relevant Plans of Management for each reserve.
- Review of any approved recovery plans for threatened species (eg. Peach Myrtle).
- Review of the REF and Master Plan (and supporting documents) for redevelopment of Minyon Falls day use area.
- A search of the BioNet Wildlife Atlas (5 km buffer centred on the TBHT).
- A search of the Protected Matters Search Tool (PMST) for Matters of National Environmental Significance (MNES).
- Review of data layers in the Fisheries NSW Spatial Data Portal and DPI Key Fish Habitat mapping.
- Review of NPWS mapping, data and documents.

Details of the survey methodology are provided in **Section 4.2**. Results of database searches are attached at **Appendix C**.

4.2 Field Assessment

The majority of field assessment was completed over multiple days between March and May 2020 (ie. within months of the fire events of 2019). Further field assessment was completed in September/ October 2020 and April 2021 to assess several areas where the track was re-sited and a new camp located. For all fieldwork the TBHT (and other data layers) were uploaded to an iPad for navigation and GIS fields set up to record features (threatened flora, fauna, habitat trees, features) as required. All data in the field was entered into the iPad for specific features and field notes taken as necessary. Where satellite averaging was poor in some areas, points of interest were recorded with a handheld GPS (Garmin 64).

The following tasks were completed in the field:

- Walking survey along all tracks and side tracks (within 10m of centreline) to identify vegetation types and identify threatened flora or ecological communities listed in the BC Act or EPBC Act. Threatened flora locations were marked with orange flagging tape (or in some cases blue and white flagging tape) and the species initial recorded in permanent marker.
- Identification of vegetation communities.
- Weed assessment and recording.
- Identification and marking any hollow-bearing trees alongside new tracks or camps with red and white survey tape (trees also surveyed by GPS).
- Opportunistic fauna survey.
- Inspection of bridges and rock outcrops for roosting microchiropteran bats.

4.3 Survey Limitations

A number of points are relevant to the survey effort completed:

- Threatened flora searches were more targeted towards rainforest and wet sclerophyll forest communities where suitable habitat occurs.
- Vehicle trails which require little modification for the TBHT were generally subject to survey along edges (~ 3 m) only.
- The Minyon loop assessment focussed effort at areas where works are required (replacement of stairs and picket fences), with targeted surveys in rainforest areas.
- Where areas were burnt in the 2019 fires, there is a high likelihood that some threatened flora species (eg. Peach Myrtle) may not have been recorded. A section of rainforest near Mount Jerusalem has been extensively burnt and shows poor recovery; there is potential for Peach Myrtle to regenerate or resprout within this area.
- Some species of a more cryptic nature (eg. orchids) may not have been detected due to survey timing to meet project requirements. Ravine Orchids (*Sarcochilus* sp.) flower October - November, and so field survey was slightly compromised with regards to readily detecting these species. These species would be unlikely to be affected by works associated with the TBHT (minimal rock disturbance, no removal of mature trees).
- No targeted survey for threatened fauna was completed, rather habitat assessment was undertaken with a focus on particular habitat features for key species (eg. *Allocasuarina* sp. for Glossy Black-cockatoo, preferred feed trees for Koalas etc).

5. Vegetation

5.1 Desktop Analysis

5.1.1 Introduction

All three reserves provide habitat for numerous vegetation associations and a diverse range of fauna, with 520 plant species recorded in Whian Whian SCA alone (Kooyman 2002), representing nearly 10% of vascular species known to occur in NSW. Kooyman (2002) also identified ten broad ecosystem types within Whian Whian SCA.

Mitchell landscape descriptions (DECC 2008): for vegetation types within the TBHT include:

Mount Warning Exhumed Slopes

Subtropical and tropical closed forest of white booyong (Argyrodendron trifoliolatum), native teak (Flindersia australis), pigeonberry ash (Cryptocarya erythroxylon), ball nut (Floydia praealta), ferny-leaf bosistoa (Bosistoa pentacocca), union nut (Bouchardatia neurococca), doughwood (Melicope octandra), crow's ash (Pentaceras australis), red lilly pilly (Syzygium hodgkinsoniae) and numerous vines. Marginal areas of tallow wood (Eucalyptus microcorys), Sydney blue gum (Eucalyptus saligna), red bloodwood (Corymbia gummifera), turpentine (Syncarpia glomulifera), brush box (Lophostemon confertus) and blackwood (Acacia melanoxylon).

Nimbin Ridges

Upper edge of the cliff with dwarf scrub of red bloodwood (Corymbia gummifera), forest oak (Allocasuarina torulosa) and scribbly gum (Eucalyptus signata). Below the cliffs; moist hardwood forest with blackbutt (Eucalyptus pilularis) and brush box (Lophostemon confertus) with a closed forest understorey and in the valleys subtropical closed forest of white booyong (Argyrodendron trifoliolatum), red carabeen (Geissois benthamii), yellow carabeen (Sloanea woollsii), red cedar (Toona australis), scentless rosewood (Synoum glandulosum), white beech (Gmelina leichhardtii), and bangalow palms (Archontophoenix cunninghamiana).

Habitat for numerous threatened flora species occurs, including endemic species such as Nightcap Oak, Minyon Quandong, Peach Myrtle and Corokia.

5.1.2 NPWS Vegetation Mapping

Draft Plant Community Type (PCT) mapping was reviewed; mapped vegetation communities within the TBHT are summarised in **Table 5.1**. All three conservation reserves are locally important in terms of containing substantial areas of subtropical and warm-temperate rainforest, with a total of approximately 7,255 ha of rainforest reserved (refer to **Table 5.2**).

Table 5.1 Plant Community Types within the TBHT

Vegetation Class	*PCT name*
Subtropical Rainforests	Far North Lowland Palm Gully Rainforest
Subtropical Rainforests	Far North Lowland Subtropical Rainforest
Subtropical Rainforests	Northern Lowland Subtropical Rainforest
Northern Warm Temperate Rainforests	Northern Ranges Coachwood Warm Temperate Rainforest
North Coast Wet Sclerophyll Forests	Far North Brush Box-Bloodwood Wet Forest
North Coast Wet Sclerophyll Forests	Far North Brush Box-Walnut Wet Forest
North Coast Wet Sclerophyll Forests	Northern Brush Box Subtropical Wet Forest
North Coast Wet Sclerophyll Forests	Northern Hinterland Blackbutt-Forest Oak Wet Forest
North Coast Wet Sclerophyll Forests	Northern Ranges Brush Box-Flooded Gum Wet Forest
North Coast Wet Sclerophyll Forests	Northern Turpentine-Brush Box Wet Forest
Northern Escarpment Wet Sclerophyll Forests	Mid North Ranges Blackbutt Forest
Northern Hinterland Wet Sclerophyll Forests	Far North Coastal Hills Blackbutt-Ironbark Forest
Northern Hinterland Wet Sclerophyll Forests	Northern Blackbutt-Turpentine Dry Shrubby Forest
Northern Hinterland Wet Sclerophyll Forests	Northern Gorges Diverse Grassy Forest
Northern Hinterland Wet Sclerophyll Forests	Northern Hinterland Grey Gum-Mahogany Grassy Forest
North Coast Dry Sclerophyll Forests	Far North Rhyolite Scribbly Gum Woodland
North Coast Dry Sclerophyll Forests	Koonyum Range Rhyolite Outcrop Shrubby Woodland
Northern Montane Heaths	Koonyum-Nightcap Tea-tree Rocky Scrub
Northern Montane Heaths	Tweed Caldera Outcrops Grassy Scrub

Table 5.2 Reserved Rainforest Communities by Area

PCT name	*Reserve*			*Total (ha)*
	Mt Jerusalem NP	*Whian Whian SCA*	*Nightcap NP*	
Far North Lowland Palm Gully Rainforest	49.49	0.00	58.69	**108.17**
Far North Lowland Subtropical Rainforest	941.36	519.08	1017.81	**2478.24**
Northern Lowland Subtropical Rainforest	36.70	10.55	545.56	**592.81**
Northern Ranges Coachwood Warm Temperate Rainforest	434.99	401.56	3239.78	**4076.33**
TOTAL	**1462.53**	**931.19**	**4861.84**	**7255.55**

5.1.3 Saving Our Species

A number of projects established under the 'Saving Our Species' (SOS) program are currently active in Nightcap NP/Whian Whian SCA for threatened flora and lowland rainforest communities, and include:

- *Davidsonia johnsonii* (Smooth Davidson's Plum)
- *Eidothea hardeniana* (Nightcap Oak)
- *Elaeocarpus sedentarius* (Minyon Quandong)
- *Elaeocarpus williamsianus* (Hairy Quandong)
- *Owenia cepiodora* (Onion Cedar)
- *Symplocos baeuerlenii* (Small-leaved Hazelwood)
- *Uromyrtus australis* (Peach Myrtle).

5.1.4 Database Search Results

All three reserves are known as biodiversity 'hotspots' with numerous records of threatened flora in the BioNet database as follows (note that many species records are likely to overlap):

- Nightcap NP: 27 threatened flora species.
- Whian Whian SCA: 16 threatened flora species.
- Mt Jerusalem NP: 20 threatened flora species.

A refined BioNet search for within a five km radius of the TBHT identified records of 46 threatened flora species listed in the BC Act. Habitat for 10 threatened ecological communities listed in the BC Act are known within the broader locality (refer to **Table 5.3** and **Table 5.4**). A number of these species/ communities are also listed in the EPBC Act.

PMST results identified habitat for 44 threatened flora species and two threatened ecological communities listed in the EPBC Act within five km of the TBHT (refer to **Appendix C**).

Table 5.3 Threatened Flora Records Within 5 km of the TBHT

Scientific Name	*Common Name*	*BC Act*	*EPBC Act*
Acacia bakeri	Marblewood	V	-
Acalypha eremorum	Acalypha	E	-
Archidendron hendersonii	White Lace Flower	V	-
Belvisia mucronata	Needle-leaf Fern	E	-
Bosistoa transversa	Yellow Satinheart	V	V
Corokia whiteana	Corokia	V	V
Cyperus rupicola	Cliff Sedge	V	-
Davidsonia jerseyana	Davidson's Plum	E	E
Davidsonia johnsonii	Smooth Davidson's Plum	E	E
Desmodium acanthocladum	Thorny Pea	V	V
Diploglottis campbellii	Small-leaved Tamarind	E	E
Doryanthes palmeri	Giant Spear Lily	V	-
Eidothea hardeniana	Nightcap Oak	E	CE
Elaeocarpus sedentarius	Minyon Quandong	E	E
Elaeocarpus williamsianus	Hairy Quandong	E	E
Endiandra floydii	Crystal Creek Walnut	E	E
Endiandra hayesii	Rusty Rose Walnut	V	V

Scientific Name	Common Name	BC Act	EPBC Act
Endiandra muelleri subsp. *bracteata*	Green-leaved Rose Walnut	E	-
Floydia praealta	Ball Nut	V	V
Fontainea australis	Southern Fontainea	V	V
Gossia fragrantissima	Sweet Myrtle	E	E
Grammitis stenophylla	Narrow-leaf Finger Fern	E	-
Hibbertia hexandra	Tree Guinea Flower	E	-
Hicksbeachia pinnatifolia	Red Boppel Nut	V	V
Lepiderema pulchella	Fine-leaved Tuckeroo	V	-
Lindsaea brachypoda	Short-footed Screw Fern	E	-
Macadamia tetraphylla	Rough-shelled Bush Nut	V	V
Marsdenia longiloba	Slender Marsdenia	E	V
Melicope vitiflora	Coast Euodia	E	-
Niemeyera whitei	Rusty Plum	V	-
Ochrosia moorei	Southern Ochrosia	E	E
Owenia cepiodora	Onion Cedar	V	V
Phyllanthus microcladus	Brush Sauropus	E	-
Plectranthus nitidus	Nightcap Plectranthus	E	E
Psilotum complanatum	Flat Fork Fern	E	-
Rhodamnia rubescens	Scrub Turpentine	CE	CE
Rhodomyrtus psidioides	Native Guava	CE	CE
Rhynchosia acuminatissima	Pointed Trefoil	V	-
Sarcochilus fitzgeraldii	Ravine Orchid	V	V
Sarcochilus hartmannii	Hartman's Sarcochilus	V	V
Senna acclinis	Rainforest Cassia	E	-
Symplocos baeuerlenii	Small-leaved Hazelwood	V	V
Syzygium hodgkinsoniae	Red Lilly Pilly	V	V
Syzygium moorei	Durobby	V	V
Tinospora tinosporoides	Arrow-head Vine	V	-
Uromyrtus australis	Peach Myrtle	E	E

V = Vulnerable; E = Endangered; CE = Critically Endangered

Table 5.4 Threatened Ecological Communities Within the Far North Coast Region

Community	BC Act	EPBC Act
Coastal Cypress Pine Forest in the New South Wales North Coast Bioregion	E	-
Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E	V
Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E	-
Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E	CE
Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions	E	CE
Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion	E	CE
Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion	E	-
Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E	-

Community	BC Act	EPBC Act
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E	E
Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions	E	-
White Gum Moist Forest in the NSW North Coast Bioregion	E	-

V = Vulnerable; E = Endangered; CE = Critically Endangered

5.2 Field Results

5.2.1 Vegetation Communities

The TBHT traverses a range of vegetation types, including dry sclerophyll forest, moist/wet sclerophyll forest, rainforest and tea tree heath. Localised vegetation communities also occur within these broader vegetation types. For example areas of palm forest dominated by Bangalow Palm (*Archontophoenix cunninghamiana*) may occur in gullies or along watercourses within wet sclerophyll forest; Stream Lily (*Helmholtzia glaberrima*) may have very localised association (several metres wide) with ephemeral watercourses. In many instances where the TBHT utilises formed tracks and trails they have been constructed along the ecotone between vegetation types and it is common to have wet or dry sclerophyll forest on the upslope and wetter rainforest or wet sclerophyll forest on the down slope. Allocating a vegetation type in these instances was sometimes difficult.

Vegetation communities are broadly described at **Table 5.5** and aligned with approved Plant Community Types (PCTs) in the BioNet Vegetation Classification system where appropriate.

Table 5.5 Vegetation Communities

	Community Description	PCT Equivalent
	Dry sclerophyll forest	
1	*Open forest (New England Blackbutt)* High elevation forest dominated by New England Blackbutt (*Eucalyptus campanulata*). Occurs at disjunct locations around Doon Doon saddle and Mount Jerusalem.	No equivalent*
2	*Open forest (Blackbutt)* Open forest dominated by Blackbutt (*E. plularis*); other canopy species include Red Bloodwood (*Corymbia gummifera*) and Scribbly Gum (*E. signata*).	*PCT 693 Blackbutt - Tallowwood tall moist forest of the far north east of the NSW North Coast Bioregion* (in part*)
3	*Open forest (Scribbly Gum)* Open forest dominated by Scribbly Gum with Red Bloodwood.	No equivalent*
4	*Open forest (Ironbark/Grey Gum)* Open forest with a mixed canopy; typical species include Grey Ironbark (*E. siderophloia*) and Small-fruited Grey Gum (*E. propinqua*). Infrequent species include Brush Box and Tallowwood (*E. microcorys*).	*PCT 872 Grey Ironbark - Grey Gum open forest of the northern escarpment ranges of the NSW North Coast Bioregion*
	Wet sclerophyll forest	
5	*Open forest (Brush Box)* Open forest dominated by Brush Box (*Lophostemon confertus*), sometimes co-dominant with Flooded Gum (*E. grandis*); rainforest understorey and secondary tree layer.	*PCT 749 Brush Box - Tallowwood shrubby open forest of the northern ranges of the NSW North Coast Bioregion* *PCT 826 Flooded Gum - Brush Box moist forest of the coastal ranges of the North Coast**

	Community Description	PCT Equivalent
6	*Open forest (Flooded Gum)* Open forest dominated by Flooded Gum (*E. grandis*), typically in gullies; rainforest understorey and secondary tree layer.	*PCT 826 Flooded Gum - Brush Box moist forest of the coastal ranges of the North Coast*
7	*Open forest (Blackbutt)* Open forest dominated by Blackbutt with occasional Turpentine (*Syncarpia glomulifera*) and/or White Mahogany (*E. acmenoides*) or Tallowwood (*E. microcorys*) with rainforest understorey. Includes ephemeral watercourses dominated by Stream Lily (*Helmholtzia glaberrima*).	*PCT 693 Blackbutt - Tallowwood tall moist forest of the far north east of the NSW North Coast Bioregion*
	Rainforest	
8	Typically dominated by Coachwood (*Ceratopetalum apetalum*), consistent with suballiance 33 (*Ceratopetalum/Schizomeria-Argyrodendron/Sloanea*) of Floyd (1990). Also includes some regrowth and disturbed forest.	*PCT 770 Coachwood - Soft Corkwood - Crabapple warm temperate rainforest of the NSW North Coast Bioregion* *PCT 1201 Soft Corkwood - Yellow Carabeen - Cryptocarya spp. subtropical rainforest of the NSW North Coast Bioregion*
9	Streamside rainforest dominated by Blue Quandong (*Elaeocarpus grandis*), typically with Bangalow Palm (*Archontophoenix cunninghamiana*); consistent with suballiance 4 (*Elaeocarpus grandis*) of Floyd (1990).	No equivalent*
10	Palm forest dominated by Bangalow Palm with infrequent emergents (Brush Box, Flooded Gum); consistent with suballiance 6 (*Archontophoenix*-Livistona) of Floyd (1990).	No equivalent*
11	Mixed rainforest with Black Bean (*Castanospermum australe*) common, with Maiden's Blush (*Sloanea australis*) and Red Carabeen (*Karrabina benthamiana*); broadly consistent with suballiance 5 (*Castanospermum-Dysoxylum muelleri*) of Floyd (1990).	No equivalent*
12	Mature mixed rainforest with infrequent emergent Figs; broadly consistent with suballiance 1 (*Argyrodendron trifoliolatum*) of Floyd (1990).	*PCT 1302 White Booyong - Fig subtropical rainforest of the NSW North Coast Bioregion*
	Heath	
13	Shrubland on exposed rock. Typical species include Teatree (*Leptospermum petersonii, L. microcarpum. L. variabile*) and Cliff Bottlebrush (*Callistemon comboynensis*); often with sprawling growth of Slender Cucumber (*Neoachmandra cunninghamii*).	No equivalent*

*PCTs currently assigned to the north coast are typically broad and/or coarse, have a low confidence level or are unsupported by robust data and are a poor fit for many vegetation communities. PCTs are currently in the process of revision and amendment by NSW Environment, Energy and Science.

Vegetation requiring disturbance for the TBHT is summarised with regard to the walking tracks and camps at **Table 5.6** and **Table 5.7**. Note that the Boggy Creek walk, while part of the TBHT track 'network' will not undergo any improvements and is not considered further with regard to any works.

Disturbance has been assessed by the following categories:

- Low to nil: woody vegetation unlikely to be disturbed, works minor.
- Low: minimal disturbance to groundcovers, shrubs or regrowth.
- Minor: small scale disturbance to groundcovers, shrubs or regrowth may occur. Removal of fallen trees/woody debris and vine regrowth. No removal of mature trees.
- High: works in undisturbed forest. Removal of select shrubs, saplings and young trees (including groundcovers and vines). No removal of mature trees.

The TBHT will not result in the removal of any mature canopy trees and vegetation community structure in the canopy and subcanopy layer would not be affected.

As noted, detailed PCT mapping for the reserves is currently in draft form, with final mapping products to be provided once approved. On this basis, a broader mapping approach to vegetation has been adopted based on the impacts of the works on native vegetation (based on **Table 5.6**); refer to **Illustration 5.1.**

Table 5.6 Vegetation Impacts - Walking Tracks

Section	Feature	Length (m)	Vegetation Community	Condition	Impacts
S1	**Manns Road to Camp 1**				
1a	Manns Road trail head to Whiskey Creek Trail	804.92	Dry sclerophyll forest (4)	Undisturbed vegetation	High
1b	Manns Road to Whiskey Creek Trail	92.48	Rainforest (8), Wet sclerophyll forest (6, 7), Dry sclerophyll forest (4)	Undisturbed vegetation	High
1c	Whiskey Creek Trail	1257.48	Dry sclerophyll forest (4), Wet sclerophyll forest (5)	Existing maintained vehicle track	Low to nil
1d	Gully/creek crossing	295.53	Rainforest (8), Wet sclerophyll forest (6)	Undisturbed vegetation	High
1e	Old logging road	1233.66	Rainforest (8), Wet sclerophyll forest (6, 7)	Old logging road with regrowth	Minor
1f	Informal walking track	870.35	Wet sclerophyll forest (6, 7)	Informal single file trail	Minor
1ff	Offshoot of 1f (steep section)	224.50	Wet sclerophyll forest (6, 7)	Undisturbed vegetation	High
1g	Vehicle trail to junction with Clay Pot Road	128.16	Wet sclerophyll forest (7)	Existing maintained vehicle track	Low to nil
1h	Clay Pot Road along Middle Ridge Trail	314.69	Dry sclerophyll forest (4)	Existing maintained vehicle track	Low to nil
1i	Sand Ridge Road to bridge	870.58	Dry sclerophyll forest (4), Rainforest (9)	Existing maintained vehicle track	Low to nil
1j	Ascent to Mt Jerusalem	1062.46	Wet sclerophyll forest (6, 7)	Old logging road with regrowth	Minor
1k	Side Trail: Rowlands creek	1489.98	Wet sclerophyll forest (7), Rainforest (9)	Existing maintained vehicle track	Low to nil
1l	Side Trail: Manns Road to Unicorn Falls	860.93	Rainforest (8), Wet sclerophyll forest (6, 7), Dry sclerophyll forest (4)	Undisturbed vegetation	High
1m	Side Trail: Manns Road to Unicorn Falls	427.58	Dry sclerophyll forest (4)	Old logging road with regrowth	Minor
S2	**Camp 1 to Camp 2**				
2a	Ascent to Mt Jerusalem	272.27	Wet sclerophyll forest (6, 7)	Old logging road with regrowth	Minor
2b	Ascent to Mt Jerusalem	1236.53	Rainforest (8), Wet sclerophyll forest (5, 6)	Undisturbed vegetation	High
2c	Rock Face Road	171.66	Wet sclerophyll forest (5), Dry sclerophyll forest (1)	Existing maintained vehicle track	Low to nil
2d	Ascent to Mt Jerusalem	984.86	Dry sclerophyll forest (1)	Undisturbed vegetation	High
2e	Descending Mt Jerusalem	849.87	Rainforest (12)	Undisturbed vegetation	High
2f	Descending Mt Jerusalem	291.37	Rainforest (12), Wet sclerophyll forest (7)	Old logging road with regrowth	Minor
2g	To Camp 2 (Nightcap Road)	2302.95	Wet sclerophyll forest (7), Dry sclerophyll forest (1, 4)	Existing vehicle track (some fallen trees)	Low to nil
2h	To Nightcap NP (Nightcap Road)	1928.13	Dry sclerophyll forest (4), Rainforest (12)	Existing vehicle track	Low to nil
2i	Ascent to Doon Doon saddle	1510.56	Dry sclerophyll forest (1)	Formal walking track	Low

Section	Feature	Length (m)	Vegetation Community	Condition	Impacts
2j	Doon Doon saddle to Gibbergunyah Range Road	3664.16	Dry sclerophyll forest (1), Rainforest (8)	Formal walking track (Historic Nightcap Track)	Low
2k	Gibbergunyah Range Road - Peates Mountain Road	200.81	Dry sclerophyll forest (4)	Existing maintained vehicle track	Low to nil
2l	Side Trail: Nightcap Road to Jerusalem Cliffs Lookout	227.11	Dry sclerophyll forest (4), Heath (13)	Formal walking track	Low
S3	**Camp 2 to Camp 3**				
3a	Gibbergunyah Range Road - Peates Mountain Road	1147.88	Dry sclerophyll forest (4)	Existing maintained vehicle track	Low to nil
3b	Peates Mountain Road parallel track to Eastern Fire Break	3274.18	Dry sclerophyll forest (4), Wet sclerophyll forest (7), Rainforest (12)	Undisturbed vegetation	High
3g	Eastern Fire Break to Camp 3	4724.01	Dry sclerophyll forest (2)	Existing vehicle track	Low to nil
S4	**Camp 3 to Minyon Falls**				
4a	Camp 3 to Eastern Fire Break/Perlite Road	2146.22	Dry sclerophyll forest (1)	Existing vehicle track	Low to nil
4b	Snow-Gully reroute	93.59	Dry sclerophyll forest (2), Wet sclerophyll forest (7)	Undisturbed vegetation	High
4c	Short section of 4b on old snig track	312.05	Wet sclerophyll forest (7)	Old logging road with regrowth	Minor
4d	Eastern Fire Break to Eastern Boundary Trail	624.99	Dry sclerophyll forest (2), Wet sclerophyll forest (7)	Undisturbed vegetation	High
4e	The Boggy Creek Walk	2660.53	Wet sclerophyll forest (7), Dry sclerophyll forest (2), Rainforest (8)	Formal walking track	Low
S5	**Minyon Falls side walks**				
5a	Eastern Boundary Trail	2170.26	Dry sclerophyll forest (2, 3)	Existing maintained vehicle track	Low to nil
5b	Eastern Boundary Trail to Minyon Falls	204.46	Wet sclerophyll forest (7)	Old logging road with regrowth	Minor
5c	Minyon Falls to Minyon Grass	1243.14	Dry sclerophyll forest (2, 3)	Undisturbed vegetation (generally)	High
5d	Minyon loop (including side track to Quandong Falls)	5436.06	Dry sclerophyll forest (2, 3), Wet sclerophyll forest (7), Rainforest (10, 11)	Formal walking track	Low
5e	Minyon Falls pool track	129.59	Rainforest (10)	Informal walking track	Low

Table 5.7 Vegetation Impacts - Camps

Camp	*Area (ha)*	*Veg. Community*	*Condition*	*Impacts*
1	~ 0.20	Wet sclerophyll forest	Intact / high condition vegetation in proposed campsite area. Along trail, some historical disturbance from logging and original trail construction.	Moderate
2	~ 0.26	Wet sclerophyll forest	Intact / moderate condition vegetation in proposed campsite area. Some historical disturbance due to recent bushfire - now regenerating	Moderate
3	~ 0.20	Wet sclerophyll forest	Intact / moderate condition vegetation in proposed campsite area. Some historical disturbance due to recent bushfire - now regenerating	Moderate

On the basis of the information presented in **Table 5.6** and **Table 5.7**, a summary of impacts on vegetation communities is provided at **Table 5.8**, based on a general disturbance corridor of two metres for new walking tracks. Calculations have not been made for the existing Minyon Loop track as disturbance is required in small disjunct sections for replacement of steps and guardrails, with the Quandong Falls side track section requiring replacement of just two single steps. These works would only be expected to total ~ 300 metres.

Based on **Table 5.8**, a total of 10.59 km of track will be constructed within undisturbed vegetation (the greatest impact), with lesser impacts from track construction along abandoned logging tracks (~ 3.80km) where selective regrowth clearing would be required. Areas of greatest vegetation impact are shown at **Illustration 5.1**).

The balance of the TBHT utilises formed roads or existing walking trails (eg Historic Nightcap Track, Nightcap Road, Eastern Fire Break) where impacts would be low to nil.

Table 5.8 Summary of Likely Vegetation Impacts

Vegetation Condition	*Impacts*	*km*	*Area (ha)**
Walking Tracks			
Undisturbed vegetation	High	10.59	2.12
Old logging road (not maintained)	Minor	3.80	0.76
Existing formal walking track	Low	13.38	Nil**
Existing maintained vehicle trail	Low to nil	18.97	Nil**
Informal walking tracks	Low to Minor	1.00	0.2
Camps			
Undisturbed vegetation (with two sites subject to recent bushfires)	High	n/a	~0.7

*Based on disturbance corridor of 2 m width for walking tracks

**No clearing works required

5.2.2 Threatened Flora

Fifteen threatened flora species were confirmed in the field (refer to **Table 5.9** and). Scrub Turpentine (*Rhodamnia rubescens*) was the most widely distributed threatened species, occurring occasionally along forest edges and within dry and wet sclerophyll forest and rainforest. The majority of Scrub Turpentine were in good condition, although many trees showing signs of previous infection by Myrtle Rust (leaf scarring). No active infection was observed, and a single tree was recorded flowering within Section 1 (15/10/2020). A single Scrub Turpentine in wet palm forest on the Minyon Loop on the track verge showed no signs of Myrtle Rust despite being in a very wet environment which is highly trafficked.

Other threatened flora species occur infrequently (Red Boppel Nut *(Hicksbeachia pinnatifolia),* Corokia *(Corokia whiteana),* Onion Cedar *(Owenia cepiodora), (Macadamia tetraphylla)*) or within disjunct populations ((*Uromyrtus australis)* Peach Myrtle*, (Symplocos baeuerlenii)* Small-leaved Hazelwood*, (Grammitis stenophylla)* Narrow-leaf Finger-fern). Several species are restricted to low-elevation rainforest and palm forest along the Minyon Falls loop (*Owenia cepiodora, Macadamia tetraphylla,* Red Lilly Pilly *(Syzygium hodgkinsoniae),* Arrow-head Vine *(Tinospora tinosporoides)*) and were not recorded elsewhere.

Tree Guinea Flower *(Hibbertia hexandra)* was recorded in only one section of the TBHT (Section 3 - Peates Mountain section). A small local population of the species along Peates Mountain Road was

destroyed in the 2019 bushfire, however substantial numbers of post-fire regeneration seedlings are present within recovering moist Blackbutt forest. The potential for these seedlings to persist and mature to established plants is unknown. A population survey by GeoLINK (in prep.) confirmed an estimated 700 mature plants within Nightcap NP and Whian Whian SCA, with prolific germination observed within some burnt areas.

Numerous Rusty Plum (*Niemeyera whitei)* seedlings occur along the edges of the Minyon Loop with several mature parent trees present. The Boggy Creek walk also features a number of mature Rusty Plum and regenerating small trees. This regeneration of a threatened species alongside popular walking tracks which have been in place for several decades is encouraging in terms of threatened species resilience.

Threatened flora records are generally consistent with data and vegetation types for the locality, and none of the survey findings represent any new populations or species that could not be confidently predicted. Any 'new' records (eg. the large numbers of *Symplocos baeuerlenii* within mature Coachwood forest east of Mt Jerusalem) are more likely representative of a lack of survey effort undertaken or for which data has not been included in the Bionet database. On a similar basis, records of *Grammitis stenophylla* are likely to represent a small portion of actual records, given the cryptic nature of the species and that it is easily overlooked in the field.

Of the three camps, only one (Camp 1) provides habitat for threatened flora, with several Scrub Turpentine located within and proximate to the camp site (refer Master Plan).

While not within the TBHT 'footprint' substantial post-fire regeneration of Rainforest Senna *(Senna acclinis)* was also observed within private land (Lot 2 DP703966) with these plants within 20 metres of the formed Nightcap Road corridor running along the Doon Doon saddle.

Table 5.9 Threatened Flora Recorded

Species	*Notes*
Corokia whiteana Corokia	One plant south of Camp 3 (S4); several plants on existing Boggy Creek walk (S5).
Endiandra hayesii Rusty Rose Walnut	Single seedling at Minyon Falls (S5); several mature trees and smaller trees along the Minyon loop track (S5); single tree alongside 'Whiskey Creek' (S1).
Endiandra muelleri subsp. *bracteata* Green-leaved Rose Walnut	Single plants on Eastern Firebreak (S4) and Historic Nightcap Track (S3).
Grammitis stenophylla Narrow-leaf Finger Fern	Small population on and adjacent to a rock outcrop and on two isolated rocks within rainforest east of Mt Jerusalem (S2). Several plants along Historic Nightcap Track (S3).
Hibbertia hexandra Tree Guinea Flower	Small population destroyed by fire in Section 3 (Peates Mountain section); substantial post-fire regeneration.
Hicksbeachia pinnatifolia Red Boppel Nut	Several plants south of Camp 2 (S2); infrequent along the Minyon loop track (S5).
Macadamia tetraphylla Rough-shelled Bush Nut	Several trees and saplings recorded along the Minyon loop track (S5).
Niemeyera whitei Rusty Plum	Infrequent individuals generally; several mature trees and numerous seedlings and saplings occur along the Minyon loop track and Boggy Creek walk (S5).
Owenia cepiodora Onion Cedar	Several trees occur along the Minyon loop track (S5).
Rhodamnia rubescens Scrub Turpentine	Occasional trees at Camp 1 and connecting track in S1 and S2; single sapling on the Minyon loop track (S5).

Species	Notes
Senna acclinis Rainforest Senna	Post-fire regeneration of numerous seedlings within private land (Lot 2 DP703966 adjacent to Nightcap Road corridor running along the Doon Doon saddle. These plants are aligned with S3 of the TBHT but outside the project footprint.
Symplocos baeuerlenii Small-leaved Hazelwood	Scattered records along Historic Nightcap Track (S3); two trees on the Minyon loop track (S5).
Syzygium hodgkinsoniae Red Lilly Pilly	Scattered trees near watercourses along the Minyon loop track (S5); small population alongside Boggy Creek (adjacent to Rummery Park campground - S5); locally common population along 'Whiskey Creek' (S1).
Tinospora tinosporoides Arrow-head Vine	Infrequent along the Minyon loop track (S5).
Uromyrtus australis Peach Myrtle	Scattered plants along Historic Nightcap Track (S3). Numerous plants within a large population within warm temperate rainforest east of Mt Jerusalem (including post-fire resprouting and/or germination in a fire affected area). Small isolated population along the Boggy Creek walk.

Threatened flora recorded on the TBHT are examined with regard to known data/ literature in **Table 5.10**.

Table 5.10 Threatened Flora Recorded - Species Information

Species	Species Information	Reference
Corokia whiteana	Highly restricted distribution. Three distinct populations are known: one in the Nightcap Range, one in the Tweed Valley and the other close to the coast near Brunswick Heads. Population counts range from 10 to 23, generally with scattered individuals. Responds well to increased light availability and thus has a positive response to disturbance.	*Corokia whiteana* profile (EES 2019); *Corokia whiteana* Conservation Advice (EPBC listing) 2008.
Endiandra hayesii	Limited distribution between the Tweed and Clarence River. Present in low numbers in at least some parts of range.	Approved Recovery Plan (DEC 2004).
Endiandra muelleri subsp. *bracteata*	Limited distribution between the Tweed and Clarence River. present in low numbers in at least some parts of range.	Approved Recovery Plan (DEC 2004).
Grammitis stenophylla	Broad but disjunct distribution; records from the south, central and north coasts and as far west as Mount Kaputar National Park near Narrabri. Few records in the locality (Bionet).	Narrow-leaf Finger Fern profile (EES 2018).
Hibbertia hexandra	Restricted distribution with two disjunct populations - a northern population (restricted to Mt Warning and Nightcap National Parks); and a southern population in the Wauchope–Kendall area (possible separate species). Susceptible to inappropriate fire regimes.	Tree Guinea Flower profile (EES 2018).
Hicksbeachia pinnatifolia	Northern population from the Tweed to Alstonville; disjunct southern population near Bellingen. Likely to be intolerant to even low intensity fires.	*Hicksbeachia pinnatifolia* Conservation Advice (EPBC listing) 2010.
Macadamia tetraphylla	Limited geographic range (Tweed to Richmond River); a population of 11-25 trees at Minyon Falls is designated as a high priority population (DOEE). Likely fire sensitive.	*(draft) Macadamia Species Recovery Plan 2019-2024* (Powell & Gould 2019).

Species	Species Information	Reference
Niemeyera whitei	Broad distribution from the Macleay River into southern Queensland; distributional stronghold around Coffs Harbour.	Rusty Plum profile (EES 2020).
Owenia cepiodora	Limited range (Tweed to Byron Bay), with population of in NSW consisting of ~ 40 mature individuals and > 400 immature individuals (including seedlings).	*Owenia cepiodora* Conservation Advice (EPBC listing) 2008.
Rhodamnia rubescens	Widely distributed, highly to extremely susceptible to infection by Myrtle Rust. No signs of resistance at populational level; sporadic reports of individuals (and very rarely small populations) with low or no infection incidence. Effective extinction in the wild within a very few years is likely (Makinson 2018).	Scrub Turpentine profile (EES 2019); Makinson (2018).
Symplocos baeuerlenii	Highly restricted distribution in NSW - Nightcap NP, Mount Jerusalem NP, Mount Warning NP.	*Symplocos baeuerlenii* Conservation Advice (EPBC listing) 2008.
Syzygium hodgkinsoniae	Limited geographic range (Tweed to Richmond River); occurs mostly as scattered individuals along watercourses.	*Syzygium hodgkinsoniae* Conservation Advice (EPBC listing) 2008.
Tinospora tinosporoides	Limited geographic range (Tweed to Richmond River); can locally common in rainforest on basalt and also occurs in complex notophyll vine forest.	*Tinospora tinosporoides* Conservation Advice (EPBC listing) 2008.
Uromyrtus australis	Restricted to high rainfall, high altitude areas on Nimbin Rhyolite geology in the Nightcap Range and nearby areas (area of approximately 13 by 11 km). Low population numbers, patchy distribution and slow growth rates. Suspected as highly susceptible to Myrtle Rust (known host taxa) (Makinson 2018). SOS monitoring detected Myrtle Rust (MR) infection on *Uromyrtus* in 2017, with monitoring completed in 2018/2019. While Peach Myrtle has produced consistent crops of flowers and fruit every year, this has not been the case over the last two seasons with very low production of flowers and fruits and high levels of leaf loss on some individuals. While detection of MR on individuals is relatively easy, separating the impact of drought, heat waves and MR on leaf loss and flowering and fruit production is more difficult. Based on monitoring for 2020, MR infection rates and impacts are similar to previous years, with the added threat of MR impacting post fire growth. Fire: populations of *Uromyrtus* were affected to various degrees by bushfire events of late 2019. Post fire monitoring has occurred at a number of sites throughout the species range. It appears that low intensity fire impacted sites have had an initial reduction in small stems, with most of these are now reshooting. High intensity sites have had a reduction in stems with some reshooting and clones persisting. There has been a small number of mortalities where all representatives of a clone have failed to reshoot.	Approved Recovery Plan (DEC 2005); Makinson (2018); Justin Mallee (NPWS) (pers. comm. 06/07/2020).

Based on review, the following threatened flora species may be particularly sensitive/ vulnerable to disturbance and/ or threatening processes:

- *Corokia whiteana*: limited distribution and small population.
- *Grammitis stenophylla*: limited local records.
- *Hibbertia hexandra*: limited distribution and small local population; vulnerability to too frequent fire.
- *Owenia cepiodora*: low population within limited geographic range.
- *Rhodamnia rubescens*: extremely susceptible to Myrtle Rust.
- *Uromyrtus australis*: limited distribution and small population; susceptible to Myrtle Rust.

Potential impacts of the TBHT on threatened flora are discussed in detail in **Sections 7.2 and 7.3**. The results of statutory assessment are provided at **Section 8**.

5.2.3 Threatened Ecological Communities (TECs)

Rainforest areas are representative of the threatened ecological community (TEC) *Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions.* The final determination for this community (NSW Scientific Committee 2011) only recognises Lowland Rainforest as occurring up to 600m above sea level in the north of its range. On this basis, any areas of rainforest above 600 metres ASL are not characteristic of lowland rainforest. Areas of lowland rainforest < 600 m ASL traversed by the TBHT total approximately 10 km and are depicted at **Illustration 5.3**.

Rainforest communities are also federally listed under the EPBC Act as the TEC *Lowland Rainforest of Subtropical Australia* ('LRSA'). LRSA criteria (DSEWPaC 2011, Threatened Species Scientific Committee 2011) are as follows:

- Occurs on basalt and alluvial soils, including sand and old/elevated alluvial soils as well as floodplain alluvia.
- Also occurs occasionally on historically enriched rhyolitic soils and basaltically enriched metasediments.
- Typically occurs in areas with high annual rainfall (>1,300 mm).
- Mostly occurs in areas <300 m above sea level. Aspect can result in the community being found at >300 m altitude on north-facing slopes, but typically 300 m defines the extent of the lowlands.

On this basis, LRSA only occurs within rainforest areas at elevations of less than 300m. Areas of LRSA traversed by the TBHT total approximately 5.8 km.

Potential impacts of the TBHT on rainforest communities are discussed in detail in **Sections 7.2 and 7.3**. The results of statutory assessment are provided at **Section 8**.

5.2.4 Weeds

Weeds are generally infrequent along the TBHT and are only prevalent in disturbed areas, where they are typically limited to introduced grasses (*Paspalum mandiocanum, Sporobolus africanus*) and herbs (*Crassocephalum crepididioides, Phytolacca octandra, Solanum nigrum, Ageratina adenophora*). Broad-leaved Paspalum is very dense along the road at Doon Doon saddle (between the National Parks) and fringes occasional tracks where prior disturbance has occurred. Woody weeds are limited to infrequent Lantana which occurs very sparsely. Infrequent climbers (*Passiflora subpeltata, P. edulis*) typically occur in disturbed areas at Doon Doon saddle. A combination of poor soils, dense canopy cover and minimal human disturbance precludes the likelihood of weeds over much of the TBHT. An inventory of weeds recorded is provided at **Appendix D**.

At the Doon Doon saddle where the TBHT occurs on private land (Lot 88 DP755710, Lots 1 and 2 DP1244434) the main landholder has requested that any weed control completed does not include

spraying of herbicide. Such measures will assist in avoiding the potential that any spray drift may affect nearby sensitive vegetation (eg. post fire regeneration of *Senna acclinis*).

NPWS will have responsibility for weed control on any easements. Mechanical control (slashing) of introduced grasses and weeds will need to be completed on a regular basis to prevent seeding events.

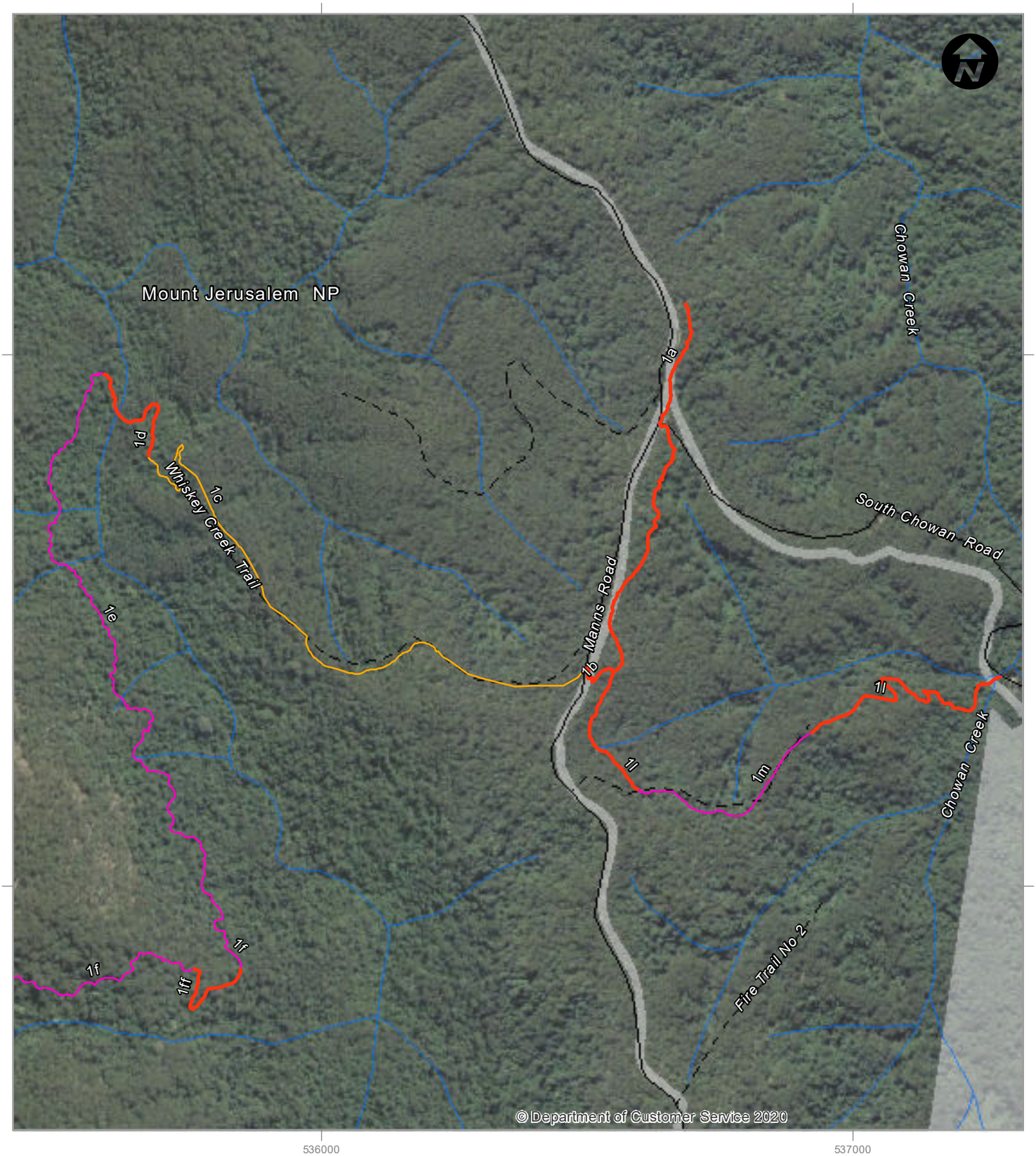
5.2.5 Condition

Forest communities are typically in excellent condition and show little signs of degradation (apart from historic track making works and forestry operations) and damage or erosion (from storms, horses etc) is very low.

Post-fire regeneration is evident in all affected vegetation within the TBHT with eucalypts showing epicormic growth and prolific regeneration in the ground layer (*Kennedia rubicunda, Dampiera sylvestris, Entolasia stricta, Solanum ditrichum, Desmodium rhytidophyllum, Acacia binervata, Solanum vescum, Homalanthus populifolius, Duboisia myoporoides, Neoachmandra cunninghamii, Commersonia breviseta*).

Common midstorey species affected by fire include *Callicoma serratifolia, Ackama paniculosa, Cryptocarya rigida, Cryptocarya meisneriana, Elaeocarpus reticulatus* and *Allocasuarina* sp. Many of these are reshooting from the base but may be unlikely to successfully resprout and regain vigour. In areas where fires appear to have been particularly hot, rainforest species and other midstorey species such as *Allocasuarina* sp. and *Callitris macleayana* appear to have been killed outright.

While fire has impacted populations of some threatened flora in Nightcap NP (Peach Myrtle, Nightcap Oak, Minyon Quandong etc), few areas where threatened flora were recorded have been severely impacted by fire (with the exception of Tree Guinea Flower). As noted, (refer **Table 5.10**) Peach Myrtle appears to have some resistance to fire at low impact sites. Whether individuals which have resprouted persist into the future (and reproduce) remains the subject of future monitoring.



GDA 1994 MGA Zone 56

LEGEND

- Local road
- Track-vehicular
- Watercourse
- Non NPWS estate

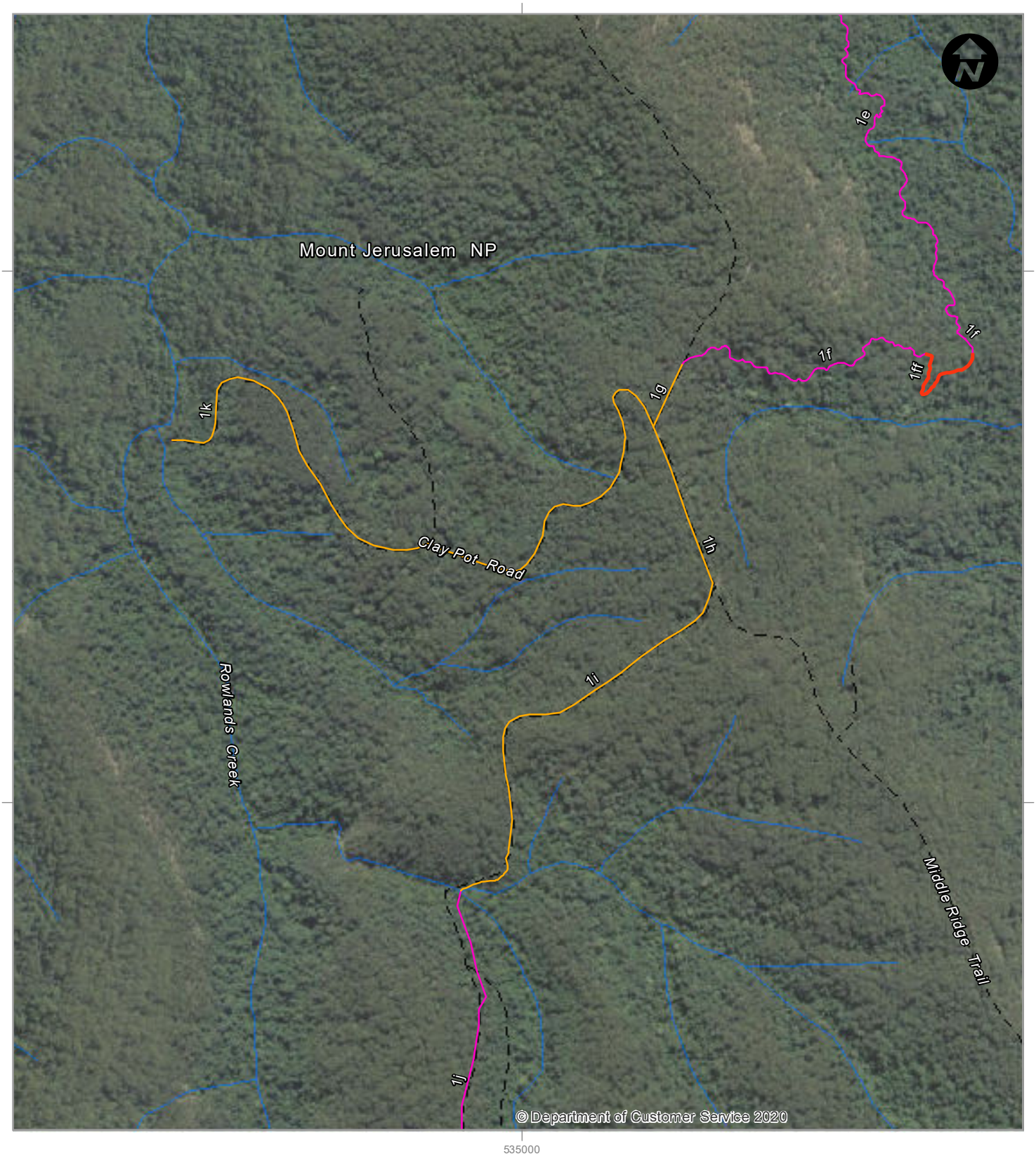
Vegetation Impacts

- High
- Low to nil
- Minor

0 200 Metres

Vegetation Impacts
Illustration 5.1 - Sheet 1 of 12

Information shown is for illustrative purposes only
Drawn by: AB Reviewed by: RE
Source of base data: DFSI
Date: 25/07/2022
Revision: B



GDA 1994 MGA Zone 56

LEGEND

- Track-vehicular
- Watercourse

Vegetation Impacts

- High
- Low to nil
- Minor

0 200 Metres

Vegetation Impacts
Illustration 5.1 - Sheet 2 of 12

Information shown is for illustrative purposes only
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Source of base data: DFSI
Date: 25/07/2022
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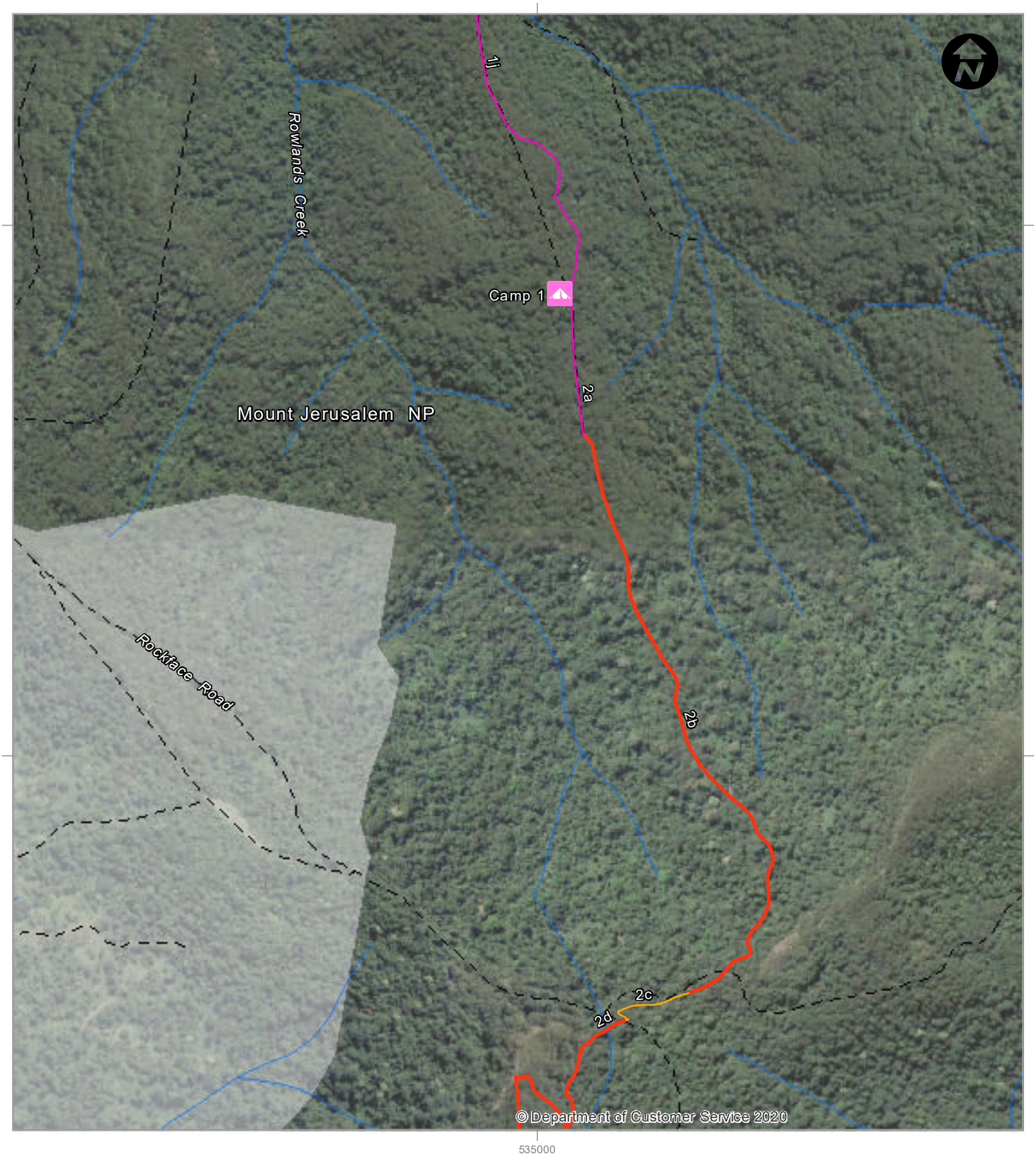

GDA 1994 MGA Zone 56

LEGEND

- Track-vehicular
- Watercourse
- Non NPWS estate

Vegetation Impacts

- High
- Low to nil
- Minor

Proposed walk-in campground

0 200 Metres

Vegetation Impacts
Illustration 5.1 - Sheet 3 of 12

Information shown is for illustrative purposes only
Drawn by: AB Reviewed by: RE
Source of base data: DFSI
Date: 25/07/2022
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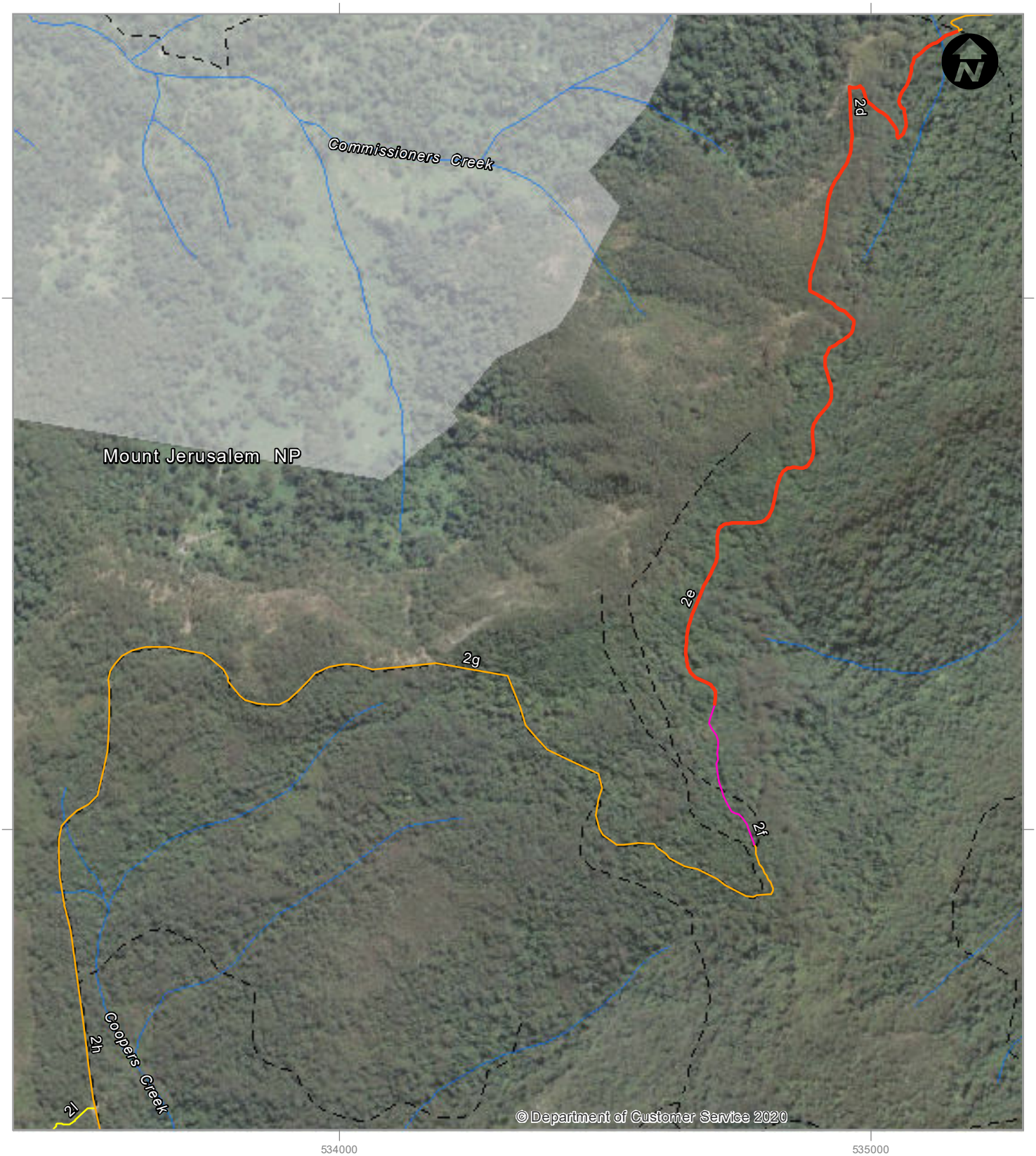

GDA 1994 MGA Zone 56

LEGEND

- Track-vehicular
- Watercourse
- Non NPWS estate

Vegetation Impacts

- High
- Low
- Low to nil
- Minor

0 200 Metres

Vegetation Impacts
Illustration 5.1 - Sheet 4 of 12

Information shown is for illustrative purposes only
Drawn by: AB Reviewed by: RE
Source of base data: DFSI
Date: 25/07/2022
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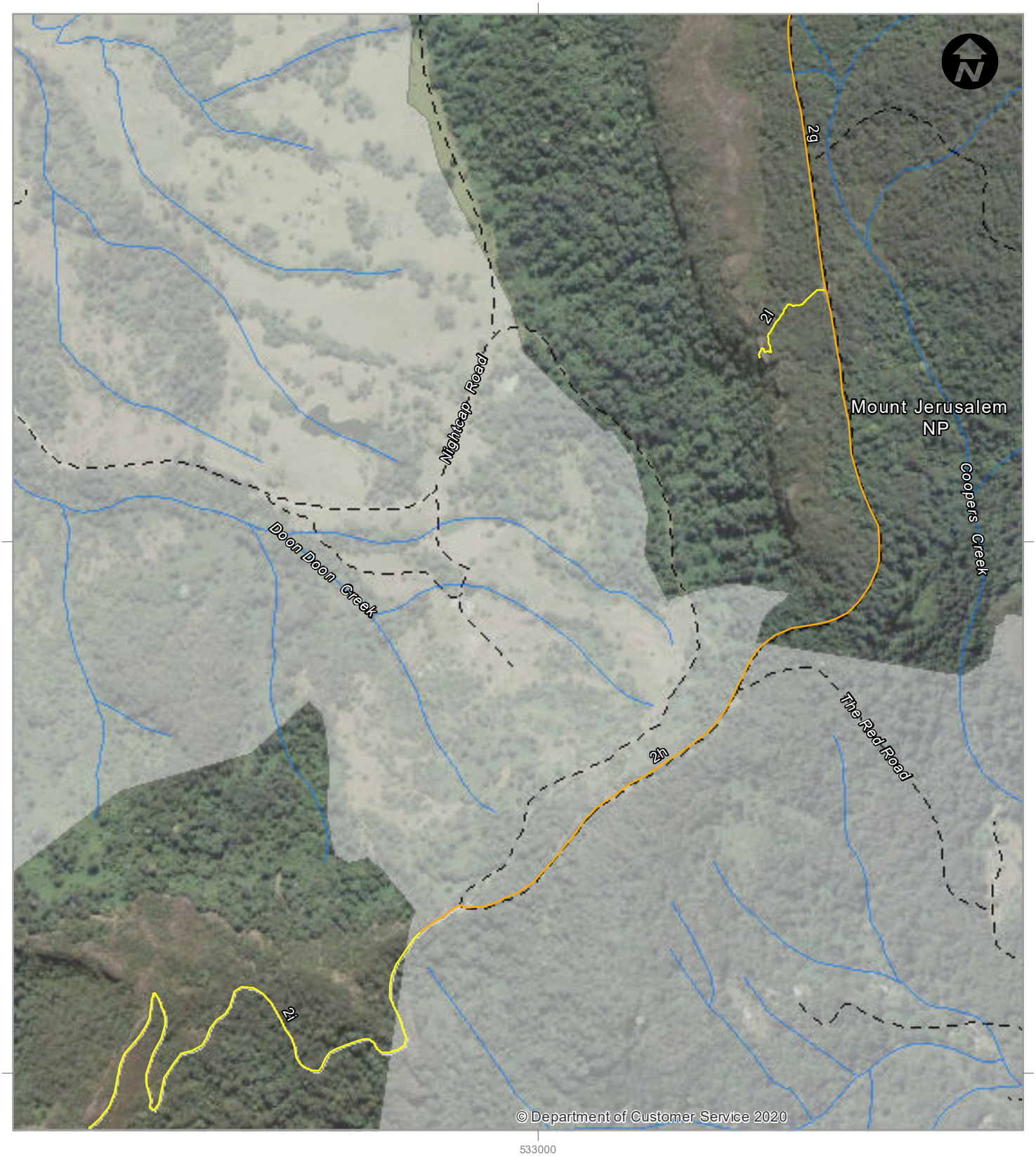

GDA 1994 MGA Zone 56

LEGEND

- Path
- Track-vehicular
- Watercourse
- Non NPWS estate

Vegetation Impacts

- Low
- Low to nil

0 200 Metres

Vegetation Impacts
Illustration 5.1 - Sheet 5 of 12

Information shown is for illustrative purposes only
Drawn by: AB Reviewed by: RE
Source of base data: DFSI
Date: 25/07/2022
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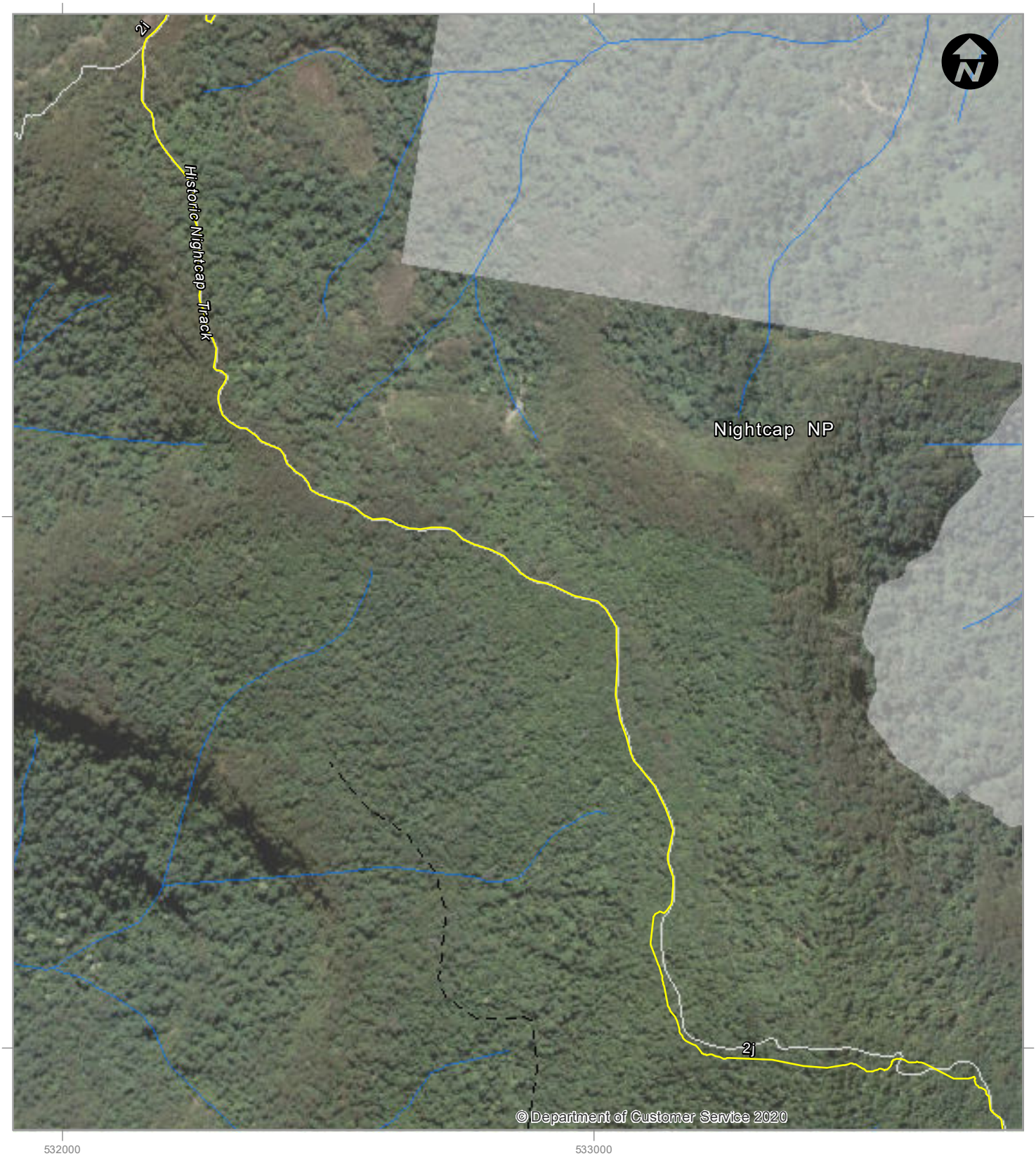


GDA 1994 MGA Zone 56

LEGEND

- Path
- Track-vehicular
- Watercourse
- Non NPWS estate

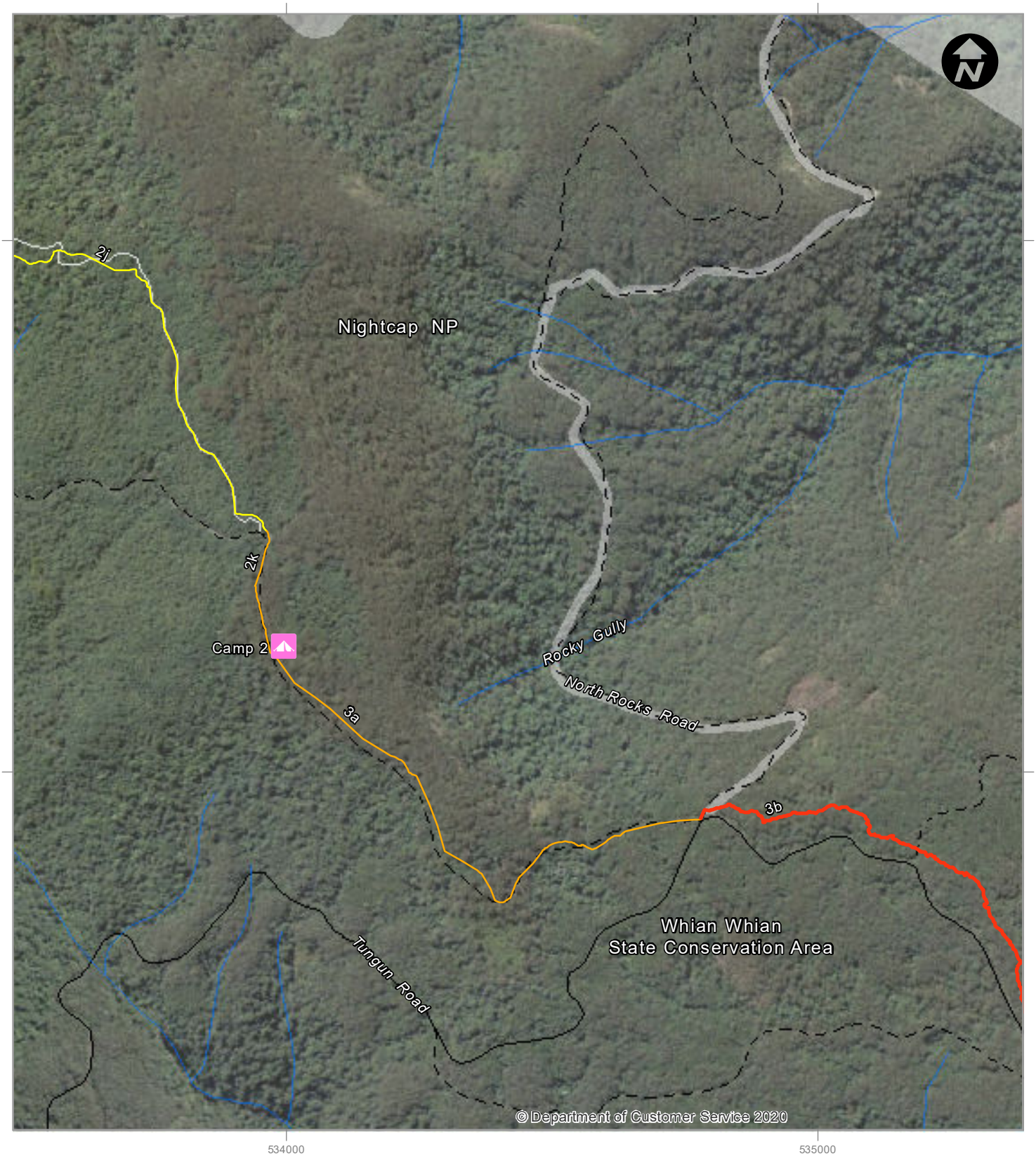
Vegetation Impacts

- Low

0 200 Metres

Vegetation Impacts
Illustration 5.1 - Sheet 6 of 12

Information shown is for illustrative purposes only
Drawn by: AB Reviewed by: RE
Source of base data: DFSI
Date: 25/07/2022
Revision: B



GDA 1994 MGA Zone 56

LEGEND

- Local road
- Path
- Track-vehicular
- Watercourse
- Non NPWS estate

Vegetation Impacts

- High
- Low
- Low to nil

Proposed walk-in campground

0 200 Metres

Vegetation Impacts
Illustration 5.1 - Sheet 7 of 12

Information shown is for illustrative purposes only
Drawn by: AB Reviewed by: RE
Source of base data: DFSI
Date: 25/07/2022
Revision: B

GDA 1994 MGA Zone 56

LEGEND

- Local road
- Path
- Track-vehicular
- Watercourse
- Non NPWS estate

Vegetation Impacts

- High
- Low to nil

0 200 Metres

Vegetation Impacts
Illustration 5.1 - Sheet 8 of 12

Information shown is for illustrative purposes only
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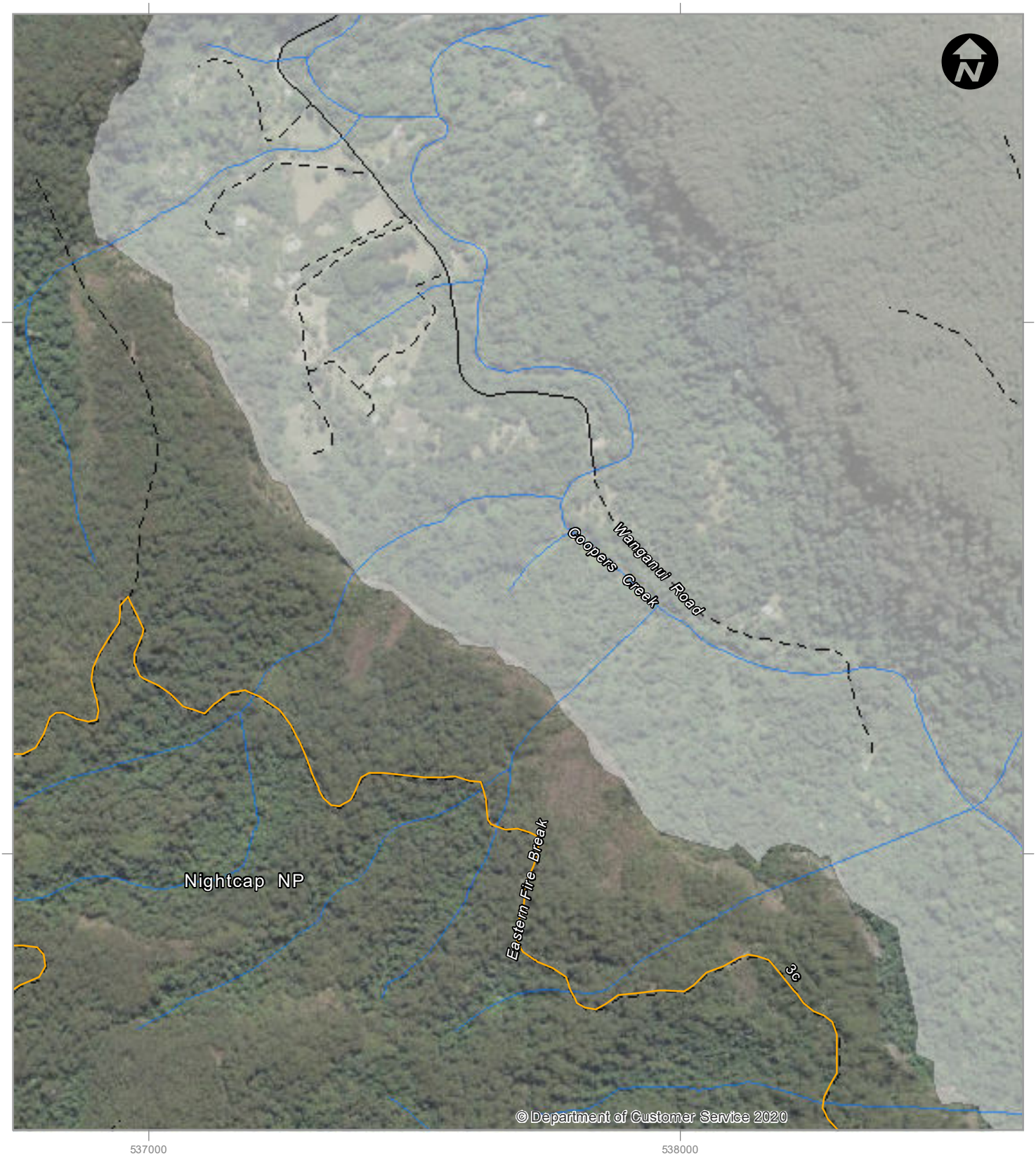

GDA 1994 MGA Zone 56

LEGEND

- Local road
- Track-vehicular
- Watercourse
- Non NPWS estate

Vegetation Impacts

- Low to nil

0 200 Metres

Vegetation Impacts
Illustration 5.1 - Sheet 9 of 12

Information shown is for illustrative purposes only
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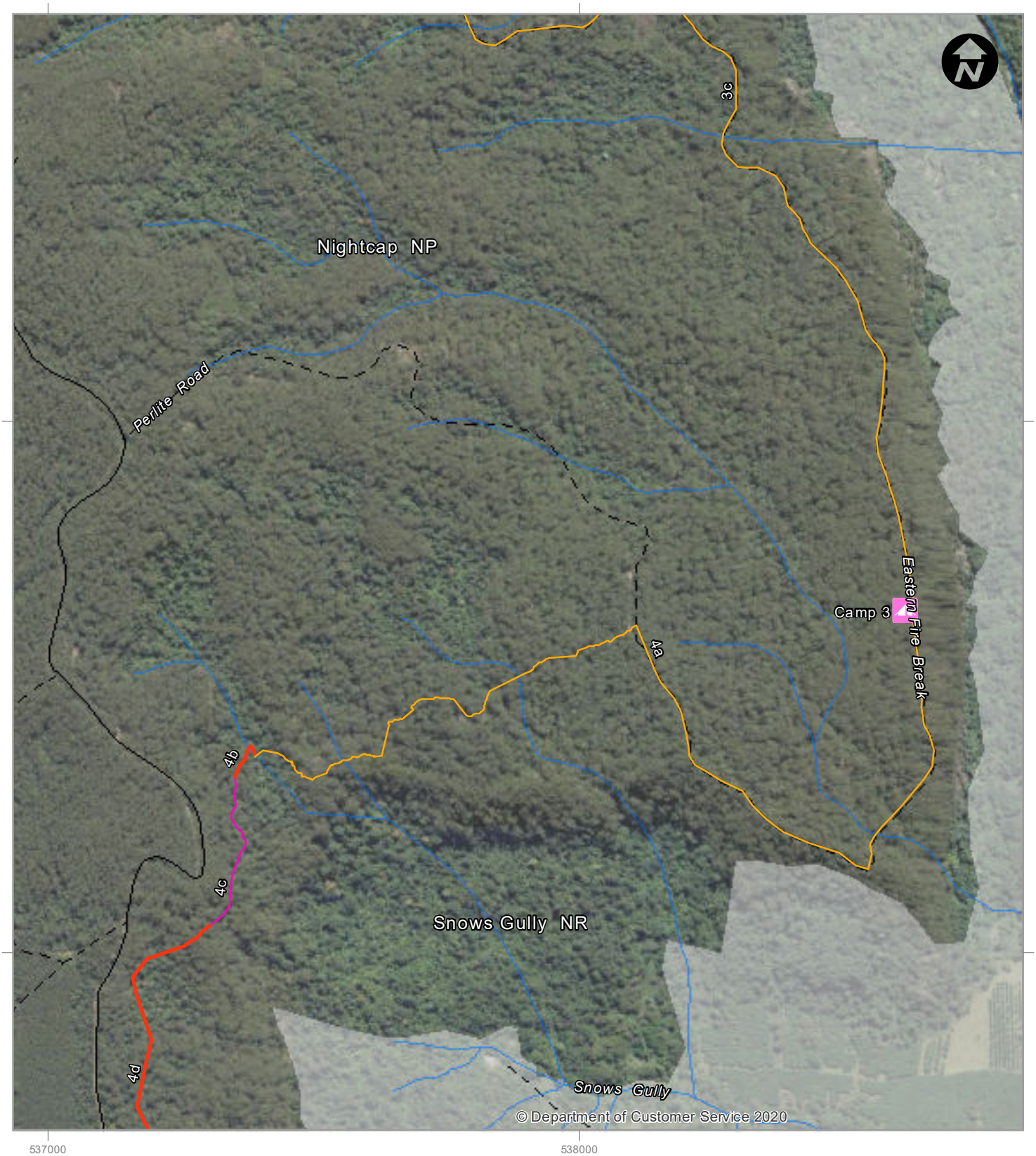
Source of base data: DFSI
Date: 25/07/2022
Revision: B



GDA 1994 MGA Zone 56

LEGEND

- Local road
- Track-vehicular
- Watercourse
- Non NPWS estate

Vegetation Impacts

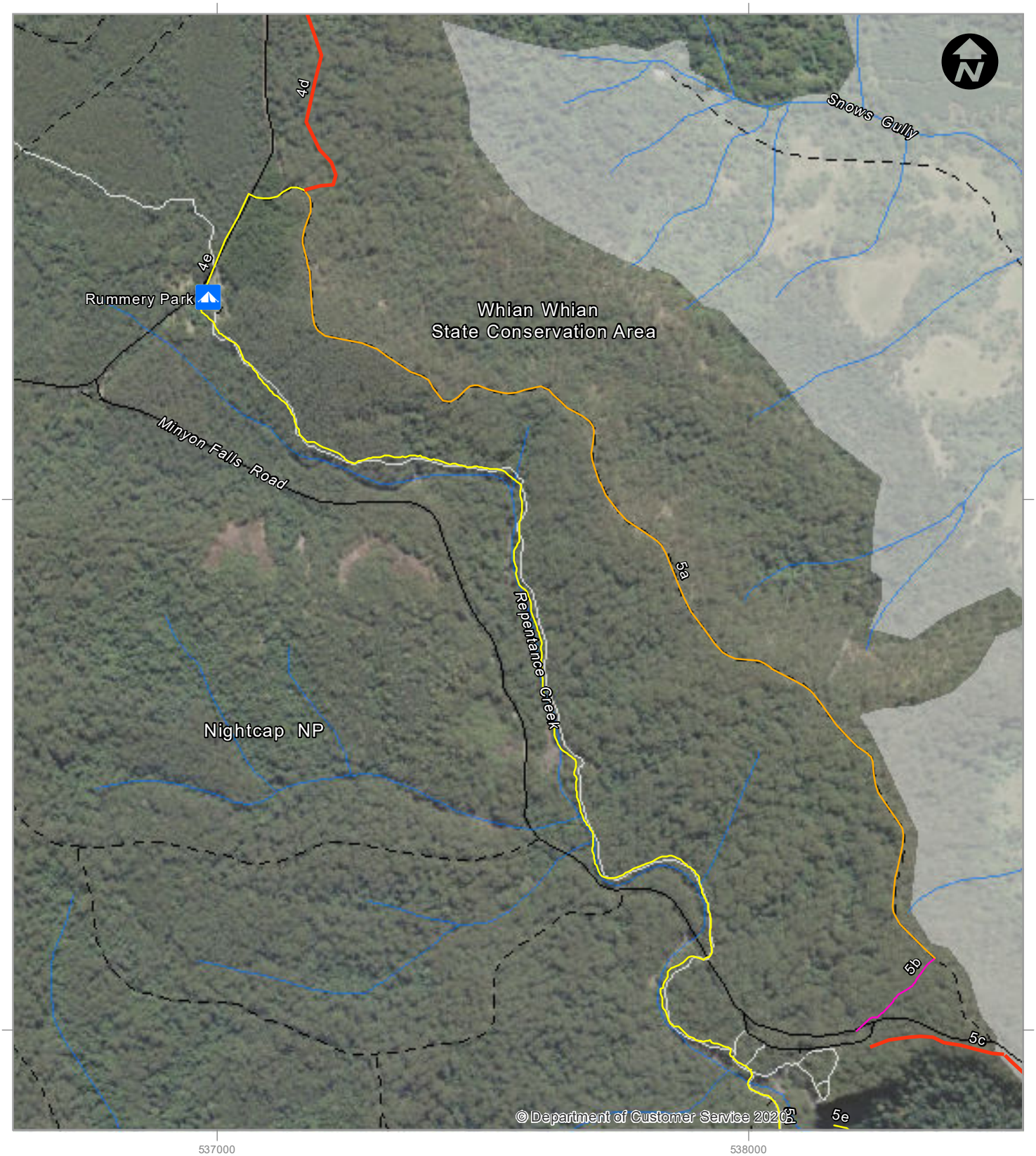
- High
- Low to nil
- Minor

Proposed walk-in campground

0 200 Metres

Vegetation Impacts
Illustration 5.1 - Sheet 10 of 12

Information shown is for illustrative purposes only
Drawn by: AB Reviewed by: RE
Source of base data: DFSI
Date: 25/07/2022
Revision: B



GDA 1994 MGA Zone 56

LEGEND

- Local road
- Path
- Track-vehicular
- Watercourse
- Non NPWS estate

Vegetation Impacts

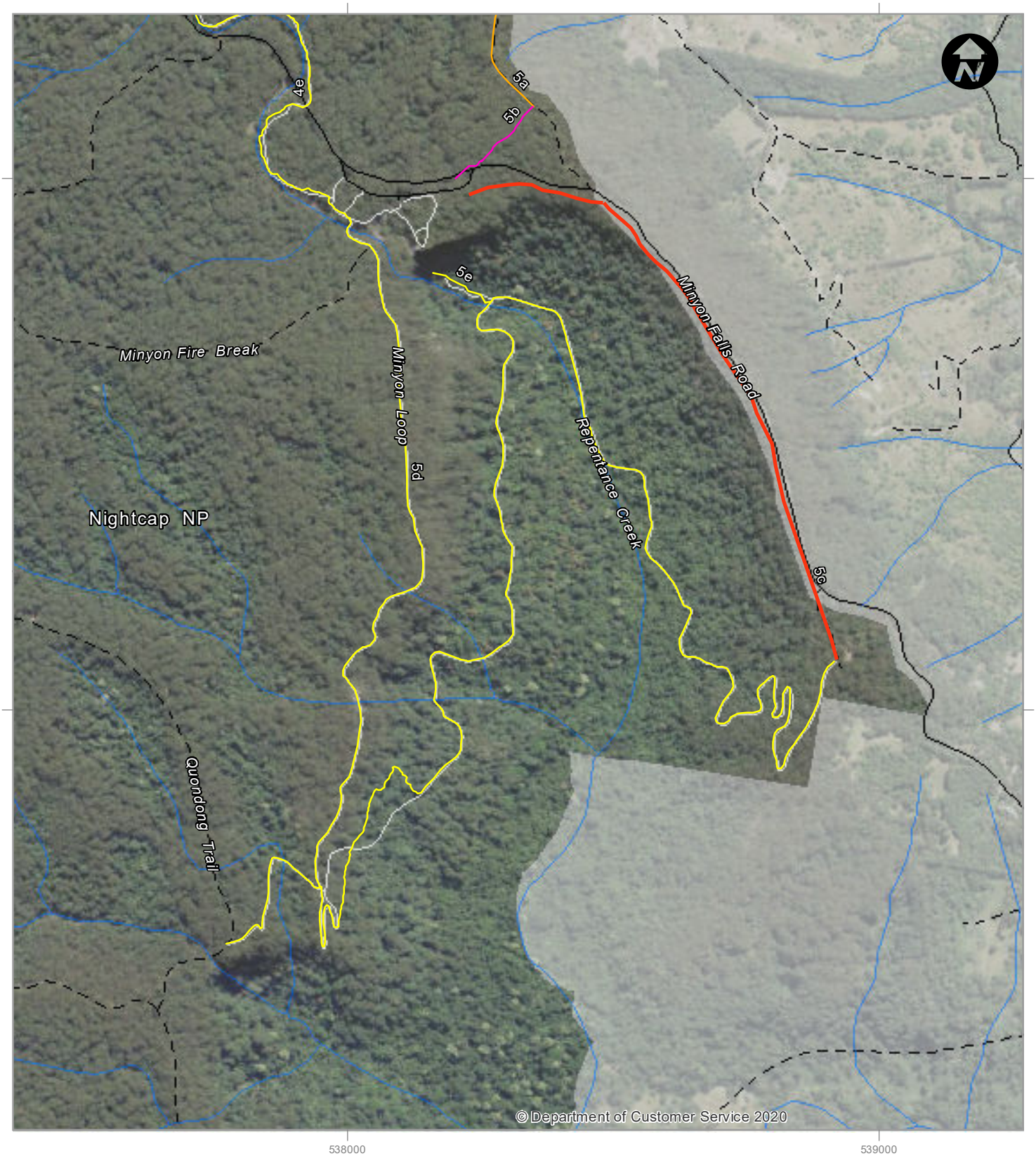
- High
- Low
- Low to nil
- Minor

Existing campground

0 200 Metres

Vegetation Impacts
Illustration 5.1 - Sheet 11 of 12

Information shown is for illustrative purposes only
Drawn by: AB Reviewed by: RE
Source of base data: DFSI
Date: 25/07/2022
Revision: B



GDA 1994 MGA Zone 56

LEGEND

- Local road
- Path
- Track-vehicular
- Watercourse
- Non NPWS estate

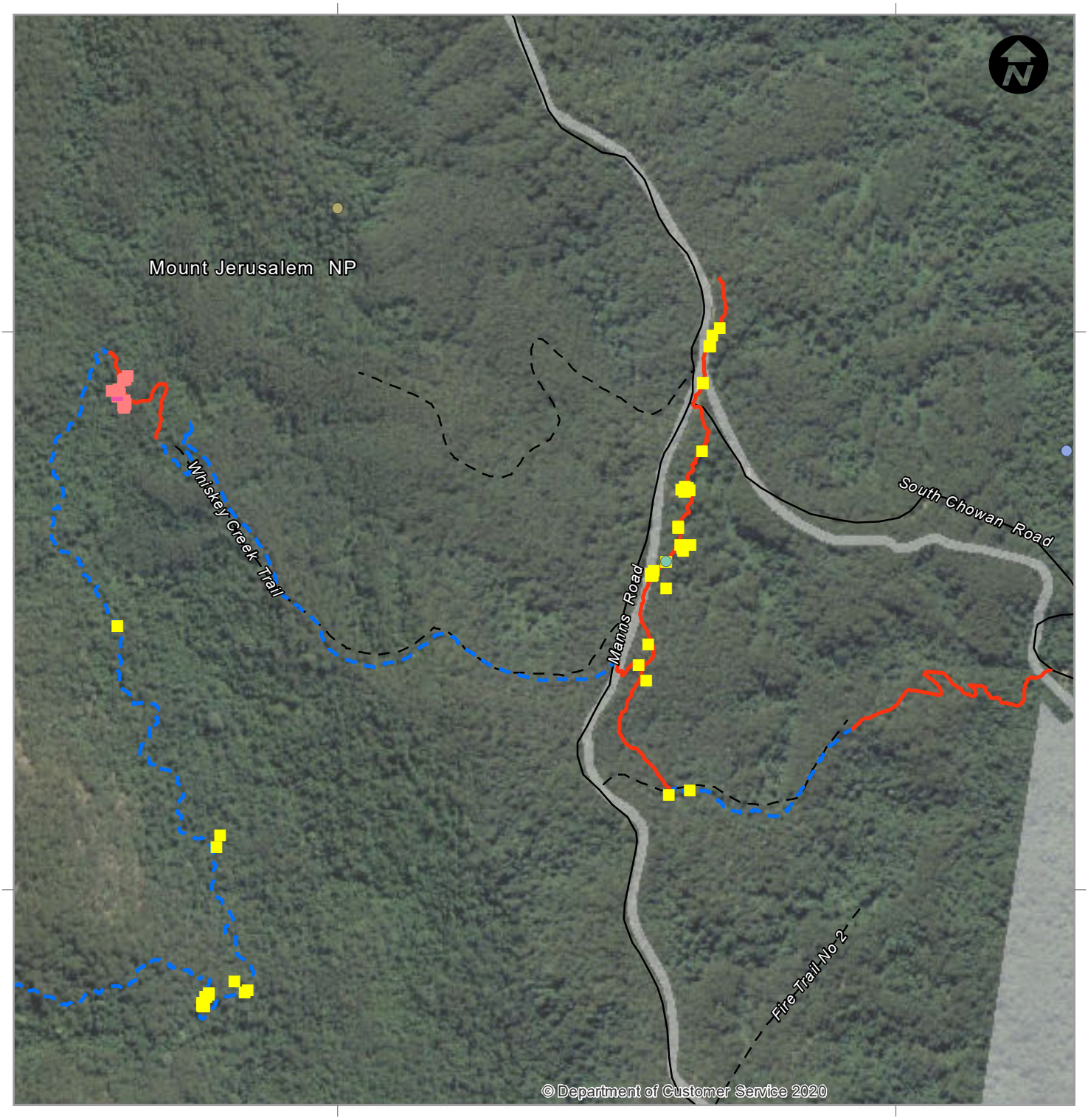
Vegetation Impacts

- High
- Low
- Low to nil
- Minor

0 200 Metres

Vegetation Impacts
Illustration 5.1 - Sheet 12 of 12

Information shown is for illustrative purposes only
Drawn by: AB Reviewed by: RE
Source of base data: DFSI
Date: 25/07/2022
Revision: B



LEGEND

- Existing walking trail
- New walking trail
- Local road
- Track-vehicular
- Non NPWS estate

GeoLink Survey Record

- Red Lilly Pilly
- Rusty Rose Walnut
- Scrub Turpentine

Bionet Atlas Records

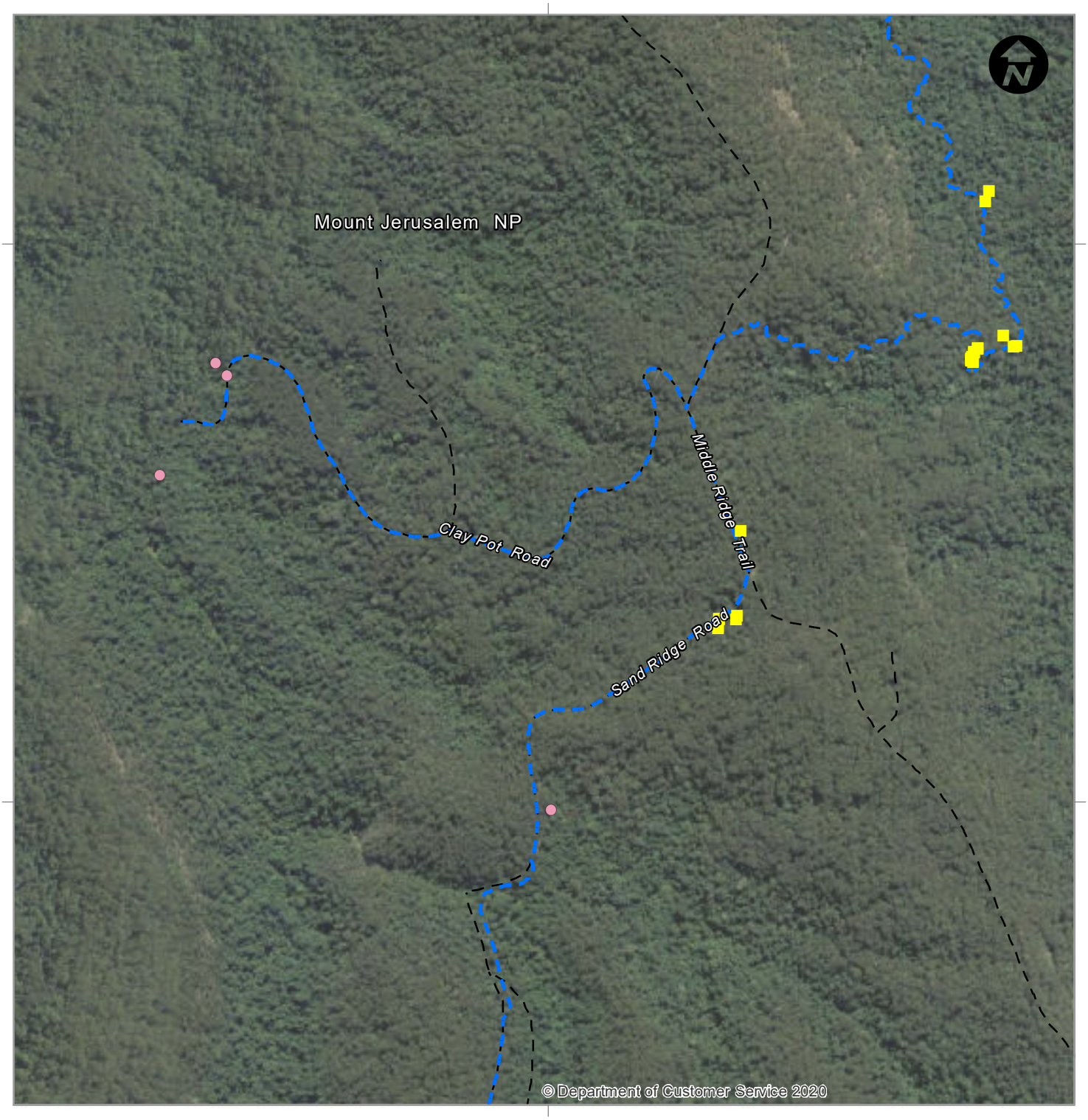
- Corokia
- Marblewood
- Red Lilly Pilly
- Scrub Turpentine

GDA 1994 MGA Zone 56

0 200 Metres

Threatened Flora
Illustration 5.2 - Sheet 1 of 12

Information shown is for illustrative purposes only
Drawn by: AB Reviewed by: RE
Source of base data: DFSI
Date: 25/07/2022
Revision: B



LEGEND

- Existing walking trail
- Track-vehicular

GeoLink Survey Record

- Scrub Turpentine

Bionet Atlas Records

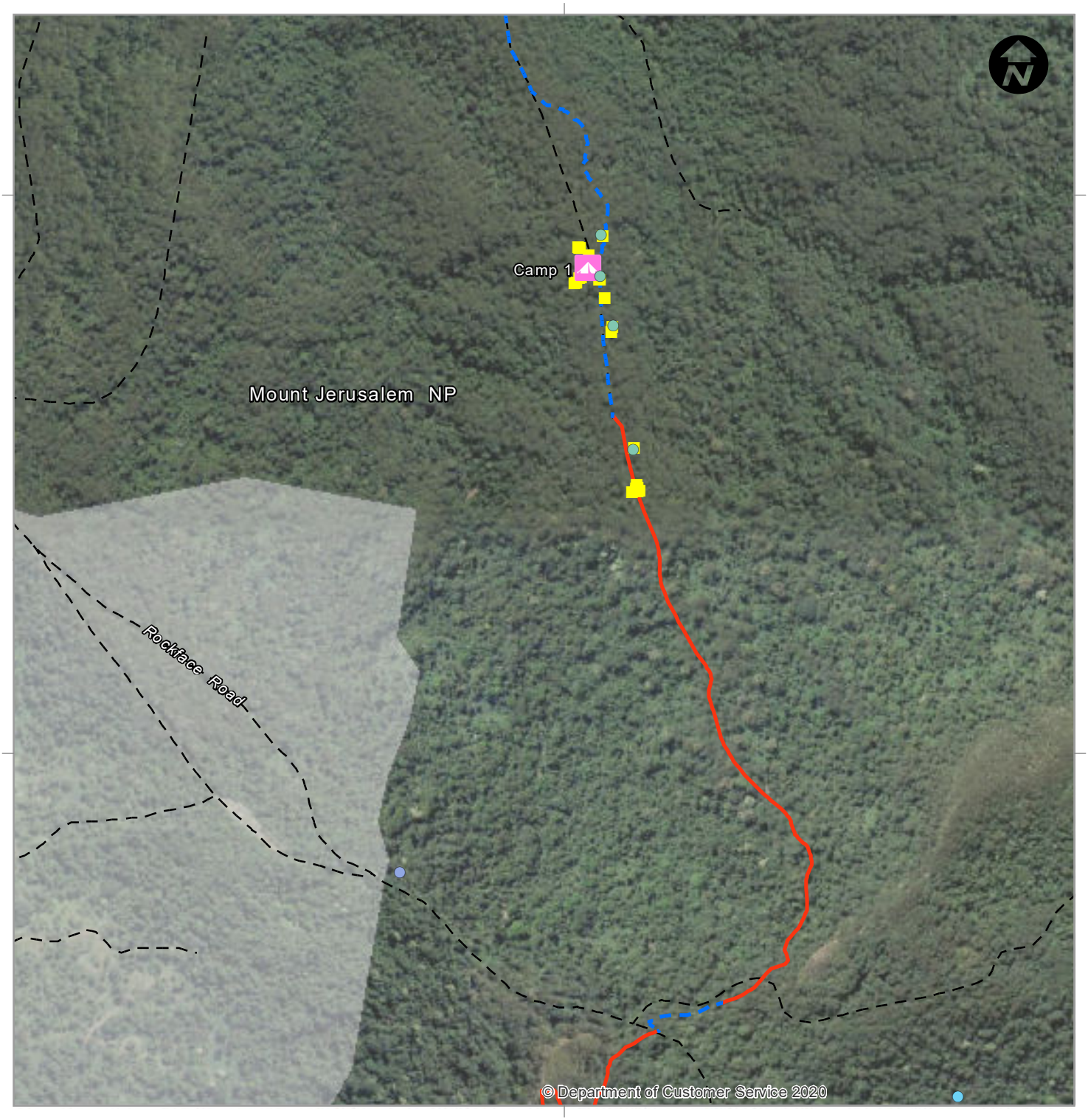
- Rusty Rose Walnut

GDA 1994 MGA Zone 56

0 200 Metres

Threatened Flora
Illustration 5.2 - Sheet 2 of 12

Information shown is for illustrative purposes only
Drawn by: AB Reviewed by: RE
Source of base data: DFSI
Date: 25/07/2022
Revision: B



LEGEND

- Existing walking trail
- New walking trail
- Proposed walk-in campground
- Track-vehicular
- Non NPWS estate

GeoLink Survey Record

- Scrub Turpentine

Bionet Atlas Records

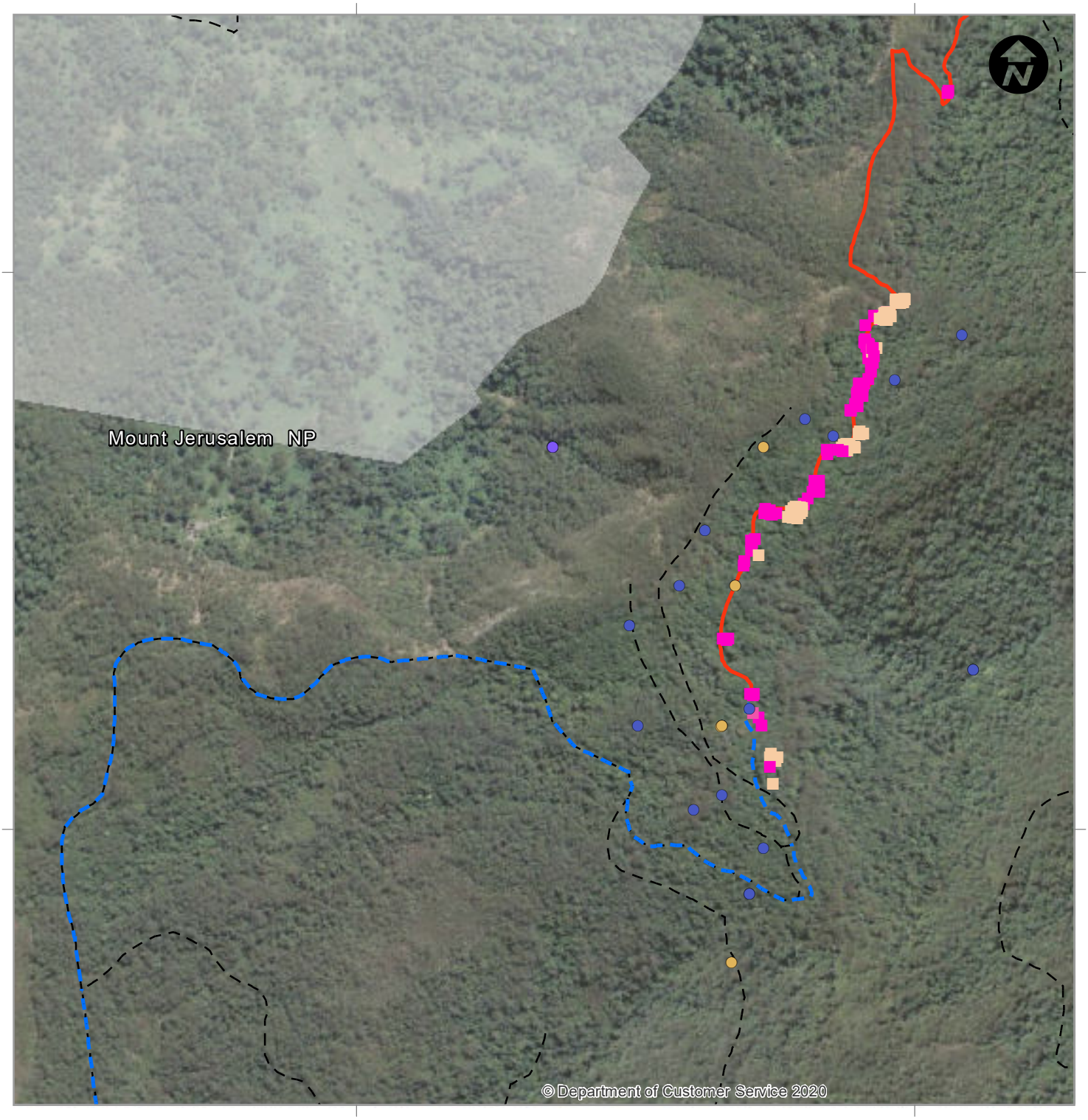
- Corokia
- Red Lilly Pilly
- Scrub Turpentine

GDA 1994 MGA Zone 56

0 200 Metres

Threatened Flora
Illustration 5.2 - Sheet 3 of 12

Information shown is for illustrative purposes only
Drawn by: AB Reviewed by: RE
Source of base data: DFSI
Date: 25/07/2022
Revision: B



LEGEND

- Existing walking trail
- New walking trail
- Track-vehicular
- Non NPWS estate

GeoLink Survey Record

- Peach Myrtle
- Rusty Rose Walnut
- Small-leaved Hazelwood

Bionet Atlas Records

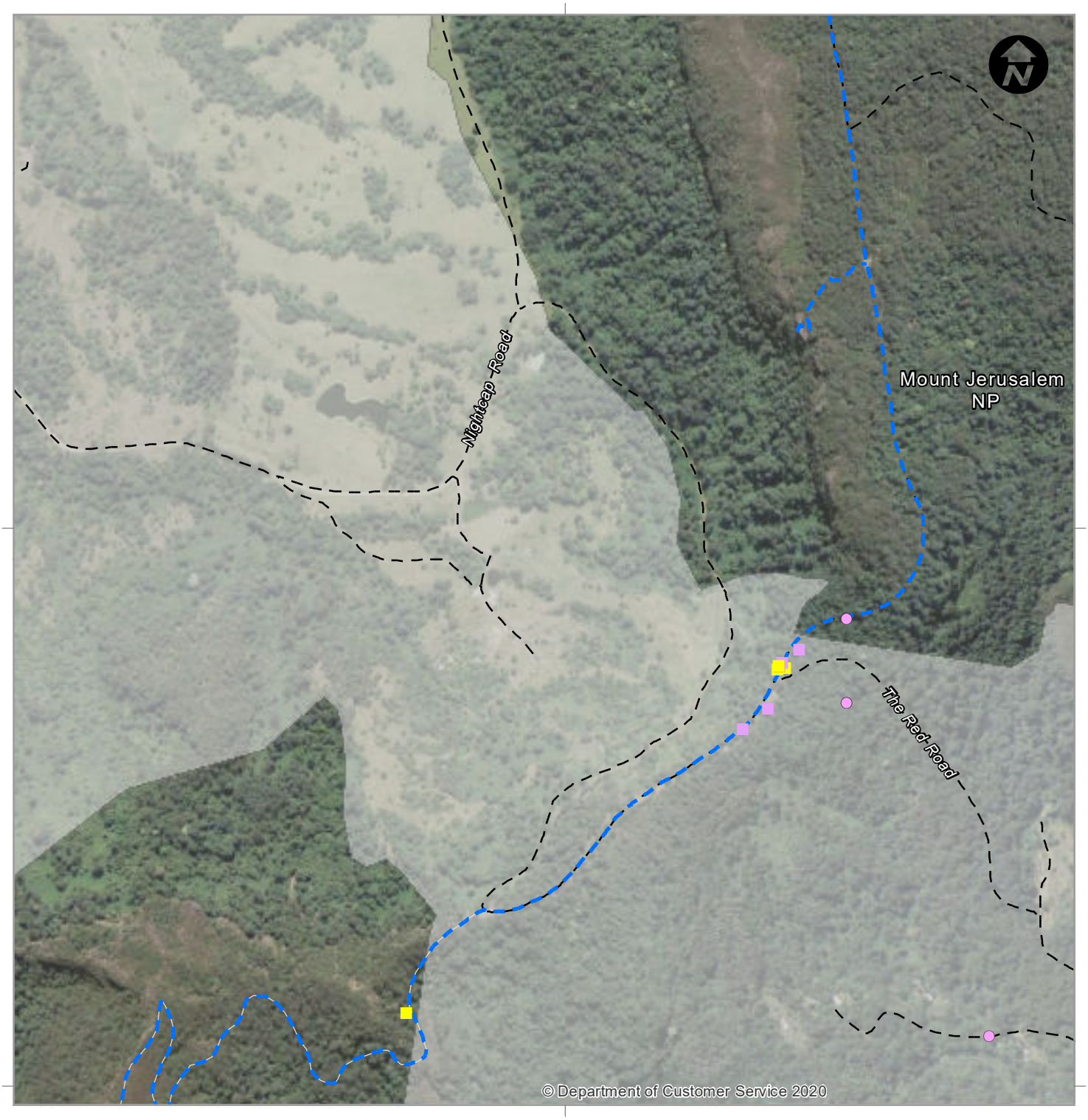
- Corokia
- Peach Myrtle
- Small-leaved Hazelwood
- Smooth Davidson's Plum

GDA 1994 MGA Zone 56

0 200 Metres

Threatened Flora
Illustration 5.2 - Sheet 4 of 12

Information shown is for illustrative purposes only
Drawn by: AB Reviewed by: RE
Source of base data: DFSI
Date: 25/07/2022
Revision: B



LEGEND

- Existing walking trail
- Path
- Track-vehicular
- Non NPWS estate

GeoLink Survey Record

- Red Boppel Nut
- Scrub Turpentine

Bionet Atlas Records

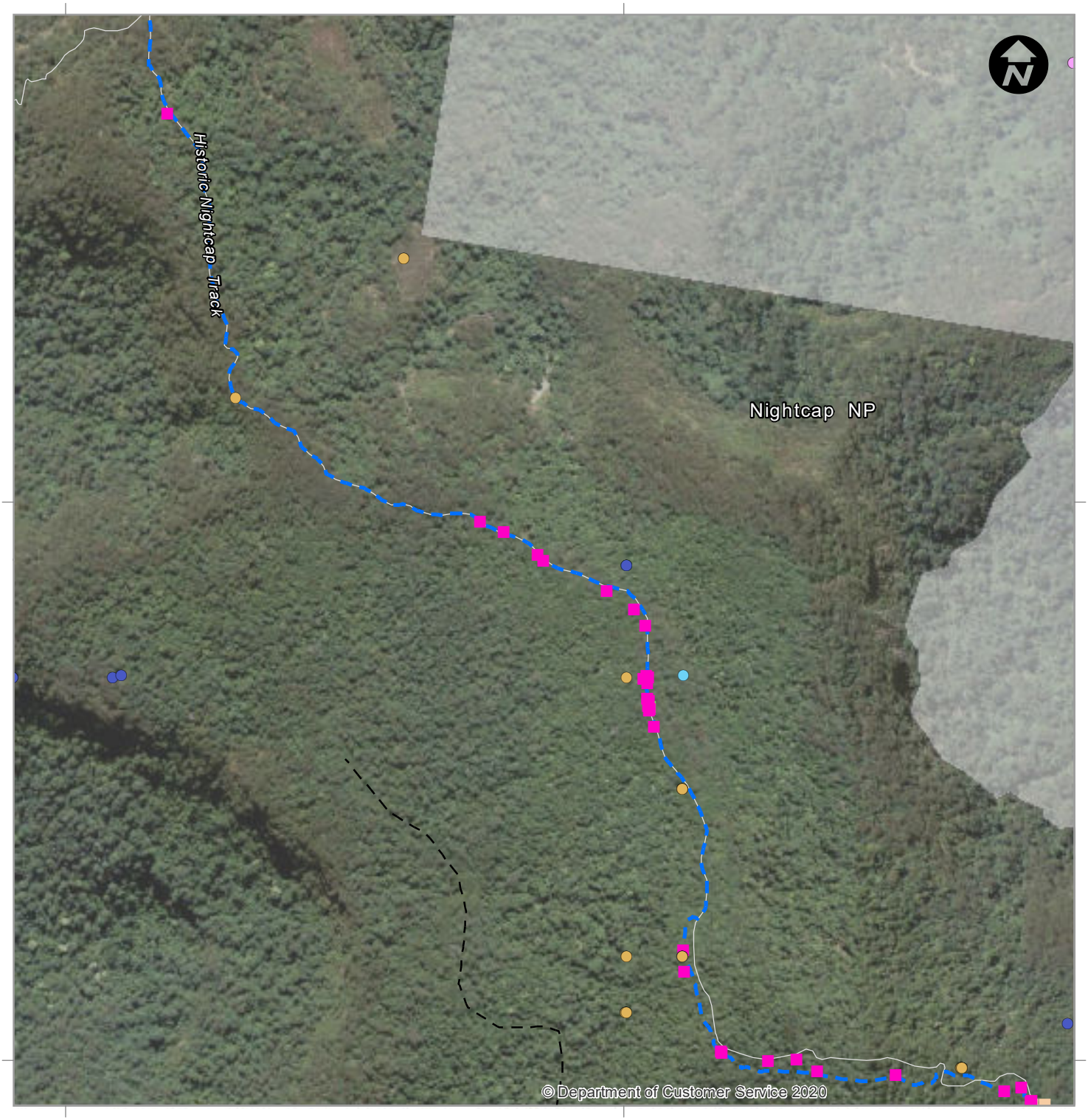
- Red Boppel Nut
- Rusty Rose Walnut

GDA 1994 MGA Zone 56

0 200 Metres

Threatened Flora
Illustration 5.2 - Sheet 5 of 12

Information shown is for illustrative purposes only
Drawn by: AB Reviewed by: RE
Source of base data: DFSI
Date: 25/07/2022
Revision: B



LEGEND

- Existing walking trail
- Path
- Track-vehicular
- Non NPWS estate

GeoLink Survey Record

- Green-leaved Rose Walnut
- Peach Myrtle
- Small-leaved Hazelwood

Bionet Atlas Records

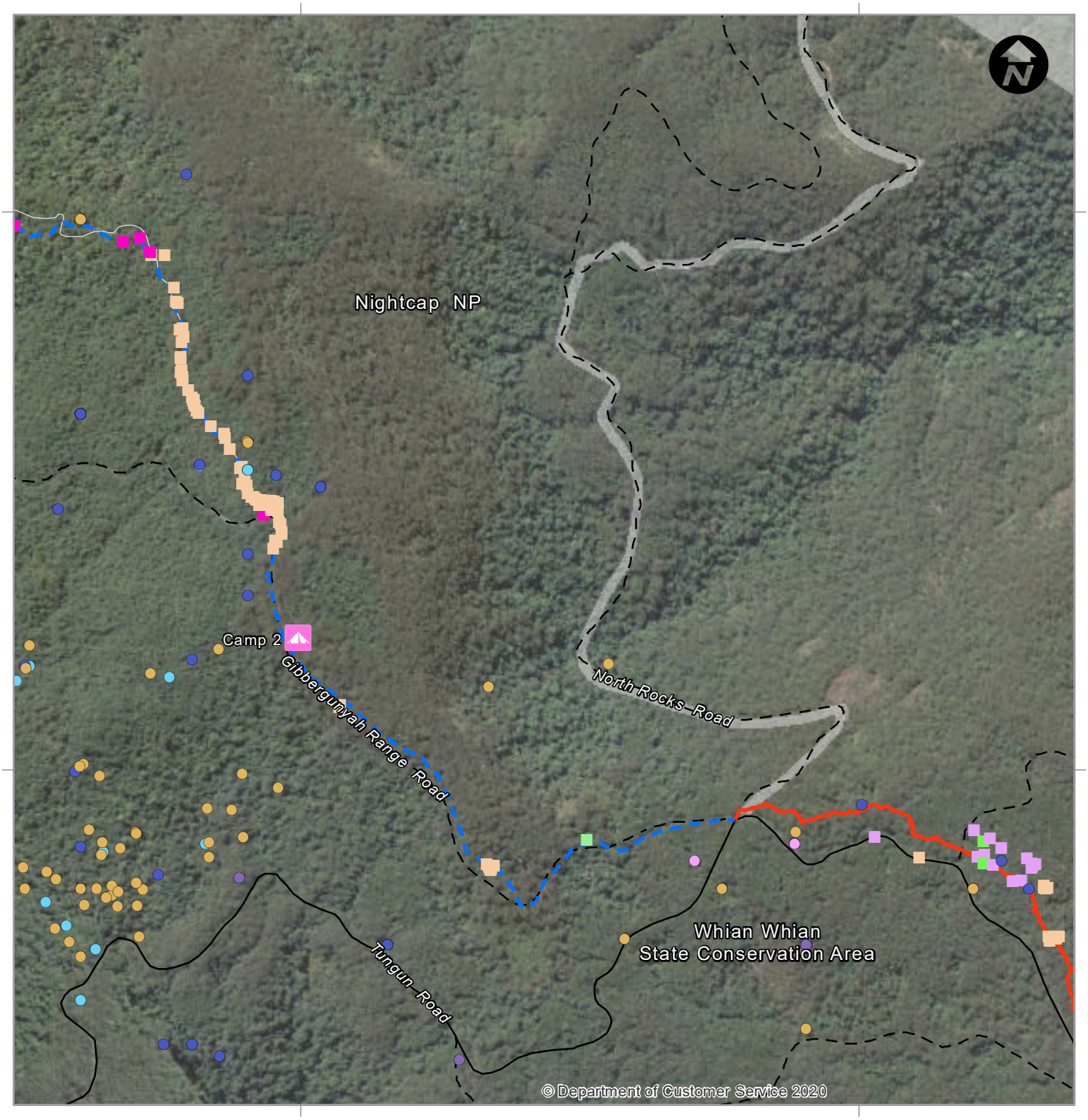
- Arrow-head Vine
- Corokia
- Peach Myrtle
- Red Boppel Nut
- Rusty Rose Walnut
- Small-leaved Hazelwood

GDA 1994 MGA Zone 56

0 200 Metres

Threatened Flora
Illustration 5.2 - Sheet 6 of 12

Information shown is for illustrative purposes only
Drawn by: AB Reviewed by: RE
Source of base data: DFSI
Date: 25/07/2022
Revision: B



LEGEND

- Existing walking trail
- New walking trail
- Proposed walk-in campground
- Local road
- Path
- Track-vehicular
- Non NPWS estate

GeoLink Survey Record

- Green-leaved Rose Walnut
- Peach Myrtle
- Red Boppel Nut
- Rusty Plum
- Small-leaved Hazelwood

Bionet Atlas Records

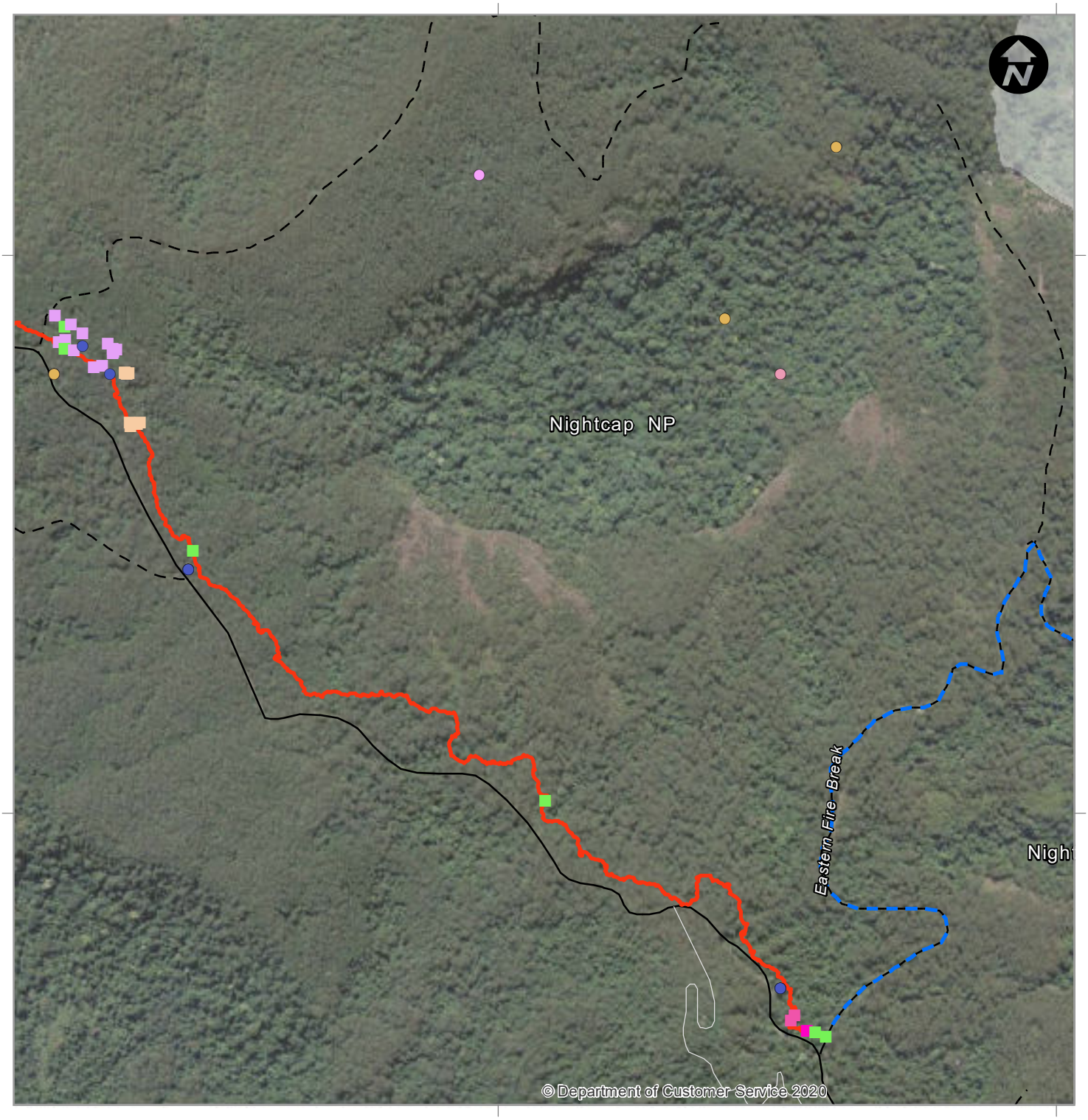
- Arrow-head Vine
- Corokia
- Giant Spear Lily
- Peach Myrtle
- Red Boppel Nut
- Rusty Rose Walnut
- Small-leaved Hazelwood
- Tree Guinea Flower

GDA 1994 MGA Zone 56

0 200 Metres

Threatened Flora
Illustration 5.2 - Sheet 7 of 12

Information shown is for illustrative purposes only
Drawn by: AB Reviewed by: RE
Source of base data: DFSI
Date: 25/07/2022
Revision: B



LEGEND

- Existing walking trail
- New walking trail
- Local road
- Path
- Track-vehicular
- Non NPWS estate

GeoLink Survey Record

- Green-leaved Rose Walnut
- Peach Myrtle
- Red Boppel Nut
- Rusty Rose Walnut
- Small-leaved Hazelwood

Bionet Atlas Records

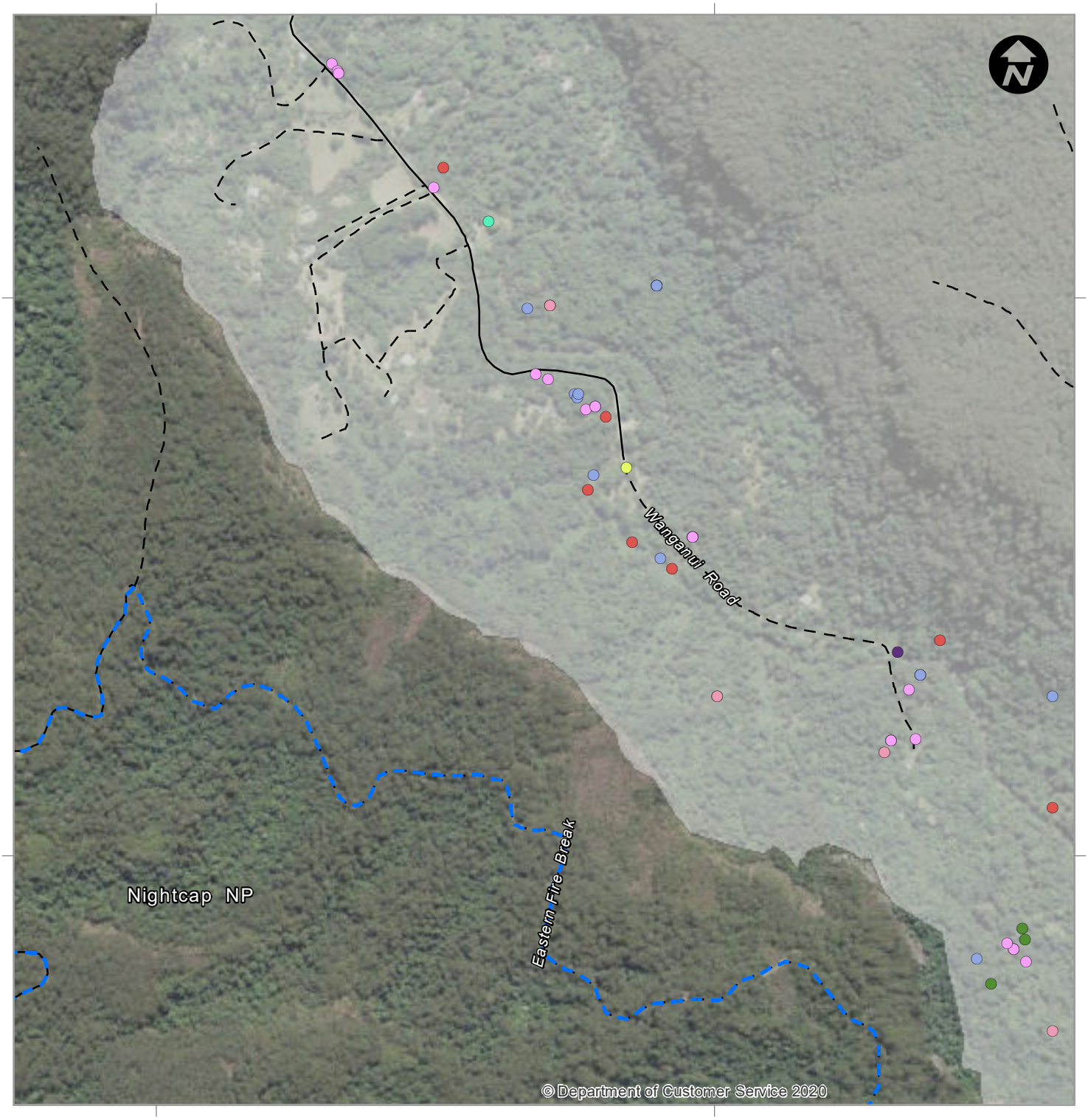
- Corokia
- Peach Myrtle
- Red Boppel Nut
- Rusty Rose Walnut
- Small-leaved Hazelwood
- Tree Guinea Flower

GDA 1994 MGA Zone 56

0 200 Metres

Threatened Flora
Illustration 5.2 - Sheet 8 of 12

Information shown is for illustrative purposes only
Drawn by: AB Reviewed by: RE
Source of base data: DFSI
Date: 25/07/2022
Revision: B



LEGEND

- Existing walking trail
- Local road
- Track-vehicular
- Non NPWS estate

Bionet Atlas Records

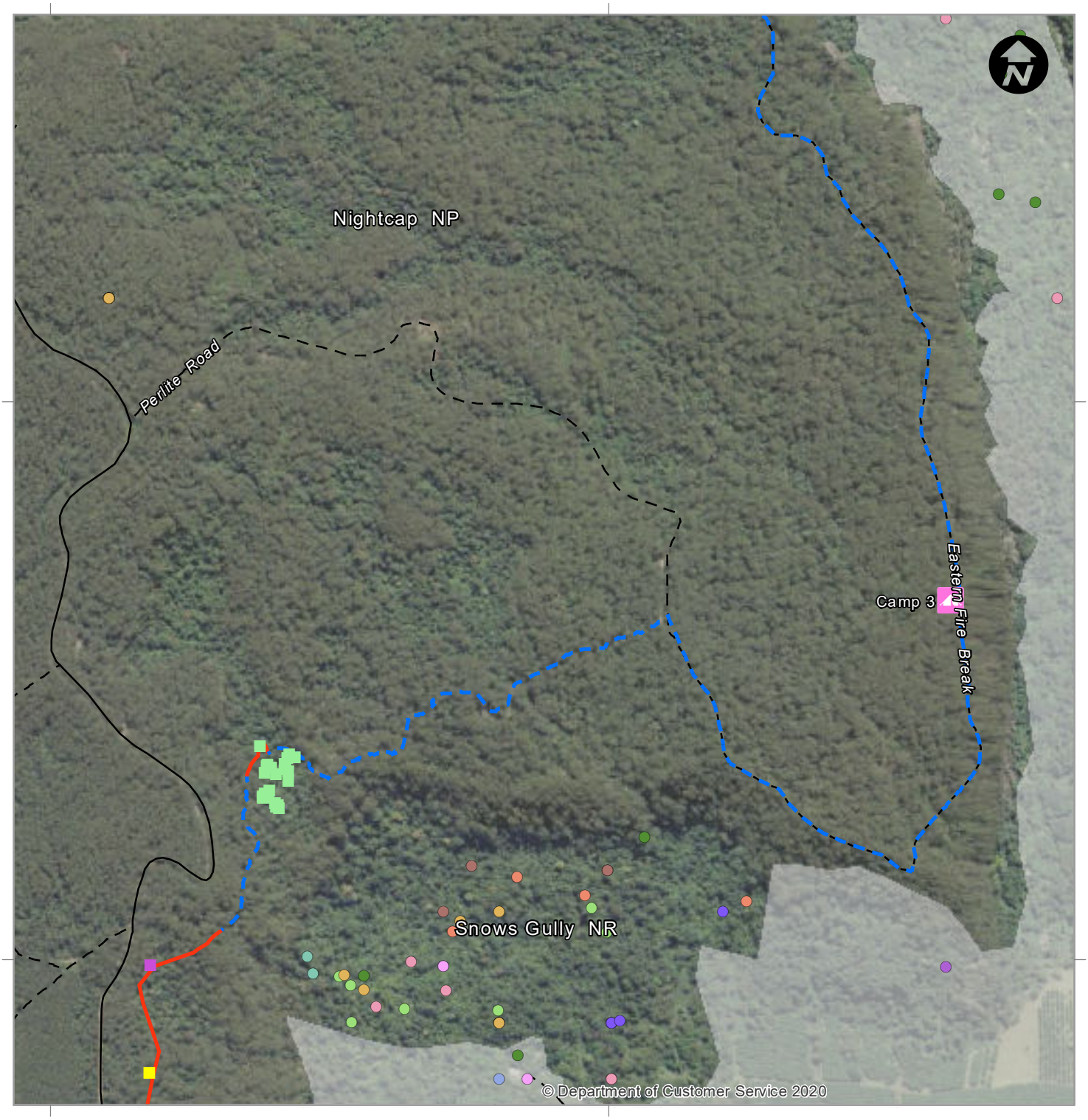
- Arrow-head Vine
- Durobby
- Giant Spear Lily
- Red Boppel Nut
- Red Lilly Pilly
- Rusty Rose Walnut
- Southern Fontainea
- Thorny Pea

GDA 1994 MGA Zone 56

0 200 Metres

Threatened Flora
Illustration 5.2 - Sheet 9 of 12

Information shown is for illustrative purposes only
Drawn by: AB Reviewed by: RE
Source of base data: DFSI
Date: 25/07/2022
Revision: B



LEGEND

- Existing walking trail
- New walking trail
- Proposed walk-in campground
- Local road
- Track-vehicular
- Non NPWS estate

GeoLink Survey Record

- Corokia
- Rusty Plum
- Scrub Turpentine

Bionet Atlas Records

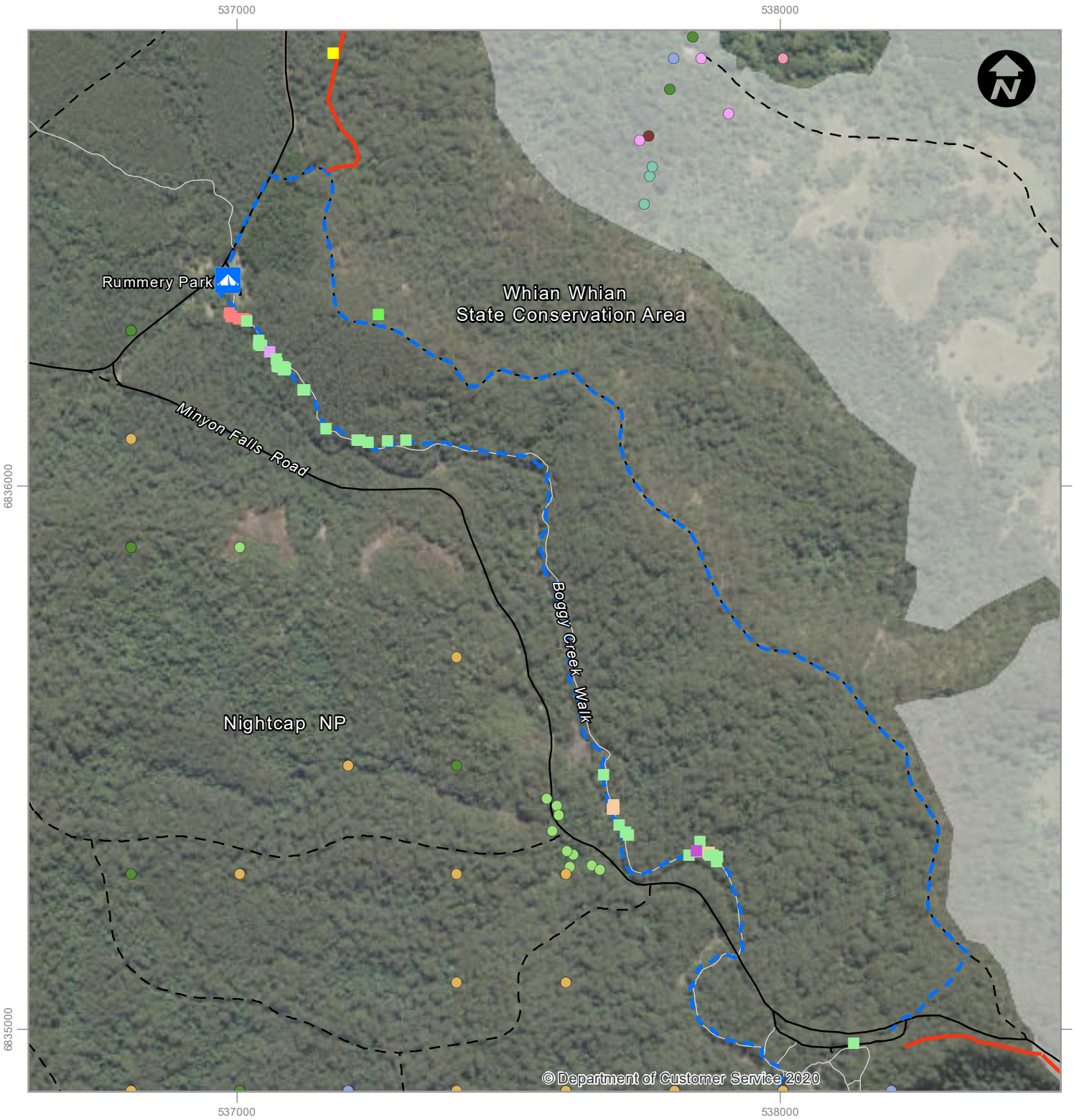
- Arrow-head Vine
- Ball Nut
- Coast Euodia
- Red Boppel Nut
- Red Lilly Pilly
- Rough-shelled Bush Nut
- Rusty Plum, Plum Boxwood
- Rusty Rose Walnut
- Scrub Turpentine
- Small-leaved Hazelwood
- Smooth Davidson's Plum
- Southern Ochrosia

GDA 1994 MGA Zone 56

0 200 Metres

Threatened Flora
Illustration 5.2 - Sheet 10 of 12

Information shown is for illustrative purposes only
Drawn by: AB Reviewed by: RE
Source of base data: DFSI
Date: 25/07/2022
Revision: B



LEGEND

- Existing walking trail
- New walking trail
- Existing campground
- Local road
- Path
- Track-vehicular
- Non NPWS estate

GeoLink Survey Record

- Corokia
- Green-leaved Rose Walnut
- Peach Myrtle
- Red Boppel Nut
- Red Lilly Pilly
- Rusty Plum
- Scrub Turpentine

Bionet Atlas Records

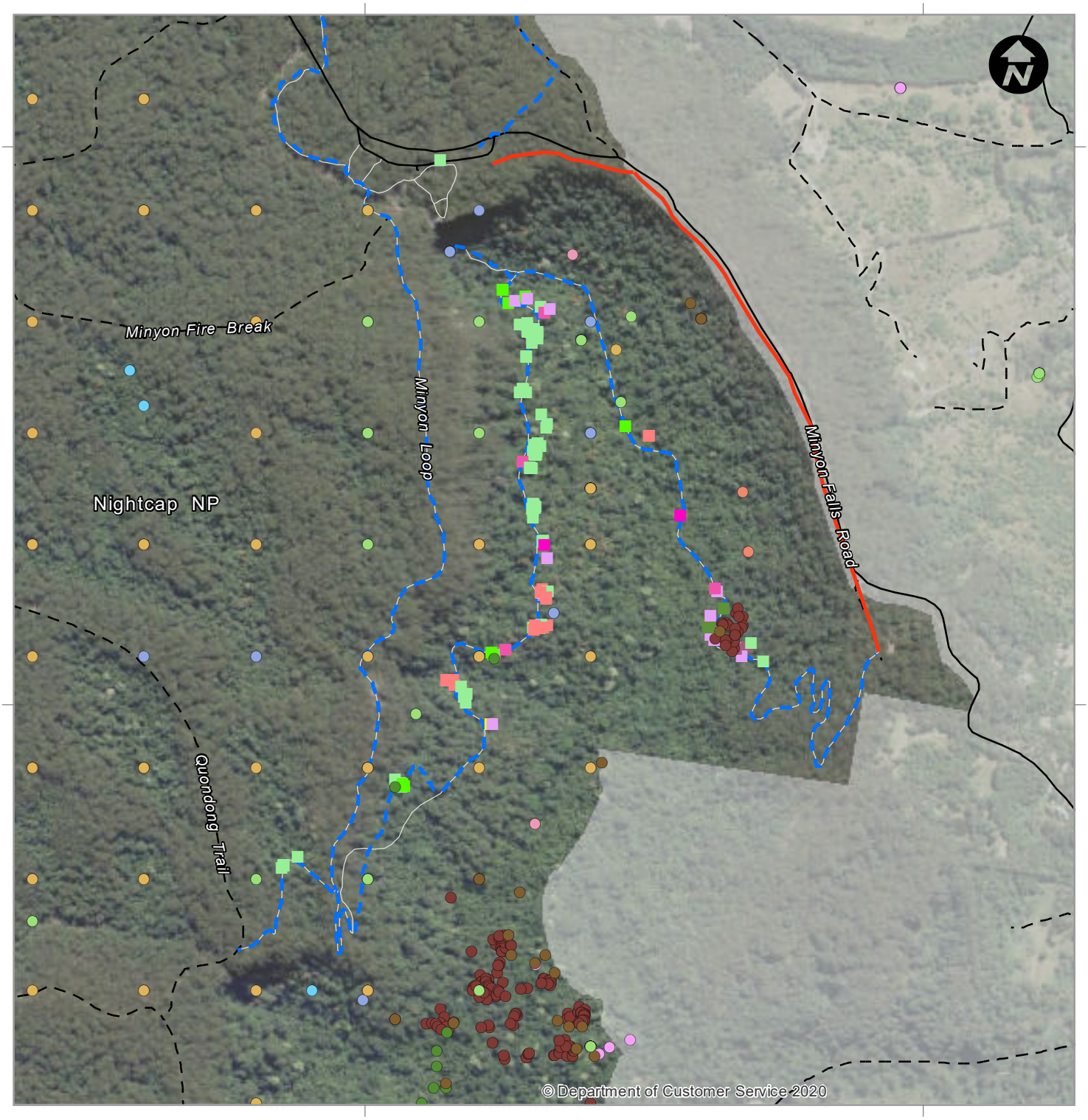
- Arrow-head Vine
- Corokia
- Onion Cedar
- Red Boppel Nut
- Red Lilly Pilly
- Rusty Plum, Plum Boxwood
- Rusty Rose Walnut
- Scrub Turpentine
- Small-leaved Hazelwood

GDA 1994 MGA Zone 56

0 200 Metres

Threatened Flora
Illustration 5.2 - Sheet 11 of 12

Information shown is for illustrative purposes only
Drawn by: AB Reviewed by: RE
Source of base data: DFSI
Date: 25/07/2022
Revision: B



LEGEND

- Existing walking trail
- New walking trail
- Local road
- Path
- Track-vehicular
- Non NPWS estate

GeoLink Survey Record

- Arrow-head Vine
- Onion Cedar
- Red Boppel Nut
- Red Lilly Pilly
- Rough-shelled Bush Nut
- Rusty Plum
- Rusty Rose Walnut
- Scrub Turpentine
- Small-leaved Hazelwood

Bionet Atlas Records

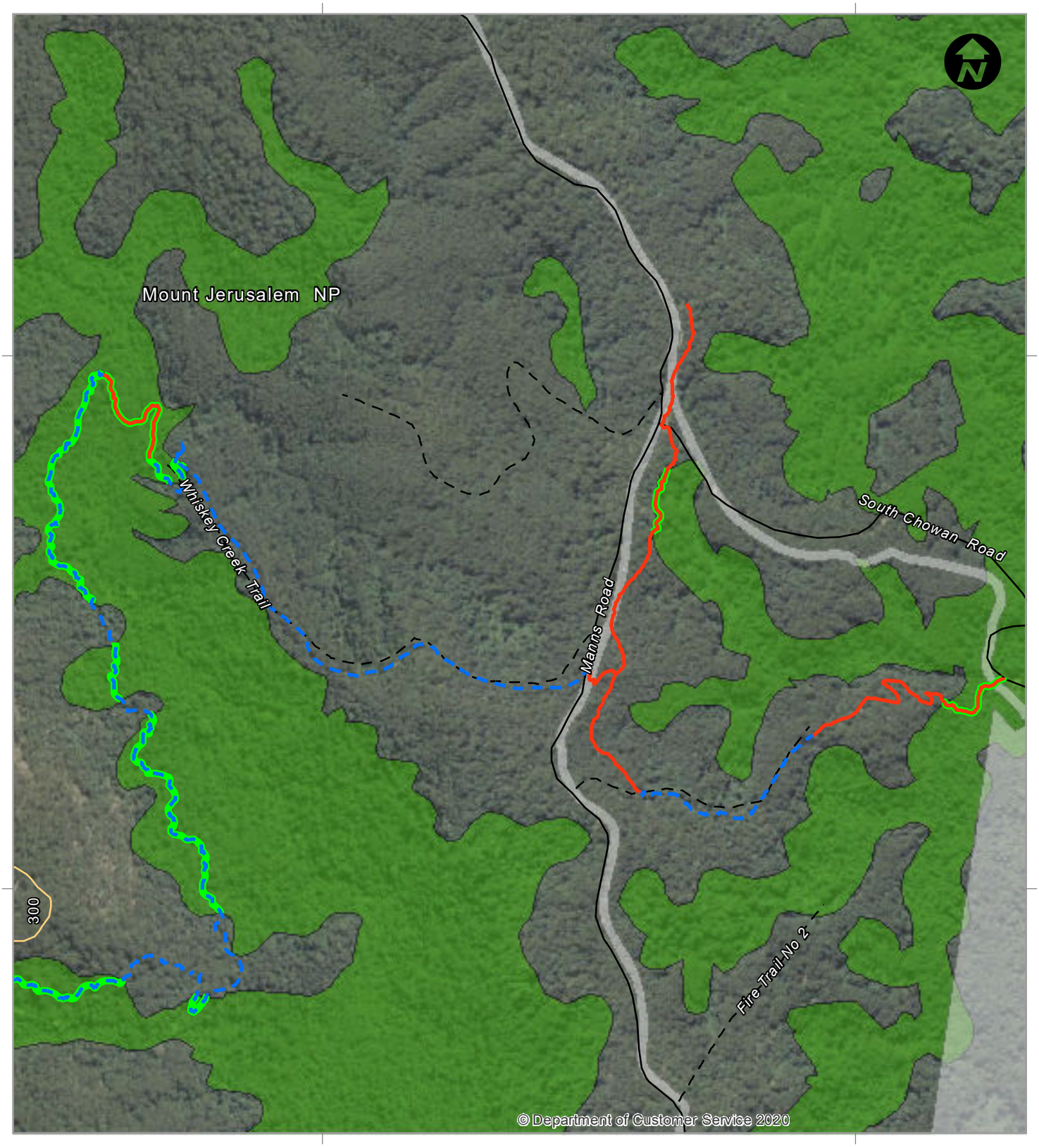
- Arrow-head Vine
- Coast Euodia
- Corokia
- Durobby
- Onion Cedar
- Peach Myrtle
- Red Boppel Nut
- Red Lilly Pilly
- Rough-shelled Bush Nut
- Rusty Plum, Plum Boxwood
- Rusty Rose Walnut
- Small-leaved Hazelwood
- Southern Ochrosia
- Thorny Pea

GDA 1994 MGA Zone 56

0 200 Metres

Threatened Flora
Illustration 5.2 - Sheet 12 of 12

Information shown is for illustrative purposes only
Drawn by: AB Reviewed by: RE
Source of base data: DFSI
Date: 25/07/2022
Revision: B



GDA 1994 MGA Zone 56

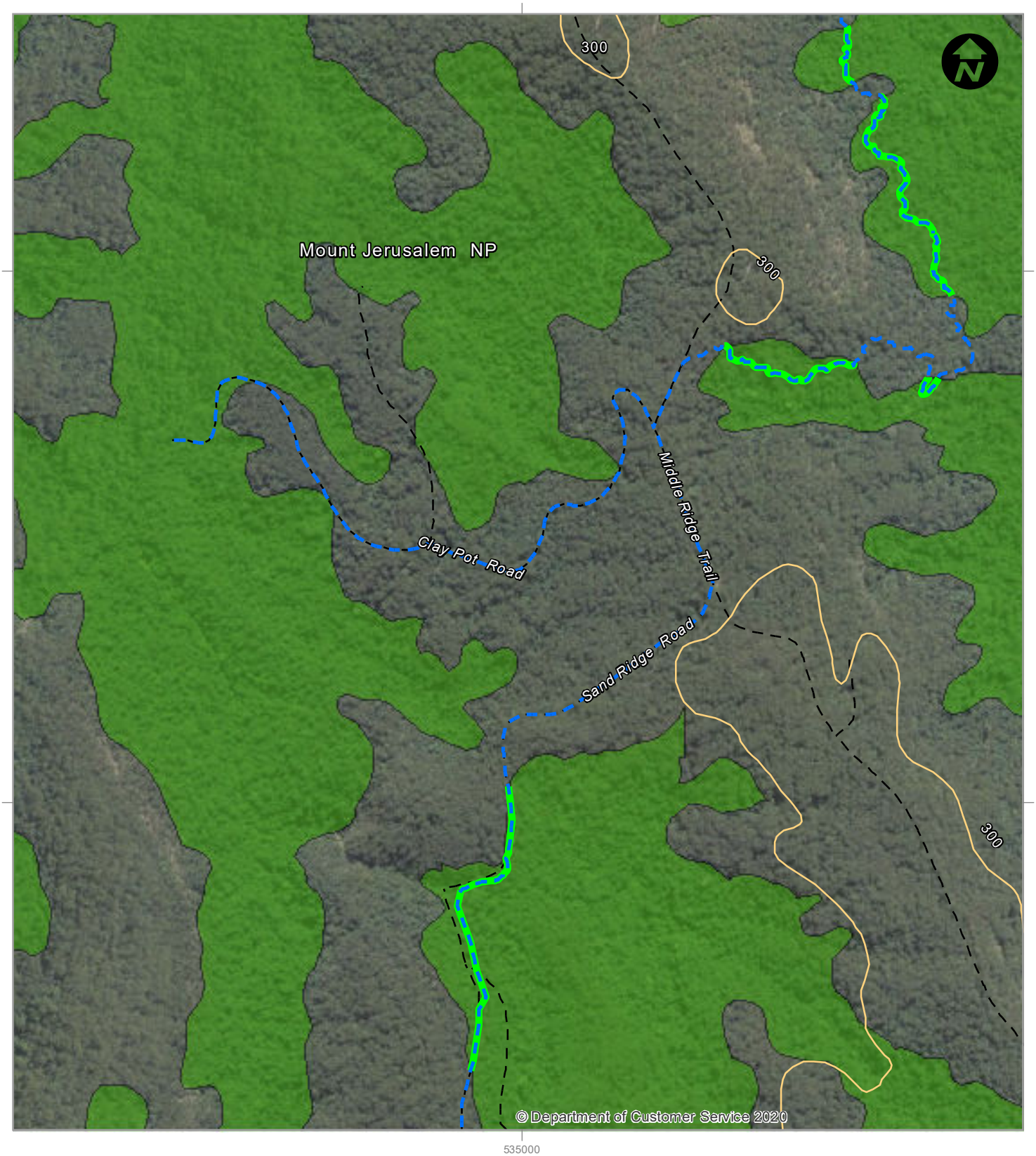
LEGEND

- Existing walking trail
- New walking trail
- Local road
- Track-vehicular
- Contour
- Non NPWS estate
- Rainforest
- Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions – Threatened Ecological Community (under 600m ASL)

0 200 Metres

Threatened Ecological Communities
Illustration 5.3 - Sheet 1 of 12

Information shown is for illustrative purposes only
Drawn by: AB Reviewed by: RE
Source of base data: DFSI
Date: 27/07/2022
Revision: C



GDA 1994 MGA Zone 56

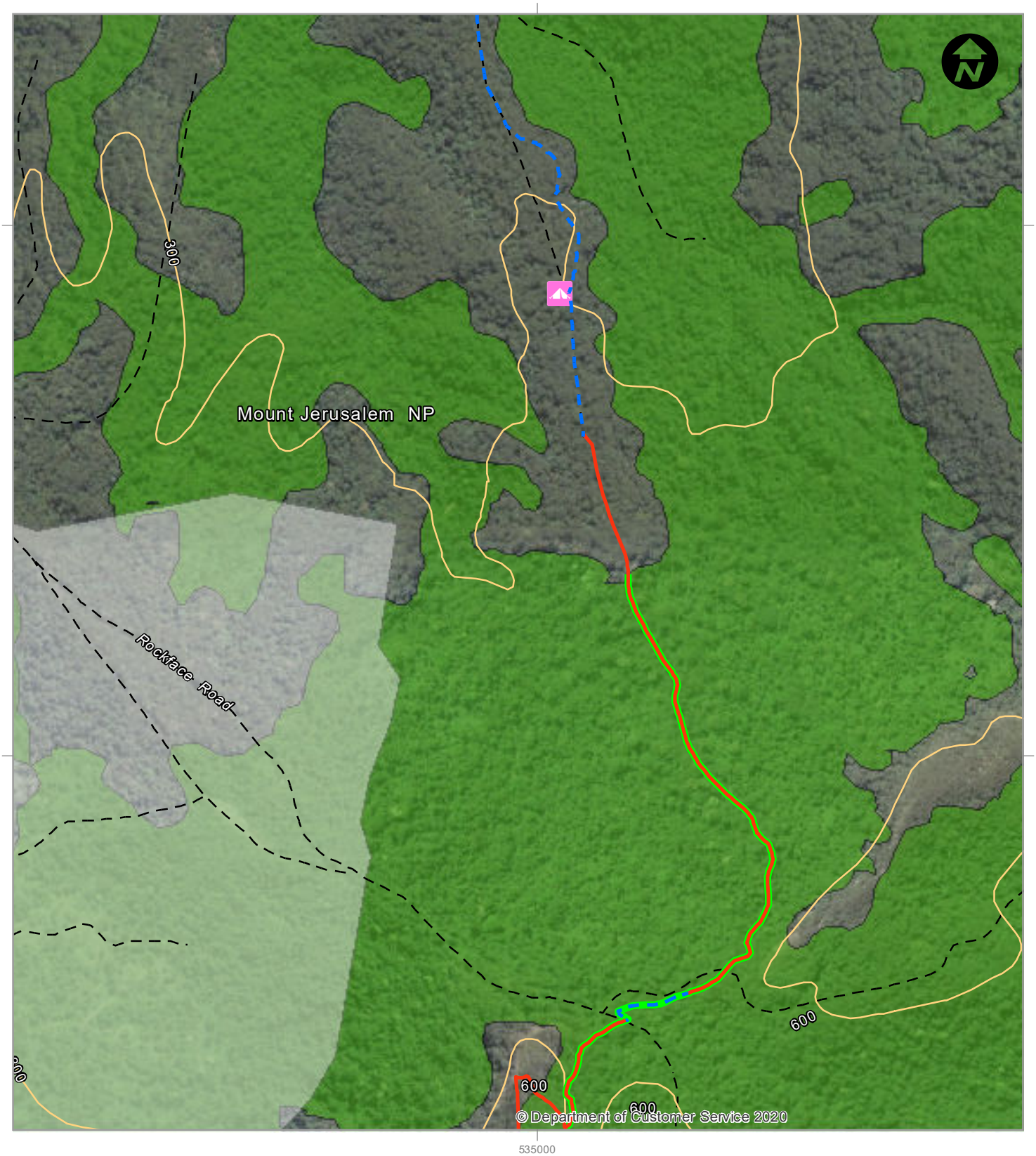
LEGEND

- Existing walking trail
- Track-vehicular
- Contour
- Rainforest
- Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions – Threatened Ecological Community (under 600m ASL)

0 200 Metres

Threatened Ecological Communities
Illustration 5.3 - Sheet 2 of 12

Information shown is for illustrative purposes only
Drawn by: AB Reviewed by: RE
Source of base data: DFSI
Date: 27/07/2022
Revision: C



GDA 1994 MGA Zone 56

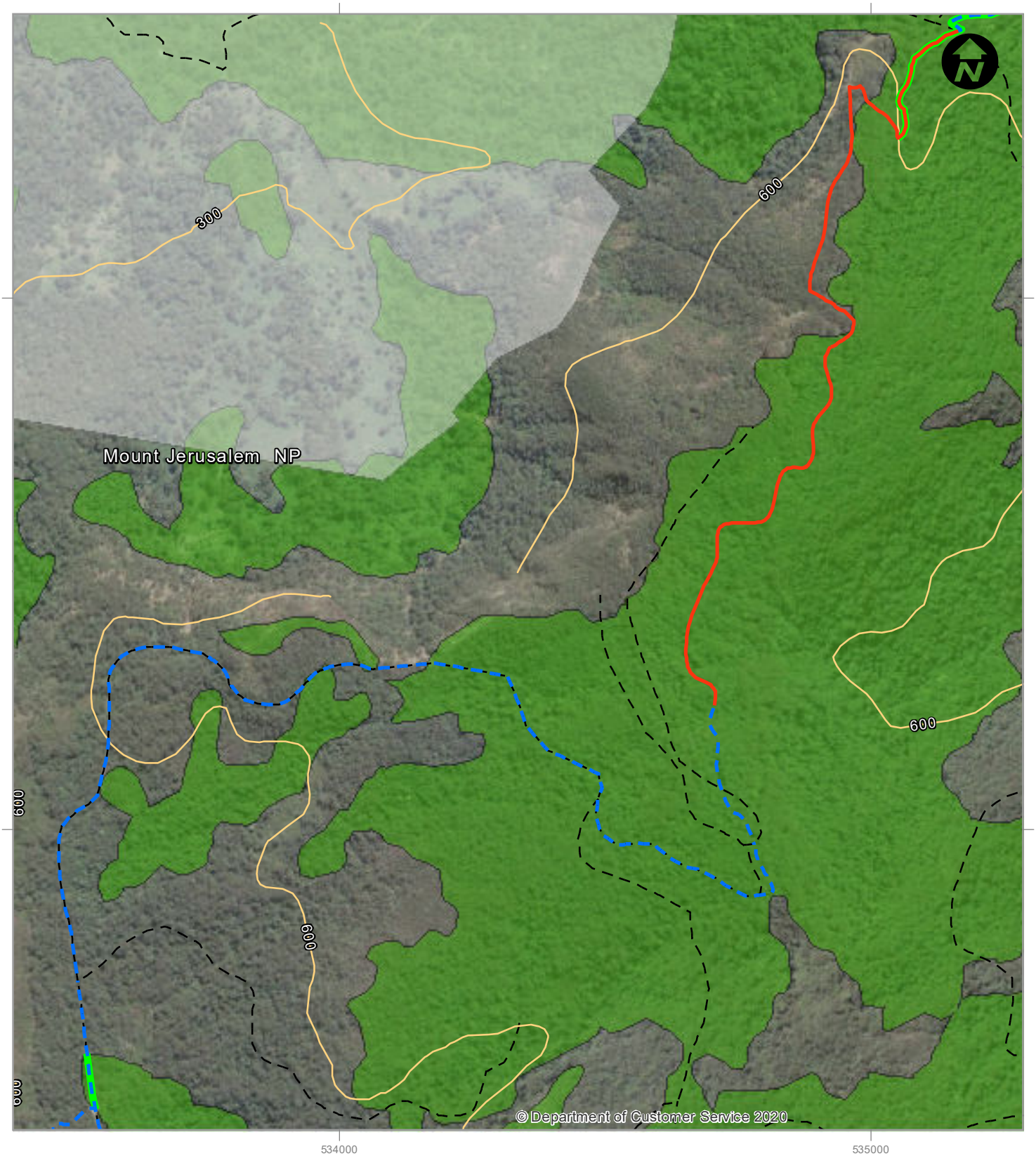
LEGEND

- Existing walking trail
- New walking trail
- Proposed walk-in campground
- Track-vehicular
- Contour
- Non NPWS estate
- Rainforest
- Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions – Threatened Ecological Community (under 600m ASL)

0 200 Metres

Threatened Ecological Communities
Illustration 5.3 - Sheet 3 of 12

Information shown is for illustrative purposes only
Drawn by: AB Reviewed by: RE
Source of base data: DFSI
Date: 27/07/2022
Revision: C



GDA 1994 MGA Zone 56

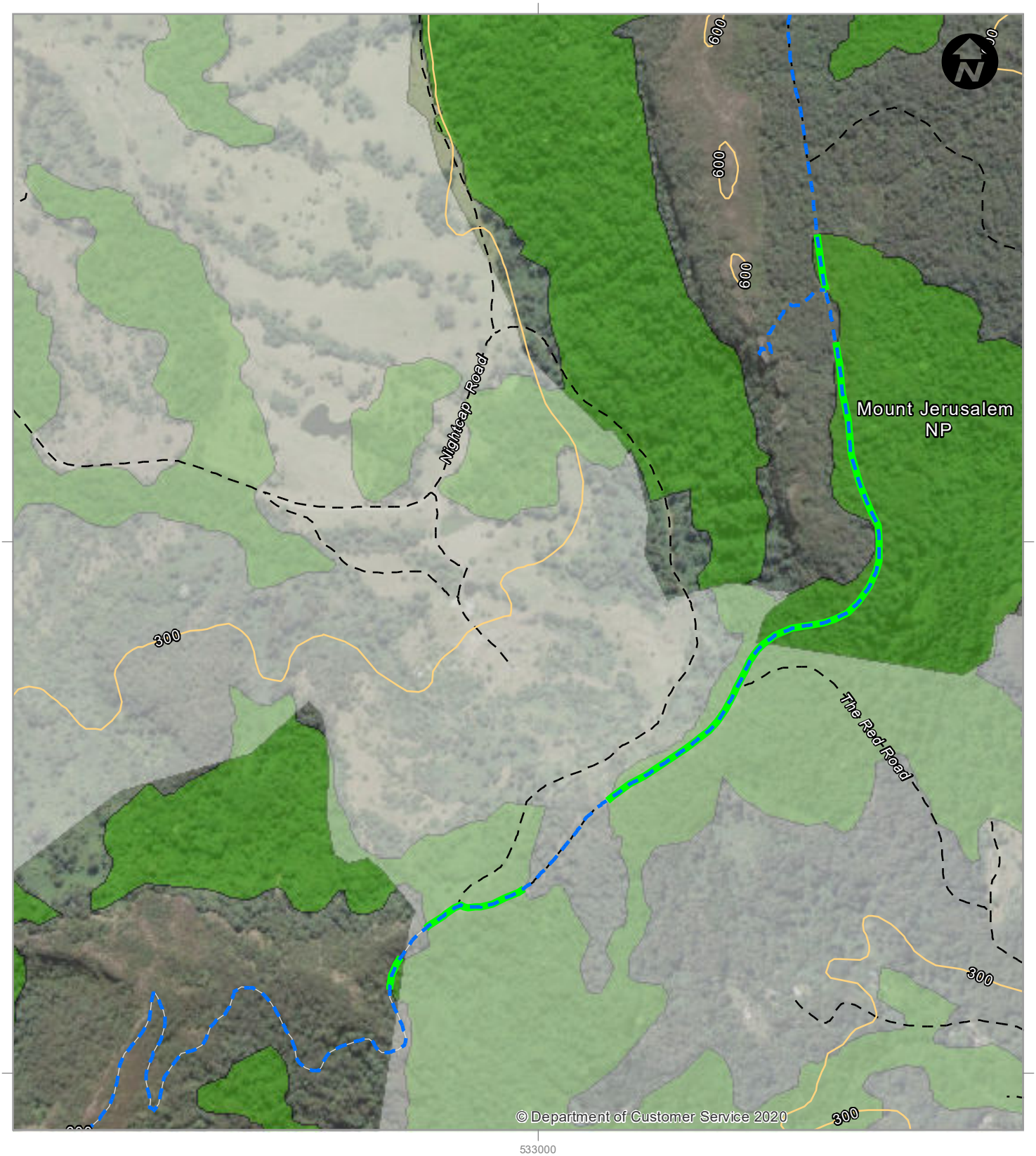
LEGEND

- Existing walking trail
- New walking trail
- Track-vehicular
- Contour
- Non NPWS estate
- Rainforest
- Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions – Threatened Ecological Community (under 600m ASL)

0 200 Metres

Threatened Ecological Communities
Illustration 5.3 - Sheet 4 of 12

Information shown is for illustrative purposes only
Drawn by: AB Reviewed by: RE
Source of base data: DFSI
Date: 27/07/2022
Revision: C



GDA 1994 MGA Zone 56

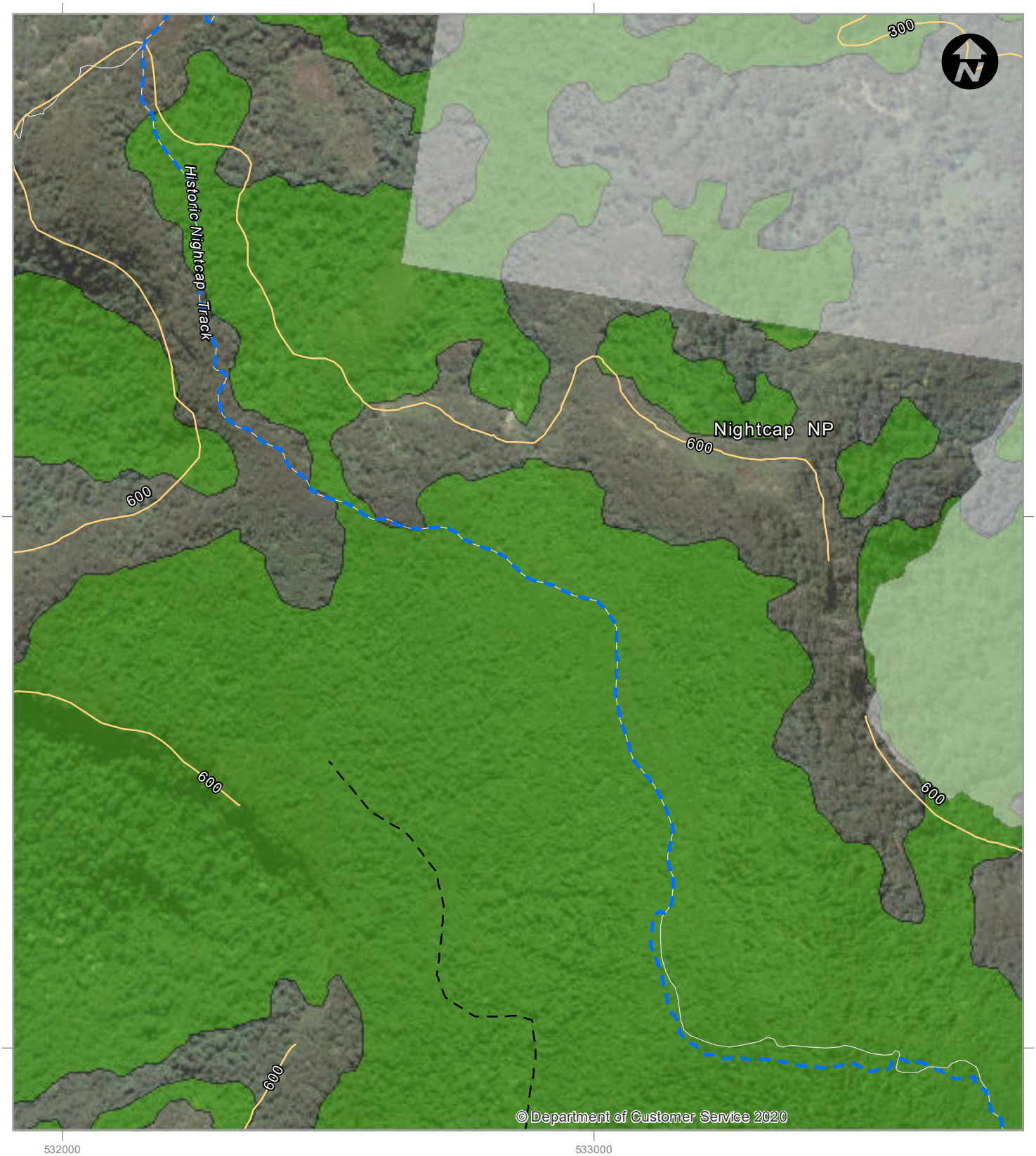
LEGEND

- Existing walking trail
- Path
- Track-vehicular
- Contour
- Non NPWS estate
- Rainforest
- Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions – Threatened Ecological Community (under 600m ASL)

0 200 Metres

Threatened Ecological Communities
Illustration 5.3 - Sheet 5 of 12

Information shown is for illustrative purposes only
Drawn by: AB Reviewed by: RE
Source of base data: DFSI
Date: 27/07/2022
Revision: C



GDA 1994 MGA Zone 56

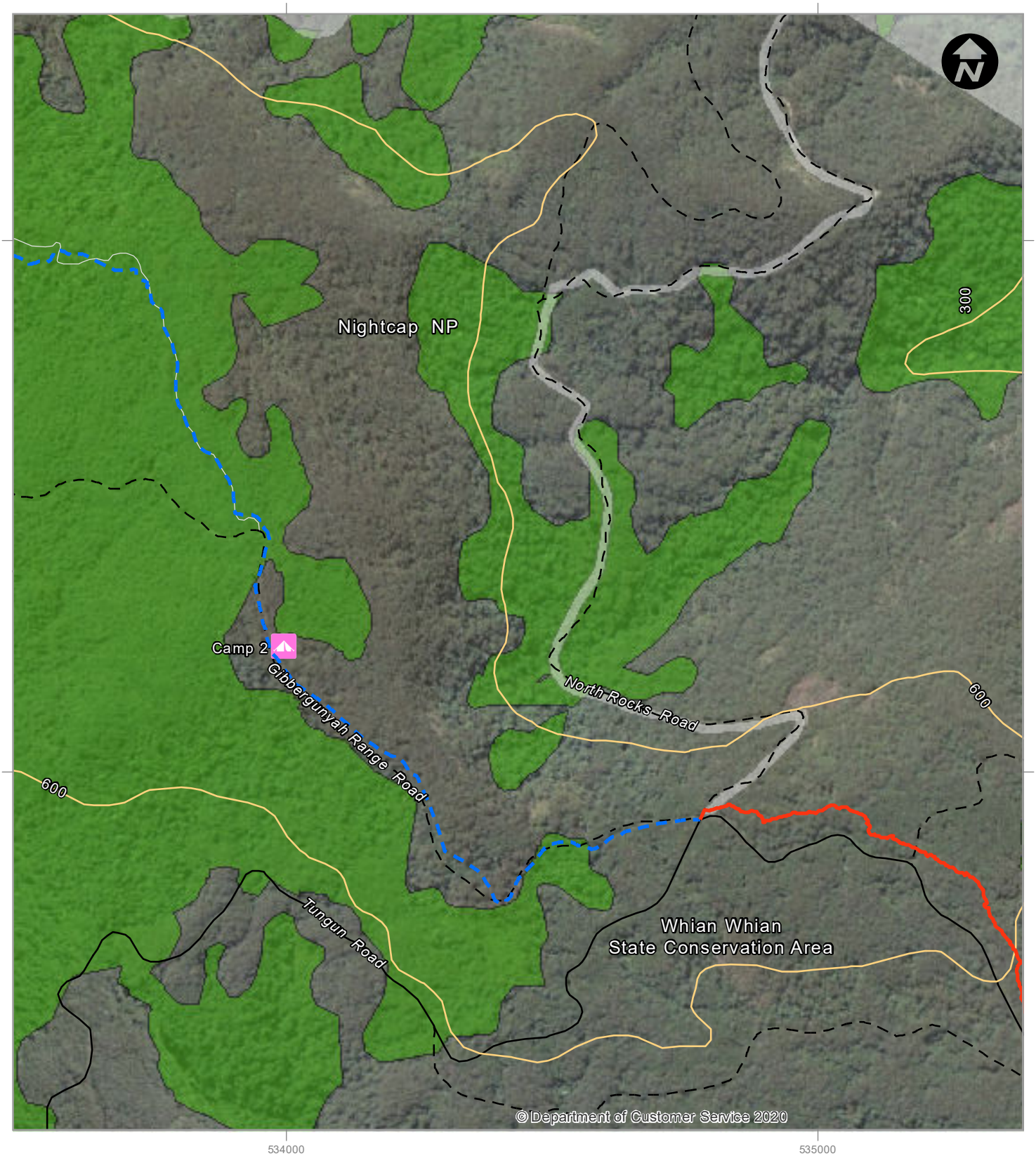
LEGEND

- Existing walking trail
- Path
- Track-vehicular
- Contour
- Non NPWS estate
- Rainforest

0 200 Metres

Threatened Ecological Communities
Illustration 5.3 - Sheet 6 of 12

Information shown is for illustrative purposes only
Drawn by: AB Reviewed by: RE
Source of base data: DFSI
Date: 27/07/2022
Revision: C



GDA 1994 MGA Zone 56

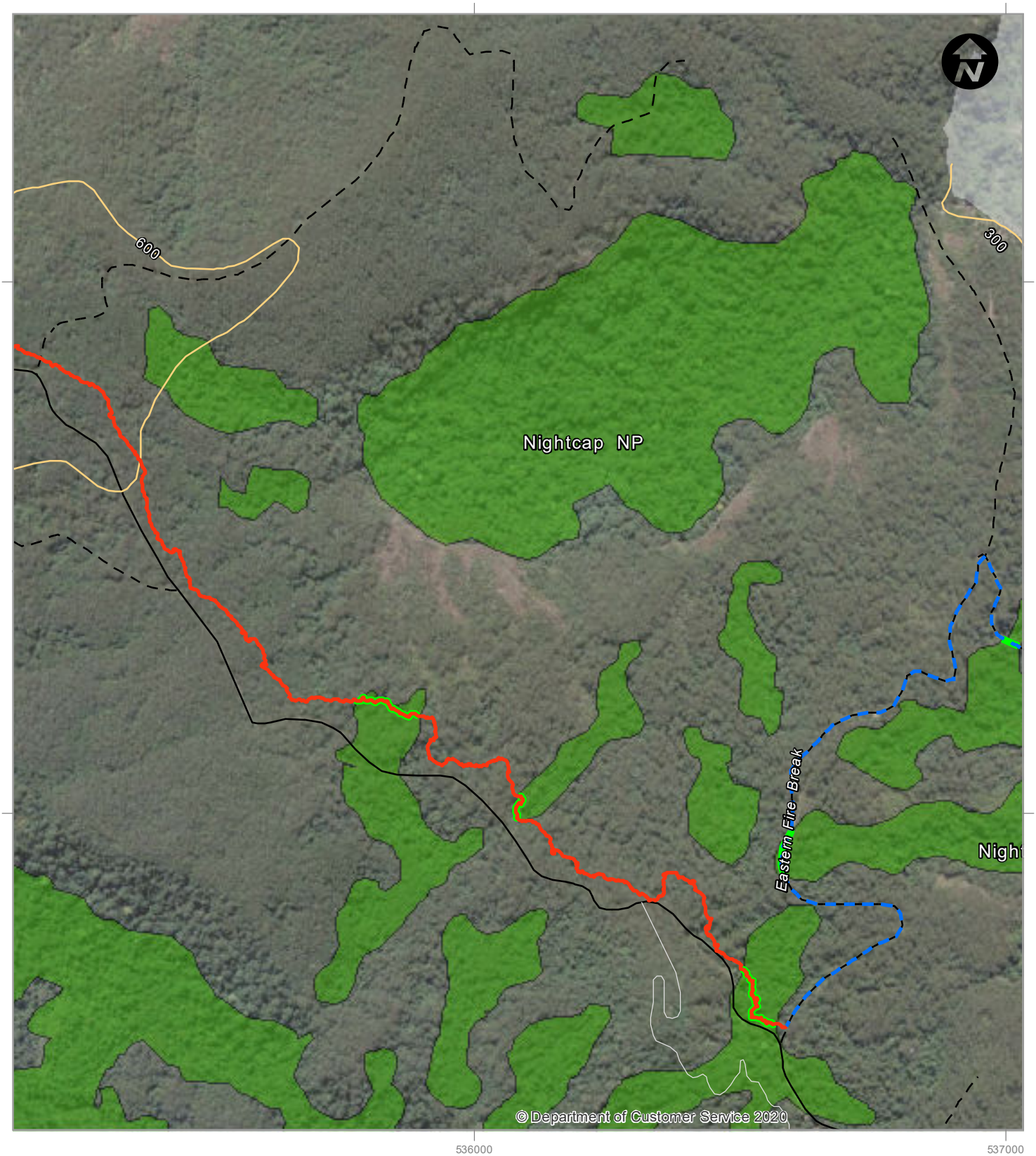
LEGEND

- Existing walking trail
- New walking trail
- Proposed walk-in campground
- Local road
- Path
- Track-vehicular
- Contour
- Non NPWS estate
- Rainforest

0 200 Metres

Threatened Ecological Communities
Illustration 5.3 - Sheet 7 of 12

Information shown is for illustrative purposes only
Drawn by: AB Reviewed by: RE
Source of base data: DFSI
Date: 27/07/2022
Revision: C



GDA 1994 MGA Zone 56

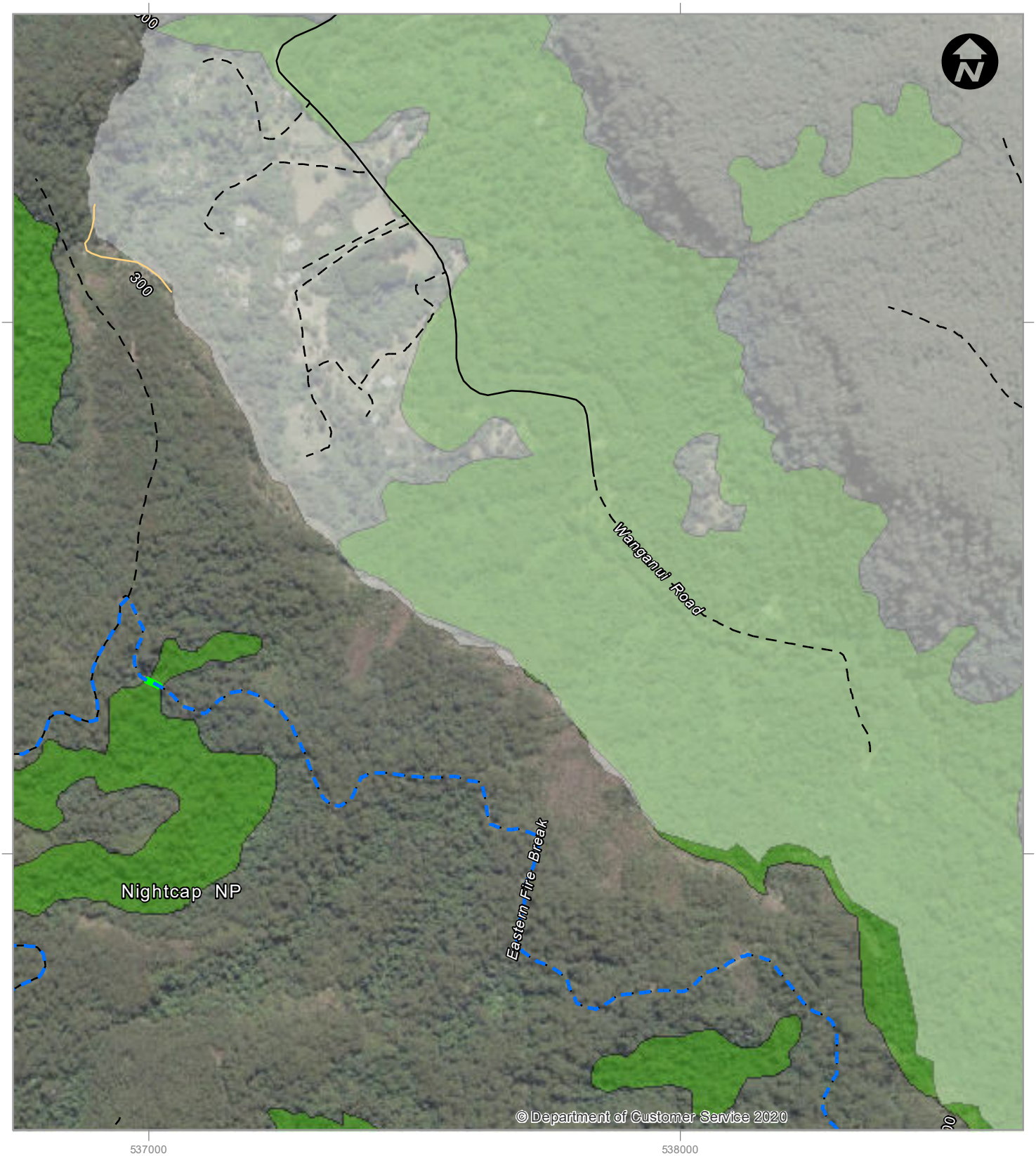
LEGEND

- Existing walking trail
- New walking trail
- Local road
- Path
- Track-vehicular
- Contour
- Non NPWS estate
- Rainforest
- Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions – Threatened Ecological Community (under 600m ASL)

0 200 Metres

Threatened Ecological Communities
Illustration 5.3 - Sheet 8 of 12

Information shown is for illustrative purposes only
Drawn by: AB Reviewed by: RE
Source of base data: DFSI
Date: 27/07/2022
Revision: C



GDA 1994 MGA Zone 56

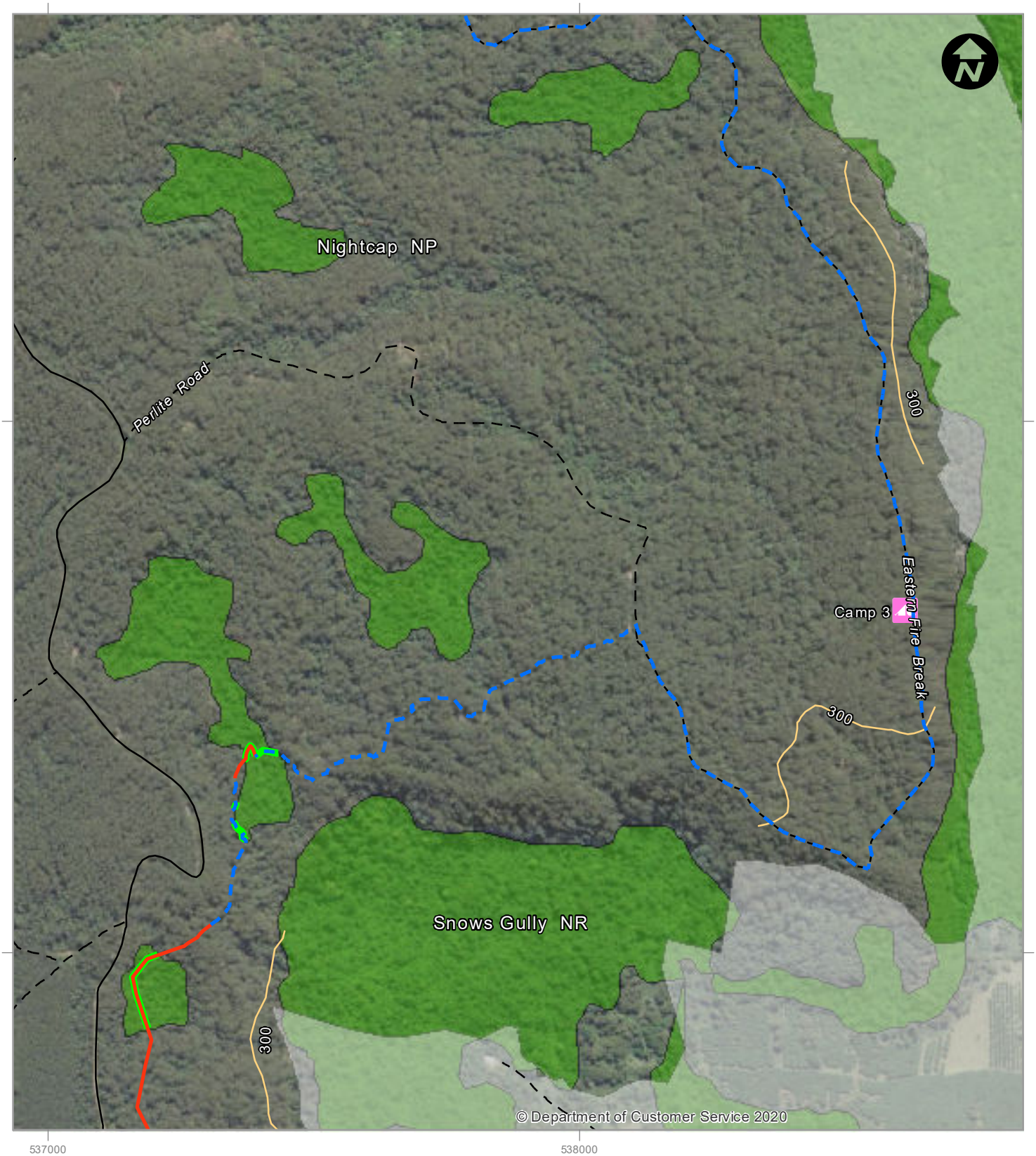
LEGEND

- Existing walking trail
- Local road
- Track-vehicular
- Contour
- Non NPWS estate
- Rainforest
- Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions – Threatened Ecological Community (under 600m ASL)

0 200 Metres

Threatened Ecological Communities
Illustration 5.3 - Sheet 9 of 12

Information shown is for illustrative purposes only
Drawn by: AB Reviewed by: RE
Source of base data: DFSI
Date: 27/07/2022
Revision: C



GDA 1994 MGA Zone 56

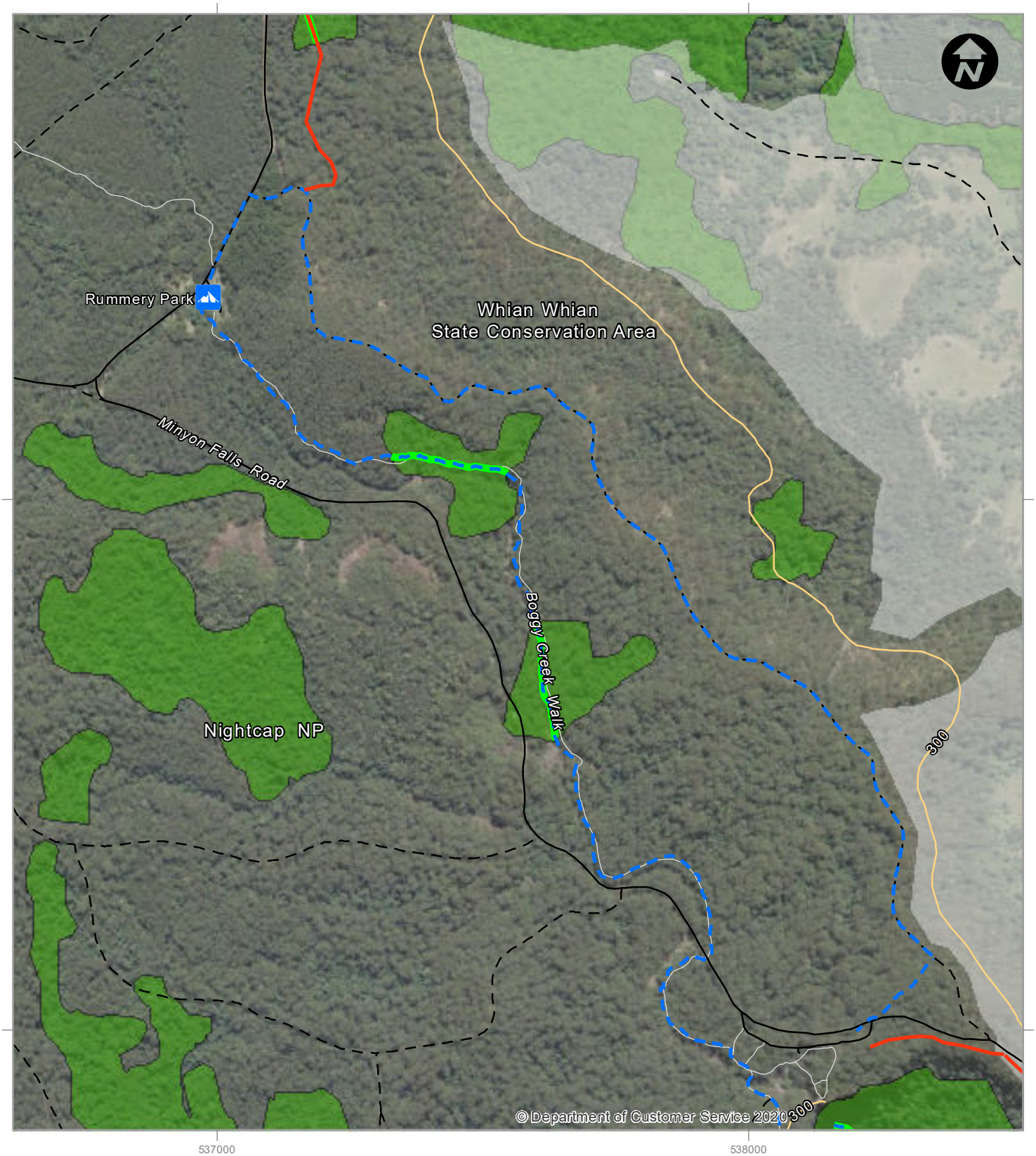
LEGEND

- Existing walking trail
- New walking trail
- Proposed walk-in campground
- Local road
- Track-vehicular
- Contour
- Non NPWS estate
- Rainforest
- Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions – Threatened Ecological Community (under 600m ASL)

0 200 Metres

Threatened Ecological Communities
Illustration 5.3 - Sheet 10 of 12

Information shown is for illustrative purposes only
Drawn by: AB Reviewed by: RE
Source of base data: DFSI
Date: 27/07/2022
Revision: C



GDA 1994 MGA Zone 56

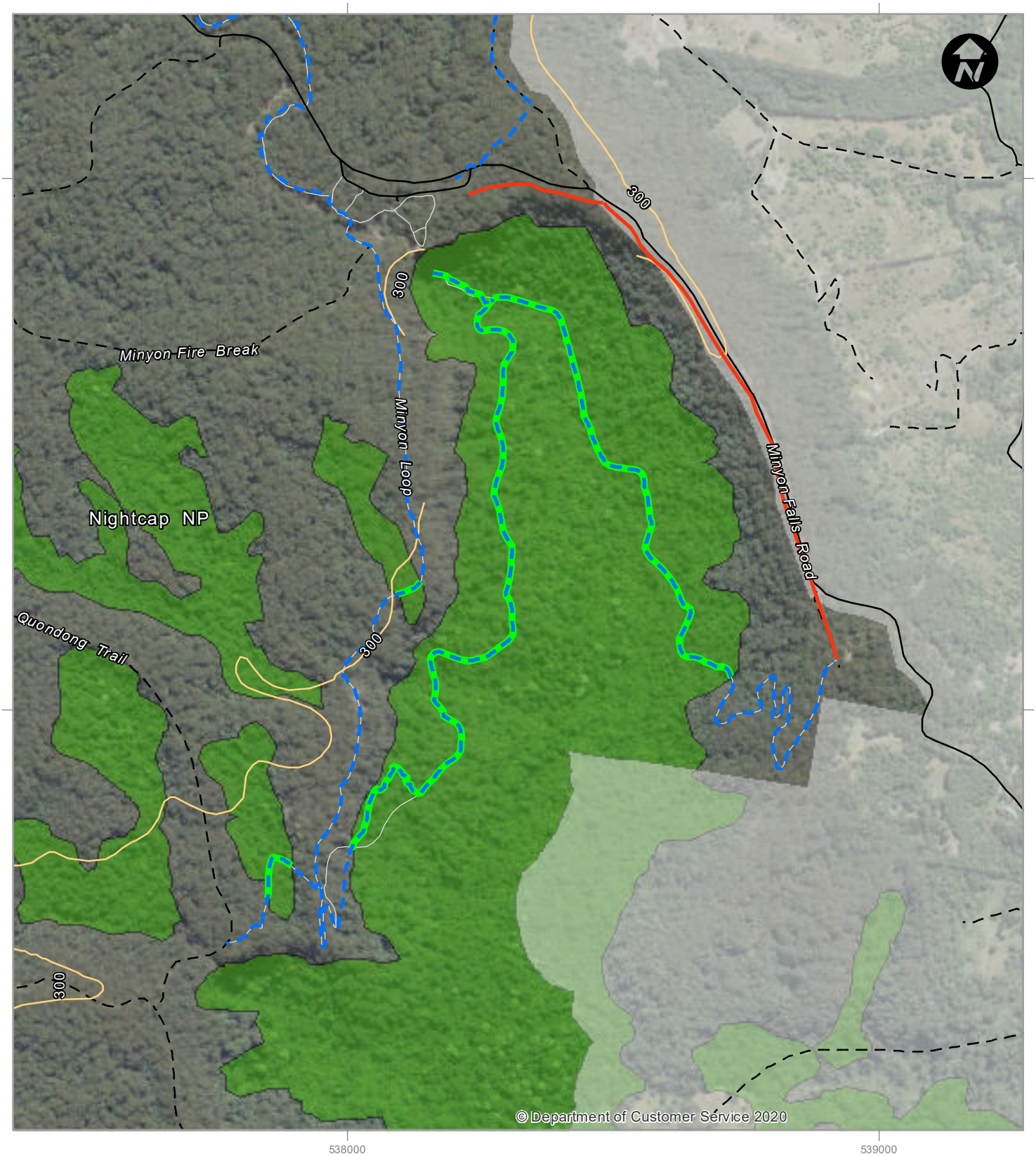
LEGEND

- Existing walking trail
- New walking trail
- Existing campground
- Local road
- Path
- Track-vehicular
- Contour
- Non NPWS estate
- Rainforest
- Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions – Threatened Ecological Community (under 600m ASL)

0 200 Metres

Threatened Ecological Communities
Illustration 5.3 - Sheet 11 of 12

Information shown is for illustrative purposes only
Drawn by: AB Reviewed by: RE
Source of base data: DFSI
Date: 27/07/2022
Revision: C



GDA 1994 MGA Zone 56

LEGEND

- Existing walking trail
- New walking trail
- Local road
- Path
- Track-vehicular
- Contour
- Non NPWS estate
- Rainforest
- Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions – Threatened Ecological Community (under 600m ASL)

0 200 Metres

Threatened Ecological Communities
Illustration 5.3 - Sheet 12 of 12

Information shown is for illustrative purposes only
Drawn by: AB Reviewed by: RE
Source of base data: DFSI
Date: 27/07/2022
Revision: C

6. Fauna Habitat

6.1 Desktop Analysis

6.1.1 Introduction

All three reserves are noted for their rich and diverse fauna, with Nightcap NP alone providing habitat for more than 40 mammal species, 27 reptile species, 23 frog species and over 140 bird species (NPWS 2004). In recognition of the high quality habitat within the locality, in 2009 BirdLife International identified the Nightcap Range as an important bird and biodiversity area (IBA). The Nightcap Range IBA includes Nightcap NP, Mount Jerusalem NP, Goonengerry NP and Whian Whian State SCA on the basis of its populations of Albert's Lyrebird (*Menura alberti*), Green Catbird (*Ailuroedus crassirostris*), Pale-yellow Robin (*Tregellasia capito*), Australian Logrunner (*Orthonyx temminckii*), Paradise Riflebird (*Ptiloris paradiseus*) and Regent Bowerbird (*Sericulus chrysocephalus*). Numerous threatened fauna species are known to occur within all three reserves, including species of limited distribution such as Fleay's Barred Frog (*Mixophyres fleayi*), Loveridge's Frog (*Philoria loveridgei*), Marbled Frogmouth (*Podargus ocellatus*), Albert's Lyrebird and Parma Wallaby (*Macropus parma*).

6.1.2 Saving Our Species

Projects established under the SOS program active in the region for threatened fauna include:

- Black-striped Wallaby *(Macropus dorsalis*)
- Fleay's Barred Frog *(Mixophyes fleayi*)
- Koala *(Phascolarctos cinereus*)
- Red-legged Pademelon *(Thylogale stigmatica*).

In addition, in-kind monitoring of Albert's Lyrebird is also being completed within Whian Whian SCA/Nightcap NP but is not part of the SOS program.

6.1.3 Database Search Results

BioNet contains numerous fauna (and threatened fauna) records each for each reserve (note that many species records are likely to overlap):

- Nightcap NP: 264 fauna species (including 50 threatened species).
- Whian Whian SCA: 178 fauna species (including 51 threatened species).
- Mt Jerusalem NP: 99 fauna species (including 31 threatened species).

A refined BioNet search within 5 km of the TBHT returned results identified records of 66 threatened fauna species listed in the BC Act (including several species also listed in the EPBC Act); refer to **Table 6.1**). PMST results identified habitat for 28 threatened fauna species and 16 migratory fauna species listed in the EPBC Act within 5 km of the TBHT.

Table 6.1 Threatened Fauna Records Within 5 km of the TBHT

Scientific Name	Common Name	BC Act	EPBC Act
Invertebrates			
Nurus brevis	Shorter Rainforest Ground-beetle	E	-
Phyllodes imperialis (southern)	Southern Pink Underwing Moth	E	E
Thersites mitchellae	Mitchell's Rainforest Snail	E	CE
Reptiles			
Coeranoscincus reticulatus	Three-toed Snake-tooth Skink	V	V
Hoplocephalus stephensii	Stephens' Banded Snake	V	-
Amphibians			
Assa darlingtoni	Pouched Frog	V	-
Litoria brevipalmata	Green-thighed Frog	V	-
Mixophyes fleayi	Fleay's Barred Frog	E	E
Mixophyes iteratus	Giant Barred Frog	E	E
Philoria loveridgei	Loveridge's Frog	E	-
Birds			
Amaurornis moluccana	Pale-vented Bush-hen	V	-
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	-
Atrichornis rufescens	Rufous Scrub-bird	V	-
Botaurus poiciloptilus	Australasian Bittern	E	E
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-
Carterornis leucotis	White-eared Monarch	V	-
Circus assimilis	Spotted Harrier	V	-
Coracina lineata	Barred Cuckoo-shrike	V	-
Cyclopsitta diophthalma coxeni	Coxen's Fig-Parrot	CE	E
Daphoenositta chrysoptera	Varied Sittella	V	-
Dasyornis brachypterus	Eastern Bristlebird	E	E
Ephippiorhynchus asiaticus	Black-necked Stork	E	-
Erythrotriorchis radiatus	Red Goshawk	CE	V
Falco subniger	Black Falcon	V	-
Glossopsitta pusilla	Little Lorikeet	V	-
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	-
Hieraaetus morphnoides	Little Eagle	V	-
Irediparra gallinacea	Comb-crested Jacana	V	-
Ixobrychus flavicollis	Black Bittern	V	-
Menura alberti	Albert's Lyrebird	V	-
Ninox connivens	Barking Owl	V	-
Ninox strenua	Powerful Owl	V	-
Pachycephala olivacea	Olive Whistler	V	-
Pandion cristatus	Eastern Osprey	V	-
Petroica boodang	Scarlet Robin	V	-
Podargus ocellatus	Marbled Frogmouth	V	-
Ptilinopus magnificus	Wompoo Fruit-Dove	V	-
Ptilinopus regina	Rose-crowned Fruit-Dove	V	-
Ptilinopus superbus	Superb Fruit-Dove	V	-
Turnix melanogaster	Black-breasted Button-quail	CE	V
Tyto novaehollandiae	Masked Owl	V	-

Scientific Name	Common Name	BC Act	EPBC Act
Tyto tenebricosa	Sooty Owl	V	-
Mammals			
Aepyprymnus rufescens	Rufous Bettong	V	-
Cercartetus nanus	Eastern Pygmy-possum	V	-
Chalinolobus dwyeri	Large-eared Pied Bat	V	V
Dasyurus maculatus	Spotted-tailed Quoll	V	E
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-
Macropus parma	Parma Wallaby	V	-
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	V	-
Miniopterus australis	Little Bent-winged Bat	V	-
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	-
Myotis macropus	Southern Myotis	V	-
Nyctimene robinsoni	Eastern Tube-nosed Bat	V	-
Nyctophilus bifax	Eastern Long-eared Bat	V	-
Petaurus australis	Yellow-bellied Glider	V	-
Petaurus norfolcensis	Squirrel Glider	V	-
Phascolarctos cinereus	Koala	E	E
Phoniscus papuensis	Golden-tipped Bat	V	-
Planigale maculata	Common Planigale	V	-
Potorous tridactylus	Long-nosed Potoroo	V	V
Pteropus poliocephalus	Grey-headed Flying-fox	V	V
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-
Syconycteris australis	Common Blossom-bat	V	-
Thylogale stigmatica	Red-legged Pademelon	V	-
Vespadelus troughtoni	Eastern Cave Bat	V	-

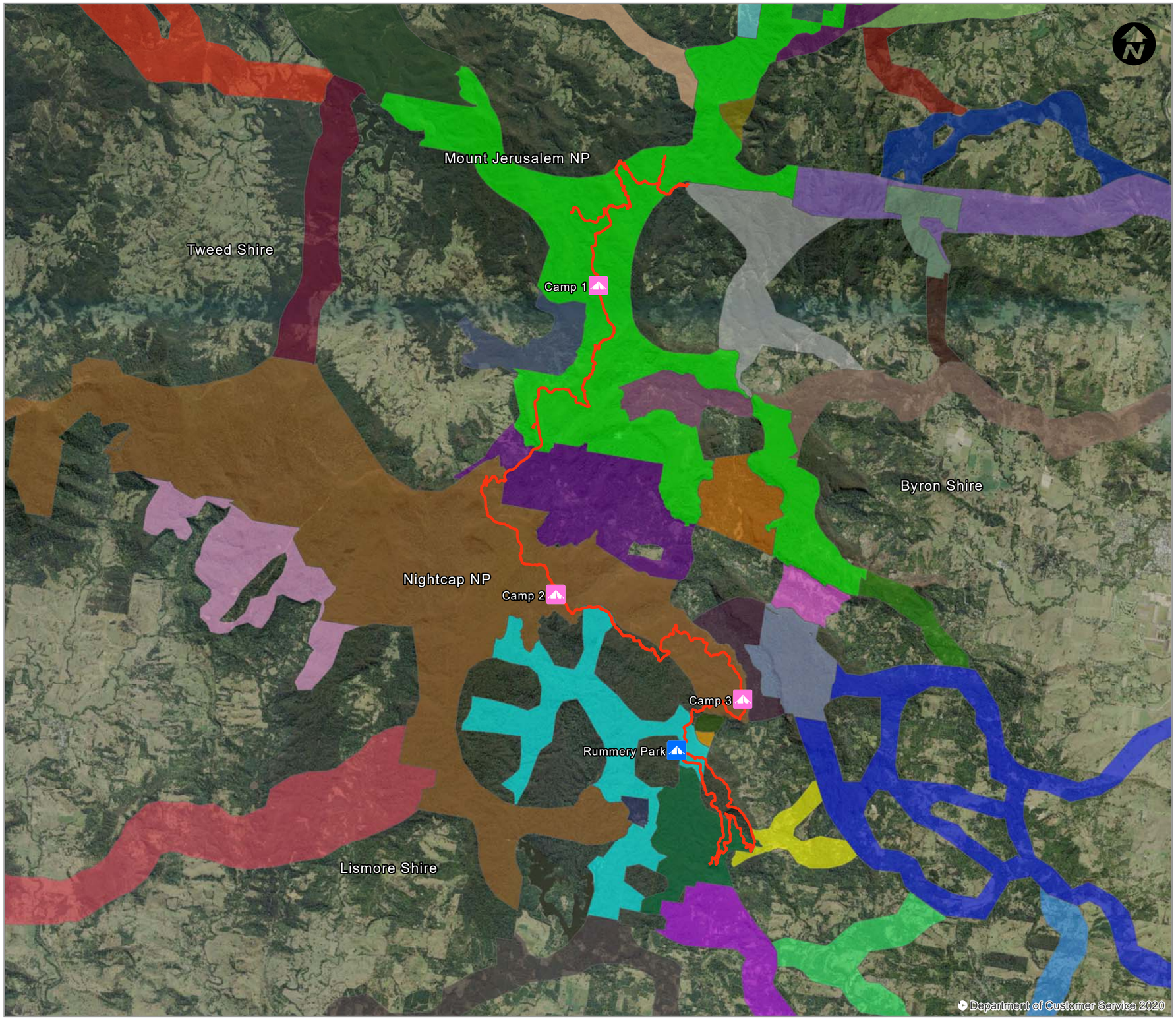
V = Vulnerable; E = Endangered; CE = Critically Endangered

6.1.4 Wildlife Corridors

The TBHT lies within several regional and sub-regional wildlife corridors as per Scotts (2003), which from north to south include (refer **Illustration 6.1**):

- Whian Whian.
- Nightcap - Mt Jerusalem.
- Nightcap NP and Nightcap 2.
- Whian Whian SF.

Focal species include Alberts Lyrebird and Marbled Frogmouth.



LEGEND

- The Tweed-Byron Hinterland Trail
- Existing campground
- Proposed walk-in campground
- Coopers, Albert's Lyrebird/Marbled Frogmouth
- Uki, No focal species
- * MtJerusalem NP, No focal species
- * Night-MtJ, No focal species
- * Nightcap NP, No focal species
- * Nightcap2 NP, No focal species
- * Upp_Coopers, Albert's Lyrebird/Marbled Frogmouth
- * Whian SF, No focal species
- Burringbar II, Koala
- Burringbar, Steph Band Snake/Koala/Bl Bittern
- Byrill Ck, Yellow-bellied Glider/Stephens Banded Snake Greate
- Byrrill Ridge, Albert's Lyrebird/ Coeranoscincus
- Chincogan, No focal species
- Commissioner, Stephens Banded Snake
- Crabbes_ck, CC fauna
- Dunoon, Koala/Albert's Lyrebird
- Goonengerry, No focal species
- Koonyum, Northern Long-eared Bat
- Mt Chowan, Yellow-bellied Glider/Stephens Banded Snake
- MtJ-IP-Bill, Long-nosed Potoroo/Stephens Bandad Snake
- MtJ-MarshallsCk, No focal species
- MtMisery, Yell-bell Glider/Albert's Lyrebird/Long-nosed Pot
- MtNullum, Albert Lyre/Steph Banded Snake/Gt Barr Frog/Koala
- Night-Goon, No focal species
- Night-MtJ, No focal species
- Nightcap_links, No focal species
- Nimbin, Albert's Lyrebird/Stephens Banded Snake/ Rufous B
- OuterPocket NR, No focal species
- Repentance, Koala/Eastern Blossum-bat/Marbled Frogmouth
- Smiths Ck, Greater Glider/Koala
- SnowsGully_nr, No focal species
- Snowslink, No focal species
- Upp_Brunswick, Stephens Banded Snake/Northern Long-eared Bat
- Upp_Wils_Ck, No focal species
- Upper Burringbar, Koala
- Whian_p, Alberts Lyrebird/Marbled Frogmouth
- Wilson's_Riv, No focal species
- Wilson's_ck1, No focal species
- Wilsons River, Koala/Yelow-bellied Glider
- Wilsons, Eastern Blossum-bat/Koala/Stephens Banded Snake

* Corridors intersected by the Tweed-Byron Hinterland Trail

0 2 Km

Wildlife Corridors - Illustration 6.1

GeoLINK environmental management and design

Natural Heritage Values Assessment - Tweed Byron Hinterland Walk
3513-1122

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Source of base data: DFSI
Date: 25/07/2022
Revision: B

6.1.5 Fisheries Mapping

The Fisheries NSW Spatial Data Portal does not map potential habitat for any threatened freshwater fish species within the TBHT footprint.

6.1.6 Koala Habitat Suitability

Review of the NSW Koala Habitat Suitability Model (v 1.0) indicates large areas of Nightcap NP provide highly suitable Koala habitat. It is understood recent dog detection surveys have recorded Koalas at numerous locations in the NP, generally consistent with the Habitat Suitability Model (pers. comm. Theresa Adams (DPIE) 01/06/2020).

6.2 Field Results

6.2.1 Habitat Values

A range of fauna species were recorded during the field assessment, with a high diversity of bird species recorded (refer to **Appendix E**). Species recorded are typical of the environments through which the TBHT passes, and intact mature forest provide high quality habitat for all fauna groups. Numerous hollow-bearing trees were observed throughout the TBHT which provide denning, roosting and breeding resources for hollow-obligate fauna within mature forest (refer **Illustration 6.2**).

Constructed bridges do not provide suitable permanent roost habitat for microchiropteran bats as they are easily accessed by predators, may be subject to flooding and have light penetration to varying degrees.

6.2.2 Aquatic Habitat

Watercourses traversed or visited by the TBHT provided habitat for a limited range of freshwater fish and are also likely to support a varied invertebrate fauna, including freshwater shrimp and crayfish. The site does not provide habitat for any threatened species listed in the FM Act.

6.2.3 Connectivity

The TBHT occurs within large contiguous landscapes with excellent connectivity for mobile fauna.

6.2.4 Threatened and Significant Fauna Habitat

6.2.4.1 Threatened Fauna

Nine threatened fauna species were confirmed during field assessment (refer **Table 6.2** and **Illustration 6.3**). Field assessment in October 2020 recorded large numbers of *Mixophyes* sp. tadpoles within 'Whiskey Creek', which may be representative of *Mixophyes iteratus*. Whiskey Creek provides high quality habitat for frog species and is the most substantial watercourse traversed by the TBHT.

With the exception of threatened frog species (*Assa darlingtonia, Philoria loveridgei, Mixophyes iteratus* [?]) and the Pale-vented Bush-hen, all species are likely to range widely throughout all reserves, with White-eared Monarch largely restricted to areas of rainforest within smaller home

ranges of up to 15 ha. Both Loveridge's Frog and Albert's Lyrebird have restricted distributions in northern NSW. Field assessment results represent just a small sample of threatened fauna which may use habitat in proximity to the TBHT on a seasonal basis.

Table 6.2 Threatened Fauna Recorded

Species	*Notes*
Amaurornis moluccana Pale-vented Bush-hen	Four birds heard calling within thickets of Lantana and rank Setaria on private land (Lot 88 DP755710) adjacent to the Nightcap Track (S3).
Assa darlingtonia Pouched Frog	Calls heard in two locations within Section 2 while walking in light rain; one call along the Minyon loop and along the Boggy Creek walk (S5). Commonly calling throughout all rainforest communities on the approach to and east of Mt Jerusalem (S2). This species is relatively common throughout much of Nightcap NP/Whian Whian SCA (pers obs.) and is likely to occur within suitable areas of wet sclerophyll forest and rainforest unaffected by fire.
Calyptorhynchus lathami Glossy Black-Cockatoo	Pair observed feeding along Eastern Firebreak (S4).
Carterornis leucotis White-eared Monarch	Pair heard calling from typical habitat (vine covered rainforest) ascending to Mt Jerusalem (S2).
Menura alberti Albert's Lyrebird	Observed and heard at various locations throughout the TBHT; a reasonably commonly occurring species within areas of wet sclerophyll forest and rainforest.
Philoria loveridgei Loveridge's Frog	Individual heard calling in dense Stream Lily south of Camp 3 (S4), Another Individual recorded in a similar habitat type easy of Mt Jerusalem (S2). Likely to occur in any areas of boggy Stream Lily habitat.
Phascolarctos cinereus Koala	Dead animal observed near Minyon Grass (S5); suspected roadkill. Old scratches consistent with Koalas observed on a Grey Gum in Section 1. Male heard bellowing east of Peates Mountain Road track (S3).
Ptilinopus magnificus Wompoo Fruit-Dove	Observed and heard at a number of locations, typically within rainforest or gullies in wet sclerophyll forest.
Tyto tenebricosa Sooty Owl	Heard calling near Quandong Falls (S5) at dusk.

Potential impacts of the TBHT on threatened fauna are discussed in detail in **Sections 7.2 and 7.3**. The results of statutory assessment are provided at **Section 8**.

6.2.4.2 Migratory Fauna

Two migratory (EPBC Act) fauna were recorded (Horsfield's Cuckoo, Rufous Fantail); refer to **Appendix E**. Habitat for both species occurs widely within the three reserves. Several other migratory bird species are also likely to occur on a seasonal or opportunistic basis.

6.3 Potential for Threatened Species Occurrence

Based on the desktop analysis, database search results (BioNet and PMST), field assessment and habitat present numerous threatened fauna species have potential to occur along the TBHT (refer to potential occurrence table at **Appendix F**). Threatened fauna recorded or with potential to occur (based on suitable habitat) are listed in **Table 6.3**. Comments are supplied on the potential impacts and sensitivities for each species. The majority of species are highly mobile and likely to utilise larger areas of habitat in the locality. The exception to this is threatened amphibians which may be highly restricted to particular habitats and are at higher risk to localised impacts, particularly during the construction process where water quality and erosion/sedimentation risks occur. On this basis (and in combination with risk of pathogens), amphibians have the greatest potential to be negatively affected by the TBHT.

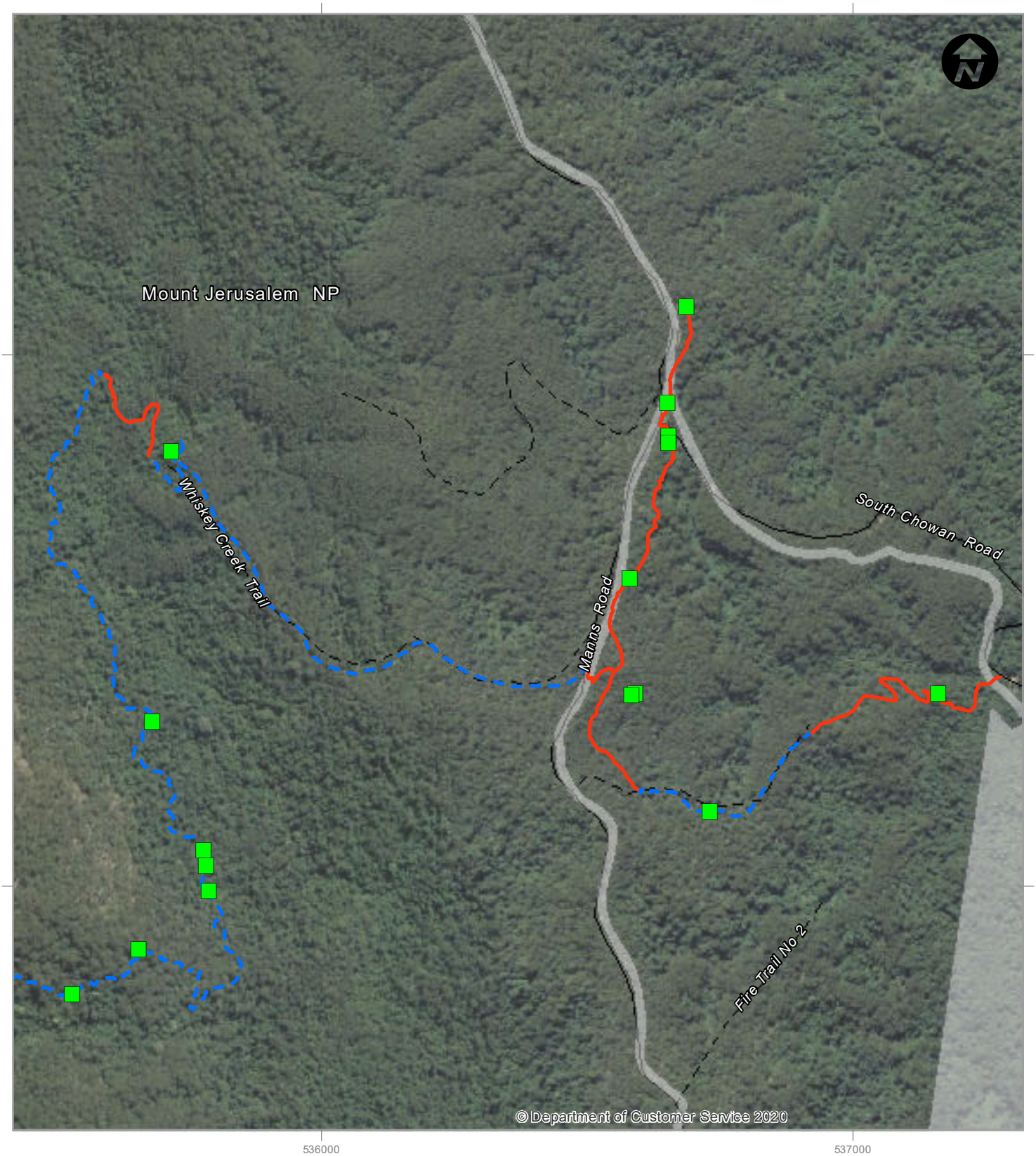
Tests of significance ('five-part tests') in accordance with Section 7.3 of the BC Act have been completed for all threatened fauna species recorded or likely to occur at the site (refer to **Appendix G**). Significance assessments have also been completed separately for threatened species listed in the EPBC Act (refer to **Appendix H**).

Table 6.3 Threatened Fauna - Potential Occurrence and Sensitivities

Species	*Comments*	*Sensitivity*
Amphibians		
Fleay's Barred Frog	Closely associated with watercourses within rainforest and wet eucalypt forest. Limited distribution with few records. Low mobility. Sensitive to localised disturbance (ground disturbance, changes in water quality).	High
Giant Barred Frog	Closely associated with watercourses within rainforest and wet eucalypt forest. Low mobility. Sensitive to localised disturbance (ground disturbance, changes in water quality).	High
Green-thighed Frog	Habitat may include rainforest and moist eucalypt forest to dry eucalypt forest in areas where surface water gathers after rain. Few records, extent of local population not well known. Low mobility. Sensitive to localised disturbance (ground disturbance, changes in water quality).	High
Loveridge's Frog	Occurs in subtropical and warm temperate rainforest and wet eucalypt forest in the headwaters of small streams and about soaks where groundwater is continually present and close to the surface. Low mobility. Sensitive to localised disturbance (ground disturbance, changes in water quality).	High
Pouched Frog	Associated with damp areas and watercourses in wet sclerophyll forest and rainforest. May be relatively common within areas of suitable habitat. Low mobility. Sensitive to localised disturbance (ground disturbance, changes in water quality).	High
Reptiles		
Stephens Banded Snake	Associated with rainforest, eucalypt forest and rocky areas. Uses arboreal shelters (under loose bark, amongst vines, hollow trunks/limbs) and rock crevices. Shelter habitats unlikely to be significantly disturbed. Moderate mobility.	Low
Birds		
Albert's Lyrebird	Ranges widely throughout wet sclerophyll forest and rainforests (including disturbed areas). Appears relatively common; high mobility.	Low
Barred Cuckoo-shrike	Ranges widely throughout sclerophyll forest and rainforests. High mobility.	Low
Glossy Black-Cockatoo	Ranges widely throughout sclerophyll forests. Specialised feeding and nesting requirements (*Allocasuarina* sp., large hollow-bearing trees). Specialised requirements are widely available in the context of the three reserves. High mobility.	Low
Little Lorikeet	Ranges widely throughout sclerophyll forests. Specialised feeding and nesting requirements (nectar bearing trees, hollow-bearing trees). Specialised requirements are widely available in the context of the three reserves. High mobility.	Low
Marbled Frogmouth	Ranges widely throughout wet sclerophyll forest and rainforests; cryptic canopy roosting species. High mobility.	Low
Masked Owl	Ranges widely throughout wet sclerophyll forest and rainforests. Requires large hollow-bearing trees for breeding (widely available in the context of the three reserves). Highly mobile, with large home ranges.	Low
Pale-vented Bush-hen	Inhabits tall dense understorey or ground-layer vegetation on the margins of freshwater streams and natural or artificial wetlands, usually within or bordering rainforest, rainforest remnants or forests. May also occur in secondary forest growth, rank grass or reeds, thickets of weeds (eg. Lantana), and pastures, crops or other farmland, such as crops of sugar cane, and grassy or weedy fields, or urban gardens where they border forest and streams or wetlands.	Low
Powerful Owl	Ranges widely throughout wet sclerophyll forest and rainforests. Requires large hollow-bearing trees for breeding (widely available in the context of the three reserves). Highly mobile, with large home ranges.	Low

Species	Comments	Sensitivity
Rose-crowned Fruit-dove	Ranges widely throughout wet sclerophyll forest and rainforests. Highly mobile.	Low
Sooty Owl	Ranges widely throughout wet sclerophyll forest and rainforests. Requires large hollow-bearing trees for breeding (widely available in the context of the three reserves). Highly mobile, with large home ranges.	Low
Superb Fruit-dove	Ranges widely throughout wet sclerophyll forest and rainforests. Highly mobile.	Low
Varied Sittella	Restricted to eucalypt forests and woodlands. No specialised breeding/feeding requirements. Probably small home ranges; moderate mobility.	Low
White-eared Monarch	Ranges widely throughout wet sclerophyll forest and rainforests. No specialised breeding/feeding requirements. Small home ranges (~ 15 ha); moderate mobility.	Low
Wompoo Fruit-dove	Ranges widely throughout wet sclerophyll forest and rainforests. Highly mobile.	Low
Mammals		
Eastern Cave Bat	Restricted to dry open forest and woodland. Specialist roost habitat in caves, cliffs or rocky overhangs. Highly mobile.	Low (generally); High in proximity to suitable roost habitat.
Eastern Coastal Free-tailed Bat	Restricted to dry open forest and woodland. Specialist roost/breeding habitat (hollow-bearing trees). Highly mobile.	As above
Eastern False Pipistrelle	Uses wetter sclerophyll forest and rainforest. Specialist roost/breeding habitat (hollow-bearing trees). Highly mobile.	As above
Eastern Long-eared Bat	Uses wetter sclerophyll forest and rainforest. Specialist roost/breeding habitat (hollow-bearing trees, foliage, vines). Highly mobile.	As above
Eastern Tube-nosed Bat	Uses wetter sclerophyll forest and rainforest. Highly mobile.	Low
Golden-tipped Bat	Uses wetter sclerophyll forest and rainforest. Specialist roost/breeding habitat (tree hollows, foliage, abandoned bird nests, epiphytes). Highly mobile.	Low (generally); High in proximity to suitable roost habitat where colonies occur.
Greater Broad-nosed Bat	Uses sclerophyll forest and rainforest. Specialist roost/breeding habitat (hollow-bearing trees). Highly mobile.	Low (generally); High in proximity to suitable roost habitat.
Greater Glider	Uses sclerophyll forest; hollow-bearing trees used for denning and breeding. Highly mobile.	Low (generally); High where den habitat occurs.
Grey-headed Flying-fox	Wide ranging specialised feeder (nectar/fruit). No roost camps present along TBHT. Highly mobile.	Low
Koala	Wide ranging specialised feeder. Highly mobile.	Low
Large Bent-winged Bat	Uses sclerophyll forest and rainforest. Specialist roost habitat (caves, rock overhangs, man-made structures). Specialised breeding in maternity caves (none known in the locality). Highly mobile.	Low (generally); High in proximity to suitable roost habitat.
Large-eared Pied Bat	Restricted to dry open forest and woodland. Specialist roost habitat in caves, cliffs or rocky overhangs. Highly mobile.	As above
Little Bent-winged Bat	Uses sclerophyll forest and rainforest. Specialist roost habitat (caves, rock overhangs, man-made structures). Specialised breeding in maternity caves (none known in the locality). Highly mobile.	As above

Species	Comments	Sensitivity
Long-nosed Potoroo	Restricted to dense rainforest and wet sclerophyll forest. Specialised diet (hypogeal fungi). Highly mobile.	Low
Parma Wallaby	Uses sclerophyll forest and rainforest. No specialised breeding/feeding requirements. Highly mobile.	Low
Red-legged Pademelon	Uses wet sclerophyll forest and rainforest. No specialised breeding/feeding requirements. Highly mobile.	Low
Rufous Bettong	Uses sclerophyll forest. No specialised breeding/feeding requirements. Highly mobile.	Low
Spotted-tailed Quoll	Wide ranging with large home ranges. No specialised breeding/feeding requirements. Highly mobile.	Low
Squirrel Glider	Uses sclerophyll forest; hollow-bearing trees used for denning and breeding. Highly mobile.	Low (generally); High where den habitat occurs.
Yellow-bellied Glider	Uses wet sclerophyll forest; hollow-bearing trees used for denning and breeding. Highly mobile.	As above
Yellow-bellied Sheathtail-bat	Forages in most habitats. Specialist roost/breeding habitat (hollow-bearing trees). Highly mobile.	Low (generally); High in proximity to suitable roost habitat.



GDA 1994 MGA Zone 56

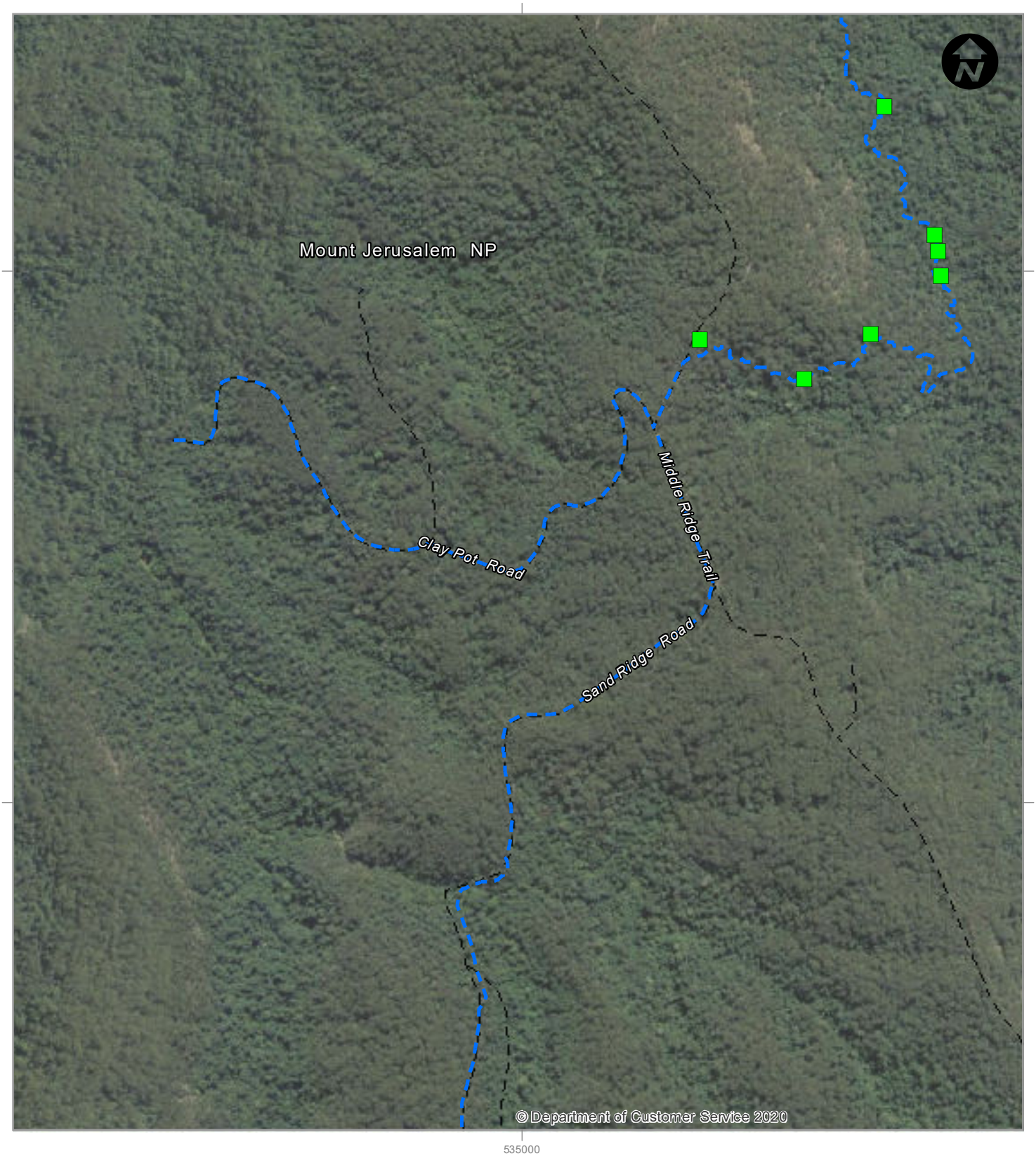
LEGEND

- Existing walking trail
- New walking trail
- Local road
- Track-vehicular
- Non NPWS estate

0 200 Metres

Hollow-bearing Trees
Illustration 6.2 - Sheet 1 of 12

Information shown is for illustrative purposes only
Drawn by: AB Reviewed by: RE
Source of base data: DFSI
Date: 27/07/2022
Revision: B



GDA 1994 MGA Zone 56

LEGEND

- Existing walking trail
- Track-vehicular

0 200 Metres

Hollow-bearing Trees
Illustration 6.2 - Sheet 2 of 12

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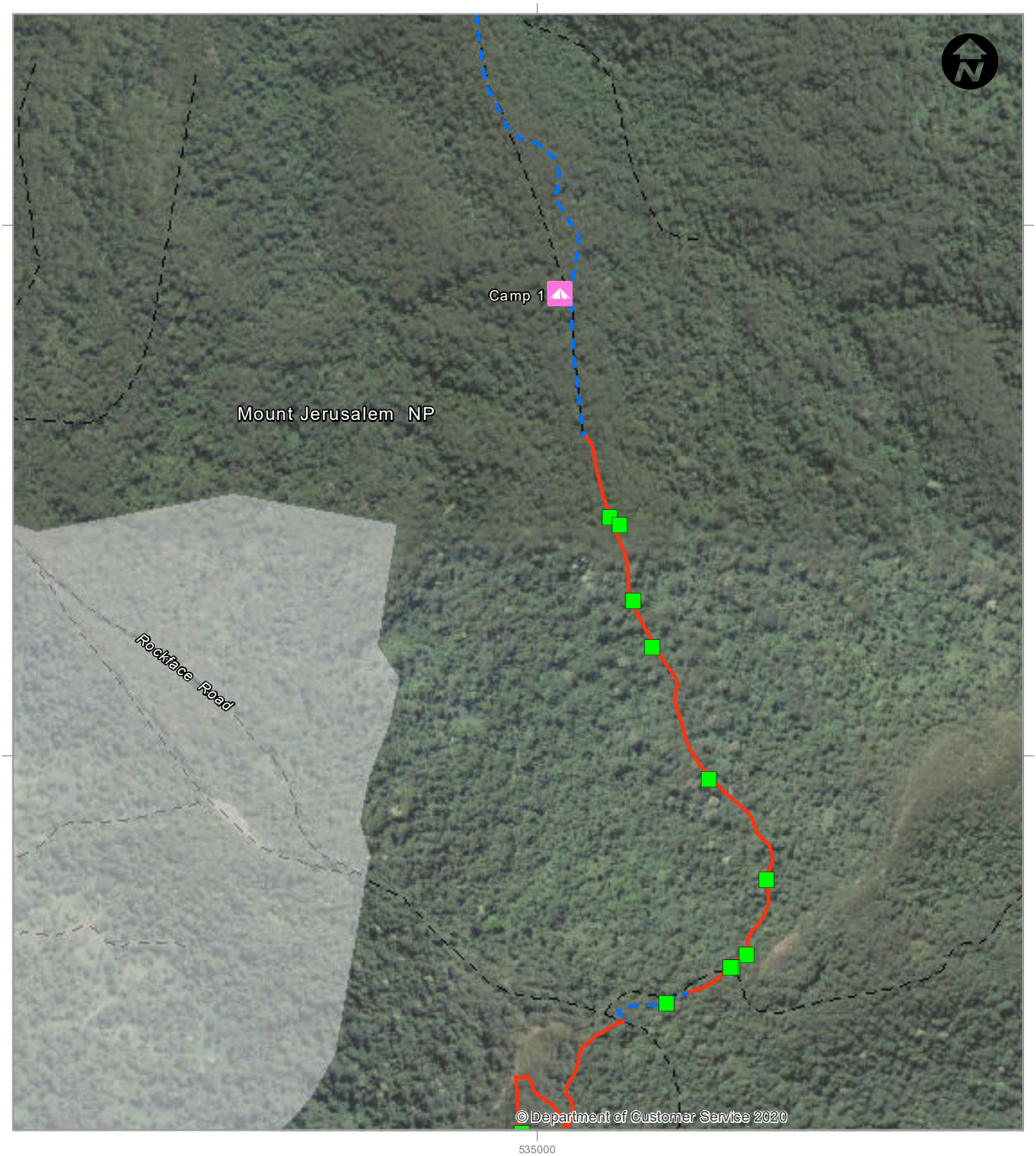

GDA 1994 MGA Zone 56

LEGEND

- Existing walking trail
- New walking trail
- Proposed walk-in campground
- Track-vehicular
- Non NPWS estate

0 200 Metres

Hollow-bearing Trees
Illustration 6.2 - Sheet 3 of 12

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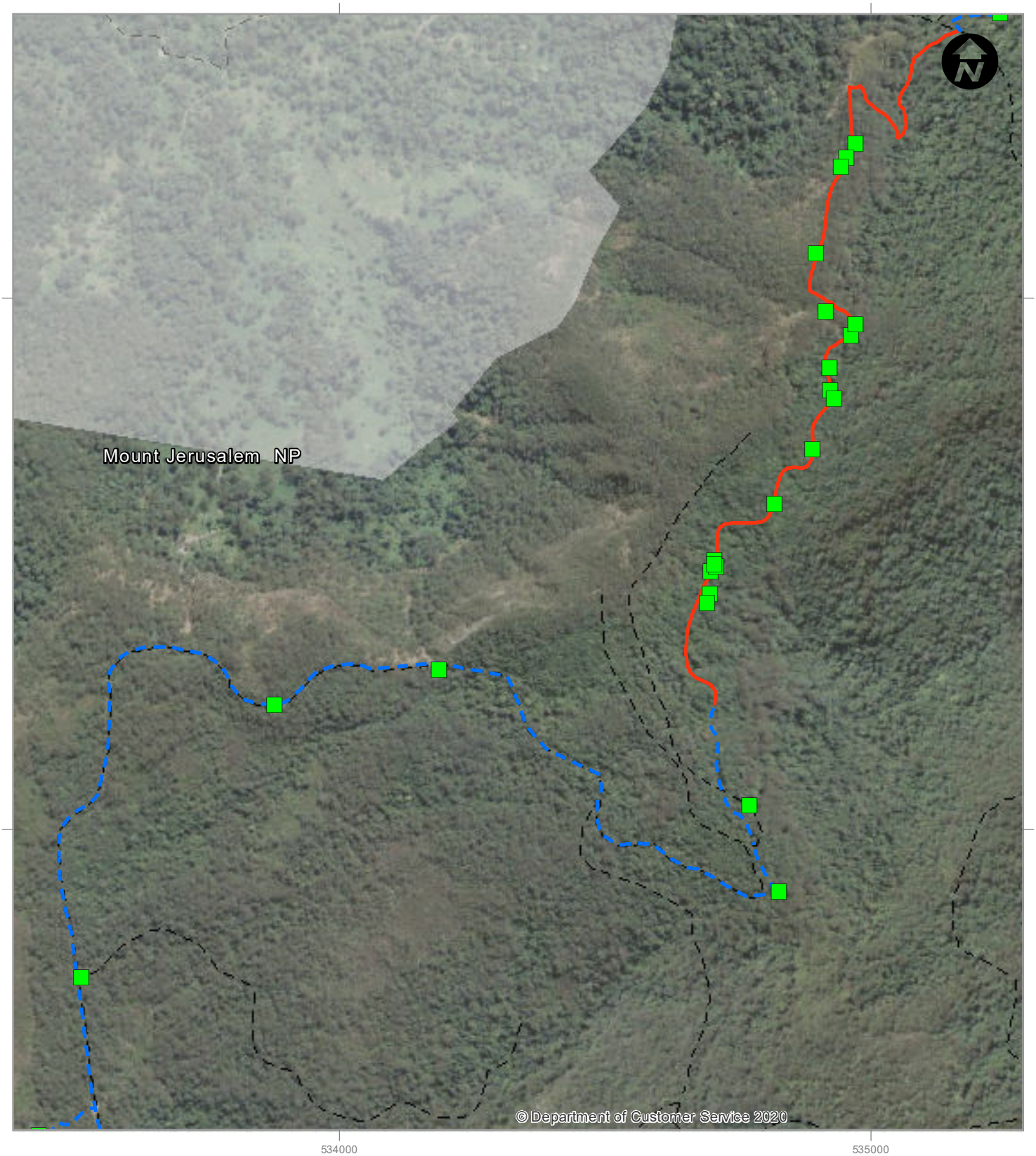
Source of base data: DFSI
Date: 27/07/2022
Revision: B



GDA 1994 MGA Zone 56

LEGEND

- Existing walking trail
- New walking trail
- Track-vehicular
- Non NPWS estate

0 200 Metres

Hollow-bearing Trees
Illustration 6.2 - Sheet 4 of 12

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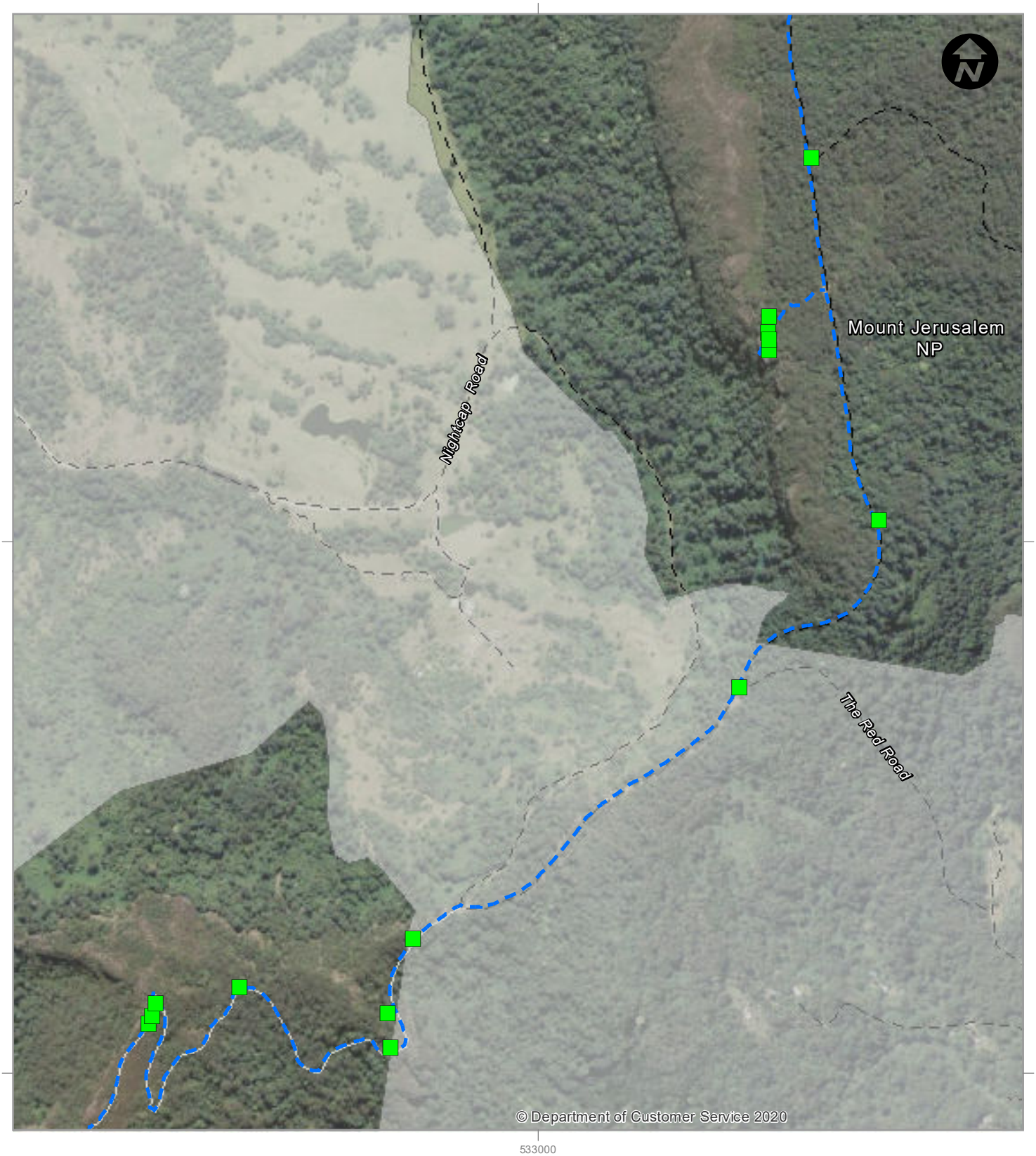
Source of base data: DFSI
Date: 27/07/2022
Revision: B



GDA 1994 MGA Zone 56

LEGEND

- Existing walking trail
- Path
- Track-vehicular
- Non NPWS estate

0 200 Metres

Hollow-bearing Trees
Illustration 6.2 - Sheet 5 of 12

Information shown is for illustrative purposes only
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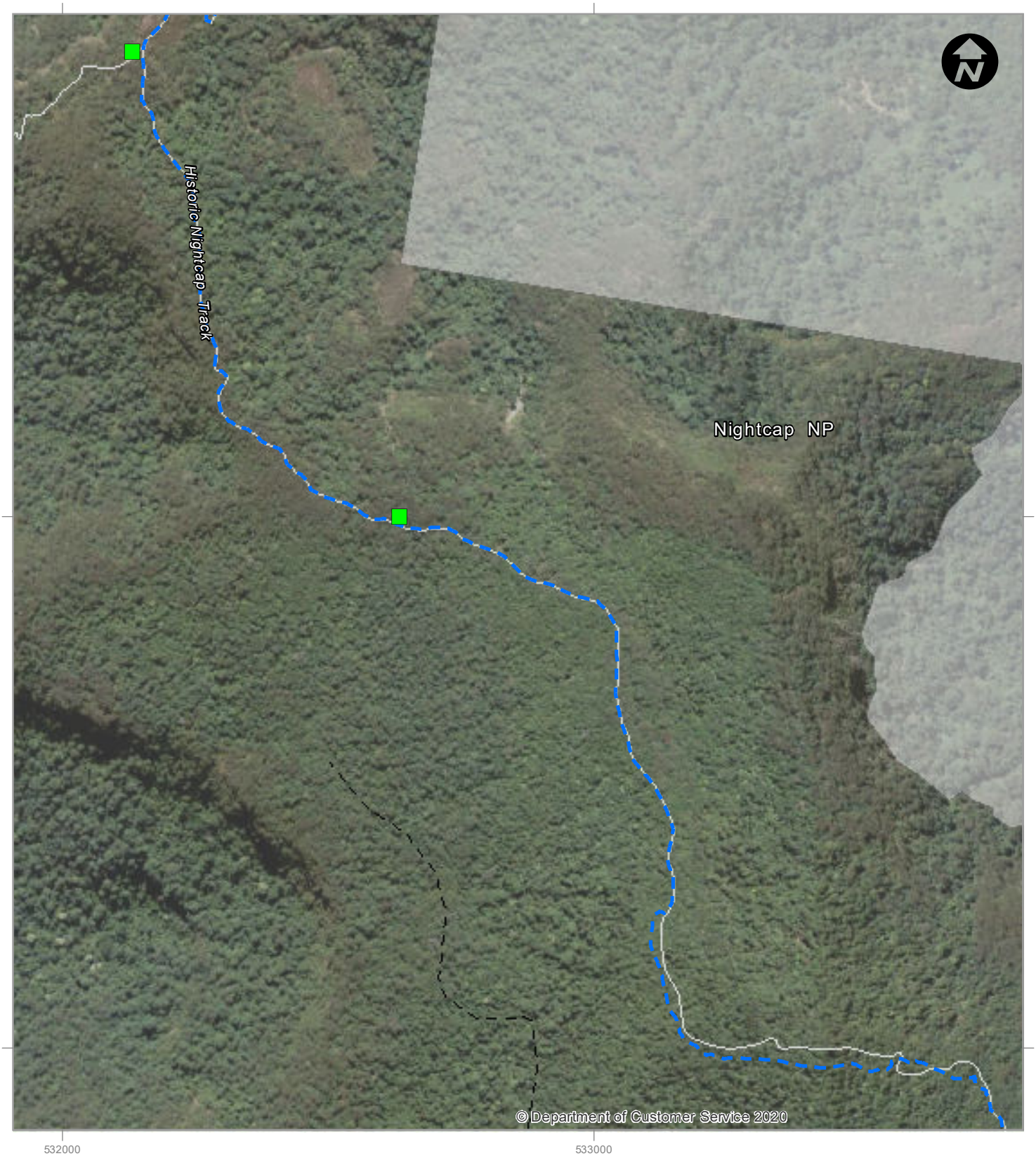
Source of base data: DFSI
Date: 27/07/2022
Revision: B



GDA 1994 MGA Zone 56

LEGEND

- Existing walking trail
- Path
- Track-vehicular
- Non NPWS estate

0 200 Metres

Hollow-bearing Trees
Illustration 6.2 - Sheet 6 of 12

Information shown is for illustrative purposes only
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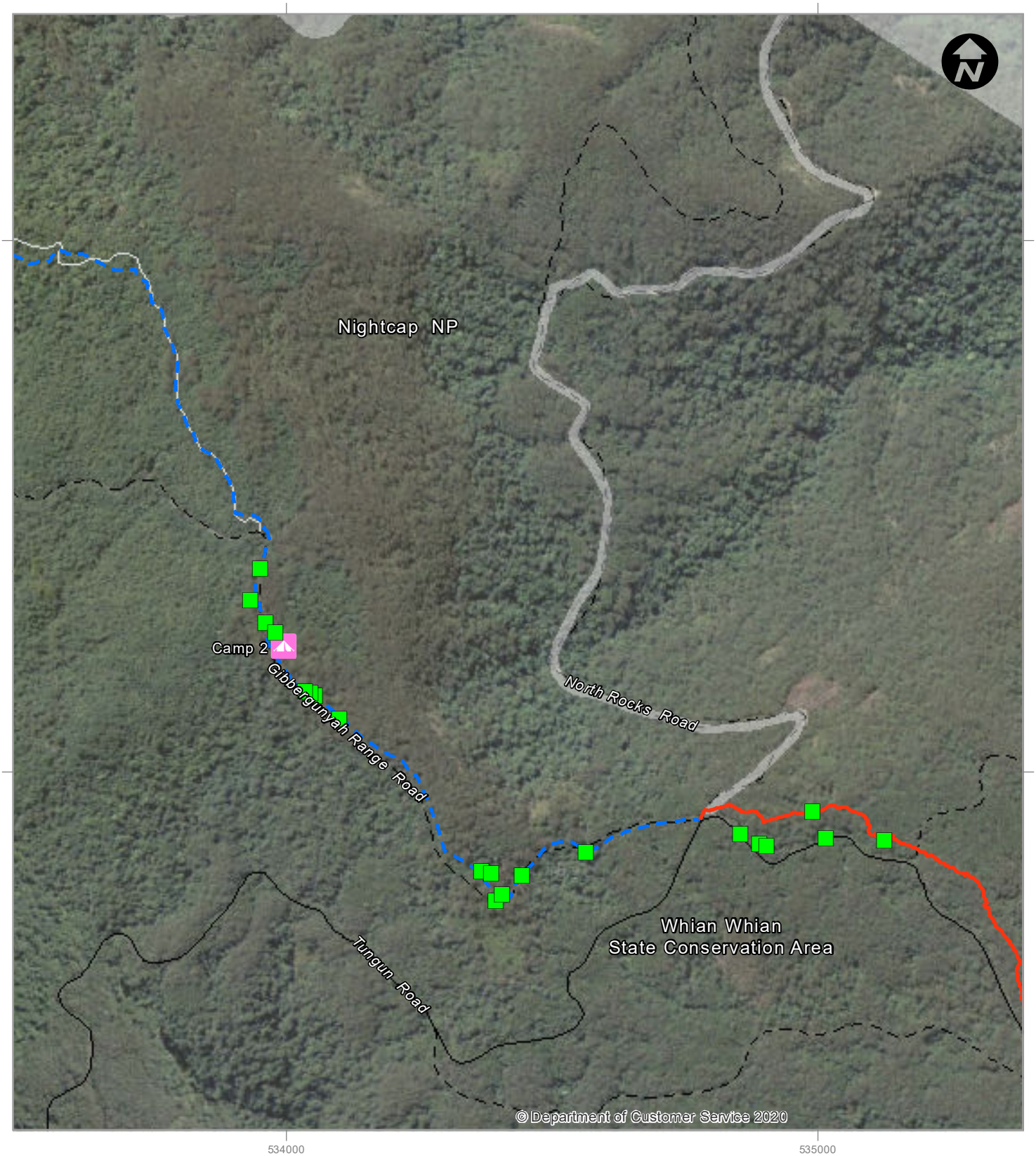
Source of base data: DFSI
Date: 27/07/2022
Revision: B



GDA 1994 MGA Zone 56

LEGEND

- Existing walking trail
- New walking trail
- Proposed walk-in campground
- Local road
- Path
- Track-vehicular
- Non NPWS estate

0 200 Metres

Hollow-bearing Trees
Illustration 6.2 - Sheet 7 of 12

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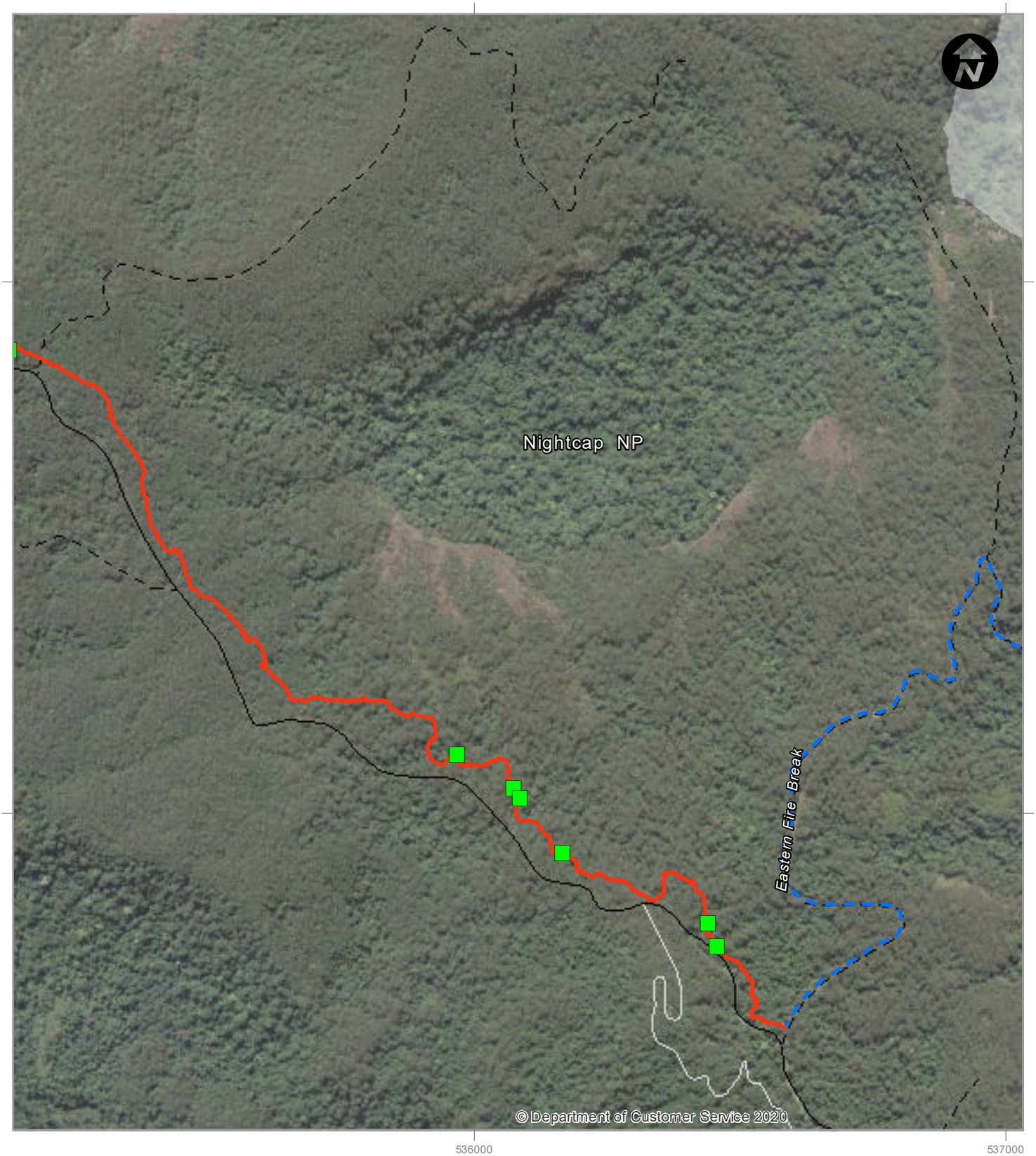
Source of base data: DFSI
Date: 27/07/2022
Revision: B



GDA 1994 MGA Zone 56

LEGEND

- Existing walking trail
- New walking trail
- Local road
- Path
- Track-vehicular
- Non NPWS estate

0 200 Metres

Hollow-bearing Trees
Illustration 6.2 - Sheet 8 of 12

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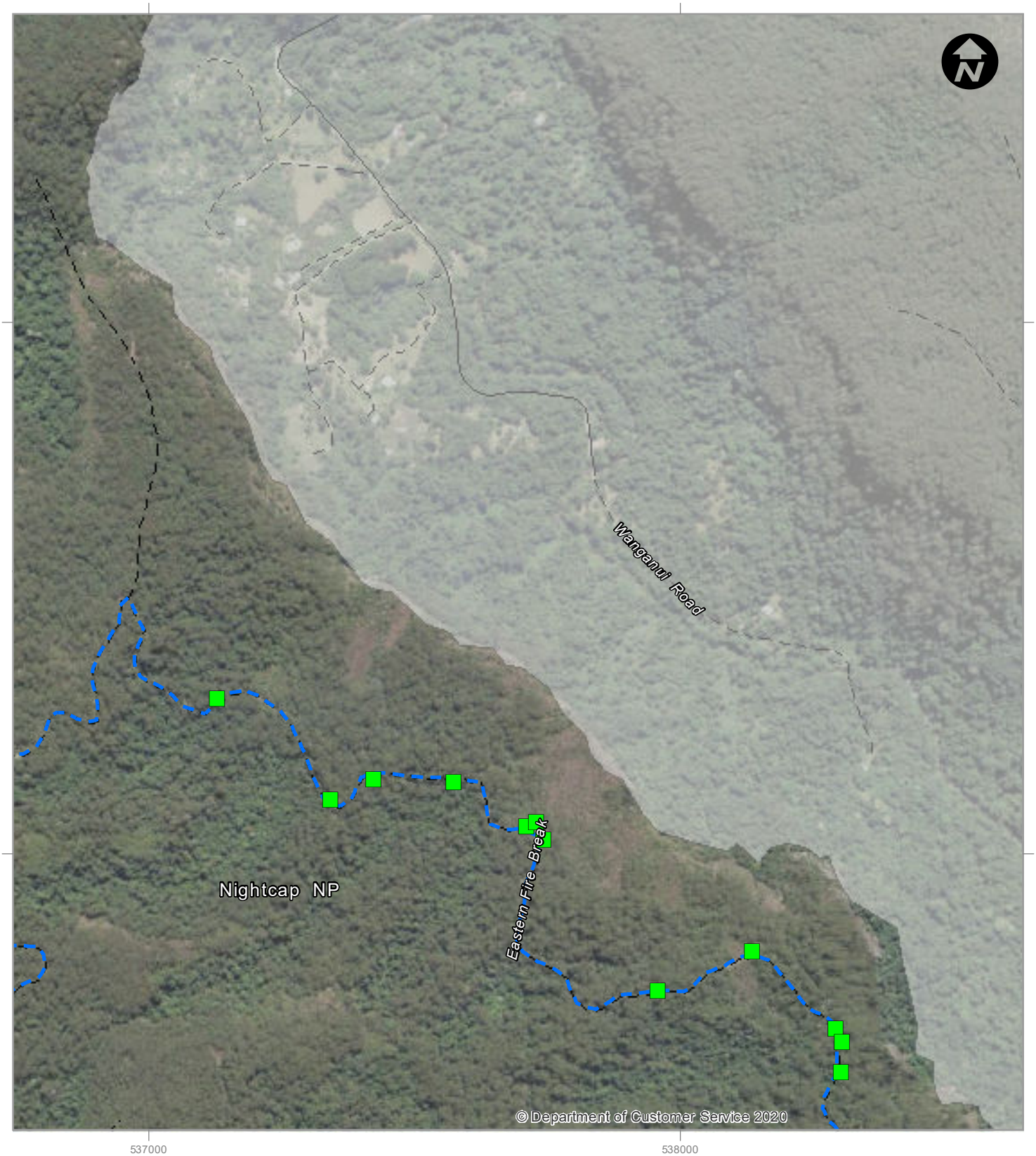
Revision: B



GDA 1994 MGA Zone 56

LEGEND

- Existing walking trail
- Non NPWS estate
- Local road
- Track-vehicular

0 200 Metres

Hollow-bearing Trees
Illustration 6.2 - Sheet 9 of 12

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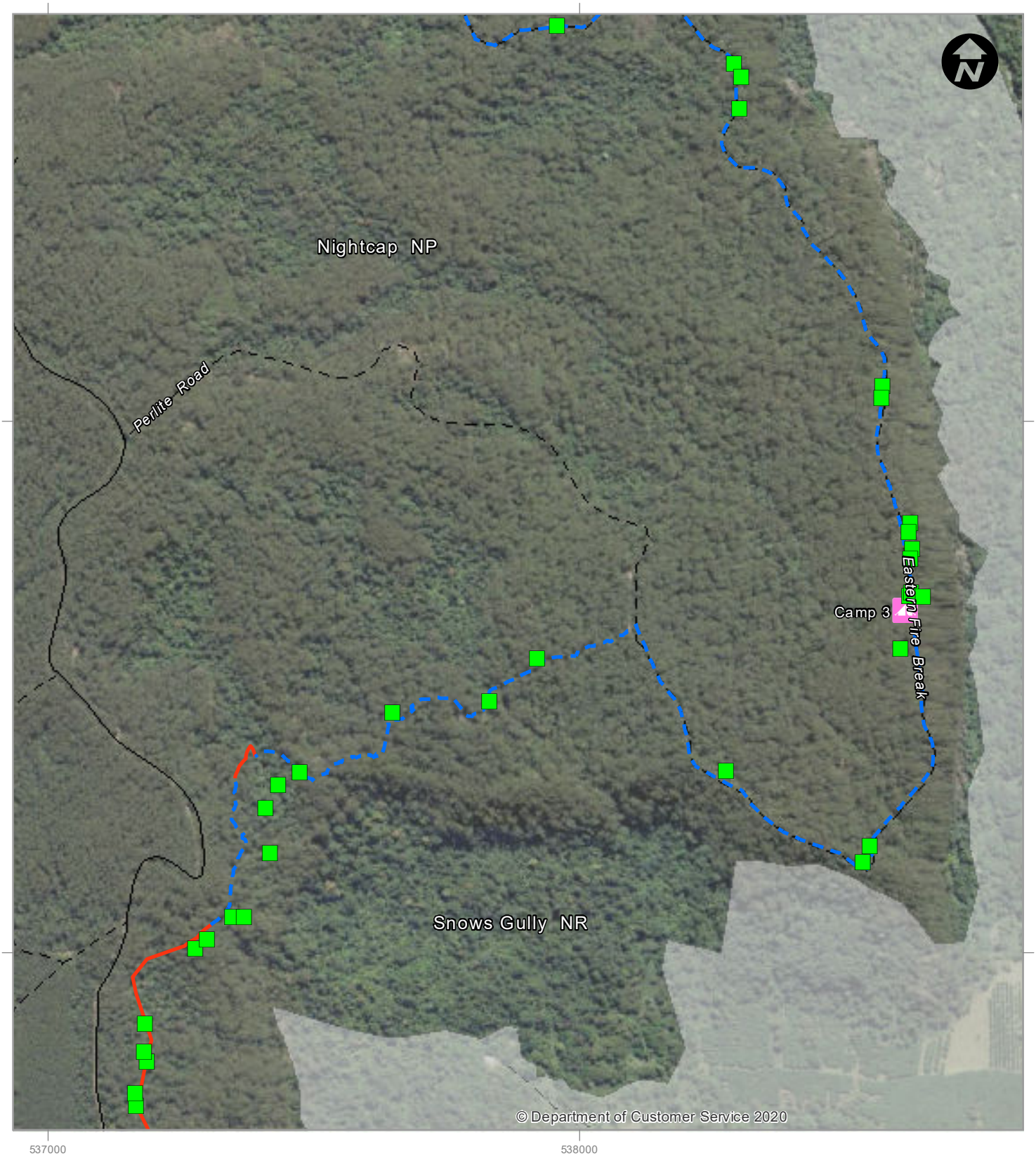
Source of base data: DFSI
Date: 27/07/2022
Revision: B



GDA 1994 MGA Zone 56

LEGEND

- Existing walking trail
- New walking trail
- Proposed walk-in campground
- Local road
- Track-vehicular
- Non NPWS estate

0 200 Metres

Hollow-bearing Trees
Illustration 6.2 - Sheet 10 of 12

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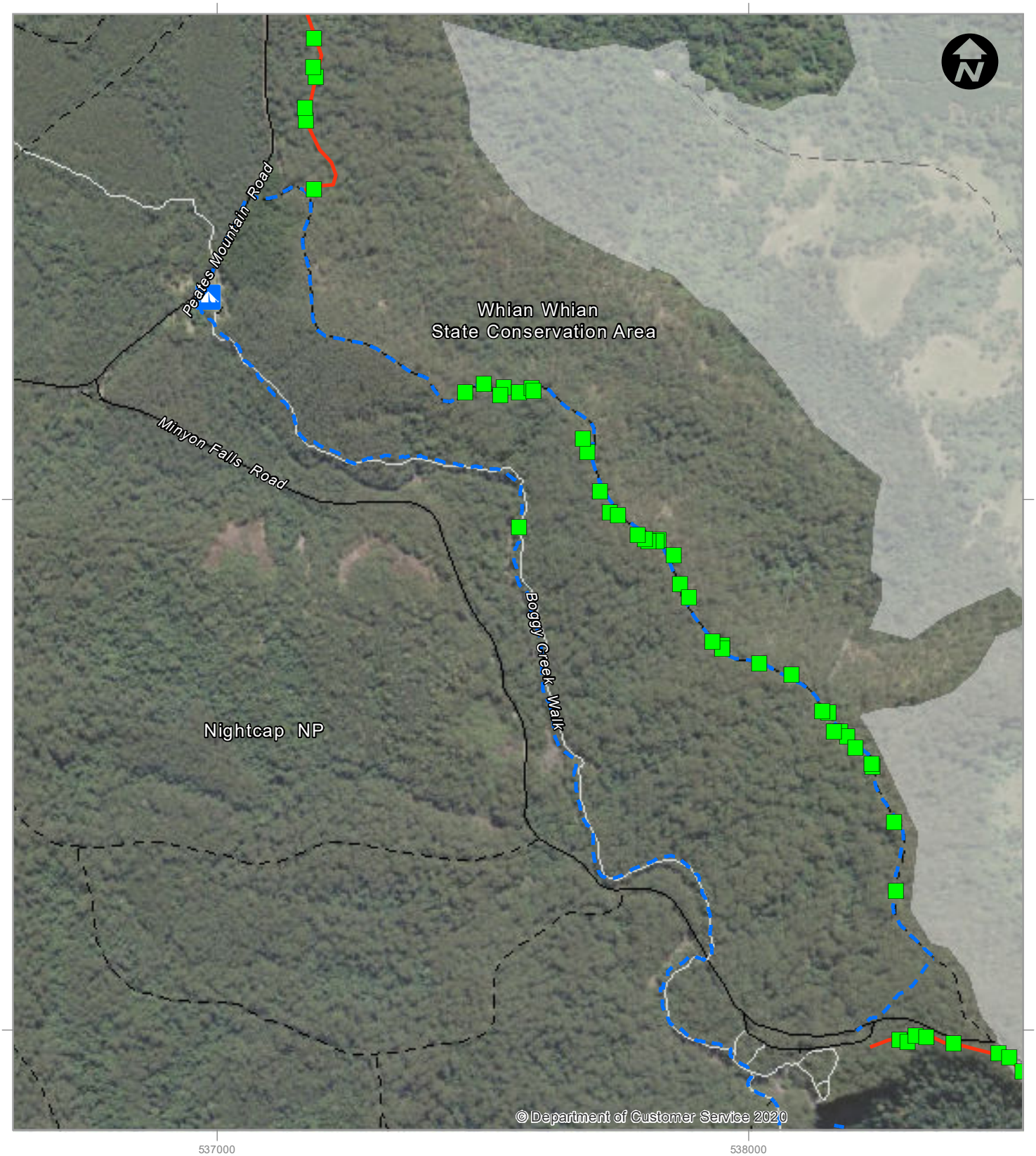

GDA 1994 MGA Zone 56

LEGEND

- Existing walking trail
- New walking trail
- Existing campground
- Local road
- Path
- Track-vehicular
- Non NPWS estate

0 200 Metres

Hollow-bearing Trees
Illustration 6.2 - Sheet 11 of 12

Information shown is for illustrative purposes only
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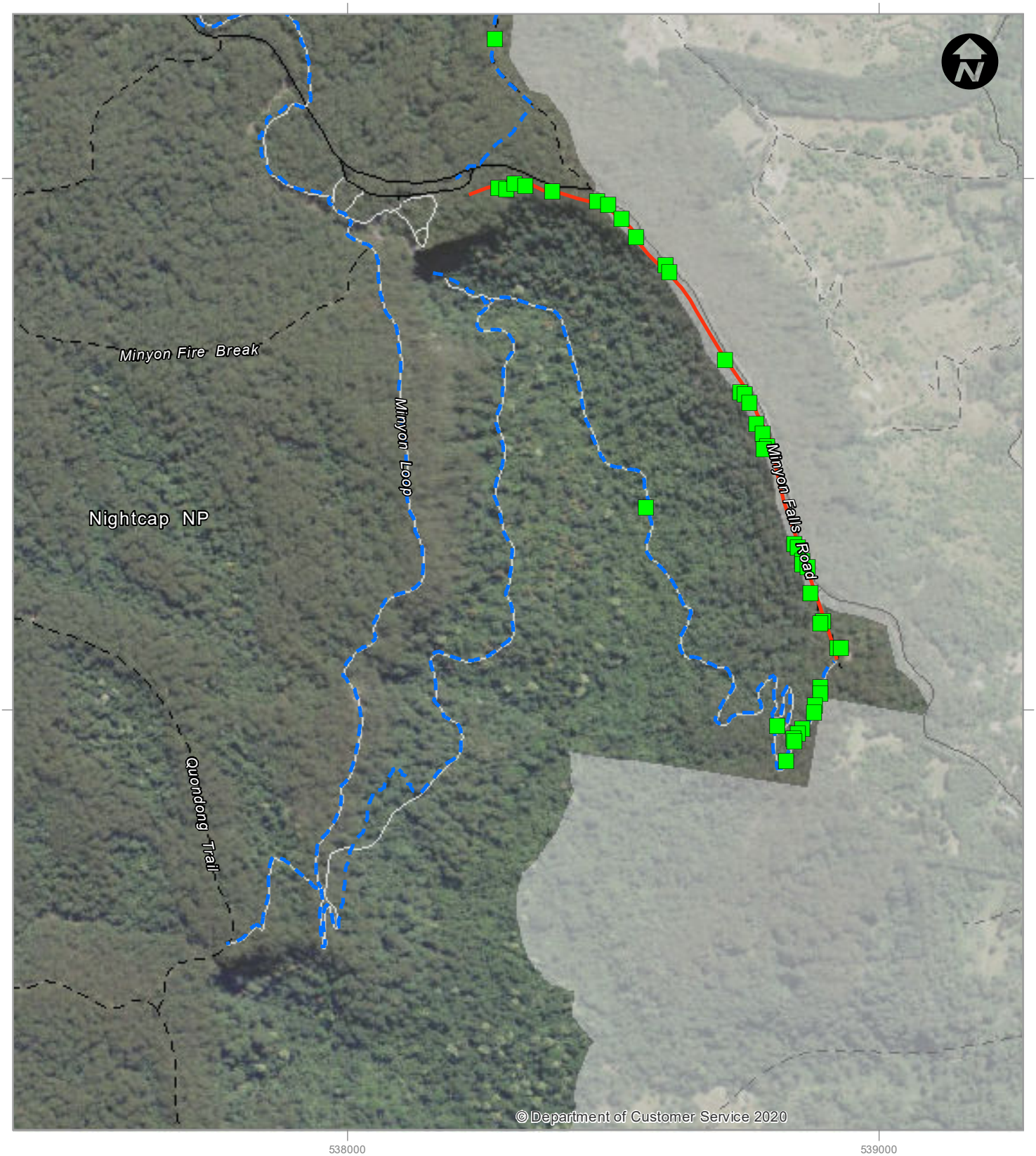
Date: 27/07/2022
Revision: B



GDA 1994 MGA Zone 56

LEGEND

- Existing walking trail
- New walking trail
- Local road
- Path
- Track-vehicular
- Non NPWS estate

0 200 Metres

Hollow-bearing Trees
Illustration 6.2 - Sheet 12 of 12

Information shown is for illustrative purposes only
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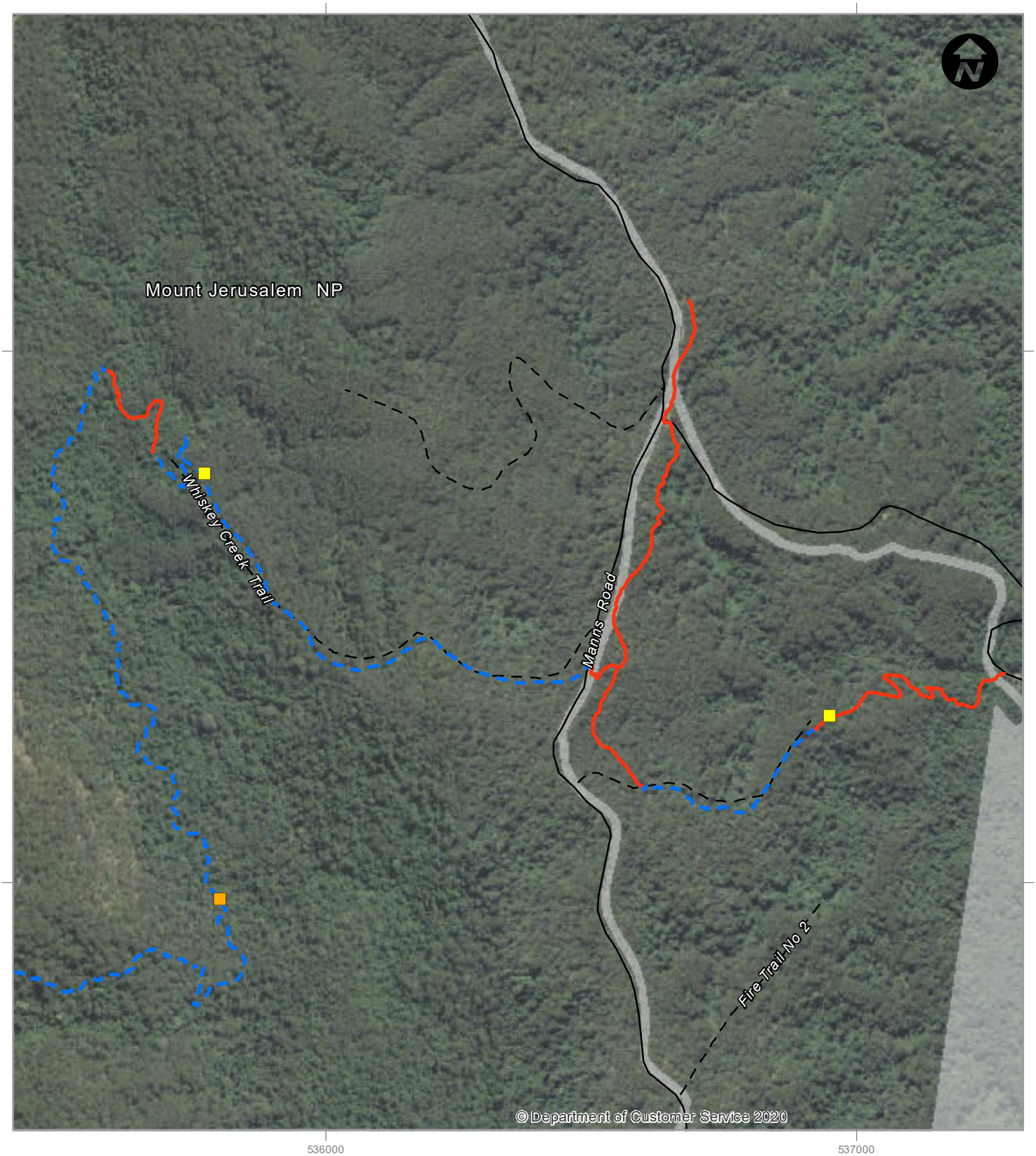
Source of base data: DFSI
Date: 27/07/2022
Revision: B



LEGEND

- Existing walking trail
- New walking trail
- Local road
- Track-vehicular
- Albert's Lyrebird
- Koala
- Non NPWS estate

0 200 Metres

Threatened Fauna Records
Illustration 6.3 - Sheet 1 of 9

Information shown is for illustrative purposes only
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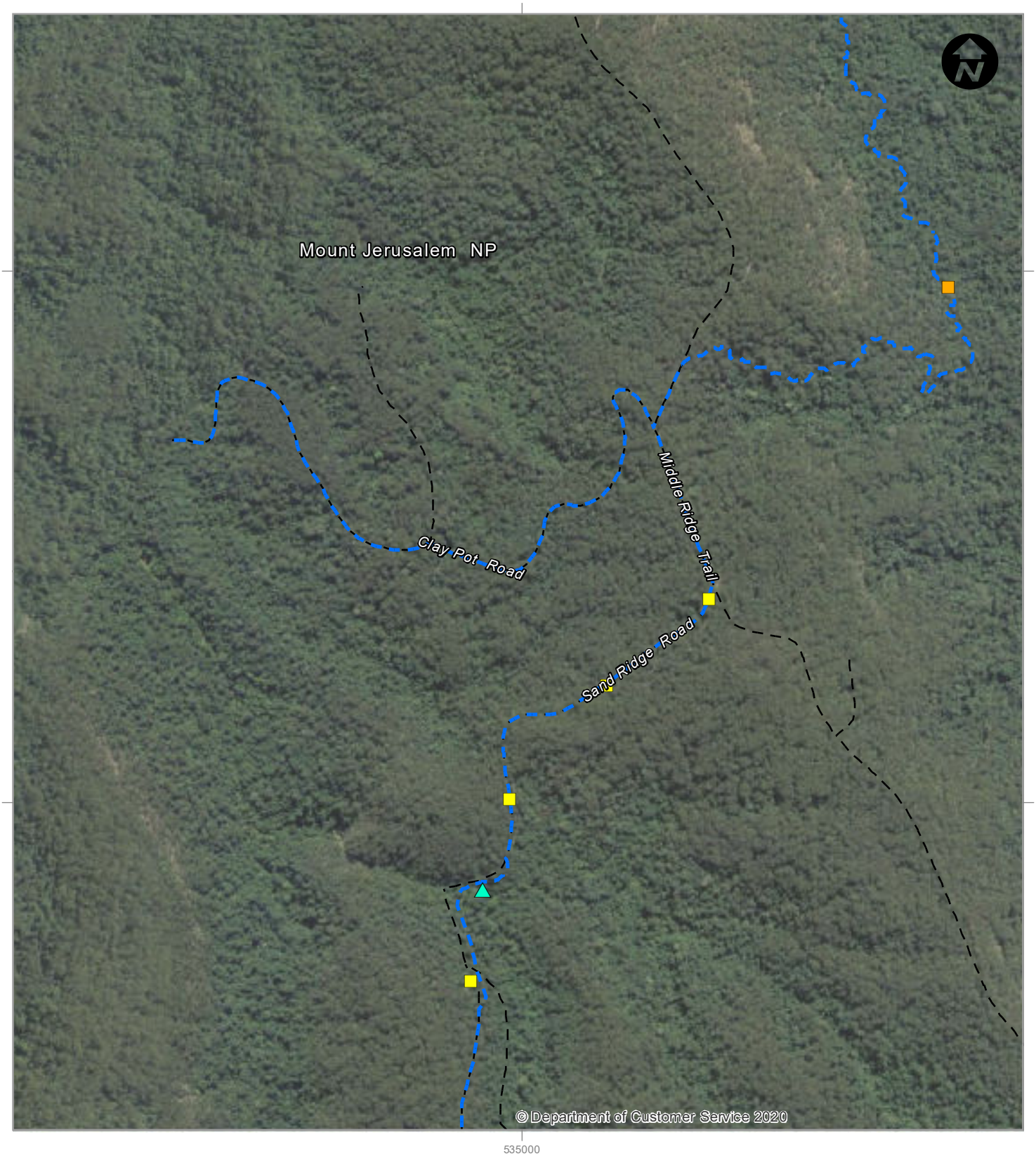
Source of base data: DFSI
Date: 25/07/2022
Revision: B



LEGEND

- Existing walking trail
- Track-vehicular
- Albert's Lyrebird
- Koala
- Wompoo Fruit-Dove

0 200 Metres

Threatened Fauna Records
Illustration 6.3 - Sheet 2 of 9

Information shown is for illustrative purposes only
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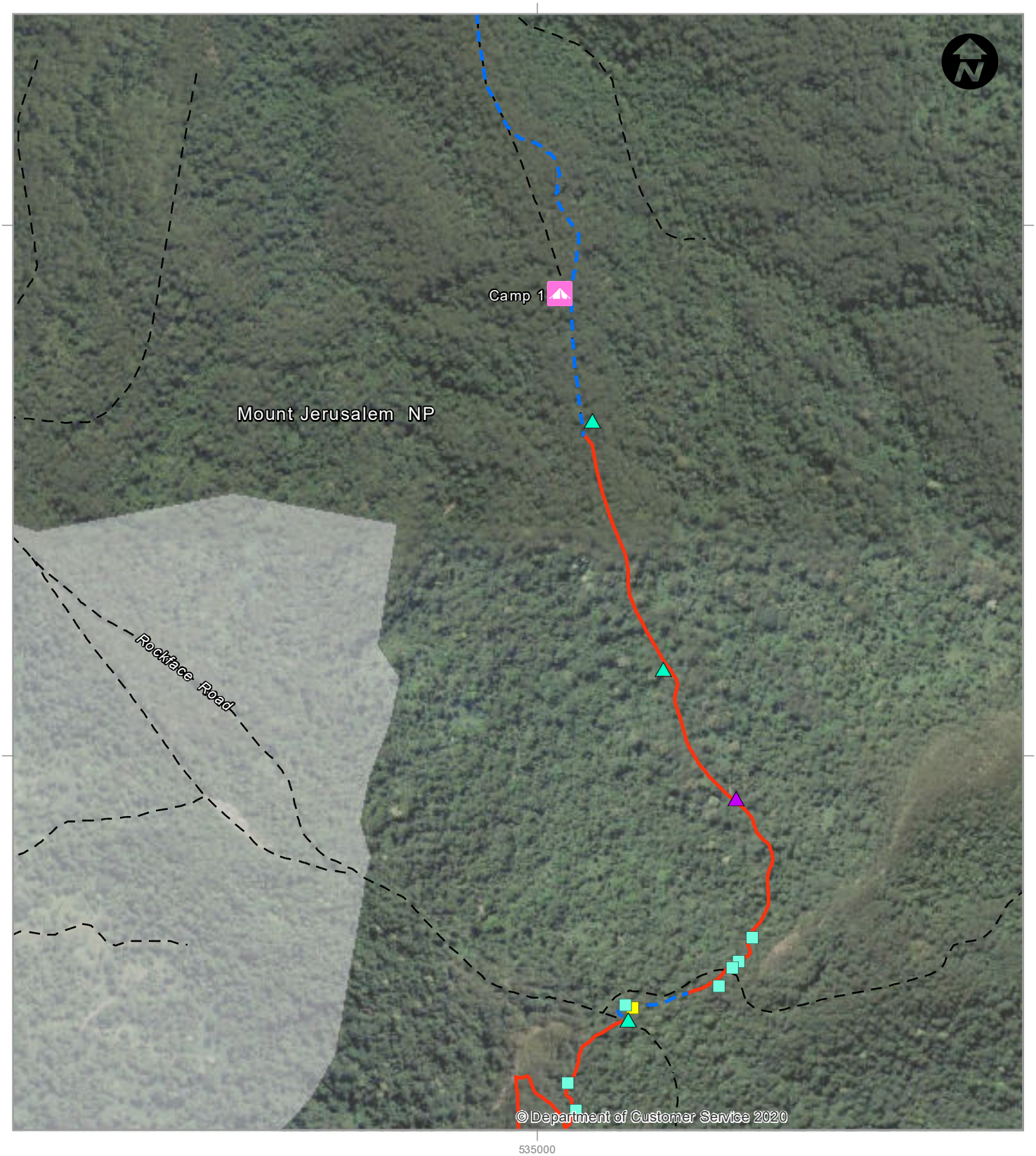
Source of base data: DFSI
Date: 25/07/2022
Revision: B



LEGEND

- Existing walking trail
- New walking trail
- Proposed walk-in campground
- Track-vehicular
- Albert's Lyrebird
- Pouched Frog
- White-eared Monarch
- Wompoo Fruit-Dove
- Non NPWS estate

0 200 Metres

Threatened Fauna Records
Illustration 6.3 - Sheet 3 of 9

Information shown is for illustrative purposes only
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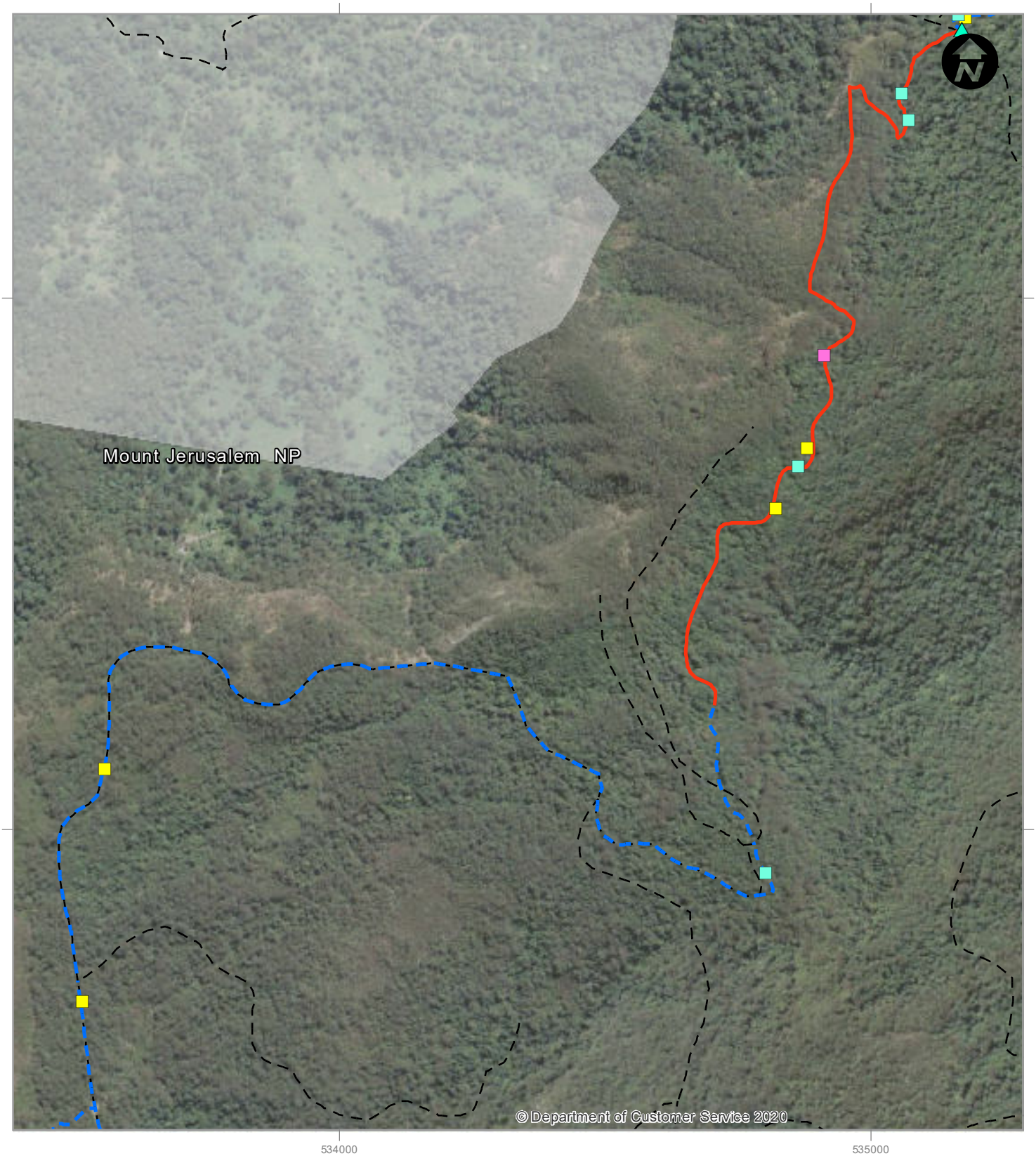
Source of base data: DFSI
Date: 25/07/2022
Revision: B



LEGEND

- Existing walking trail
- New walking trail
- Track-vehicular
- Albert's Lyrebird
- Loveridge's Frog
- Pouched Frog
- Wompoo Fruit-Dove
- Non NPWS estate

0 200 Metres

Threatened Fauna Records
Illustration 6.3 - Sheet 4 of 9

Information shown is for illustrative purposes only
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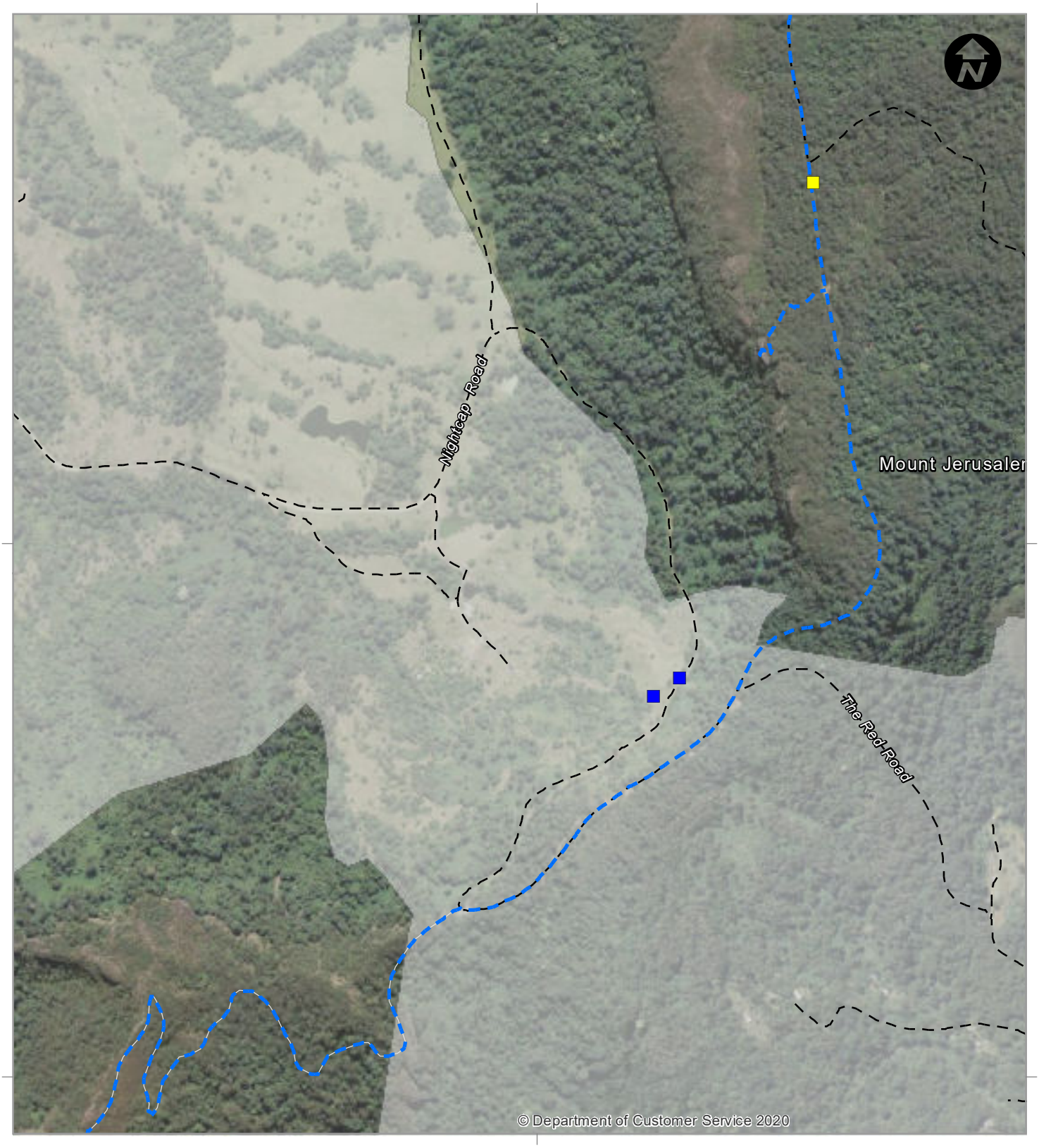
Source of base data: DFSI
Date: 25/07/2022
Revision: B



LEGEND

- Existing walking trail
- Albert's Lyrebird
- Pale vented Bush hen
- Non NPWS estate
- Path
- Track-vehicular

0 200 Metres

Threatened Fauna Records
Illustration 6.3 - Sheet 5 of 9

Information shown is for illustrative purposes only
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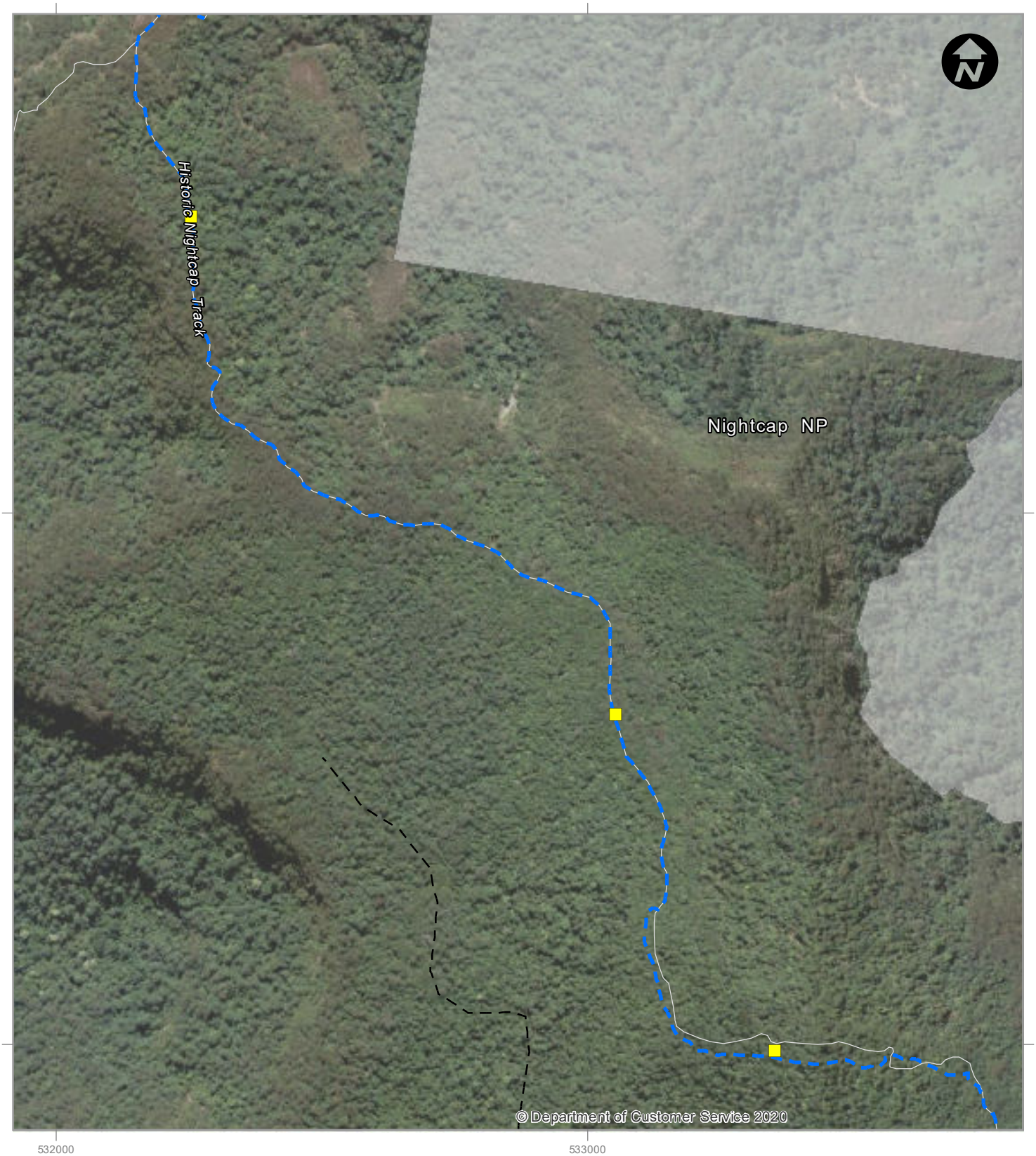
Source of base data: DFSI
Date: 25/07/2022
Revision: B



LEGEND

- Existing walking trail
- Albert's Lyrebird
- Non NPWS estate
- Path
- Track-vehicular

0 200 Metres

Threatened Fauna Records
Illustration 6.3 - Sheet 6 of 9

Information shown is for illustrative purposes only
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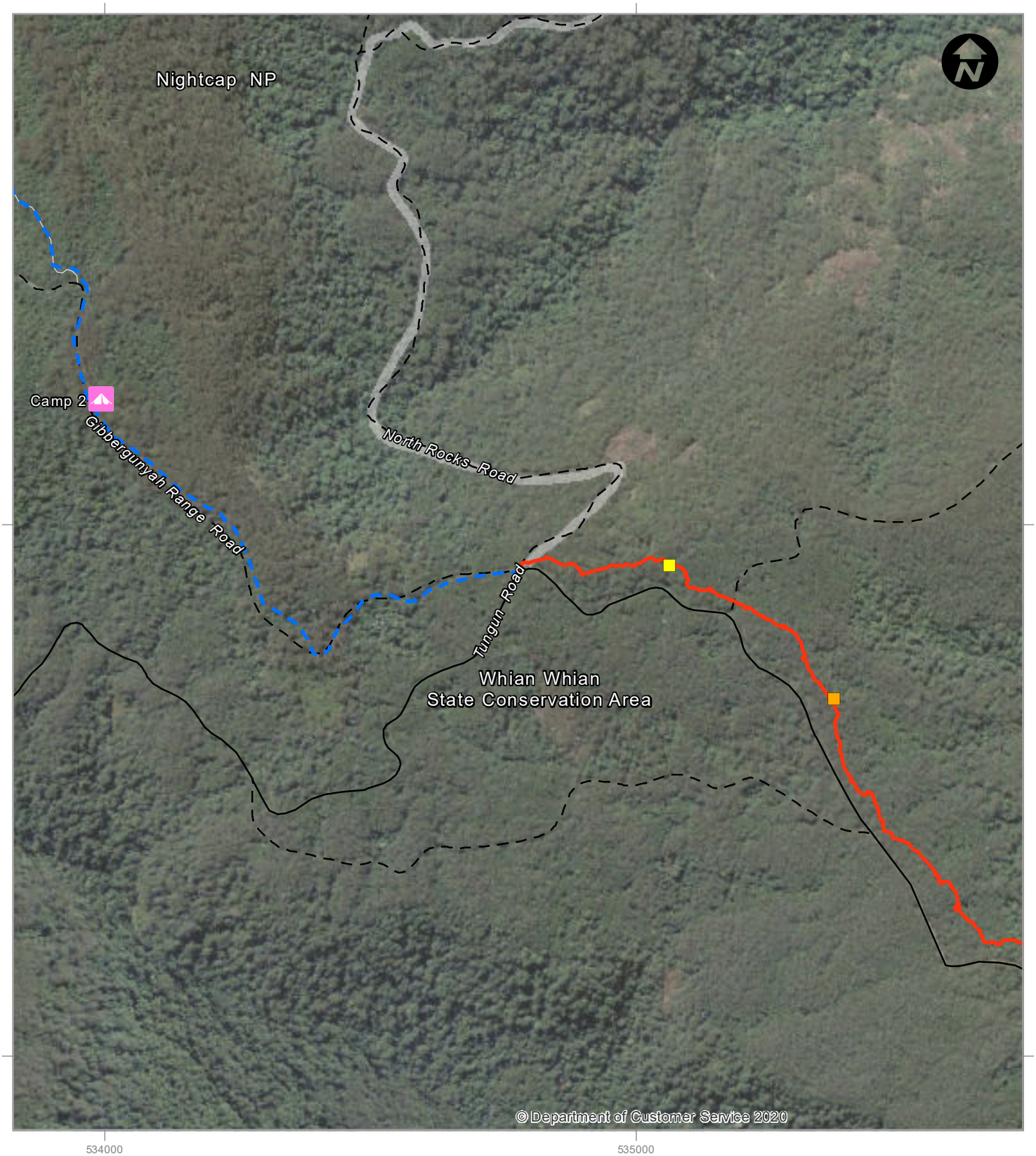
Source of base data: DFSI
Date: 25/07/2022
Revision: B



LEGEND

- Existing walking trail
- New walking trail
- Proposed walk-in campground
- Local road
- Path
- Track-vehicular
- Albert's Lyrebird
- Koala
- Non NPWS estate

0 200 Metres

Threatened Fauna Records
Illustration 6.3 - Sheet 7 of 9

Information shown is for illustrative purposes only
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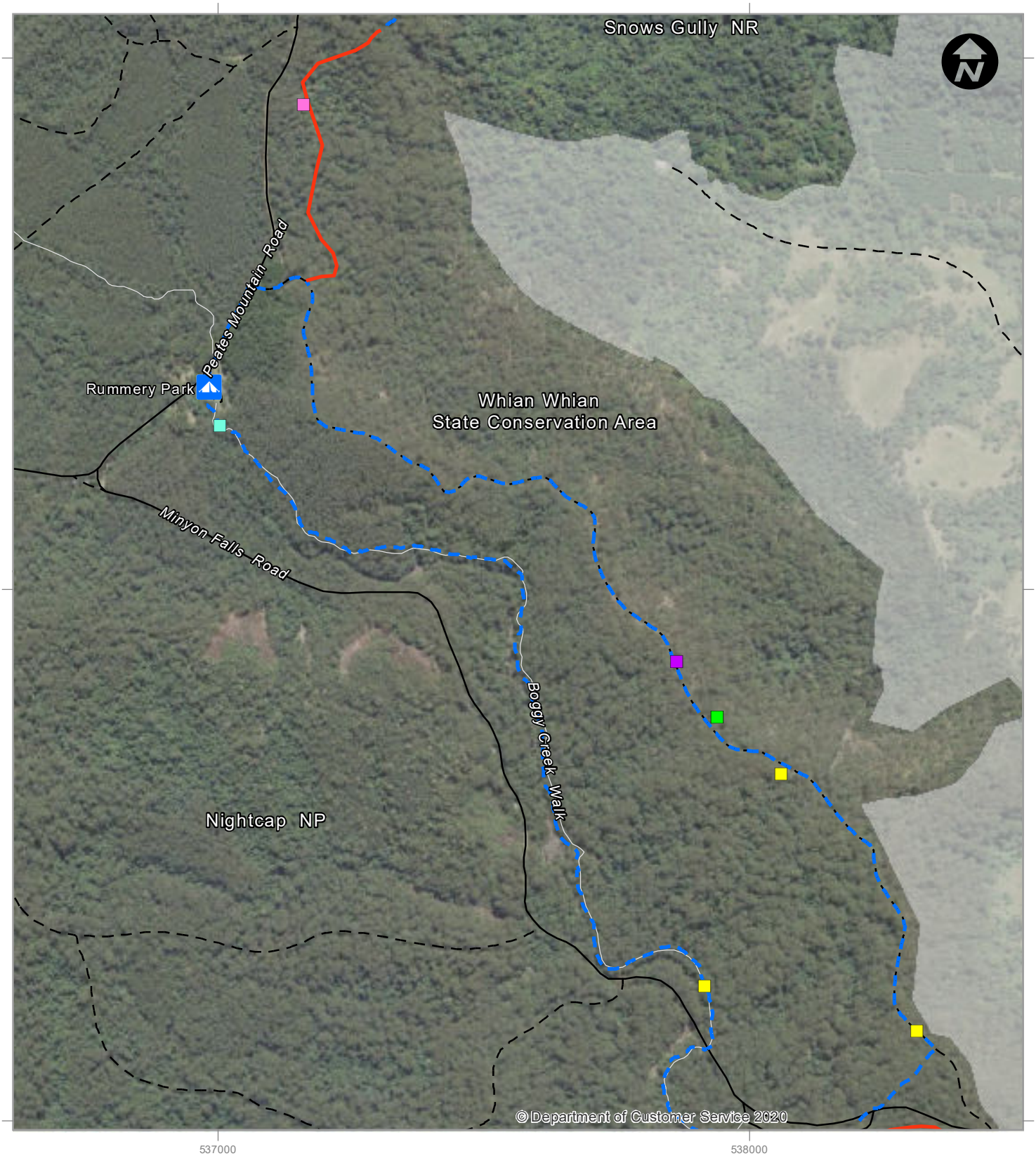
Source of base data: DFSI
Date: 25/07/2022
Revision: B



LEGEND

- Existing walking trail
- New walking trail
- Existing campground
- Local road
- Path
- Track-vehicular
- Albert's Lyrebird
- Glossy Black-cockatoo
- Little lorikeet
- Loveridge's Frog
- Pouched Frog
- Non NPWS estate

0 200 Metres

Threatened Fauna Records
Illustration 6.3 - Sheet 8 of 9

Information shown is for illustrative purposes only
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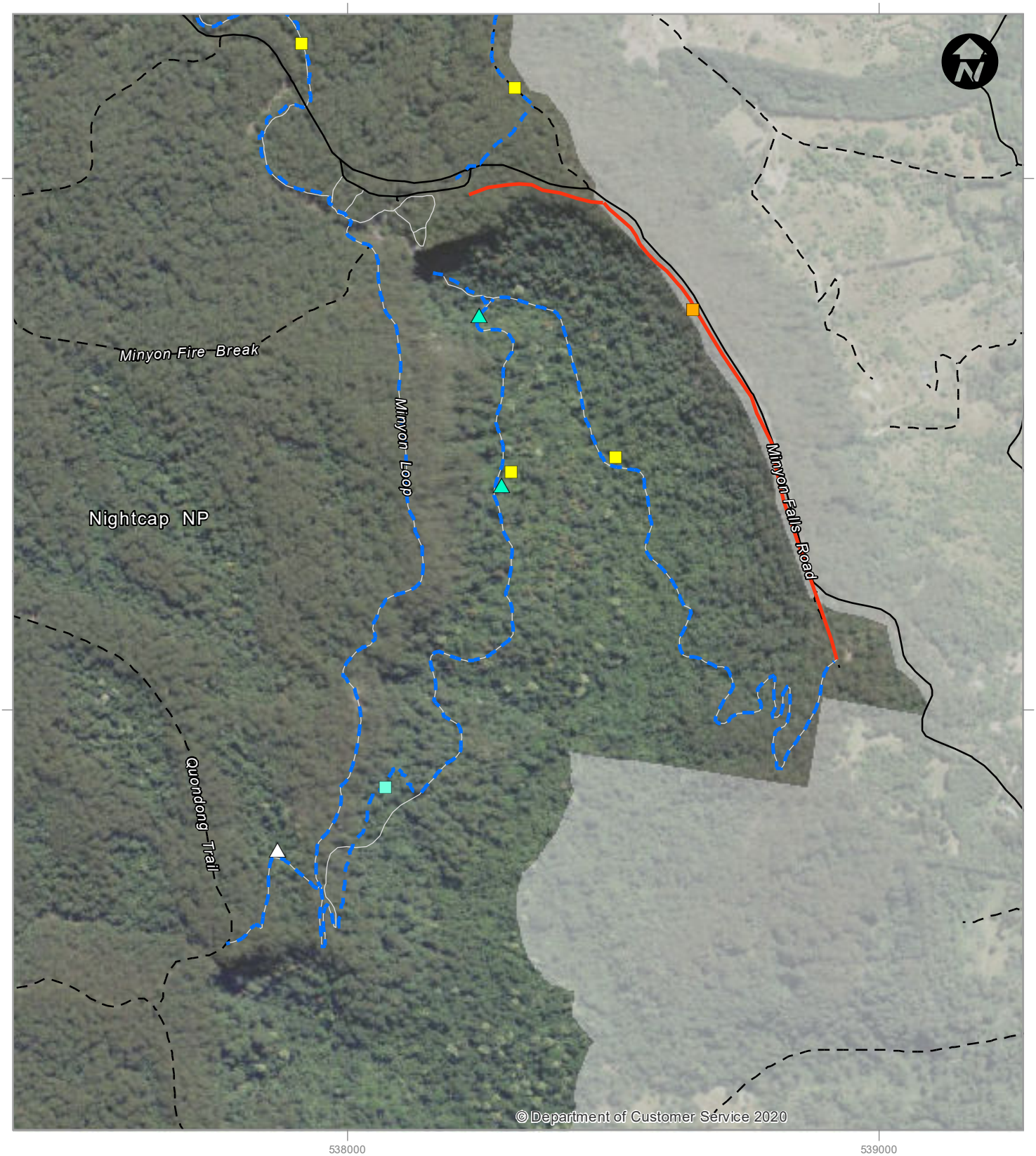
Source of base data: DFSI
Date: 25/07/2022
Revision: B



LEGEND

- Existing walking trail
- New walking trail
- Local road
- Path
- Track-vehicular
- Albert's Lyrebird
- Koala
- Pouched Frog
- Sooty Owl
- Wompoo Fruit-Dove
- Non NPWS estate

0 200 Metres

Threatened Fauna Records
Illustration 6.3 - Sheet 9 of 9

Information shown is for illustrative purposes only
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Source of base data: DFSI
Date: 25/07/2022
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7. Constraints, Impacts and Mitigation

7.1 Biodiversity Values and Constraints

While the TBHT typically occurs within previously disturbed environments (existing tracks and trails), several environmental constraints relevant to the project require consideration:

1. **Threatened flora:** fifteen threatened species were recorded at numerous locations and consideration of direct and indirect impacts is required. Potential direct impacts include physical removal (eg. seedlings of Tree Guinea Flower), disturbance or damage during construction. Indirect impacts relate more to the operation of the TBHT with potential for threatened plants to be damaged, picked or vandalised by walkers. There is also potential for the introduction of pests and pathogens (refer below).

2. **Rainforest:** the TBHT traverses areas of rainforest characteristic of the TEC *Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions.* Some areas of rainforest are intact communities where track formation is required (refer to **Illustration 5.1**). While these impacts represent a fraction of rainforest communities within the reserves (refer to **Table 5.2**), impacts on sensitive high conservation environments (which also contained habitat for threatened species) are a priority for biodiversity management.

3. **Native vegetation removal:** native vegetation removal will be required over a substantial part of the TBHT, ranging from minor clearing of regrowth to clearing within intact communities.

4. **Introduction of weeds and pathogens:** construction and operation of the TBHT risks introducing or intensifying the plant pathogens Myrtle Rust and Cinnamon Fungus. Two threatened flora along the TBHT (Scrub Turpentine, Peach Myrtle) are highly susceptible to Myrtle Rust. Introduction and spread of weed species may also result from construction and operation of the TBHT.

5. **Impacts to threatened fauna habitat:** a diverse range of threatened fauna are known to use the TBHT locality, with eight species recorded during field assessments. Impacts are most likely to be from disturbance within key habitats (eg. nesting habitats, water quality impacts at watercourses [frog habitat]).

6. **Disturbance to fauna during construction:** the presence and operation of vehicles and plant would create noise and disturbance over a substantial timeframe along the TBHT route.

7. **Intensification of use:** while parts of the TBHT are currently used by the public for recreation (bushwalking, mountain biking, horse-riding, swimming etc), levels of use (outside Minyon Falls) are very low. The TBHT will intensify human activity and facilitate access to parts of the reserves to increased visitor numbers and activity.

The construction and operation of the TBHT of the site may result in a number of direct and indirect biodiversity impacts would occur during both the construction and operational stages of the project, with the majority of impacts occurring during construction and establishment works.

Impacts to natural heritage values of the TBHT are further discussed in **Section 7.2** and **Section 7.3**.

7.2 Construction impacts

Potential construction impacts may include:

- Loss of native vegetation.
- Disturbance within and proximate to threatened flora habitat.
- Direct impacts to regenerating seedlings (n = 86) of Tree Guinea Flower.
- Disturbance to rainforest communities.
- Introduction and transmission of Myrtle Rust (and other pathogens).
- Localised disturbance to fauna from noise and disturbance.
- Potential for spread and/ or introduction of weeds or pests (eg. Yellow Crazy Ants).
- Potential injury or mortality of native fauna during vegetation clearing works or earth works.
- Potential for impacts to waterways during works (eg. spills, erosion/ sedimentation etc).
- Noise from vehicles, plant, helicopters and personnel.

Construction impacts on the natural heritage values of the TBHT are discussed in detail below:

7.2.1 Clearing of Native Vegetation

An estimated 10.59 km of the TBHT would require impacting native vegetation along a 2 m wide disturbance corridor, with localised disturbance at the three camps (refer to **Tables 5.6 - 5.8**). The greatest impacts to vegetation/habitat will occur within areas of undisturbed vegetation, which total approximately 10.59 km (refer **Illustration 5.1**) and includes an estimated 3.42 km of rainforest.

Due to the relatively small footprint of disturbance required for the tracks and camps, no mature trees would require removal. Rather works would use a small excavator to remove shrubs, midstorey vines (eg. *Calamus muelleri*) and groundcovers (eg. *Lomandra spicata*) to the minimum extent necessary, Track making works would be completed by hand in sensitive environments (eg. rainforest).

Other vegetation impacts may include:

- Minor pruning of several native trees (Sally Wattle, Macaranga) would be required along the verge of the Nightcap Track where it leads up to the Doon Doon saddle to allow vehicle passage. No trees would require removal.
- Selective vegetation removal would be required at the three camps (~0.9 ha in total) for the siting of infrastructure and facilities, with vegetation impacts reduced to the minimum extent necessary.
- Minor disturbance within existing formalised walking tracks.

7.2.2 Clearing of Exotic Vegetation

Nominal clearing/ slashing of exotic vegetation (Lantana, Setaria, Paspalum) would be required along the verge of the Nightcap Track where it leads up to the Doon Doon saddle. Pasture grasses along the Doon Doon saddle along the road formation would also be slashed. Machine operations have potential to spread seeds and propagules of weed species in these disturbed areas.

7.2.3 Threatened Flora

In principle, all threatened flora will be retained in-situ on the basis of the 'avoid and minimise' principle and they would not be directly (physically) impacted by construction works. However, it must be acknowledged there is potential for accidental disturbance or damage to threatened flora which are easily overlooked (eg. seedlings or small plants of Peach Myrtle, Tree Guinea Flower, Narrow-leaf Finger Fern) during construction (or pre-construction).

To minimise this potential, a project ecologist will supervise works in threatened flora habitat and work with track-builders to microsite tracks to avoid threatened flora (including any new germination which may have occurred since these baseline surveys have been completed) and create buffers to threatened flora where appropriate.

The exception to this is where the TBHT will directly impact 86 regenerating seedlings of Tree Guinea Flower within Section 3. This area is highly constrained by topography and the existing road formation (Peates Mountain Road) to the south. Several options were examined to minimise impacts to regenerating seedlings of Tree Guinea Flower, however the chosen alignment was the only viable option with respect of the broader project parameters. An additional study (GeoLINK, in prep.) was commissioned of other populations of Tree Guinea Flower within Nightcap NP/Whian Whian SCA to ensure impacts would not be significant on the overall population of the species.

7.2.4 Threatened Ecological Communities (Rainforest)

Tracks within areas of rainforest will be cut by hand and vegetation removal completed to the minimum extent necessary over a disturbance zone of two metres width. No trees would be removed and any fallen trees/ woody debris would be relocated. Relocation of woody debris may be substantial in some areas (particularly where there has been recent fire activity).

7.2.5 Removal of Hollow-bearing Trees

Walking track and camp design have considered retention of any hollow-bearing trees as a high priority. No standing hollow-bearing trees would require removal for construction works. There is potential that fallen trees blocking access may contain small hollows; fallen timber will be relocated and these habitat features retained.

7.2.6 Threatened Fauna

Impacts to threatened fauna during construction relate to noise and disturbance during the construction process rather than any species habitat impacts, due to the majority of threatened fauna in the locality being highly mobile and having access to substantial areas of suitable habitat. The exception to this may be where tracks cross watercourses where threatened frog habitat may occur and impacts are more localised and may include risks such as altering water quality, disturbing breeding habitat, removing leaf litter and introducing chytrid. In these instances, construction impacts are extremely localised (unlikely to be no more than a few metres wide) and of short duration.

7.2.7 Introduction and Spread of Pathogens

Myrtle Rust

Signs of infection by Myrtle Rust were observed on several Scrub Turpentine (leaf scarring) but no active infection was recorded. The status and impacts of Myrtle Rust within the three reserves is not known with any confidence. As noted (refer **Table 5.10**), low levels of Myrtle Rust infection have been recorded within populations of Peach Myrtle since 2017 and low production of flowers and fruits and high levels of leaf loss on some individuals has been recorded since that time. It is not apparent whether this is entirely as a result of Myrtle Rust infection.

With the exception of the high use area at Minyon Falls, the majority of the TBHT is remote and not highly trafficked, hence Myrtle Rust transmission is likely to be relatively low. There is also evidence that higher elevation areas are also less susceptible to Myrtle Rust (Makinson 2018). With the adoption of appropriate hygiene protocols, the risk of introducing Myrtle Rust may be managed with a reasonable degree of confidence.

Cinnamon Fungus

Testing by NPWS identified Cinnamon Fungus at 38 out of 45 sites tested along the TBHT, and it is likely widespread within the reserves, with vehicle movements providing dispersal vectors. Given this, disinfection stations were not considered necessary in the final design. Adoption of appropriate hygiene protocols will substantially reduce the movement of Cinnamon Fungus to areas offsite.

Chytrid Fungus

Amphibian chytrid fungus has led to the decline and extinction of frog populations globally and in Australia (OEH 2018). The fungus is transferred by direct contact between frogs and tadpoles or via zoospores in infected water (OEH 2018). The disease may be spread by contaminated footwear and equipment. While Chytrid is already present within the reserves, appropriate hygiene protocols would be practiced during construction to minimise the spread of this disease, in accordance with NPWS protocols (refer DPIE 2020).

7.2.8 Introduction and Spread of Weeds and Pests

Construction works may introduce weed seed/propagules to the TBHT or spread existing weeds such as exotic grasses. Weed dispersal risks would be managed by a combination of appropriate hygiene procedures (washdown etc) and pre-construction weed control (spraying out grasses within construction areas).

While Yellow Crazy Ants (*Anoplolepis gracilipes*) have been recorded in Lismore and Terania Creek, NSW DPI and Local Land Services confirm that following an extensive baiting program, no Yellow Crazy Ants have been detected since March 2019 at either location. On this basis, the likelihood of Crazy Ants being imported to the site is very low, and basic hygiene procedures for plant and equipment would address this issue. The TBHT will not require the importation of any soil or mulch, significantly reducing the risk of transport of Crazy Ants to the reserve system.

7.3 Operational impacts

Operational impacts of the TBHT may include:

- Disturbance to vegetation/ habitat (including habitat for threatened flora) from trampling from informal track making and informal 'widening' of disturbance footprints around and within camps and off tracks.
- Soil compaction and exposure from repeated trampling and disturbance within and around camps.
- Erosion of tracks by short-cutting.
- Transmission of Myrtle Rust by walkers.
- Dispersal of weed seed (eg. from Broad-leaved Paspalum along track verges).
- Rubbish dumping.
- Increased risk of fire.
- Impacts on water quality from pollutants (eg. soap, sunscreen).
- Increased dispersal opportunities for feral animals such as wild dogs and foxes.
- Localised noise/ disturbance at camps in the evening.
- Disturbance from helicopters/ vehicles accessing the TBHT for waste disposal* and maintenance works.
- Increased vehicle movements between start and end points which may increase potential for roadkill on public roads.

*Note that Camps 1 and 3 will comprise composting toilet facilities that require a small absorption trench for liquid overflow. Camp 2 will have all liquids removed due to the proximity to an ephemeral water course.

Operational impacts most likely to result are the trampling or disturbance of vegetation at camps and informal track making/ disturbance where patrons explore around side tracks or along places of interest (eg. watercourses). Limiting operational impacts would largely be minimised by the development of a code of conduct for the TBHT which would be detailed on the TBHT website and printed information. Given that the majority of walkers on multi-day hikes would be expected to behave responsibly within forest environments, operational human impacts would not be expected to be significant. The minimal impacts to surrounding environments at Rummery Park campground and around Minyon Falls day use area (both in operation for several decades) provide an indication of future expectations.

Shoe cleaning stations will be installed at the start of the track and at the three camps for managing weeds. Each station will include a bench seat, brush attached to the seat with a chain, and a gravel pit. Walkers will brush their shoes over a gravel pit, weed seeds collect in the gravel pit and NPWS staff remove/ replace the gravel within the pit on a regular basis. Weed seed would be disposed of at licensed disposal facilities.

Intensification of human impacts also needs to be considered - while the TBHT will operate on a booking process, with up to 22 patrons permitted per day, additional 'loading' of the track will also occur from people completing day walks or using the TBHT for exploration. While the levels of 'unregistered' patrons is unknown, this additional intensification of use (which cannot be controlled) would not be expected to be significant, nor impact substantially on biodiversity values.

7.4 Mitigation

7.4.1 Construction

To minimise biodiversity impacts which may result from the TBHT, a number of mitigation measures are recommended. The majority of these are relatively standard mitigation measures for construction projects where the objective is to minimise impacts to native vegetation and protect adjacent/ sensitive habitats (threatened flora, fauna habitat, waterways etc).

DPIE have recently released hygiene guidelines to protect priority biodiversity areas in NSW from Cinnamon Fungus, Myrtle Rust, amphibian chytrid fungus and invasive plants (DPIE 2020). The guidelines promote the adoption of basic hygiene procedures into daily routines when working in the field and are simple procedures to ensure potentially contaminated material is not transferred to a new, susceptible area. The Guidelines have application to pathogens which may occur along the TBHT.

Recommendations include:

- Limiting impacts on adjacent areas of native vegetation (eg. by installation of temporary fencing or flagging).
- Implementing measures to minimise the potential for the spread of weeds (eg. vehicle and plant washdown).
- Developing an 'unexpected finds' procedure for threatened flora or fauna features to reduce impacts and establish protocols for reconsideration or re-design of construction processes.
- Developing and implementing measures to minimise the potential for the spread of Myrtle Rust. This is best completed by preparation of a project specific Myrtle Rust Management Plan to cover the construction phases and operational phases of the project, based on recent best practice guidelines (refer DPIE 2020). A basic hygiene protocol for people, clothing, footwear and equipment would include:
  - Check for soil, plant material and other debris.
  - Remove all soil, plant material and other debris using a hard brush and clean water. Dispose of appropriately (at source site if possible).
  - Decontaminate boots (eg. brush and spray liberally with 70% methylated spirits / 30% water), clothing, bags, field gear and car seats (spray with 70% methylated spirits / 30% water) or machine wash.
  - Carry fresh clothing and sufficient decontamination gear.
- Implementing a Myrtle Rust monitoring program once the TBHT is operational, with measures for adaptive management of protocols and amending information on the TBHT website.
- Implementing and maintaining appropriate sediment fencing and erosion controls during construction.
- Protecting sensitive environments such as waterways by incorporating enclosures and netting to minimise potential pollution from materials and debris.

These broad actions would be supported by specific actions to be included within a Construction Environmental Management Plan (CEMP) for the construction of the project and include other measures such as:

- Re-survey and flagging of threatened flora (given that flagging competed for this report may be removed or deteriorate) prior to construction.

- Have field ecologists work collaboratively with the construction contractor in sensitive habitats to avoid any impacts to threatened flora.
- Pre-clearing surveys (to minimise impacts on fauna habitat such as active nests or dreys) and identification of any fauna features (eg. Brush Turkey mounds) which may require track redesign.
- Restriction fencing to limit machinery access to adjacent vegetation/ habitat.
- Prescriptions for vegetation removal and disposal (chipping, mulch dispersal, salvage etc).

Mitigation measures for construction of the TBHT are prescribed at **Table 7.1**.

Table 7.1 Mitigation - Construction

Impact	*Mitigation*	*Responsibility*
CONSTRUCTION		
Native vegetation loss and disturbance	1. A track guidance note will be prepared for contractors detailing specific measures to minimise environmental impacts and provide contingency measures as appropriate.	NPWS/ track designer
	2. The final TBHT alignment will be clearly marked and shown to clearing contractors prior to construction works commencing.	Project manager/ contractor
	3. The extent of camps will be defined by parawebbing to limit disturbance by plant/machinery.	Project manager/ contractor
	4. Vegetation removal will be completed sensitively using appropriate equipment (eg. 'mini' excavators) and to the minimum extent necessary.	Project contractor
	5. Vegetation to be cleared will be mulched and/or dispersed into surrounding vegetation.	Project contractor
	6. No burning or other disposal of cleared vegetation will occur.	Project contractor
	7. If lopping or pruning of any vegetation is required, it must be completed by a certified and experienced arborist in accordance with *AS 4970-2009 Protection of trees on development sites*.	Project contractor/arborist
	8. Any landscaping or screen plantings installed at camps will be native flora species consistent with the plant community type in which each camp is located. Planting schedules will be developed in conjunction with NPWS.	Project contractor
Threatened flora	9. Prior to construction works, an ecologist will re-survey the locations of threatened flora (based on findings of this assessment) and clearly mark any threatened flora within the works zone (allowing for earthworks, clearing and access). Surveys will be particularly thorough in areas of burnt rainforest or wet sclerophyll forest where germination of threatened flora may have occurred prior to project commencement.	Project ecologist
	10. An 'unexpected finds' procedure is developed to allow for redesign of the TBHT if additional threatened flora are recorded during any pre-clearing or preliminary surveys.	Project contractor in liaison with NPWS
	11. A threatened flora database (using BioNet data, data from this assessment and any future	NPWS

Impact	Mitigation	Responsibility
	assessment) shall be established and maintained to be available to all TBHT contractors and relevant NPWS staff.	
	12. A plan of threatened flora locations will be provided to contractors prior to clearing and where aggregations of threatened flora occur signage is to be installed stating 'threatened flora location' (or words of similar intention) to alert construction personnel.	Project ecologist
	13. The project ecologist will be present to work collaboratively with the construction contractor and guide works within sensitive environments (rainforest, gully crossings) where threatened flora are present to ensure construction of the track avoids directly impacting any threatened flora species. If impacts are unavoidable in some instances, track redirection may be required.	Project ecologist
	14. Seedlings of affected Tree Guinea Flower are salvaged and replanted within adjacent habitat to the track footprint.	Project ecologist in liaison with NPWS
Fauna	15. Prior to any vegetation removal, an ecologist will complete a pre-clearing survey to examine impacted areas for active nests or dreys, with inspections completed daily within each work section. Clearing may only commence to the satisfaction of the project ecologist.	Project contractor/ ecologist
Soil and water	16. A site specific soil and water management plan is developed in consultation with NPWS to minimise soil and water impacts. The plan and all contingency measures will be included in the project CEMP.	NPWS/Project contractor
	17. Appropriate soil and erosion control measures are implemented and maintained for the duration of construction in accordance with the approved soil and water management plan.	Project contractor
	18. A detailed construction schedule is developed based on predicted annual rainfall and applied to works requiring greatest disturbance so that works are scheduled within periods of low rainfall (May - October) to minimise the potential for soil erosion, sedimentation and negative water quality impacts.	Project contractor
Biosecurity	19. Measures will be implemented during construction works so that machinery and plant do not introduce weed seed, pests or propagules to the site (eg. by adoption and implementation of the *'Arrive Clean, Leave Clean'* guidelines (DoE 2015).	Project contractor
	20. Prior to construction works commencing, areas of known weed infestations (introduced grasses) will be treated by a qualified operator to reduce the spread of weed seed.	Project contractor
	21. In accordance with the wishes of private landowner at the Doon Doon saddle, weed control will be limited to slashing only and no herbicide is to be used.	

Impact	Mitigation	Responsibility
	22. Measures will be implemented during construction works to ensure hygiene protocols for minimising the introduction and spread of Myrtle Rust/ Chytrid Fungus/ Cinnamon Fungus are developed and maintained in accordance with current best practice and/or NPWS policies or guidelines (eg. *Saving Our Species Hygiene Guidelines* DPIE 2020).	Project contractor
	23. To minimise transmission of Cinnamon Fungus/ Myrtle Rust, materials will be sourced from clean sites where these pathogens are absent.	Project contractor
	24. All construction materials and plant/ equipment will be certified to come from areas free of any known Yellow Crazy Ant infestations.	Project contractor

7.4.2 Operation

Mitigation of potential impacts on biodiversity during operation of the TBHT would be managed in two ways:

1. Educational resources are made available on the TBHT website and printed material regarding appropriate conduct (eg. the 'Tread softly' code) and expectations which patrons need to understand and prepare for prior to commencing the walk. Educational resources may also be required via signage to inform day users of the TBHT who may not access the website for information.

2. Physical measures (eg. installation of bollards at camps and/ or signage to limit user access or provide information) installed along the TBHT in accordance with the code of conduct.

Operational measures would be developed by NPWS staff and adapted over time depending on their success or in response to specific circumstances. Mitigation measures for operation of the TBHT are prescribed at **Table 7.2**.

Table 7.2 Mitigation - Operation

Impact	Mitigation	Responsibility
OPERATION/ OCCUPATION		
General	1. A Code of Practice detailing walker protocols for protection of the environment is written and displayed on the TBHT website and made available for download. This information would form part of an Information Kit supplied to all walkers. Signage may also be required as part of an adaptive approach to management.	NPWS
Native vegetation disturbance	2. Information shall be provided on the TBHT website outlining the need for sensitivity in forest environments to protect vegetation and soils. This message may be assisted by signage at key locations.	NPWS
Threatened flora	3. Appropriate signage is placed at where the TBHT occurs proximate to any sensitive locations of threatened flora.	NPWS
	4. The TBHT website will provide guidelines and information on threatened flora along the TBHT.	NPWS

Impact	Mitigation	Responsibility
	5. Annual monitoring of key species such as Corokia, Scrub Turpentine and Peach Myrtle is completed along the TBHT.	NPWS
Soil and water	6. Monitoring of erosion and sediment control post construction shall be completed until staff are satisfied they can be safely removed.	NPWS
	7. Information regarding reducing water quality impacts from washing and swimming is outlined in the Code of Practice and educational resources on TBHT website.	NPWS
Biosecurity	8. Weeds are controlled/managed as required and in accordance with requested control methods on private land.	NPWS
	9. The TBHT website provides details on appropriate protocols to reduce spreading weeds along the TBHT.	NPWS
	10. Installation of shoe cleaning stations (with signage and information provided both on site and on the TBHT website) to reduce the spread of weeds.	Project contractor/ NPWS
	11. Shoe cleaning stations are maintained appropriately.	NPWS
	12. Information on appropriate Myrtle Rust minimisation measures is provided on the TBHT website and updated according to new information/best practice.	NPWS
	13. Myrtle Rust is monitored along the TBHT route.	NPWS

7.5 Biodiversity Risks

A risk assessment has been completed for the anticipated impacts from both stages of the proposal (construction, operation) with consideration of how impacts may be mitigated (refer **Table 7.3**). Based on the assessment completed, risks to biodiversity are unlikely to be significant and mitigation measures are available to minimise environmental impacts.

Table 7.3 Biodiversity Risk Assessment

Impact	Likelihood	Mitigation	Risk
Construction			
Loss of native vegetation	High	Avoid and minimise	Low
Disturbance to threatened flora	High	Avoid and minimise	Low
Disturbance to rainforest TEC	High	Minimise; supervised ground works	Low
Myrtle Rust (and other pathogens)	Moderate	Hygiene protocols	Low
Fauna disturbance	Moderate	Diurnal works only	Low
Weeds and pests	Moderate	Hygiene protocols	Low
Injury to fauna	Low	Avoid and minimise, pre-clearing surveys	Low
Reduced water quality	Moderate	Erosion/sediment controls	Low
Disturbance and noise	Moderate	Diurnal works only (short-term, localised)	Low
Operation			
Vegetation degradation	Low	Education	Low
Myrtle Rust (and other pathogens)	Moderate	Education, Hygiene protocols	Low
Weed dispersal	Low	Education, Hygiene protocols	Low
Rubbish dumping	Low	Education	Low

Impact	*Likelihood*	*Mitigation*	*Risk*
Fire	Low	Education	Low
Feral pests	Low	Monitoring, baiting (if required)	Low
Reduced water quality	Moderate	Education	Low
Disturbance and noise (walkers)	Low	Education	Low
Disturbance and noise (maintenance)	Low	none	Low
Fauna roadkill on public roads	Low	Education	Low

7.6 Opportunities

The TBHT provides opportunities to provide educational and cultural experiences for tourists, residents, Aboriginal people and school or community groups. Due to the access the TBHT provides to more remote areas, there may also be opportunities to utilise track patrons to participate in 'citizen science' projects or collect data on behalf of NPWS. Monitoring of Myrtle Rust on Scrub Turpentine also creates opportunities for data collection and research, with potential for collecting cuttings and leaf material to contribute to the larger conservation response for this species.

8. Statutory Assessment

The following sections assess the proposal with regard to relevant statutory requirements.

8.1 Biodiversity Conservation Act 2016 (BC Act)

The BC Act requires a test of significance (five-part test) when assessing whether an action, development or activity is likely to significantly affect threatened species, ecological communities or their habitats. Based on the potential for several threatened fauna species to occur at the site and the occurrence of threatened flora and lowland rainforest tests of significance have been completed (refer to **Appendix G**).

The tests concluded that the TBHT would be unlikely to significantly increase the risk of extinction for any fauna species, and hence the need for either a Species Impact Statement (SIS) or a *Biodiversity Development Assessment Report* (BDAR) is not triggered.

8.2 Fisheries Management Act 1994

An assessment of significance ('seven-part test') under Section 220ZZA of the *Fisheries Management Act 1994* (FM Act) is required where impacts on threatened species, populations and communities listed in the FM Act may occur. No watercourses traversed by or in proximity to the TBHT support habitat for any other threatened species, populations and communities listed in the FM Act, therefore an assessment of significance is not required.

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

Under the EPBC Act, actions that have, or are likely to have, a significant impact on a matter of national environmental significance (MNES) require approval from the Australian Government Minister for the Environment (the Minister).

The nine matters of national environmental significance protected under the EPBC Act are:

- World heritage properties
- National heritage places
- Wetlands of international importance (listed under the Ramsar Convention)
- Nationally threatened species and ecological communities
- Migratory species protected under international agreements
- Commonwealth marine areas
- The Great Barrier Reef Marine Park
- Nuclear actions (including uranium mines)
- A water resource, in relation to coal seam gas development and large coal mining development.

Table 8.1 summarises the results of the MNES database search and provides further information based on potential impacts of the TBHT.

On 24 March 2020 the Australian Government entered into a new agreement ('Amending Agreement No. 1') with New South Wales to amend the bilateral agreement signed in 2015 relating to environmental assessment. The Amending Agreement declares that an action does not require

assessment under part 8 of the EPBC Act if it is listed in the declared classes of actions in Schedule 1 of the Amending Agreement, as follows:

i. Actions that are assessed under Part 4, Division 4.7 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and which includes an environmental impact statement (EIS).

ii. Actions that are assessed under Division 5.2 of Part 5 of the EP&A Act and which include an EIS.

iii. Actions that are assessed under Part 4, Division 4.9 of the EP&A Act and are classified as State significant development.

iv. Actions that are assessed under section 75W of the EP&A Act pursuant to Schedule 2 of the Environmental Planning and Assessment (Savings, Transitional and Other Provisions) Regulation 2017.

v. Actions that are assessed as designated development that can be carried out with development consent under Part 4 of the EP&A Act and which includes an EIS.

vi. Actions that are not classified as State significant development or complying development or designated development and are assessed as development that can be carried out with development consent under Part 4 of the EP&A Act, which includes species impact statements prepared in accordance with the BC Act or FM Act.

vii. Actions that are not classified as State significant development or complying development or designated development and are assessed as development that can be carried out with development consent under Part 4 of the EP&A Act, which does not include a species impact statements prepared in accordance with the BC Act or FM Act.

viii. Actions that are not classified as State significant development or complying development and are assessed under Part 4, Division 4.9 of the EP&A Act.

The TBHT is assessed under Division 5.1 of the EP&A Act. Therefore, the project is not characteristic of any of the above listed declared classes of actions. On this basis, a ‘standard’ assessment applies.

As the site comprises known Koala habitat, the *EPBC Act Significant Impact Guidelines* requires consideration. Review of the Guidelines indicates that the TBHT is unlikely to have a significant impact on Koalas.

Additionally, as the TBHT will pass through habitat of the Greater Glider (a species not listed in the BC Act) and approximately 5 km of World Heritage property, significant impact assessments have been prepared as required (refer to **Appendix H**).

On the basis of the above, the TBHT would not significantly impact on MNES and referral to the Minister for the Environment is not required.

Table 8.1 Assessment of MNES

Matter	*Impact*
Any impact on a World Heritage Property?	
Approximately 5km of the TBHT occurs within the 'Gondwana Rainforests of Australia' World Heritage Area (WHA). Impacts to the WHA within Nightcap NP (~4900 ha) due to minor vegetation and habitat loss/disturbance would be negligible in the context of the surrounding environment and the proposal would have negligible impacts on the 'Gondwana Rainforests of Australia' World Heritage Area as a whole. Direct and indirect impacts of the Proposal would be unlikely to reduce the values of the 'Gondwana Rainforests of Australia' World Heritage Area within Nightcap NP. A Significant Impact Assessment has been completed for the WHA and determined that impacts would be low and manageable and that natural or cultural heritage values would not be significantly affected (refer to **Appendix H**).	Low
Any impact on a National Heritage Place?	
Refer above (WHA's are also National Heritage Places). A Significant Impact Assessment has been completed for the National Heritage Place and determined that impacts would be low and manageable and that natural or Indigenous heritage values would not be significantly affected (refer to **Appendix H**).	Low
Any impact on a Wetland of International Importance?	
No wetlands of international importance (Ramsar sites) occur within 5 km of the site.	Nil
Any impact on nationally threatened species and ecological communities?	
Habitat for two threatened ecological communities and 72 threatened species is identified within 5 km of the site. Eight threatened flora species were recorded during field assessment (Corokia, Rusty Rose Walnut, Red Boppel Nut, Rough-shelled Bush Nut, Onion Cedar, Small-leaved Hazelwood, Red Lilly Pilly, Peach Myrtle). Significant Impact Assessments have been completed for endangered species listed under the EPBC Act and determined that impacts would be low and manageable (refer to **Appendix H)**. The threatened ecological community *Lowland rainforest of subtropical Australia* ('LRSA') is also present in select parts of the TBHT below 300 ASL. Impacts to LRS are minor in nature and would not substantially alter the structure, function or composition of lowland rainforest in a local context (refer to Significant Impact Assessment at **Appendix H**). Impacts to LRSA would be very low based on substantial areas of rainforest occurring within the three reserves (~ 7255 ha), where the TBHT would only require disturbance to a negligible area in this greater context. One listed threatened fauna species was recorded (Koala). The Grey-headed Flying-fox is also likely to use the site on an opportunistic or seasonal basis when myrtaceae canopy trees are in flower, while several other threatened fauna species may occur on an opportunistic or seasonal basis. Via the Test of Significance it was established impacts of the TBHT would be low and manageable for these species (refer to **Appendix G**). As the TBHT will pass through habitat of the Greater Glider, a significant impact assessment has been prepared for this species (refer to **Appendix H**). The impact assessment concluded that habitat for the Greater Glider would not be significantly affected. The proposal is unlikely to be significant to any threatened species in the locality over its life cycle in the context of three large conservation reserves where secure tenure allows for long term conservation.	Low
Any impact on Migratory species?	
Habitat for 19 migratory species is identified within 5 km of the site. Two migratory fauna species were recorded at the site and several others may occur on a seasonal or opportunistic basis. The proposal is not significant to any migratory species in the locality over its life cycle in the context of three large conservation reserves.	Low

Matter	Impact
Any impact on a Commonwealth marine area?	
No Commonwealth marine areas occur within 5 km of the site.	Nil
Any impact on the Great Barrier Reef Marine Park?	
The proposal will not impact on the Great Barrier Reef Marine Park (Qld).	Nil
Does the project involve a nuclear action?	
No nuclear actions are proposed.	Nil
Does the project involve impacts to a water resource, in relation to coal seam gas development and large coal mining development?	
The proposal is not a mining development.	Nil

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Copyright and Usage

Appendix A

Photographs

	Plate 1. Bushfire damage at Camp 3.
	Plate 2. Gallery rainforest at Rowlands Creek (side track from section 1).
	Plate 3. Formalised vehicle firetrail - Eastern Boundary Trail.

	Plate 4. Eastern Firetrail - Blackbutt forest (recently burnt).
	Plate 5. Steps on the Minyon loop track which will be replaced with stone.
	Plate 6. Bridge at Sand Ridge Road which will be repaired/replaced.

	Plate 7. New England Blackbutt forest near Mt Jerusalem (recently burnt).
	Plate 8. Infestation of Broad-leaved Paspalum on the saddle between Nightcap NP and Mt Jerusalem NP.
	Plate 9. Colony of *Grammitis stenophylla* in warm temperate rainforest east of Mt Jerusalem.

	Plate 10. The Historic Nightcap Track.
	Plate 11. Teatree scrub at Teatree Lookout.
	Plate 12. Regenerating Tree Guinea Flower seedlings in Section 3.

	Plate 13. Watercourse crossing in Section 4 and use of natural rock shelf to minimise disturbance.

Appendix B

Master Plan

Appendix C

Database Search Results

Appendix D

Weed Inventory

Table D1. Weed Inventory

Family	*Scientific name*	*Common name*
Apocynaceae	*Araujia sericifera*	Moth Vine
Apocynaceae	*Asclepias curassavica*	Red-head Cottonbush
Apocynaceae	*Gomphocarpus physocarpus*	Balloon Cotton Bush
Asteraceae	*Ageratina adenophora*	Crofton Weed
Asteraceae	*Ageratina riparia*	Mistflower
Asteraceae	*Ageratum houstonianum*	Blue Billygoat Weed
Asteraceae	*Ambrosia artemisiifolia*	Ragweed
Asteraceae	*Bidens pilosa*	Cobbler's Pegs
Asteraceae	*Cirsium vulgare*	Spear Thistle
Asteraceae	*Conyza bonariensis*	Fleabane
Asteraceae	*Crassocephalum crepidioides*	Thickhead
Asteraceae	*Galinsoga parviflora*	Potato Weed
Asteraceae	*Senecio madagascariensis*	Fireweed
Fabaceae (Faboideae)	*Desmodium uncinatum*	Silver-leaved Desmodium
Fabaceae (Faboideae)	*Trifolium repens*	White Clover
Lauraceae	*Cinnamomum camphora*	Camphor Laurel
Lythraceae	*Cuphea carthagenensis*	Cuphea
Malvaceae	*Sida rhombifolia*	Paddy's Lucerne
Ochnaceae	*Ochna serrulata*	Mickey Mouse Plant
Passifloraceae	*Passiflora edulis*	Common Passionfruit
Passifloraceae	*Passiflora suberosa*	Corky Passionfruit
Passifloraceae	*Passiflora subpeltata*	White Passionfruit
Phytolaccaceae	*Phytolacca octandra*	Inkweed
Plantaginaceae	*Plantago major*	Large Plantain
Poaceae	*Cenchrus clandestinus*	Kikuyu
Poaceae	*Cenchrus purpureus*	Barner Grass
Poaceae	*Chloris gayana*	Rhodes Grass
Poaceae	*Eleusine indica*	Crowsfoot Grass
Poaceae	*Eragrostis cilianensis*	Stinkgrass
Poaceae	*Paspalum mandiocanum*	Broad-leaved Paspalum
Poaceae	*Paspalum urvillei*	Vasey Grass
Poaceae	*Setaria palmifolia*	Palm Grass
Poaceae	*Setaria sphacelata*	Pigeon Grass
Poaceae	*Sporobolus africanus*	Parramatta Grass
Solanaceae	*Solanum capsicoides*	Devil's Apple
Solanaceae	*Solanum chrysotrichum*	Giant Devil's Fig
Solanaceae	*Solanum mauritianum*	Wild Tobacco
Solanaceae	*Solanum nigrum*	Blackberry Nightshade
Verbenaceae	*Lantana camara*	Lantana
Verbenaceae	*Verbena bonariensis*	Purpletop

Appendix E

Fauna Inventory

Table E1. Fauna Inventory

Family	Scientific Name	Common Name
AMPHIBIANS		
Hylidae	*Litoria caerulea*	Green Tree Frog
Hylidae	*Litoria pearsonia*	Cascade Tree Frog
Limnodynastidae	*Adelotus brevis*	Tusked Frog
Myobatrachidae	***Assa darlingtoni****	**Pouched Frog**
Myobatrachidae	*Crinia signifera*	Common Eastern Froglet
Myobatrachidae	*Mixophyes fasciolatus*	Great Barred Frog
Myobatrachidae	*Mixophyes sp.*	[Unidentified tadpoles]
Myobatrachidae	***Philoria loveridgei****	**Loveridge's Frog**
Myobatrachidae	*Pseudophryne coriacea*	Red-backed Toadlet
REPTILES		
Colubridae	*Dendrelaphis punctulata*	Green Tree Snake
Pythonidae	*Morelia spilota*	Carpet Python
Scincidae	*Bellatorias major*	Land Mullet
Scincidae	*Lampropholis delicata*	Sun-skink
Scincidae	*Saproscincus challengeri*	Orange-tailed Shadeskink
Varanidae	*Varanus varius*	Lace Monitor
AVIFAUNA		
Acanthizidae	*Acanthiza lineata*	Striated Thornbill
Acanthizidae	*Acanthiza pusilla*	Brown Thornbill
Acanthizidae	*Gerygone mouki*	Brown Gerygone
Acanthizidae	*Gerygone olivacea*	White-throated Gerygone
Acanthizidae	*Sericornis citreogularis*	Yellow-throated Scrubwren
Acanthizidae	*Sericornis frontalis*	White-browed Scrubwren
Acanthizidae	*Sericornis magnirostra*	Large-billed Scrubwren
Accipitridae	*Accipiter novaehollandiae*	Grey Goshawk
Alcedinidae	*Dacelo novaeguineae*	Laughing Kookaburra
Artamidae	*Cracticus nigrogularis*	Pied Butcherbird
Artamidae	*Cracticus tibicen*	Australian Magpie
Artamidae	*Cracticus torquatus*	Grey Butcherbird
Artamidae	*Strepera graculina*	Pied Currawong
Cacatuidae	*Cacatua galerita*	Sulphur-crested Cockatoo
Cacatuidae	*Calyptorhynchus funereus*	Yellow-tailed Black-cockatoo
Cacatuidae	***Calyptorhynchus lathami****	**Glossy Black-cockatoo**
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike
Campephagidae	*Coracina tenuirostris*	Cicadabird
Climacteridae	*Cormobates leucophaea*	White-throated Treecreeper
Columbidae	*Chalcophaps indica*	Emerald Dove
Columbidae	*Columba leucomela*	White-headed Pigeon
Columbidae	*Geopelia humeralis*	Bar-shouldered Dove
Columbidae	*Leucosarcia melanoleuca*	Wonga Pigeon
Columbidae	*Lopholaimus antarcticus*	Topknot Pigeon
Columbidae	*Macropygia amboinensis*	Brown Cuckoo-dove
Columbidae	***Ptilinopus magnificus****	**Wompoo Fruit-dove**
Corvidae	*Corvus orru*	Torresian Crow
Cuculidae	*Cacomantis flabelliformis*	Fan-tailed Cuckoo
Cuculidae	*Cacomantis variolosus*	Brush Cuckoo
Cuculidae	*Centropus phasianinus*	Pheasant Coucal

Family	Scientific Name	Common Name
Cuculidae	*Chalcites basalis*	Horsefield's Bronze-cuckoo
Cuculidae	*Chalcites lucidus*	Shining Bronze-cuckoo
Cuculidae	*Scythrops novaehollandiae*	Channel-billed Cuckoo
Dicaeidae	*Dicaeum hirundinaceum*	Mistletoe Bird
Dicruridae	*Dicrurus bracteatus*	Spangled Drongo
Estrildidae	*Neochmia temporalis*	Red-browed Finch
Falconidae	*Falco longipennis*	Australian Hobby
Megapodiidae	*Alectura lathami*	Australian Brush Turkey
Meliphagidae	*Acanthorhynchus tenuirostris*	Eastern Spinebill
Meliphagidae	*Caligavis chrysops*	Yellow-faced Honeyeater
Meliphagidae	*Lichmera indistincta*	Brown Honeyeater
Meliphagidae	*Meliphaga lewinii*	Lewin's Honeyeater
Meliphagidae	*Myzomela sanguinolenta*	Scarlet Honeyeater
Meliphagidae	*Philemon corniculatus*	Noisy Friarbird
Menuridae	***Menura alberti****	**Albert's Lyrebird**
Monarchidae	***Carterornis leucotis****	**White-eared Monarch**
Oriolidae	*Sphecotheres vieilloti*	Australasian Figbird
Orthonychidae	*Orthonyx temminckii*	Australian Logrunner
Pachycephalidae	*Colluricincla harmonica*	Grey Shrike-thrush
Pachycephalidae	*Pachycephala pectoralis*	Golden Whistler
Paradisaeidae	*Ptiloris paradiseus*	Paradise Riflebird
Pardalotidae	*Pardalotus punctatus*	Spotted Pardalote
Pardalotidae	*Pardalotus striatus*	Striated Pardalote
Petroicidae	*Eopsaltria australis*	Eastern Yellow Robin
Petroicidae	*Petroica rosea*	Rose Robin
Petroicidae	*Tregellasia capito*	Pale Yellow Robin
Pittidae	*Pitta versicolor*	Noisy Pitta
Psittaculidae	*Alisterus scapularis*	Australian King Parrot
Psittaculidae	*Glossopsitta concinna*	Musk Lorikeet
Psittaculidae	*Platycercus elegans*	Crimson Rosella
Psittaculidae	*Platycercus eximius*	Eastern Rosella
Psittaculidae	*Trichoglossus moluccanus*	Rainbow Lorikeet
Psophodidae	*Psophodes olivaceus*	Eastern Whipbird
Ptilonorhynchidae	*Ailuroedus crassirostris*	Green Catbird
Ptilonorhynchidae	*Ptilonorhynchus violaceus*	Satin Bowerbird
Rhipiduridae	*Rhipidura albiscapa*	Grey Fantail
Rallidae	***Amaurornis moluccana****	**Pale-vented Bush-hen**
Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail
Rhipiduridae	*Rhipidura rufifrons*	Rufous Fantail
Tytonidae	*Tyto alba*	Barn Owl
Tytonidae	***Tyto tenebricosa****	**Sooty Owl**
Zosteropidae	*Zosterops lateralis*	Silvereye
MAMMALS		
Canidae	*Vulpes vulpes*	Red Fox
Macropodidae	*Thylogale thetis*	Red-necked Pademelon
Macropodidae	*Wallabia bicolor*	Swamp Wallaby
Phascolarctidae	***Phascolarctos cinereus****	**Koala**

Bold recorded during field surveys

* Threatened species

Appendix F

Potential for Threatened Fauna Occurrence

Table F.1 Threatened Fauna Potential Occurrence Assessment

Scientific Name	*Common Name*	*Status*		*Habitat Requirements*	*Suitability of Site Habitat*	*Potential Occurrence & Requirement for Test of Significance*
		BC Act	*EPBC Act*			
Invertebrates						
Argynnis hyperbius inconstans	Australian Fritillary	E	CE	Open swampy coastal habitat where the caterpillar's food plant, Arrowhead Violet (*Viola betonicifolia*) occurs.	No suitable habitat occurs. No BioNet records.	Unlikely. Test of significance not required.
Nurus brevis	Shorter Rainforest Ground-beetle	E	-	Low elevation rainforest, predominantly drier rainforests.	Historic records from the locality are *N. latipennis* or *N. moorei* (refer Charley and Andren 2018).	Unlikely. Test of significance not required.
Phyllodes imperialis southern subspecies	Southern Pink Underwing Moth	E	E	Undisturbed subtropical rainforest below 600 m. Breeding restricted to areas where the caterpillar's food plant, a native rainforest vine, *Carronia multisepalea*, grows in a collapsed shrub-like form.	Habitat marginal.	Unlikely. Test of significance not required.
Thersites mitchellae	Mitchell's Rainforest Snail	E	CE	Remnant areas of lowland subtropical rainforest and swamp forest on alluvial soils, found amongst leaf litter on the forest floor.	No suitable habitat occurs.	Unlikely. Test of significance not required.
Amphibians						
Assa darlingtoni	**Pouched Frog**	V	-	Cool, moist rainforest, including Antarctic Beech, or moist eucalypt forest in mountainous areas, mostly above 800 m but have been found as low as 300m.	Suitable habitat occurs commonly.	**Recorded. Test of significance required.**
Litoria brevipalmata	**Green-thighed Frog**	V	-	Rainforest, moist to dry eucalypt forest and heath, typically where surface water gathers after rain.	Suitable habitat occurs; few records in proximity to the TBHT.	**Possible. Test of significance required.**
Mixophyes fleayi	**Fleay's Barred Frog**	E	E	Rainforest and wet eucalypt forest of the escarpment and foothills, close to gravely streams.	Suitable habitat occurs; few records in proximity to the TBHT.	**Possible. Test of significance required.**
Mixophyes iteratus	**Giant Barred Frog**	E	E	Freshwater streams with permanent or semi-permanent water, generally (but not always) at lower elevation.	Suitable habitat occurs.	**Possible. Test of significance required.**

Scientific Name	Common Name	Status		Habitat Requirements	Suitability of Site Habitat	Potential Occurrence & Requirement for Test of Significance
		BC Act	EPBC Act			
Philoria loveridgei	**Loveridge's Frog**	E	-	Dependent on high moisture levels, headwaters of small streams and soaks where groundwater is continually present, subtropical, warm temperate rainforest and wet eucalypt forest.	Suitable habitat occurs.	**Recorded. Test of significance required.**
Reptiles						
Coeranoscincus reticulatus	Three-toed Snake-tooth Skink	V	E	Rainforest and occasionally moist eucalypt forest, on loamy or sandy soils.	Habitat marginal; no recent records.	Unlikely. Test of significance not required.
Delma torquata	Collared Delma	-	V	Eucalypt-dominated woodlands and open-forests in Queensland Regional Ecosystem Land Zones.	Marginal habitat; no BioNet records.	Unlikely. Assessed under EPBC Act.
Hoplocephalus stephensii	**Stephens' Banded Snake**	V	-	Rainforest and eucalypt forests and rocky areas up to 950 m.	Suitable habitat occurs.	**Possible. Test of significance required.**
Avifauna						
Amaurornis moluccana	Pale-vented Bush-hen	V	-	Variety of coastal wetlands from wetlands, mangroves, lagoons and swamps to river margins and creeks running through rainforest.	Moderate habitat occurs.	**Recorded. Test of significance required.**
Anthochaera phrygia	Regent Honeyeater	CE	CE	Dry open forest and woodland with an abundance of nectar-producing eucalypts, particularly box-ironbark woodland, swamp mahogany forests, and riverine sheoak woodlands.	Marginal habitat; no BioNet records.	Unlikely. Test of significance not required.
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	-	Woodlands and dry open sclerophyll forests, usually dominated by eucalypts; also recorded in shrublands, heathlands and various modified habitats.	No suitable habitat occurs.	Unlikely. Test of significance not required.
Atrichornis rufescens	Rufous Scrub-bird	V	E	Subtropical, warm temperate, cool temperate rainforest and moist eucalypt forest with rainforest mid-storey.	Suitable habitat occurs. Record never confirmed (pers. comm. David Charley).	Unlikely. Test of significance not required.
Botaurus poiciloptilus	Australasian Bittern	E	E	Permanent freshwater wetlands with tall dense vegetation, particularly bullrushes and spikerushes.	No suitable habitat occurs.	Unlikely. Test of significance not required.
Calidris ferruginea	Curlew Sandpiper	CE	CE	Tidal mudflats, sandy ocean shores and occasionally inland freshwater or salt-lakes.	No suitable habitat occurs. No BioNet records.	Unlikely. Test of significance not required.

Scientific Name	Common Name	Status		Habitat Requirements	Suitability of Site Habitat	Potential Occurrence & Requirement for Test of Significance
		BC Act	EPBC Act			
Calyptorhynchus lathami	**Glossy Black-Cockatoo**	V	-	Sheoaks in coastal forests and woodlands, timbered watercourses, and moist and dry eucalypt forests of the coast and the Great Divide up to 1,000 m.	Suitable habitat occurs.	**Recorded. Test of significance required.**
Carterornis leucotis	**White-eared Monarch**	V	-	Coastal rainforest, swamp forest and wet eucalypt forest, prefers edges where trees frequently covered with vines.	Suitable habitat occurs.	**Recorded. Test of significance required.**
Circus assimilis	Spotted Harrier	V	-	Grassy open woodland, inland riparian woodland, grassland and shrub steppe.	No suitable habitat occurs.	Unlikely. Test of significance not required.
Coracina lineata	**Barred Cuckoo-shrike**	V	-	Rainforest, eucalypt woodlands, swamp woodlands and timber along watercourses.	Suitable habitat occurs.	**Possible. Test of significance required.**
Cyclopsitta diophthalma coxeni	Coxen's Fig-Parrot	CE	E	Drier rainforests and adjacent wet eucalypt forest, also wetter lowland rainforests.	No suitable habitat occurs, no recent confirmed records.	Unlikely. Test of significance not required.
Daphoenositta chrysoptera	**Varied Sittella**	V	-	Inhabits eucalypt forests and woodlands, especially rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland.	Suitable habitat occurs.	**Possible. Test of significance required.**
Dasyornis brachypterus	Eastern Bristlebird	E	E	High elevation open forest, woodland with dense tussock or sedge understorey adjacent to rainforest or wet eucalypt forest.	Habitat marginal. Records never confirmed (pers. comm. David Charley).	Unlikely. Test of significance not required.
Ephippiorhynchus asiaticus	Black-necked Stork	E	-	Swamps, mangroves, mudflats, dry floodplains.	No suitable habitat occurs.	Unlikely. Test of significance not required.
Erythrotriorchis radiatus	Red Goshawk	CE	V	In NSW, preferred habitats include mixed subtropical rainforest, Melaleuca swamp forest, riparian Eucalyptus forest of coastal rivers. Population in NSW is naturally small (probably only one pair) and lies at extreme of the natural range of the species in Australia.	No suitable habitat occurs.	Unlikely. Test of significance not required.
Falco subniger	Black Falcon	V	-	Mostly in inland regions; hunts over open wooded grasslands, saltbush plains, bluebush plains and other low vegetation. In NSW there is assumed to be a single population that is continuous with a broader continental population.	No suitable habitat occurs.	Unlikely. Test of significance not required.

Scientific Name	Common Name	Status		Habitat Requirements	Suitability of Site Habitat	Potential Occurrence & Requirement for Test of Significance
		BC Act	EPBC Act			
Glossopsitta pusilla	**Little Lorikeet**	V	-	Forages in open Eucalyptus forest and woodland; also feeds on Angophora, Melaleuca and other tree species.	Suitable habitat occurs.	**Possible. Test of significance required.**
Haliaeetus leucogaster	White-bellied Sea-eagle	V	-	Coastal habitats and around terrestrial wetlands characterised by the presence of large areas of open water (larger rivers, swamps, lakes, ocean).	No suitable habitat occurs.	Unlikely. Test of significance not required.
Hieraaetus morphnoides	Little Eagle	V	-	Open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used.	Habitat marginal.	Unlikely. Test of significance not required.
Hirundapus caudacutus	White-throated Needletail	-	V	Most often recorded aerial foraging above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy.	Suitable habitat occurs.	Assessed under EPBC Act.
Irediparra gallinacea	Comb-crested Jacana	V	-	Among vegetation floating on slow-moving rivers and permanent lagoons, swamps, lakes and dams.	No suitable habitat occurs.	Unlikely. Test of significance not required.
Ixobrychus flavicollis	Black Bittern	V	-	Dense vegetation fringing and in streams, swamps, tidal creeks and mudflats, particularly amongst swamp sheoaks and mangroves.	No suitable habitat occurs.	Unlikely. Test of significance not required.
Lathamus discolor	Swift Parrot	E	CE	Foraging occurs where eucalypts are flowering profusely or where abundant lerp infestations occur. Favoured feed trees include winter flowering species such as Swamp Mahogany, Spotted Gum, Red Bloodwood, Forest Red Gum, Mugga Ironbark and White Box. Commonly used lerp infested trees include Inland Grey Box, Grey Box, Blackbutt and Yellow Box.	Marginal habitat; no BioNet records.	Unlikely. Test of significance not required.
Menura alberti	**Albert's Lyrebird**	V	-	Mixed rainforest and open wet forest frequently dominated by Brush Box.	Suitable habitat occurs.	**Recorded. Test of significance required.**
Ninox connivens	Barking Owl	V	-	Eucalypt woodland, open forest, swamp woodlands and timber along watercourses.	No suitable habitat occurs.	Unlikely. Test of significance not required.
Ninox strenua	**Powerful Owl**	V	-	Woodland and open forest to tall moist forest and rainforest. Requires large tracts of forest or woodland habitat but may also occur in fragmented landscapes.	Suitable habitat occurs.	**Possible. Test of significance required.**
Numenius madagascariensis	Eastern Curlew	-	CE	Estuaries, bays, harbours, inlets and coastal lagoons, intertidal mudflats and sometimes saltmarsh of sheltered coasts.	No suitable habitat occurs. No BioNet records.	Unlikely. Assessed under EPBC Act.

Scientific Name	Common Name	Status		Habitat Requirements	Suitability of Site Habitat	Potential Occurrence & Requirement for Test of Significance
		BC Act	EPBC Act			
Pachycephala olivacea	Olive Whistler	V	-	Wet high altitude forests above 500 m	Habitat suitable; no recent local records.	Unlikely. Test of significance not required.
Pandion cristatus	Eastern Osprey	V	-	Wetland habitats include inshore waters, reefs, bays, coastal cliffs, beaches, estuaries, mangrove swamps, broad rivers, reservoirs and large lakes and waterholes.	No suitable habitat occurs.	Unlikely. Test of significance not required.
Petroica boodang	Scarlet Robin	V	-	Dry eucalypt forests and woodlands with an open and grassy understorey with few scattered shrubs.	Habitat marginal; few local records.	Unlikely. Test of significance not required.
Podargus ocellatus	**Marbled Frogmouth**	V	-	Subtropical rainforest spending most time in deep, wet sheltered gullies.	Suitable habitat occurs.	**Possible. Test of significance required.**
Ptilinopus magnificus	**Wompoo Fruit-dove**	V	-	Rainforests, low-elevation moist eucalypt forest, and Brush Box forests.	Suitable habitat occurs.	**Recorded. Test of significance required.**
Ptilinopus regina	**Rose-crowned Fruit-dove**	V	-	Subtropical and dry rainforest, moist eucalypt forest and swamp forest.	Suitable habitat occurs.	**Possible. Test of significance required.**
Ptilinopus superbus	**Superb Fruit-Dove**	V	-	Subtropical and dry rainforest, moist eucalypt forest and swamp forest.	Suitable habitat occurs.	**Possible. Test of significance required.**
Rostratula australis	Australian Painted Snipe	E	E	Well-vegetated shallows and margins of wetlands, dams, sewage ponds, wet pastures, marshy areas, irrigation systems, lignum, tea-tree scrub, and open timber.	No suitable habitat occurs. No BioNet records.	Unlikely. Test of significance not required.
Thinornis rubricollis rubricollis	Hooded Plover (eastern)	-	V	Wide beaches backed by dunes with large amounts of seaweed and jetsam, creek mouths and inlet entrances.	No suitable habitat occurs. No BioNet records.	Unlikely. Assessed under EPBC Act.
Turnix melanogaster	Black-breasted Button-quail	CE	V	Drier rainforests and vine scrubs, often in association with Hoop Pine and a deep moist leaf litter layer.	No suitable habitat occurs.	Unlikely. Test of significance not required.
Tyto novaehollandiae	**Masked Owl**	V	-	Dry eucalypt forest and woodlands.	Suitable habitat occurs.	**Possible. Test of significance required.**
Tyto tenebricosa	**Sooty Owl**	V	-	Dry, subtropical and warm temperate rainforests and wet eucalypt forests. Nest in large tree hollows.	Suitable habitat occurs.	**Recorded. Test of significance required.**
Mammals						
Aepyprymnus rufescens	**Rufous Bettong**	V	-	Tall moist eucalypt forest to open woodland with tussock grass understorey.	Suitable habitat occurs; recent records.	**Possible. Test of significance required.**

Scientific Name	Common Name	Status		Habitat Requirements	Suitability of Site Habitat	Potential Occurrence & Requirement for Test of Significance
		BC Act	EPBC Act			
Cercartetus nanus	Eastern Pygmy-possum	V	-	In northern NSW mainly in rainforest, wet eucalypt forest and tea-tree-banksia scrub.	Habitat marginal; no recent records.	Unlikely. Test of significance not required.
Chalinolobus dwyeri	**Large-eared Pied Bat**	V	V	Near cave entrances and crevices in cliffs.	Suitable habitat occurs.	**Possible. Test of significance required.**
Dasyurus maculatus	**Spotted-tailed Quoll**	V	E	Dry and moist eucalypt forests and rainforests, fallen hollow logs, large rocky outcrops.	Suitable habitat occurs.	**Possible. Test of significance required.**
Falsistrellus tasmaniensis	**Eastern False Pipistrelle**	V	-	Moist and dry eucalypt forest and rainforest, particularly at high elevations.	Suitable habitat occurs.	**Possible. Test of significance required.**
Macropus parma	**Parma Wallaby**	V	-	Moist eucalypt forest with thick shrubby understorey, often with nearby grassy areas and rainforest margins.	Suitable habitat occurs.	**Possible. Test of significance required.**
Micronomus norfolkensis	**Eastern Coastal Free-tailed Bat**	V	-	Dry sclerophyll forest and woodland east of the Great Dividing Range.	Suitable habitat occurs.	**Possible. Test of significance required.**
Miniopterus australis	**Little Bent-winged Bat**	V	-	Moist eucalypt forest, rainforest and dense coastal scrub.	Suitable habitat occurs.	**Possible. Test of significance required.**
Miniopterus schreibersii oceanensis	**Large Bent-winged Bat**	V	-	Forest or woodland, roost in caves, old mines and stormwater channels.	Suitable habitat occurs.	**Possible. Test of significance required.**
Myotis macropus	Southern Myotis	V	-	Bodies of water, rainforest streams, large lakes, reservoirs.	No suitable habitat occurs.	Unlikely. Test of significance not required.
Nyctimene robinsoni	**Eastern Tube-nosed Bat**	V	-	Streamside habitats within coastal subtropical rainforest and moist eucalypt forests with well-developed rainforest understorey.	Suitable habitat occurs.	**Possible. Test of significance required.**
Nyctophilus bifax	**Eastern Long-eared Bat**	V	-	Lowland subtropical rainforest and wet and swamp eucalypt forest, extending to adjacent moist eucalypt forest.	Suitable habitat occurs.	**Possible. Test of significance required.**
Petauroides volans	**Greater Glider**	-	E	Ranges and coastal plains of eastern Australia, where it inhabits a variety of eucalypt forests and woodlands.	Suitable habitat occurs.	**Assessed under EPBC Act (refer Appendix H).**
Petaurus australis	**Yellow-bellied Glider**	V	-	Tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils.	Suitable habitat occurs.	**Possible. Test of significance required.**
Petaurus norfolcensis	**Squirrel Glider**	V	-	Blackbutt, bloodwood and ironbark eucalypt forest with heath understorey in coastal areas, and box-ironbark woodlands and River Red Gum forest inland.	Suitable habitat occurs.	**Possible. Test of significance required.**

Scientific Name	Common Name	Status		Habitat Requirements	Suitability of Site Habitat	Potential Occurrence & Requirement for Test of Significance
		BC Act	EPBC Act			
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	North-facing cliffs and dry eucalypt forest and woodland, inhabiting rock crevices, caves, overhangs during the day, and foraging in grassy areas nearby at night.	No suitable habitat occurs. No BioNet records.	Unlikely. Test of significance not required.
Phascolarctos cinereus	**Koala**	V	V	Appropriate food trees in forests and woodlands, and treed urban areas.	Suitable habitat occurs.	**Recorded. Test of significance required.**
Phoniscus papuensis	**Golden-tipped Bat**	V	-	Rainforest and adjacent sclerophyll forest.	Suitable habitat occurs.	**Possible. Test of significance required.**
Potorous tridactylus	**Long-nosed Potoroo**	V	V	Cool temperate rainforest, moist and dry forests, and wet heathland, inhabiting dense layers of grass, ferns, vines and shrubs.	Suitable habitat occurs.	**Possible. Test of significance required.**
Pseudomys novaehollandiae	New Holland Mouse	-	V	Occurs in open heathlands, open woodlands with a heathland understorey, and vegetated sand dunes.	No suitable habitat occurs. No BioNet records.	Unlikely. Test of significance not required.
Pteropus poliocephalus	**Grey-headed Flying-fox**	V	V	Subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops.	Suitable habitat occurs.	**Possible. Test of significance required.**
Saccolaimus flaviventris	**Yellow-bellied Sheathtail-bat**	V	-	Forages in a variety of habitats, roosts in tree hollows and buildings.	Suitable habitat occurs.	**Possible. Test of significance required.**
Scoteanax rueppellii	**Greater Broad-nosed Bat**	V	-	Woodland through to moist and dry eucalypt forest and rainforest; most commonly found in tall wet forest.	Suitable habitat occurs.	**Possible. Test of significance required.**
Syconycteris australis	Common Blossom-bat	V	-	Feeds in heathland and paperbark swamps; roosts in littoral rainforest. Also recorded in subtropical rainforest, wet sclerophyll forest and other coastal forests.	Habitat marginal, no recent records.	Unlikely. Test of significance not required.
Thylogale stigmatica	**Red-legged Pademelon**	V	-	Rainforest, vine scrub, moist eucalypt forest with dense understorey and ground cover.	Suitable habitat occurs.	**Possible. Test of significance required.**
Vespadelus troughtoni	**Eastern Cave Bat**	V	-	Cave roosting species found in dry open forest and woodland near cliffs and rocky overhangs.	Suitable habitat occurs.	**Possible. Test of significance required.**

V = Vulnerable; E = Endangered; CE = Critically Endangered

Appendix G

Tests of Significance (BC Act)

Tests of significance ('five-part tests') under Section 7.3 of the BC Act have been completed for the following threatened species and communities:

Flora:

- Arrow-head Vine
- Corokia
- Green-leaved Rose Walnut
- Narrow-leaf Finger Fern
- Onion Cedar
- Peach Myrtle
- Rainforest Senna
- Red Boppel Nut
- Red Lilly Pilly
- Rough-shelled Bush Nut
- Rusty Plum
- Rusty Rose Walnut
- Scrub Turpentine
- Small-leaved Hazelwood
- Tree Guinea Flower

TECs:

- Lowland rainforest

Fauna:

Highly Mobile Birds

- Barred Cuckoo-shrike
- Glossy Black-Cockatoo
- Little Lorikeet
- Marbled Frogmouth
- Varied Sittella
- White-eared Monarch
- Rose-crowned Fruit-dove
- Superb Fruit-dove
- Wompoo Fruit-dove

Less Mobile Birds

- Albert's Lyrebird
- Pale-vented Bush-hen

Owls

- Masked Owl
- Powerful Owl
- Sooty Owl

Ground-dwelling Mammals

- Long-nosed Potoroo
- Spotted-tailed Quoll

Macropods

- Parma Wallaby
- Red-legged Pademelon

- Rufous Bettong

Arboreal mammals

- Koala
- Squirrel Glider
- Yellow-bellied Glider

Flying-foxes

- Eastern Tube-nosed Bat
- Grey-headed Flying-fox

Microbats

- Eastern Cave Bat
- Eastern Coastal Free-tailed Bat
- Eastern False Pipistrelle
- Eastern Long-eared Bat
- Golden-tipped Bat
- Greater Broad-nosed Bat
- Large Bent-winged Bat
- Large-eared Pied Bat
- Little Bent-winged Bat
- Yellow-bellied Sheathtail-bat

Reptiles

- Stephens Banded Snake

Amphibians

- Fleay's Barred Frog
- Giant Barred Frog
- Green-thighed Frog
- Loveridge's Frog
- Pouched Frog

FLORA & TECs

Arrow-head Vine

Arrow-head Vine is a tall woody climber associated with wetter subtropical rainforest, including littoral rainforest, on fertile, basalt-derived soils.

Threatening processes for this species include:

- Clearing and fragmentation of habitat for development, agriculture, and roading.
- Risk of local extinction because populations are small at some locations.
- Grazing and trampling by domestic stock.
- Fire.
- Invasion of habitat by introduced weeds.
- Accidental damage to plants when cutting introduced vines during bush regeneration.

Corokia

Corokia is a shrub or small tree to 4 m tall, with a highly restricted distribution. Flowering occurs spring–summer, with red drupes following shortly after. Typically found at the boundaries between wet eucalypt forest and warm temperate rainforest, at altitudes up to 800 m.

Threatening processes for this species include:

- Loss of habitat from clearing for urban expansion.
- Risk of extinction because populations are small and distribution is highly restricted.
- Timber harvesting activities.
- Fire, as hot fires will kill the plants.
- Invasion of habitat by weeds.

Green-leaved Rose Walnut

The Green-leaved Rose Walnut is a tree up to 30 m tall with brown bark, often in loose round plates. Twigs and branchlets are covered in hairs. The moderately glossy leaves are oval or drawn out towards the tips, and measure 6 – 12 cm long and 3 – 5 cm wide, with three to five pairs of side veins. Flushes of new growth are pinkish-green. Flowers are small, yellowish and hairless, and are held in small clusters. The fleshy fruits are egg-shaped, 2.5 – 3 cm long and black when ripe.

Threatening processes for this species include:

- Clearing and fragmentation of habitat for coastal development.
- Clearing and fragmentation of habitat for agriculture.
- Infestation of habitat by weeds.
- Clearing and fragmentation of habitat for road-works.
- Frequent fire.
- Disturbance from recreational users in reserve areas.
- Forestry related activities within wet sclerophyll forest habitat.
- Damage from domestic stock.
- Habitat loss and fragmentation as a result of infrastructure development including powerline construction.

Narrow-leaf Finger Fern

The Narrow-leaf Finger Fern is a small fern, growing in small colonies, with hanging or erect fronds, which occurs in moist places, usually near streams, on rocks or in trees, in rainforest and moist eucalypt forest.

Threatening processes for this species include:

- Loss of habitat through clearing, especially along streamsides.
- Damage to habitat by human visitation.
- Illegal collection by fern enthusiasts.

Onion Cedar

Onion Cedar is a tall evergreen tree, up to 30 m, with a dense glossy dark-green crown which occurs in subtropical and dry rainforest from Bangalow to the McPherson Range.

Threatening processes for this species include:

- Clearing and fragmentation of habitat for development, agriculture, and road-works.
- Climate change
- Weed invasion, primarily *Lantana camara*.
- Activation of acid sulfate soils
- Grazing by domestic stock.
- Fire.
- Current or potential future land management practices do not support species conservation

Peach Myrtle

Peach Myrtle is a shrub or small tree growing up to 12 m tall, the trunk often crooked and covered in brown scaly or flaky bark. It often forms clumps of plants as it grows from root suckers and coppice shoots. Found only in the far north-east of NSW in Nightcap and Mount Jerusalem National Parks and Whian Whian State Conservation Area, west of Mullumbimby. Occurs in Warm temperate rainforest on less fertile soils derived from rhyolite rock; often associated with Coachwood (*Ceratopetalum apetalum*).

Threatening processes for this species include:

- Fire.
- Risk of local extinction because distribution is restricted.
- Susceptible to Myrtle Rust.
- Risk of local extinction because numbers are low.
- Road maintenance.
- Possible mining activities.
- Low recruitment.

Rainforest Senna

Rainforest Senna grows on the margins of subtropical, littoral and dry rainforests and is often found as a gap phase shrub. Flowering occurs in spring and summer and the fruit is ripe in summer and autumn. Primarily pollinated by a variety of bees.

Threatening processes for this species include:

- Clearing of habitat for agriculture.
- Clearing of habitat for development.
- Invasion by introduced weeds, particularly lantana, bitou bush and exotic and native vines.
- Accidental removal during weed-control programs.
- Disturbance and habitat damage from domestic stock.
- Timber harvesting activities.
- Disturbance during road/track maintenance activities.

- Inappropriate fire regime, either too intense/frequent or too infrequent, preventing growth and recruitment.
- Potential for disturbance or degradation of habitat close to walking tracks.
- Poor knowledge of the species distribution and population dynamics.

Red Boppel Nut

Red Boppel Nut is a small tree to 10 m tall, often with several unbranched stems rising from the rootstock. Flowering is mostly winter; fruits appear in spring and summer. Occurs in subtropical rainforest, moist eucalypt forest and Brush Box forest.

Threatening processes for this species include:

- Clearing of rainforest habitat for development or agriculture.
- Invasion of habitat by introduced weeds, particularly Lantana and exotic vines.
- Fire.
- Collection of seed for horticulture.
- Disturbance by domestic stock.
- Disturbance during roadworks.

Red Lilly Pilly

Small tree to about 11 m tall, with a restricted range from the Richmond River in north-east NSW to Gympie in Queensland. Usually found in riverine and subtropical rainforest on rich alluvial or basaltic soils. Flowering occurs February–March.

Threatening processes for this species include:

- Clearing and fragmentation of habitat for development, agriculture, road-works and powerlines.
- Weed infestation and general degradation of rainforest habitat.
- Grazing and trampling of seedlings and saplings by domestic stock.
- Roadside slashing and mowing.
- Illegal collection for horticulture.
- Large scale, high intensity fire is likely to cause significant damage to the population.

Rough-shelled Bush Nut

The Rough-shelled Bush Nut is a small to medium-sized, usually densely bushy, tree growing up to 18m tall. The species is confined chiefly to the north of the Richmond River in north-east NSW, extending just across the border into Queensland; occurs in subtropical rainforest, usually near the coast. Flowering occurs August–October, fruit ripe January.

Threatening processes for this species include:

- Clearing and fragmentation of habitat for coastal development, agriculture and roadworks.
- Risk of local extinction due to low numbers.
- Grazing and trampling by domestic stock.
- Fire.
- Invasion of habitat by weeds.
- Loss of local genetic strains through hybridisation with commercial varieties.
- Reduction of genetic diversity as a result of fragmentation.

Rusty Plum

Rusty Plum is a small to medium-sized tree to 20 m high with a very fluted or irregular trunk, occurring in the coast and adjacent ranges of northern NSW from the Macleay River into southern Queensland. Typically found in gully, warm temperate or littoral rainforests and the adjacent understorey of moist eucalypt forest; occurs on poorer soils in areas below 600 metres above sea level.

Threatening processes for this species include:

- Clearing of habitat for development.
- Timber harvesting activities.
- Clearing for agriculture.
- Invasion of habitat by introduced weeds, particularly Lantana.
- Inappropriate fire regime altering habitat and resulting in direct loss of individuals.
- Road work and track maintenance.
- Trampling by domestic stock.

Rusty Rose Walnut

Often a small crooked tree but can grow to 35 m tall; has a restricted distribution from Burleigh Heads in Queensland to the Richmond River in north-east NSW. It is locally abundant in some parts of its range in NSW. Occurs in sheltered moist gullies in lowland subtropical and warm temperate rainforest on alluvium or basaltic soils. The species occurs in regrowth and highly modified forms of these habitats. Flowers have been recorded in spring and in March, October and November, with fruits recorded in March and May.

Threatening processes for this species include:

- Clearing and fragmentation of habitat for coastal development and agriculture.
- Infestation of habitat by weeds.
- Clearing and fragmentation of habitat for road-works.
- Frequent fire.
- Disturbance from recreational users in reserve areas.
- Forestry related activities within wet sclerophyll forest habitat.
- Damage from domestic stock.
- Habitat loss and fragmentation as a result of infrastructure development including powerline construction.

Scrub Turpentine

Scrub Turpentine is a shrub or small tree to 25 m high which occurs in a range of forest communicates including Subtropical Rainforests, Northern Warm Temperate Rainforests, Littoral Rainforest and Wet Sclerophyll Forests. Populations and individuals of Scrub Turpentine are often found in wet sclerophyll associations in rainforest transition zones and creekside riparian vegetation. The species may also occur as a pioneer in adjacent areas of dry sclerophyll and grassy woodland associations Flowering occurs in late winter through to spring, with a peak in October, and fruits typically begin to appear in December.

The key threat to Scrub Turpentine is mortality caused by infection by Myrtle Rust (*Austropuccinia psidii*).

Small-leaved Hazelwood

The Small-leaved Hazelwood is a tall shrub or small tree that grows to 7 m tall and is restricted to the Mount Warning caldera from Springbrook in Queensland, to the Nightcap Range in north-east New South Wales and within 40 km of the coast. This species grows in subtropical and warm temperate rainforests on less fertile soils derived from rhyolite and occasionally in wet sclerophyll forest adjacent to rainforest. The altitude of known sites ranges from 140 m to 1000 m above sea level. Flowering has been recorded from August to September and fruiting has been recorded in December and February

Threatening processes for this species include:

- Clearing of habitat for agriculture.
- Fire destroying individuals and their habitat.
- Private native forestry.
- Clearing of habitat for development.
- Disturbance from road maintenance and construction.
- Risk of local extinction because populations are small.
- Risk of local extinction because of limited distribution.
- Climate changed induced habitat modifications.
- Weed invasion.

Tree Guinea Flower

Tree Guinea Flower grows as a tall shrub to small tree with star-shaped hair-clusters on the branches. Showy yellow flowers with 5 petals are produced in spring. The fruit is a dry pod, splitting at the top to expose the seeds. The species is associated with heath, open forest or rainforest and is restricted to the coastal ranges of the Mount Warning area of north-east NSW including Mt Warning and Nightcap National Parks; with a separate population in the Wauchope–Kendall area.

Based on recent field assessment (GeoLINK, in prep.), a population of up to 1000 mature plants may occur within the Nightcap range. Fire affected populations of the species were killed outright, with substantial post-fire seedling germination observed.

Threatening processes for this species include:

- Isolation of populations.
- Trampling by tourist activities.
- Timber harvesting activities.
- Inappropriate fire regimes, which do not encourage regeneration of the species.

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,

Works required for the TBHT will traverse threatened flora habitat at numerous locations, however based on the construction methodology (ecologist present to guide works in sensitive locations) it would be unlikely that any threatened flora would be directly physically impacted by the construction works given that avoidance of impacts is both an aim of the proposal and is able to be practically achieved by micro-siting of the track and/or any facilities.

Tree Guinea Flower will be directly affected where 86 seedlings will be impacted in section 3 of the track. While efforts to avoid these plants were implemented, germination in this area is prolific and the track siting opportunities highly constrained. Following survey of other populations of Tree Guinea Flower within Nightcap NP/Whian Whian SCA (GeoLINK, in prep.), it was determined that a

reasonably robust population of the species occurs (despite some small populations being affected by the 2019 fires) and that the loss of 86 seedlings of the species would not significantly affect the viability of the local population, where the greatest threat is posed by future wildfires or too frequent fires.

Once operational, there is increased potential for disturbance to threatened flora by accidental damage or disturbance, creation of informal tracks or side tracks / shortcuts or by patrons actively picking or collecting fruit or flowers (eg. Red Boppel Nut). While the incidence of these impacts cannot be quantified, it is expected that they would be very low. The persistence of numerous stems of threatened flora along existing tracks and trails and low levels of impact (including the highly trafficked Minyon Loop) is an encouraging baseline by which to measure potential impacts of the TBHT.

Transmission of Myrtle Rust is a key threat to stems of Scrub Turpentine and Peach Myrtle, with the TBHT increasing the potential for infection from the construction and operational stages of the project. Myrtle Rust will be controlled during construction works via standard minimisation measures and operational impacts limited by provision of 'best practice' information to patrons to limit the spread of Myrtle Rust (and any other pathogens).

On this basis, the construction and operation of the TBHT would be unlikely to have an adverse effect on the life cycle of any of the subject species such that a viable local population would be placed at risk of extinction.

b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Lowland rainforest: the TBHT will impact on areas of lowland rainforest < 600 m ASL from track construction and formation at several locations. An estimated 2.37 km of walking track will be constructed within undisturbed lowland rainforest whereby removal of shrubs, saplings, vines and groundcovers will be removed/disturbed by staff completing works by hand with mattocks and crowbars. This sensitive approach without using machinery will minimise disturbance to both vegetation and the ground layer and no canopy trees or mature trees will require removal. Allowing for a maximum of 2 m of disturbance, approximately 0.474 ha of lowland rainforest may be disturbed. This disturbance is negligible in the context of substantial areas of lowland rainforest within the three reserves, where an estimated 3179 ha of lowland rainforest occurs (refer to **Table 5.2**). On this basis the works may result in physical disturbance (via track construction) of approximately 0.015% of lowland rainforest within the three reserves. On this basis, the localised nature and low impacts of the works would not place lowland rainforest at increased risk of extinction and would not substantially and adversely modify the composition of lowland rainforest in the locality.

Other impacts within lowland rainforest where existing trails and tracks occur (and where minor refinements are required) would be negligible.

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

Threatened flora: as noted, 86 seedlings of Tree Guinea Flower will require removal for track construction in Section 3 of the TBHT. The loss of these plants represents a very small population of the established population in the locality with large numbers of adult plants occurring (est. ~ 1000) and substantial evidence of post fire germination being evident (GeoLINK, in prep.).

No other threatened flora will be directly removed for the construction of the TBHT. Where habitat for more sensitive species occurs (*Grammitis stenophylla*) the TBHT will be micro-sited to avoid these areas and maintain separation from the walking track.

Lowland rainforest: an estimated 0.474 ha of lowland rainforest will be disturbed by construction and subjected to selective removal of shrubs, vines and groundcovers. This forms a negligible portion of the ~3179 ha of lowland rainforest within the three conservation reserves in which the works would occur. Other impacts within lowland rainforest where existing trails and tracks occur (and where minor refinements are required) would be negligible.

(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

Threatened flora: the construction and operation of the TBHT would not result in the fragmentation of habitat for any of the subject threatened flora such that any population would be isolated or that key life cycle functions (flowering, pollination, genetic exchange, propagule dissemination) would be negatively impacted by the construction or operation of the TBHT. The TBHT will partially fragment Tree Guinea Flower seedlings within an area of post fire regeneration, however the track would not contribute to any genetic isolation or limit reproductive success of the species.

Lowland rainforest: a total of 9.7 km of the TBHT will occur within rainforest, of which 2.37 km requires track construction within undisturbed areas. Tracks within undisturbed areas will be narrow (600 mm in width, with a potential disturbance footprint of 2 m width) and would not result in fragmentation of any vegetation, create canopy disruption or exacerbate any edge effects within closed forest environments.

(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,

Threatened flora: Tree Guinea Flower - the habitat to be removed represents a small portion of available habitat for the species in the context of numerous adult and regenerating populations within the two southern reserves.

For other species, no habitat of any threatened flora will be removed as a result of the proposed construction methodology. Ongoing walking along the constructed track would be unlikely to significantly impact on threatened flora habitat.

Lowland rainforest: an estimated 0.015% of lowland rainforest will be disturbed from construction within undisturbed vegetation within the context of the three conservation reserves. These impacts are very low and are limited to select removal of shrubs, vines and groundcovers. This habitat is of low importance to the structural complexity and long term survival of lowland rainforest in the locality. Use of existing tracks and trails within/abutting rainforest is unlikely to result in any significant impacts to existing rainforest communities.

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 areas of outstanding biodiversity value listed in the BC Act occur at or in proximity to the site.

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.

A key threatening process (KTP) is a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species or ecological communities. The current list of KTP under the BC Act, and whether the Proposal is recognised as a KTP is shown in **Table G.1**.

Table G.1 Key Threatening Processes

Key Threatening Process (as per Schedule 4 of the BC Act)	*Is the activity characteristic of, or likely to increase the risk of a key threatening process?*		
	Likely	*Possible*	*Unlikely*
Aggressive exclusion of birds by noisy miners (*Manorina melanocephala*)			✓
Alteration of habitat following subsidence due to longwall mining			✓
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands			✓
Anthropogenic climate change			✓
Bushrock removal	✓		
Clearing of native vegetation	✓		
Competition and grazing by the feral European Rabbit (*Oryctolagus cuniculus*)			✓
Competition and habitat degradation by feral goats (*Capra hircus*)			✓
Competition from feral honeybees (*Apis mellifera*)			✓
Death or injury to marine species following capture in shark control programs on ocean beaches			✓
Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments			✓
Forest eucalypt dieback associated with over-abundant psyllids and bell miners			✓
Habitat degradation by Feral Horses, *Equus caballus*			✓
Herbivory and environmental degradation caused by feral deer			✓
High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition			✓
Importation of red imported fire ants (*Solenopsis invicta*)			✓
Infection by *Psittacine circoviral* (beak and feather) disease affecting endangered psittacine species and populations			✓
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis			✓
Infection of native plants by *Phytophthora cinnamomi*		✓	
Introduction and Establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae		✓	
Introduction of the large earth bumblebee (*Bombus terrestris*)			✓
Invasion and establishment of exotic vines and scramblers			✓
Invasion and establishment of Scotch Broom (*Cytisus scoparius*)			✓
Invasion and establishment of the Cane Toad (*Bufo marinus*)			✓
Invasion, establishment and spread of Lantana (*Lantana camara*)			✓
Invasion of native plant communities by African Olive (*Olea europaea L. subsp. cuspidata*)			✓
Invasion of native plant communities by *Chrysanthemoides monilifera*			✓
Invasion of native plant communities by exotic perennial grasses		✓	
Invasion of the Yellow Crazy Ant (*Anoplolepis gracilipes*) into NSW		✓	
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants			✓
Loss of hollow-bearing trees		✓	
Loss or degradation (or both) of sites used for hill-topping by butterflies			✓
Predation and hybridisation by feral dogs (*Canis lupus familiaris*)		✓	
Predation by the European Red Fox (*Vulpes vulpes*)		✓	
Predation by the feral cat (*Felis catus*)			✓
Predation by *Gambusia holbrooki* (Plague Minnow or Mosquito Fish)			✓
Predation by the Ship Rat (*Rattus rattus*) on Lord Howe Island			✓

Key Threatening Process (as per Schedule 4 of the BC Act)	*Is the activity characteristic of, or likely to increase the risk of a key threatening process?*		
	Likely	*Possible*	*Unlikely*
Predation, habitat degradation, competition and disease transmission by feral pigs (*Sus scrofa*)			✓
Removal of dead wood and dead trees	✓		

Several KTPs may apply to the construction and operation of the TBHT:

- *Bushrock removal*: Bush rock will be removed or relocated at strategic locations where rock is already disturbed or will be unearthed from excavation or has fallen from the cliff face at Minyon Falls (refer to **Section 3.2.3**). The extent of bush rock removal will be negligible in the context of the overall TBHT. This KTP is not relevant to the subject threatened flora; nor would it substantially affect the structure and integrity of lowland rainforest.
- *Clearing of Native Vegetation:* refers to the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation. Construction works would require clearing of shrubs, vines and groundcovers over a distance of approximately 14.39 km (estimated area of ~ 2.88 ha), with nominal vegetation disturbance required to adapt existing tracks and trails and install facilities at the three camps (estimated area of ~ 0.7 ha). Contributions to this KTP are therefore very minor in the context of three large conservation reserves.
- *Infection of frogs by amphibian chytrid causing the disease chytridiomycosis*: not relevant to threatened flora and communities; addressed by adoption and implementation of standard hygiene protocols during construction.
- *Infection of native plants by Phytophthora cinnamomic*: Phytophthora is already present within all reserves. The operation and construction of the TBHT would be unlikely to increase the incidence of Phytophthora such that any of the subject species (or lowland rainforest) would be significantly affected.
- *Introduction and Establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae*: introduction and transmission of Myrtle Rust is a concern for the project but can be managed by standard control and minimisation measures during construction and addressed by education on best practice management during operations.
- *Invasion, establishment and spread of Lantana (Lantana camara)*: Lantana already occurs at low densities in select areas of the TBHT. The construction and operation of the project would be unlikely to significantly increase the incidence of Lantana such that it would significantly affect threatened flora or communities.
- *Invasion of native plant communities by exotic perennial grasses*: Exotic grasses (mostly Broad-leaved paspalum) are common along track verges in some disturbed areas. There is potential that patrons may spread grass seed along the track and into areas of native vegetation. There is little risk of native grass invasion affecting any of the subject threatened flora or rainforest TEC due to low light conditions being unfavourable to exotic grasses.
- *Invasion of the Yellow Crazy Ant (Anoplolepis gracilipes) into NSW*: Yellow Crazy Ants have been recorded in the Lismore region and have potential to be transported to the site by machinery during the construction phase. Adoption and maintenance of appropriate hygiene procedures would address this issue.
- *Loss of hollow-bearing trees*: no standing hollow-bearing trees would require removed for the construction works. Timber 'deadfalls' require clearing across old snig tracks along parts of the TBHT and some fallen trees may contain small hollows; the importance of these habitats at ground level (ie. accessed by predators) is likely to be very low.
- *Predation and hybridisation by feral dogs (Canis lupus familiaris)/Predation by the European Red Fox (Vulpes vulpes)*: The TBHT will improve opportunities for dispersal by feral animals such as wild dogs and foxes. However, the majority of the TBHT already occurs and there is a large

network of roads and informal pathways throughout all three reserves from historic operations. As such, contributions to this KTP are expected to be minor.

- *Removal of dead wood and dead trees*: Fallen timber is common along less well maintained tracks and will require removal and relocation. The impacts of these works are unlikely to be significant.

Conclusion

It is considered unlikely that the local population of any of the subject species or communities would be placed at significant risk of extinction as a result of the proposal.

FAUNA

Highly Mobile Birds

Barred Cuckoo-shrike

The Barred Cuckoo-shrike occurs within rainforest, eucalypt forests and woodlands, clearings in secondary growth, swamp woodlands and timber along watercourses. They are usually seen in pairs or small flocks foraging among foliage of trees for insects and fruit. They are active birds, frequently moving from tree to tree.

Threatening processes for this species include:

- Reduction of habitat, particularly rainforest, due to clearing for agriculture, development and timber harvesting.

Glossy Black-Cockatoo

Glossy Black-Cockatoo inhabit open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Black Sheoak (*Allocasuarina littoralis*) and Forest Sheoak (*A. torulosa*) are important foods. Inland populations feed on a wide range of sheoaks, including Drooping Sheoak (*Allocasuarina diminuta*) and *A. gymnathera*. Belah is also utilised and may be a critical food source for some populations. Glossy Black-Cockatoo are dependent on large hollow-bearing eucalypts for nest sites. A single egg is laid between March and May.

Threatening processes for this species include:

- Reduction of suitable habitat through clearing for development.
- Decline of hollow-bearing trees over time due to land management activities.
- Excessively frequent fire which eliminates sheoaks from areas, prevents the development of mature sheoak stands, and destroys nest trees.
- Firewood collection resulting in loss of hollow-bearing trees, reduced recruitment of hollow-bearing trees, and disturbance of breeding attempts.
- Decline in extent and productivity of sheoak foraging habitat due to feral herbivores.
- Reduced access to surface water in close proximity to foraging and nesting habitat.
- Limited information on the location of nesting aggregations and the distribution of high quality breeding habitat.
- Disturbance from coal seam gas and open cut coal mining causing loss of foraging and breeding habitat as well as disturbing reproductive attempts.
- Decline in extent and productivity of sheoak foraging habitat caused by moisture stress due to climate change.
- Forestry activity resulting in loss of hollow-bearing trees, reduced recruitment of hollow-bearing trees, degradation of foraging habitat, and disturbance of breeding attempts.
- Degradation of foraging habitat and reduced regeneration of sheoak stands due to grazing by domestic stock.
- Loss of foraging habitat due to slashing/ under scrubbing.
- Change in the spatial and temporal distribution of resources due to global warming.
- Illegal bird smuggling and egg-collecting.
- Habitat infestation by weeds such as African Boxthorn, Gazania, Buffel Grass and other invasive grasses.

Little Lorikeet

The Little Lorikeet mostly forages in the canopy of open eucalypt forest and woodland, utilising *Eucalyptus*, *Angophora, Melaleuca* and other tree species. Nomadic movements are common, influenced by season and food availability, although some areas retain residents for much of the year. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. The species feeds mostly on nectar and pollen, but occasionally also on native fruits such as mistletoe. Nests are generally located in proximity to feeding areas if possible and entrances are small (3 cm) and usually high above the ground (2-15 m). Nest sites are often used repeatedly for decades, suggesting that preferred sites are limited. Riparian trees are often chosen, including species like *Allocasuarina*. The nesting season extends from May to September.

Threatening processes for this species include:

- Clearing of woodlands for agriculture.
- Loss of old hollow-bearing trees.
- Competition with the introduced Honeybee.
- Infestation of habitat by invasive weeds.
- Inappropriate fire regimes.
- Aggressive exclusion from forest and woodland habitat by over abundant Noisy Miners.
- Climate change impacts including reduction in resources due to drought.
- Degradation of woodland habitat and vegetation structure due to overgrazing.

Marbled Frogmouth

Marbled Frogmouths inhabit subtropical rainforest, particularly in deep, wet, sheltered gullies along creek lines and often containing stands of Bangalow Palms or ferns. In NSW, the species is most often found in moist, lowland, mesophyll vine forest. Less often, Marbled Frogmouths are found in the ecotone between rainforest and wet Eucalyptus forests, or occasionally in cool rainforest and higher elevation temperate rainforests. The Marbled Frogmouth is, like other frogmouths, nocturnal, hunting at night and roosting by day. The diet consists mainly of large nocturnal insects. Birds breed from about August to December. The usual clutch is one but is sometimes two eggs.

Threatening processes for this species include:

- Clearing, fragmentation and isolation of rainforest and associated wet eucalypt forests for agriculture and forestry has been the main cause of past declines and continue to operate as a threat for the species.
- Opening of the canopy and promotion of dense understorey growth caused by timber harvesting.
- Invasion of habitat by weeds following disturbance.
- Isolation of patches of habitat owing to frequent burning of connecting forest.

Varied Sittella

The Varied Sittella is distributed widely in NSW, extending from the coast to the far west. The NSW population has undergone a moderate reduction over the past several decades. Habitat includes eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and *Acacia* woodland. The Varied Sittella forages for arthropods on bark, dead branches and small branches and twigs; the nest is cup-shaped and built of plant fibres and cobwebs in an upright tree fork high in the living tree canopy.

Threatening processes for this species include:

- Habitat decline.
- Dominance of Noisy Miners in woodland patches.
- Threats include habitat degradation through small-scale clearing for fence lines and road verges, rural tree decline, loss of paddock trees and connectivity, 'tidying up' on farms, and firewood collection.
- Infestation of habitat by invasive weeds.
- Inappropriate fire regimes.
- Climate change impacts including reduction in resources due to drought.
- Overgrazing by stock impacting on leaf litter and shrub layer.

White-eared Monarch

In NSW, White-eared Monarchs occurs in rainforest, especially drier types, such as littoral rainforest, as well as wet and dry sclerophyll forests, swamp forest and regrowth forest. They appear to prefer the ecotone between rainforest and other open vegetation types or the edges of rainforest, such as along roads. The White-eared Monarch eats insects, but their diet is not well studied. They breed from about September to March, usually nesting high in the canopy, and often at the edge of patches of rainforest.

Threatening processes for this species include:

- Clearing and increasing fragmentation and isolation of habitat, especially low-elevation subtropical rainforest, littoral rainforest and wet sclerophyll forest, through agricultural, tourist and residential development or forestry activities.
- Forest management that results in conversion of multi-aged forests to young, even-aged stands.
- Invasion of forests by weeds.
- Inappropriate fire regimes that degrade habitat or allow invasion by weeds.
- Degradation or loss of habitat through grazing of stock.
- Changes to rainforest habitat with climate change including drying and increased fire frequency.
- Lack of information on the species habitat requirements in NSW, particularly breeding habitat.
- Easily disturbed by the presence of people

Wompoo/ Rose-crowned/ Superb Fruit-dove

Fruit-doves occupy similar habitat niches in moist sclerophyll and rainforests, predominantly along the east coast of NSW. They feed on ripe fruits from a diverse range of fruit bearing species including figs, palms, trees, shrubs and vines. These birds are thought to be effective medium to long distance vectors for seed dispersal due their locally nomadic behaviour. Breeding takes place from spring to summer within a stick nest where typically a single egg is laid. Both parent birds take turns to incubate the egg.

Threatening processes for these species include:

- Clearing and fragmentation of low to mid-elevation rainforest due to coastal development and grazing.
- Logging and roading in moist eucalypt forest with well-developed rainforest understorey.
- Burning, which reduces remnant rainforest habitat patches.
- Infestation of rainforest habitat by invasive weeds.
- Removal of Camphor Laurel food source without appropriate mitigation measures.

Less Mobile Birds

Albert's Lyrebird

Albert's Lyrebird mainly occurs in the wettest rainforests or wet sclerophyll forests with a wet understorey, often of rainforest plants. Higher densities of Albert's Lyrebirds occur in association with a canopy of eucalypts compared with rainforest lacking eucalypts (for equivalent climate), and in wet sclerophyll forest with greater weights of litter and logs and slower rates of litter decomposition.

Threatening processes for this species include:

- Clearing of rainforest and wet eucalypt forest habitat, and subsequent, fragmentation and isolation of remnant patches, for forestry and agriculture is thought to be the main reason for the decline of the species and continued clearing through forestry activities or for agricultural and residential development remains a threat to the species.
- Intensive management of forests, especially loss of optimal wet sclerophyll forest habitat to plantations of eucalypts or Hoop Pines (*Araucaria cunninghamii*), but also including damage to the canopy, understorey and ground layers of rainforest and wet sclerophyll forest habitats through forestry practices.
- Invasion of logged or otherwise damaged habitat by weeds, especially Lantana (*Lantana camara*), which reduces suitability of the habitat.
- Damage to habitat by grazing stock.
- Encroachment of urban or rural development close to habitat of Albert's Lyrebirds, as densities of Lyrebirds are lower close to such developments than would be expected.
- The isolated population in the Blackwall Range is under threat because it is so small, with possibly as few as ten or fewer birds, and isolated from other populations.
- Fire may be a threat in exceptionally dry years, particularly isolated outlying populations.
- Predation by Red Foxes (*Vulpes vulpes*), and feral or, close to settlements, domestic Dogs and Cats may pose some threat, though this is thought to be of minor significance.
- Anthropogenic climate change, and potential changes to habitat and further restrictions of range linked to such change.

Pale-vented Bush-hen

The Pale-vented Bush-hen inhabits tall dense understorey or ground-layer vegetation on the margins of freshwater streams and natural or artificial wetlands, usually within or bordering rainforest, rainforest remnants or forests. Bush-hens also occur in secondary forest growth, rank grass or reeds, thickets of weeds, such as Lantana and pastures, crops or other farmland, such as crops of sugar cane, and grassy or weedy fields, or urban gardens where they border forest and streams or wetlands, such as farm dams. Key elements of their habitat are dense undergrowth 2 to 4 m tall and within 300 m of water.

The diet consists of seeds, plant matter, earthworms, insects and some frogs, taken from ground cover or by wading at edges of streams or wetlands. The breeding season is from spring to early autumn, October to April. The nest is a shallow bowl or cup of grass stems, often partly hooded, built close to water in thick ground vegetation such as dense Blady Grass (*Imperata cylindrica*), Mat Rush (*Lomandra* spp.) or reeds, often under or growing through shrubs or vine or beneath a tree.

Birds lay 4 to 7 eggs in a clutch and will re-lay after a successful breeding attempt and make multiple attempts after nesting failures. The incubation period is about 3 weeks. The hatchlings are precocial and can run soon after hatching; they are probably dependent on their parents for 4 to 5 weeks after hatching.

Threatening processes for this species include:

- Clearing, filling and draining of wetlands for agricultural, residential and industrial development.
- Pollution of wetlands from agricultural, urban and industrial run-off, including herbicides and pesticides.
- Changes to wetlands caused by weed invasion, often associated with sedimentation or grazing.
- Predation by introduced, feral and domestic predators, particularly Red Foxes (*Vulpes vulpes*) and Cats (*Felis catus*).
- Destruction of habitat and predation by feral Pigs (*Sus scrofa*).
- Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands.
- Loss of dense and rank understorey vegetation near streams and wetlands with clearing associated with urban and semi-rural developments.

Owls

Masked Owl

Masked Owls live in dry eucalypt forests and woodlands from sea level to 1ten0 m and often hunt along the edges of forests, including roadsides. The typical diet consists of tree-dwelling and ground mammals, especially rats. Pairs have a large home-range of 500 to ten00 ha. Masked Owls roost and breed in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.

Threatening processes for this species include:

- Loss of mature hollow-bearing trees and changes to forest and woodland structure, which leads to fewer such trees in the future.
- Clearing of habitat for grazing, agriculture, forestry or other development.
- A combination of grazing and regular burning is a threat, through the effects on the quality of ground cover for mammal prey, particularly in open, grassy forests.
- Secondary poisoning from rodenticides.
- Being hit by vehicles.

Powerful Owl

The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine (*Syncarpia glomulifera)*, Black She-oak (*Allocasuarina littoralis)*, Blackwood (*Acacia melanoxylon)*, Rough-barked Apple (*Angophora floribunda)*, Cherry Ballart (*Exocarpos cupressiformis)* and a number of eucalypt species.

The main prey items are medium-sized arboreal marsupials, particularly the Greater Glider, Common Ringtail Possum and Sugar Glider. Flying-foxes are important prey in some areas; birds comprise about ten-50% of the diet depending on the availability of preferred mammals. As most prey species require hollows and a shrub layer, these are important habitat components for the owl.

Pairs of Powerful Owls demonstrate high fidelity to a large territory, the size of which varies with habitat quality and thus prey densities. In good habitats a mere 400 can support a pair; where hollow trees and prey have been depleted the owls need up to 4000 ha. Powerful Owls nest in large tree hollows (at least 0.5 m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old. Powerful Owls are monogamous and mate for life. Nesting occurs from late autumn to mid-winter but is slightly earlier in north-eastern NSW (late summer - mid autumn). Clutches consist of two dull white eggs and incubation lasts approximately 38 days.

Threatening processes for this species include:

- Historical loss and fragmentation of suitable forest and woodland habitat from land clearing for residential and agricultural development. This loss also affects the populations of arboreal prey species, particularly the Greater Glider which reduces food availability for the Powerful Owl.
- Inappropriate forest harvesting practices that have changed forest structure and removed old growth hollow-bearing trees. Loss of hollow-bearing trees reduces the availability of suitable nest sites and prey habitat.
- Can be extremely sensitive to disturbance around the nest site, particularly during pre-laying, laying and downy chick stages. Disturbance during the breeding period may affect breeding success.
- High frequency hazard reduction burning may also reduce the longevity of individuals by affecting prey availability.
- Road kills.
- Secondary poisoning.
- Predation of fledglings by foxes, dogs and cats.

Sooty Owl

Sooty Owls occur in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. Roosts by day in the hollow of a tall forest tree or in heavy vegetation; hunts by night for small ground mammals or tree-dwelling mammals such as the Common Ringtail Possum (*Pseudocheirus peregrinus*) or Sugar Glider (*Petaurus breviceps*). Nests in very large tree-hollows.

Threatening processes for this species include:

- Loss of mature hollow-bearing trees and changes to forest and woodland structure, which leads to fewer such trees in the future.
- Clearing of habitat for grazing, agriculture, forestry or other development.
- A combination of grazing and regular burning is a threat, through the effects on the quality of ground cover for mammal prey, particularly in open, grassy forests.
- Secondary poisoning from rodenticides.

Ground-dwelling Mammals

Long-nosed Potoroo

Long-nosed Potoroo inhabit coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature.

Threatening processes for this species include:

- Habitat loss and fragmentation from land clearing for residential and agricultural development.
- Predation from foxes, wild dogs and cats.
- Too frequent fires or grazing by stock that reduce the density and floristic diversity of understorey vegetation.
- Logging or other disturbances that reduce the availability and abundance food resources, particularly hypogeous fungi, and ground cover.
- Unplanned clearing in areas where the species occurs on private property is likely to degrade the species' habitat.

- Removal of wild dogs and dingoes potentially exposes potoroos to other threats (competition from other species of wallaby / fox predation) due to removal of top order predator.

Spotted-tailed Quoll

The Spotted-tailed Quoll is 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. Individual animals use hollow-bearing trees, fallen logs, small caves, rock outcrops and rocky-cliff faces as den sites. Quolls are mostly nocturnal, although will hunt during the day; spend most of the time on the ground, although also an excellent climber and will hunt possums and gliders in tree hollows and prey on roosting birds.

A generalist predator with a preference for medium-sized (500g-5kg) mammals. Consumes a variety of prey, including gliders, possums, small wallabies, rats, birds, bandicoots, rabbits, reptiles and insects. Also eats carrion and takes domestic fowl. Females occupy home ranges of 200-500 hectares, while males occupy very large home ranges from 500 to over 4000 hectares. Are known to traverse their home ranges along densely vegetated creek lines. Average litter size is five; both sexes mature at about one year of age. Life expectancy in the wild is about 3-4 years.

Threatening processes for this species include:

- Loss, fragmentation and degradation of habitat.
- Competition with introduced predators such as cats and foxes.
- Deliberate poisoning, shooting and trapping, primarily in response to chicken predation.
- Roadkill
- Poisoning from eating cane toads in the wild.

Macropods

Parma Wallaby

Preferred habitat is moist eucalypt forest with thick, shrubby understorey, often with nearby grassy areas, rainforest margins and occasionally drier eucalypt forest. Typically feed at night on grasses and herbs in more open eucalypt forest and the edges of nearby grassy areas. During the day they shelter in dense cover.

Threatening processes for this species include:

- Predation by foxes.
- Predation by domestic and wild dogs/dingos.
- Loss and fragmentation of habitat through clearing and under scrubbing.
- Inappropriate fire regime reducing or degrading habitat, especially as a result of overly frequent or intense fires and regular burning of forest margins.
- Climate change altering habitat and increasing risks associated with fire.
- Removal of the understorey and shrub layer by grazing stock.
- Predation by feral cats.
- Habitat degradation and grazing competition by feral horses, cattle, pigs and rabbits.
- Intensive forestry practices resulting in, or exacerbating, habitat loss and fragmentation.
- Habitat degradation and grazing competition by domestic stock.
- Vehicle strike.
- Lack of information about disease prevalence and susceptibility.

Red-legged Pademelon

Red-legged Pademelons inhabit forest with a dense understorey and ground cover, including rainforest, moist eucalypt forest and vine scrub. Wet gullies with dense, shrubby ground cover provide shelter from predators. Animals disperse from dense shelter areas to feed from late afternoon to early morning, favouring native grasses and herbs on the edge of the forest. Also known to feed on fruits, young seedling leaves and stems, fungi and ferns.

Threatening processes for this species include:

- Loss or fragmentation of habitat due to land clearing and under scrubbing.
- Predation by domestic and wild dogs/dingos.
- Predation by foxes.
- Inappropriate fire regime reducing or degrading habitat, especially as a result of overly frequent or intense fires and regular burning of forest margins.
- Habitat degradation and grazing competition by feral horses, cattle, pigs, and rabbits.
- Predation by feral cats.
- Habitat degradation and grazing competition by domestic stock.
- Climate change altering habitat and increasing risks associated with fire.
- Intensive forestry practices resulting in, or exacerbating, habitat loss and fragmentation.
- Broad scale lantana removal resulting in habitat loss.
- Lack of information about disease prevalence and susceptibility.

Rufous Bettong

Rufous Bettongs inhabit a variety of forests from tall, moist eucalypt forest to open woodland, with a tussock grass understorey. A dense cover of tall native grasses is the preferred shelter. They sleep during the day in cone-shaped nests constructed of grass in a shallow depression at the base of a tussock or fallen log. At night they feed on grasses, herbs, seeds, flowers, roots, tubers, fungi and occasionally insects.

Threatening processes for this species include:

- Changes to the grassy understorey by inappropriate burning and grazing.
- Competition from rabbits.
- Predation by feral cats and foxes, whose numbers appear to increase when dingoes are reduced through baiting.
- Loss of habitat through clearing, logging and collection of fallen timber.
- Poor knowledge of the species' abundance and distribution in the western parts of its range.

Arboreal mammals

Koala

In NSW, Koalas mainly occur on the central and north coasts, with populations on the western side of the Great Dividing Range. Habitat consists of eucalypt woodlands and forests, in which the Koala feeds on more than 70 eucalypt species and 30 non-eucalypt species. Preferred browse species differ across regions. In Lismore, Byron and Tweed LGAs, preferred food trees include Forest Red Gum (*Eucalyptus tereticornis*), Tallowwood (*E. microcorys*), Swamp Mahogany (*E. robusta*) and Small-fruited Grey Gum (*E. propinqua*), with several other species recognised as secondary feed trees.

Home range size varies with quality of habitat, ranging from less than 2 ha to several hundred hectares in size. Generally solitary, the Koala has complex social hierarchies based on a dominant

male with a territory that overlaps that of several females, with sub-ordinate males on the periphery. Females breed at two years of age and produce one young per year.

Threatening processes for this species include:

- Loss, modification and fragmentation of habitat.
- Predation by feral and domestic dogs.
- Intense fires that scorch or kill the tree canopy.
- Road-kills.
- Human-induced climate change, especially drought.

Squirrel Glider

Squirrel Gliders inhabits mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. They prefer mixed species stands with a shrub or Acacia mid-storey. Squirrel Gliders live in family groups of a single adult male one or more adult females and offspring and require abundant tree hollows for refuge and nest sites. The diet varies seasonally and consists of *Acacia* gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein.

Threatening processes for this species include:

- Habitat loss and degradation.
- Fragmentation of habitat.
- Loss of hollow-bearing trees.
- Loss of understorey food resources.
- Inappropriate fire regimes.
- Reduction in food resources due to drought.
- Mortality due to entanglement on barbed wire.
- Occupation of hollows by exotic species.
- Mortality due to collision with vehicles.
- Predation by exotic predators.
- Changes in spatial and temporal distribution of habitat due to climate changes.

Yellow-bellied Glider

Yellow Bellied Gliders predominantly occur in tall mature Eucalypt Forest in areas typically with high rainfall and nutrient rich soils. Forest type preferences include tall montane, mixed coastal and dry escarpment forests, moist gullies and creek flats and tend to vary depending on latitude and elevation. Yellow-bellied Gliders feed primarily on plant and insect exudates including nectar from flowers, sap, honeydew and manna. Protein is acquired from pollen and insects. Distinctive V shaped scars indicate Yellow-bellied Glider feed trees where the animal bites or incises the trunk or limbs of preferred trees to encourage the edible sap to flow. This highly mobile species occupies a large home range between 20 to 85 hectares dispersing to find seasonally variable food resources. They depend on large hollow bearing trees for denning and breeding where family groups of two to six individuals have been recorded.

Threatening processes for this species include:

- Loss and fragmentation of habitat.
- Loss of hollow-bearing trees.
- Loss of feed trees
- Climate change and reduction in resources due to drought.

Flying-foxes

Eastern Tube-nosed Bat

Eastern Tube-nosed Bats favour streamside habitats within coastal subtropical rainforest and moist eucalypt forests with a well-developed rainforest understorey. They feed mainly on fruit and nectar from trees in the rainforest canopy and sometimes come close to human settlement to visit flowering or fruiting trees.

Threatening processes for this species include:

- Clearing and fragmentation of rainforest and wet eucalypt forest for agriculture and residential development.
- Habitat fragmentation and degradation from past land clearing for agriculture, forestry, and urban development reducing habitat availability and condition and food and water availability
- Degradation from weeds including lantana and vines suppressing regeneration of food trees.
- Destruction of Black Bean, an important food tree, because the seeds are toxic to cattle.
- Predation by cats particularly while foraging on low hanging fruit and flowers.
- Disturbance due to agricultural development, individuals getting caught on barbed wire fences near feeding and drinking areas (e.g. near orchards and dams).
- Alteration of habitat from climate change including structure, floristic composition, resource availability (water and food trees and palms), rainforest drying including gullies and streams.
- Monitoring is required to assess the species population trends over time
- Monitoring is required to assess the severity of threats.

Grey-headed Flying-fox (GHFF)

Grey-headed Flying-foxes (GHFF) forage within subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. GHFF feed on the nectar and pollen of native trees, in particular *Eucalyptus, Melaleuca* and *Banksia*, and fruits of rainforest trees and vines, as well as from cultivated gardens and orchards. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young. Annual mating commences in January and conception occurs in April or May; a single young is born in October or November. Site fidelity to camps is high; some camps have been used for over a century. GHFF may travel up to 50 km from the camp to forage; commuting distances are more often <20 km.

Threatening processes for this species include:

- Clearing of woodlands for agriculture.
- Loss of roosting and foraging sites.
- Electrocution on powerlines, entanglement in netting and on barbed-wire.
- Heat stress.
- Conflict with humans.
- Incomplete knowledge of abundance and distribution across the species' range.

Microbats

Eastern Cave Bat

A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals. Occasionally found along cliff-lines in wet eucalypt forest and rainforest. Little is understood of its feeding or breeding requirements or behaviour.

Threatening processes for this species include:

- Clearing and isolation of dry eucalypt forest and woodland, particularly about cliffs and other areas containing suitable roosting and maternity sites, mainly as a result of agricultural and residential development.
- Loss of suitable feeding habitat near roosting and maternity sites as a result of modifications from timber harvesting and inappropriate fire regimes usually associated with grazing.
- Pesticides and herbicides may reduce the availability of invertebrates, or result in the accumulation of toxic residues in individuals' fat stores.
- Damage to roosting and maternity sites from mining operations, and recreational activities such as caving.
- There is a strong likelihood that unrecorded populations could be unintentionally affected by land management actions.
- Probable predation by cats and foxes.
- Very little is known about the ecology, behaviour and habitat requirements.

Eastern Coastal Free-tailed Bat

Occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roosts mainly in tree hollows but will also roost under bark or in man-made structures. Usually solitary but also recorded roosting communally, probably insectivorous.

Threatening processes for this species include:

- Loss of hollow-bearing trees.
- Loss of foraging habitat.
- Application of pesticides in or adjacent to foraging areas.
- Artificial light sources spilling onto foraging and/or roosting habitat
- Large scale wildfire or hazard reduction burns on foraging and/or roosting habitat.

Eastern False Pipistrelle

The Eastern False Pipistrelle prefers moist habitats, with trees taller than 20 m. It generally roosts in eucalypt hollows but has also been found under loose bark on trees or in buildings. Hunts beetles, moths, weevils and other flying insects above or just below the tree canopy. Females are pregnant in late spring to early summer.

Threatening processes for this species include:

- Disturbance to winter roosting and breeding sites.
- Loss of roosting habitat, primarily hollow-bearing eucalypts.
- Loss and fragmentation of foraging habitat, particularly extensive areas of continuous forest and areas of high productivity.

Eastern Long-eared Bat

Occurs in lowland subtropical rainforest and wet and swamp eucalypt forest, extending into adjacent moist eucalypt forest. Coastal rainforest and patches of coastal scrub are particularly favoured. Roosts in tree hollows, the hanging foliage of palms, in dense clumps of foliage of rainforest trees, under bark and in shallow depressions on trunks and branches, among epiphytes, in the roots of strangler figs, among dead fronds of tree ferns and less often in buildings.

Threatening processes for this species include:

- Development pressures in or near swamp, wet sclerophyll and rainforests resulting in habitat degradation, alterations to moisture regimes, and edge effects, and loss of connectivity
- Loss of hollow-bearing trees and stands of palms and rainforest trees used for roosting and maternity sites.
- Invasion of habitat by weeds, particularly by Bitou Bush on the coast.
- High frequency fire.
- Climate change resulting in degradation of habitat from forest drying and increasing likelihood of fire.
- Limited known sites for the species reducing NSW population viability.
- Predation from cats.
- Vehicle strike.
- Light pollution in and near habitat areas impacting species behaviour.

Golden-tipped Bat

The Golden-tipped Bat occurs in rainforest and adjacent wet and dry sclerophyll forest up to 1000m. It is also recorded in tall open forest, Casuarina-dominated riparian forest and coastal Melaleuca forests. Roosting sites are mainly in rainforest gullies on small first- and second-order streams in usually abandoned hanging Yellow-throated Scrubwren and Brown Gerygone nests modified with an access hole on the underside. Bats may also roost under thick moss on tree trunks, in tree hollows, dense foliage and epiphytes.

Threatening processes for this species include:

- Loss of riparian rainforest for roosting and foraging habitat.
- Loss of understorey habitat on upper-slopes for foraging.
- Forestry operations that fragment habitat or result in loss of roosting habitat.
- Habitat fragmentation.
- Lack of knowledge of the threats to the species.
- Burning rainforest habitat.
- Loss of hollow bearing trees.
- Pesticides and other chemicals used in or adjacent to habitat areas.
- Exotic weeds, particularly lantana and vines, that degrade habitat and alter the structure of rainforest and adjacent wet and dry sclerophyll forest vegetation communities.

Greater Broad-nosed Bat

Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings. Forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 - 6 m. Open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects; this species has been known to eat other bat species. Little is known of its reproductive cycle, however a single

young is born in January; prior to birth, females congregate at maternity sites located in suitable trees, where they appear to exclude males during the birth and raising of the single young.

Threatening processes for this species include:

- Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest.
- Although this species usually roosts in tree hollows, it has also been found in buildings.
- Forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 - 6 m.
- Open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects; this species has been known to eat other bat species.
- Little is known of its reproductive cycle, however a single young is born in January; prior to birth, females congregate at maternity sites located in suitable trees, where they appear to exclude males during the birth and raising of the single young.

Large and Little Bent-winged Bat

Bent-winged bats occur in moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Roosting occurs in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats. Little Bentwinged-bats often share roosting sites with the Large Bent-winged Bat and, in winter, the two species may form mixed clusters.

In NSW, the largest maternity colony is in close association with a large maternity colony of Large Bent-winged Bats and appears to depend on the large colony to provide the high temperatures needed to rear its young. Maternity colonies form in spring and birthing occurs in early summer. Males and juveniles disperse in summer. Only five nursery sites/ maternity colonies are known in Australia.

Threatening processes for these species include:

- Disturbance of colonies, especially in nursery or hibernating caves, may be catastrophic.
- Destruction of caves that provide seasonal or potential roosting sites.
- Changes to habitat, especially surrounding maternity/ nursery caves and winter roosts.
- Pesticides on insects and in water consumed by bats bio accumulates, resulting in poisoning of individuals.
- Predation from foxes, particularly around maternity caves, winter roosts and roosts within culverts, tunnels and under bridges.
- Predation from feral cats, particularly around maternity caves, winter roosts and roosts within culverts, tunnels and under bridges.
- Introduction of exotic pathogens such as the White-nosed fungus.
- Hazard reduction and wildfire fires during the breeding season.
- Large scale wildfire or hazard reduction can impact on foraging resources.
- Poor knowledge of reproductive success and population dynamics.

Large-eared Pied Bat

Found in well-timbered areas containing gullies. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Petrochelidon ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves and overhangs. They remain loyal to

the same cave over many years. Likely to hibernate through the coolest months. It is uncertain whether mating occurs early in winter or in spring.

Threatening processes for this species include:

- Clearing and isolation of forest and woodland habitats near cliffs, caves and old mine workings for agriculture or development.
- Loss of foraging habitat close to cliffs, caves and old mine workings from forestry activities and too-frequent burning, usually associated with grazing.
- Damage to roosting and maternity sites from mining operations, and recreational caving activities.
- Use of pesticides.
- Disturbance to roosting areas by goats.

Yellow-bellied Sheathtail-bat

Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory. Breeding has been recorded from December to mid-March, when a single young is born. Seasonal movements are unknown; there is speculation about a migration to southern Australia in late summer and autumn.

Threatening processes for this species include:

- Disturbance to roosting and summer breeding sites.
- Foraging habitats are being cleared for residential and agricultural developments, including clearing by residents within rural subdivisions.
- Loss of hollow-bearing trees; clearing and fragmentation of forest and woodland habitat.
- Pesticides and herbicides may reduce the availability of insects or result in the accumulation of toxic residues in individuals' fat stores.

Reptiles

Stephen’s Banded Snake

Stephens’ Banded Snake occupies rainforest and eucalypt forests and rocky areas up to 950 m in altitude on the coast and ranges. Stephens' Banded Snake is nocturnal, and shelters during the day between loose bark and tree trunks, amongst vines, or in hollow trunks and limbs, or in rock crevices and under rock slabs. Common prey includes frogs, lizards, birds and small mammals.

Threatening processes for this species include:

- Clearing and fragmentation of habitat.
- Forestry practices which result in loss of old or dead trees.
- Too frequent burning for fuel reduction or grazing management which destroys old and dead trees and removes understorey vegetation.
- Illegal collection of snakes from the wild.
- Poor knowledge of the species' habitat preferences

Amphibians

Fleay's Barred Frog

Occurs in rainforest and wet eucalypt forest of the escarpment and foothills, usually close to gravely streams. The species occurs along stream habitats from first to third order streams (i.e. small streams close to their origin through to permanent streams with grades of 1 in 50) but is not found in ponds or ephemeral pools. A nest is constructed in the shallow running water that occurs between pools in relatively wide, flat sections of the stream. Eggs are deposited in a shallow excavation in the stream bed or pasted directly onto bed rock.

Threatening processes for this species include:

- Clearing and fragmentation of areas of habitat for agriculture or development.
- Sedimentation of creeks resulting from upstream activities and cattle access.
- Changes in water flow patterns, either increased or decreased flows.
- Chytrid fungal disease.
- Timber harvesting and other forestry practices.
- Use of herbicides and chemicals (including sunscreen and soaps) near streams.
- Regular roadside slashing damaging critical breeding habitat and refugia.
- Reduction of leaf-litter and fallen log cover through burning.
- Cane toads use the same niche, competing for food and habitat; they may be a vector for disease and possibility predate on juveniles.
- Mistflower; causing changes in breeding habitat structure - clogging up gravel beds and constraining available space.
- Habitat disturbance and direct mortality from feral pigs.
- Habitat disturbance and trampling resulting from human visitation
- Trampling by domestic stock, particularly of oviposition sites.

Giant Barred Frog

Giant Barred Frogs are found along freshwater streams with permanent or semi-permanent water, generally (but not always) at lower elevation. Moist riparian habitats such as rainforest or wet sclerophyll forest are favoured for the deep leaf litter that they provide for shelter and foraging, as well as open perching sites on the forest floor. However, Giant Barred Frogs will also sometimes occur in other riparian habitats, such as those in drier forest or degraded riparian remnants, and even occasionally around dams. Breeding takes place from late spring to summer. Once eggs are laid and fertilised in the water, the female kicks them out of the water where they stick onto a suitable bank (e.g. overhanging or steeply sloped). Hatchlings drop or wriggle into the water. Tadpoles grow to about 11cm and it may take up to 14 months between egg laying and the completion of metamorphosis.

Although generally found within about 20m of the stream, outside the breeding season, the Giant Barred Frog may disperse away from the stream (e.g. 50m or further). It is a generalist feeder, with large insects, snails, spiders and frogs included in its diet.

Threatening processes for this species include:

- Much of the habitat of the Giant Barred Frog occurs in the lower reaches of streams that are also the focus of agricultural and rural residential activities. Clearance of riparian vegetation is a major threat in these environments.

- Tall, dense weed infestations can decrease the quality and amount of habitat available, particularly where there are canopy gaps in the riparian vegetation. Lantana and exotic grasses decrease habitat suitability.
- Reduction in water quality or alterations to flow patterns. Embryos and tadpoles can be vulnerable to siltation.
- Inadequate protection of riparian habitat during forestry activities.
- In some locations, the Giant Barred Frog is known to carry chronic infections of the fungal pathogen *Batrachochytrium dendrobatidis* that causes chytridiomycosis. This pathogen is a threat as it is a known cause of decline in frog species, however it is unclear whether the Giant Barred Frog is currently declining from this cause.
- Predation of individuals and disturbance of habitat or destruction of eggs by feral pigs.
- Damage to riparian habitats from grazing and physical disturbance by domestic stock.
- Small population sizes particularly within the south of the species range may make it susceptible to stochastic events and loss of genetic variation.

Green-thighed Frog

Green-thighed Frogs occur in a range of habitats from rainforest and moist eucalypt forest to dry eucalypt forest and heath, typically in areas where surface water gathers after rain. It prefers wetter forests in the south of its range but extends into drier forests in northern NSW and southern Queensland. Breeding occurs following heavy rainfall from spring to autumn, with larger temporary pools and flooded areas preferred. Frogs may aggregate around breeding sites and eggs are laid in loose clumps among water plants, including water weeds. The larvae are free swimming**.**

Threatening processes for this species include:

- Changes to drainage patterns which reduce periodic local flooding.
- Damage to semi-permanent and ephemeral ponds and flood-prone vegetation.
- Clearing of habitat for development.
- Clearing of habitat for agriculture
- Habitat disturbance through timber harvesting.
- Reduction in water quality through pasture fertilisation.
- Reduction in habitat and water quality as a result of grazing
- Reduction of leaf-litter and cover of fallen logs through burning for agricultural purposes.

Loveridge's Frog

Loveridge's Frog favours subtropical and warm temperate rainforest and wet eucalypt forest, but also occurs in moist eucalypt forest where rocky outcropping creates surface water. The species is dependent on high moisture levels, occurring in the headwaters of small streams and about soaks where ground-water is continually present and close to the surface.

Threatening processes for this species include:

- Risk of local extinction due to small, scattered populations.
- Isolation of populations through clearing and forest fragmentation associated with agricultural and forestry practices.
- Infection by amphibian chytrid fungus.
- Reduction of moisture levels and reduced water quality from road-works, forestry activities, frequent burning associated with grazing management and trampling by domestic stock.
- Reduction of moisture levels caused by logging opening up the forest and drying out the ground litter, and forest management which changes old-growth forest to young even-aged stands, causing substantial water loss.

- Anthropogenic climate change altering microhabitat.
- Competition for habitat and other resources by the cane toad.
- Disturbance and degradation (e.g. substrate damage, turbidity) of habitat due to road/track maintenance.

Pouched Frog

Pouched frogs live in cool, moist rainforest, including Antarctic Beech, or moist eucalypt forest in mountainous areas, mostly above 800 m but have been found as low as 300m. They spend most of the time in damp leaf litter, or under rocks and rotten logs.

Threatening processes for this species include:

- Timber harvesting.
- Road construction and maintenance activities.
- Weed invasion in productive environments
- Removal of fallen logs and leaf litter through frequent fire, particularly fire associated with grazing management.
- Anthropogenic climate change
- Infection by amphibian chytrid fungus
- Drought and climate change leading to increased temperatures.
- Habitat damage from trampling by domestic stock.

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,

Highly Mobile Birds

The TBHT would not involve removal of mature native vegetation and as such would not impact areas of nesting/ roosting habitat for any of the subject species. Vegetation removal required for the construction works would be minor in the context of the species home ranges or habitat requirements and no specific key resources (eg. figs) would require removal. Being highly mobile, none of the subject species would be likely to be impacted by the construction works (directly or indirectly). Human impacts from the operation of the TBHT are likely to be minor and represent a relatively low intensification of use in the reserves which would be unlikely to affect foraging or breeding behaviours.

As such the proposal is unlikely to have an adverse effect on the life cycle of such species such that a viable local population would be placed at risk of extinction.

Less Mobile Birds

Albert's Lyrebird would be impacted by disturbance and human presence during the construction period, with works unlikely to affect any key resources (foraging or breeding habitat) which do not occur widely within the project footprint. As for mobile birds, the effects of human impacts during operation of the TBHT are likely to be relatively low.

As such the proposal is unlikely to have an adverse effect on the life cycle of Albert's Lyrebird such that a viable local population would be placed at risk of extinction.

Habitat for the Pale-vented Bush-hen comprises streamside habitats and disturbed Lantana on adjacent private land. While minor Lantana removal would be required to upgrade the Nightcap Road, this would be negligible in a local context in regard to refuge habitat for the species. As for Albert's

Lyrebird, the effects of human impacts during operation of the TBHT are likely to be relatively low. As such the proposal is unlikely to have an adverse effect on the life cycle of the Pale-vented Bush-hen such that a viable local population would be placed at risk of extinction.

Owls

The TBHT would not involve removal of mature native vegetation and as such would not impact areas of nesting/ roosting habitat for any of the subject species. Vegetation removal required for the construction works would be minor in the context of the species home ranges or habitat requirements and habitat for prey items would be unlikely to be significantly affected. Being highly mobile, none of the subject species would be likely to be impacted by the construction works (directly or indirectly). Human impacts from the operation of the TBHT are likely to be minor and represent a relatively low intensification of use in the reserves which would be unlikely to affect foraging or breeding behaviours.

As such the proposal is unlikely to have an adverse effect on the life cycle of such species such that a viable local population would be placed at risk of extinction.

Ground-dwelling Mammals

Disturbance for the TBHT would result in a narrow corridor of impacts (~ 2m) to native groundcovers, shrubs and vines, in addition to localised impacts at the camps. These impacts would form a negligible part of the foraging and sheltering requirements of any of the subject macropod species. Similarly, human impacts from the operation of the TBHT are likely to be minor and represent a relatively low intensification of use in the reserves which would be unlikely to affect foraging or breeding behaviours.

As such the proposal is unlikely to have an adverse effect on the life cycle of such species such that a viable local population would be placed at risk of extinction.

Arboreal mammals

Disturbance for the TBHT would result in a narrow corridor of impacts (~ 2m) to native groundcovers, shrubs and vines, in addition to localised impacts at the camps. No hollow-bearing trees which may be used for denning or breeding would be removed. These impacts would form a negligible part of the foraging and sheltering requirements of any of the subject arboreal species, and dispersal ability would not be impaired. Similarly, human impacts from the operation of the TBHT are likely to be minor and represent a relatively low intensification of use in the reserves which would be unlikely to affect foraging or breeding behaviours.

As such the proposal is unlikely to have an adverse effect on the life cycle of such species such that a viable local population would be placed at risk of extinction.

Flying-foxes

Disturbance for the TBHT would not affect resources (foraging, shelter/camps) for nectar-feeding bats. Night-time human disturbance (noise, light) would limited in range and expected to be at low levels; such disturbance would be unlikely to hinder foraging activity. As such the proposal is unlikely to have an adverse effect on the life cycle of such species such that a viable local population would be placed at risk of extinction.

Microbats

Disturbance for the TBHT would result in a narrow corridor of impacts (~ 2m) to native groundcovers, shrubs and vines, in addition to localised impacts at the camps. No hollow-bearing trees which may be used for roosting or breeding would be removed. These impacts would form a negligible part of the foraging and sheltering requirements of any of the subject microbats, and dispersal ability would not be impaired. Similarly, human impacts from the operation of the TBHT are likely to be minor and represent a relatively low intensification of use in the reserves which would be unlikely to affect foraging or breeding behaviours.

As such the proposal is unlikely to have an adverse effect on the life cycle of such species such that a viable local population would be placed at risk of extinction.

Reptiles

Impacts to rainforest and wet sclerophyll forest (habitat for Stephen's Banded Snake) will be minimised in a spatial sense (9.72 km of the TBHT occurs within undisturbed habitats with intact litter and ground layers) and result in negligible disturbance to areas of leaf litter which may harbour prey items. No hollow-bearing trees would be removed and any fallen timber will be removed and relocated (ie. there will be no net reduction of shelter sites). Disturbance within rocky areas would be minimal with regard to impacting potential shelter areas.

As such the proposal is unlikely to have an adverse effect on the life cycle of the species such that a viable local population of Stephen's Banded Snake would be placed at risk of extinction.

Amphibians

Impacts to rainforest and wet sclerophyll forest will be minimised in a spatial sense (9.72 km of the TBHT occurs within undisturbed habitats with intact litter and ground layers) and result in discreet localised disturbance to watercourses (stepping stones) and areas of leaf litter. These impacts are negligible in the context of available habitats in the reserves. While there is potential for reductions in water quality during construction and operation of the TBHT this can be managed by standard erosion/sediment controls and promoting best practice to patrons of the track (to reduce any pollution entering streams) to minimise harm to sensitive environments.

As such the proposal is unlikely to have an adverse effect on the life cycle of amphibian species such that a viable local population would be placed at risk of extinction.

b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Refer previous assessment re: lowland rainforest.

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

- Highly Mobile Birds: Habitat loss from within the greatest areas of impacts (~ 8km) would be very low in the context of reserved land in the locality and would not affect any core foraging, roosting, refuge or breeding habitat. Impacts from other aspects of the TBHT (construction in modified habitats), occupation would be unlikely to significantly affect habitat for any of the subject species.
- Less Mobile Birds: The minor works required for construction of the TBHT and camps would not disturb any significant foraging or nesting habitat for Albert's Lyrebird or the Pale-vented Bush-hen in the context of extensive areas of conservation reserved land.
- Owls: The minor works required for construction of the TBHT and camps would not significantly disturb foraging, roosting or nesting habitat for the subject owl species and would be unlikely to affect the prey base on which these species depend.
- Ground-dwelling mammals: The minor works required for construction of the TBHT and camps would not significantly disturb foraging or refuge habitat for the subject species in the context of extensive areas of conservation reserved land.
- Macropods: The minor works required for construction of the TBHT and camps would not significantly disturb foraging or refuge habitat for the subject species in the context of extensive areas of conservation reserved land.
- Arboreal mammals: No tree removal would be required, and no hollow-bearing trees would require removal. The TBHT would not significantly affect the subject species in the context of extensive areas of conservation reserved land.
- Flying-foxes: The TBHT would be unlikely to have any impact any foraging or roosting resources for nectar-feeding bats in the context of extensive areas of conservation reserved land.
- Microbats: Foraging habitat for all species would be unaffected, and key roost habitats such as hollow-bearing trees and rock areas/caves are avoided. The small scale loss of micro habitats (birds nest, vine thickets) which may be utilised as roost habitat would be negligible in the context of extensive areas of conservation reserved land.
- Reptiles: Disturbance to the litter layer, minor removal of shrubs and vine thickets and selective rock removal would be unlikely to affect habitat for Stephens Banded Snake in the context of extensive areas of conservation reserved land.
- Amphibians: Localised impacts to watercourses and adjacent environments during the construction phase would be very minor over the length of the TBHT and could be confidently managed via standard construction mitigation measures. Ongoing operational impacts from reduced water quality would be unlikely to affect habitat for the subject species in the context of extensive areas of conservation reserved land.

(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

The TBHT (and camps) require small and/or lineal disturbance to habitat for the subject species, with the majority of the walking track already modified or fragmented by historic works. Additional works required for the TBHT are at a small scale and would not reduce the ability for dispersal, breeding or genetic exchange between any of the subject species.

(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,

- Highly Mobile Birds: The habitat to be removed/modified is unlikely to be important for foraging, roosting, refuge or breeding for any of the subject species in the context of extensive areas of conservation reserved land.
- Less Mobile Birds: The habitat to be removed/modified is unlikely to be important for foraging or breeding for Albert's Lyrebird or Pale-vented Bush-hen in the context of extensive areas of conservation reserved land.

- Owl: The habitat to be removed/modified is unlikely to be important for foraging, roosting or breeding for any of the subject species in the context of extensive areas of conservation reserved land.
- Ground-dwelling mammals: The habitat to be removed/modified is unlikely to be important for foraging, refuge or breeding for any of the subject species in the context of extensive areas of conservation reserved land.
- Macropods: The habitat to be removed/modified is unlikely to be important for foraging, refuge or breeding for any of the subject species in the context of extensive areas of conservation reserved land.
- Arboreal mammals: The habitat to be removed/modified is unlikely to be important for foraging, refuge, denning or breeding for any of the subject species in the context of extensive areas of conservation reserved land.
- Flying-foxes: The habitat to be removed/modified is unlikely to be important for foraging or roosting for either of the subject species in the context of extensive areas of conservation reserved land.
- Microbats: The habitat to be removed/modified is unlikely to be important for foraging, roosting or breeding for any microbat species in the context of extensive areas of conservation reserved land.
- Reptiles: The habitat to be removed/modified is unlikely to be important for foraging or breeding for Stephen's Banded Snake in the context of extensive areas of conservation reserved land.
- Amphibians: The habitat to be removed/modified is unlikely to be important for foraging, refuge or breeding for any of the subject amphibian species in the context of extensive areas of conservation reserved land.

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 areas of outstanding biodiversity value listed in the BC Act occur at or in proximity to the site.

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.

A key threatening process (KTP) is a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species or ecological communities. The current list of KTP under the BC Act, and whether the Proposal is recognised as a KTP is shown in **Table G.2** (below).

Table G.2 Key Threatening Processes

Key Threatening Process (as per Schedule 4 of the BC Act)	*Is the activity characteristic of, or likely to increase the risk of a key threatening process?*		
	Likely	*Possible*	*Unlikely*
Aggressive exclusion of birds by noisy miners (*Manorina melanocephala*)			✓
Alteration of habitat following subsidence due to longwall mining			✓
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands			✓
Anthropogenic climate change			✓
Bushrock removal	✓		
Clearing of native vegetation	✓		
Competition and grazing by the feral European Rabbit (*Oryctolagus cuniculus*)			✓
Competition and habitat degradation by feral goats (*Capra hircus*)			✓
Competition from feral honeybees (*Apis mellifera*)			✓
Death or injury to marine species following capture in shark control programs on ocean beaches			✓
Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments			✓

Key Threatening Process (as per Schedule 4 of the BC Act)	*Is the activity characteristic of, or likely to increase the risk of a key threatening process?*		
	Likely	*Possible*	*Unlikely*
Forest eucalypt dieback associated with over-abundant psyllids and bell miners			✓
Habitat degradation by Feral Horses, *Equus caballus*			✓
Herbivory and environmental degradation caused by feral deer			✓
High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition			✓
Importation of red imported fire ants (*Solenopsis invicta*)			✓
Infection by *Psittacine circoviral* (beak and feather) disease affecting endangered psittacine species and populations			✓
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis			✓
Infection of native plants by *Phytophthora cinnamomi*		✓	
Introduction and Establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae		✓	
Introduction of the large earth bumblebee (*Bombus terrestris*)			✓
Invasion and establishment of exotic vines and scramblers			✓
Invasion and establishment of Scotch Broom (*Cytisus scoparius*)			✓
Invasion and establishment of the Cane Toad (*Bufo marinus*)			✓
Invasion, establishment and spread of Lantana (*Lantana camara*)			✓
Invasion of native plant communities by African Olive (*Olea europaea L. subsp. cuspidata*)			✓
Invasion of native plant communities by *Chrysanthemoides monilifera*			✓
Invasion of native plant communities by exotic perennial grasses		✓	
Invasion of the Yellow Crazy Ant (*Anoplolepis gracilipes*) into NSW		✓	
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants			✓
Loss of hollow-bearing trees		✓	
Loss or degradation (or both) of sites used for hill-topping by butterflies			✓
Predation and hybridisation by feral dogs (*Canis lupus familiaris*)		✓	
Predation by the European Red Fox (*Vulpes vulpes*)		✓	
Predation by the feral cat (*Felis catus*)			✓
Predation by *Gambusia holbrooki* (Plague Minnow or Mosquito Fish)			✓
Predation by the Ship Rat (*Rattus rattus*) on Lord Howe Island			✓
Predation, habitat degradation, competition and disease transmission by feral pigs (*Sus scrofa*)			✓
Removal of dead wood and dead trees	✓		

Several KTPs may apply to the construction and operation of the TBHT:

- *Bushrock removal*: Bush rock will be removed or relocated at strategic locations where rock is already disturbed or will be unearthed from excavation or has fallen from the cliff face at Minyon Falls (refer to **Section 3.2.3**). The extent of bush rock removal will be negligible in the context of the overall TBHT and is unlikely to represent important refuge for any threatened species as these areas are already disturbed. The removal of bush rock is unlikely to substantially affect habitat for threatened amphibians or Stephen's Banded Snake in the context of the overall TBHT.
- *Clearing of Native Vegetation:* refers to the destruction of a sufficient proportion of one or more strata (layers) within a stand or stands of native vegetation. Construction works would require clearing of shrubs, vines and groundcovers at campgrounds of ~ 0.07ha and over a distance of approximately 14.39 km (estimated area of ~ 2.88 ha), with nominal vegetation disturbance required to adapt existing tracks and trails and install facilities at the three camps. Contributions to this KTP are therefore very minor in the context of three large conservation reserves.
- *Infection of frogs by amphibian chytrid causing the disease chytridiomycosis*: the existing levels of chytrid in the local amphibian population is not known. This threat would be addressed by adoption and implementation of standard hygiene protocols during construction.

- *Infection of native plants by Phytophthora cinnamomic*: Phytophthora is already present within all reserves. The operation and construction of the TBHT would be unlikely to increase the incidence of Phytophthora such that any of the subject species (or lowland rainforest) would be significantly affected.
- *Introduction and Establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae*: introduction and transmission of Myrtle Rust is a concern for the project but can be managed by standard control and minimisation measures during construction and addressed by education on best practice management during operations.
- *Invasion, establishment and spread of Lantana (Lantana camara)*: Lantana already occurs at low densities in select areas of the TBHT. The construction and operation of the project would be unlikely to significantly increase the incidence of Lantana such that it would significantly affect threatened flora or communities.
- *Invasion of native plant communities by exotic perennial grasses*: Exotic grasses (mostly Broad-leaved paspalum) are common along track verges in some disturbed areas. There is potential that patrons may spread grass seed along the track and into areas of native vegetation. There is little risk of native grass invasion affecting any of the subject threatened flora or rainforest TEC due to low light conditions being unfavourable to exotic grasses.
- *Invasion of the Yellow Crazy Ant (Anoplolepis gracilipes) into NSW*: Yellow Crazy Ants have been recorded in the Lismore region and have potential to be transported to the site by machinery during the construction phase. Adoption and maintenance of appropriate hygiene procedures would address this issue.
- *Loss of hollow-bearing trees*: no standing hollow-bearing trees would require removed for the construction works. Timber 'deadfalls' require clearing across old snig tracks along parts of the TBHT and some fallen trees may contain small hollows; the importance of these habitats at ground level (ie. accessed by predators) is likely to be very low.
- *Predation and hybridisation by feral dogs (Canis lupus familiaris)/Predation by the European Red Fox (Vulpes vulpes)*: The TBHT will improve opportunities for dispersal by feral animals such as wild dogs and foxes. However, the majority of the TBHT already occurs and there is a large network of roads and informal pathways throughout all three reserves from historic operations. As such, contributions to this KTP are expected to be minor.
- *Removal of dead wood and dead trees*: Fallen timber is common along less well maintained tracks and will require removal and relocation. The impacts of these works are unlikely to be significant to any of the subject species.

Conclusion

It is considered unlikely that the local population of any of the subject species would be placed at significant risk of extinction as a result of the proposal.

Appendix H

Significant Impact Assessment (EPBC Act)

Based on field results and the potential occurrence assessment (fauna only), this Significant Impact Assessment has been prepared in accordance with the *Matters of National Environmental Significance Significant impact guidelines* (v1.1; DoE 2013).

Several species/ communities listed in the EPBC Act have been recorded within or are considered as potentially occurring within the TBHT footprint (refer **Table H.1**).

In addition, approximately 5 km of the TBHT occurs within the 'Gondwana Rainforests of Australia' World Heritage Area (WHA) and assessment of the natural and cultural values of the WHA is required. The WHA is also a registered Natural Heritage Place.

Table H.1 EPBC Act listed species/communities recorded at or potentially occurring on the TBHT

Scientific name	*Common name*	*EPBC Act listing*
FLORA/TECs		
Corokia whiteana	Corokia	Vulnerable
Endiandra hayesii	Rusty Rose Walnut	Vulnerable
Hicksbeachia pinnatifolia	Red Boppel Nut	Vulnerable
Macadamia tetraphylla	Rough-shelled Bush Nut	Vulnerable
Owenia cepiodora	Onion Cedar	Vulnerable
Rhodamnia rubescens	Scrub Turpentine	Critically Endangered
Symplocos baeuerlenii	Small-leaved Hazelwood	Vulnerable
Syzygium hodgkinsoniae	Red Lilly Pilly	Vulnerable
Uromyrtus australis	Peach Myrtle	Endangered
n/a	Lowland Rainforest of Subtropical Australia	Critically Endangered
FAUNA		
Dasyurus maculatus	Spotted-tailed Quoll	Endangered
Mixophyes fleayi	Fleay's Barred Frog	Endangered
Mixophyes iteratus	Giant Barred Frog	Endangered
Petauroides volans	Greater Glider	Endangered
Phascolarctos cinereus	Koala	Endangered
Potorous tridactylus	Long-nosed Potoroo	Vulnerable
Pteropus poliocephalus	Grey-headed Flying-fox	Vulnerable

The Significant Impact Guidelines (SIG) assess species and communities under their relevant listing criteria (ie. vulnerable, endangered, critically endangered). With the exception of the Greater Glider, five-part tests have been completed for all these species as per BC Act requirements (refer **Appendix H**). However, significant impact criteria differ between the two Acts and endangered and critically endangered species/communities listed in the EPBC Act are subject to a more rigorous assessment than that required under the BC Act (which doesn't discriminate between listing status).

On this basis a Significant Impact Assessment has been completed for all endangered and critically endangered species/communities listed in **Table H.1** (ie. Peach Myrtle, Scrub Turpentine, Lowland Rainforest of Subtropical Australia, Spotted-tailed Quoll, Fleay's Barred Frog, Giant Barred Frog) in addition to the Greater Glider (which is not listed in the BC Act and hence not subject to a five-part test) and the 'Gondwana Rainforests of Australia' World Heritage Area (WHA) and Natural Heritage Place.

Significant Impact Assessment - World Heritage properties

World Heritage properties are places with natural or cultural heritage values which are recognised to have outstanding universal value. Approval under the EPBC Act is required for any action occurring within or outside a declared World Heritage property that has, will have, or is likely to have a significant impact on the World Heritage values of the World Heritage property.

An action is likely to have a significant impact on the World Heritage values of a declared World Heritage property if there is a real chance or possibility that it will cause:

- *one or more of the World Heritage values to be lost*
- *one or more of the World Heritage values to be degraded or damaged, or*
- *one or more of the World Heritage values to be notably altered, modified, obscured or diminished.*

World Heritage properties with natural heritage values

An action is likely to have a significant impact on natural heritage values of a World Heritage property if there is a real chance or possibility that the action will affect the following values:

Values associated with geology or landscape

- *damage, modify, alter or obscure important geological formations in a World Heritage property*
- *damage, modify, alter or obscure landforms or landscape features, for example, by excavation or infilling of the land surface in a World Heritage property*
- *modify, alter or inhibit landscape processes, for example, by accelerating or increasing susceptibility to erosion, or stabilising mobile landforms, such as sand dunes, in a World Heritage property*
- *divert, impound or channelise a river, wetland or other water body in a World Heritage property, and*
- *substantially increase concentrations of suspended sediment, nutrients, heavy metals, hydrocarbons, or other pollutants or substances in a river, wetland or water body in a World Heritage property.*

Biological and ecological values

- *reduce the diversity or modify the composition of plant and animal species in all or part of a World Heritage property*
- *fragment, isolate or substantially damage habitat important for the conservation of biological diversity in a World Heritage property*
- *cause a long-term reduction in rare, endemic or unique plant or animal populations or species in a World Heritage property, and*
- *fragment, isolate or substantially damage habitat for rare, endemic or unique animal populations or species in a World Heritage property.*

Wilderness, natural beauty or rare or unique environment values

- *involve construction of buildings, roads, or other structures, vegetation clearance, or other actions with substantial, long-term or permanent impacts on relevant values, and*
- *introduce noise, odours, pollutants or other intrusive elements with substantial, long-term or permanent impacts on relevant values.*

NOTE: the Gondwana Rainforests of Australia (GDA) World Heritage Area includes approximately 40 separate reserves located between Newcastle and Brisbane on the east coast of Australia and covers a total area of approximately 370,000 ha. Nightcap NP forms only a small portion of the total WHA, and GDA within the NP covering an area of approximately 4,900 ha. The 5 km of the TBHT within the WHA utilises the existing Historic Nightcap Track, an established walking track established decades previously.

An assessment of the potential impacts on the natural heritage values of the Gondwana Rainforests WHA within Nightcap NP is provided in **Table H.2**.

World Heritage properties with cultural heritage values

An action is likely to have a significant impact on cultural heritage values of a World Heritage property if there is a real chance or possibility that the action will affect the following values:

Historic heritage values

- *permanently remove, destroy, damage or substantially alter the fabric of a World Heritage property*
- *extend, renovate, refurbish or substantially alter a World Heritage property in a manner which is inconsistent with relevant values*
- *permanently remove, destroy, damage or substantially disturb archaeological deposits or artefacts in a World Heritage property*
- *involve activities in a World Heritage property with substantial and/or long-term impacts on its values*
- *involve construction of buildings or other structures within, adjacent to, or within important sight lines of, a World Heritage property which are inconsistent with relevant values, and*
- *make notable changes to the layout, spaces, form or species composition in a garden, landscape or setting of a World Heritage property which are inconsistent with relevant values.*

Other cultural heritage values including Indigenous heritage values

- *restrict or inhibit the existing use of a World Heritage property as a cultural or ceremonial site causing its values to notably diminish over time*
- *permanently diminish the cultural value of a World Heritage property for a community or group to which its values relate*
- *alter the setting of a World Heritage property in a manner which is inconsistent with relevant values*
- *remove, damage, or substantially disturb cultural artefacts, or ceremonial objects, in a World Heritage property, and*
- *permanently damage or obscure rock art or other cultural or ceremonial features with World Heritage values.*

An assessment of the potential impacts on the cultural heritage values of the Gondwana Rainforests WHA within Nightcap NP is provided in **Table H.3**.

Note: **Table H.3** was reviewed by Tim Hill (Everick Heritage) to ensure consistency with heritage matters.

Table H.2 Potential impacts of the Activity on the natural heritage values of the Gondwana Rainforests WHA

Values	*Potential impacts*
Geology or landscape values	
damage, modify, alter or obscure important geological formations in a World Heritage property	The Activity will not result in any damage, modify, alter or obscure important geological formations within the WHA in Nightcap NP.
damage, modify, alter or obscure landforms or landscape features, for example, by excavation or infilling of the land surface in a World Heritage property	No substantial works other than minor adjustments to the existing walking track (Historic Nightcap Track) will occur within the WHA. No camps are sited within the WHA and no earthworks, excavation or other substantial works will occur.
modify, alter or inhibit landscape processes, for example, by accelerating or increasing susceptibility to erosion, or stabilising mobile landforms, such as sand dunes, in a World Heritage property	The degree of works within the WHA will be very minor, as the TBHT utilises an existing walking track (Historic Nightcap Track). Any amendments to the track will be constructed sensitively (by hand) and erosion and sediment controls will be established and maintained for the duration of construction to ensure environmental impacts are minimised.
divert, impound or channelise a river, wetland or other water body in a World Heritage property	Nil
substantially increase concentrations of suspended sediment, nutrients, heavy metals, hydrocarbons, or other pollutants or substances in a river, wetland or water body in a World Heritage property	Nil. As noted, the impacts within WHA are at a very small scale and erosion and sediment controls will mitigate the potential for environmental impacts.
Biological and ecological values	
reduce the diversity or modify the composition of plant and animal species in all or part of a World Heritage property	The relatively minor nature of the Activity would result in small scale disturbance within the context of a substantial area of NPWS conservation reserve. Within the WHA, works will be extremely minor due to utilisation of the existing Historic Nightcap Track and no works in undisturbed habitats will occur. As such, the Activity will not reduce the diversity or modify the composition of plant and animal species within the WHA.
fragment, isolate or substantially damage habitat important for the conservation of biological diversity in a World Heritage property	Refer above. The TBHT utilises an existing walking track within the WHA, and no further fragmentation of habitat will occur.
cause a long-term reduction in rare, endemic or unique plant or animal populations or species in a World Heritage property	Within the WHA, works will be extremely minor due to utilisation of the existing Historic Nightcap Track and no works in undisturbed habitats will occur. On this basis there is little potential for the Activity resulting in a long-term reduction in rare, endemic or unique plant or animal populations or species in the WHA.
fragment, isolate or substantially damage habitat for rare, endemic or unique animal populations or species in a World Heritage property	Refer previous responses.
Wilderness, natural beauty or rare or unique environment values	
involve construction of buildings, roads, or other structures, vegetation clearance, or other actions with substantial, long-term or permanent impacts on relevant values	Works within the WHA will be completed sensitively and at a small scale, with minor works required to improve the existing Historic Nightcap Track walking track. Works required not significantly impact the values of the WHA.

Values	*Potential impacts*
introduce noise, odours, pollutants or other intrusive elements with substantial, long-term or permanent impacts on relevant values	Intrusive elements of the construction process within the WHA include short-term noise and odours (eg. vehicle emissions). These would have no lasting impacts on the values of the WHA. Once operational, the TBHT would have negligible intrusive impacts within the WHA environments apart from occasional noise associated with track maintenance.

Table H.3 Potential impacts of the Activity on the cultural heritage values of the Gondwana Rainforests WHA

Values	*Potential impacts*
Historic heritage values	
permanently remove, destroy, damage or substantially alter the fabric of a World Heritage property* ** physical material including structural elements and other components, fixtures, fittings, contents and items with historic value*	Nil
extend, renovate, refurbish or substantially alter a World Heritage property in a manner which is inconsistent with relevant values	Nil
permanently remove, destroy, damage or substantially disturb archaeological deposits or artefacts in a World Heritage property	As noted, works within the WHA will be completed sensitively and at a small scale, with minor works required to improve the existing Historic Nightcap Track walking track. While the 5 km of the TBHT within WHA occurs in proximity to Aboriginal heritage sites, no impacts to these sites would occur. NOTE: being a walking track the TBHT is consistent with the heritage values of the Historic Nightcap Track and will provide opportunities for interpretation of heritage values.
involve activities in a World Heritage property with substantial and/or long-term impacts on its values	The TBHT would not have substantial and/or long-term impacts on cultural values within the WHA/ Historic Nightcap Track as it utilises an existing walking track and impacts from construction and operation (intensification of use) would not affect cultural heritage values.
involve construction of buildings or other structures within, adjacent to, or within important sight lines of, a World Heritage property which are inconsistent with relevant values	Nil. No structures will be built within the WHA.
make notable changes to the layout, spaces, form or species composition in a garden, landscape or setting of a World Heritage property which are inconsistent with relevant values	Nil
Other cultural heritage values including Indigenous heritage values	
restrict or inhibit the existing use of a World Heritage property as a cultural or ceremonial site causing its values to notably diminish over time	The WHA is within land of the Widjabul Wia-bal People and is subject to a Native Title Claim. The TBHT will not restrict or inhibit the existing use of land within the WHA for the Widjabul Wia-bal.

Values	*Potential impacts*
permanently diminish the cultural value of a World Heritage property for a community or group to which its values relate	As noted, impacts to the WHA are negligible in the context of Nightcap NP and more broadly (within 39 other reserves in eastern Australia). No cultural heritage values will be permanently diminished. The track design has a minimal footprint and the construction method is considered to be reversible or consistent with the natural rocky landscape.
alter the setting of a World Heritage property in a manner which is inconsistent with relevant values	Nil. The TBHT is consistent with the existing landscape values of natural bushland and the existing walking track.
remove, damage, or substantially disturb cultural artefacts, or ceremonial objects, in a World Heritage property	Nil. No cultural artefacts or ceremonial objects will be removed as a result of the TBHT occurring within the WHA.
permanently damage or obscure rock art or other cultural or ceremonial features with World Heritage values	Works for the TBHT are minor in the context of the WHA and no rock art or other cultural or ceremonial features would be damaged or obscured by the minor improvements to the existing walking track.

Significant Impact Assessment - Natural Heritage places

The National Heritage List contains places or groups of places with outstanding heritage value to Australia - whether natural, Indigenous or historic or a combination of these. Approval under the EPBC Act is required for any action occurring within, or outside, a National Heritage place that has, will have, or is likely to have a significant impact on the National Heritage values of the National Heritage place.

An action is likely to have a significant impact on the National Heritage values of a National Heritage place if there is a real chance or possibility that it will cause:

- *one or more of the National Heritage values to be lost*
- *one or more of the National Heritage values to be degraded or damaged, or*
- *one or more of the National Heritage values to be notably altered, modified, obscured or diminished.*

The significant impact criteria for Natural Heritage places are identical for World Heritage properties (refer previous pages), with the exception of matters of Indigenous heritage values - these are addressed below.

National Heritage places with Indigenous heritage values

An action is likely to have a significant impact on Indigenous heritage values of a National Heritage place if there is a real chance or possibility that the action will:

- *restrict or inhibit the continuing use of a National Heritage place as a cultural or ceremonial site causing its values to notably diminish over time*
- *permanently diminish the cultural value of a National Heritage place for an Indigenous group to which its National Heritage values relate*
- *alter the setting of a National Heritage place in a manner which is inconsistent with relevant values*
- *remove, destroy, damage or substantially disturb archaeological deposits or cultural artefacts in a National Heritage place*
- *destroy, damage or permanently obscure rock art or other cultural or ceremonial, artefacts, features, or objects in a National Heritage place*
- *notably diminish the value of a National Heritage place in demonstrating creative or technical achievement*
- *permanently remove, destroy, damage or substantially alter Indigenous built structures in a National Heritage place, and*
- *involve activities in a National Heritage place with substantial and/or long-term impacts on the values of the place.*

An assessment of the potential impacts on the Indigenous heritage values of the Gondwana Rainforests National Heritage place within Nightcap NP is provided in **Table H4**.

Note: **Table H4** was reviewed by Tim Hill (Everick Heritage) to ensure consistency with heritage matters.

Table H.4 Potential impacts of the Activity on Indigenous heritage values of the Gondwana Rainforests National Heritage place

Values	*Potential impacts*
restrict or inhibit the existing use of a National Heritage place as a cultural or ceremonial site causing its values to notably diminish over time	The National Heritage place (NHP) is within land of the Widjabul Wia-bal People and is subject to a Native Title Claim. The TBHT will not restrict or inhibit the existing use of land within the NHP for the Widjabul Wia-bal.
permanently diminish the cultural value of a National Heritage place for a community or group to which its National Heritage values relate	As noted, impacts to the NHP are negligible in the context of Nightcap NP and more broadly (within 39 other reserves in eastern Australia). No Indigenous heritage values will be permanently diminished. The track design has a minimal footprint and the construction method is considered to be reversible or consistent with the natural rocky landscape.
alter the setting of a National Heritage place in a manner which is inconsistent with relevant values	Nil. The TBHT is consistent with the existing landscape values of natural bushland and the existing walking track.
remove, destroy, damage or substantially disturb archaeological deposits or cultural artefacts in a National Heritage place	Nil. No archaeological deposits or cultural artefacts will be removed, destroyed, damaged or substantially disturbed as a result of the NHP occurring within the TBHT.
destroy, damage or permanently obscure rock art or other cultural or ceremonial, artefacts, features, or objects in a National Heritage place	Works for the TBHT are minor in the context of the WHA and no rock art or other cultural or ceremonial features would be damaged or obscured by the minor improvements to the existing walking track.
notably diminish the value of a National Heritage place in demonstrating creative or technical achievement	N/A
permanently remove, destroy, damage or substantially alter Indigenous built structures in a National Heritage place	N/A. No Indigenous built structures occur in the National Heritage place.
involve activities in a National Heritage place with substantial and/or long-term impacts on the values of the place	Once constructed, the TBHT will operate as a 'low key' remote walking track which is unlikely to intrude upon the existing values of the NHP. This is particularly relevant in the context of utilising an existing public walking track and the minor intensification of existing usage.

Significant Impact Assessment - Critically endangered and endangered species listed in the EPBC Act

Significant impact criteria: An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- *lead to a long-term decrease in the size of a population*
- *reduce the area of occupancy of the species*
- *fragment an existing population into two or more populations*
- *adversely affect habitat critical to the survival of a species*
- *disrupt the breeding cycle of a population*
- *modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*
- *result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*
- *introduce disease that may cause the species to decline, or*
- *interfere with the recovery of the species.*

Definitions: A 'population of a species' is an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to:

- geographically distinct regional population, or collection of local populations, or
- a population, or collection of local populations, that occurs within a particular bioregion.

Assessments have been completed for six endangered species (Peach Myrtle, Spotted-tailed Quoll, Fleay's Barred Frog, Giant Barred Frog, Grater Glider and Koala) and one critically endangered species (Scrub Turpentine) listed in the EPBC Act as follows. Species profiles are provided in **Appendix G** (five-part tests) except for Greater Glider which is provided below as it is not listed under the BC Act.

Greater Glider - Species profile:

The Greater Glider is Australia's largest gliding marsupial, weighing approximately 900–1700 g and is distributed throughout forests and woodlands of eastern Australia from temperate eastern Victoria to tropical northeast Queensland (Taylor & Goldingay 2009). Greater Gliders feed almost exclusively on the foliage of eucalypts and use gliding locomotion to move between trees. Home ranges are commonly between 1 - 3 ha but may reach up to 11 ha in environments where hollow-bearing trees are limited (Smith et al. 2007, cited in Taylor & Goldingay 2009). Density estimates range from 0.1 to 3.8 individuals/ha (Henry 1984, Kehl and Borsboom 1984, Comport et al. 1996, Smith et al. 2007; cited in Taylor & Goldingay 2009).

Threats to the species include (refer Threatened Species Scientific Committee 2016):

- Habitat loss (through clearing, clearfell logging and the destruction of senescent trees due to prescribed burning) and fragmentation
- Too intense or frequent fires
- Timber production
- Climate change
- Barbed wire fencing (entanglement)
- Hyper-predation by owls
- Competition from sulphur-crested cockatoos
- Phytophthora root fungus.

An assessment of the potential impact of the TBHT on the subject species (as above) with reference to the significant impact criteria follows.

Is there possibility that the activity will:

- *lead to a long-term decrease in the size of a population?*

Peach Myrtle: the TBHT will pass through or proximate to small areas of known habitat for Peach Myrtle, however no plants will be directly impacted with the implementation of various mitigation strategies in the construction methodology (ecologist present to guide works in sensitive locations). Transmission of Myrtle Rust is a key threat to Peach Myrtle, with the TBHT increasing the potential for infection from the construction and operational stages of the project. Myrtle Rust will be controlled during construction works via standard minimisation measures and operational impacts limited by provision of 'best practice' information to patrons to limit the spread of Myrtle Rust (and any other pathogens).

No other sub-populations of Peach Myrtle within the three reserves would be affected directly or indirectly. On this basis the activity would be unlikely to lead to a long-term decrease in the size of the local population of Peach Myrtle.

Scrub Turpentine: the TBHT will pass through or proximate to small areas of known habitat for Scrub Turpentine, however no plants will be directly impacted with the implementation of various mitigation strategies in the construction methodology (ecologist present to guide works in sensitive locations). Transmission of Myrtle Rust is a key threat to Peach Myrtle, with the TBHT increasing the potential for infection from the construction and operational stages of the project. Myrtle Rust will be controlled during construction works via standard minimisation measures and operational impacts limited by provision of 'best practice' information to patrons to limit the spread of Myrtle Rust (and any other pathogens).

No other sub-populations of Scrub Turpentine within the three reserves would be affected directly or indirectly. On this basis the activity would be unlikely to lead to a long-term decrease in the size of the local population of Scrub Turpentine.

Spotted-tailed Quoll: Disturbance for the TBHT would result in a narrow corridor of impacts (~ 2m) to native groundcovers, shrubs and vines, in addition to localised impacts at the camps. No hollow-bearing trees which may be used for denning or breeding would be removed. These impacts would form a negligible part of the foraging and sheltering requirements of any of the Spotted-tailed Quoll and dispersal ability would not be impaired over the extensive home ranges occupied by the species. Similarly, human impacts from the operation of the TBHT are likely to be minor and represent a relatively low intensification of use in the reserves which would be unlikely to affect foraging or breeding behaviours. On this basis the activity would be unlikely to lead to a long-term decrease in the size of the local population of the Spotted-tailed Quoll.

Koala

Disturbance for the TBHT would result in a narrow corridor of impacts (~ 2m) to native groundcovers, shrubs and vines, in addition to localised impacts at the camps. Dispersal ability would not be impaired over the home ranges occupied by the species. The TBHT would not result in any loss of mature trees and human impacts from the operation of the TBHT are likely to be minor and represent a relatively low intensification of use in the reserves which would be unlikely to affect foraging or breeding behaviours. On this basis the activity would be unlikely to lead to a long-term decrease in the size of the local population of the Koala.

Greater Glider

Greater Gliders reside within Nightcap NP, Mt Jerusalem NP and Whian Whian SCA. They occupy a small area of habitat in the context of the species extensive home range (northern Queensland to southern Victoria), where the species is estimated to occupy ~ 16,000 km² within an area of occurrence of ~ 1,500 000 km² (Threatened Species Scientific Committee 2016). The species is also considered widespread and common in north-eastern New South Wales (Kavanagh 2004). Gliders in the locality would be unlikely to represent a key source population for breeding or dispersal, would be unlikely to be necessary for maintaining genetic diversity and the TBHT and local area are not at the extent of the species' distributional limits. The TBHT would not result in any loss of mature trees (including hollow-bearing trees) and hence impacts on habitat of the local Greater Glider population are expected to be negligible.

Fleay's & Giant Barred Frog: the TBHT requires minor localised works within several watercourses and at bridge locations which may support Fleay's & Giant Barred Frog. Direct impacts to the species habitat would be negligible, and implementation and maintenance of erosion and sediment control would minimise potential for downstream water quality impacts during and post construction. Potential negative impacts to water quality from patrons of the track would be minimised by educational information and signage. On this basis the construction and operation of the TBHT would be unlikely to lead to a long-term decrease in the size of the local population of Fleay's & Giant Barred Frog within any of the affected catchments in the context of the three reserves.

- *reduce the area of occupancy of the species?*

Peach Myrtle: the minor works required for the TBHT would not result in any significant reduction of warm-temperate rainforest which would reduce the area of occupancy of the species.

Scrub Turpentine: the minor works required for the TBHT would not result in any significant reduction of sclerophyll forest or rainforest communities which would reduce the area of occupancy of the species.

Spotted-tailed Quoll, Koala, Greater Glider: substantial areas of habitat of several thousand hectares occurs for the species within the three reserves. The TBHT would not reduce the area of occupancy of the species in this context.

Koala

The relatively minor works required for the TBHT would not result in any significant reduction of sclerophyll forest which would reduce the area of occupancy of the species.

Greater Glider

The relatively minor works required for the TBHT would not result in any significant reduction of sclerophyll forest which would reduce the area of occupancy of the species.

Fleay's & Giant Barred Frog: the relatively minor works required for the TBHT would not result in any significant reduction of rainforest/watercourse habitats which would reduce the area of occupancy of either of the subject species.

- *fragment an existing population into two or more populations?*

Peach Myrtle: the TBHT would not result in any significant fragmentation of rainforest habitat for Peach Myrtle which would affect pollination, breeding or reproductive potential.

Scrub Turpentine: the TBHT would not result in any significant fragmentation of habitat for Scrub Turpentine which would affect pollination, breeding or reproductive potential.

Spotted-tailed Quoll: the TBHT would not result in any fragmentation of habitat for the Spotted-tailed Quoll in a local context and extensive areas of habitat within the three reserves would be unaffected.

Koala

The TBHT would not fragment habitat for the Koala; no canopy trees will require removal and no barriers to movement or dispersal would occur.

Greater Glider

The TBHT would not fragment habitat for the Greater Glider; no canopy trees will require removal and no barriers to movement or dispersal would occur.

Fleay's & Giant Barred Frog: the TBHT would not result in any significant fragmentation of rainforest habitat for either of the subject species which would affect breeding or reproductive potential.

- *substantial adversely affect habitat critical to the survival of a species?*

Peach Myrtle: based on the low impacts of construction, the TBHT would not result in any significant impacts to rainforest habitat for Peach Myrtle which is critical to the survival of the species.

Scrub Turpentine: based on the low impacts of construction, the TBHT would not result in any significant impacts to habitat for Scrub Turpentine which is critical to the survival of the species.

Spotted-tailed Quoll: based on the likelihood of very low impacts to habitat for the Spotted-tailed Quoll, the TBHT would not result in any significant impacts to habitat which is critical to the survival of the species.

Koala: based on the low impacts of construction and no removal of canopy trees, the TBHT would not result in any significant impacts to habitat which is critical to the survival of the species.

Greater Glider: Due to the extensive range occupied by the species, the low scale impacts of the TBHT would not adversely affect habitat critical to the survival of the Greater Glider.

Fleay's & Giant Barred Frog: the TBHT requires minor localised works within several watercourses and bridge locations which may provide habitat for Fleay's & Giant Barred Frog. Direct impacts to potential habitat would be negligible, and implementation and maintenance of erosion and sediment control would minimise potential for downstream water quality impacts during and post construction. On this basis the TBHT would be unlikely to substantially adversely affect habitat critical to the survival of either species in the context of the three reserves.

- *disrupt the breeding cycle of a population?*

Peach Myrtle: reproduction of Peach Myrtle is unlikely to be affected by the TBHT during either construction or operation as no individuals would be removed or disturbed. While infection by Myrtle Rust poses a significant risk of hampering reproductive success, prescribed mitigation measures will minimise the likelihood of Myrtle Rust infection. No other sub-populations of Peach Myrtle within the three reserves would be affected directly or indirectly.

Scrub Turpentine: reproduction of Scrub Turpentine is unlikely to be affected by the TBHT during either construction or operation as no individuals would be removed or disturbed. While infection by Myrtle Rust poses a significant risk of hampering reproductive success, prescribed mitigation measures will minimise the likelihood of Myrtle Rust infection. No other sub-populations of Peach Myrtle within the three reserves would be affected directly or indirectly. Scrub Turpentine

Spotted-tailed Quoll: based on the likelihood of very low impacts to habitat for the Spotted-tailed Quoll, the TBHT would be unlikely to disrupt the breeding cycle of a population of the species in a local context.

Koala: based on the likelihood of very low impacts to habitat for the Koala, the TBHT would be unlikely to disrupt the breeding cycle of a population of the species in a local context.

Greater Glider: The TBHT construction process would be unlikely to disrupt breeding given the large areas of habitat available within the three reserves and where hollow-bearing trees are reasonably common.

Fleay's & Giant Barred Frog: the minor works to watercourse habitat would be completed during periods of low or no flow (autumn/winter/spring) and would be unlikely to disrupt breeding success (late spring to summer) of either species in the context of the three reserves.

- *modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?*

Peach Myrtle: the works (as previously described) are of a minor nature over the extent of the TBHT and would not modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that Peach Myrtle is likely to decline. No other sub-populations of Peach Myrtle within the three reserves would be affected directly or indirectly.

Scrub Turpentine: the works (as previously described) are of a minor nature over the extent of the TBHT and would not modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that Scrub Turpentine is likely to decline. No other sub-populations of Scrub Turpentine within the three reserves would be affected directly or indirectly.

Spotted-tailed Quoll: based on the likelihood of very low impacts to habitat for the Spotted-tailed Quoll, the TBHT would be unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the Spotted-tailed Quoll is likely to decline.

Koala: the works (as previously described) are of a minor nature over the extent of the TBHT and would not modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that Koalas are likely to decline.

Greater Glider: The negligible habitat loss that the TBHT would incur (regrowth, vines, shrubs and groundcovers) would not have an impact on the Greater Glider.

Fleay's & Giant Barred Frog: the works (as previously described) are of a minor nature over the extent of the TBHT and would not modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that either of the subject species is likely to decline. No other sub-populations of the subject species within the three reserves would be affected directly or indirectly.

- *result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?*

Peach Myrtle: the risk of any invasive species (weeds, pests or pathogens) affecting habitat for Peach Myrtle is relatively low and would be mitigated by the various biosecurity strategies prescribed.

Scrub Turpentine: the risk of any invasive species (weeds, pests or pathogens) affecting habitat for Scrub Turpentine is relatively low and would be mitigated by the various biosecurity strategies prescribed.

Spotted-tailed Quoll: the risk of any invasive species (weeds, pests or pathogens) significantly affecting the Spotted-tailed Quoll is very low and would be mitigated by the various biosecurity strategies prescribed.

Koala: the risk of any invasive species (weeds, pests or pathogens) significantly affecting the Koala is very low and would be mitigated by the various biosecurity strategies prescribed.

Greater Glider: The TBHT would be unlikely to result in a significant increase in invasive species which may significantly affect the local population of the Greater Glider. Hygiene and monitoring protocols will manage invasive species with a high degree of confidence.

Fleay's & Giant Barred Frog: the risk of any invasive species (weeds, pests or pathogens) affecting habitat for the subject species is relatively low and would be mitigated by the various biosecurity strategies prescribed.

- *introduce disease that may cause the species to decline?*

Peach Myrtle: transmission of Myrtle Rust is a key threat to Peach Myrtle, with the TBHT increasing the potential for infection from the construction and operational stages of the project. Myrtle Rust will be controlled during construction works via standard minimisation measures and operational impacts limited by provision of 'best practice' information to patrons to limit the spread of Myrtle Rust (and any other pathogens).

Scrub Turpentine: transmission of Myrtle Rust is a key threat to Scrub Turpentine, with the TBHT increasing the potential for infection from the construction and operational stages of the project. Myrtle Rust will be controlled during construction works via standard minimisation measures and operational impacts limited by provision of 'best practice' information to patrons to limit the spread of Myrtle Rust (and any other pathogens).

Spotted-tailed Quoll: the construction or operation of the TBHT would be unlikely to introduce any disease that may cause the species to decline.

Koala: the construction or operation of the TBHT would be unlikely to introduce any disease that may cause the species to decline.

Greater Glider: the potential for introduction of disease which may negatively affect the Greater Glider will be managed by implementation of appropriate hygiene and management protocols.

Fleay's & Giant Barred Frog: introduction and establishment of chytrid disease is a key threat to Fleay's & Giant Barred Frog. While the construction and operation of the TBHT may increase the potential for chytrid transmission this will be mitigated via standard minimisation measures.

- *interfere with the recovery of the species?*

Peach Myrtle: the construction or operation of the TBHT would be unlikely to interfere with the recovery of Peach Myrtle due to low impacts within small areas of habitat. Other sub-populations of Peach Myrtle within the three reserves would not be placed at any additional risk which might affect recovery of the species.

Scrub Turpentine: the construction or operation of the TBHT would be unlikely to interfere with the recovery of Scrub Turpentine due to low impacts within small areas of habitat. Other sub-populations of Scrub Turpentine within the three reserves would not be placed at any additional risk which might affect recovery of the species.

Spotted-tailed Quoll: the construction or operation of the TBHT would be unlikely to interfere with the recovery of the species due to low impacts within substantial areas of high quality habitat within the three reserves.

Koala: the construction or operation of the TBHT would be unlikely to interfere with the recovery of the species due to low impacts within substantial areas of high quality habitat within the three reserves.

Greater Glider: The construction and operation of the TBHT is a low risk activity in the context of the life cycle requirements of the Greater Glider and within extensive areas of high quality habitat within conservation reserves. The recovery of the species would be unlikely to be impacted as a result of the TBHT.

Fleay's & Giant Barred Frog: the construction or operation of the TBHT would be unlikely to interfere with the recovery of either species due to low localised impacts within substantial areas of high quality habitat within the three reserves.

Significant Impact Assessment - Critically endangered and endangered ecological communities listed in the EPBC Act

Significant impact criteria: An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

- *reduce the extent of an ecological community*
- *fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines*
- *adversely affect habitat critical to the survival of an ecological community*
- *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*
- *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*
- *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*
- *interfere with the recovery of an ecological community.*

An assessment has been completed for the critically endangered ecological community Lowland Rainforest of Subtropical Australia (LRSA) as follows. It is noted that the conservation advice for LRSA only considers this community as occurring up to elevations of 300 m ASL.

Is there possibility that the activity will:

- *reduce the extent of an ecological community?*

Approximately 5.8 km of the TBHT occurs within lowland rainforest ≤ 300 m ASL, with works in undisturbed vegetation accounting for only 0.52 km (~ 0.1 ha). This disturbance represents a fraction of the substantial areas of rainforest within the three reserves which comprise the site. The construction works required for the TBHT would not result in any significant structural modification to LRSA which would reduce the extent of this community in a local context.

- *fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines?*

The TBHT will result in micro-impacts to rainforest by the hand clearing and disturbance for the walking track over a 2 metre width (~ 0.1 ha), whereby no canopy cover or larger trees or shrubs would be removed. These works would not fragment or increase fragmentation of LRSA.

- *adversely affect habitat critical to the survival of an ecological community?*

The minor impacts of the TBHT are negligible in a local context to the extent that they would not adversely affect habitat critical to the survival of LRSA.

- *modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns?*

The construction and operation of the TBHT (as previously described) are of a small scale such that impacts on abiotic factors such as soil/nutrients would be minimal and would be managed carefully through erosion and sediment control. The minor nature of works would not have potential to impact on groundwater or surface water drainage patterns.

- *cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting?*

Construction works would require the removal of groundcovers and vines only, and these impacts would be reduced wherever possible during the hand constriction process. The flora species impacted are all common within LRSA and their nominal loss would not substantially alter species composition or hasten the decline of these species within LRSA.

- *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*

While the TBHT may have minor potential for increasing the incidence of weeds, these risks are low in remote rainforest communities and can be capably managed by prescribed mitigation measures. It would be unlikely that any other invasive species harmful to LRSA may be introduced, or their influence increased by the construction or operation of the TBHT.

There is minor potential for an increase in nutrients within waterway from walkers using sunscreen or soaps. These risks can be minimised by appropriate educational material and promotion of best practice guidelines. Any risks of pollutants (eg. oils, fuel) entering waterways during the construction phase can be managed via standard environmental strategies (eg. refuelling policies, bunding, booms, spill kits etc).

- *interfere with the recovery of an ecological community?*

The construction or operation of the TBHT is of relatively low risk to LRSA and the low impacts would be unlikely to interfere with the recovery of this community in a local context.