Snowies Iconic Walk: Flora and fauna assessment & Test of Significance report

Prepared for National Parks and Wildlife Service

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Biosis offices

NEW SOUTH WALES

Albury
Phone: (02) 6069 9200
Email: albury@biosis.com.au

Newcastle
Phone: (02) 4911 4040
Email: newcastle@biosis.com.au

Sydney
Phone: (02) 9101 8700
Email: sydney@biosis.com.au

Wollongong
Phone: (02) 4201 1090
Email: wollongong@biosis.com.au

VICTORIA

Ballarat
Phone: (03) 5304 4250
Email: ballarat@biosis.com.au

Melbourne
Phone: (03) 8686 4800
Email: melbourne@biosis.com.au

Wangaratta
Phone: (03) 5718 6900
Email: wangaratta@biosis.com.au

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Prepared by:	Matt Looby, Ewan Kelly, Georgina Zacks Jules Farquhar & Anthony Cable
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Other current Biosis staff involved in this project were Aaron Harvey, Mark Venosta (assistance in the field) & Lauren Harley (mapping)

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Glossary

ToS	Test of Significance
BC Act	*NSW Biodiversity Conservation Act 2016*
Biosecurity Act	*Biosecurity Act 2015*
BOS	Biodiversity Offsets Scheme
CBD	Central Business District
CEEC	Critically Endangered Ecological Community
DBH	Diameter at breast height
DCP	Development Control Plan
DEE	Department of the Environment and Energy
DPE	NSW Department of Planning and Environment
DPI	Department of Primary Industries
DPIE	Department of Planning, Industry and Environment
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
FM Act	*Fisheries Management Act 1994*
GIS	Geographic Information System
KTP	Key Threatening Process
LEP	Local Environmental Plan
LGA	Local Government Area
LLS	Local Land Services
Matters of NES	Matters of National Environmental Significance
NPW Act	*National Parks and Wildlife Act 1974*
NSW	New South Wales
OEH	NSW Office of Environment and Heritage (now DPIE)
PCT	Plant Community Type
SEPP	State Environmental Planning Policy

SIC	Significant Impact Criteria
SIS	Species Impact Statement
study area	Subject site and surrounding areas, in this case a 7.5 m buffer on either side of the proposed trail centrelines
subject site	The area of impact for the proposed trail construction, operation, maintenance and ancillary areas.
TEC	Threatened Ecological Community
VEC	Vulnerable Ecological Community
VRZ	Vegetated Riparian Zone
WM Act	*Water Management Act 2000*

Summary

The project

Biosis Pty Ltd was commissioned by New South Wales (NSW) National Parks and Wildlife Service (NPWS) to undertake a flora and fauna assessment, threatened species surveys and micro-siting of new walking trail alignments for the Snowies Iconic Walk multi-day walking track in Kosciuszko National Park. These investigations have been used to prepare impact assessments on native vegetation and threatened species and ecological communities along the proposed trail alignments that make up the multi-day track. This assessment will inform the Review of Environmental Factors (REF) and Commonwealth referral being prepared for the project.

The proposed trail alignments, options and ancillary areas assessed in this report include:

- Three alignment options for the Charlotte Pass to Guthega trail.
- Multiple alignment options for the Guthega to Perisher Valley trail including over Mount Perisher and at Wheatley Gap.
- Three alignment options for the Perisher Valley to Bullocks Flat trail.
- Charlotte Pass to Perisher Valley via Ramshead Range as an alternative option to avoid Mount Perisher for the Guthega to Perisher trail section.
- Camping areas:
  - West of Illawong Hut.
  - On the western side of Spencers Creek.
  - South-west of Porcupine Rocks.
- Upgrades of car parking facilities at the existing Porcupine Rock trailhead at Perisher Valley.

Three final alignment options for new trails that make up the multi-day walking track have been chosen after two years of field investigations, analysis of environmental values and potential impacts, extensive on-ground micro-siting and consideration of other critical project requirements such as user experience and constructability. The avoidance of significant impacts on threatened species and communities, especially alpine bogs, threatened reptiles and Mountain Pygmy-possum *Burramys parvus*, has been a major driver in selecting the final trail configuration. The final options and ancillary areas include:

- Charlotte Pass to Guthega Track following the lower slopes of the Snowy River valley downstream to the existing Illawong Track. This option includes a bridge crossing of Spencers Creek and a camp site at the bottom of Guthrie Ridge.
- Charlotte Pass to Perisher Valley Track following the southern extent of the Ramshead Range to the existing Porcupine Walking Track. This option includes a campsite in the vicinity of Porcupine Rocks and upgrades of the existing Porcupine Rocks trailhead at Perisher Valley.
- Perisher Valley to Bullocks Flat Track heading south across the plateau before traversing downslope to meet the existing Bullocks Walking Track near the Thredbo River.

Biodiversity values and impacts

Biodiversity assessments identified eight alpine, sub-alpine and montane plant community types and small areas of exotic vegetation. These communities include forest, woodland, heathland, shrubland, grassland and peatland habitats across many landscape settings, elevations and aspects. The trails cross several local permanent waterways and many tributaries of the Snowy and Thredbo Rivers where a diverse range of aquatic habitats are present.

Two threatened terrestrial ecological communities, one endangered aquatic ecological community, six threatened plants, nine threatened mammals, eight threatened birds, two threatened reptiles, one threatened fish and one threatened invertebrate listed under State and Commonwealth legislation were identified as occurring or having reasonable potential to occur in the study area of the final trail alignments.

The project is likely to result in the following adverse impacts:

- Native vegetation disturbance will be up to 9.23 hectares based on:
  - 1.56 hectares of native vegetation to be permanently lost or modified (e.g. through clearing for rock paving, natural surface trails or through shading under elevated structures).
  - 1.76 hectares of native vegetation to be modified for ongoing trail maintenance through minor pruning of taller shrubs close to the new tracks.
  - Up to 5.91 hectares of native vegetation to be temporarily disturbed through creating side cuts, machinery movements, material storage and construction access. These areas will be fully rehabilitated to their natural state once works are complete.
- Threatened species and ecological community impacts, most of which are temporary in nature (e.g. during the construction phase) or of a relatively minor scale in the context of the extensive areas of intact habitat available in the national park, these include:
  - Possible disturbance of habitat for Shining Cudweed *Argyrotegium nitidulum*, Anemone Buttercup *Ranunculus anemoneus*, Perisher Wallaby-grass *Rytidosperma vickeryae,* Blue-tongued Greenhood *Pterostylis oreophila*, Mountain Greenhood *P. alpina* and Slender Greenhood *P. foliata*. Known populations of Anemone Buttercup and Perisher Wallaby-grass along the final alignments have been avoided through micro-siting in 2018 and 2019
  - Removal of grassy heathland vegetation that provides habitat for Alpine She-oak Skink *Cyclodomorphus praealtus*. Key areas of habitat on Mount Perisher have been avoided and most other areas of open grassy heathland vegetation will be spanned with elevated structures.
  - High quality Guthega Skink *Liopholis guthega* habitat has mostly been avoided by abandoning the Guthega to Perisher Valley trail alignment that crossed Mount Perisher. Significant effort has been made to avoid other suitable rocky habitat with potential burrow sites along the final trail alignments during field surveys and micro-siting with NPWS staff and external experts.
  - Broad-toothed Rat *Mastacomys fuscus* occurs extensively across most of the impact area. Habitat loss for this species is considered relatively minor in the context of the extensive areas of suitable habitat across the national park and Australian Alps bioregion. The trails may lead to increased localised predation of this species by foxes and cats. This will be managed as part of the broader predator control program operating in the national park or predator control initiatives to be undertaken directly associated with this project.
  - Mountain Pygmy-possum habitat was recorded either through direct observations or reference to NPWS boulderfield mapping across most trail alignments. Areas of key core habitat with

Mountain Plum-pine *Podocarpus lawrencei* shrubs were specifically avoided during trail alignment selection and micro-siting. This species still has the potential to disperse through most high elevation heathland and woodland communities and vegetation removal will result in a minor reduction in dispersal habitat. As with Broad-toothed Rat, the trails may lead to increased localised predation of dispersing individuals by cats and foxes. This will be managed as part of the broader predator control program operating in the national park or predator control initiatives to be undertaken directly associated with this project.

- A range of threatened forest and woodland-dependent mammals are likely to occur in forests, woodlands and heathlands. These species are generally reliant on the canopy, upper vegetation strata or hollow-bearing trees, except for Smoky Mouse *Pseudomys fumeus* and Spotted-tailed Quoll *Dasyurus maculatus*, and therefore impacts to most of these species are likely to be minor given the narrow trail footprint, avoidance of large trees in forested environments and the contiguous nature of habitat availability in the national park.
- A range of threatened birds are likely to occur at most elevations and across all vegetation communities. These species utilise a range of habitat elements such as understorey vegetation, hollow-bearing trees, perching, roosting and nesting sites and fallen timber. Impacts to these species are likely to be minor and localised given the narrow trail footprint and the contiguous nature of habitat availability in the national park.
- Two species reliant on aquatic habitats, River Blackfish *Gadopsis marmoratus* and Alpine Redspot Dragonfly *Austropetalia tonyana*, may occur in high quality waterways and minor tributaries. Direct impacts to these species are likely to be avoided through use of elevated structures and bridges to cross waterways and drainage lines.
- Up to 0.13 hectares of the Alpine Sphagnum Bogs / Montane Peatland threatened ecological community will be permanently impacted by installation of elevated structures to span all occurrences of this community along the final trail alignments. It is likely construction of elevated structures will cause minor permanent loss of this community where footings are installed. Elevated structures will have an ongoing shading influence that may alter vegetation composition and structure towards an increase in shade-tolerant species. These structures are unlikely to significantly modify hydrological functioning. There are many examples of retained vegetation and habitat under elevated structures within the national park, and in other alpine environments of Australia, but it is recommended that monitoring via impact and control sites be established to monitor vegetation changes and respond if required over time.
- The Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland community occurs for the last 300 metres of the Perisher to Bullocks Flat trail in the South Eastern Highland bioregion. Impacts to this community are likely to include permanent removal of up to 0.015 hectares of already disturbed understorey vegetation along the Thredbo River. These impacts are considered minimal in the context of extensive stands of this community in the Thredbo Valley. It should be noted that the diagnostics and listing of this threatened community was recently amended (28 June 2019). The community is now referred to as Monaro Tableland Cool Temperate Grassy Woodland in the South Eastern Highlands Bioregion Critically Endangered Ecological Community. The examples of the former community in the study area may not meet the new diagnostics and listing based on vegetation structure, landscape setting, floristics, rainfall and geographic distribution. Further work may be required in spring 2019 to resolve this.
- The final alignments cross several named waterways and unnamed tributaries that flow directly into the Snowy and Thredbo Rivers, therefore all biota in these aquatic habitats are considered part of the Snowy River aquatic endangered ecological community. It is intended that all

waterways will be spanned with elevated structures or bridges to avoid disturbance to the bed, banks and instream habitat features such as woody debris, rocks and pools.

Recommendations

A range of recommendations are provided that underpin avoiding and minimising impacts on biodiversity. These recommendations will need to be considered in the detailed design phase of the project, when finalising construction methods with the appointed construction contractor and during operation of the trails.

Biosis understands that NPWS has adopted a number of guiding design principles, mitigation measures and construction methods to avoid and minimise biodiversity impacts, these include:

- Avoiding the high value threatened reptile habitats on Mount Perisher by abandoning the trail option between Guthega and Perisher Valley.
- Adhering to preliminary micro-sited alignments and trail surface treatments proposed in Figure 4 of this report, and where these vary during final design and construction undertaking any necessary supplementary investigations of biodiversity impacts.
- Adhering to the construction corridors, maintenance zones and permanent vegetation removal footprints described in this report which form the basis of impact assessment conclusions presented here.
- Committing to undertake pre-construction micro-siting for elevated structures in alpine bog vegetation communities, montane drainage lines, open grassy heathland habitats and forest/woodland environments with the intent of:
  - Avoiding and minimising impacts on the threatened bog community.
  - Avoiding any undiscovered populations of Blue-tongued Greenhood or other threatened flora species.
  - Minimising impacts on high quality Alpine She-oak Skink Habitat.
  - Avoiding impacts on nest sites for threatened passerine bird species.
- Minimising the impacts of construction by 'building from the trail and elevated structures' and airlifting materials and personnel into construction sites, where appropriate.
- Avoiding the removal of large hollow-bearing trees and disturbance of their root zones in forest and woodland environments, unless significant safety concerns are posed by such trees and the trail cannot be realigned around them.
- If hollow-bearing trees are to be lopped or removed, then felled material will be retained on-site to supplement existing habitat.
- Implementing best practice trail design, construction and sediment management practices during construction and operation.
- Implementing strict weed and pathogen hygiene protocols during construction and operation of trails.
- Including all new trails in current trail maintenance programs that operate for other infrastructure in the national park, and developing project-specific programs for pathogen, pest plant and animal control and monitoring.

Biosis also recommends the following pre-construction and construction measures be implemented:

- All environmental controls and mitigation measures should be included in a detailed Construction Environmental Management Plan (CEMP) to be developed by NPWS and the construction contractor.
- Prior to any works commencing micro-siting and clear delineation of all works sites should be undertaken by NPWS/NSW Department of Planning, Industry and Environment (DPIE) staff or an independent party.
- Any large hollow-bearing trees, or trees that support raptor nests, adjacent to works areas should be protected during construction.
- Where hollow-bearing tree removal is required, these activities should avoid the breeding season of hollow-dependent species.
- Fauna uncovered during removal of vegetation or soil disturbance should be salvaged and relocated to adjacent suitable habitat by a qualified and licenced operator.
- An unexpected threatened species finds protocol should be established to ensure impacts of unexpected finds can be appended to a CEMP, with the aim of further reducing impacts. The protocol should also include a notification and reporting process to NPWS and DPIE by the trail construction contractor.
- An impact and control-based monitoring program should be established to monitor changes to vegetation health, vigour and functioning under elevated structures, especially for the threatened alpine bog community. If serious negative changes in vegetation occur over time (e.g. major increase in plant death or bare ground within 3-5 years) the platform surface should be reviewed.
- Review the recent (28 June 2019) listing advice for Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Bioregions to confirm whether the new entity Monaro Tableland Cool Temperate Grassy Woodland in the South Eastern Highlands Bioregion Critically Endangered Ecological Community occurs in the study area.

Government legislation and policy

An assessment of the project against key biodiversity legislation and policy is provided and summarised below.

Legislation / Policy	Relevant ecological feature	Permit / approval required
Environment Protection and Biodiversity Conservation Act 1999	Eight flora species and 15 fauna species have been recorded or are predicted to occur in the locality. This assessment indicates that 11 of these species occur and may be impacted by the project or have an important population in or near the final trail alignments. One threatened ecological community was recorded and occurs extensively along the final trail alignments. Matters of National Environmental Significance that occur and may be impacted include: • Shining Cudweed • Anemone Buttercup • Blue-tongued Greenhood • Broad-toothed Rat • Greater Glider • Koala • Mountain Pygmy-possum • Smoky Mouse • Spotted-trailed Quoll • Alpine She-oak Skink • Guthega Skink • Alpine Sphagnum Bogs and associated Fens	Assessments against the Significant Impact Criteria (CoA 2013) have been prepared for all 11 species and one ecological community that are likely to occur and where some level of impact may result from the project. It has been concluded that if the avoidance and minimisation strategies outlined in this report are implemented then a significant impact is unlikely. Given the large nature of the project and number of relevant Matters of National Environmental Significance, it is recommended that NPWS submit a referral for legal certainty.
Environmental Planning & Assessment Act 1979	Threatened species and ecological communities occur.	A significant effect on threatened species or ecological communities is not likely to result from the project if construction related impacts and ongoing trail management is implemented according to the commitments and recommendations in this report. A Species Impact Statement or consideration of entry into the NSW Biodiversity Offset Scheme (BOS) is therefore not considered necessary.

Legislation / Policy	Relevant ecological feature	Permit / approval required
Biodiversity Conservation Act 2016	Twenty-five (25) terrestrial threatened species and two ecological communities with a medium or greater likelihood of occurrence within the works areas where some level of impact may occur have been identified.	Tests of Significance were completed for the terrestrial species and communities. These assessments indicate that a significant effect is not likely to result from the project. A Species Impact Statement or consideration of entry into the BOS is therefore not considered necessary.
Fisheries Management Act 1994	Two aquatic species and one aquatic Endangered Ecological Community have a medium or greater likelihood of occurring within the works areas where some impact may occur: • River Blackfish (endangered population) • Alpine Redspot Dragonfly • Snowy River Aquatic Endangered Ecological Community	Assessments of Significance indicate that a significant effect is not likely to result from the proposal if proposed impact avoidance and minimisation strategies are implemented, at the detailed design stage, and mitigation measures are adhered to. A Species Impact Statement is therefore not required. Consultation should be undertaken with DPI Fisheries regarding concurrence and approvals requirements under the FM Act.
State Environmental Planning Policy No 44	The project is within the Snowy Monaro Regional Council local government area (LGA). This LGA was formerly made up of three separate LGAs (Bombala, Cooma-Monaro and Snowy River) and all of these former LGAs are Schedule 1 listed Councils. Therefore SEPP No. 44 is relevant to the current assessment.	The study area supports one tree species, Manna Gum, which is a Koala feed tree. Permanent impacts to PCT 679 and PCT 1196 will be approximately 0.12 hectares, mostly limited to understorey vegetation removal and removal of fire-killed trees for safety reasons. It is intended to retain all large living canopy trees. No evidence of Koala was recorded within the study area and therefore, the habitat does not constitute core Koala habitat as defined under SEPP No. 44. Preparation of a Koala Plan of Management is not considered necessary.

Legislation / Policy	Relevant ecological feature	Permit / approval required
Water Management Act 2000	Several waterways of various stream orders will be crossed by the final trail alignments.	Works are proposed within 40 metres of the top of the bank along several waterways. As specified in *Water Management (General) Regulation 2011* a public authority does not need to obtain a controlled activity approval for any controlled activities that it carries out in, on or under waterfront land. It is however an expectation that the overarching objective of the Act, to preserve the integrity of riparian corridors, will be maintained.
Biosecurity Act 2015	No exotic species recorded within the study area are declared priority weeds within the South East Region (Snowy Monaro Regional).	Control requirements for any priority listed weed detected during final planning and construction will be required as well as compliance with General Biosecurity duties for other weeds. In addition to priority listed weeds, other non-listed species that pose a high threat to alpine vegetation will need to be managed in accordance with current and project specific weed control programs (e.g. targeting Sweet Vernal-grass *Anthoxanthum odoratum*, Soft Rush *Juncus effusus* and Milfoil *Achillea millefolium*).

Note: Guidance provided in this report does not constitute legal advice.

1 Introduction

1.1 Project background

Biosis Pty Ltd was commissioned by NPWS to undertake a flora and fauna assessment, threatened species surveys and micro-siting of the proposed Snowies Iconic Walk in the Kosciuszko National Park (the 'project') (Figure 1). The Snowies Iconic Walk is a new 45 kilometre multi-day walking track connecting the alpine resorts, accommodation and services across the Park. The project will extend and connect existing walking tracks and iconic landmarks, delivering a new walking experience in the Park. Key elements of the project include construction of approximately 27 kilometres of new walking track and upgrades and realignments of another 20 kilometres of existing track (some of which has already commenced). This investigation is specific to proposed new sections of walking track.

1.2 Scope

The objectives of this investigation are to:

- Undertake a desktop review of relevant documents and existing data relating to Kosciuszko National Park, as well as a search of relevant databases relating to threatened species, communities and vegetation mapping.
- Provide a description of vegetation communities and fauna habitat that may be directly or indirectly impacted by the project for various alignment options.
- Assess the potential for threatened biota, or their habitat, to occur along the proposed trail alignments based on desktop review and targeted surveys.
- Assess terrestrial and aquatic habitat values along the trail alignments, and identify strategies and mitigation measures to avoid impacts on listed threatened species and ecological communities through micro-siting, trail realignments to avoid highest constraint areas, trail design responses and sensitive construction techniques.
- Apply the Test for Significance (ToS) under Section 7 of the NSW *Biodiversity Conservation Act 2016* (BC Act) as this project is being assessed under Part 5 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) through preparation of a Review of Environmental Factors (REF). The objective of the ToS is to determine if terrestrial threatened species or ecological communities that occur in areas to be impacted by the construction and operation of the trails will be significantly affected.
- Apply an Assessment of Significance as required under the NSW *Fisheries Management Act 1994* (FM Act) for aquatic fauna and aquatic ecological communities.
- Assess whether a significant impact on Matters of National Environmental Significance listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is likely to occur, particularly for threatened species or ecological communities.
- Provide a description of the potential impacts on other environmental values (e.g. waterways, rock outcrops, hollow-bearing trees) and determine suitable mitigation measures. These are tailored to the narrow and linear nature of the proposed works.

1.2.1 Options assessed

Biosis has assessed multiple trail options and various alignments within these options since May 2017. The objective has been to identify the trail configuration that will result in the least impact, whilst still achieving the constructability and user experience outcomes required by NPWS. The trail alignments and ancillary areas assessed to date are shown in Figure 2 and include:

- Charlotte Pass to Guthega trail, including three options and ancillary areas:
  - Guthrie Ridge option
  - Mid-slope option
  - Lower slopes option above the Snowy River
  - Spencers Creek bridge crossing near the Snowy River
  - Realignment of Illawong Walk closer to the Snowy River
  - Two camp site options between Illawong Hut and the bottom of Guthrie Ridge
- Guthega to Perisher Valley trail via Mount Perisher, Perisher Gap and Porcupine Rocks, including:
  - Mount Perisher western option
  - Mount Perisher central option
  - Mount Perisher eastern option
  - Two options for the Wheatley Gap bog crossing (western option or existing track upgrade option)
- Perisher Valley to Bullocks Flat trail via the escarpment above the Thredbo Valley and along the Thredbo River, including:
  - Lubra Creek option
  - Western option
  - Eastern option
- Charlotte Pass to Perisher Valley trail via Ramshead Range as an alternative option to the Guthega to Perisher Valley Trail

1.2.2 Final alignments

The final three trail alignment options have been chosen after detailed analysis of environmental values and potential impacts, extensive on-ground micro-siting and consideration of other critical project requirements such as user experience and constructability. The avoidance of significant impacts on threatened species and communities, especially alpine bogs, threatened reptiles and Mountain Pygmy-possum, has been a major driver in selecting the final trail configuration. The final options that are the subject of this impact assessment are shown in Figure 2 and include:

- **Charlotte Pass to Guthega Track** – A new track connecting Charlotte Pass to Guthega from the Main Range Track (200 metres south of the current Snowy River crossing) and following the slopes above the Snowy River downstream to the existing Illawong Track. This option includes a bridge crossing of Spencers Creek near its confluence with the Snowy River and a camp site at the bottom of Guthrie Ridge.
- **Charlotte Pass to Perisher Valley Track** - A new track starting from Charlotte Pass access road and following the southern extent of the Ramshead Range to Porcupine Rocks where it meets the existing

Porcupine Walking Track. This option includes a bridge over Wrights Creek and Trapyard Creek (headwaters), a campsite in the vicinity of Porcupine Rocks and upgrades of the existing Porcupine Rocks Track trailhead at Perisher Valley.

- **Perisher Valley to Bullocks Flat Track** – A new track starting at Perisher Valley at the existing Porcupine Rocks trailhead then heading south across the plateau before traversing downslope to meet the existing Bullocks Walking Track near the ski-tube bridge over the Thredbo River.

This report includes information and reference to all the studies undertaken across the preliminary and final options between May 2017 and April 2019.

1.3 Location and features of the study area and subject site

The study area is the assessment corridor that was used to investigate biodiversity values and is located within Kosciuszko National Park approximately 28 kilometres west of Jindabyne (Figure 1). It is currently zoned *E1 – National Parks and Nature Reserves* in the *Snowy River Local Environmental Plan (LEP) 2013*.

The study area is within the:

- Australian Alps Bioregion (majority) and South Eastern Highlands Bioregion (last 300 metres of the Perisher Valley to Bullocks Flat track)
- Snowy River Basin (Snowy River catchment)
- South East and Murray Local Land Services (LLS) Management Areas
- Snowy Monaro Regional Council local government area (formerly Bombala, Cooma-Monaro and Snowy River Councils)

The study area consists of the proposed trail centrelines buffered by 7.5 metres on each side to create a 15 metre wide assessment corridor.

1.3.1 Subject site and defining extent of impacts

The subject site sits within the study area in accordance with OEH (2018a) and consists of the trail construction footprint and future maintenance corridor. This is the area likely to be directly impacted by construction and operation of the trails. Ancillary areas including proposed camping sites and additional car parking were also considered as part of the impact area within the subject site.

The expected disturbance to soil and vegetation associated with trail construction and maintenance has been defined by NPWS based on their extensive experience with track building in the Park. Key trail surface types proposed are rock paving (including pitched rock), natural/gravel surface, elevated structures and bridges. The impacts associated with these surface types are described below.

Rock paving and natural/gravel surface tracks

- Permanent removal of a 500 millimetre (0.5 metre) wide area of vegetation and habitat for tracks with rock paving or natural surface.

To construct rock paving or natural surface tracks an additional area of up to 1500 millimetres (1.5 metres) either side of the track surface will be required. This area will be temporarily disturbed by trail surface formation, construction access, small machinery and laydown areas for materials and equipment. The temporarily disturbed area either side of the track will be rehabilitated, where required, and allowed to regenerate as native vegetation and habitat. For operation of this trail surface an area of 350 millimetres (0.35 metres) either side of the final track surface will be required for vegetation pruning.

Elevated structures (raised steel mesh) and bridges

- Permanent disturbance of vegetation and habitat under these structures through shading and installation of footings resulting in an anticipated maximum disturbance width of 800 millimetres (0.8 metres).

To install elevated structures over wet areas, sensitive vegetation or habitat types, no more than 1000 millimetres (1 metre) either side of the structure surface will be required. This area will be temporarily disturbed by foot traffic, installation of footings and laydown areas for materials and equipment. It is anticipated all materials for structures will be flown into site by helicopter. It is likely construction and storage can also be done from the elevated structure as it is built, as recently demonstrated by the installation of the Main Range steel platform in 2018-2019 summer. The temporarily disturbed area either side of and near the structure will be rehabilitated, where required, and allowed to regenerate as native vegetation and habitat. For operation of elevated structures an area of 200 millimetres (0.2 metres) either side of the structure will be required for vegetation pruning, especially where taller heath occurs.

Final subject site

Therefore the subject site is defined as (Plates 1 and 2):

- 3500 millimetres (3.5 metres) wide for rock paving and natural/gravel surface tracks.
- 2800 millimetres (2.8 metres) wide for elevated structures and bridges.

1.3.2 Trail alignments description and options analysis

Trail alignments and options have undergone multiple iterations in an attempt to avoid and minimise impacts on the national park and its biota. Table 1 provides a summary of how the final trail alignments were arrived at through various investigations and consideration of risks to biodiversity, soils and waterways.

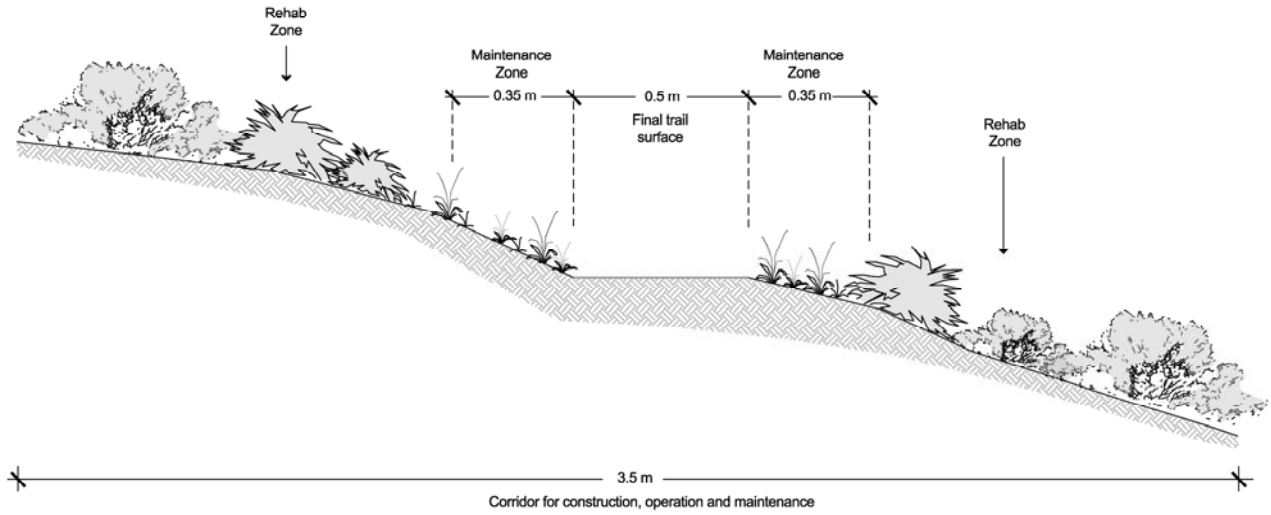

Plate 1 Typical cross section of the subject site for rock paving, nature/graving trail surface

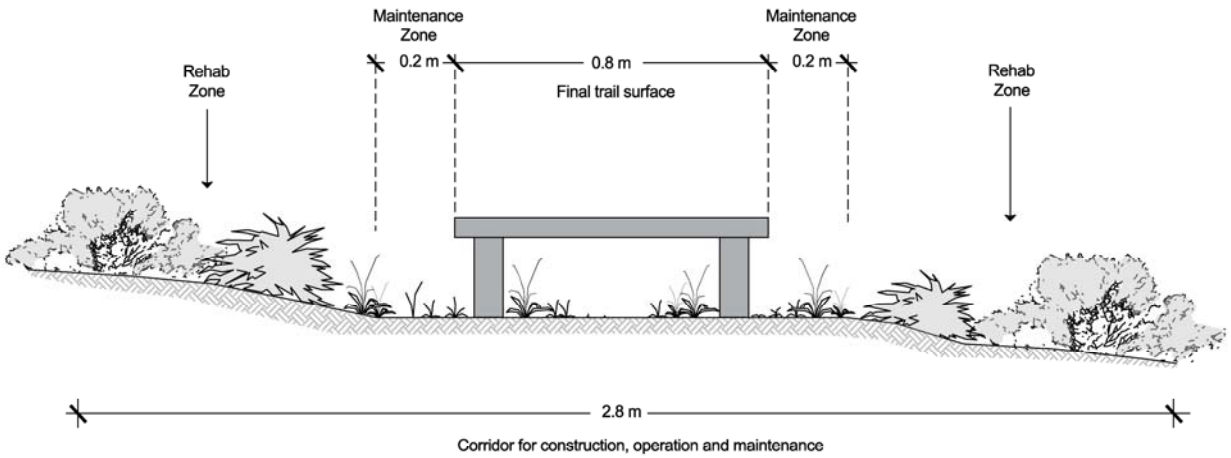

Plate 2 Typical cross section of the subject site for elevated structures trail surface

Table 1 Summary of options assessed and outcomes leading to final trail alignments (*denotes final alignment)**

Trail section and options	Brief description	Recommendation	Outcome
Charlotte Pass to Guthega			
Mid-slope Option	Option was investigated in 2017 for new track from Charlotte Pass viewing platform along the mid-slopes above the Snowy River to Spencers Creek.	The mid-slopes of this terrain were found to be very wet and dominated by threatened alpine bog vegetation and significant areas of Broad-toothed Rat habitat. Biosis recommended investigating other options to link Charlotte Pass to Guthega.	NPWS agreed to investigate ridgeline and lower slopes options and the mid-slope option was abandoned
Ridge-line Option	Option was investigated extensively during three field visits in 2017, 2018 and 2019 for a new track from Charlotte Pass viewing platform to Spencers Creek along the ridge dividing the Kosciusko Road and Snowy River.	This alignment was the preferred option for some time but after several targeted surveys, consultation with NPWS ecologists and habitat mapping this option was considered to be significantly constrained by the presence of high quality habitat for threatened alpine reptiles and Mountain Pygmy Possum.	NPWS agreed to investigate the lower slopes option and the ridgeline option was abandoned
***Lower-slope Option**	Option was investigated in 2019 after the other two options above were abandoned. This new track is proposed from the Main Range Track below Charlotte Pass and traverses the lower slopes of the Snowy River Valley to Spencers Creek.	Micro-siting of the proposed alignment in 2019 with NPWS ecologists resulted in a lower impact alignment being recommended further away from the Snowy River flats to minimise impacts on waterway health, riparian zones and bog vegetation. The alignment will still impact on Broad-toothed Rat, Alpine She-oak Skink and alpine bog habitats but is a considerably lower impact than higher elevation options discussed above. A range of trail surface treatments including extensive elevated structures were also recommended.	NPWS has adopted this as the final alignment between Charlotte Pass and Guthega
***Spencers Creek crossing**	Various options were investigated to find the lowest impact crossing site at Spencers Creek	A micro-sited crossing option was assessed with NPWS ecologists and recommended as part of the final alignment.	NPWS has adopted the preferred crossing option and propose a bridge in this location

Trail section and options	Brief description	Recommendation	Outcome
Illawong Track extension Option	Option was investigated in 2017 for a new track from the swing bridge over the Snowy River to align the existing track closer to the River.	Biosis recommended abandoning this option as an existing walking track occurs in this location and its realignment would result in unnecessary vegetation removal and threatened species habitat disturbance	NPWS agreed to remove this option from the project
Guthega to Perisher (incl. Porcupine Rocks)			
Mount Perisher – Western Option	An option on the western slopes of Mount Perisher (mostly outside the resort boundary) with a link to Mount Perisher summit. Investigated in 2017 and 2018.	This option was found to intersect boulderfields known to support important populations of Mountain Pygmy-possum in the context of the broader Perisher resort area. It also intersects extensive high-quality habitat for Guthega Skink, Alpine She-oak Skink and Broad-toothed Rat. Biosis recommended avoiding this option.	After extensive investigations by Biosis, NPWS ecologists, DPIE and independent experts, the entire Guthega to Perisher trail alignment has been abandoned due to the potential for significant impacts on threatened reptiles and Mountain Pygmy Possum habitat on Mount Perisher. This has been a significant compromise for the project resulting in the selection of the Charlotte Pass to Perisher Valley alignment via the Ramshead Range.
Mount Perisher – Central Option	An option on southern slopes of Mount Perisher (within the ski field and resort) traversing over Mount Perisher summit	This option was found to intersect high quality areas of Guthega Skink and Alpine She-oak Skink habitat (Atkin 2019). It also intersects boulderfields on the Mount Perisher summit that have potential to support Mountain Pygmy-possum. This option also impacts occurrences of Anemone Buttercup. Biosis recommended avoiding this option.	
Mount Perisher – Eastern Option	An option on the south-eastern slopes of Mount Perisher (within the ski field and resort) avoiding the summit of Mount Perisher and including an option to upgrade several existing vehicle access tracks in the ski field.	This option intersects small areas of habitat for Guthega Skink habitat (Atkins 2019), and areas of Alpine She-oak Skink and Broad-toothed Rat habitat but avoids Mountain Pygmy-possum boulderfield habitat. This option would also impact occurrences of Anemone Buttercup. Biosis considered this to be the lowest impact option to cross the slopes of Mount Perisher and it was suggested as the preferred option.	

Trail section and options	Brief description	Recommendation	Outcome
Wheatley Gap bog crossing	An existing track through bog community is currently degrading the bog between Perisher and Porcupine Rocks.	Two alignments were explored in efforts to avoid and minimise impacts to the bog community – one directly through the bog over an existing trail, and one around its western perimeter. If elevated structures were to be used, the alignment that tracks through the bog is considered lowest impact option (most preferred).	
Perisher Valley to Bullock's Flat			
Lubra Creek Option	This was the initial option investigated in 2017 with a trail along the plateau from Perisher Valley before descending steeply into the Thredbo River Valley	Potential impacts to a culturally significant site near Lubra Creek were identified by the heritage consultant and traditional owners. Biosis recommended significant realignments would be required to avoid bog vegetation on the plateau and minimise soil erosion risks on the steep slopes above the Thredbo River.	This option was abandoned due to cultural heritage consideration.
Western Option	This was a secondary option investigated in 2018 with a trail along the plateau from Perisher Valley before descending steeply into the Thredbo River Valley	Increased separation from a culturally significant site was achieved but Biosis still recommended significant realignments would be required to avoid bog vegetation on the plateau, minimise soil erosion risks on the steep slopes and avoid montane bog systems/drainage lines above the Thredbo River.	This option was abandoned due to very steep slopes
***Eastern Option**	This option was investigated in 2019 with a trail along the plateau from Perisher Valley before descending steeply into the Thredbo River Valley to the east of Lubra Creek	Biosis recommended realignments to avoid bog vegetation on the plateau. A better grade on the steep slopes above the Thredbo River was also achieved by lengthening the trail to avoid fall lines. This outcome has reduced soil erosion risks on the steep slopes but management of impacts for montane bog systems/drainage lines above the Thredbo River will be required through careful siting of elevated structures.	NPWS has adopted this as the final alignment with Biosis' suggested changes on the plateau and recommendations for pre-construction siting of structures across bogs and drainage lines in the sub-alpine and montane zones

Trail section and options	Brief description	Recommendation	Outcome
Charlotte Pass to Perisher Valley			
***Ramshead Range option	This alignment was investigated as an alternative to the Guthega to Perisher Valley trail and was assessed late in project planning during April 2019. This new track is proposed from the access road into Charlotte Pass and travels in a south-easterly direction along the Ramshead Range. It crosses Spencers Creek headwater, Wrights Creek and the headwaters of Trapyard Creek and the catchment of Betts Creek before arriving at an existing trailhead via Porcupine Rocks.	Micro-siting of the proposed alignment in 2019 with NPWS ecologists resulted in a lower impact alignment being recommended that avoids extensive bog systems along valley floors and provides separation from rocky outcrops. A range of trail surface treatments including extensive elevated structures were also recommended to minimise impacts on bogs and open grassy habitats that may be used by threatened alpine reptiles.	NPWS has adopted this as the final alignment with Biosis' suggested changes between Charlotte Pass and Perisher Valley

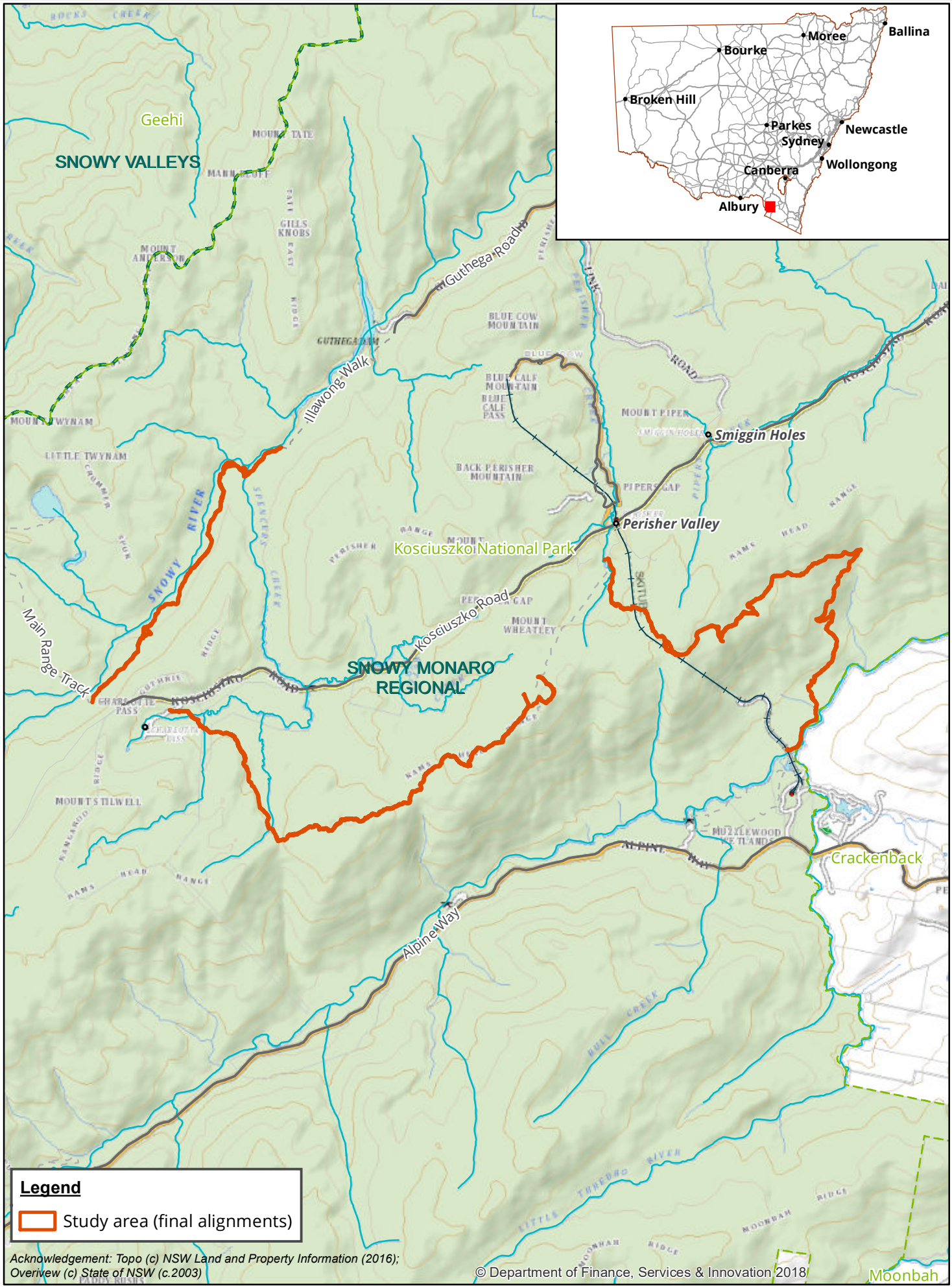

Figure 1 Location of the study area

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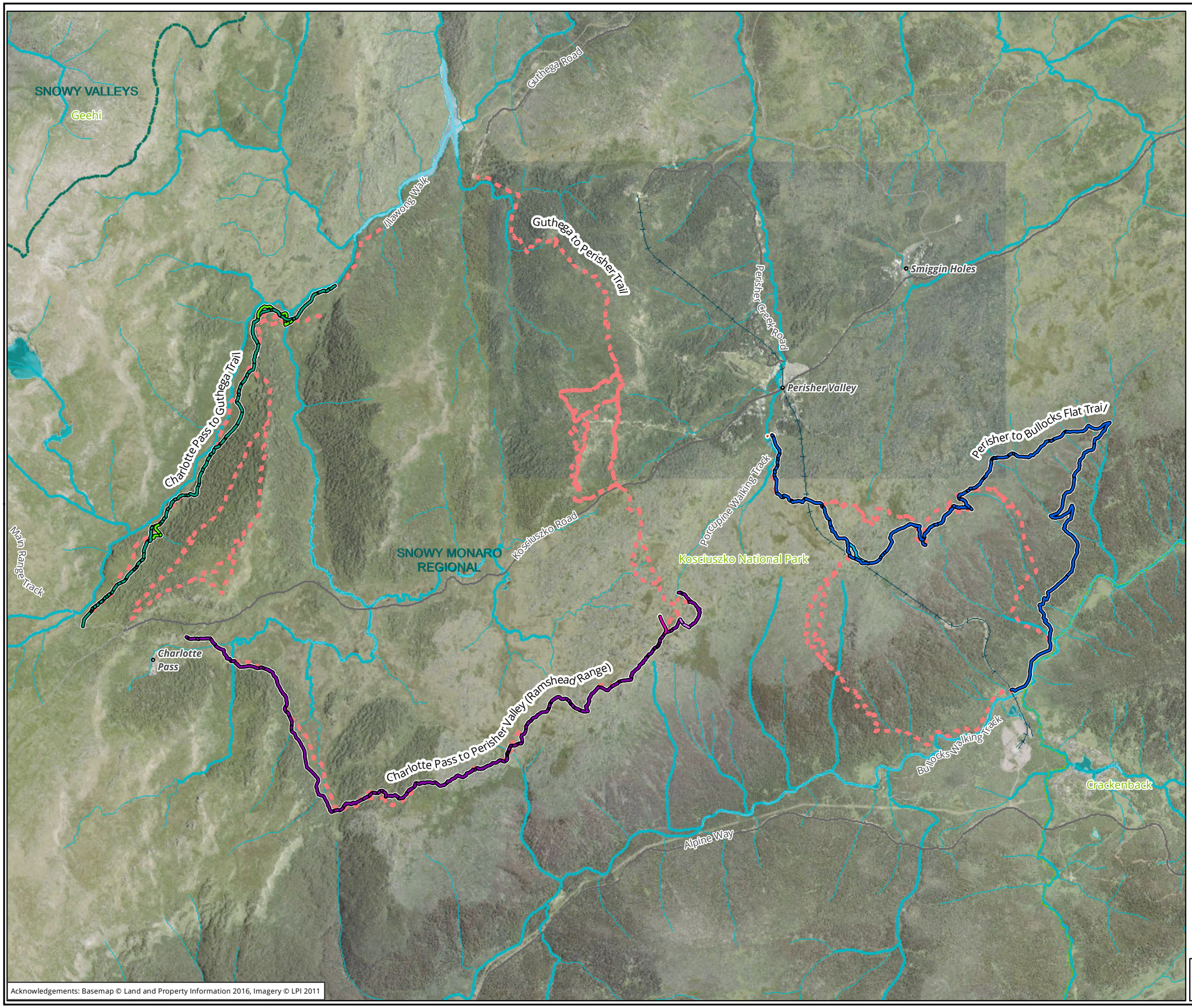

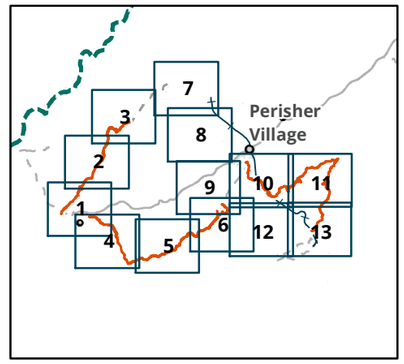

Legend

- Study area
- Previous alignments

Final alignments

- Charlotte Pass to Guthega Trail
- Charlotte Pass to Guthega Trail - Possible alignment - requires further assessment
- Charlotte Pass to Perisher Valley (Ramshead Range)
- Charlotte Pass to Perisher Valley (Ramshead Range) - Existing walking trail to be modified
- Charlotte Pass to Perisher Valley (Ramshead Range) - Possible alignment - requires further assessment
- Perisher to Bullocks Flat Trail
- Perisher to Bullocks Flat Trail - Possible alignment - requires further assessment

Figure 2 Trail alignments - overview

0 400 800 1,200 1,600 2,000

Metres

Scale: 1:40,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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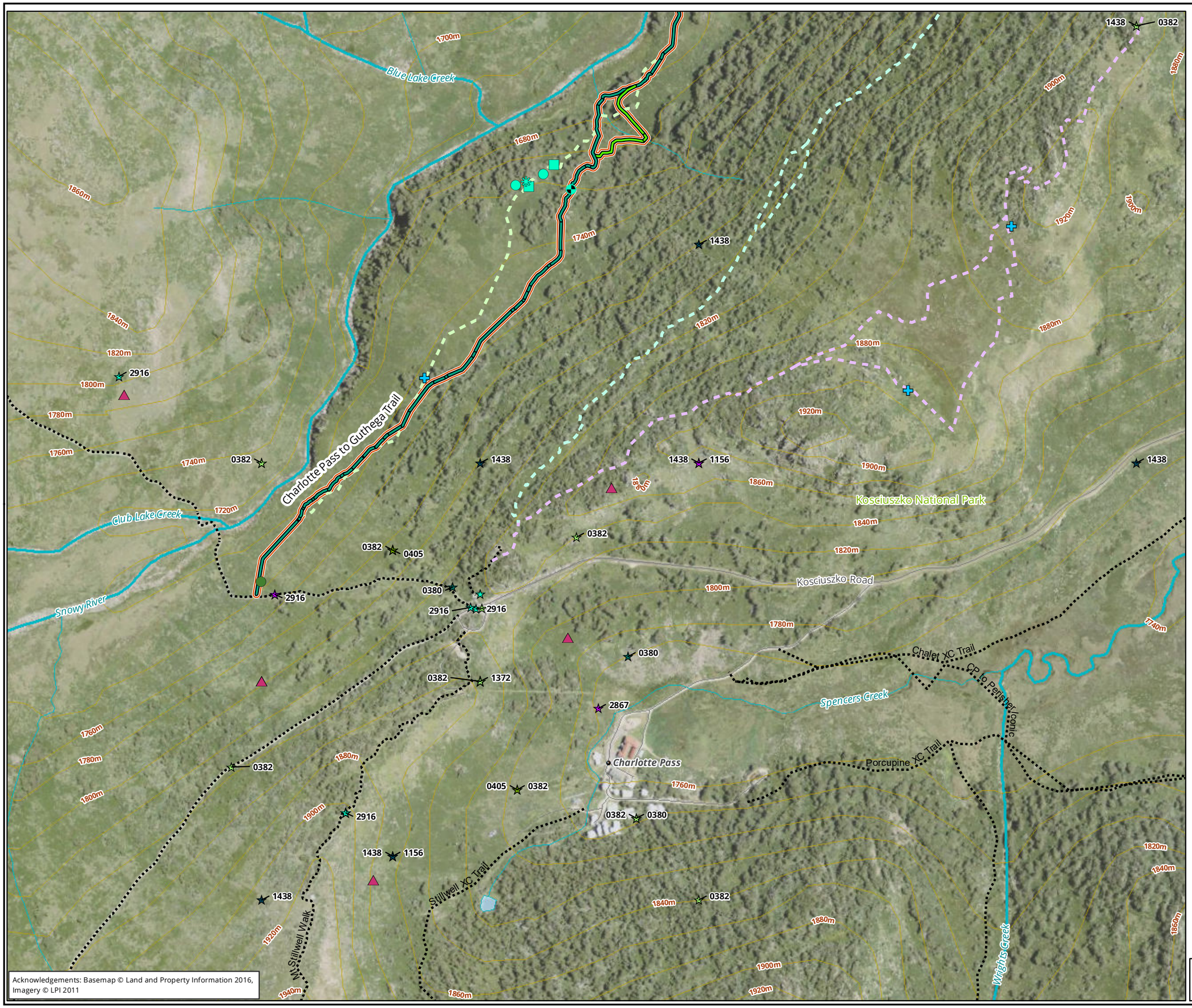

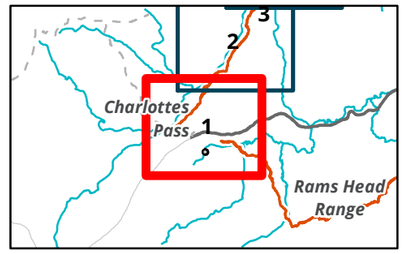

Legend

- Study area
- Existing walking tracks
- Contour

Final alignments

- Charlotte Pass to Guthega Trail
- Charlotte Pass to Guthega Trail - Possible alignment - requires further assessment

Previous alignments

- Charlotte Pass to Guthega Trail
- Charlotte Pass to Guthega Trail (2017)
- Charlotte Pass to Guthega Trail (Option B)

Guthega Skink surveys (Zak Atkins 2019)

- Guthega Skink
- Guthega burrows
- Guthega colony
- Potential Guthega habitat

Threatened flora (Biosis 2017-19)

- Ranunculus anemoneus - Anemone Buttercup

Threatened flora (Biosis 2017-19)

- Broad-toothed Rat - Mastacomys fuscus

Threatened Fauna (Bionet 2019)

- 0380 - Scarlet Robin
- 0382 - Flame Robin
- 0405 - Olive Whistler
- 1156 - Mountain Pygmy-possum
- 1372 - Eastern False Pipistrelle
- 1438 - Broad-toothed Rat
- 2867 - Alpine She-oak Skink
- 2916 - Guthega Skink

Threatened Flora (Bionet 2019)

- Ranunculus anemoneus - Anemone Buttercup

Figure 2.1 Trail alignments - Charlotte Pass to Guthega Trail

0 80 160 240 320 400

Metres
Scale: 1:8,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55

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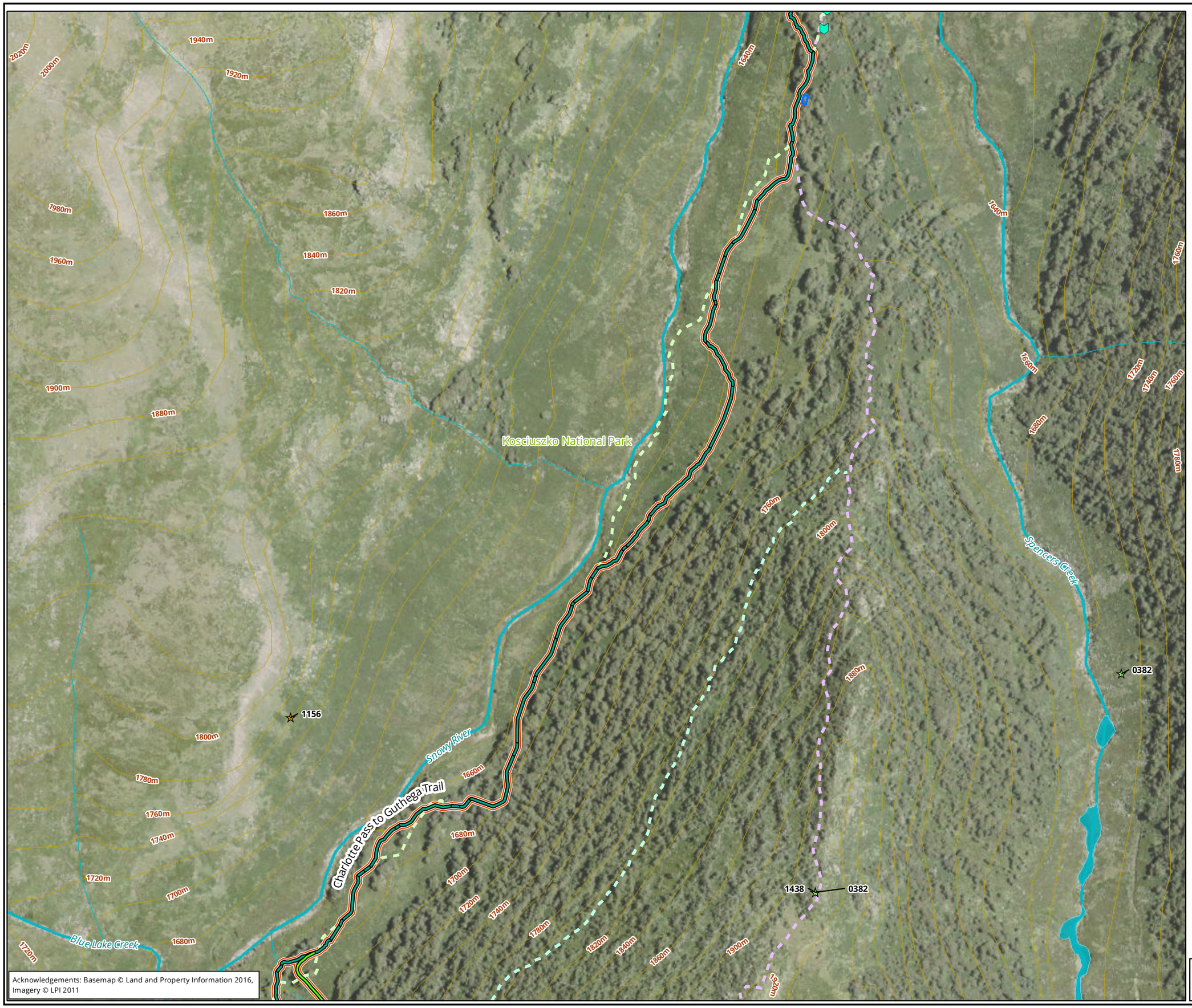

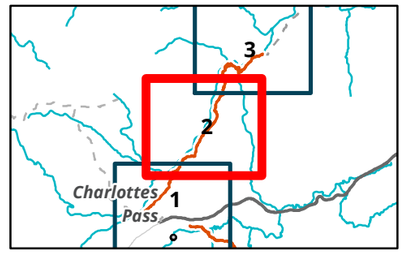

Legend

- Study area
- Contour
- Proposed camp site

Final alignments

- Charlotte Pass to Guthega Trail
- Charlotte Pass to Guthega Trail - Possible alignment - requires further assessment

Previous alignments

- Charlotte Pass to Guthega Trail
- Charlotte Pass to Guthega Trail (2017)
- Charlotte Pass to Guthega Trail (Option B)

Guthega Skink surveys (Zak Atkins 2019)

- Potential Guthega burrows

Threatened Fauna (Bionet 2019)

- 0382 - Flame Robin
- 1156 - Mountain Pygmy-possum
- 1438 - Broad-toothed Rat

Figure 2.2 Trail alignments - Charlotte Pass to Guthega Trail

0 80 160 240 320 400

Metres

Scale: 1:8,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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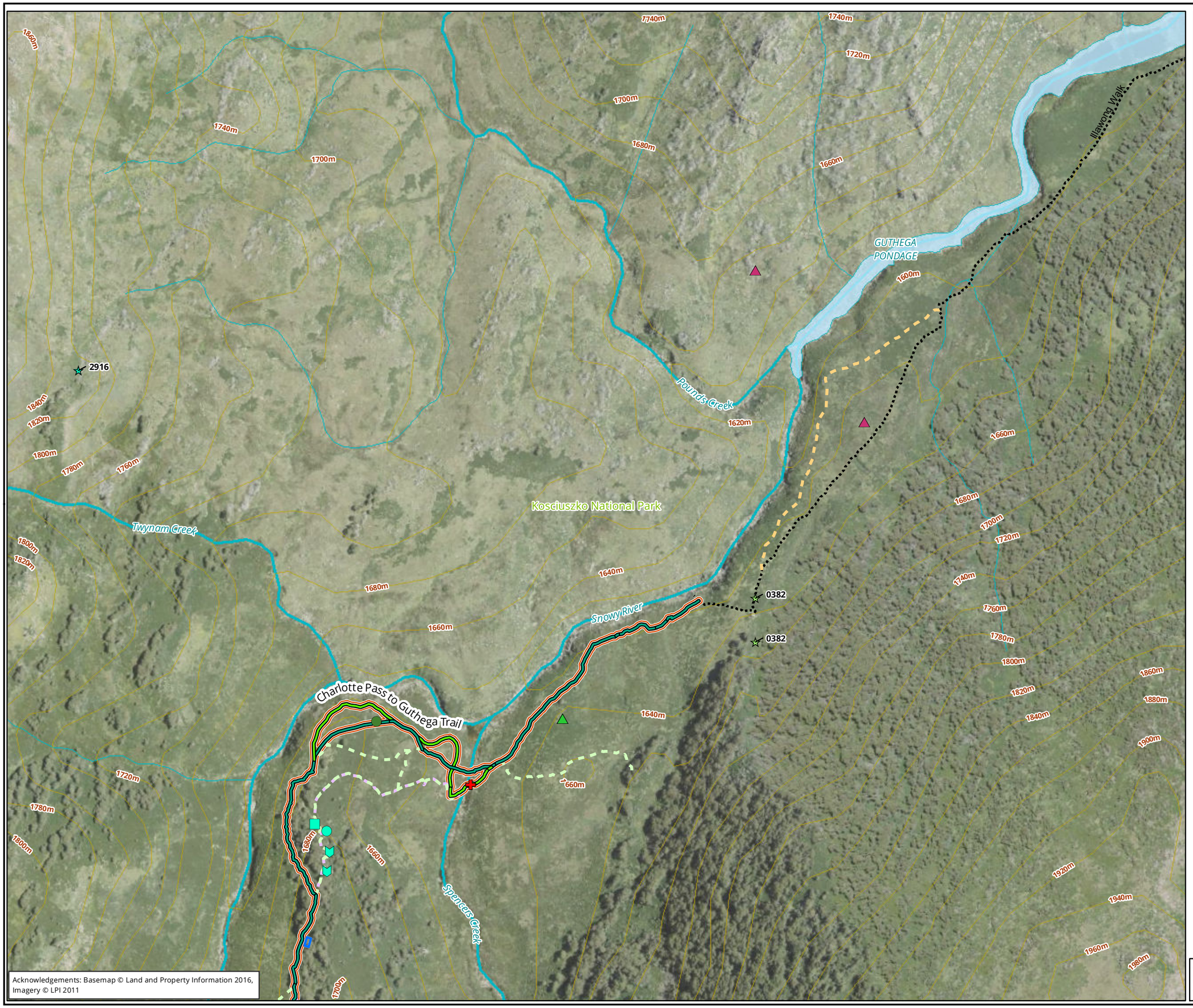

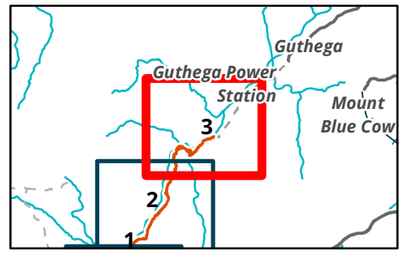

Legend

- Study area
- Existing walking tracks
- Contour
- Proposed camp site

Final alignments

- Charlotte Pass to Guthega Trail
- Charlotte Pass to Guthega Trail - Possible alignment - requires further assessment

Previous alignments

- Charlotte Pass to Guthega Trail
- Charlotte Pass to Guthega Trail (2017 Illawong extension option)
- Charlotte Pass to Guthega Trail (Option B)

Guthega Skink surveys (Zak Atkins 2019)

- Guthega Skink
- Guthega burrows
- Potential Guthega burrows

Threatened flora (Biosis 2017-19)

- Rytidosperma vickeryae - Perisher Wallaby-grass

Threatened flora (Biosis 2017-19)

- Broad-toothed Rat - Mastacomys fuscus

Threatened Fauna (Bionet 2019)

- 0382 - Flame Robin
- 2916 - Guthega Skink

Threatened Flora (Bionet 2019)

- Argyrotegium nitidulum - Shining Cudweed
- Ranunculus anemoneus - Anemone Buttercup

Figure 2.3 Trail alignments - Charlotte Pass to Guthega Trail

0 80 160 240 320 400

Metres

Scale: 1:8,000 @ A3

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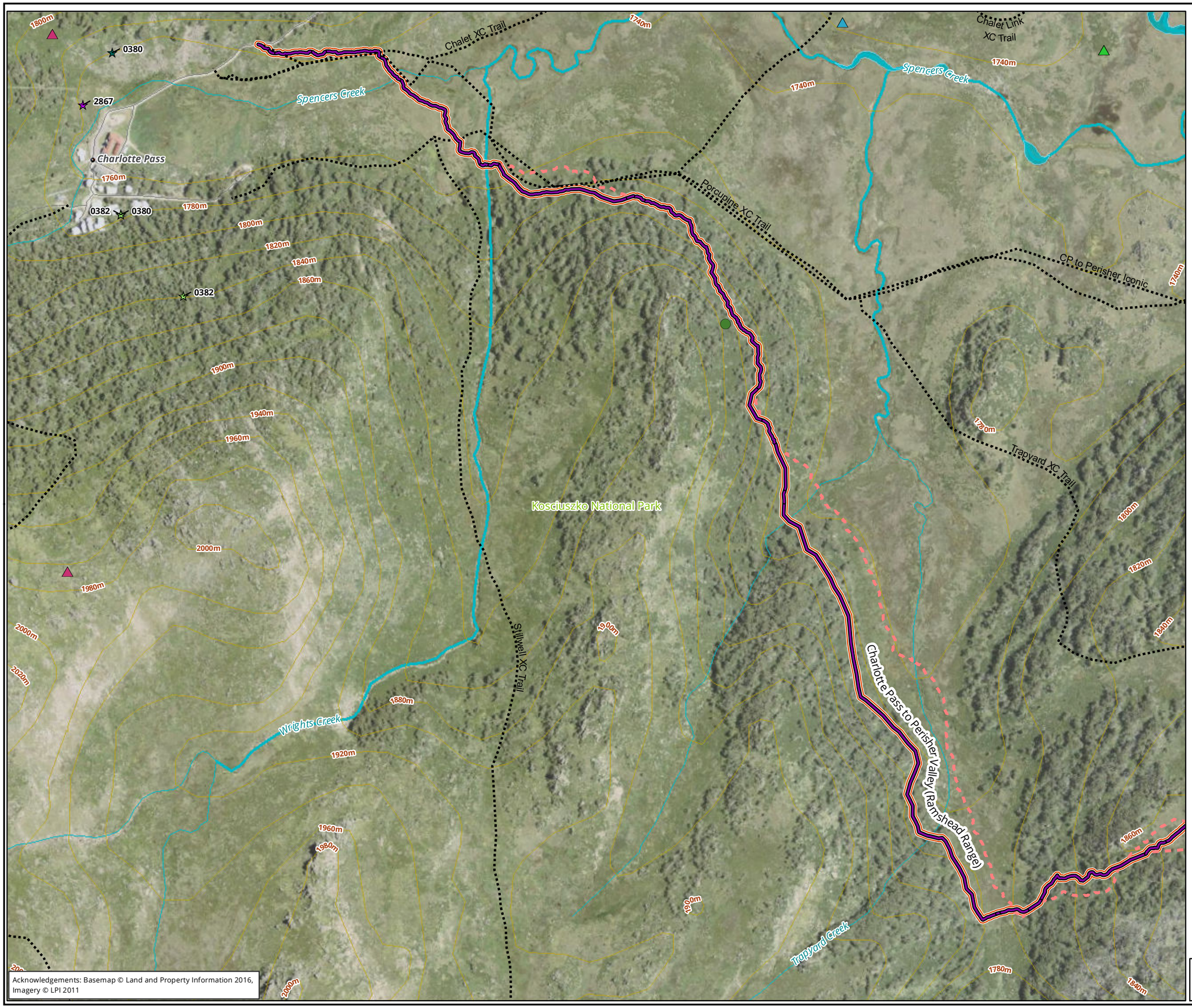

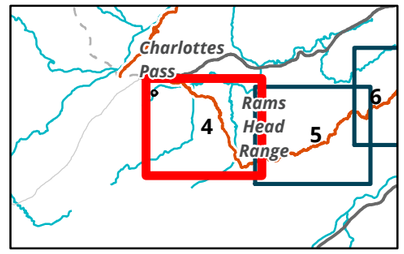

Legend

- Study area
- Existing walking tracks
- Contour

Final alignments

- Charlotte Pass to Perisher Valley (Ramshead Range)

Previous alignments

- Charlotte Pass to Perisher Valley (Ramshead Range)

Threatened flora (Biosis 2017-19)

- Broad-toothed Rat - Mastacomys fuscus

Threatened Fauna (Bionet 2019)

- 0380 - Scarlet Robin
- 0382 - Flame Robin
- 0405 - Olive Whistler
- 2867 - Alpine She-oak Skink

Threatened Flora (Bionet 2019)

- Argyrotegium nitidulum - Shining Cudweed
- Carex raleighii - Raleigh Sedge
- Ranunculus anemoneus - Anemone Buttercup

Figure 2.4 Trail alignments - Charlotte Pass to Perisher Valley

0 80 160 240 320 400

Metres

Scale: 1:8,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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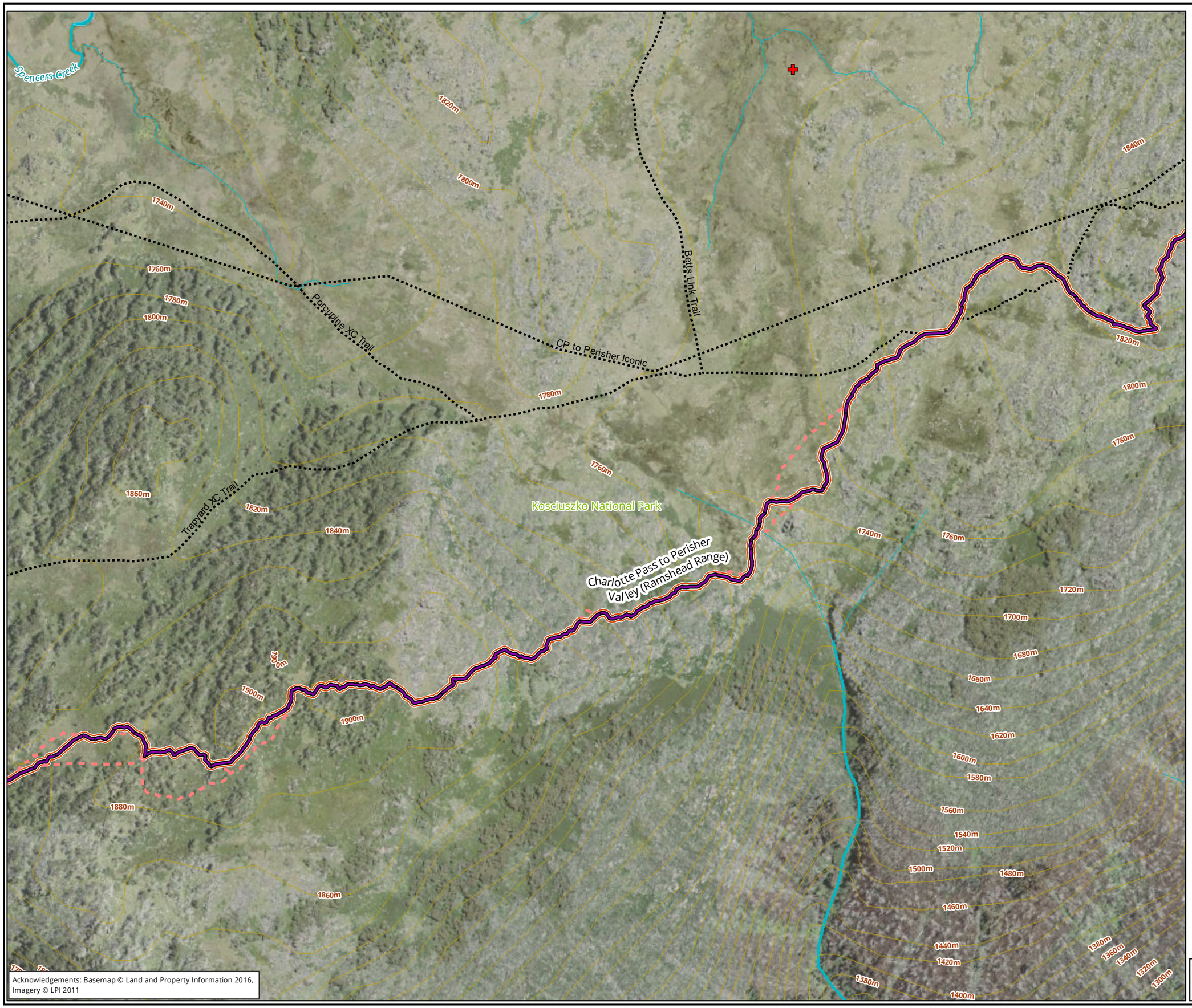

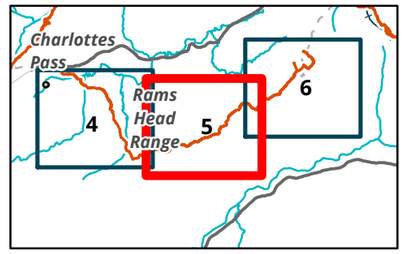

Legend

- Study area
- Existing walking tracks
- Contour

Final alignments

- Charlotte Pass to Perisher Valley (Ramshead Range)

Previous alignments

- Charlotte Pass to Perisher Valley (Ramshead Range)

Threatened flora (Biosis 2017-19)

- Rytidosperma vickeryae - Perisher Wallaby-grass

Figure 2.5 Trail alignments - Charlotte Pass to Perisher Valley

0 80 160 240 320 400

Metres

Scale: 1:8,000 @ A3

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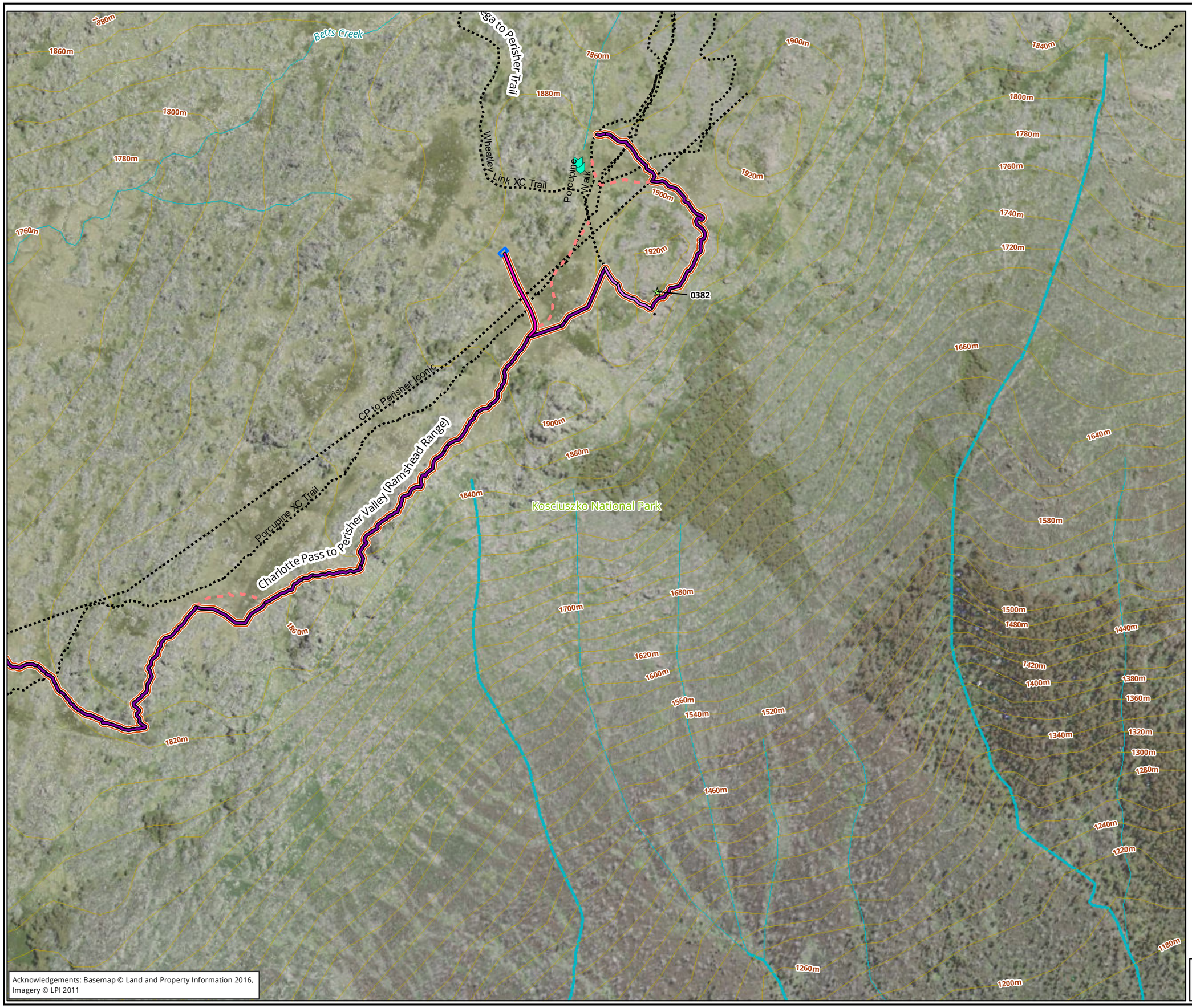

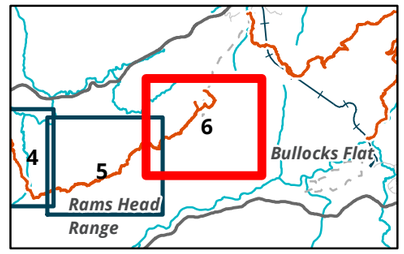

Legend

- Study area
- Existing walking tracks
- Contour
- Proposed camp site

Final alignments

- Charlotte Pass to Perisher Valley (Ramshead Range)
- Charlotte Pass to Perisher Valley (Ramshead Range) - Existing walking trail to be modified
- Charlotte Pass to Perisher Valley (Ramshead Range) - Possible alignment - requires further assessment

Previous alignments

- Charlotte Pass to Perisher Valley (Ramshead Range)

Guthega Skink surveys (Zak Atkins 2019)

- Potential Guthega burrows

Threatened Fauna (Bionet 2019)

- ☆ 0382 - Flame Robin

Figure 2.6 Trail alignments - Charlotte Pass to Perisher Valley

0 80 160 240 320 400

Metres

Scale: 1:8,000 @ A3

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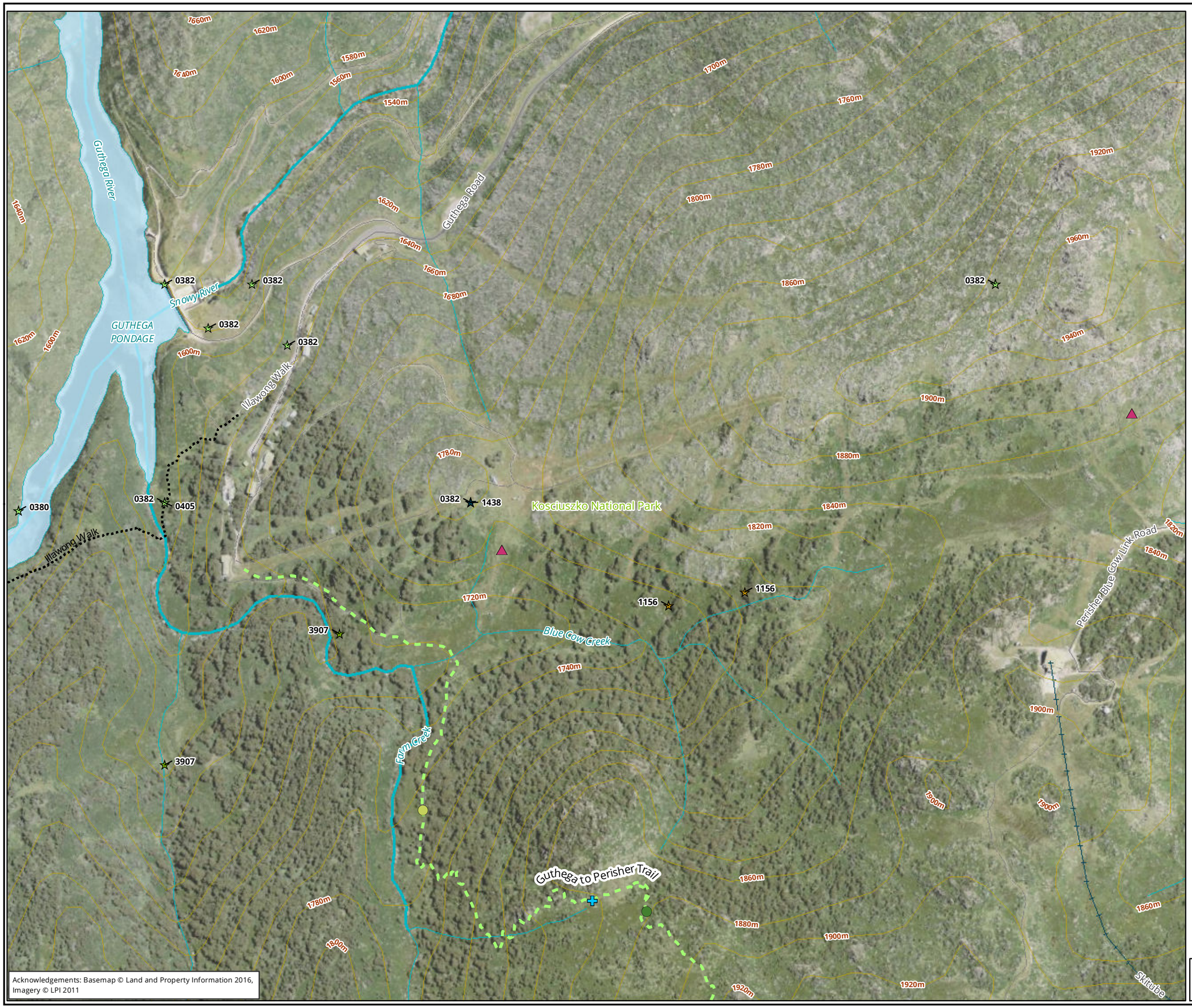

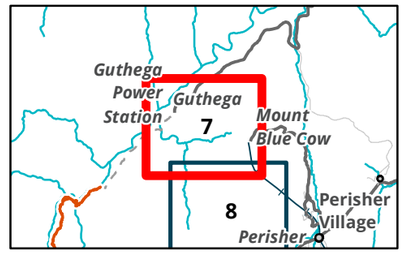

Legend

- Existing walking tracks
- Contour

Previous alignments

- Guthega to Perisher Trail (2017 & 2018, including Porcupine Rocks Trail)

Threatened flora (Biosis 2017-19)

- Ranunculus anemoneus - Anemone Buttercup

Threatened flora (Biosis 2017-19)

- Broad-toothed Rat - Mastacomys fuscus
- Flame Robin - Petroica phoenicea

Threatened Fauna (Bionet 2019)

- 0380 - Scarlet Robin
- 0382 - Flame Robin
- 0405 - Olive Whistler
- 1156 - Mountain Pygmy-possum
- 1438 - Broad-toothed Rat
- 3907 - Alpine Tree Frog

Threatened Flora (Bionet 2019)

- Ranunculus anemoneus - Anemone Buttercup

Figure 2.7 Trail alignments - Guthega to Perisher Trail

0 80 160 240 320 400

Metres

Scale: 1:8,000 @ A3

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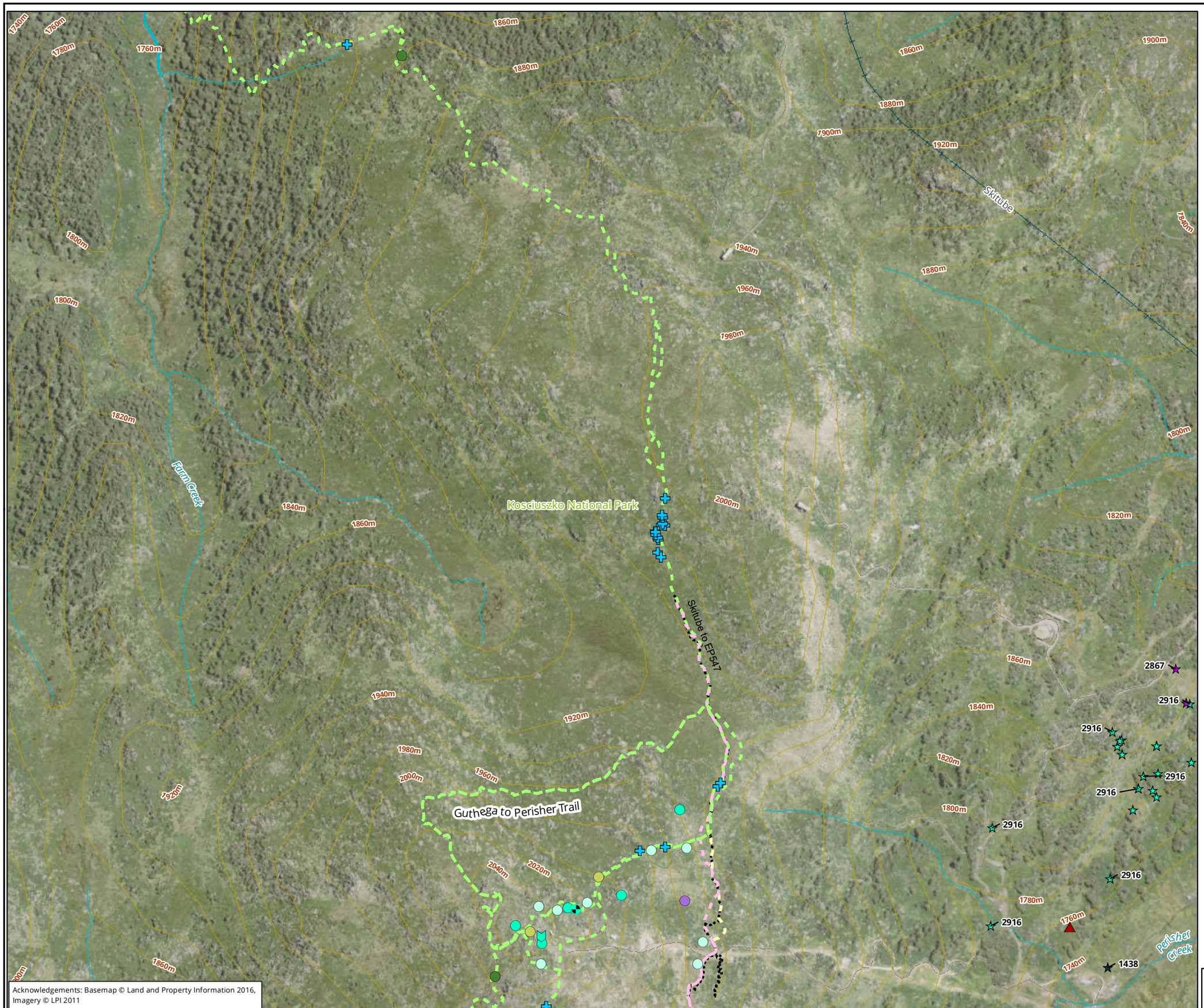

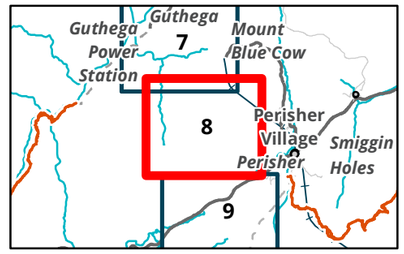

Legend

Contour

Previous alignments

- Guthega to Perisher Trail (2017 & 2018, including Porcupine Rocks Trail)
- Guthega to Perisher Trail (2018 approach to Mt Perisher)
- Guthega to Perisher Trail (2019 Mt P east option)

Guthega Skink surveys (Zak Atkins 2019)

- Guthega Skink
- Potential Guthega burrows
- Potential Guthega habitat

Threatened flora (Biosis 2017-19)

- Ranunculus anemoneus - Anemone Buttercup

Threatened flora (Biosis 2017-19)

- Alpine She-oak Skink - Cyclodomorphus praealtus
- Broad-toothed Rat - Mastacomys fuscus
- Flame Robin - Petroica phoenicea
- Guthega Skink - Liopholis guthega

Threatened Fauna (Bionet 2019)

- 1438 - Broad-toothed Rat
- 2867 - Alpine She-oak Skink
- 2916 - Guthega Skink

Threatened Flora (Bionet 2019)

- Rytidosperma vickeryae - Perisher Wallaby-grass

Figure 2.8 Trail alignments - Guthega to Perisher Trail

0 80 160 240 320 400

Metres

Scale: 1:8,000 @ A3

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Legend

- Existing walking tracks
- Contour
- Proposed camp site

Previous alignments

- Guthega to Perisher Trail (2017 & 2018, including Porcupine Rocks Trail)
- Guthega to Perisher Trail (2018 approach to Mt Perisher)
- Guthega to Perisher Trail (2019 Mt P east option)
- Guthega to Perisher Trail (2019 Mt P west option)

Guthega Skink surveys (Zak Atkins 2019)

- Guthega Skink
- Guthega burrows
- Guthega colony
- Potential Guthega burrows
- Potential Guthega habitat

Threatened flora (Biosis 2017-19)

- Ranunculus anemoneus - Anemone Buttercup

Threatened flora (Biosis 2017-19)

- Alpine She-oak Skink - Cyclodomorphus praealtus
- Broad-toothed Rat - Mastacomys fuscus
- Flame Robin - Petroica phoenicea
- Guthega Skink - Liopholis guthega

Threatened Fauna (Bionet 2019)

- 0382 - Flame Robin
- 1438 - Broad-toothed Rat
- 2916 - Guthega Skink

Threatened Flora (Bionet 2019)

- Rytidosperma vickeryae - Perisher Wallaby-grass
- Ranunculus anemoneus - Anemone Buttercup

Figure 2.9 Trail alignments - Guthega to Perisher Trail

0 80 160 240 320 400

Metres

Scale: 1:8,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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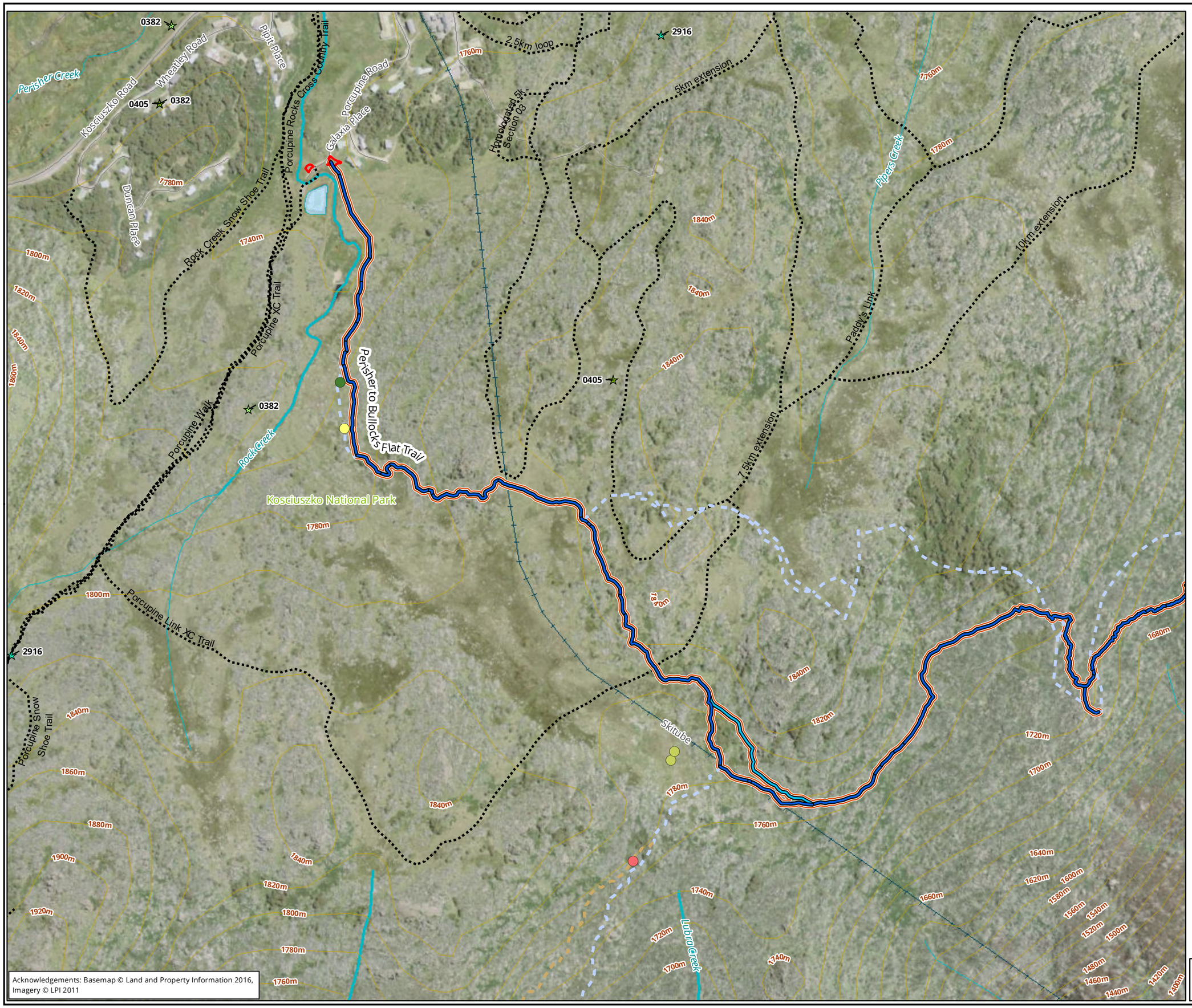

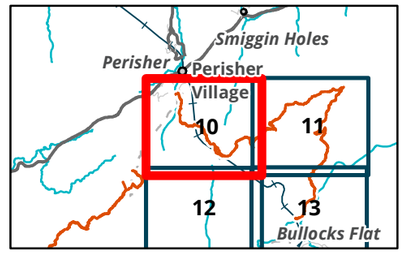

Legend

- Study area
- Existing walking tracks
- Contour
- Proposed carpark extension

Final alignments

- Perisher to Bullocks Flat Trail
- Perisher to Bullocks Flat Trail - Possible alignment - requires further assessment

Previous alignments

- Perisher to Bullocks Flat Trail
- Perisher to Bullocks Flat Trail (2018 West of Lubra Creek)

Threatened flora (Biosis 2017-19)

- Broad-toothed Rat - Mastacomys fuscus
- Flame Robin - Petroica phoenicea
- Gang-gang Cockatoo - Callocephalon fimbriatum
- Olive Whistler - Pachycephala olivacea

Threatened Fauna (Bionet 2019)

- 0382 - Flame Robin
- 0405 - Olive Whistler
- 2916 - Guthega Skink

Acknowledgements: Basemap © Land and Property Information 2016, Imagery © LPI 2011

Figure 2.10 Trail alignments - Perisher to Bullocks Flat Trail

0 80 160 240 320 400

Metres

Scale: 1:8,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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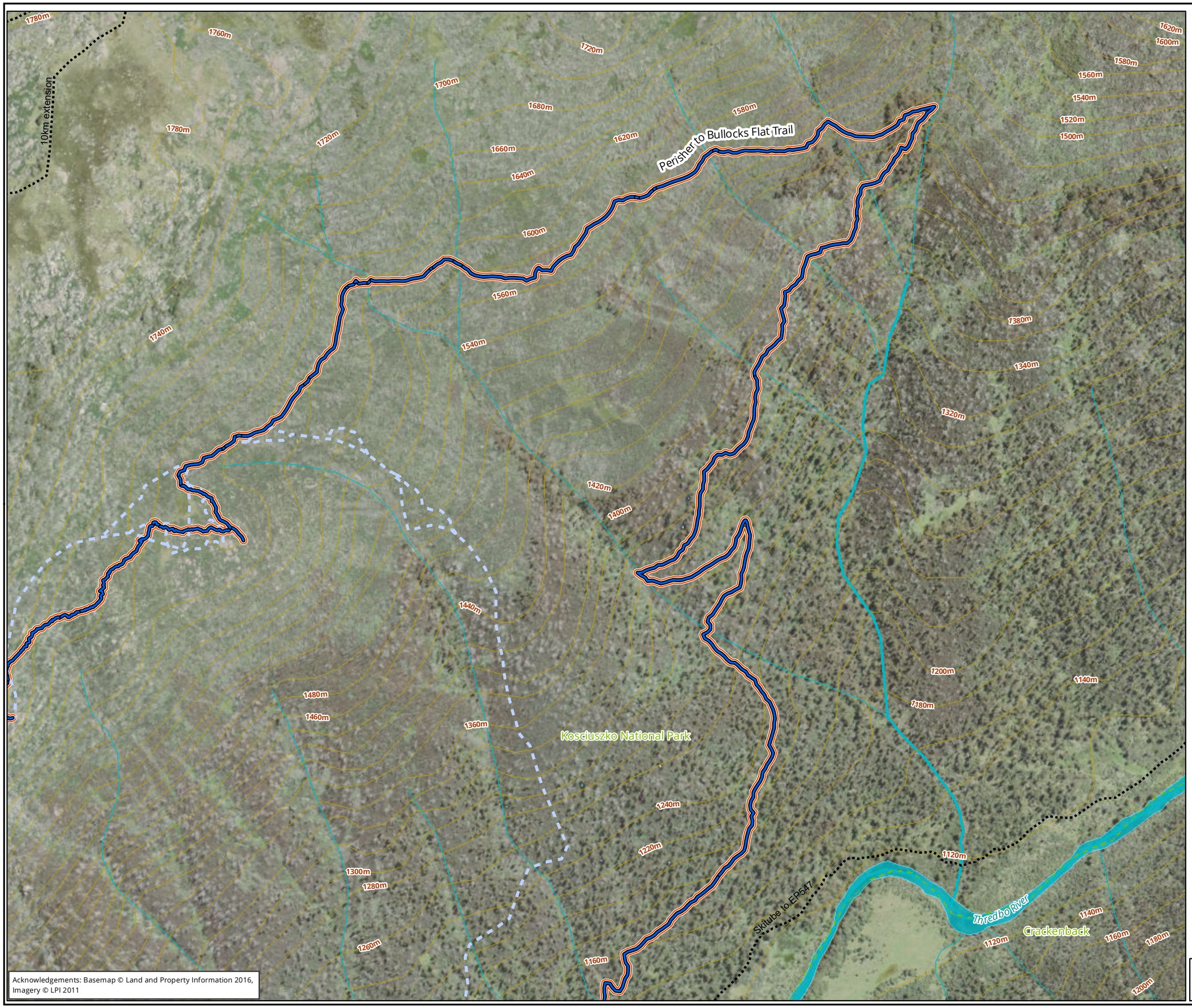
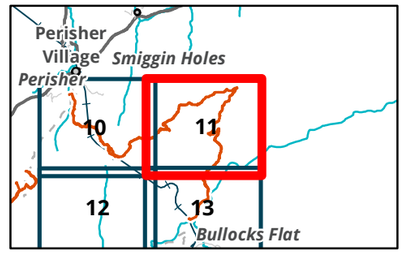
Matter: 29243
Date: 26 July 2019,
Checked by: MJAL, Drawn by: LH, Last edited by: lharley
Location:P:\29200s\29243\Mapping\29243_FFA_F2_StudyArea_detail





Legend

- Study area
- Existing walking tracks
- Contour

Final alignments

- Perisher to Bullocks Flat Trail

Previous alignments

- Perisher to Bullocks Flat Trail

Acknowledgements: Basemap © Land and Property Information 2016, Imagery © LPI 2011

Figure 2.11 Trail alignments - Perisher to Bullocks Flat Trail

0 80 160 240 320 400

Metres

Scale: 1:8,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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Matter: 29243
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Checked by: MJAL, Drawn by: LH, Last edited by: lharley
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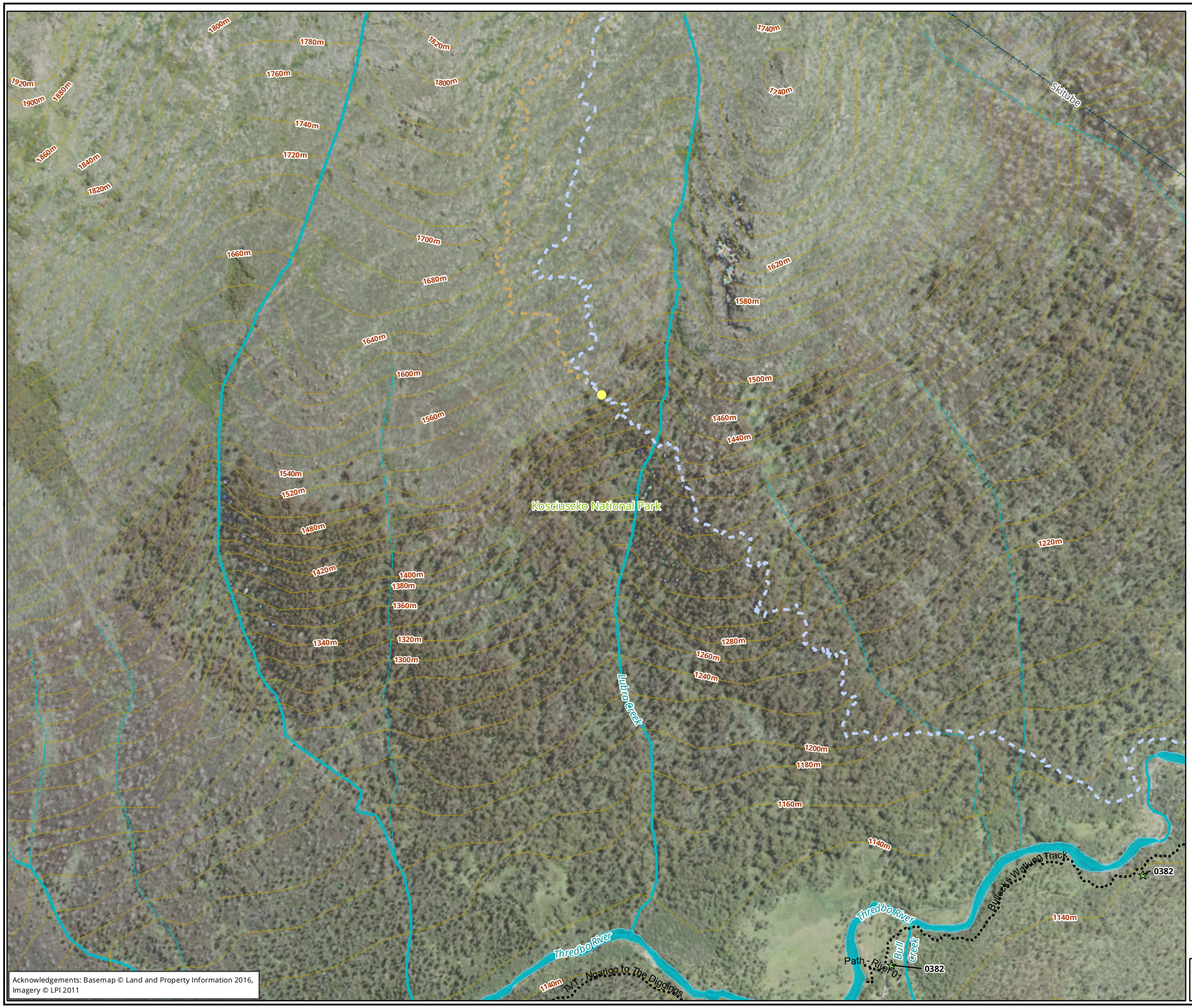

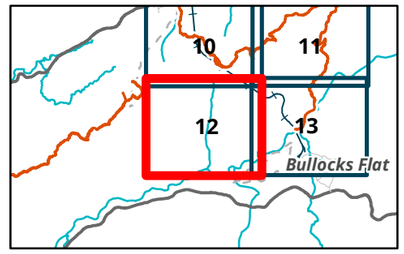

Legend

- Existing walking tracks
- Contour

Previous alignments

- Perisher to Bullocks Flat Trail
- Perisher to Bullocks Flat Trail (2018 West of Lubra Creek)

Threatened flora (Biosis 2017-19)

- Gang-gang Cockatoo - Callocephalon fimbriatum

Threatened Fauna (Bionet 2019)

- 0382 - Flame Robin

Figure 2.12 Trail alignments - Perisher to Bullocks Flat Trail

0 80 160 240 320 400

Metres

Scale: 1:8,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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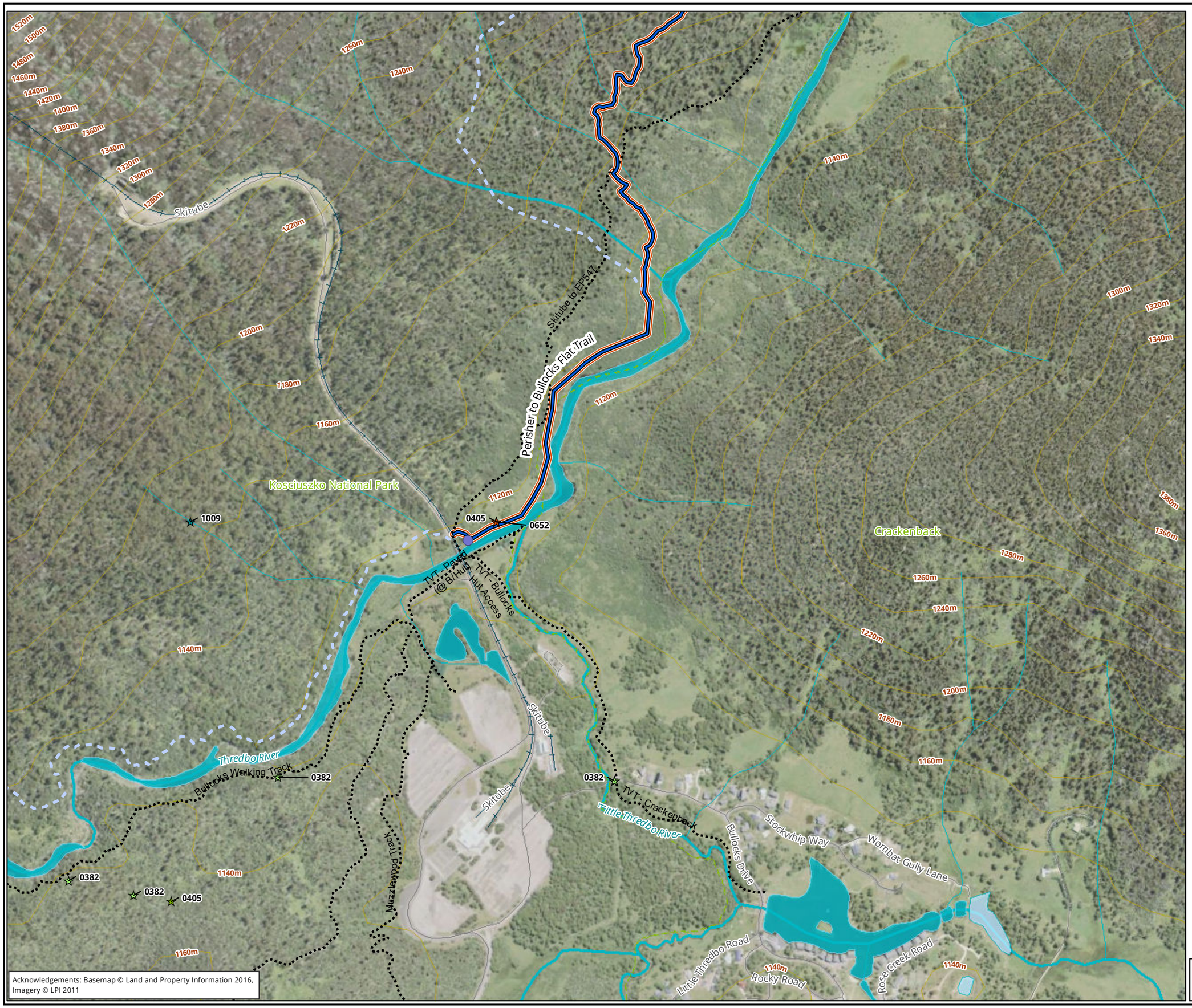

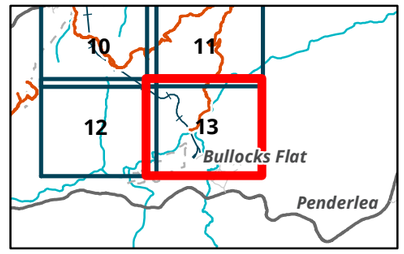

Legend

- Study area
- Existing walking tracks
- Contour

Final alignments

- Perisher to Bullocks Flat Trail

Previous alignments

- Perisher to Bullocks Flat Trail

Threatened flora (Biosis 2017-19)

- Scarlet Robin - Petroica boodang

Threatened Fauna (Bionet 2019)

- 0380 - Scarlet Robin
- 0382 - Flame Robin
- 0405 - Olive Whistler
- 0652 - Diamond Firetail
- 1009 - Eastern Quoll
- 8127 - Brown Treecreeper (eastern subspecies)

Figure 2.13 Trail alignments - Perisher to Bullocks Flat Trail

0 80 160 240 320 400

Metres

Scale: 1:8,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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Matter: 29243
Date: 26 July 2019,
Checked by: MJAL, Drawn by: LH, Last edited by: lharley
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2 Legislative context

This section provides an overview of key biodiversity legislation and government policy considered in this assessment. Where available, links to further information are provided. This section does not describe the legislation and policy in detail and guidance provided here does not constitute legal advice.

2.1 Commonwealth

2.1.1 Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Australian Government's key piece of environmental legislation. The EPBC Act applies to developments and associated activities that have the potential to significantly impact on Matters of National Environmental Significance (NES) protected under the Act.

Nine Matters of NES are identified under the EPBC Act:

- World heritage properties
- National heritage places
- Wetlands of international importance (also known as "Ramsar" wetlands)
- Nationally threatened species and ecological communities
- Migratory species
- Commonwealth marine areas
- The Great Barrier Reef Marine Park
- Nuclear actions (including uranium mining)
- A water resource, in relation to coal seam gas development and large coal mining development

Under the EPBC Act, activities that have potential to result in significant impacts on Matters of NES must be referred to the Commonwealth Minister for the Environment for assessment.

Matters of NES relevant to the project include nationally threatened species and ecological communities, Ramsar wetlands, world heritage places and national heritage places. Threatened species and ecological communities protected by the EPBC Act are outlined in Section 4 and significant impact criteria (SIC) assessments are provided in Appendix 3.

An assessment of potential impacts to all Matters of NES under the provisions of the EPBC Act, and consideration of referral of the project to the Commonwealth Minister for the Environment for assessment is provided in Section 7.

2.2 State

2.2.1 Environmental Planning and Assessment Act 1979

The EP&A Act was enacted to encourage the proper consideration and management of impacts of proposed development or land-use changes on the environment (both natural and built) and the community. The EP&A Act is administered by the NSW Department of Planning and Environment (DPE).

The EP&A Act provides the overarching structure for planning in NSW and is supported by other statutory environmental planning instruments. Sections of the EP&A Act of primary relevance to the natural environment are outlined further below.

Test of Significance

Section 1.7 of the EP&A Act requires proponents and consent authorities to consider if a development will have a significant effect on threatened species, populations or communities listed under the *Biodiversity Conservation Act 2016* (BC Act) and *Fisheries Management Act 1994* (FM Act).

Section 1.7 (Section 7.3 of the BC Act and Part 7A of the FM Act) outlines factors that must be considered in a Test of Significance (ToS). Where any ToS determines that a development will result in a significant effect to a threatened species, population or community a Species Impact Statement (SIS) or preparation of a Biodiversity Offsets Scheme (BOS) application is required.

Threatened species, populations and communities listed under the BC Act and FM Act are discussed in Section 4. Tests of Significance are provided in Appendix 4.

An assessment of whether the project will result in a significant effect to any threatened species, populations or communities listed under the BC Act or FM Act, and whether an SIS or preparation of a BOS application is required, is provided in Section 7.

State Environmental Planning Policies

State Environmental Planning Policies (SEPPs) are environmental planning instruments under the EP&A Act that outline policy objectives relevant to State or regional environmental planning issues. There are over 65 SEPPs; however, only those relevant to the proposed development have been considered and are detailed below.

SEPP No. 44 – Koala Habitat Protection

SEPP No. 44 aims to encourage the conservation and management of natural vegetation areas that provide habitat for koalas to ensure permanent free-living populations will be maintained over their present range and to reverse the current trend of koala-population decline. It applies to areas of native vegetation greater than one hectare and in Local Government Areas (LGAs) listed in Schedule 1 to the SEPP.

The project is within the Snowy Monaro Regional Council LGA. This LGA was formerly made up of three separate LGAs (Bombala, Cooma-Monaro and Snowy River) and all of these former LGAs are Schedule 1 listed Councils. Therefore, SEPP No. 44 is relevant to the current assessment and is discussed further in Section 7.

SEPP Kosciuszko National Park – Alpine Resorts 2007

The SEPP Kosciuszko National Park – Alpine Resorts applies to the alpine resorts located within Kosciuszko National Park. The majority of the proposed trail alignment is located outside of the alpine resort SEPP boundaries, however it may cross into the Charlotte Pass Alpine Resort and Bullocks Flat Terminal where this SEPP applies. Therefore, this SEPP has been considered. Clause 25 however, states that development carried

out on land to which the policy applies by or on behalf of the Crown or a public authority does not require consent.

Local Environmental Plans

Local Environmental Plans guide planning decisions for local government areas. Through zoning and development controls, they allow councils and other consent authorities to manage the ways in which land is used. Where a LEP is inconsistent with a SEPP, a SEPP prevails over a LEP.

The study area is zoned E1 – National Parks and Nature Reserves under the Snowy River LEP (that covers this part of the current Snowy Monaro LGA). The relevant objectives of E1 zoning are:

- To enable the management and appropriate use of land that is reserved under the *National Parks and Wildlife Act 1974* or that is acquired under Part 11 of that Act.
- To enable uses authorised under the *National Parks and Wildlife Act 1974*.
- To identify land that is to be reserved under the *National Parks and Wildlife Act 1974* and to protect the environmental significance of that land.

The proposal is considered to be consistent with the objectives of E1 zoning and the LEP is not inconsistent with the applicable SEPPs.

2.2.2 Biodiversity Conservation Act 2016

The BC Act is the key piece of legislation providing for the protection and conservation of biodiversity in NSW through the listing of threatened species, populations and communities, key threatening processes and critical habitat for threatened species, populations and communities. Impacts to threatened species, populations and communities are assessed under Section 7 of the BC Act, which includes Section 7.3 the *Test for determining whether proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats* (the 'Test of Significance').

Under Part 5 of the EP&A Act, if assessment under Section 7.3 of the BC Act determines a project is likely to result in a significant effect to threatened species, populations or communities, then the proponent must prepare a Species Impact Statement (SIS) or, optionally apply the Biodiversity Offsets Scheme (BOS). In the case of this project, DPIE has advised that triggering a significant effect would escalate the project to a SIS rather than the entry into the BOS as biodiversity credits are not available in the national park, however, metrics used under the BOS could be adopted to quantify offset requirements.

Threatened species, populations and communities listed under the BC Act are discussed in Section 4. An assessment of whether the project will result in a significant effect to these threatened species, populations and communities is summarised in Section 7, and detailed in Appendix 4.

2.2.3 Fisheries Management Act 1994

The FM Act provides for the protection and conservation of aquatic species and their habitat throughout NSW. Impacts to threatened species, populations and communities, and critical habitats listed under the FM Act must be assessed through the ToS process under Section 1.7 of the EP&A Act (see above). If assessment under Section 1.7 of the EP&A Act determines a project is likely to result in a significant effect to threatened species, populations or communities then a SIS should be prepared.

Two key objectives of the FM Act are to; conserve fish stocks and key fish habitats, and conserve threatened species, populations and ecological communities of fish and marine vegetation. When reviewing applications the Department of Primary Industries (DPI) will assess the likelihoods of impacts to waterways in relation to their sensitivity (TYPE) and waterway class (CLASS).

Threatened species, populations and communities listed under the FM Act are discussed in Section 4. Tests of Significance are provided in Appendix 4. An assessment of whether the project will result in a significant effect to these threatened species, populations and communities is summarised in Section 7.

An assessment of the waterways is provided in Section 4. An assessment of the project against the objectives of the FM Act is provided in Section 7.

2.2.4 Biosecurity Act 2015

The Biosecurity Act outlines biosecurity risks and impacts, which in relation to the current assessment includes those risks and impacts associated with weeds. A biosecurity risk is defined as the risk of a biosecurity impact occurring, which for weeds includes the introduction, presence, spread or increase of a pest into or within the State or any part of the State. A pest plant that has the potential to out-compete other organisms for resources, including food, water, nutrients, habitat and sunlight and / or harm or reduce biodiversity.

Under the Biosecurity Act a priority weed is any weed identified in a local strategic plan, for a region that includes that land or area, as a weed that is or should be prevented, managed, controlled or eradicated in the region. A local strategic plan here refers to a local strategic plan approved by the Minister under Division 2 of Part 4 of the *Local Land Services Act 2013*.

The Biosecurity Act also introduces the General Biosecurity Duty, which states:

> *All plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.*

Priority Weeds are discussed further in Sections 6 and 7.

2.2.5 Water Management Act 2000

The WM Act provides for the sustainable and integrated management of the state's water for the benefit of both present and future generations based on the concept of ecologically sustainable development. Under the WM Act an approval is required to undertake controlled activities on waterfront land, unless that activity is otherwise exempt under Section 91E. Waterfront land is defined within the Act as the bed of any river, lake or estuary and any land within 40 metres of the river banks, lake shore or estuary mean high water mark.

As specified in *Water management (General) Regulation 2011* a public authority does not need to obtain a controlled activity approval for any controlled activities that it carries out in, on or under waterfront land. It is however an expectation that the overarching objective of the WM Act, to preserve the integrity of riparian corridors, will be maintained.

2.2.6 National Parks and Wildlife Act 1974

The main objective of the NPW Act is to ensure the conservation of nature which includes habitat, ecosystems and ecosystems processes, biological diversity, landforms of significance including geological features and landscapes such as wilderness and wild rivers. The NPW Act also extends to the conservation of objects, places and features of cultural value to Aboriginal Australians and places of historic, architectural and scientific significance. The NPW Act contains provisions for the management of land which has been reserved under the Act using a management approach developed in accordance with each type of reservation.

The NPW Act applies to this proposal as the study area occurs within Kosciuszko National Park which has been reserved under the NPW Act.

Kosciuszko National Park Plan of Management

According to Section 72 of the NPW Act, a Plan of Management must be prepared for declared National Parks in NSW. As such, the Kosciuszko National Park Plan of Management (NPWS 2006) has been prepared by NPWS in accordance with Part 5 of the NPW Act to guide the long–term management of natural, cultural and recreational values within Kosciuszko National Park. In pursuance of this aim, this document outlines a series of management actions to be undertaken by NPWS in addition to other organisations, contractors and subcontractors. The Kosciuszko National Park Plan of Management is relevant to this flora and fauna assessment as the entire study area occurs within the park. An assessment of the project against the principles listed in the Kosciusko National Park Plan of Management is provided in Section 7.3. The proposal has also been nominated in the Draft Walking Tracks Strategy for the Kosciuszko Summit Precinct (OEH 2018h) and is subject to Kosciuszko National Park Proposed Amendment to Plan of Management (OEH 2019b).

3 Methods

Field investigations, mapping and reporting for this project have been undertaken between May 2017 and April 2019. An outline of all investigations conducted to date across all trail options and alignments is provided in this section.

3.1 Literature and database review

To provide context for the study area, information about flora and fauna from within 10 kilometres (the 'locality') was obtained from relevant public databases. Aquatic fauna records were searched from the Snowy River Basin. Records from the following databases were collated and reviewed:

- Commonwealth Department of the Environment and Energy (DEE) Protected Matters Search Tool for matters protected by the EPBC Act.
- DPIE BioNet Atlas of NSW Wildlife, for items listed under the BC Act.
- The DPI Spatial Data Portal for FM Act listed threatened species, populations and communities.
- PlantNET (Royal Botanic Gardens and Domain Trust 2017) for Rare or Threatened Australian Plants (RoTAP).
- BirdLife Australia, the New Atlas of Australian Birds 1998-2013.

Database searches were undertaken initially in May 2017 and updated in February 2019.

Other sources of biodiversity information reviewed include:

- Relevant vegetation mapping:
  - *Treeless Vegetation of the Australian Alps* (McDougall and Walsh 2007).
  - *Kosciuszko Ski Resorts Vegetation Assessment 2002-30* (Ecology Australia 2003).
  - *Vegetation mapping in relation to ecological interpretation and management in the Kosciusko alpine area* (Wimbush and Costin 1973).

The following reports were also reviewed:

- *Snowy Mountains Iconic Walk, Environmental Scoping Assessment* (Biosis 2017).
- *Summary of results and provision of spatial data: biodiversity assessments for the Snowies Iconic Walk project, Kosciuszko National Park* (Biosis 2018)
- *Kosciuszko Snowies Iconic Great Walk Track and Facilities Design Concept* (Newscape Design 2017).
- *Summit Area Trails Upgrades Plan 2016* (NPWS 2016).
- *Kosciuszko National Park Plan of Management* (NPWS 2006).
- NSW Scientific Committee final determinations for threatened biodiversity.
- *Guthega Skink (Liopholis guthega) Assessment, Proposed Snowies Iconic Walk Project Kosciuszko National Park* (Atkins 2019, unpublished).
- *Review of Environmental Factors: Proposed Lower Thredbo Valley Track, Bullocks Flat to Thredbo River Picnic Area* (EnviroKey 2015).

3.2 Field investigations

3.2.1 Survey effort

Four separate field investigations were undertaken between May 2017 and April 2019 across the various trail options and alignments, including:

Initial environmental scoping study, 1 to 4 May 2017

- 111.5 person hours of survey effort by four ecologists (Matt Looby, Ewan Kelly, Aaron Harvey and Nicola Trulock) to undertake initial vegetation mapping and assess likelihood of threatened species/communities presence during sub-optimal seasonal and poor weather conditions. The Biosis team was accompanied by one NPWS representative (Chris Darlington).

Targeted surveys, 5 to 9 March 2018

- 150 person hours of survey effort by three ecologists (Matt Looby, Ewan Kelly and Mark Venosta) to refine vegetation mapping and search for threatened flora and fauna populations or habitats during favourable seasonal and clear weather conditions. The Biosis team was accompanied by two NPWS representatives over various survey days (Mel Schroder and Mark Feeney).
- Aquatic surveys were undertaken over three days between 6 and 8 March 2018 by two aquatic ecologists (Tony Cable and Luke Stone) with a survey effort of 60 person hours.

Flora and fauna assessment and micro-siting, 26 February to 1 March 2019

- 160 person hours of survey effort by four ecologists (Matt Looby, Ewan Kelly, Alejandro Barreto and Georgina Zacks) over four days during favourable seasonal and clear weather conditions. Survey effort aimed to undertake further targeted surveys and vegetation mapping, and to micro-site trail alignments to inform track construction methods. The Biosis team was accompanied by four NPWS representatives over various survey days (Maggie Sutcliffe, Anthony Evans, Mel Schroder and Janelle Herlihy).

Flora and fauna assessment and micro-siting, 15 to 18 April 2019

- 140 hours of survey effort by four ecologists (Matt Looby, Ewan Kelly, Jules Farquhar and Georgina Zacks) over four days during sub-optimal seasonal and clear weather conditions. Survey effort aimed to undertake further targeted surveys and vegetation mapping, and to micro-site trail alignments to inform track construction methods. The Biosis team was accompanied by three NPWS representatives over various survey days (Maggie Sutcliffe, Anthony Evans and Mel Schroder). Low-level aerial surveys of the Perisher Valley to Bullocks Flat track were also undertaken from a light helicopter during this survey period.

3.2.2 Flora assessment methods

During the initial May 2017 environmental scoping assessment the study area was investigated using a combination of BioBanking (BBAM) plots (consisting of a 50 metre transect and 20 x 20 metre quadrat), spot locations and random meanders to determine the vegetation types present. Floristic data were collected from 22 plots and transects during that survey.

Targeted flora surveys, undertaken between 5 and 9 March 2018, followed the *NSW Guide to Surveying Threatened Plants* (OEH 2016) and involved walking a complete transect of each trail alignment while searching for a range of threatened herbs, shrubs, grasses and orchids (see Appendix 1 for target flora species list). Vegetation mapping updates according to the NSW Plant Community Type (PCT) typology were also

undertaken during the flora surveys and were based on observations of landscape position, structure and floristic composition along the trails.

The flora assessments undertaken between 26 February and 1 March and between 15 and 18 April 2019 used a combination of 20 x 20 metre full floristic quadrats, targeted surveys according to OEH (2016), spot locations and random meanders to further delineate boundaries between vegetation types and to micro-site the trail alignment within the study area. Sixteen additional full floristic plots were captured during this period.

3.2.3 Vegetation mapping methods

Plant community type (PCT) mapping and descriptions are relatively undeveloped for the Australian Alps bioregion within the NSW BioNet Vegetation Classification database. However, PCT is the typology used to assess vegetation removal and biodiversity impacts according to the Biodiversity Assessment Method (BAM) (OEH 2017a). Although BAM has not been applied to this project, it is considered a standard method in NSW and therefore PCTs were the most appropriate vegetation typology to use. Other typologies have been applied to the NSW Alps, and specifically to the Kosciuszko area including:

- Treeless Vegetation of the Australian Alps (McDougall and Walsh 2007)
- Kosciuszko Ski Resorts Vegetation Assessment (Ecology Australia 2003)

Ecology Australia (2003) provides a finer resolution of vegetation classification than the PCTs of the BioNet Vegetation Classification database applicable to the study area. Where appropriate, we have included a corresponding plant community according to the typology of Ecology Australia (2003) in this report and in spatial datasets supplied to NPWS.

The main limitations encountered with the BioNet Vegetation Classification database PCTs for the Australian Alps bioregion relate to PCT 641 – *Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion*. This is a broad grouping of several grassland, herbfield and heathland communities. Tall heaths dominated by *Nematolepis ovatifolia* that lack extensive rocky outcropping do not fit well into this PCT but have been assigned here due to the lack of suitable alternatives.

The general condition of native vegetation was observed as well as the effects of current seasonal conditions. Notes were made on specific issues such as noxious weed infestations, evidence of management works, current grazing impacts by deer and the regeneration capacity of the vegetation.

A list of flora species was compiled for each vegetation type based on the full floristic plots, targeted searches and incidental observations. Records of threatened flora species will be submitted to DPIE for incorporation into the BioNet Wildlife Atlas.

3.2.4 Fauna assessment methods

During the May 2017 initial environmental scoping assessment, the study area was investigated to characterise values for fauna based on vegetation communities and habitat features. A desktop assessment of threatened fauna likelihood of occurrence was undertaken by Daniel Gilmore (Senior Consultant Zoologist) for this initial assessment. During field surveys in March 2018 and February, March and April 2019, fauna surveys were conducted by a zoologist and were primarily habitat-based with a focus on detecting suitable rocky habitats, boulderfields, wetlands and vegetation types likely to support threatened alpine fauna (see target list in Appendix 2).

Active searching included:

- Searching beneath rocks and logs for sheltering reptiles and scanning rock exfoliations for basking reptiles.
- Bird observations were undertaken through aural survey and with binoculars.

- Indirect evidence through detection of scats, or other signs of fauna occupancy.

Given the reasonably large body of knowledge on threatened terrestrial vertebrate fauna that exists in Kosciusko National Park, and the assumption that high quality suitable habitats would support these fauna, it was not deemed appropriate to employ invasive or resource-intensive survey techniques such as trapping, artificial shelter or nocturnal spotlighting. To supplement knowledge gaps on species presence and habitat use we relied on information provided by DPIE and NPWS experts (see Section 5).

3.2.5 Aquatic survey methods

The March 2018 aquatic surveys focussed on creek, river and fen pool crossings likely to be impacted by trail construction including Spencers Creek, Rock Creek, Lubra Creek, Farm Creek, Betts Creek and unnamed tributaries of the Thredbo and Snowy Rivers. These surveys assessed trail options and alignments available at the time but were considered adequate to characterise local waterways. Aquatic surveys involved back pack electrofishing, Alpine Redspot Dragonfly macroinvertebrate surveys (dip netting) and habitat characterisation.

3.2.6 Weather conditions during all surveys

Table 2 provides a summary of weather conditions from the 071032 Thredbo Top Station AWS NSW during all survey effort between May 2017 and April 2019 (http://www.bom.gov.au/climate/data/).

Table 2 Temperature and rainfall observations during all surveys

Date	Maximum temperature ˚C	Minimum temperature ˚C	Rainfall (mm)
April 2019 surveys			
15 April 2019	12.1	1.5	0
16 April 2019	12.9	3.2	0
17 April 2019	13.2	3.7	0
18 April 2019	12.7	7.5	0
February-March 2019 surveys			
26 February 2019	19.2	6.7	0
27 February 2019	19.4	6.6	3.2
28 February 2019	20.0	8.1	0
1 March 2019	20.0	10.1	1.6
March 2018 surveys			
5 March 2018	14.8	3.3	0
6 March 2018	9.6	1.1	0.8
7 March 2018	14.8	2.4	0.4
8 March 2018	17.3	3.3	8
May 2017 surveys			
1 May 2017	7.5	1.5	0
2 May 2017	2.7	1.2	0.6

Date	Maximum temperature ˚C	Minimum temperature ˚C	Rainfall (mm)
3 May 2017	4.3	-8.5	2.4
4 May 2017	7.1	-4.5	0

3.3 Permits and licences

All flora and fauna assessments were conducted under the terms of Biosis' Scientific Licence issued by DPIE under the NPW Act (SL100758, expiry date 31 March 2020).

3.4 Consultation

During the preparation of this report Biosis discussed the project with DPIE and NPWS ecologists to more fully understand biodiversity values and potential impacts. See Section 5 for full documentation of consultation with local experts.

3.5 Limitations and survey effort

Two threatened greenhood orchid species (*Pterostylis alpina* and *P. foliata*, listed as Vulnerable under the BC Act) are known from the Thredbo Valley, however the 2018 and 2019 survey period did not coincide with their flowering times making these species difficult to detect. No evidence of greenhood orchids in the form of spent seed pods or rosettes were recorded and we understand that NPWS staff have checked some of the drainage systems above the Thredbo River for these species. The February-March 2019 surveys observed vegetative evidence of orchid species in montane bog systems along the Perisher Valley to Bullocks Flat Trail, however expert advice has since concluded that the leaves found were a non-threatened *Chiloglottis* species.

Several sections of the final Perisher Valley to Bullocks Flat trail below the plateau were not walked by Biosis ecologists due to the late finalisation of the proposed trail alignment. Biosis ecologists conducted low-level aerial surveys from a light helicopter of these areas during April 2019 to map vegetation and identify drainage systems. This aerial survey information, combined with remote-sensed information, was used to undertake vegetation mapping for several areas below the plateau. This is not considered a significant limitation as Biosis ecologists have surveyed the slopes above the Thredbo River on three other occasions in 2017, 2018 and 2019 in similar vegetation communities to where the final trail is proposed. Furthermore, this report recommends pre-construction micro-siting of elevated structures across sub-alpine and montane bogs be undertaken to avoid and minimise any impact on threatened vegetation and greenhood orchid species that may occur in the vicinity of the proposed trail.

Intensive fauna surveys such as trapping, artificial shelter installation and remote cameras were not deemed necessary, as there is a considerable body of knowledge on the occurrence of threatened alpine fauna in the Kosciuszko National Park. Furthermore, NPWS ecologists accompanied Biosis staff on all surveys and the intention of the fauna surveys was to detect suitable habitat near the trail alignments and develop appropriate design responses.

The water quality parameters measured/analysed provide a snapshot of conditions at a given point in time. Some of these parameters typically exhibit a high degree of temporal variation and can change substantially over small periods of time (weeks, days and even hours), particularly in response to significant weather events. The surface water quality results have been compared to the ANZECC (2000) guideline values for

upland streams in south-eastern Australia. Upland streams are defined by the guidelines as those at greater than 150 metres elevation, while alpine streams are those at elevation greater than 1500 metres. Since alpine stream guideline values are not provided for the parameters monitored, the values for upland streams have been presented as a guide.

The Snowy River, Thredbo River, Blue Cow Creek, Spencers Creek, Guthrie Creek, Lubra Creek, Wrights Creek, Trapyard Creek, Betts Creek and numerous unnamed tributaries intersect, or occur close to, the proposed trails. A thorough survey for aquatic fauna has not been conducted on these channels as this was beyond the scope of assessments. A search of the DPI Viewer was undertaken to determine the presence of threatened aquatic biota within the Snowy River Basin. These records, combined with the general habitat values recorded during the 2018 aquatic assessment have been analysed against relevant biodiversity legislation (EPBC / FM Act) to determine constraints to development.

The combined effort of 621.5 person hours over four separate terrestrial surveys and one aquatic survey and consultation with NPWS/DPIE experts is considered adequate to accurately characterise the ecological features of the study area and provide an understanding of habitat availability for threatened biota.

Database searches, and associated conclusions on the likelihood of species to occur within the study area are reliant upon external data sources and information managed by third parties.

3.6 Mapping

Trail alignments and options were supplied by NPWS in Geographic Information System (GIS) format. All mapping was conducted using hand-held (uncorrected) Tablet Personal Computer units (GDA94) and aerial photo interpretation. The accuracy of this mapping is therefore subject to the accuracy of the GPS units (generally ± 5 metres) and dependent on the limitations of aerial photo rectification and registration.

Mapping has been produced using a GIS. Electronic GIS files containing the relevant flora and fauna spatial data are available to incorporate into trail design plans. However this mapping may not be sufficiently precise for detailed design purposes.

4 Results

The ecological values of the study area are described below and mapped in Figure 3.

4.1 Landscape description

The study area occurs in an intact alpine, sub-alpine and montane landscape that supports large tracts of native vegetation. Current land uses including nature conservation, road infrastructure, hydroelectricity production, ski resorts and other recreational infrastructure. In the wider locality, similar land uses occur throughout the Kosciuszko National Park. The study area also has a history of seasonal cattle/sheep grazing which has contributed to small infestations of agricultural and environmental weeds. Cattle have been absent from the study area since the ban on cattle grazing in Kosciuszko National Park, instituted in 1969.

Kosciuszko National Park was named a UNESCO Biosphere Reserve in 1997 and forms part of the Great Eastern Ranges Initiative, one of the six major wildlife corridors in Australia. Ramsar site 68, Blue Lake (including Hedley Tarn), occurs approximately 1.5 kilometres to the north-west of the study area, however no creeks or rivers intersected by the project drain into the Blue Lake Ramsar site. The study area forms a continuous corridor of intact bushland within Kosciuszko National Park which is contiguous with the Snowy River National Park to the south, Alpine National Park to the south-west and Bimberi Wilderness to the north-east.

4.2 Soils

The dominant geology present consists of Silurian-Devonian gneissic granite with soils consisting of the Main Range Sub-alpine Mitchell Landscape throughout areas between 2200 metres and 1550 metres elevation. Soils shift to Main Range Montane Mitchell Landscape along the Perisher Valley to Bullocks Flat Trail at elevations between 1550 metres and 1150 metres and then to Jindabyne Plains between 1150 metres and 1100 metres (DECC 2002). A description of soils associated with the above Mitchell Landscapes is provided in Table 3.

Table 3 NSW (Mitchell) landscapes and soils within the study area

Mitchell Landscape	Landscape	Geology	Soils
Main Range Sub-alpine	High plateau and block faulted ranges, mountain peaks and tors including extensive plains and valley swamps. Local relief of up to 300 m.	Silurian-Devonian gneissic granite and granites with greywacke, phyllite and schist.	Uniform textured alpine humus and transitional alpine humus soils and peat with abundant organic matter.
Main Range Montane	Well drained steep slopes	Silurian-Devonian gneissic granite, granite and granodiorite and Ordovician slate, chert, quartzite and phyllite.	Soils range from gritty clay loams on granites and pedal red to yellow clay subsoils on metasediments.

Mitchell Landscape	Landscape	Geology	Soils
Jindabyne Plains	Wide open valleys and plains including low ranges and rounded peaks.	Silurian-Devonian granite and granodiorite.	Shallow gravelly loams on slopes, extensive red and yellow texture contrast soils on slopes near main streams and dark coloured gritty loams and clays in alluvium.

4.3 Vegetation communities

The study area supports a range of vegetation formations including Alpine Complex, Grassy Woodlands and Wet Sclerophyll Forest representing the diverse elevations, landscape settings, soils and aspects traversed by the project. Within these formations, and their associated vegetation classes, eight PCTs were identified, including:

- PCT 637 – *Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion.*
- PCT 638 – *Alpine Ash - Mountain Gum moist shrubby tall open forest of montane areas, southern South Eastern Highlands Bioregion and Australian Alps Bioregion.*
- PCT 641 – *Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion.*
- PCT 643 – *Alpine shrubland on scree, blockstreams and rocky sites of high altitude areas of Kosciuszko National Park, Australian Alps Bioregion.*
- PCT 644 – *Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion.*
- PCT 645 – *Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion.*
- PCT 679 – *Black Sallee - Snow Gum low woodland of montane valleys, South Eastern Highlands Bioregion and Australian Alps Bioregion.*
- PCT 1196 – *Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion.*

Descriptions of these PCTs are summarised in Table 4 with a comparison to corresponding vegetation communities described by other authors. A full description of each PCT is provided in Appendix 5. A list of all flora recorded during investigations across all trail options is included in Appendix 1.

Small areas of non-native vegetation were also recorded at existing trailheads and when options that pass through ski resorts were investigated but this vegetation type is not described here in detail.

4.4 Fauna habitat

The study area contains a variety of habitat features suitable for threatened and non-threatened fauna. A summary of the habitat types recorded within the study area, native fauna likely to utilise them and the location of these features are listed in Table 5. More detailed descriptions and fauna habitat/PCT associations are provided in Appendix 5.

Table 4 Summary of vegetation communities

Landscape setting	Plant Community Type	Equivalent communities (McDougall and Walsh 2007)	Equivalent communities (Ecology Australia 2003)	Location	Full floristic plots	Listing status
Alpine and sub-alpine wet valleys, gullies and drainage lines	PCT 637 – Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion	Communities 2, 3, 8, 10	Communities 11, 12, 14, 15, 24	All trails	5	EPBC Act & BC Act – endangered ecological community
Slopes between 1200 and 1500 m elevation	PCT 638 – Alpine Ash - Mountain Gum moist shrubby tall open forest of montane areas, southern South Eastern Highlands Bioregion and Australian Alps Bioregion.	Not applicable to treed communities	Community 27	Perisher Valley to Bullocks Flat	3	Not a listed TEC
Alpine plains and slopes and below inverted tree-lines	PCT 641 – Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion.	Communities 4, 5, 14, 18, 19, 22, 23, 33, 35, 36, 37, 39, 42	Communities 2, 5, 6, 8, 9, 13	All trails	11	Not a listed TEC
High ridges and rocky slopes	PCT 643 – Alpine shrubland on scree, blockstreams and rocky sites of high altitude areas of Kosciuszko National Park, Australian Alps Bioregion.	Communities 46, 51, 53, 54	Communities 3, 4, 19, 20	All trails	6	Not a listed TEC
Slopes between 1500 and 1650 m elevation	PCT 644 – Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion.	Not applicable to treed communities	Community 18	Perisher Valley to Bullocks Flat	0	Not a listed TEC

Landscape setting	Plant Community Type	Equivalent communities (McDougall and Walsh 2007)	Equivalent communities (Ecology Australia 2003)	Location	Full floristic plots	Listing status
Plains and slopes above 1650 m elevation	PCT 645 – Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion.	Not applicable to treed communities	Communities 19, 20, 25	All trails	10	Not a listed TEC
Slopes and valley floors below 1100 m elevation	PCT 679 – Black Sallee - Snow Gum low woodland of montane valleys, South Eastern Highlands Bioregion and Australian Alps Bioregion.	Not applicable to treed communities	Community 28	Perisher Valley to Bullocks Flat – along Thredbo River	1	BC Act listed TEC in South Eastern Highlands bioregion only. New listing to be resolved in spring 2019.
Slopes between 1100 and 1300 m elevation	PCT 1196 – Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion.	Not applicable to treed communities	Community 27, 28 (partial)	Perisher Valley to Bullocks Flat	1	Not a listed TEC
Various	Non-native vegetation	Not applicable	Not applicable	Perisher Valley	1	Not applicable

Table 5 Summary of fauna habitat types along the final trail alignments (x – represents habitat type present)

Habitat type	Fauna type	Charlotte Pass to Guthega	Charlotte Pass to Perisher Valley	Perisher Valley to Bullocks Flat
Hollow-bearing trees (small to medium sized hollows)	Hollow dependent microbats, woodland birds and small parrots and small arboreal mammals	X	X	X
Hollow-bearing trees (small to large sized hollows)	Hollow dependent microbats, woodland birds, large and small parrots, large cockatoos, forest owls and large and small arboreal mammals			X
Coarse woody debris	Small and medium-sized mammals, reptiles and woodland birds	X	X	X
Waterways	Freshwater fish and crustaceans, amphibians, reptiles, small mammals and aquatic invertebrates.	X	X	X
Bogs & fens	Amphibians, reptiles and small mammals	X	X	X
Rock outcrops and boulder fields	Small and medium-sized mammals, reptiles and woodland birds	X	X	X
Exposed rock and existing rock paving	Reptiles	X	X	X
Heathland	Small and medium-sized mammals, reptiles and woodland birds	X	X	X
Grassland	Large marsupials, raptors, reptiles, small mammals and woodland birds	X	X	X

4.5 Waterways and aquatic habitats

4.5.1 Charlotte Pass to Guthega Track

The final alignment for this trail crosses a seasonal unnamed tributary of the Snowy River, between Charlotte Pass and the bottom of Guthrie Ridge, and also crosses Spencers Creek near its confluence with the Snowy River (Figure 2). Several other small seasonal drainage lines are also crossed. Aquatic surveys were undertaken at site AQ1 in March 2018 (Spencers Creek, Figure 3). Survey included surface water quality monitoring, backpack electrofishing and aquatic habitat descriptions. Aquatic habitat condition and availability at Spencers Creek is considered high and water quality good (Table 6), although this system does receive run-off from Charlotte Pass resort some 7 kilometres upstream. The dissolved oxygen value recorded was marginally lower than expected, but is not expected to significantly impair aquatic ecological function. Only a small number of Brown Trout *Salmo trutta* were recorded, suggesting a highly altered fish community. Detailed fish catch results are provided in Table 7. A relatively high amount of filamentous algae was observed at this site. The presence of Brown Trout and degree of algae observed indicate a degraded aquatic ecological community, impacted both by the introduction of Brown Trout and impoundment downstream (Guthega Pondage).

No River Blackfish *Gadopsis marmoratus* individuals (part of the Snowy River endangered population) were recorded in Spencers Creek and this species is considered unlikely to occur within this section of the creek due to the prevalence of Brown Trout. The unnamed tributary crossed by the final alignment is seasonal in nature and unlikely to support River Blackfish. The tributary also lacks habitat characteristics required by Alpine Redspot Dragonfly *Austropetalia tonyana*, such as rocks, logs and moss in the splash zone of waterfalls (DPI 2014a), and is therefore unlikely to support this species.

4.5.2 Charlotte Pass to Perisher Valley Track

This trail alignment was selected late in the project planning (April 2019) and therefore was not subject to direct aquatic survey in March 2018. The final alignment crosses the headwaters of Spencers Creek near Charlotte Pass, Wrights Creek, the headwater and one tributary of Trapyard Creek and the headwaters of unnamed tributary of the Thredbo River (Figure 2). It also occurs in the southern part of the Betts Creek catchment. Survey at AQ6 (Betts Creek headwater near Wheatley Gap) was limited to aquatic habitat descriptions and observations due to the limited availability of water at the time of survey. This site is approximately 800 metres north of where the final trail alignment was selected but survey results are indicative of the general condition of unnamed tributaries and headwater systems the track will intersect (Figure 3). Aquatic habitat condition is good at AQ6, with very limited disturbance observed. Spiny Crayfish burrows (presumed to belong to *Euastacus reiki*) were observed on site. The Betts Creek survey site was not considered to provide suitable habitat for River Blackfish or breeding habitat for the Alpine Redspot Dragonfly.

The Wrights Creek crossing may provide suitable habitat for River Blackfish. The various unnamed tributaries crossed by the final alignment lack habitat characteristics required by Alpine Redspot Dragonfly, such as rocks, logs and moss in the slash zone of waterfalls (DPI 2014a), and are therefore unlikely to support this species.

4.5.3 Perisher Valley to Bullocks Flat Track

This final trail alignment was also selected late in the project planning (April 2019) and therefore parts of the alignment were not subject to direct aquatic survey in March 2018. The upper section of the trail on the plateaux was subject to survey near Rock Creek, however, survey effort on the escarpment above the Thredbo River focussed on previous alignments to the east and west of Lubra Creek. The final alignment passes close to Rock Creek at Perisher Valley, traverses the upper catchment of Pipers Creek and then

descends steeply along the slopes above the Bullocks Flat and crosses five unnamed tributaries of the Thredbo River. Site AQ7 (Rock Creek near Perisher Valley, Figure 3) survey included backpack electrofishing and aquatic habitat descriptions. The electrofishing survey only identified Brown Trout at this site, detailed fish catch results are provided in Table 7. Flow impoundment and the introduction of Brown Trout along this waterway has resulted in a modified and degraded aquatic environment. Rock Creek at this location is not considered to provide suitable breeding habitat for the Alpine Redspot Dragonfly, and River Blackfish is not considered likely to occur at this site.

The survey result for Lubra Creek and other tributaries of the Thredbo River along previous trail alignments are indicative of the general condition and habitat values of unnamed tributaries in forested environments crossed by the final alignment (see below). Inferences from these surveys indicate that River Blackfish is unlikely to occur in these tributaries. Alpine Redspot Dragonfly may occur in fast flowing high relief tributaries with logs, rocks and moss cover.

4.5.4 Other survey results

Multiple alignment options were surveyed during project planning and several of these have been abandoned due to various constraints. Aquatic survey results from these previous alignments are still valid and provide an indication of waterway health, aquatic habitat condition and threatened biota occurrence more broadly across this part of the national park.

Farm Creek / Blue Cow Creek

Site AQ2 (Farm Creek, near Blue Cow Creek, Figure 3) survey included surface water quality monitoring, dip netting and aquatic habitat descriptions. Aquatic habitat condition and availability at Farm Creek is considered high and water quality good, with only the dissolved oxygen value recorded being marginally lower than expected. This low reading is not expected to significantly impair aquatic ecological function. Full water quality results are presented in Table 6. A yet to be described species of Mountain galaxias *Galaxias olidus* complex (pers. comm. Tarmo Raadik) was identified within pool sections of Farm Creek at site AQ2. This was the only fish species recorded at this site, detailed fish catch results are provided in Table 7. A waterfall downstream of the site interrupts fish passage, preventing invasion by Brown Trout into this section of Farm Creek, leaving the site relatively intact. River Blackfish is not considered likely to occur at this site.

Lubra Creek and unnamed tributaries of Thredbo River

At sites AQ3, AQ4 (unnamed tributaries of the Thredbo River, Figure 3) and AQ5 (Lubra Creek, Figure 3), survey included aquatic habitat descriptions, along with surface water quality monitoring and macroinvertebrate sampling, where surface water was present. Sites AQ3, AQ4 and AQ5 are small, high relief tributaries of the Thredbo River. These sites exhibit a very low level of disturbance and recorded good water quality values (Table 6). No surface flow was recorded at AQ3, with only a small amount of flow present at site AQ4 allowing dip netting for macroinvertebrate survey but not enough to allow submersion of the water quality probe. No Alpine Redspot Dragonfly nymphs were recorded in the macroinvertebrate survey conducted at sites AQ4 and AQ5. However, this species is naturally rare (DPI 2014) with very few recorded sightings, especially in NSW (Fisheries Scientific Committee 2014). Site AQ5 (Lubra Creek) is considered to provide potential breeding habitat for Alpine Redspot Dragonfly, due to the presence of rocks, woody debris and moss within waterfall splash zones. Given the similar aquatic habitats that occur where the final Perisher Valley to Bullocks Flat trail is proposed, it is possible breeding habitat for Alpine Redspot Dragonfly occurs in high relief tributaries along the final trail alignment. Full macroinvertebrate taxon lists are presented in Table 8. These high relief tributaries above the Thredbo River are not considered to provide suitable habitat for River Blackfish.

Table 6 Surface water quality results

Physicochemical parameter	ANZECC (2000) guidelines: upland rivers	Spencers Creek	Farm Creek	Lubra Creek
		AQ1	AQ2	AQ5
Water Temperature (°C)	-	14.76	13.73	10.36
Water pH	6.5 - 7.5	7.5	7.0	7.1
ORP (mV)	-	153	185	185
Conductivity µS/cm	30-350	11	11	16
Dissolved Oxygen (%)	90-110	71	75	69
Turbidity	6 - 50	0	0	0

Table 7 Fish catch results

Site	Waterbody	Scientific name	Common name	Caught	Observed	Length (mm)
AQ1	Spencers Creek	*Salmo trutta*	Brown Trout	11	3	95-280
AQ2	Farm Creek	*Galaxias olidus* complex	Mountain Galaxias	4	7	35-70
AQ7	Rock Creek	*Salmo trutta*	Brown Trout	6	3	45-270

Table 8 Macroinvertbrate survey taxon lists

Taxacode	Taxon	AQ4	AQ5
QP029999	Austroperlidae	1	3
QE029999	Baetidae		2
QT189999	Calocidae	2	
QDAJ9999	Chironominae		1
QC349999	Elmidae	1	
OP039999	Eusiridae	6	13
QP019999	Eustheniidae		1
QT069999	Hydropsychidae	9	1
QE069999	Leptophlebiidae	3	21
QT109999	Limnephilidae		2
QE019999	Nesamelitidae (Formerly Siphlonuridae)		12
QP049999	Notonemouridae	1	
LO999999	Oligochaeta		3
QT219999	Philorheithridae		1
QD109999	Simuliidae	2	
QO239999	Synthemistidae	1	1
QD239999	Tabanidae	1	
QO219999	Telephlebiidae		3

4.6 Threatened biota

Threatened biota includes all flora and fauna species, populations and ecological communities listed under the EPBC Act and BC Act. Lists of threatened biota recorded or predicted to occur within 10 kilometres of the proposed Snowies Iconic Walk alignments are provided in Appendix 1 (flora) and Appendix 2 (fauna). Previous records of threatened biota within the locality are shown in Figures 2 and 3.

An assessment of the likelihood of these species occurring along the trail final alignments was undertaken considering the guidance provided in OEH (2018). Where there was insufficient evidence to make a conclusive decision the species was assumed to occur and significant impact assessments were conducted accordingly (i.e. the precautionary principle was applied to species' likelihood of occurrence assessments).

Two ecological communities, six plants, nine mammals, eight birds, two reptiles, one fish and one invertebrate listed as threatened under the EPBC and/or BC Act have been identified as having a medium or greater likelihood of occurrence in, or adjacent to, the study area for the final trail alignments (Appendices 1 and 2). Table 9 discusses areas of value and potential impacts for all biota with a medium or greater likelihood of occurrence and determines the need for a Significant Impact Criteria (SIC) assessment (EPBC Act) or Test of Significance (BC Act).

Table 9 Threatened biota likely to occur in the study area

Species name	EPBC status	BC/FM status	Relevance to study area and potential for impact
Ecological communities			
Alpine Sphagnum Bogs and associated Fens / Montane Peatlands	Endangered	Endangered (Montane Peatlands Endangered Ecological Community [EEC])	See description in Appendix 5 (PCT 637) and ToS and SIC assessment in Appendix 3 and 4.
Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions	-	Endangered in South Eastern Highlands bioregion	See description in Appendix 5 (PCT 679) and ToS in Appendix 4. Not relevant to Australian Alps bioregion. It should be noted that the diagnostics and listing of this threatened community was recently amended (28 June 2019). The community is now referred to as Monaro Tableland Cool Temperate Grassy Woodland in the South Eastern Highlands Bioregion Critically Endangered Ecological Community. The examples of the former community in the study area may not meet the new diagnostics and listing based on vegetation structure, landscape setting, floristics, rainfall and geographic distribution. Further work may be required in spring 2019 to resolve this.

Species name	EPBC status	BC/FM status	Relevance to study area and potential for impact
Aquatic ecological communities			
Aquatic Ecological Community in the Catchment of the Snowy River in NSW	-	Endangered	The aquatic ecological community in the Catchment of the Snowy River in NSW occurs within the Snowy River, Thredbo River and Guthega Pondage. See ToS in Appendix 4.
Flora			
Shining Cudweed *Argyrotegium nitidulum*	Vulnerable	Vulnerable	See description in Section 4.6.2 and ToS and SIC assessment in Appendix 3 and 4.
Mountain Greenhood *Pterostylis alpina*	-	Vulnerable	See description in Section 4.6.2 and ToS in Appendix 4.
Slender Greenhood *Pterostylis foliata*	-	Vulnerable	See description in Section 4.6.2 and ToS in Appendix 4.
Blue-tongued Greenhood *Pterostylis oreophila*	Critically endangered	Critically endangered	See description in Section 4.6.2 and ToS and SIC assessment in Appendix 3 and 4.
Anemone Buttercup *Ranunculus anemoneus*	Vulnerable	Vulnerable	See description in Section 4.6.2 and ToS and SIC assessment in Appendix 3 and 4.
Perisher Wallaby-grass *Rytidosperma vickeryae*	-	Vulnerable	See description in Section 4.6.2 and ToS in Appendix 4.
Mammals			
Broad-toothed Rat *Mastacomys fuscus*	Vulnerable	Vulnerable	See description in Section 4.6.3 and ToS and SIC assessment in Appendix 3 and 4.
Eastern False Pipistrelle *Falsistrellus tasmaniensis*	-	Vulnerable	See description in Section 4.6.3 and ToS in Appendix 4.
Greater Glider *Petauroides volans*	Vulnerable	-	See description in Section 4.6.3 and SIC assessment in Appendix 3 (this species is not listed in NSW).
Koala *Phascolarctos cinereus*	Vulnerable	Vulnerable	See description in Section 4.6.3 and ToS and SIC assessment in Appendix 3 and 4.
Eastern Pygmy-possum *Cercartetus nanus*	-	Vulnerable	See description in Section 4.6.3 and ToS in Appendix 4.
Mountain Pygmy-possum *Burramys parvus*	Endangered	Endangered	See description in Section 4.6.3 and ToS and SIC assessment in Appendix 3 and 4.
Smoky Mouse *Pseudomys fumeus*	Endangered	Critically endangered	See description in Section 4.6.3 and ToS and SIC assessment in Appendix 3 and 4.
Spotted-tailed Quoll *Dasyurus maculatus*	Endangered	Vulnerable	See description in Section 4.6.3 and ToS and SIC assessment in Appendix 3 and 4.

Species name	EPBC status	BC/FM status	Relevance to study area and potential for impact
Eastern Bentwing-bat *Miniopterus schreibersii oceanensis*	-	Vulnerable	See description in Section 4.6.3 and ToS in Appendix 4.
Birds			
Gang-gang Cockatoo *Callocephalon fimbriatum*	-	Vulnerable	See description in Section 4.6.4 and ToS in Appendix 4.
Flame Robin *Petroica phoenicea*	-	Vulnerable	See description in Section 4.6.4 and ToS in Appendix 4.
Olive Whistler *Pachycephala olivacea*	-	Vulnerable	See description in Section 4.6.4 and ToS in Appendix 4.
Pink Robin *Petroica rodinogaster*	-	Vulnerable	See description in Section 4.6.4 and ToS in Appendix 4.
Scarlet Robin *Petroica boodang*	-	Vulnerable	See description in Section 4.6.4 and ToS in Appendix 4.
Powerful Owl *Ninox strenua*	-	Vulnerable	See description in Section 4.6.4 and ToS in Appendix 4.
Diamond Firetail *Stagonopleura guttata*	-	Vulnerable	See description in Section 4.6.4 and ToS in Appendix 4.
Brown Treecreeper (eastern subspecies) *Climacteris picumnus victoriae*	-	Vulnerable	See description in Section 4.6.4 and ToS in Appendix 4.
Reptiles			
Alpine She-oak Skink *Cyclodomorphus praealtus*	Endangered	Endangered	See description in Section 4.6.5 and ToS and SIC assessment in Appendix 3 and 4.
Guthega Skink *Liopholis guthega*	Endangered	Endangered	See description in Section 4.6.5 and ToS and SIC assessment in Appendix 3 and 4.
Aquatic fauna and invertebrates			
River Blackfish (Snowy River population) *Gadopsis marmoratus*	-	Endangered population	See description in Section 4.6.6 and ToS in Appendix 4.
Alpine Redspot Dragonfly *Austropetalia tonyana*	-	Vulnerable	See description in Section 4.6.6 and ToS in Appendix 4.

4.6.1 Threatened ecological communities

Terrestrial ecological communities

Prior to the field investigation, five TECs were identified as potentially occurring in the broader landscape, including:

- *Alpine Sphagnum Bogs and Associated Fens* (EEC, EPBC Act) and State listed equivalent *Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions* (EEC, BC Act). Referred to as Alpine Sphagnum Bogs EEC.
- *Windswept Feldmark in the Australian Alps Bioregion* (Critically Endangered Ecological Community [CEEC], BC Act). Referred to as Windswept Feldmark CEEC.
- *Snowpatch Herbfield in the Australian Alps Bioregion* (CEEC, BC Act). Referred to as Snowpatch Herbfield CEEC.
- *Snowpatch Feldmark in the Australian Alps Bioregion* (CEEC, BC Act). Referred to as Snowpatch Feldmark CEEC.
- *Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions* (EEC, BC Act), see previous notes regarding recent updates to determination and listing of this community.

Two listed TECs represented by two PCTs were identified in the study area and along the final trail alignments:

- Alpine Sphagnum Bogs EEC occurs extensively in alpine and sub-alpine areas as PCT 637.
- The Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions EEC has a minor occurrence as PCT 679 on the boundary between the Australian Alps and South Eastern Highlands bioregion near Bullocks Flat (last 300 metres of this trail). This community does not apply to examples of PCT 679 in the Australian Alps bioregion upslope of Bullocks Flat. It should be noted that the diagnostics and listing of this threatened community was recently amended (28 June 2019). The community is now referred to as Monaro Tableland Cool Temperate Grassy Woodland in the South Eastern Highlands Bioregion Critically Endangered Ecological Community. The examples of the former community in the study area may not meet the new diagnostics and listing based on vegetation structure, landscape setting, floristics, rainfall and geographic distribution. Further work may be required in spring 2019 to resolve this. Refer to https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Scientific-Committee/Determinations/2019/monaro-tableland-final-determination-CEEC.pdf?la=en&hash=08778611BB71929B4B80EAE429060ABA50664030

The three CEECs (BC Act) Windswept Feldmark, Snowpatch Herbfield and Snowpatch Feldmark occur along the Main Range in Kosciuszko National Park. An assessment of the extent of these communities was undertaken when Biosis completed the REF for the Main Range Track realignment in 2018. As these communities occur in highly discrete locations at high elevations on the Main Range, along ridges or associated with late lying snow patches on eastern and southern aspects (McDougall and Walsh 2007), they can be readily identified. These high elevation communities were not recorded away from the Main Range for the final trail alignments assessed as part of this investigation and will not be impacted by the project.

Aquatic ecological community

The *Aquatic Ecological Community in the Catchment of the Snowy River* EEC (FM Act) includes all native fish and aquatic invertebrates within all rivers, creeks and streams of the catchment (DPI 2012). The final trail alignments cross several named waterways and unnamed tributaries that flow directly into the Snowy and Thredbo Rivers, therefore all biota in these aquatic habitats are considered part of the listed community.

4.6.2 Threatened flora

Shining Cudweed

Shining Cudweed is a mat forming perennial daisy with creeping rhizomes restricted to Kosciuszko National Park and to the Bogong High Plains in Victoria. Flowering between December and March (OEH 2018f), it is found growing in herbfields or open heathland, near streams and bogs from alpine to subalpine areas. Potential threats include trampling by feral species and bush walkers and the invasion of inter-tussock spaces by shrubs due to disturbances, such as track formation or grazing (Williams 1987).

Shining Cudweed was previously recorded along the Main Range realignment (Biosis 2018), however was not found along the final trail alignments assessed during this investigation. If the species has remained undetected trail construction works have the potential to impact on it, however Shining Cudweed is known to grow on the edge of walking tracks (NPWS 2001), and was recorded along the edge of the existing Main Range Walking Track at the southern extent of that realignment (Biosis 2018).

Anemone Buttercup

Anemone Buttercup is a robust, perennial herb restricted to a narrow band along the Great Dividing Range within Kosciuszko National Park. Most records are from alpine areas at elevations above 1900 metres, although there are a few records from below the treeline (to as low as 1600 metres) (NPWS 2001). Preferred habitat is in areas with late melting snow; on south to east facing, steep grassy slopes, rock crevices, or short alpine herbfields. Habitat and plants are threatened by ski slope development and grazing if pest animals become more prevalent (OEH 2018b). Forming buds in the autumn, the Anemone Buttercup is especially susceptible to grazing if buds are eaten before flowering soon after snow-melt can occur.

Extensive populations of Anemone Buttercup were recorded at multiple locations along the various options and alignments assessed, particularly on Mount Perisher and Back Perisher Mountain. As the Guthega to Perisher Valley trail that crosses Mount Perisher will not be proceeding, the large and intact populations in that location will be avoided. The species was only recorded in one location along the final trail alignments between Charlotte Pass and Guthega where it occupied an area of 3 metres x 6 metres (Figure 3). During micro-siting in March 2019, the trail was realigned around this population to avoid direct impacts. The track construction works may impact on populations of this species that remain undetected, however the species has underground rhizomes and is able to re-shoot following disturbance. It has also shown resilience following transplanting (M. Schroder pers. comm.). At the time livestock grazing ceased in the Kosciuszko National Park the Anemone Buttercup was close to extinction, however the species has since flourished and is now widespread in alpine herbfields (Good et al. 2019). Viability of populations in the park is considered high due to the extensive high quality of surrounding habitat.

Perisher Wallaby-grass

Perisher Wallaby-grass is a small perennial grass to 30 centimetres, forming tufts of leaves at intervals along an underground rhizome. It is restricted to Kosciuszko National Park in Perisher Valley and nearby Snow River tributaries, with one outlying population recorded at Happy Jacks Plain. It has also been found in a number of other catchments Geehi, Snowy Plain in very restricted locations (Wright et al. 2017). Perisher Wallaby-grass is commonly found in sphagnum moss in montane peatland communities or along stream edges. Potential

threats include wetland habitat damage by development for tourism, wetland drying and other unpredictable effects of climate change, habitat destruction by feral animals (deer and pigs), and competition from weed species (OEH 2018c).

Perisher Wallaby-grass was recorded near the crossing of Spencers Creek on the Charlotte Pass to Guthega track. One flower stem was recorded on the stream bank amongst sphagnum hummocks and sedges in typical habitat. The creek crossing at this location can be aligned / constructed to avoid this plant and immediate areas along the creek were surveyed for other populations without any being detected. The species was not recorded in other suitable habitat along the Charlotte Pass to Perisher Valley track (e.g. Spencers Creek headwater) but was found in the Betts Creek Valley 700 metres north of the final trail alignment in suitable habitat. The species is susceptible to impacts from track construction, especially where drainage and creek lines are crossed. Viability of any population impacted by the proposed development is likely to be high due to the extensive nature and high quality of surrounding habitat.

Blue-tongued Greenhood

Blue-tongued Greenhood is a terrestrial herb known from a few small populations within Kosciuszko National Park, and one other small population in and adjoining Bago State Forest (possibly now extinct). It grows along subalpine watercourses, in muddy ground under more open thickets of *Leptospermum*, and less commonly in peaty soils and sphagnum mounds (OEH 2018d). Blue-tongued Greenhood flowers between November and January. Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands, anthropogenic climate change, predation, habitat degradation, competition and disease transmission by feral pigs, are listed as key threats (OEH 2019a).

Blue-tongued Orchid has potential to occur in montane thickets along waterways crossed by the Perisher Valley to Bullocks Flat track, however the species or evidence of other *Pterostylis* was not found along the proposed trail alignment during surveys. It should be noted that several waterway crossings were not inspected along the Perisher Valley to Bullocks Flat track due to access issues and late alignment decisions. The species is susceptible to impacts from track construction, especially where drainage and creek lines are crossed. Viability of any population impacted by the proposed development is likely to be high due to the extensive nature and high quality of surrounding habitat.

Mountain Greenhood

Mountain Greenhood is a terrestrial orchid flowering between August and October. Within NSW, Mountain Greenhood occurs in moist forests on foothills and ranges, extending into montane areas in the Southern Tablelands south from Bondo State Forest. It often grows in rich loam on sheltered southern slopes near streams. Threats include habitat destruction by feral species, competition by exotic grasses and more frequent drought and other effects of climate change (OEH 2018e).

Mountain Greenhood has potential to occur in montane forests and woodlands crossed by the Perisher Valley to Bullocks Flat track, however the species or evidence of other *Pterostylis* was not found along the proposed trail alignment during surveys. The survey timing was outside the optimal season for survey but we understand NPWS staff have surveyed suitable habitat above Bullocks Flat for the species during spring and have not detected it. The species is susceptible to impacts from track construction, especially where suitable micro-environments are crossed. Viability of any population impacted by the proposed development is likely to be high due to the extensive nature and high quality of surrounding habitat.

Slender Greenhood

Slender Greenhood is a terrestrial orchid flowering between September and December. Within NSW, it occurs in eucalypt forests on sheltered sloping to steep ground and open seepage areas, mainly in the Southern

Tablelands south from Batlow. Threats to this species include habitat destruction by feral species and competition by exotic grasses such as sweet vernal grass, especially after fire (OEH 2018g).

Slender Greenhood has potential to occur in montane forests and woodlands crossed by the Perisher Valley to Bullocks Flat track, however the species or evidence of other *Pterostylis* was not found along the proposed trail alignment during surveys. The survey timing was outside the optimal seasonal but we understand NPWS staff have surveyed suitable habitat above Bullocks Flat for the species during spring and have not detected it. The species is susceptible to impacts from track construction, especially where suitable micro-environments are crossed. Viability of any population impacted by the proposed development is likely to be high due to the extensive nature and high quality of surrounding habitat.

4.6.3 Threatened mammals

Mountain Pygmy-possum

The Mountain Pygmy-possum is restricted to very high elevations within the alpine regions of NSW and Victoria (OEH 2017f). It prefers areas of large boulderfields which have been deposited from past glacial events, where the Bogong Moth are in high abundance. Kosciuszko National Park is one of three known populations of the Mountain Pygmy-possum. Mountain Pygmy-possum is threatened by a number of processes including loss and fragmentation of habitat through land-clearing and climate change, mortality on roads through habitat and movement areas, predation from cats, dogs and foxes.

Mountain Pygmy-possum was not recorded during the surveys (no targeted survey was undertaken). There are known records of the species within 10 kilometres of the study area (Figure 3). The species is likely to occur in sections of the study area for previous alignments that contain granitic boulderfield habitat with podocarp shrubs, such as the Mount Perisher summit. For the final trail alignments small areas of potential dispersal habitat and limited boulderfield habitat occur along the Charlotte Pass to Perisher Valley track. All areas of mapped boulderfield habitat provided by NPWS have been avoided by the final trail alignments (Figure 3).

Broad-toothed Rat

In NSW the Broad-toothed Rat is found in two widely separated areas: the wet alpine and subalpine heaths and woodlands of the Snowy Mountains and an endangered population on the Barrington Tops (OEH 2017b). Populations of the Broad-toothed Rat appear to be restricted to patches of optimum habitat characterised by areas with a moderate to dense groundcover of grasses, sedges and shrubs (NPWS 2000; Van Dyck & Strahan 2008). In the Snowy Mountains, they are often found near streams and steep banks where an abundance of grasses, rushes and shrubs provide dense understorey. The Broad-toothed Rat is the most specialised herbivore of all Australian rodents and has broad, teeth adapted to a high-fibre diet (Breed & Ford 2007). They predominantly consume grasses, and to a lesser extent the leaves of shrubs, sedge stems, bark, seeds, and moss spore cases (NPWS 2000; OEH 2012; Van Dyck & Strahan 2008).

The Broad-toothed Rat lives in a complex of runways under dense heath vegetation and builds well-insulated nests of shredded grass in these runways or under logs. The runways are cool in summer, and relatively warm in winter (below the snow pack), enabling this species to remain active throughout the year. In the Snowy Mountains, the breeding season occurs from December to March (Van Dyck & Strahan 2008). The home range of the Broad-toothed Rat varies according to season. Outside the breeding season, the home range of males and females is 0.1 hectares. During the breeding season, it increases to 0.16 hectares for females and 0.27 hectares for males (Van Dyck & Strahan 2008). The home range of males overlaps with those of several females. Individuals nest alone (females with young until weaned) except in winter, when up to five individuals share a group nest (Van Dyck & Strahan 2008).

Broad-toothed Rat runways and scats were recorded extensively across all trail options and alignments investigated and this species is likely to occur in a variety of habitats in the study area.

Eastern Pygmy-possum

The Eastern Pygmy-possum is a very small arboreal mammal found in found in a variety of habitats including rainforest, open forests and woodlands and heathlands. Woodlands and heathlands are preferred habitat. The species is hollow-dependent and feeds mostly on nectar and pollen from Proteaceae and Myrtaceae species but also on insects in wetter habitats.

Evidence of Eastern Pygmy-possum was not recorded during the surveys (no targeted survey was undertaken) but there are known records of the species within 5 kilometres of the study area (Figure 3). There is potential forest and woodland habitat for this species at various elevations along the Perisher Valley to Bullocks Flat track.

Spotted-tailed Quoll

The Spotted-tailed Quoll is a large carnivorous marsupial that occupies a broad range of dry to wet sclerophyll forest and woodland habitats (Van Dyck & Strahan 2008). Den sites comprise of rock crevices, caves, hollow logs and trees. The species may occupy boulderfields near the study area as den sites and for foraging. The presence of suitable habitat and the wide ranging nature of this species suggest that there is potential for individuals to move through the study area as part of a broader foraging range.

Greater Glider

Greater Glider is restricted to eastern Australia with the distribution extending from the Windsor Table in Queensland to Central Victoria. Preferring open woodland and eucalypt forest, it is known to occur in moist forest at higher elevations. The Greater Glider shelters in hollows and populations numbers are dependent on suitable hollow-bearing tree density (Threatened Species Scientific Committee 2016).

Greater Glider is threatened by a number of processes including loss and fragmentation habitat through land-clearing, mortality on roads through habitat and movement areas, predation from cats, dogs and foxes. The Greater Glider is slow to respond to disturbance and therefore is at a higher susceptibility of population decline.

Evidence of Greater Glider was not recorded during the surveys (no targeted survey was undertaken) but there are known records of the species within 5 kilometres of the study area (Figure 3). There is potential forest habitat for this species at montane elevations along the Perisher Valley to Bullocks Flat track.

Koala

Important populations of Koala in NSW occur on central and north coasts, the southern tablelands and the south coast. The species is found in a variety of forests and woodlands dominated by trees in the genus *Eucalyptus*. Koalas generally occur at very low densities in southern NSW and due to the cold conditions are generally absent from montane forest types. Their distribution is tied to the occurrence of preferred food tree species, which varies from region to region. Koalas feed primarily on leaves of trees in the genus *Eucalyptus*, but are known to feed to a lesser extent on of tree species from the genera *Angophora*, *Corymbia*, *Syncarpia*, *Lophostemon*, *Melaleuca*, *Allocasuarina*, *Casuarina*, *Callitris*, *Banksia* and *Acacia* (Melzer et al. 2014).

Koalas are solitary animals and their home range size varies depending on the quality of the habitat (diversity and abundance of preferred food trees). Koalas breed in spring and summer and females give birth to a single young after a gestation period of 35 days. Individuals can be long-lived, sometimes reaching 14 years of age.

The species is facing a number of threats across its range in NSW and habitat loss is key driver of regional declines, together with disease, road mortality, dog attack and climate change.

Montane and foothill forest communities adjacent to the Perisher Valley to Bullocks Flat track may be used as a foraging, dispersal and breeding resource by Koala.

Smoky Mouse

The Smoky Mouse primarily occurs within NSW in the most southern end of the state around Mount Poole and Nullica State Forest. The Smoky Mouse has three records from Kosciuszko National Park with more recent populations detected in the northern part of the park.

The Smoky Mouse occurs within a wide range of vegetation types and is known to live in heath, sclerophyll forest and open forest along ridge tops and slopes from the coast to 1800 metres above sea level. It can sometimes also live in ferny gullies (OEH 2017d). There is an indication that the Smoky Mouse prefers ridge-top sclerophyll forest with floristically diverse shrub layers dominated by Ericaceae and Fabaceae families. The occurrence of tussock grass, rocks and logs for sheltering is also important (OEH 2011).

The Smoky Mouse lives in small groups with up to five breeding females for each male within a large burrow system (OEH 2011). The presence of good quality habitat with abundant food resources is particularly important in winter to ensure young mice are able to survive the winter (Cockburn 1981).

Smoky Mouse was not recorded during the surveys (no targeted survey was undertaken). There are no records of the species within 10 kilometres of the study area but potential open forest habitat supporting a diversity of shrubs and tussock grasses occurs along the Perisher Valley to Bullocks Flat track (PCT 1196).

Eastern False Pipistrelle

Eastern False Pipistrelle is wide-ranging, occurring along the south-east coast of Australia with records indicating that its distribution extends from south-east Queensland to Victoria, but is also found in Tasmania. The species is known to occur in sclerophyll forests stretching from the Great Dividing Range to the coastline, with a general preference for wet habitats where trees are higher than 20 metres (OEH 2017e).

Roosting usually occurs in hollow trunks of *Eucalyptus* trees, typically in single sex colonies, but roosting in caves, under loose bark and occasionally in old wooden buildings is not uncommon. Their flight pattern is high and fast with foraging taking place within or just below the tree canopy feeding on an array of invertebrates and insects (OEH 2017e).

Eastern False Pipistrelle is threatened by a number of processes including loss of trees for foraging and hollow-bearing trees for roosting, disturbance to winter roosting and breeding sites, and application of pesticides in or adjacent to foraging areas (OEH 2017e).

Eastern False Pipistrelle was not recorded during surveys (no targeted survey was undertaken). There are known records of the species within 5 kilometres of the study area (Figure 3). Montane and foothill forest communities adjacent to the Perisher Valley to Bullocks Flat track may be used as a foraging, dispersal and breeding resource by this species.

Eastern Bentwing-bat

Eastern Bentwing-bat occupies a range of forested environments (including wet and dry sclerophyll forests), along the coastal portion of eastern Australia, and through the Northern Territory and Kimberley area (subject to subdivision of this species) (OEH 2017g).

This species has a fast and level, flight exhibiting swift shallow dives. It forages from just above the tree canopy, to many times the canopy height in forested areas, and will utilise open areas where it is known to

forage at lower levels. Moths appear to be the main dietary component. This highly mobile species is capable of large regional movements in relation to seasonal differences in reproductive behaviour and winter hibernation. Though individuals often use numerous roosts, it congregates in large numbers at a small number of nursery caves to breed and hibernate. Although roosting primarily occurs in caves, it has also been recorded in mines, culverts, stormwater channels, buildings, and occasionally tree-hollows. This species occupies a number of roosts within specific territorial ranges usually within 300 kilometres of the maternity cave, and may travel large distances between roost sites (OEH 2017g).

Eastern Bentwing-bat is threatened by a number of processes including loss of foraging habitat, damage to or disturbance of roosting caves (particularly during winter or breeding), application of pesticides in or adjacent to foraging areas, and predation by feral cats and foxes (OEH 2017g).

Eastern Bentwing-bat was not recorded during the surveys (no targeted survey was undertaken). There are known records of the species within 5 kilometres of the study area (Figure 3) and the species may use forested habitats along the Perisher Valley to Bullocks Flat track.

4.6.4 Threatened birds

Powerful Owl

Powerful Owl is widely distributed over eastern and south-eastern Australia primarily residing on the eastern side of the Great Dividing Range within a range of vegetation communities. Powerful Owl requires large tracts of forest or woodland habitat and is therefore susceptible to largescale fragmentation of habitat (OEH 2017i).

Powerful Owl feeds on a range of medium-sized marsupials nocturnally and roosts by day in dense vegetation. Powerful Owl occurs in breeding pairs within territories, with the size of the territory dependent on quality of habitat. (OEH 2017i). Powerful Owl is threatened by a number of processes including loss and fragmentation of habitat through land-clearing, disturbance around nest sites in breeding period and loss of old growth hollow bearing trees (OEH 2017i).

Evidence of Powerful Owl was not recorded during the surveys (no targeted survey was undertaken). There are known records of the species within 5 kilometres of the study area (Figure 3) and the species may use forested habitats along the Perisher Valley to Bullocks Flat track.

Gang-gang Cockatoo

The Gang-gang Cockatoo is a distinctive, stocky cockatoo with a creaky call quite unlike any other cockatoo species. The species' preferred habitat is tall mountain sclerophyll forests dominated by eucalypts. The species is an altitudinal migrant, moving to low altitude forests and even parks and gardens during winter (Higgins et al. 1999). Gang-gang Cockatoos feed primarily on seeds of native and introduced trees and shrubs, particularly seeds of eucalypts, acacias and introduced Hawthorn *Crataegus monogyna*. The species breeds in large hollows in mature dead or living eucalypts. Key threats to the species include loss of foraging and breeding habitat due to wildfire and forestry operations, climate change and habitat modification as a result of weed invasion.

Gang-gang Cockatoo was recorded within the study area at several locations and there are numerous records within 10 kilometres. This species could potentially occur in any woodland or forest habitat along the final trail alignments.

Olive Whistler

The Olive Whistler is a medium-sized passerine inhabiting dense understorey vegetation (particularly gullies) in rainforest, wet eucalypt forest including montane forests and sub-alpine woodlands above 500 metres elevation. Threats to the species include habitat loss and fragmentation, wildfire and inappropriate fire regimes, predation by foxes and cats. Suitable woodland and forest habitat occurs in the study area and there are numerous records of the species within 10 kilometres, the species was recorded above Bullocks Flat during various surveys of that area.

Scarlet Robin

The Scarlet Robin is a small Australian passerine inhabiting mainly dry sclerophyll forests and woodlands with a sparse understorey. It is widely distributed in eastern New South Wales from coastal areas to the inland slopes of the Great Dividing Range. Threats include habitat loss and degradation (especially simplification of the understorey through the loss of shrubs, logs and grasses), habitat fragmentation, weed invasion and predation by feral cats (Barrett et al. 2007).

Scarlet Robin was recorded within the study area at several locations and there are numerous records within 10 kilometres. This species could potentially occur in any woodland or forest habitat along the final trail alignments.

Flame Robin

The Flame Robin is the largest robin in the genus *Petroica*. During spring and summer (the breeding season) the species inhabits upland moist eucalypt forests up to 1800 metres above sea level. During autumn and winter (the non-breading season), the species migrates to lower altitudes and can be found in more open habitats such as grasslands and pasture. This species is considered to be in decline in NSW. Threats include habitat loss (both breeding and non-breeding habitat), particularly through the removal of coarse woody debris and other important structural elements such as leaf litter (Barrett et al. 2007). Other threats include predation by feral cats and overabundant populations of native predatory birds such as Pied Currawong *Streptera graculina*.

Flame Robin was recorded within the study area at several locations and there are numerous records within 10 kilometres. This species could potentially occur in any woodland or forest habitat along the final trail alignments.

Pink Robin

In NSW, the Pink Robin is restricted to the far south-east corner of the state. During the breeding season, the species inhabits rainforest and gullies in tall wet forests. During the non-breeding season, they disperse to more open, drier habitats. In Kosciusko National Park, they have been recorded in wet forest dominated by Alpine Ash, Snow Gum and Mountain Gum. Clearing of rainforest is considered to be a principal threat. Severe and extensive wildfires are also likely to reduce habitat availability.

There are known records of the species within 5 kilometres of the study area (Figure 2) and the species may use forested habitats along the Perisher Valley to Bullocks Flat track.

Diamond Firetail

The Diamond Firetail is a small woodland finch that feeds on the ground on a variety of seeds (principally from grasses). The species is one of a suite of woodland birds that has undergone a substantial and ongoing decline as a result of habitat loss and degradation. It inhabits a range of drier vegetation types, including woodlands and forests, particularly those with a grassy understorey. The species is sensitive to fragmentation and does not appear to be able to persist in woodland remnants of less than 200 hectares.

Suitable habitat is present in the study area, particularly around Bullocks Flat.

Brown Treecreeper (eastern subspecies)

The Brown Treecreeper (eastern subspecies) occurs in open forests and woodlands east of the inland slopes of the Great Dividing Range. This species is generally sedentary and individuals may disperse locally. Birds forage on the ground, logs and the trunks of trees and shrubs. It is a hollow nesting species.

Possible habitat is present in the study area, particularly around Bullocks Flat although the species is likely to be more common lower in the Thredbo Valley in drier woodland habitats.

4.6.5 Threatened reptiles

The occurrence of two threatened alpine reptiles within the study area is highly relevant to this investigation because these species are relatively sedentary, are poor dispersers and have specific terrestrial habitat requirements that may be adversely impacted by the proposed ground disturbance works. In a national context, these species occur over a small area consisting of widely disjunct populations restricted to 'sky island' ecosystems of the Australian Alps (Koumoundouros et al. 2009; Atkins et al. 2018).

Alpine She-oak Skink

The Alpine She-oak Skink is a robust, medium-sized scincid lizard, with a snout-vent length of up to 126 millimetres (Clemann 2003). The Alpine She-oak Skink inhabits alpine and sub-alpine grasslands and low heathlands above 1500 metres in the Australian Alps; in an area estimated to be less than 100 square kilometres (TSSC 2009). Tussock grasses are believed to be an important habitat feature (Clemann 2003). The species has been recorded in short alpine heath, herbfield and grassland throughout the Main Range, but detailed distributional knowledge of the species throughout Kosciusko National Park is not yet available.

Major threats to the Alpine She-oak Skink include loss and degradation of habitat, fire and predation. Climate change and weeds are also considered to be potential threats. Known populations are threatened by development for recreational infrastructure and by recreational activities (Clemann 2003). There are currently no reliable total population size estimates for this species. Monitoring of the species in Victoria suggests that local abundance can be highly variable, possibly due to variations in habitat quality, grazing and fire history, and predation pressure (DoE 2016).

During surveys of the various trail options Alpine She-oak Skink was recorded three times (March 2018, February 2019 and April 2019) on the eastern and southern slopes of Mount Perisher in high quality open grassy heathland habitat (PCT 641). Due to the presence of this species and Guthega Skink on Mount Perisher, Biosis recommended avoiding these alignments. This position was supported by independent advice from Atkins (2019). After consideration of impacts on threatened species, NPWS abandoned the Guthega to Perisher Valley track option in favour of a lower impact option between Charlotte Pass and Perisher Valley. Although high quality habitat for this species on Mount Perisher has now been avoided there are still areas of potential habitat along the final trail alignments of all trails. These areas have been mapped and it is intended to install elevated structures in these locations to minimise ground and vegetation disturbance (Figures 3 and 4).

Guthega Skink

The Guthega Skink is a robust, medium-sized scincid lizard with a snout-vent length up to 111 mm (Donnellan et al. 2002). The species is restricted to cold temperate ecosystems of the Australian Alps, where it lives colonially in predominantly rocky areas in snow gum woodlands, heathlands and tussock grasslands above 1600 metres (Donnellan et al. 2002). The lizards construct burrows which have entrances under shrubs and rocks. Two isolated populations exist; in the vicinity of the Main Range, Ramshead Range, Perisher and Munyang Ranges in NSW and the Bogong High Plains in north-eastern Victoria (Wilson and Swan 2017). The species is largely insectivorous in early to mid-summer, with seasonally abundant berries from Snow Beard Heath *Acrothamnus montanus* providing an important food source in late-summer (Atkins et al. 2018).

Major threats to the Guthega Skink include loss and degradation of habitat, fire and predation. Climate change and weeds are also considered to be potential threats. In Kosciuszko National park three of the four alpine ski resorts (Thredbo, Perisher and Charlotte Pass) occur within the distribution of the species and approximately 225.2 ha of potential habitat has been previously disturbed (OEH 2017c).

Four individual Guthega Skinks (three adults and one juvenile) were observed during the April 2019 site investigation at Mount Perisher. Three of these observations were on the proposed summit trail alignment at the top of Mount Perisher. One adult Guthega Skink was observed lower on the eastern slopes of Mount Perisher beneath disused snow-fence posts laying on the ground. Mount Perisher constitutes high quality habitat for the species in the form of extensive granitic boulderfields. Trail development proposals in the Mount Perisher area have now been abandoned by NPWS to avoid impact on this species. By comparison with Mount Perisher, the final trail alignments chosen and surveyed in February, March and April 2019 are considered less important habitat for the species owing to the scattered and widely spaced occurrence of suitable rock habitat and relative paucity of Guthega Skink burrows beneath rocks and shrubs. Minimising the extent to which trail alignments transect rock outcrops and areas with small scattered surface rocks will be critical in reducing impacts to Guthega Skinks and their habitat.

4.6.6 Threatened aquatic fauna

River Blackfish (Snowy River endangered population)

The River Blackfish of the Snowy River is considered part of the East Gippsland form of this species (DPI 2014b). The East Gippsland form is habitat-specific, preferring clear flowing streams with good instream cover such as woody debris, aquatic vegetation and undercut banks (DPI 2014b). The River Blackfish is highly territorial and a non-migratory species. Threats include soil erosion degrading habitat/sites, cold water released from large dams, removal of woody debris, competition with introduced species of trout and redfin as well as predation of juveniles, accidental capture by anglers and altered water flow in the Snowy River (DPI 2014b).

Potential habitat for River Blackfish occurs in streams such as Wrights Creek along the Charlotte Pass to Perisher Valley track. It is intended to elevate all waterways crossings along this trail to reduced soil erosion risk, avoid and minimise disturbance to riparian vegetation and habitat structure in waterways, and to limit any changes to stream flow.

Alpine Redspot Dragonfly

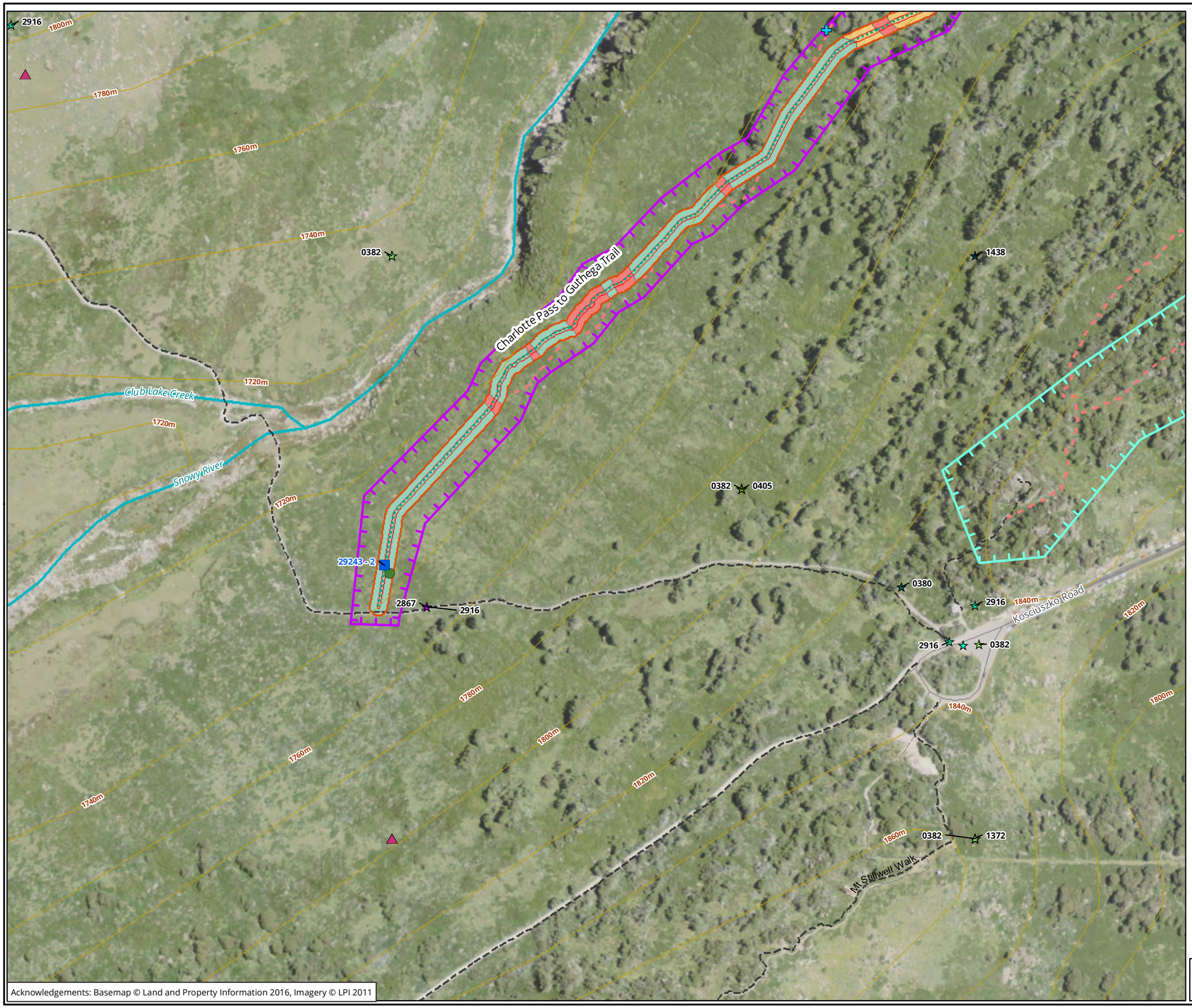
The Alpine Redspot Dragonfly is restricted to mountainous regions between 600 and 1,800 metres above sea level (DPI 2014a). It occurs in its larval stage amongst rocks, logs and moss within the splash zone of waterfalls or in the nearby stream edge (DPI 2014a). The species flight period is thought to occur between October and January (DPI 2014a). Threats include climate change resulting in reduced precipitation, reduced stream flows from forestry activities, impacts of fire on habitat and catchment health and capture of wild dragonflies (DPI 2014a).

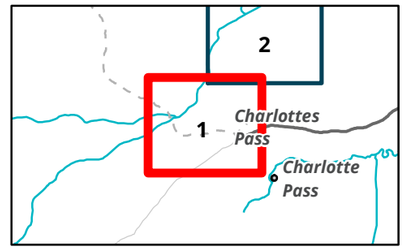
Potential breeding and larval stage habitat occurs in high relief tributaries of the Thredbo River along the Perisher Valley to Bullocks Flat track. It is intended to elevate all waterways crossings along this trail to avoid and minimise disturbance to riparian vegetation and habitat structure in waterways, and to limit any changes to stream flow.

4.7 Key Threatening Processes

The most relevant Key Threatening Processes (KTP) listed under Schedule 4 of BC Act, and relevant to the ToS for threatened biota prepared for this project, include:

- Clearing of native vegetation (as defined and described in the final determination of the Scientific Committee to list the key threatening process)
- Herbivory and environmental degradation caused by feral deer
- Infection of frogs by amphibian chytrid causing the disease chytridiomycosis
- Infection of native plants by *Phytophthora cinnamomi*
- Invasion of native plant communities by exotic perennial grasses
- Loss of hollow-bearing trees
- Predation by the European Red Fox *Vulpes vulpes*
- Predation by the Feral Cat *Felis catus*
- Predation, habitat degradation, competition and disease transmission by Feral Pigs *Sus scrofa*
- Removal of dead wood and dead trees





Legend

- Study area
- Subject site
- Existing walking tracks
- Previous alignments
- Contour
- Quadrats

Threatened flora (Biosis 2017-19)

- Ranunculus anemoneus - Anemone Buttercup

Threatened flora (Biosis 2017-19)

- Broad-toothed Rat - Mastacomys fuscus

Threatened Fauna (Bionet 2019)

- 0380 - Scarlet Robin
- 0382 - Flame Robin
- 0405 - Olive Whistler
- 1372 - Eastern False Pipistrelle
- 1438 - Broad-toothed Rat
- 2867 - Alpine She-oak Skink
- 2916 - Guthega Skink

Threatened Flora (Bionet 2019)

- Ranunculus anemoneus - Anemone Buttercup

Threatened fauna habitat

- Alpine She-oak Skink
- Guthega Skink

Final alignments

- Charlotte Pass to Guthega Trail

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 641 Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion
- PCT 645 Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion

Figure 3.1 Ecological values - Charlotte Pass to Guthega Trail

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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Matter: 29243
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Checked by: MJAL, Drawn by: LH, Last edited by: lharley
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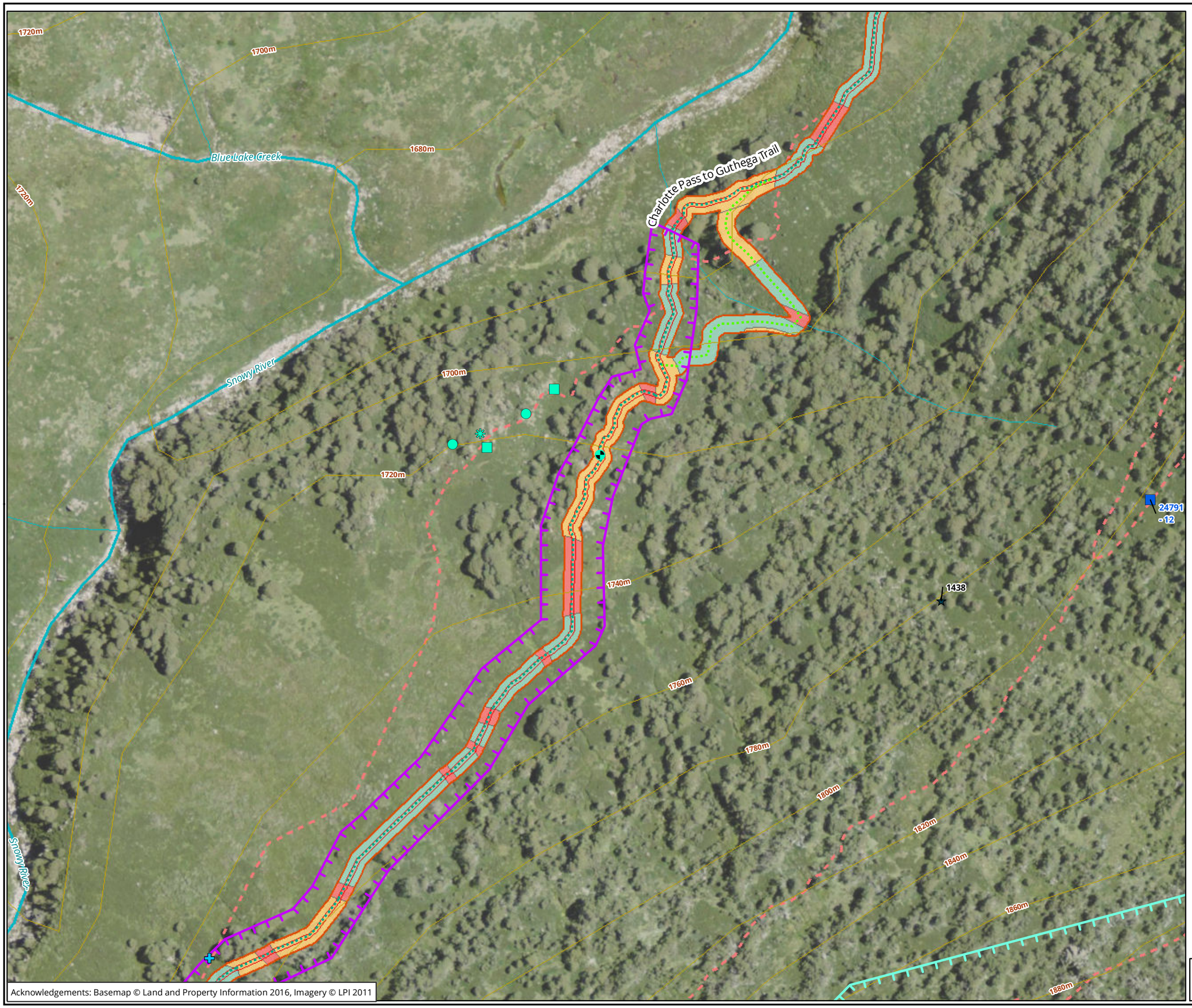

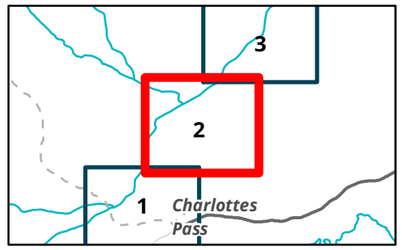

Legend

- Study area
- Subject site
- Previous alignments
- Contour
- Quadrats

Guthega Skink surveys (Zak Atkins 2019)

- Guthega Skink
- Guthega burrows
- Guthega colony
- Potential Guthega habitat

Threatened flora (Biosis 2017-19)

- Ranunculus anemoneus - Anemone Buttercup

Threatened Fauna (Bionet 2019)

- 1438 - Broad-toothed Rat

Threatened fauna habitat

- Alpine She-oak Skink
- Guthega Skink

Final alignments

- Charlotte Pass to Guthega Trail
- Charlotte Pass to Guthega Trail - Possible alignment - requires further assessment

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 641 Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion
- PCT 645 Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion

Figure 3.2 Ecological values - Charlotte Pass to Guthega Trail

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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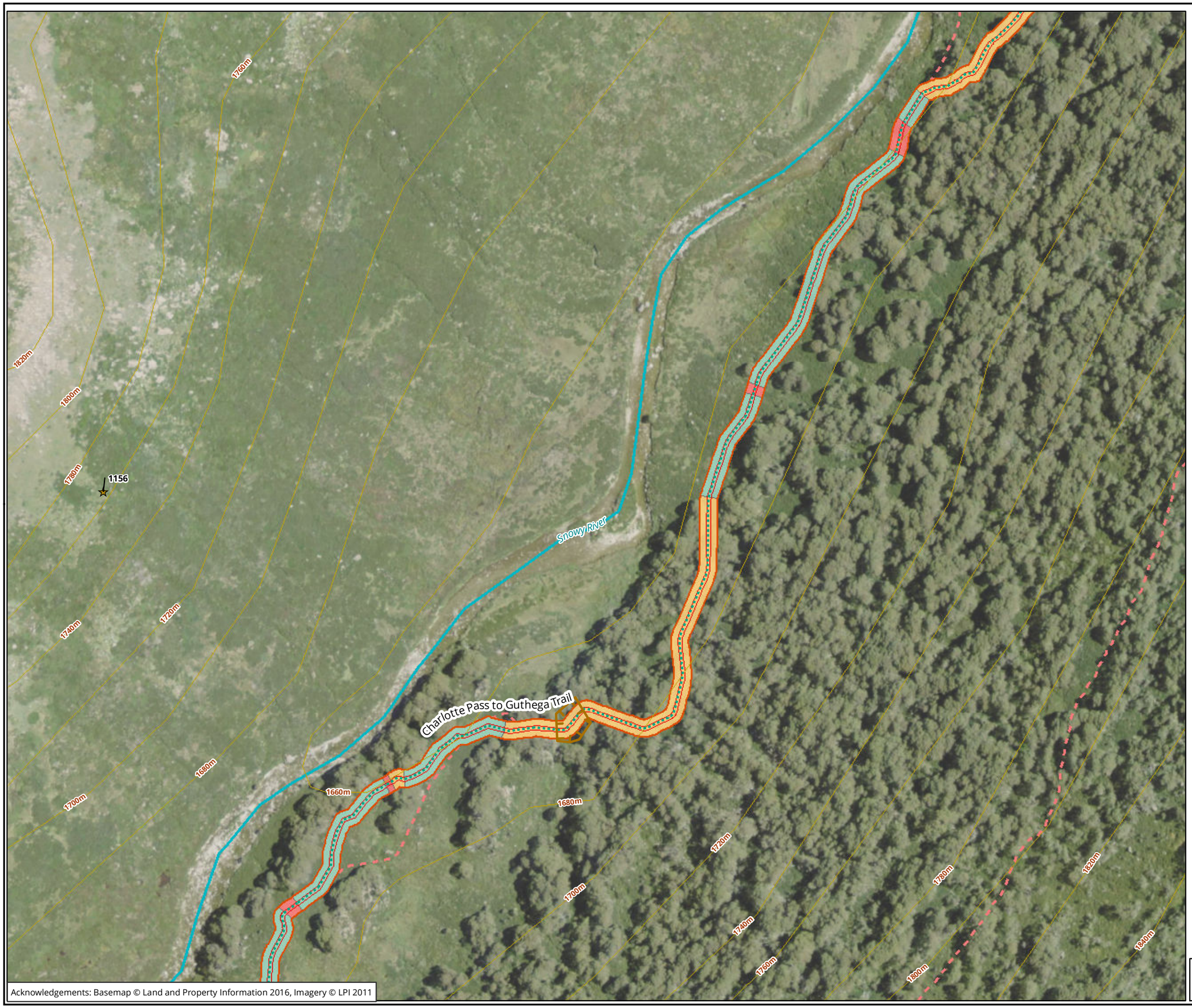

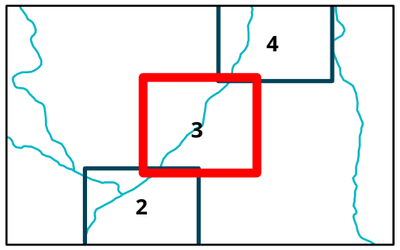

Legend

- Study area
- Subject site
- Previous alignments
- Contour

Threatened Fauna (Bionet 2019)

- 1156 - Mountain Pygmy-possum

Threatened fauna habitat

- Mountain Pygmy-possum

Final alignments

- Charlotte Pass to Guthega Trail

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 641 Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion
- PCT 645 Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion

Figure 3.3 Ecological values - Charlotte Pass to Guthega Trail

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

N

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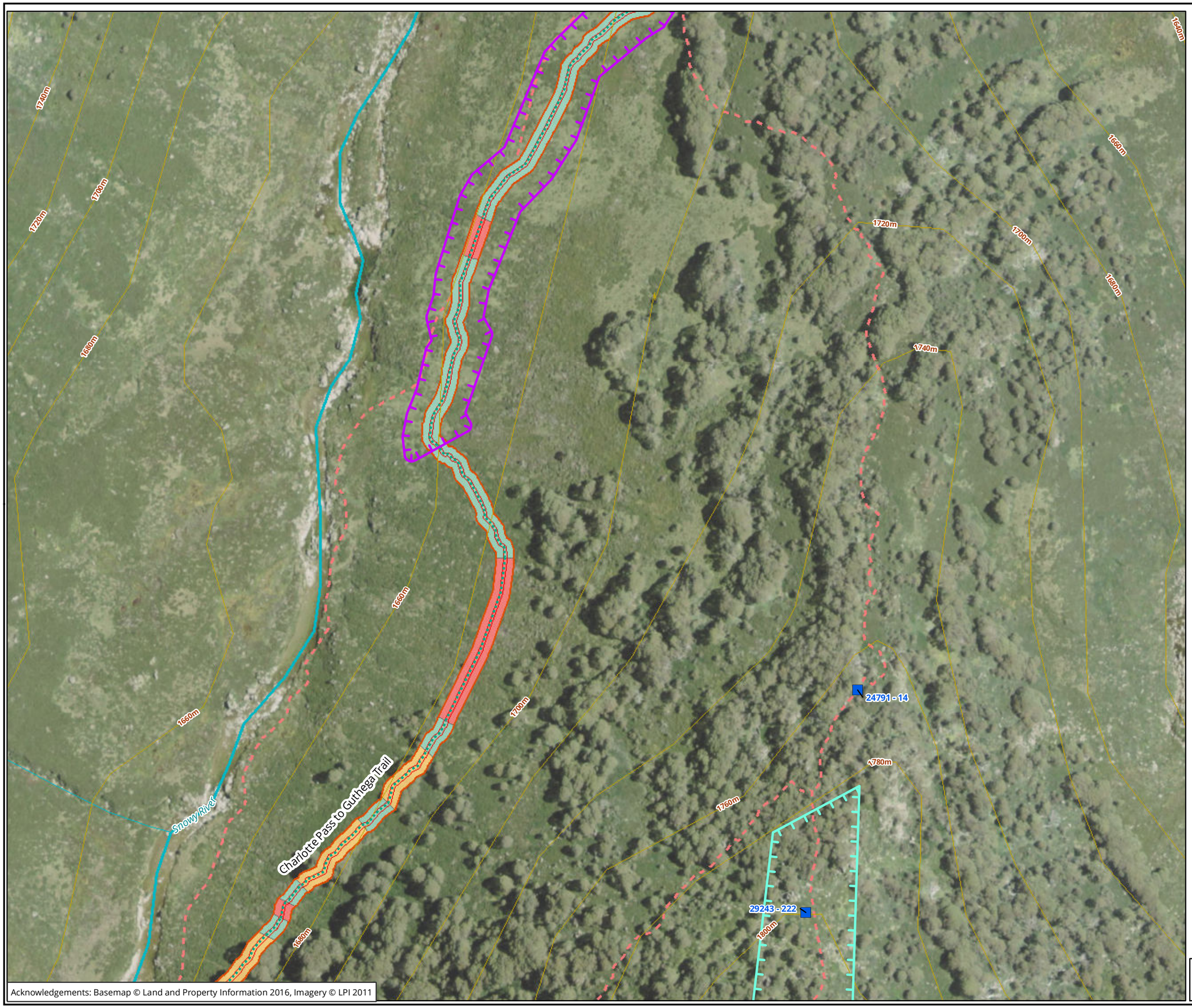

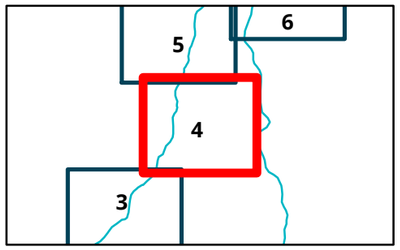

Legend

- Study area
- Subject site
- Previous alignments
- Contour
- Quadrats

Threatened fauna habitat

- Alpine She-oak Skink
- Guthega Skink

Final alignments

- Charlotte Pass to Guthega Trail

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 641 Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion
- PCT 645 Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion

Figure 3.4 Ecological values - Charlotte Pass to Guthega Trail

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

N

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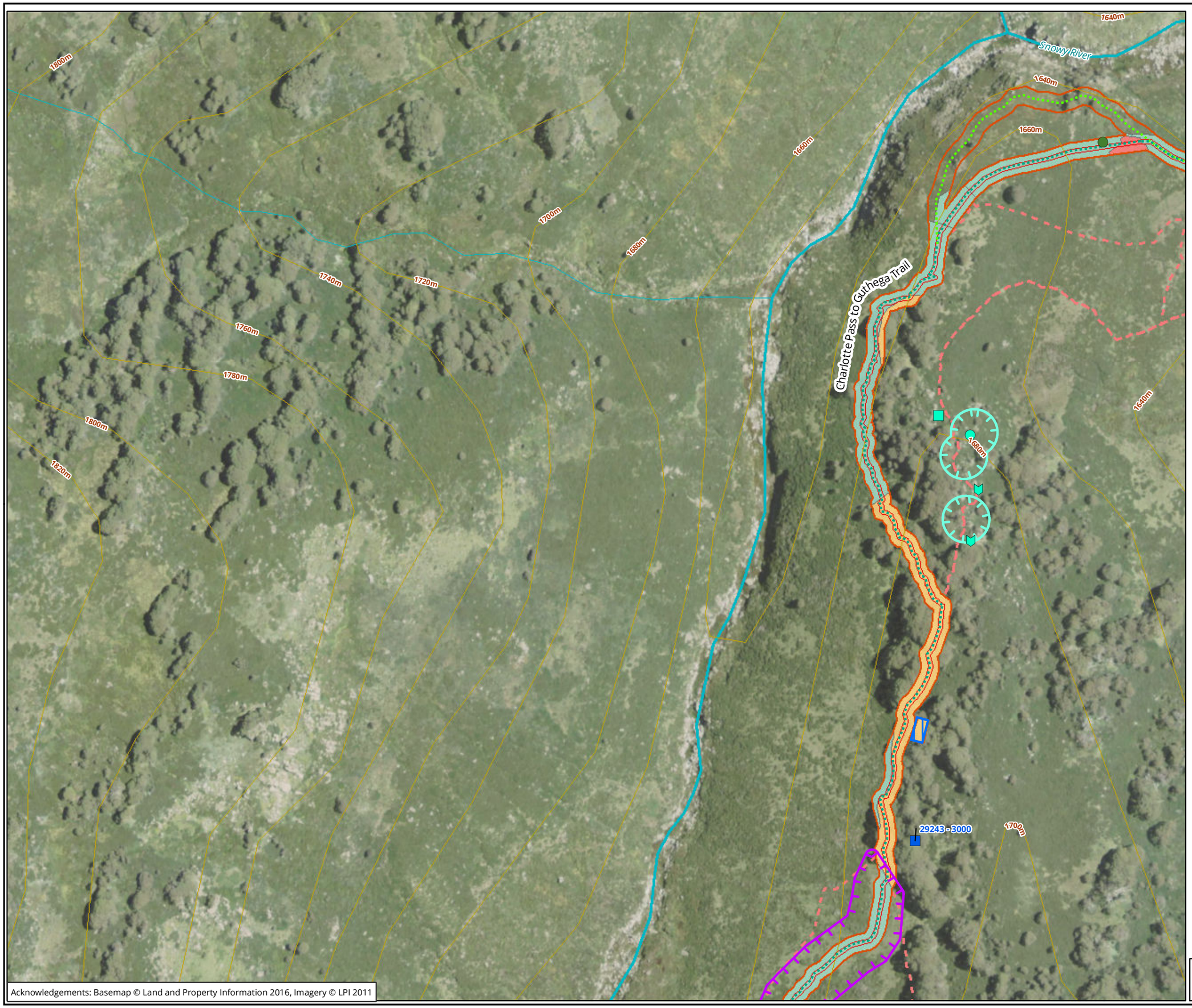

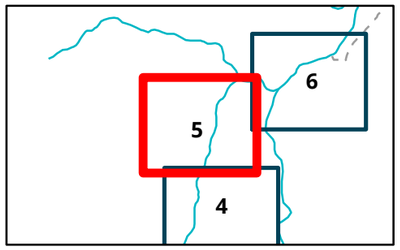

Legend

- Study area
- Subject site
- Proposed camp site
- Previous alignments
- Contour
- Quadrats

Guthega Skink surveys (Zak Atkins 2019)

- Guthega Skink
- Guthega burrows
- Potential Guthega burrows

Threatened flora (Biosis 2017-19)

- Broad-toothed Rat - Mastacomys fuscus

Threatened fauna habitat

- Alpine She-oak Skink
- Guthega Skink

Final alignments

- Charlotte Pass to Guthega Trail
- Charlotte Pass to Guthega Trail - Possible alignment - requires further assessment

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 641 Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion
- PCT 645 Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion

Figure 3.5 Ecological values - Charlotte Pass to Guthega Trail

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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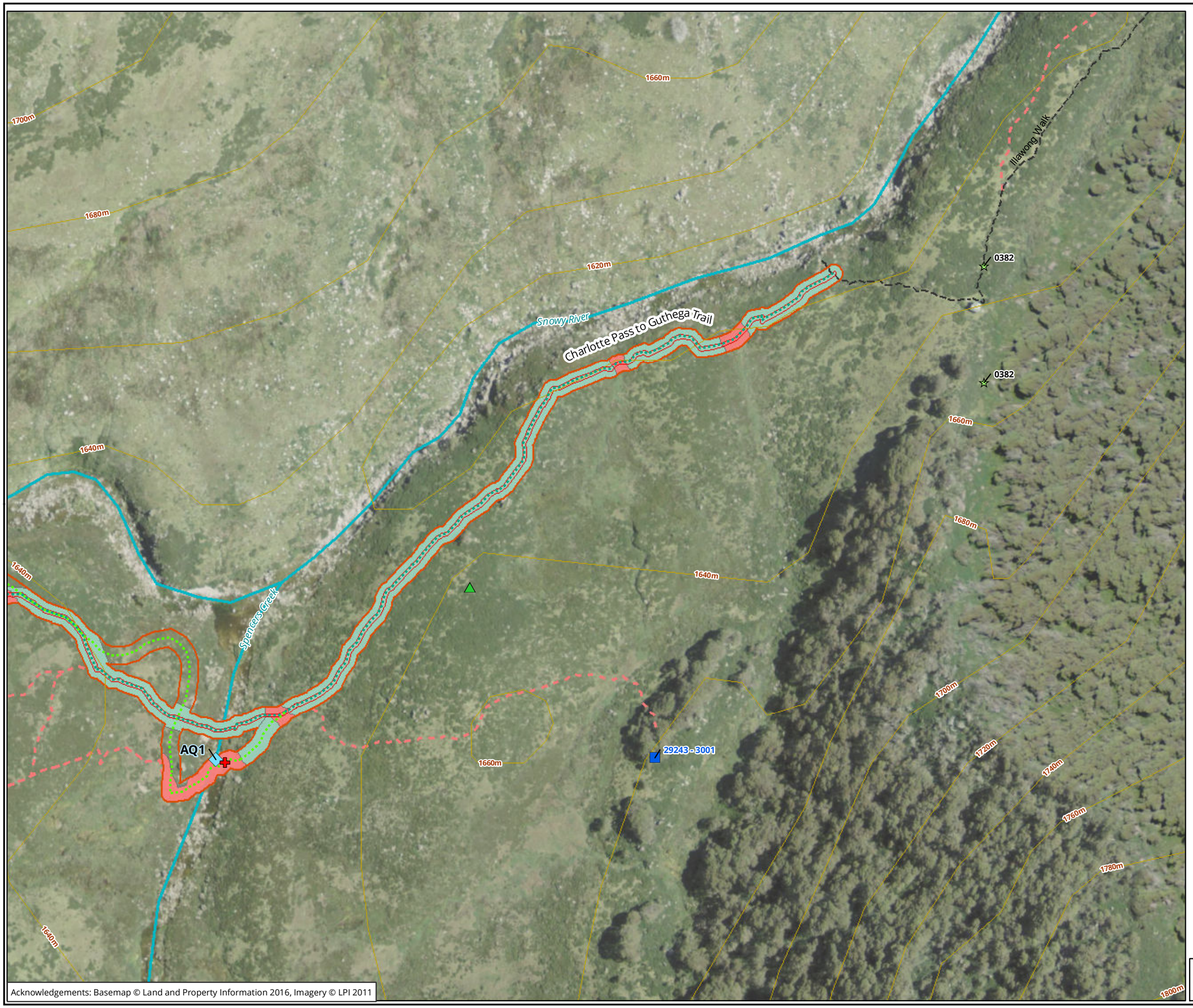

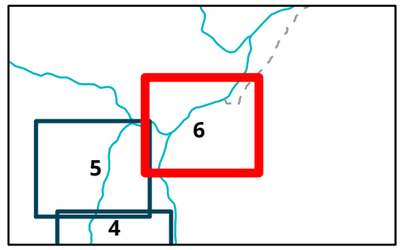

Legend

- Study area
- Subject site
- Existing walking tracks
- Previous alignments
- Contour
- Quadrats
- 26508_Aquatic survey site

Threatened flora (Biosis 2017-19)

- Rytidosperma vickeryae - Perisher Wallaby-grass

Threatened Fauna (Bionet 2019)

- 0382 - Flame Robin

Threatened Flora (Bionet 2019)

- Argyrotegium nitidulum - Shining Cudweed

Final alignments

- Charlotte Pass to Guthega Trail
- Charlotte Pass to Guthega Trail - Possible alignment - requires further assessment

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 641 Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion

Figure 3.6 Ecological values - Charlotte Pass to Guthega Trail

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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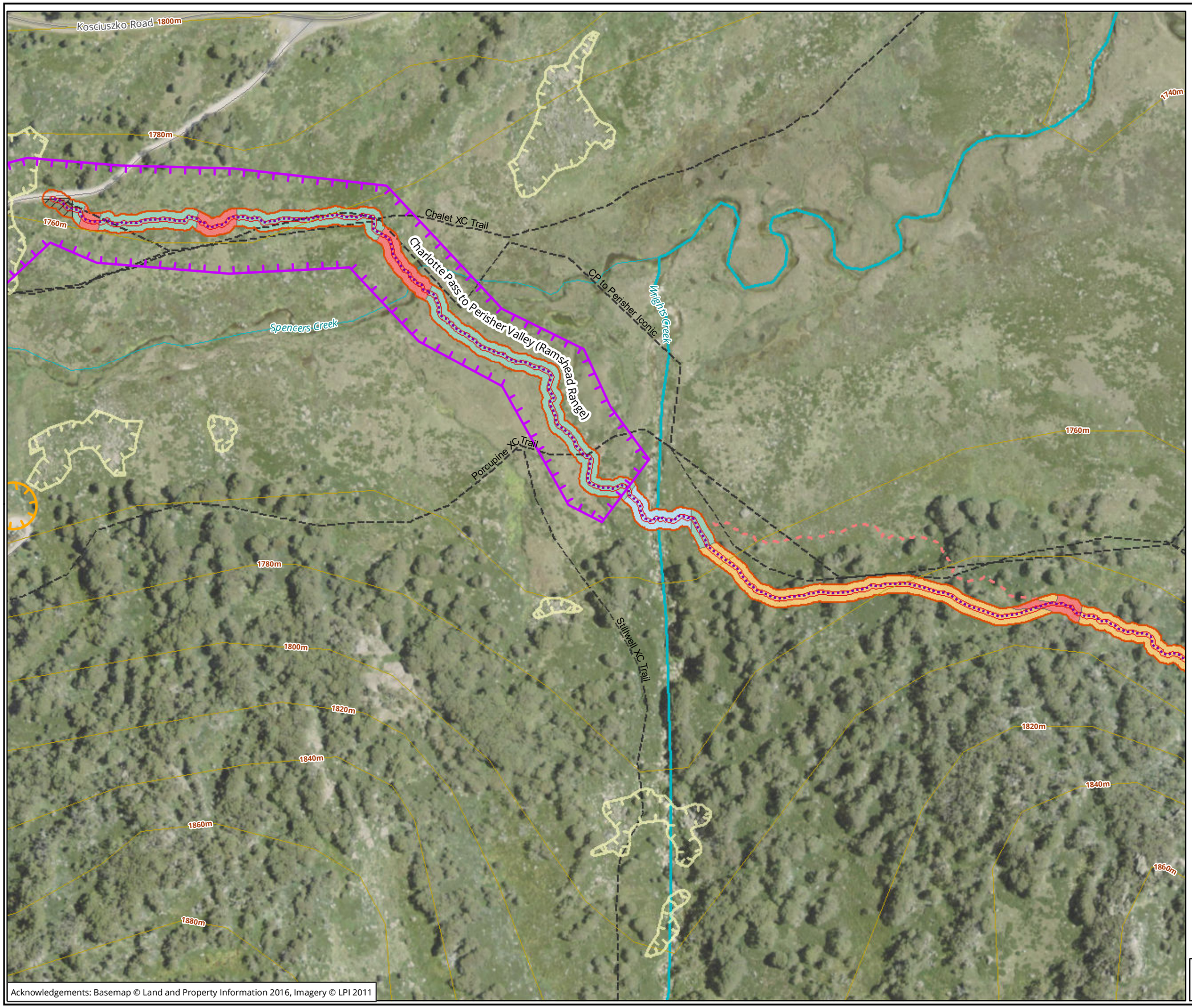

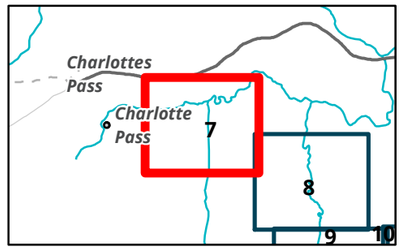

Legend

- Study area
- Subject site
- Existing walking tracks
- Previous alignments
- Contour
- Boulderfields 2014

Threatened fauna habitat

- Alpine She-oak Skink
- Broad-toothed Rat

Final alignments

- Charlotte Pass to Perisher Valley (Ramshead Range)

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 641 Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion
- PCT 643 Alpine shrubland on scree, blockstreams and rocky sites of high altitude areas of Kosciuszko National Park, Australian Alps Bioregion
- PCT 645 Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion
- Non-native vegetation / disturbed area

Figure 3.7 Ecological values - Charlotte Pass to Perisher Valley

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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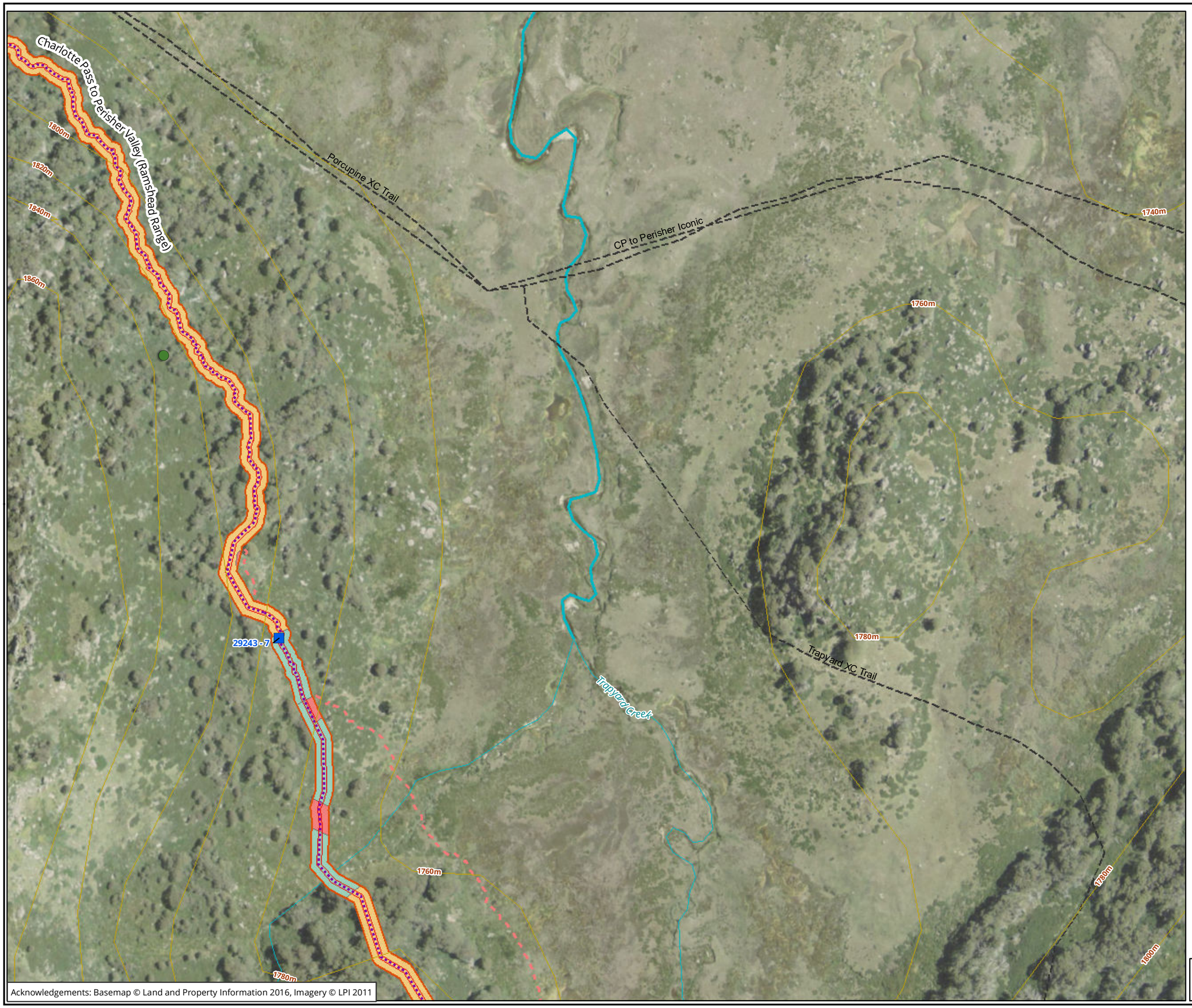

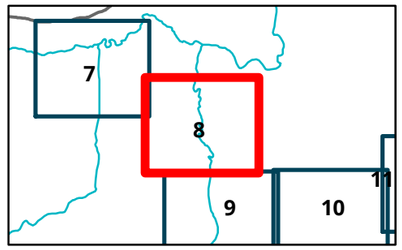

Legend

- Study area
- Subject site
- Existing walking tracks
- Previous alignments
- Contour
- Quadrats

Threatened flora (Biosis 2017-19)

- Broad-toothed Rat - Mastacomys fuscus

Final alignments

- Charlotte Pass to Perisher Valley (Ramshead Range)

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 641 Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion
- PCT 645 Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion

Figure 3.8 Ecological values - Charlotte Pass to Perisher Valley

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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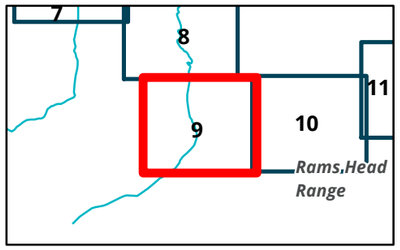

Legend

- Study area
- Subject site
- Existing walking tracks
- Previous alignments
- Contour

Threatened fauna habitat

- Mountain Pygmy-possum

Final alignments

- Charlotte Pass to Perisher Valley (Ramshead Range)

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 641 Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion
- PCT 645 Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion

Figure 3.9 Ecological values - Charlotte Pass to Perisher Valley

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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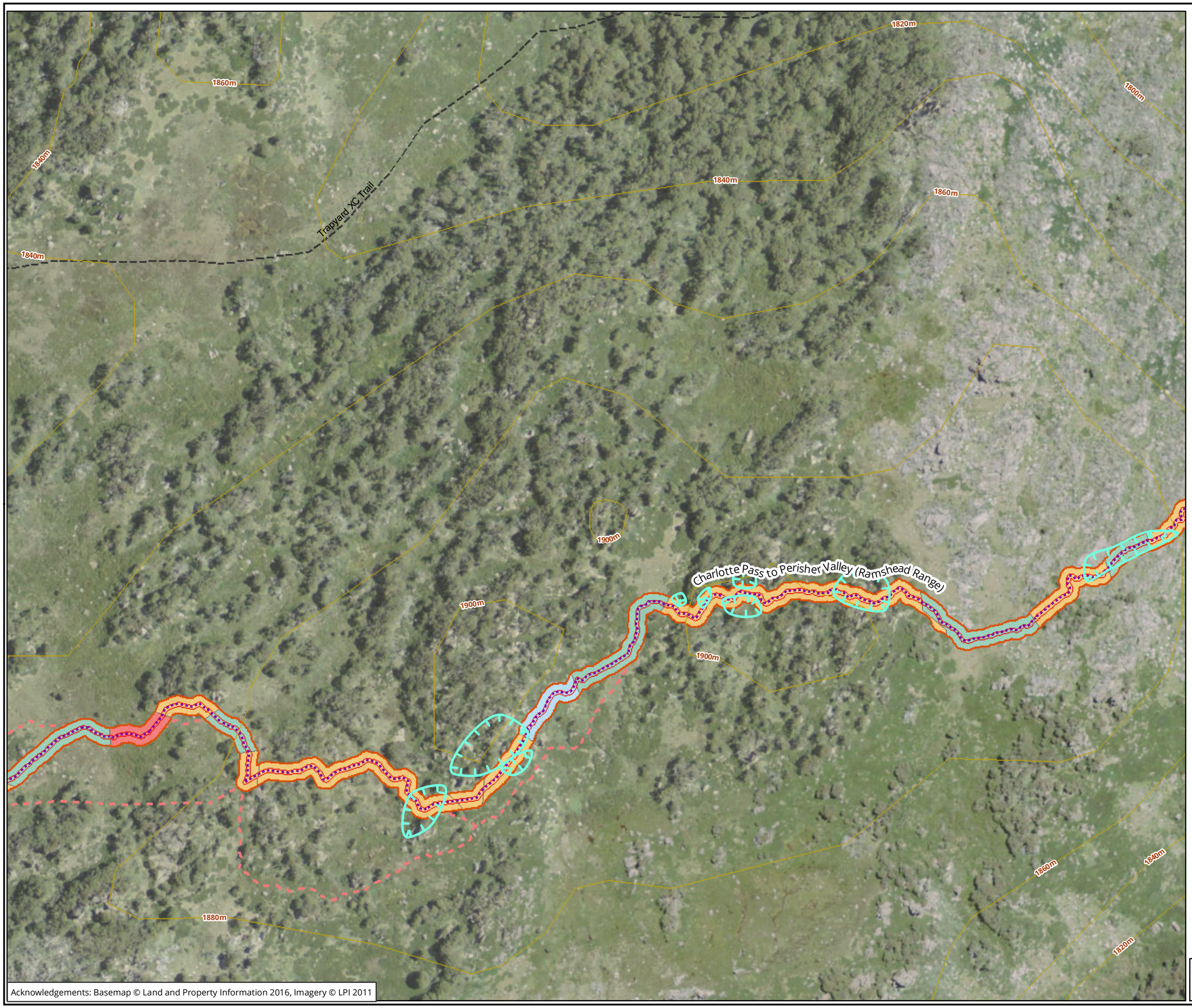

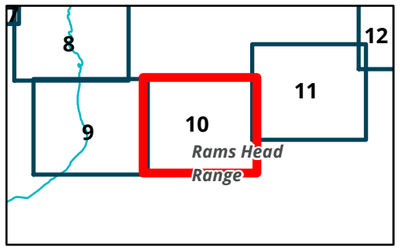

Legend

- Study area
- Subject site
- Existing walking tracks
- Previous alignments
- Contour

Threatened fauna habitat

- Guthega Skink

Final alignments

- Charlotte Pass to Perisher Valley (Ramshead Range)

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 641 Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion
- PCT 643 Alpine shrubland on scree, blockstreams and rocky sites of high altitude areas of Kosciuszko National Park, Australian Alps Bioregion
- PCT 645 Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion

Figure 3.10 Ecological values - Charlotte Pass to Perisher Valley

0 30 60 90 120 150

Metres
Scale: 1:3,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55

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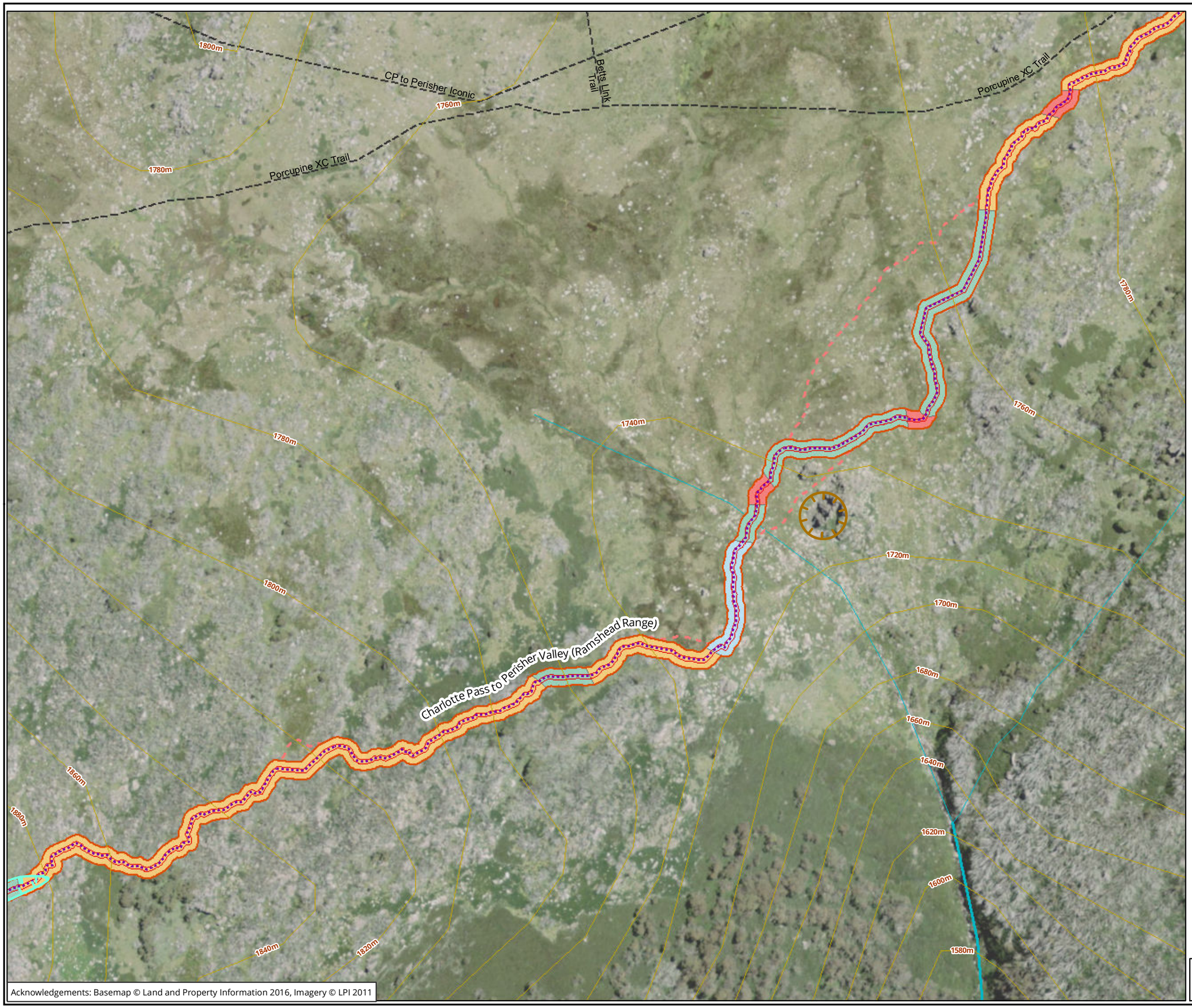

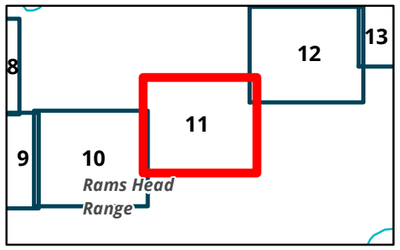

Legend

- Study area
- Subject site
- Existing walking tracks
- Previous alignments
- Contour

Threatened fauna habitat

- Guthega Skink
- Mountain Pygmy-possum

Final alignments

- Charlotte Pass to Perisher Valley (Ramshead Range)

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 641 Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion
- PCT 643 Alpine shrubland on scree, blockstreams and rocky sites of high altitude areas of Kosciuszko National Park, Australian Alps Bioregion
- PCT 645 Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion

Figure 3.11 Ecological values - Charlotte Pass to Perisher Valley

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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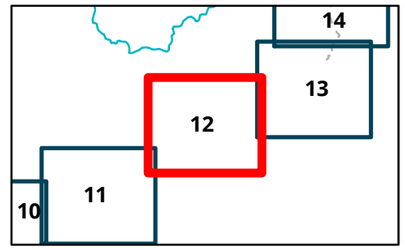

Legend

- Study area
- Subject site
- Existing walking tracks
- Previous alignments
- Contour

Final alignments

- Charlotte Pass to Perisher Valley (Ramshead Range)

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 641 Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion
- PCT 645 Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion

Figure 3.12 Ecological values - Charlotte Pass to Perisher Valley

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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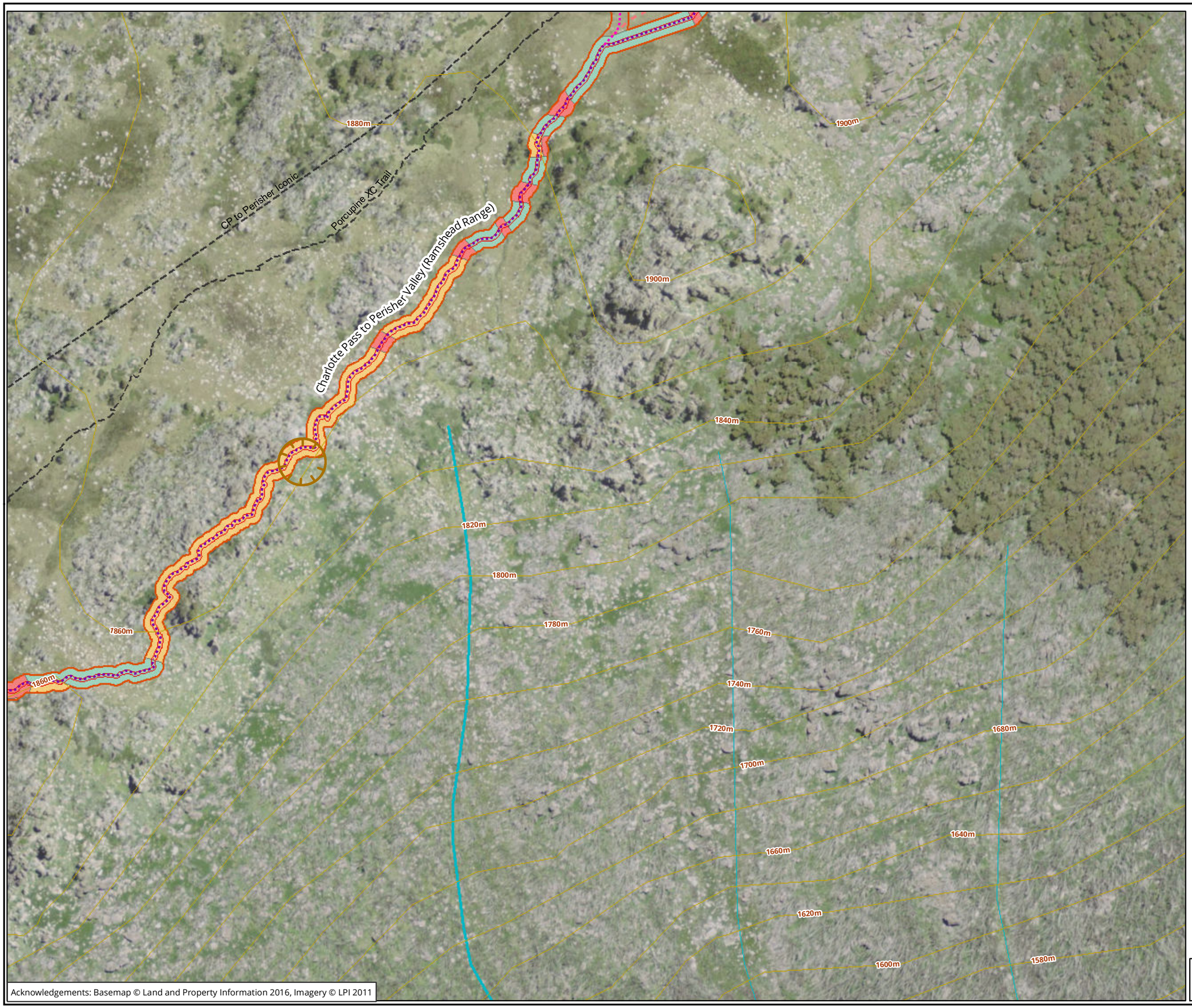

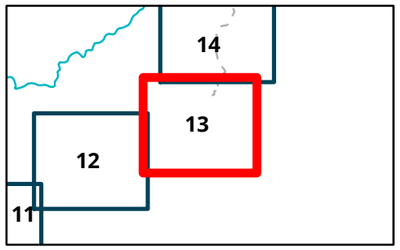

Legend

- Study area
- Subject site
- Existing walking tracks
- Previous alignments
- Contour

Threatened fauna habitat

- Mountain Pygmy-possum

Final alignments

- Charlotte Pass to Perisher Valley (Ramshead Range)
- Charlotte Pass to Perisher Valley (Ramshead Range) - Possible alignment - requires further assessment

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 641 Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion
- PCT 645 Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion

Figure 3.13 Ecological values - Charlotte Pass to Perisher Valley

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

N

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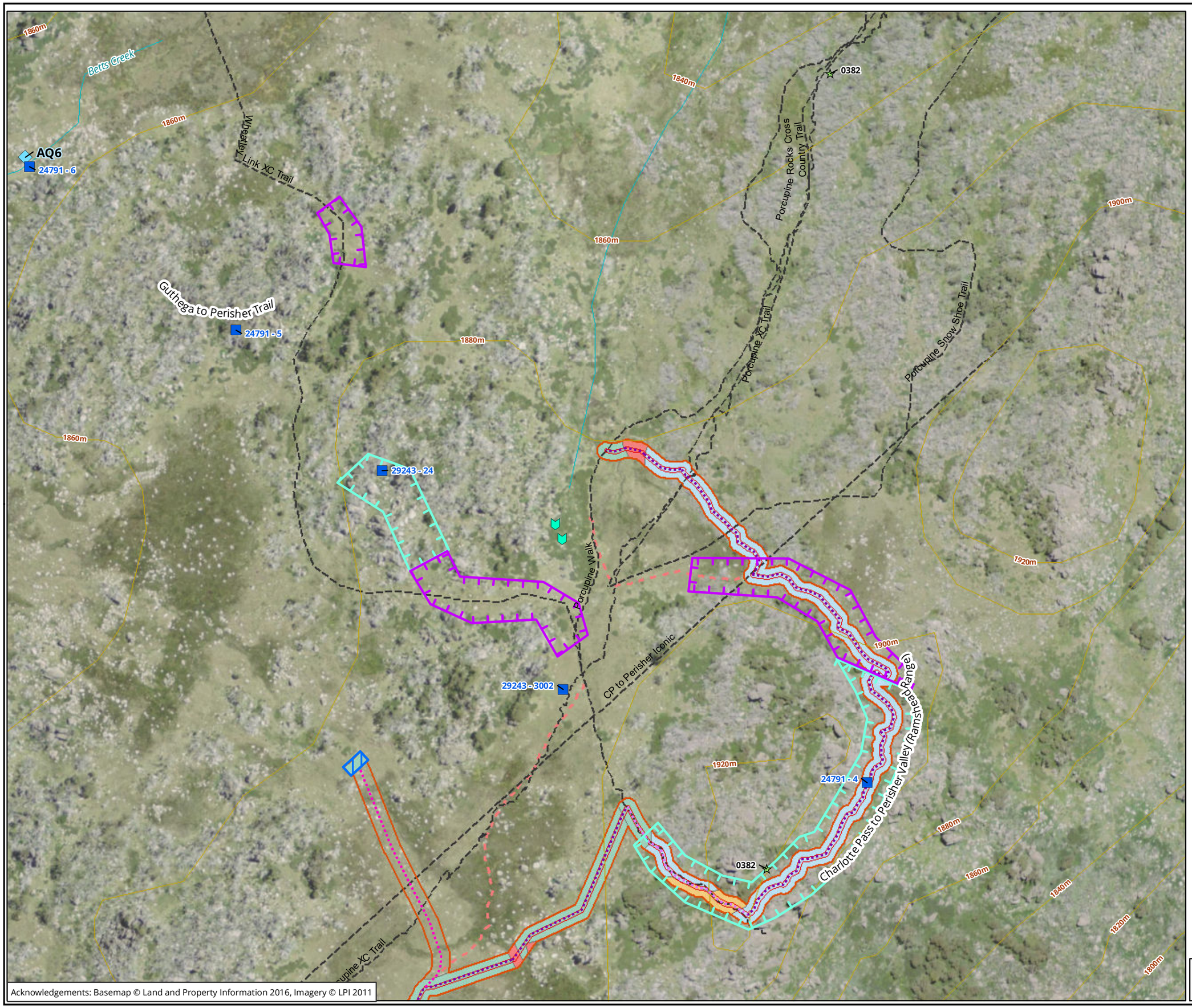

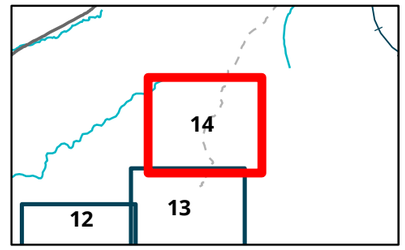

Legend

- Study area
- Subject site
- Proposed camp site
- Existing walking tracks
- Previous alignments
- Contour
- Quadrats
- 26508_Aquatic survey site

Guthega Skink surveys (Zak Atkins 2019)

- Potential Guthega burrows

Threatened Fauna (Bionet 2019)

- 0382 - Flame Robin

Threatened fauna habitat

- Alpine She-oak Skink
- Guthega Skink

Final alignments

- Charlotte Pass to Perisher Valley (Ramshead Range)
- Charlotte Pass to Perisher Valley (Ramshead Range) - Existing walking trail to be modified
- Charlotte Pass to Perisher Valley (Ramshead Range) - Possible alignment - requires further assessment

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 641 Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion
- PCT 643 Alpine shrubland on scree, blockstreams and rocky sites of high altitude areas of Kosciuszko National Park, Australian Alps Bioregion
- PCT 645 Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion

Figure 3.14 Ecological values - Charlotte Pass to Perisher Valley

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

N

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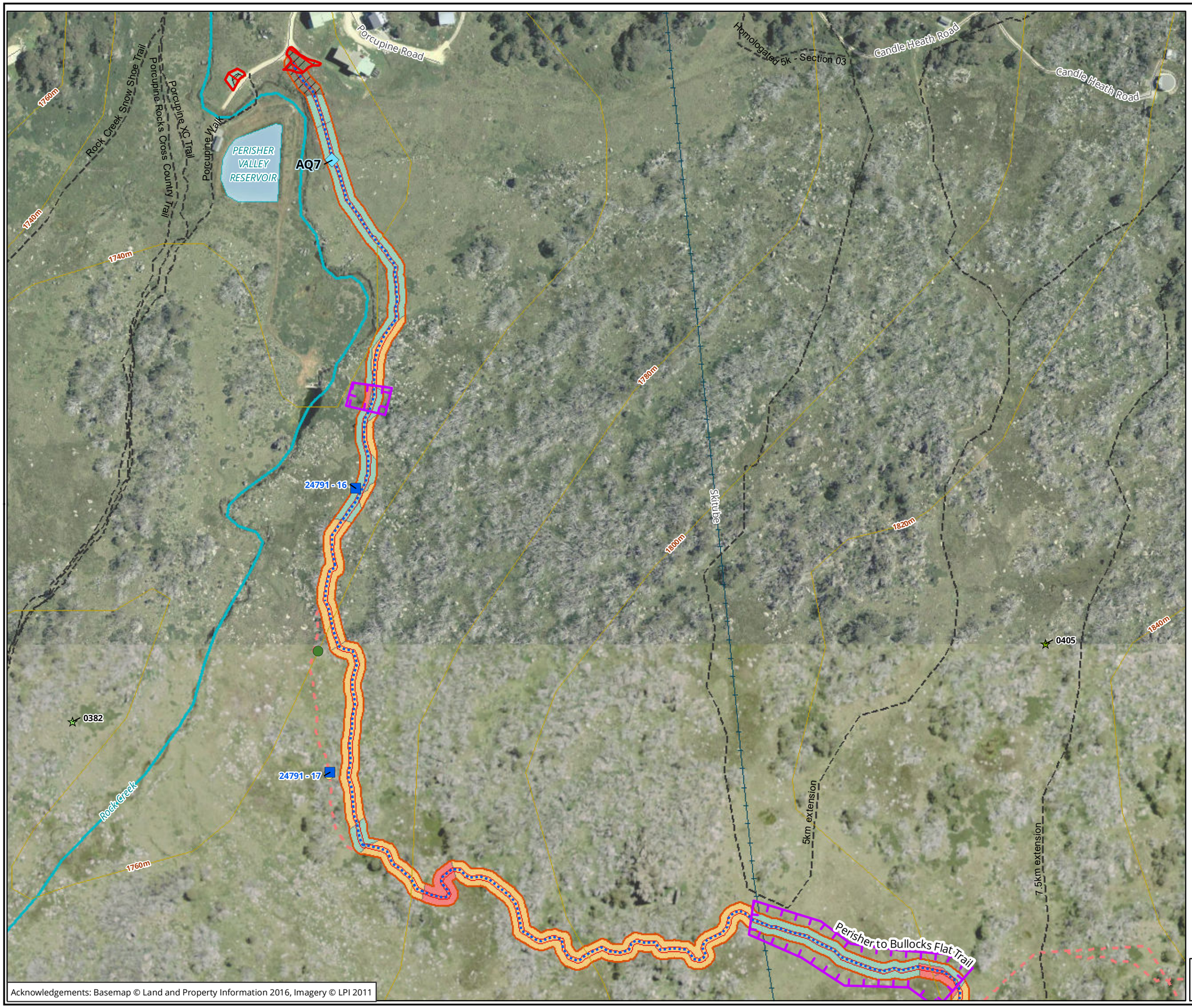

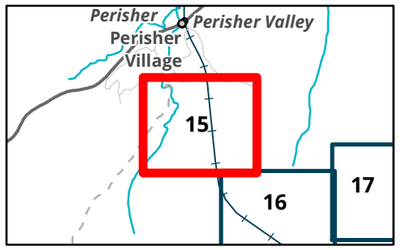

Legend

- Study area
- Subject site
- Proposed carpark extension
- Existing walking tracks
- Previous alignments
- Contour
- Quadrats
- 26508_Aquatic survey site

Threatened flora (Biosis 2017-19)

- Broad-toothed Rat - Mastacomys fuscus
- Gang-gang Cockatoo - Callocephalon fimbriatum

Threatened Fauna (Bionet 2019)

- 0382 - Flame Robin
- 0405 - Olive Whistler

Threatened fauna habitat

- Alpine She-oak Skink

Final alignments

- Perisher to Bullocks Flat Trail

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 641 Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion
- PCT 645 Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion
- Non-native vegetation / disturbed area

Figure 3.15 Ecological values - Perisher to Bullocks Flat Trail

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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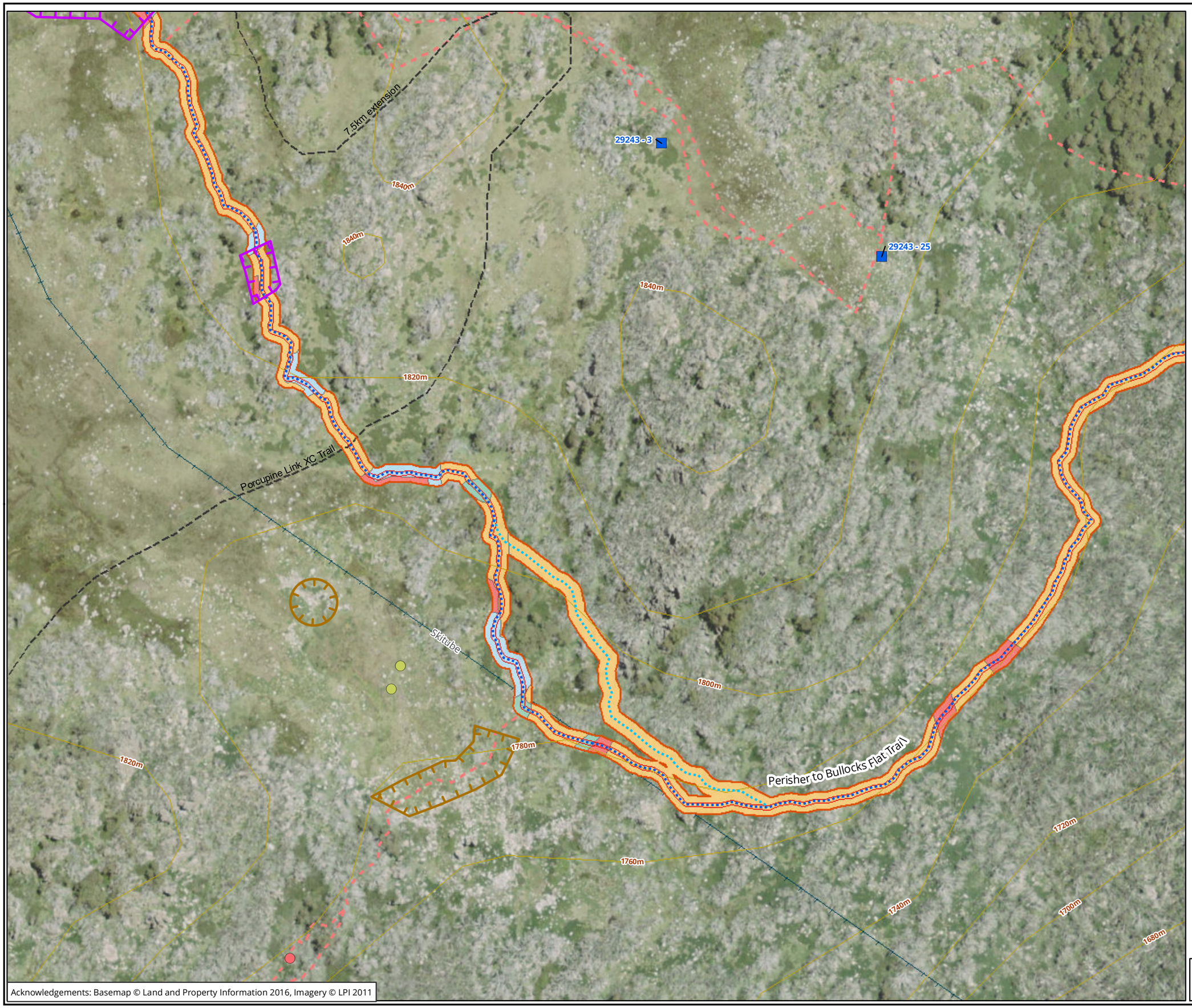

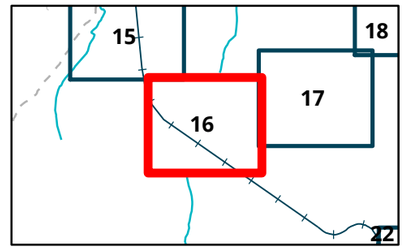

Legend

- Study area
- Subject site
- Existing walking tracks
- Previous alignments
- Contour
- Quadrats

Threatened flora (Biosis 2017-19)

- Flame Robin - Petroica phoenicea
- Olive Whistler - Pachycephala olivacea

Threatened fauna habitat

- Alpine She-oak Skink
- Mountain Pygmy-possum

Final alignments

- Perisher to Bullocks Flat Trail
- Perisher to Bullocks Flat Trail - Possible alignment - requires further assessment

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 641 Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion
- PCT 643 Alpine shrubland on scree, blockstreams and rocky sites of high altitude areas of Kosciuszko National Park, Australian Alps Bioregion
- PCT 644 Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion
- PCT 645 Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion

Figure 3.16 Ecological values - Perisher to Bullocks Flat Trail

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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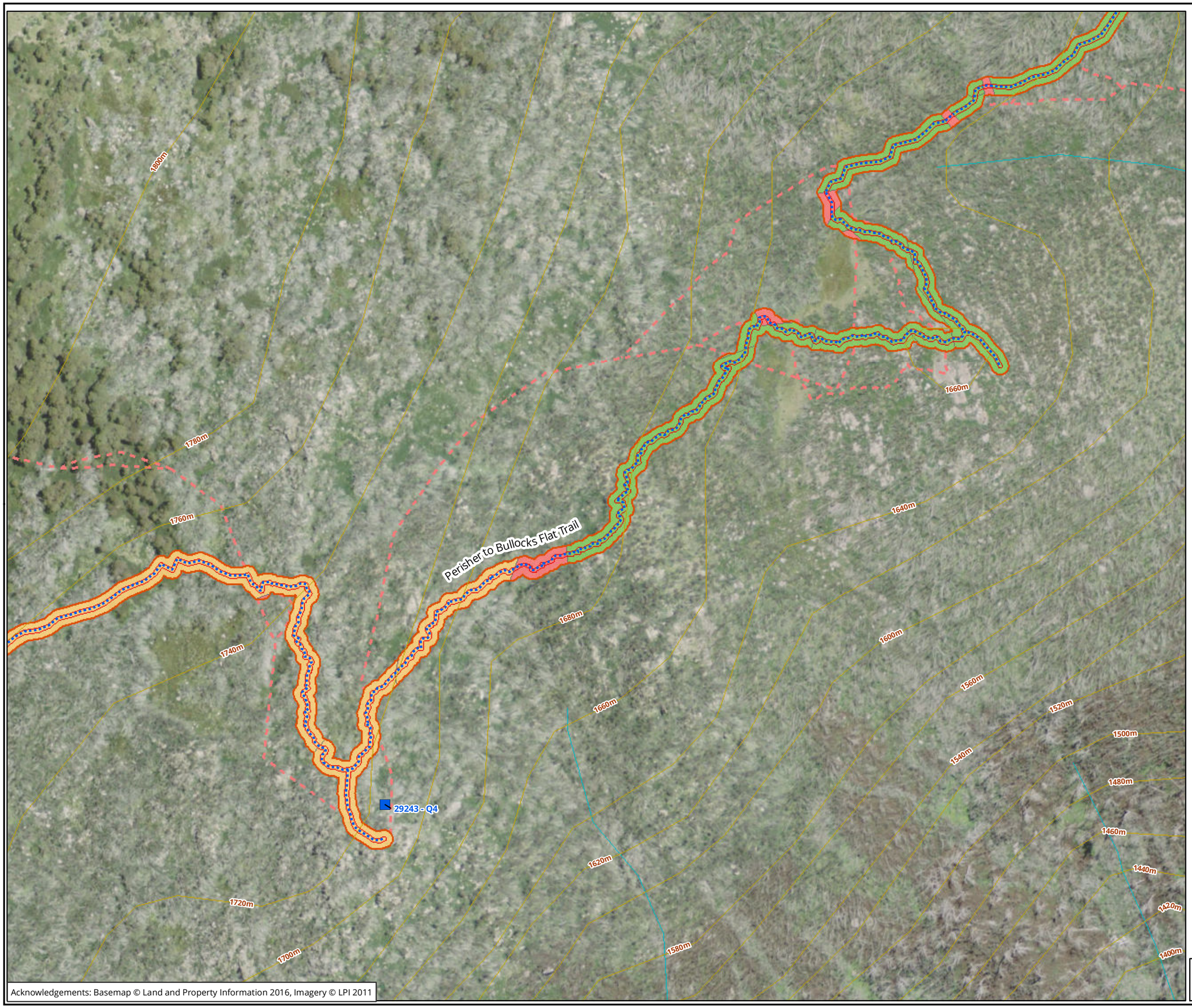

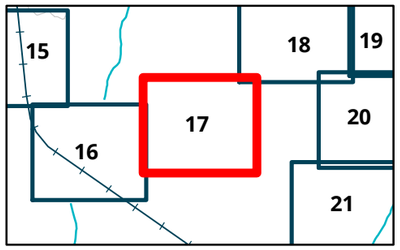

Legend

- Study area
- Subject site
- Previous alignments
- Contour
- Quadrats

Final alignments

- Perisher to Bullocks Flat Trail

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 644 Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion
- PCT 645 Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion

Figure 3.17 Ecological values - Perisher to Bullocks Flat Trail

0 30 60 90 120 150

Metres
Scale: 1:3,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55

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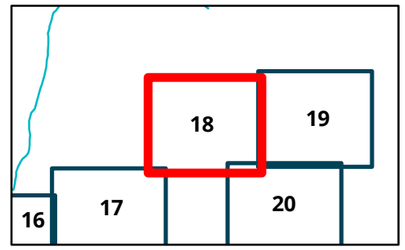

Legend

- Study area
- Subject site
- Contour

Final alignments

- Perisher to Bullocks Flat Trail

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 644 Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion

Figure 3.18 Ecological values - Perisher to Bullocks Flat Trail

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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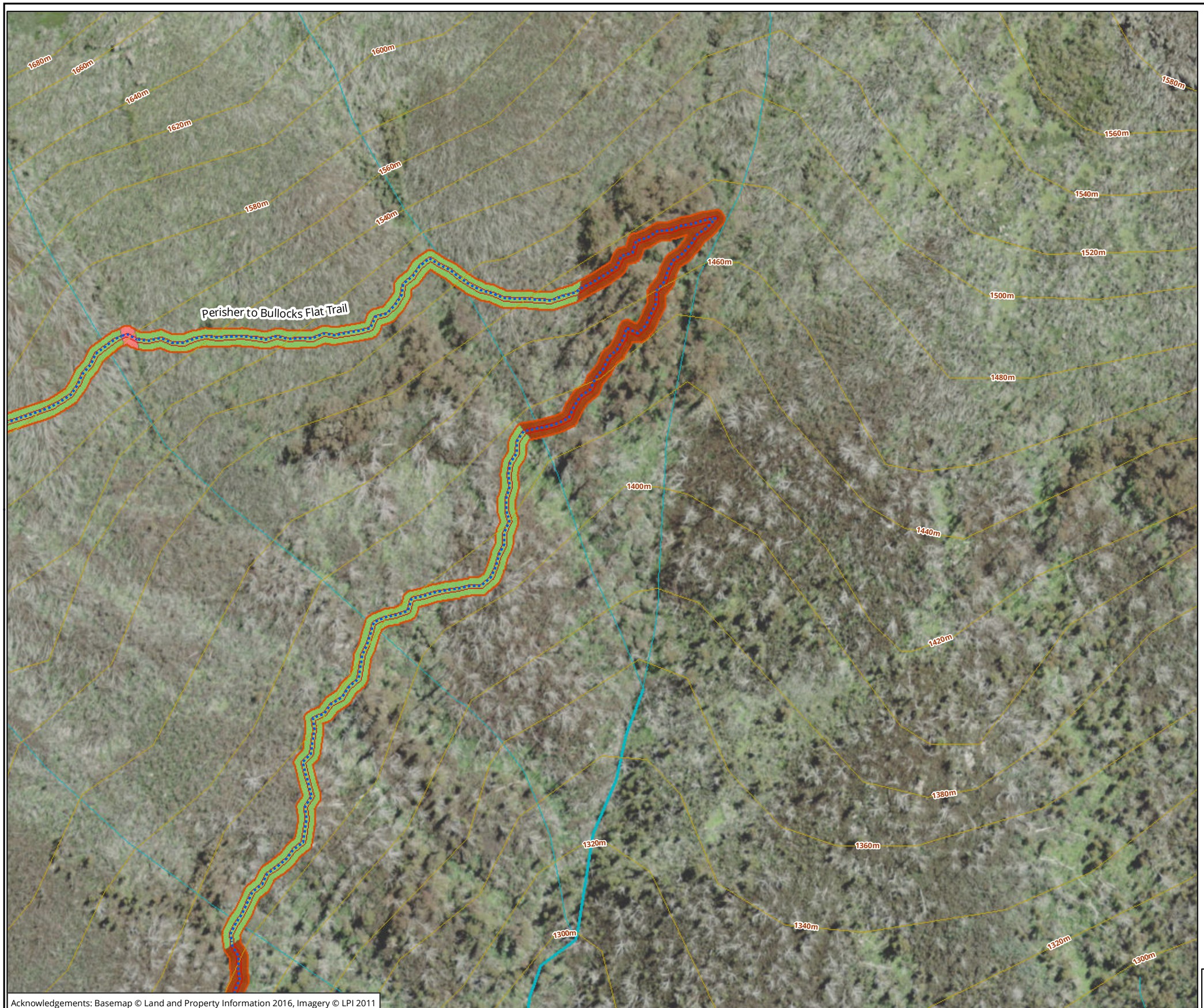

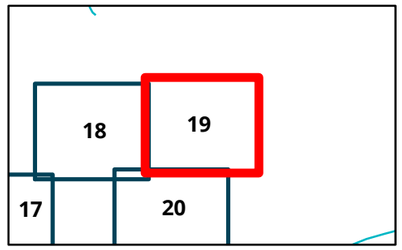

Legend

- Study area
- Subject site
- Contour

Final alignments

- Perisher to Bullocks Flat Trail

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 638 Alpine Ash - Mountain Gum moist shrubby tall open forest of montane areas, southern South Eastern Highlands Bioregion and Australian Alps Bioregion
- PCT 644 Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion

Figure 3.19 Ecological values - Perisher to Bullocks Flat Trail

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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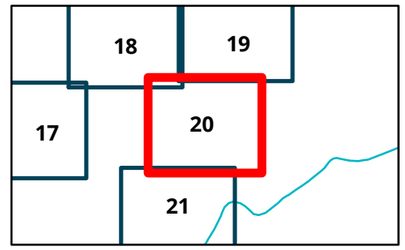

Legend

- Study area
- Subject site
- Contour

Final alignments

- Perisher to Bullocks Flat Trail

Plant Community Type

- PCT 638 Alpine Ash - Mountain Gum moist shrubby tall open forest of montane areas, southern South Eastern Highlands Bioregion and Australian Alps Bioregion
- PCT 1196 Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion

Figure 3.20 Ecological values - Perisher to Bullocks Flat Trail

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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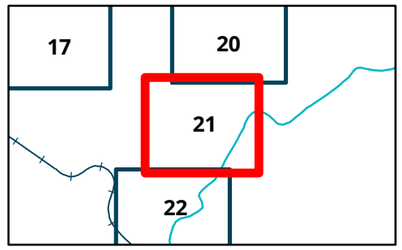

Legend

- Study area
- Subject site
- Previous alignments
- Contour
- Aquatic Ecological Community in the Catchment of the Snowy River in NSW

Final alignments

- Perisher to Bullocks Flat Trail

Plant Community Type

- PCT 1196 Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion

Figure 3.21 Ecological values - Perisher to Bullocks Flat Trail

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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Legend

- Study area
- Subject site
- Existing walking tracks
- Previous alignments
- Contour
- Aquatic Ecological Community in the Catchment of the Snowy River in NSW

Threatened flora (Biosis 2017-19)

- Scarlet Robin - Petroica boodang

Threatened Fauna (Bionet 2019)

- 0380 - Scarlet Robin
- 0405 - Olive Whistler
- 0652 - Diamond Firetail
- 8127 - Brown Treecreeper (eastern subspecies)

Final alignments

- Perisher to Bullocks Flat Trail

Plant Community Type

- PCT 679 Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland
- PCT 1196 Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion

Acknowledgements: Basemap © Land and Property Information 2016, Imagery © LPI 2011

Figure 3.22 Ecological values - Perisher to Bullocks Flat Trail

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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5 Consultation with experts

Biosis has consulted with Dr Keith McDougall and Mel Schroder from DPIE (formerly OEH) via telephone and email on several occasions, and during field surveys (with Mel Schroder) between May 2017 and April 2019. NPWS has also engaged Dr Zac Atkins to provide independent advice on the impacts of the project on threatened alpine reptiles (Atkins 2019).

The results of background research and the field investigation were discussed in addition to particulars of the proposal such as alignments and trail construction methods. The key outcomes from these discussions are listed in Table 10 below.

Table 10 Key outcomes of consultation with DPIE/NPWS experts

Discussion point	Item discussed	Dr Keith McDougall	Mel Schroder	Biosis response
Vegetation typology	Most appropriate vegetation typology for use within this report.	Recommended use of PCTs in combination with local mapping projects and endangered ecological community listings.	Highlighted that consideration should be given to current accuracy of late-lying snow patch mapping.	Biosis has based vegetation typology on PCTs, local mapping projects and endangered ecological community listings.
Charlotte Pass to Guthega	Weighing up impacts of ridge, mid-slope and lower slopes options.	Alignment choice determined by which impacts (Alpine bogs, threatened reptiles and increased predator access to Mountain Pygmy Possum) are able to be successfully managed.	Ridgeline option may impact on Mountain Pygmy Possum and threatened alpine reptiles by opening the area to predators on a micro-scale. Known populations of Guthega Skink have been detected along the ridge. Survey to detect occurrence and burrow networks to inform track location was deemed necessary.	Biosis has presented an analysis of the impacts on threatened species associated with all trail alignment options to inform trail alignment design and allow for micro-siting.

Discussion point	Item discussed	Dr Keith McDougall	Mel Schroder	Biosis response
	Track construction methods for least impact.	Raised walkways will minimise impacts to Alpine Bog but may still require assessment under the EPBC Act.	Avoid soil disturbance, minimise width and damage, use local material, sods salvage. Imported materials may alter soil chemistry, introducing highly alkaline materials to be avoided – granite based materials.	Biosis has presented an analysis of impacts associated with track construction methods and recommendations regarding optimal track construction surfaces (Figure 4).
	Spencer's Creek crossing	Spencer's Creek crossing forms habitat for Perisher Wallaby-grass and Raleigh Sedge. Targeted surveys will be required for these species. Overall, the proposed track location is viable.	Guthega area is weedy and tracks aid dispersal. Weeds known in area include: Sweet Vernal Grass *Anthoxanthum odoratum*, *Juncus effusus* and *Juncus articulatus* (in wetlands) and Creeping Soft Grass *Holcus mollis*, Bird's Foot Trefoil *Lotus uliginosus* (in general). Mouse-eared Hawkweed *Hieracium pilosella* is on the Main Range to the west and at this stage is unlikely an issue.	Biosis undertook targeted surveys for Perisher Wallaby-grass and Raleigh Sedge. Biosis has recommended management actions designed to suppress and reduce the extent of current weed populations and prevent incursion of novel weeds.

Discussion point	Item discussed	Dr Keith McDougall	Mel Schroder	Biosis response
Perisher to Guthega	Impacts to threatened species	Large areas of habitat for threatened species (Guthega Skink, Alpine She-oak Skink, Mountain Pygmy Possum, Broad-toothed Rat and Anemone Buttercup) and Alpine bogs and fens. Unusual wetland features have been recorded in this area and there may be Feldmark near the summit of Mount Perisher. Avoid Snow Gums and Bogs.	A large population of Mountain Pygmy Possum utilise habitat within the vicinity of the proposed trail. Use Mountain Pygmy Possum habitat maps to aid micro siting and avoid primary and secondary habitat. Known populations of Guthega skink have been detected in this area. Survey to detect occurrence and burrow networks to inform track location may be necessary.	Biosis recommended avoiding this trail alignment due to significant threatened species issues and this recommendation has been adopted by NPWS.
Porcupine Rocks	Impacts to threatened species	Has not looked at the area in detail.	Predation issues for Broad-toothed Rat, design features required to maintain connectivity – small tunnel crossings.	As above, Biosis has presented an analysis of impacts to threatened species to inform trail alignment design.
Perisher Valley to Bullocks Flat	Trail alignment	Negotiate around and over Alpine Bogs and Fens EEC patches recorded along the trail.	As stated above for Charlotte Pass to Guthega trail.	As above, Biosis has presented an analysis of impacts to threatened species to inform trail alignment design.

Discussion point	Item discussed	Dr Keith McDougall	Mel Schroder	Biosis response
	Impacts to threatened species	Avoid Blue-tongued Greenhood and Leafy Anchor Plant and locally important species, Alpine Star-bush *Asterolasia trymalioides* subsp. *trymalioides* which have habitat near the vicinity of Thredbo River and its tributaries. Ensure consideration is given to Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland EEC.	As above, design trails to maintain habitat connectivity and avoid primary and secondary habitats of threatened fauna species.	As above, Biosis has presented an analysis of impacts to threatened species to inform trail alignment design.
Miscellaneous	Listed communities	Ensure consideration for listed communities: • Alpine Bogs and Fens EEC • Windswept Feldmark EEC • Snow Patch Feldmark • Short Alpine Herbfield • Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland EEC.	Protect large trees.	Biosis has ensured a precautionary approach has been used when assessing these communities.
	Threatened species	Shining Cudweed is locally common. *Euphrasia caudata* could occur in the vicinity of the Perisher to Bullocks Flat trail. Targeted surveys for threatened flora and trail micro-siting will be required.	Alpine Tree Frog has a low likelihood of occurrence in the proposed trail alignment and the project is unlikely to result in significant impacts.	Biosis undertook targeted surveys for these threatened species and micro-siting to avoid their populations and habitats.

6 Ecological impacts and recommendations

This section identifies the potential impacts of the walking track development on the ecological values within and adjacent to the final trail alignments across design, pre-construction, construction and operational phases.

A range of impact avoidance and minimisation measures have been adopted by NPWS at the project design phase, and these will inform the detailed design of works and proposed construction methods. Additional pre-construction and construction measures are recommended here and will be subject to endorsement by NPWS and their construction contractor.

General measures to avoid, minimise and mitigation impacts that apply across the entire project and its phases are provided below.

6.1 Potential impacts

6.1.1 Native vegetation removal

The subject site for the trails varies in width from 2.8 metres to 3.5 metres (Plates 1 and 2) depending on trail construction method. Including campsites, which will be on elevated platforms, and the carpark upgrade at Perisher Valley, the subject site covers approximately 9.28 hectares. Within this subject site permanent vegetation removal and disturbance will occur to create tracks and install elevated structures. Vegetation will also be modified to maintain clearance along the tracks. Areas will be temporarily disturbed during construction and then actively rehabilitated, or where appropriate, allowed to naturally regenerate once works are completed. Native vegetation impacts are estimated as:

- 1.56 hectares of native vegetation will be permanently lost or modified (e.g. through clearing for rock paving, natural surface trails or through shading under elevated structures).
- 1.76 hectares of native vegetation will be modified for ongoing trail maintenance through minor pruning of taller shrubs close to the new tracks.
- Up to 5.91 hectares of native vegetation will be temporarily disturbed through creating side cuts, machinery movements, material storage and construction access. These areas will be fully rehabilitated to their natural state once works are complete.

Remaining areas are exotic vegetation. Estimated native vegetation removal and disturbance in each PCT is summarised for the final trail alignments and proposed trail surface types in Table 11.

Table 11 Estimated native vegetation removal for final alignments based on proposed trail surface types and PCTs, exotic vegetation has been excluded from this table (*note minor rounding errors from raw data in this table)

Final trail alignment, surface type, ancillary works and PCT	Permanent impact (ha)*	Maintenance zone (ha)*	Rehabilitation zone (ha)*	Total in subject site (ha)*
Charlottes Pass to Guthega Trail				
Elevated structures				
637 - Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion (EEC)	0.05	0.02	0.10	0.17
641 - Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion	0.10	0.05	0.19	0.34
645 - Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion	0.01	0.00	0.01	0.02
Rock paving/ Pitched rock				
637 - Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion (EEC)	0.00	0.00	0.00	0.00
641 - Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion	0.13	0.18	0.59	0.89
645 - Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion	0.07	0.09	0.31	0.47
Campsite				
641 - Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion	0.02	0	0	0.02
Total impacts for Charlottes Pass to Guthega Trail	**0.37**	**0.35**	**1.20**	**1.92**

Final trail alignment, surface type, ancillary works and PCT	Permanent impact (ha)*	Maintenance zone (ha)*	Rehabilitation zone (ha)*	Total in subject site (ha)*
Perisher to Bullocks Flat				
Elevated structures				
637 - Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion (EEC)	0.03	0.02	0.06	0.11
641 - Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion	0.03	0.02	0.07	0.12
643 - Alpine shrubland on scree, blockstreams and rocky sites of high altitude areas of Kosciuszko National Park, Australian Alps Bioregion	0.00	0.00	0.00	0.00
644 - Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion	0.00	0.00	0.00	0.00
645 - Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion	0.01	0.01	0.02	0.04
Natural surface				
1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	0.04	0.06	0.19	0.29
637 - Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion (EEC)	0.00	0.00	0.00	0.00
641 - Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion	0.00	0.00	0.00	0.01
644 - Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion	0.14	0.20	0.64	0.98
645 - Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion	0.08	0.11	0.35	0.53

Final trail alignment, surface type, ancillary works and PCT	Permanent impact (ha)*	Maintenance zone (ha)*	Rehabilitation zone (ha)*	Total in subject site (ha)*
679 - Black Sallee - Snow Gum low woodland of montane valleys, South Eastern Highlands Bioregion and Australian Alps Bioregion (EEC, part) – status of this community in the study area to be review in spring 2019	0.05	0.07	0.24	0.36
Rock paving/ Pitched rock				
1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	0.03	0.04	0.15	0.22
638 - Alpine Ash - Mountain Gum moist shrubby tall open forest of montane areas, southern South Eastern Highlands Bioregion and Australian Alps Bioregion	0.08	0.12	0.39	0.59
641 - Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion	0.01	0.01	0.03	0.04
643 - Alpine shrubland on scree, blockstreams and rocky sites of high altitude areas of Kosciuszko National Park, Australian Alps Bioregion	0.01	0.01	0.05	0.07
644 - Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion	0.03	0.04	0.12	0.18
645 - Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion	0.06	0.09	0.29	0.45
Total impacts for Perisher Valley to Bullocks Flat Trail	**0.60**	**0.78**	**2.59**	**3.97**

Final trail alignment, surface type, ancillary works and PCT	Permanent impact (ha)*	Maintenance zone (ha)*	Rehabilitation zone (ha)*	Total in subject site (ha)*
Charlotte Pass to Perisher Valley (Ramshead Range)				
Elevated structure				
637 - Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion (EEC)	0.05	0.02	0.09	0.16
641 - Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion	0.11	0.06	0.22	0.39
643 - Alpine shrubland on scree, blockstreams and rocky sites of high altitude areas of Kosciuszko National Park, Australian Alps Bioregion	0.01	0.00	0.02	0.03
645 - Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion	0.01	0.00	0.01	0.02
Rock paving/ Pitched rock				
637 - Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion (EEC)	0.00	0.00	0.01	0.01
641 - Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion	0.06	0.09	0.30	0.45
643 - Alpine shrubland on scree, blockstreams and rocky sites of high altitude areas of Kosciuszko National Park, Australian Alps Bioregion	0.04	0.06	0.19	0.29
645 - Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion	0.28	0.39	1.28	1.96
Campsite				
641 - Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion	0.02	0	0	0.02
Carpark extension				
641 - Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion	0.01			0.01

Final trail alignment, surface type, ancillary works and PCT	Permanent impact (ha)*	Maintenance zone (ha)*	Rehabilitation zone (ha)*	Total in subject site (ha)*
Total impacts for Charlotte Pass to Perisher Valley Trail	**0.59**	**0.63**	**2.12**	**3.34**
Total project impacts on native vegetation	**1.56**	**1.76**	**5.91**	**9.23**

6.1.2 Threatened species and ecological communities

The following potential impacts have been identified for threatened species and ecological communities. Most of these impacts are temporary in nature (e.g. during the construction phase) or of a relatively minor scale in the context of the extensive areas of intact habitat available in the national park (see Appendices 3 and 4 for further discussion of species impacts):

- Possible disturbance of habitat for Shining Cudweed, Anemone Buttercup, Perisher Wallaby-grass, Blue-tongued Greenhood, Mountain Greenhood and Slender Greenhood. Known populations of Anemone Buttercup and Perisher Wallaby-grass along the final alignments have been avoided through micro-siting in 2018 and 2018 (Figure 3).
- Permanent removal of grassy heathland vegetation that provides habitat for Alpine She-oak Skink. This habitat generally aligns with PCT 641 and it is estimated up to 0.49 hectares of this vegetation will be permanently lost or modified. Not all areas of PCT 641 are suitable Alpine She-oak Skink habitat mainly due to structural variation (i.e. some areas are very dense heathland). It is proposed to elevate the trail across 0.24 hectares of PCT 641, especially where vegetation structure is open and grassy (Figure 4). This will further reduce permanent loss of this habitat type down to 0.25 hectares. Temporary short-term impacts could extend out to 2.29 hectares in PCT 641 during construction.
- High quality Guthega Skink habitat has mostly been avoided by abandoning the Guthega to Perisher Valley trail alignment that crossed Mount Perisher. There is still potential for this species to occur in isolated locations along all final trail alignments. The species was documented by Atkins (2019) at two locations along the Charlotte Pass to Guthega Trail (Figure 3). The trail alignment at these locations has been changed to avoid areas of suitable habitat and burrow sites identified by Atkins (2019) and as recommended in his report. Significant effort has also been made during field surveys and micro-siting with NPWS staff to avoid other known burrow sites and suitable rocky habitat with potential burrow sites.
- Broad-toothed Rat occurs extensively across most of the impact area. Although it has potential to occupy all vegetation communities, key grassland, heathland and woodland vegetation habitats occur in PCT 637, PCT 641, PCT 643, PCT 644 and PCT 645. Habitat loss for this species is considered relatively minor in the context of the extensive areas of suitable habitat across the national park and Australian Alps bioregion. The trails also have the potential to increase localised predation on this species, especially by foxes that have been documented to preferentially feed on Broad-toothed Rat (Green 2002). During the field assessment it was noted that fox scats are already widespread throughout many un-tracked sections of the park so new incursions by feral predators are not likely to increase however, localised predation opportunities may change by reducing vegetation cover.
- Mountain Pygmy-possum habitat was recorded either through direct observations or reference to NPWS boulderfield mapping across most trail alignments (Figure 3). Areas of key boulderfield habitat with podocarpus shrubs were specifically avoided during trail alignment selection and micro-siting. This species still has the potential to disperse through most high elevation heathland and woodland communities particularly PCT 641, PCT 643 and PCT 645. Vegetation removal in these PCTs will result in a minor reduction in dispersal habitat and may increase localised predation of dispersing individuals
- A range of threatened forest and woodland-dependent mammals are likely to occur at lower elevations including Eastern False Pipistrelle, Eastern Bentwing-bat, Greater Glider, Eastern Pygmy-possum, Smoky Mouse, Spotted-tailed Quoll and Koala. Forest and woodland PCTs suitable for these species generally occur along the Perisher Valley to Bullocks Flat trail and include PCT 638, PCT 644, PCT 679 and PCT 1196. These species are generally reliant on the canopy, upper vegetation strata or

hollow-bearing trees, except for Smokey Mouse and Spot-tailed Quoll, and therefore impacts to most of these species are likely to be minor given the narrow trail footprint, avoidance of large trees in forested environments and the contiguous nature of habitat availability in the national park.

- A range of threatened birds are likely to occur at most elevations and across various vegetation communities including Gang-gang Cockatoo, Flame Robin, Scarlet Robin, Pink Robin, Olive Whistler, Diamond Firetail, Brown Treecreeper and Powerful Owl. These species utilise a range of habitat elements such as understorey vegetation, hollow-bearing trees, perching, roosting and nesting sites and fallen timber. Impacts to these species are likely to be minor and localised given the narrow trail footprint in forest and woodland environments and the contiguous nature of habitat availability in the national park.
- Two species reliant on aquatic habitats, River Blackfish and Alpine Redspot Dragonfly, may occur in high quality waterways and minor tributaries. Direct impacts to these species are likely to be avoided through use of elevated structures and bridges to cross waterways and drainage lines (Figure 4). Use of elevated structures will also ensure the integrity of stream banks, beds and habitat features, such as rocks, logs and moss beds, are maintained. Risk of indirect impacts through loss of riparian vegetation, erosion and sediment runoff will need to be managed carefully during trail construction and operation.
- Two terrestrial threatened ecological communities will be impacted by trail construction.
  - Up to 0.13 hectares of the Alpine Sphagnum Bogs (PCT 637) community will be permanently impacted by installation of elevated structures to span all occurrences of this community along the final trail alignments (Figure 4). It is likely construction of elevated structures will cause minor permanent loss of this community where footings are installed. Elevated structures will have an ongoing shading influence that may alter vegetation composition and structure towards shade-tolerant species. Temporary short-term impacts could extend out to 0.45 hectares in PCT 637.
  - The Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland community occurs for the last 300 metres of the Perisher to Bullocks Flat trail in the South Eastern Highland bioregion. Impacts to this community are likely to include permanent removal of up to 0.015 hectares of already disturbed understorey vegetation along the Thredbo River. These impacts are considered minimal in the context of extensive stands of this community in the Thredbo Valley. See previous notes regarding the determination and listing of this community and need for review of findings after additional field work in spring 2019.
- The final alignments cross several named waterways and unnamed tributaries that flow directly into the Snowy and Thredbo Rivers, therefore all biota in these aquatic habitats are considered part of the Snowy River aquatic endangered ecological community. It is intended that all waterways will be spanned with elevated structures or bridges to avoid disturbance to the bed, banks and instream habitat features such as woody debris, rocks and pools (Figure 4). These structures will be single span in most instances and are unlikely to change water flow, velocity, turbidity or seasonality. Impacts to localised sections of riparian vegetation are required in order to facilitate the project works such as trail clearing and structure installation. Where impacts will occur they will be temporary in nature, with a commitment to undertake best practice in-stream rehabilitation works following construction, if required around structure footings.

6.2 Other impacts and recommendations

A number of environmental risks, such as weed invasion, erosion and pest animals, are associated with track construction and operation, the majority of which already occur across the national park.

6.2.1 Impacts resulting from trail construction methods

The use of elevated structures/platforms or pitched rock to create trails in or near sensitive habitat types has the potential to cause some disruption to dispersal and water flows if not completed in a site responsive and sensitive manner. This disruption is unlikely to cause complete isolation of plant or animal populations as has been experienced through larger infrastructure in the alps, such as water storages, roads and ski-fields. Elevated structures are likely to better facilitate connectivity as vegetation cover can be retained under such structures. The use of pitched rock may increase available habitat opportunities for threatened reptiles by providing basking sites. Elevated structures are proposed for all areas supporting the Alpine Sphagnum Bogs community (PCT 637). The structures will also facilitate the movement of Broad-toothed Rat as they allow for continued existence of the drainage line vegetation and dispersal of this threatened species. Elevated structures may also create a movement corridor and provide shelter from predators for Broad-toothed Rat.

Disturbance of soils during construction may result in increased risk of sedimentation entering receiving waterbodies. Sedimentation may impact threatened and non-threatened biota resident within affected waterways. This can be mitigated by preparation and implementation of an erosion and sediment control plan.

6.2.2 Increased access for pest animal

Indirect signs and impacts of pest animals such as fox, feral deer, feral pigs, rabbits and wild dogs are evident through all areas investigated. The formalisation of trails throughout the study area may facilitate the dispersal of these species and worsen existing impacts, particularly by increasing risk of predation for small native fauna species at a site level.

Pest management programs are in place to control species which have been selected according to the criteria listed in 11.4.1 of the Kosciuszko National Park Plan of Management (NPWS 2006). The Southern Ranges Pest Management Strategy also identifies priorities for weed and vertebrate pest management programs. A project-specific pest management strategy should be developed based on the principles of adaptive management and should include provisions for monitoring (e.g. camera traps to detect feral predator densities), evaluation and control strategies through baiting or other means, where appropriate. Any new program needs to be integrated with existing control strategies in the park and broader initiative such as Saving Our Species (SOS) programs.

6.2.3 Increased weed infestations

The proposal may worsen existing weed infestations or result in the accidental introduction of new weed species. The formalisation of the trails may also increase opportunities for weed dispersal, particularly weeds that use humans and animals as their primary dispersal mechanism. Weed management programs are already in place throughout key areas of Kosciuszko National Park with mixed success (NPWS 2006).

It is advised that NPWS create a weed management strategy aimed at suppressing and eradicating existing weed populations and preventing establishment of new weeds along the new trail alignments in accordance with priorities listed in Section 11.3.1 of the Kosciuszko National Park Plan of Management (NPWS 2006). The weed management plan should contain provisions for monitoring and evaluation and be adaptive in scope. A construction hygiene protocol will also be required to prevent weed or pathogen spread during trail construction.

6.2.4 Pathogens

Construction activities associated with the proposal and future movements of trail users may result in the introduction of plant and soil borne pathogens such as Phytophthora *Phytophthora cinnamomi,* Myrtle Rust *Uredo rangelii* and Pythium *Pythium* spp. These pathogens are introduced via mud, soil and debris on the undercarriages of vehicles, plant and equipment, soles of footwear and via rocks and boulders used in construction. The risk of these pathogens being able to establish once introduced are exacerbated by climate change.

Pathogens detrimental to fauna may also be introduced to the subject site including Chytridiomycosis *Batrachochytrium dendrobatidis* (detrimental to frogs) and Sarcoptic Mange (detrimental to the Common Wombat *Vombatus Vombatus*). These pathogens are introduced via mud and soil debris on vehicle, plant, machinery and footwear and through feral animals respectively. These pathogens are known in the study area (NPWS 2006).

Areas of potential dieback on *Nematolepis ovatifolia* were also noted and mapped along several trails. Die back in this species was recorded by Green (2016) in the Snowy Mountains.

It is advised that controls be put in place during construction activities to prevent the accidental introduction of soil borne and plant pathogens and Chytridiomycosis (e.g. foot baths and vehicle wash down). In addition, implementation of a pest management program will prevent the spread of Sarcoptic Mange.

6.2.5 Pollution and waste

Activities associated with trail construction and use increase the risk of pollution to sensitive receiving environments. Pollution may take the form of:

- Water and/or soil pollution via oil or petrol leaks from vehicles, plant and equipment.
- Dumping of general rubbish and waste discarded during construction and post construction by park visitors.
- Dumping of construction materials.
- Noise pollution associated with construction and increased visitor use of newly formed trails.

Risk of pollution incidents can be avoided, minimised or mitigated by ensuring appropriate controls are used as per Section 11.6 of the Kosciuszko National Parks Plan of Management (NPWS 2006). The project Site Environmental Management Plan will also need to address this risk and be consistent with the conditions of any regulatory approvals or mitigation measures stated in the REF.

6.3 Slope and erosion

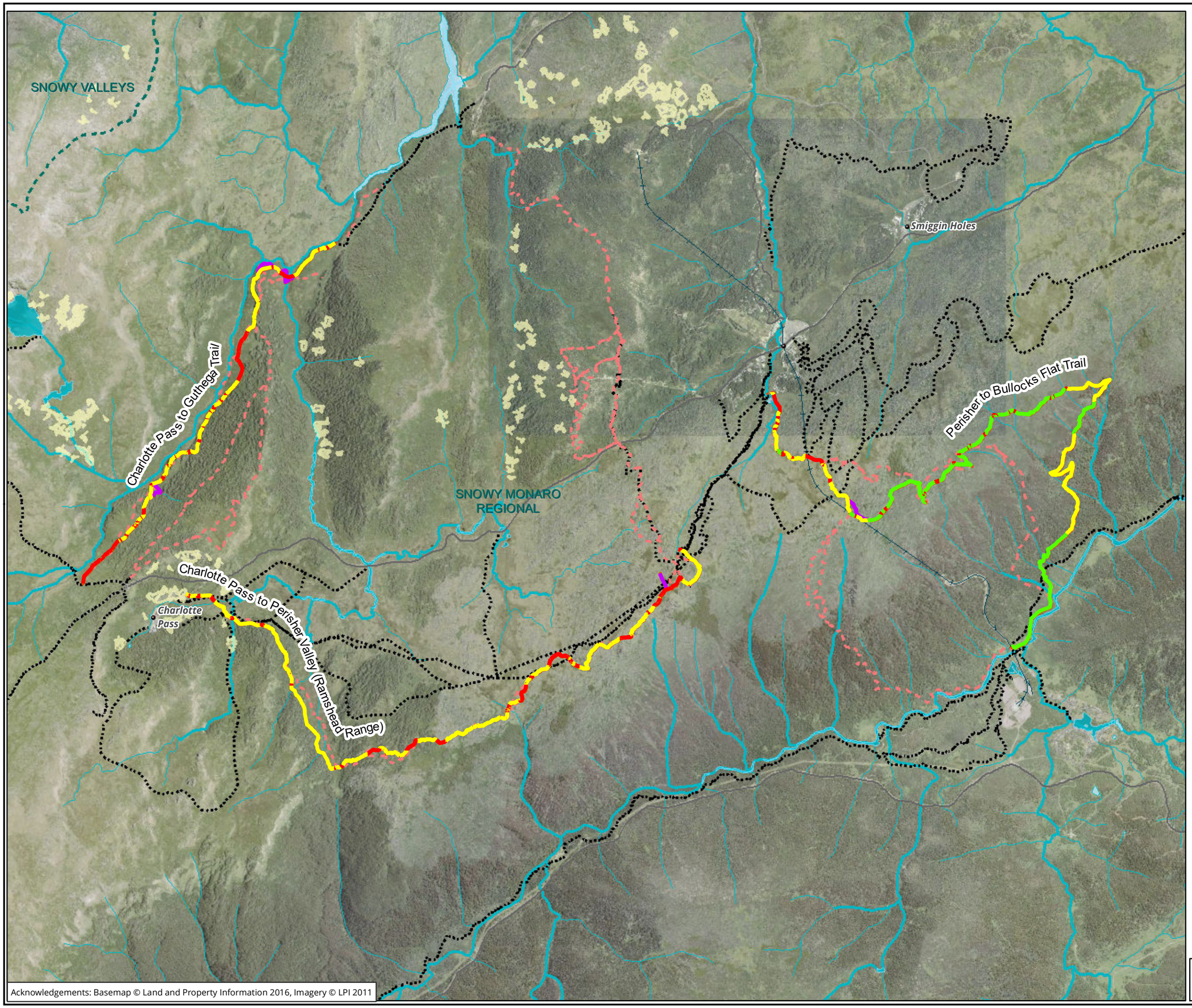
The majority of the study area is covered in dense vegetation and no signs of severe erosion were observed. Minor areas of sheet and rill erosion and track trenching and braiding was observed in the vicinity of established trails and roadside edges, mainly along the Illawong Walk at the northern extent of the Charlotte Pass to Guthega trail.

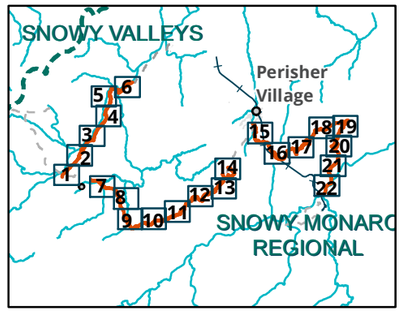
Rill and gully erosion was observed along the banks of the Snowy River, Thredbo River and Spencers Creek. Limited patches of rill and gully erosion were evident along ephemeral drainage lines on the steep upper slopes of the Perisher Valley to Bullocks Flat trail.

Pedestrian use of existing trails is contributing to this erosion via soil compaction and disturbance preventing establishment of vegetation, in addition to trail widening, trenching and braiding (NPWS 2016). The proposed use of elevated structures to create raised walking trails, and paving with rock in some areas, is expected to

mitigate and minimise risk of worsening erosion in sensitive areas and will improve current erosion by removing the source of disturbance.

The slope along the majority of all trail alignments varies between 0-15 percent. The steepest sections of track coincided with the upper reaches of ridgelines in the vicinity of summits along Guthrie Ridge, Ramsheads Range and the descent into the Thredbo River valley where slopes reached 15-20 percent.





Legend

- Study area
- Existing walking tracks
- Previous alignments
- Boulderfields 2014

Final alignments - construction type

- Elevated structure
- Natural surface
- Rock paving/ Pitched rock
- To be determined

Figure 4 Impacts and mitigation methods

0 400 800 1,200 1,600 2,000

Metres
Scale: 1:40,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55

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Location:P:\29200s\29243\Mapping
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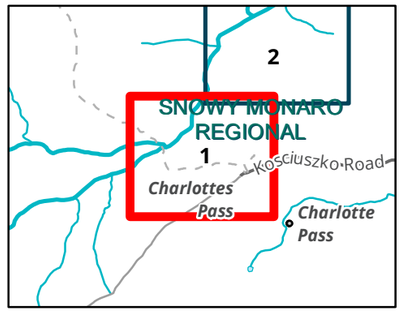

Legend

- Study area
- Existing walking tracks
- Trail realignment (Biosis)
- Previous alignments
- Contour

Final alignments - construction type

- Elevated structure
- Rock paving/ Pitched rock

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 641 Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion
- PCT 645 Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion

Figure 4.1 Impacts and mitigation methods - Charlotte Pass to Guthega Trail

0 30 60 90 120 150

Metres
Scale: 1:3,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55

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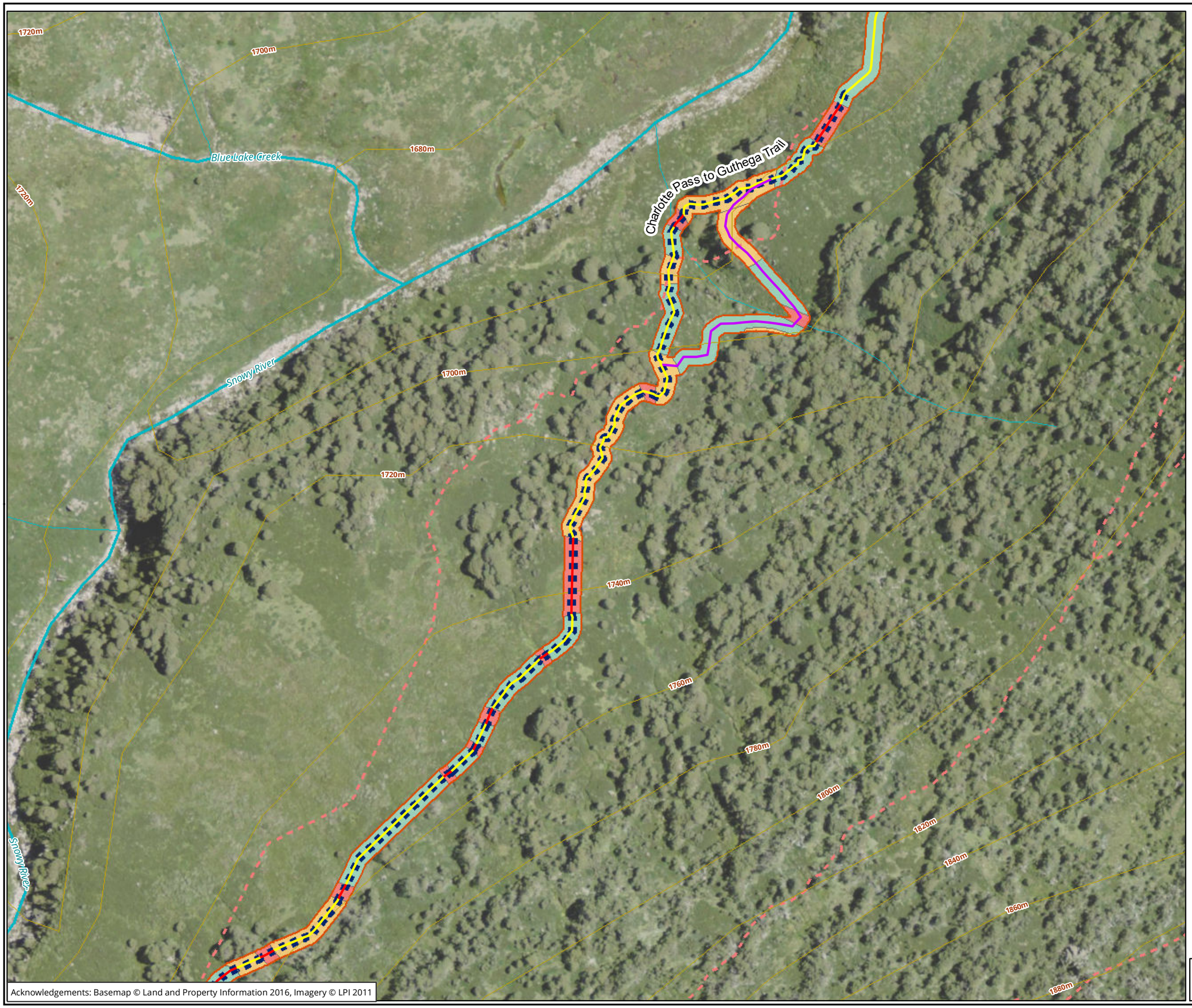

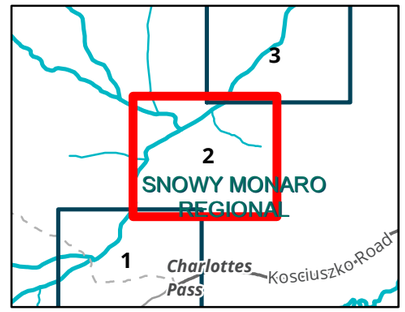

Legend

- Study area
- Trail realignment (Biosis)
- Previous alignments
- Contour

Final alignments - construction type

- Elevated structure
- Rock paving/ Pitched rock
- To be determined

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 641 Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion
- PCT 645 Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion

Figure 4.2 Impacts and mitigation methods - Charlotte Pass to Guthega Trail

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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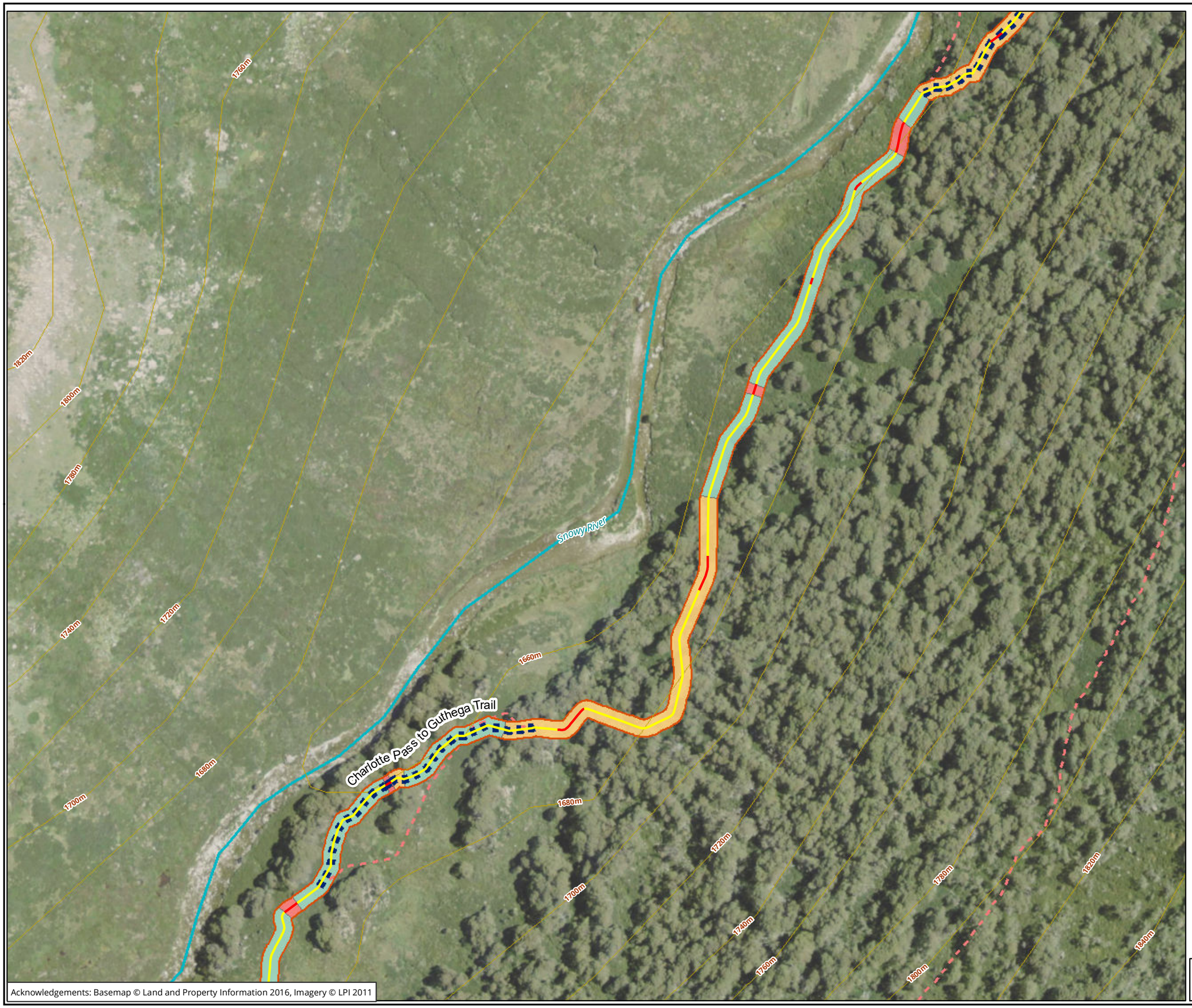

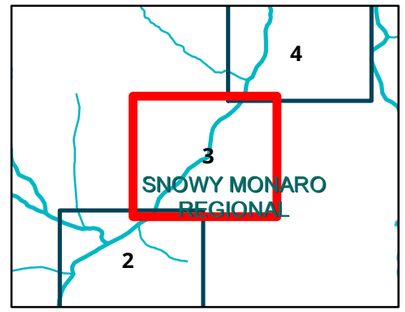

Legend

- Study area
- Trail realignment (Biosis)
- Previous alignments
- Contour

Final alignments - construction type

- Elevated structure
- Rock paving/ Pitched rock

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 641 Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion
- PCT 645 Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion

Figure 4.3 Impacts and mitigation methods - Charlotte Pass to Guthega Trail

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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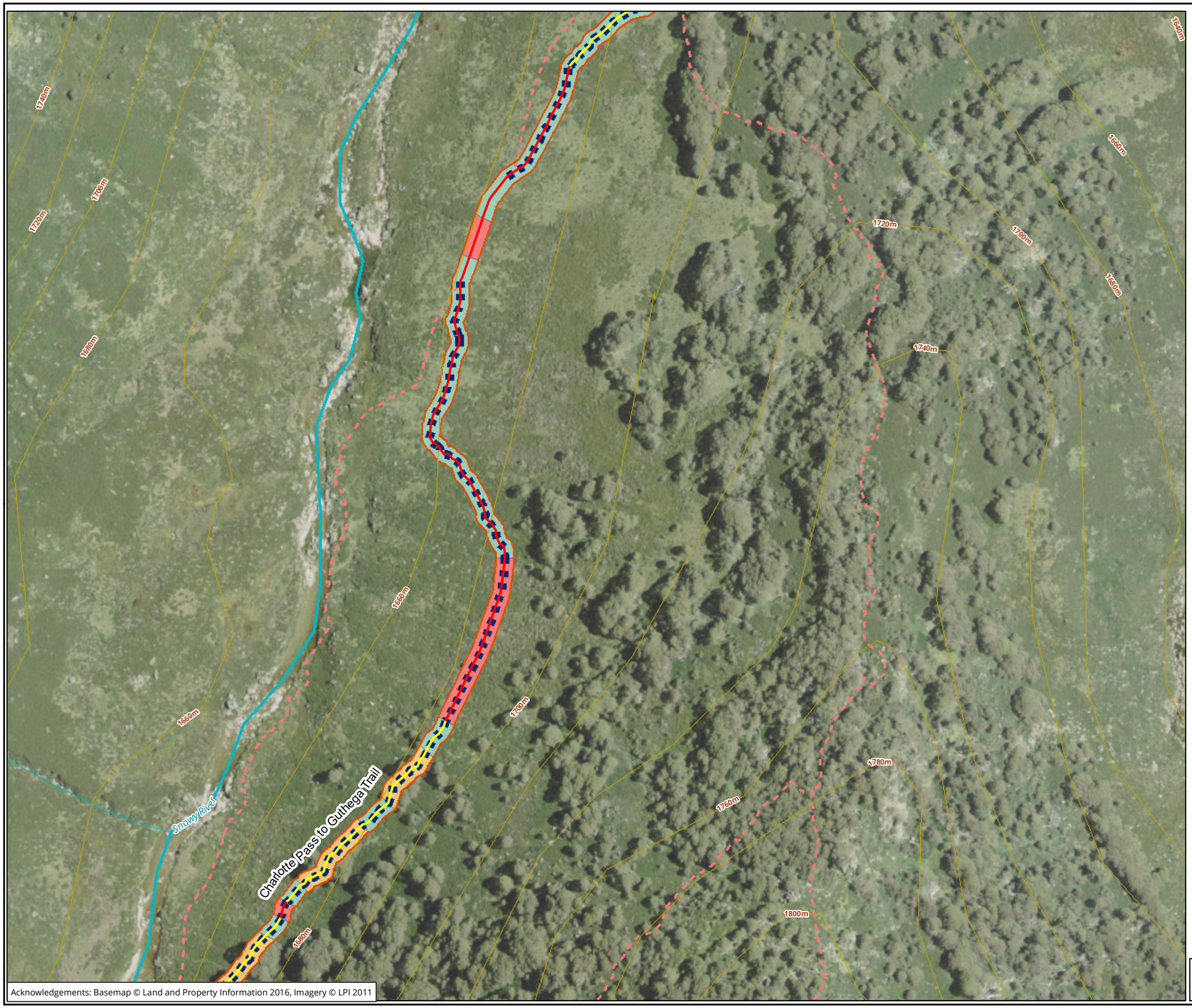

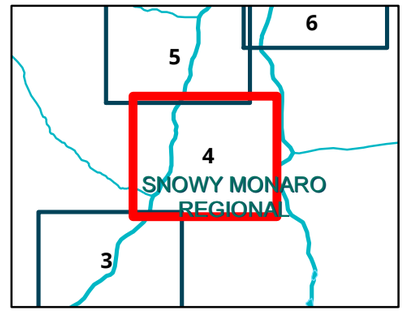

Legend

- Study area
- Trail realignment (Biosis)
- Previous alignments
- Contour

Final alignments - construction type

- Elevated structure
- Rock paving/ Pitched rock

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 641 Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion
- PCT 645 Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion

Figure 4.4 Impacts and mitigation methods - Charlotte Pass to Guthega Trail

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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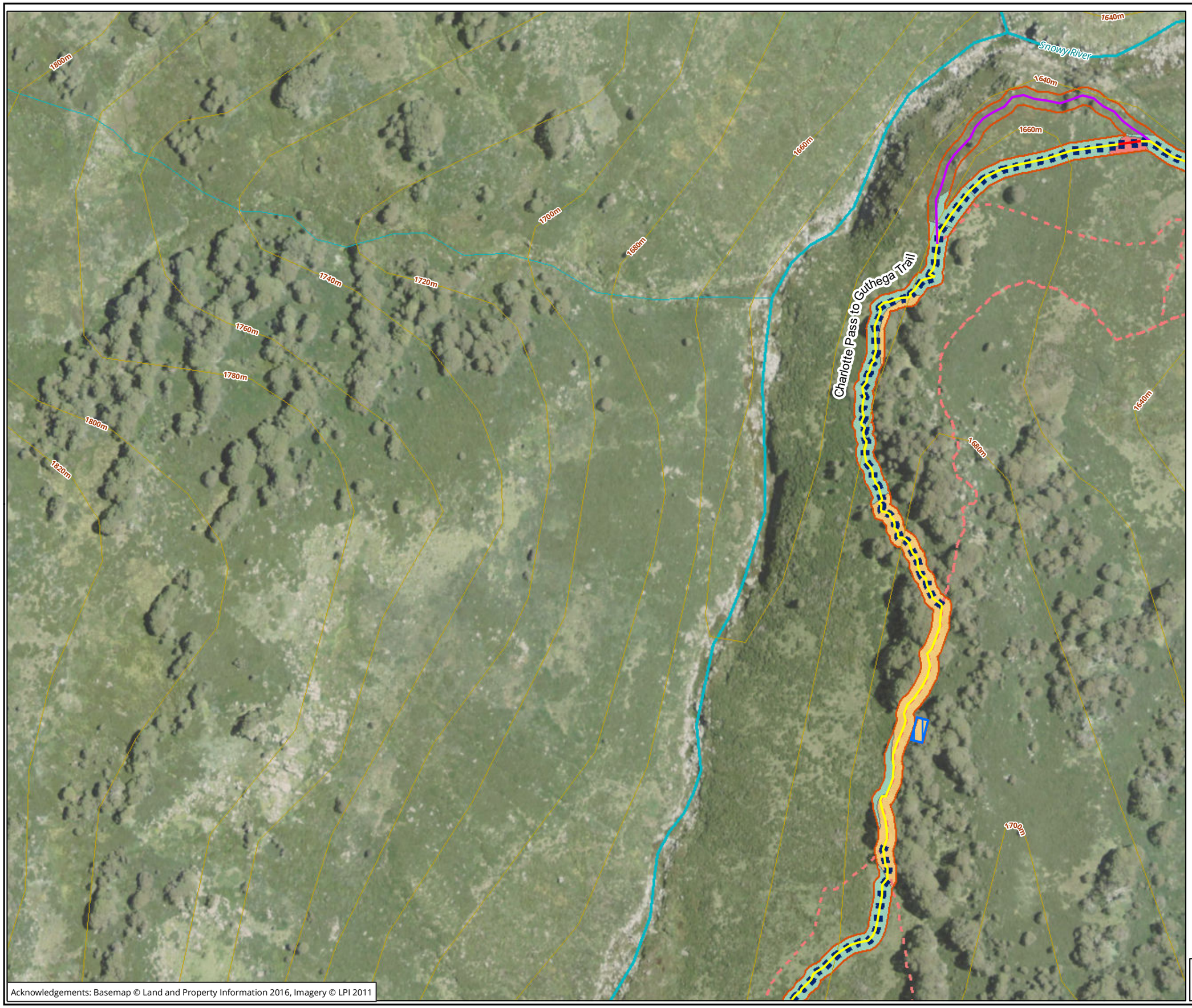

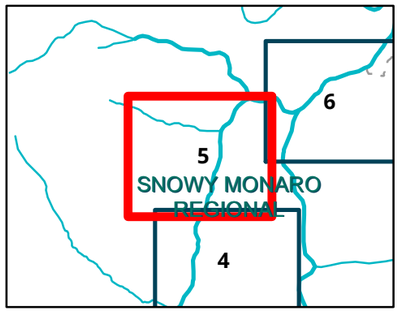

Legend

- Study area
- Proposed camp site
- Trail realignment (Biosis)
- Previous alignments
- Contour

Final alignments - construction type

- Elevated structure
- Rock paving/ Pitched rock
- To be determined

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 641 Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion
- PCT 645 Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion

Figure 4.5 Impacts and mitigation methods - Charlotte Pass to Guthega Trail

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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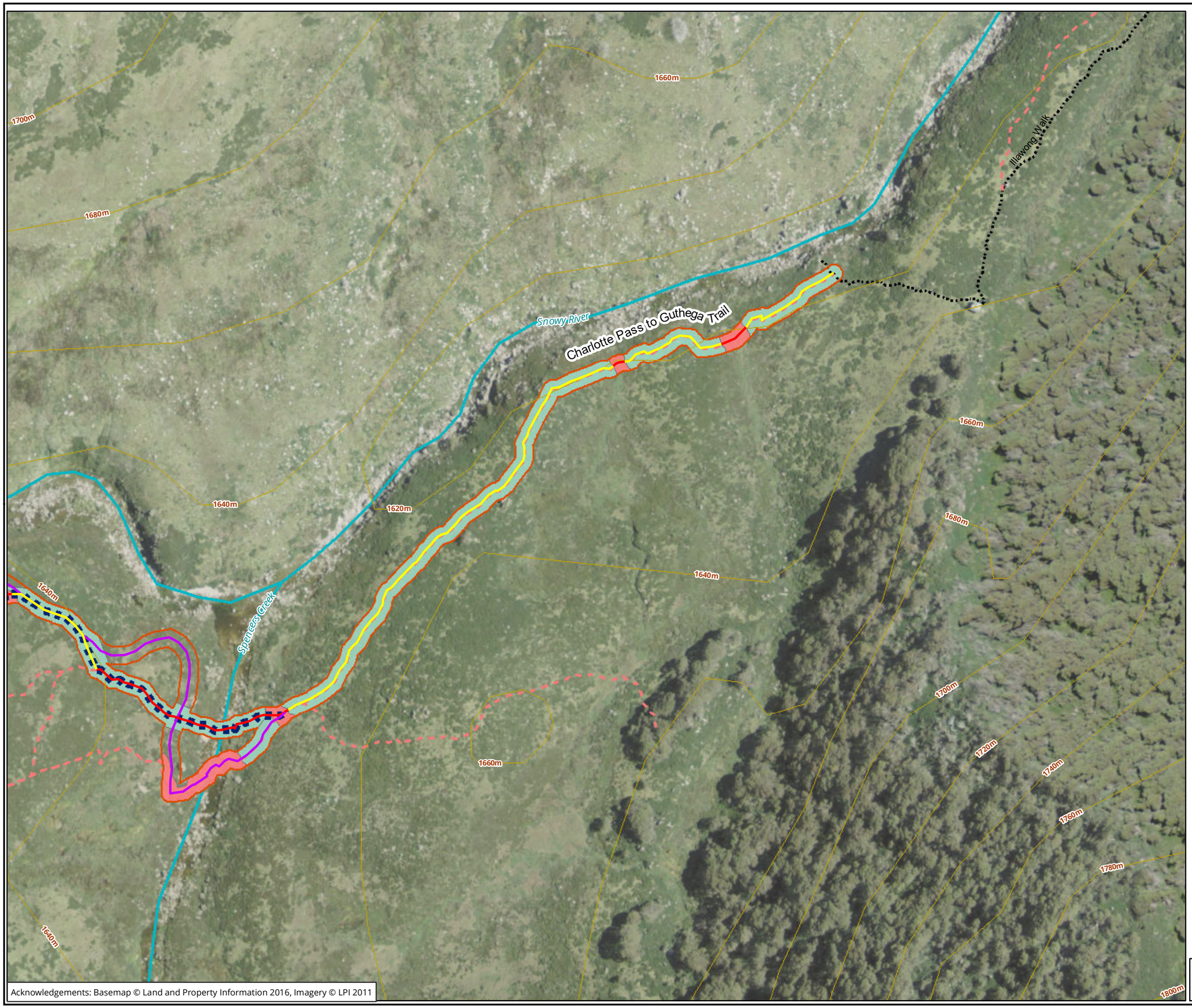

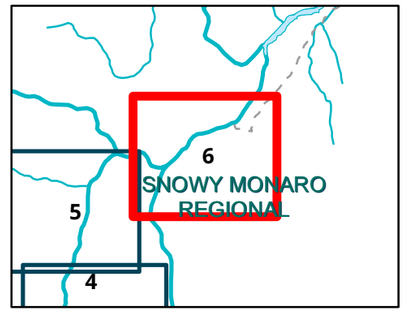

Legend

- Study area
- Existing walking tracks
- Trail realignment (Biosis)
- Previous alignments
- Contour

Final alignments - construction type

- Elevated structure
- Rock paving/ Pitched rock
- To be determined

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 641 Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion

Figure 4.6 Impacts and mitigation methods - Charlotte Pass to Guthega Trail

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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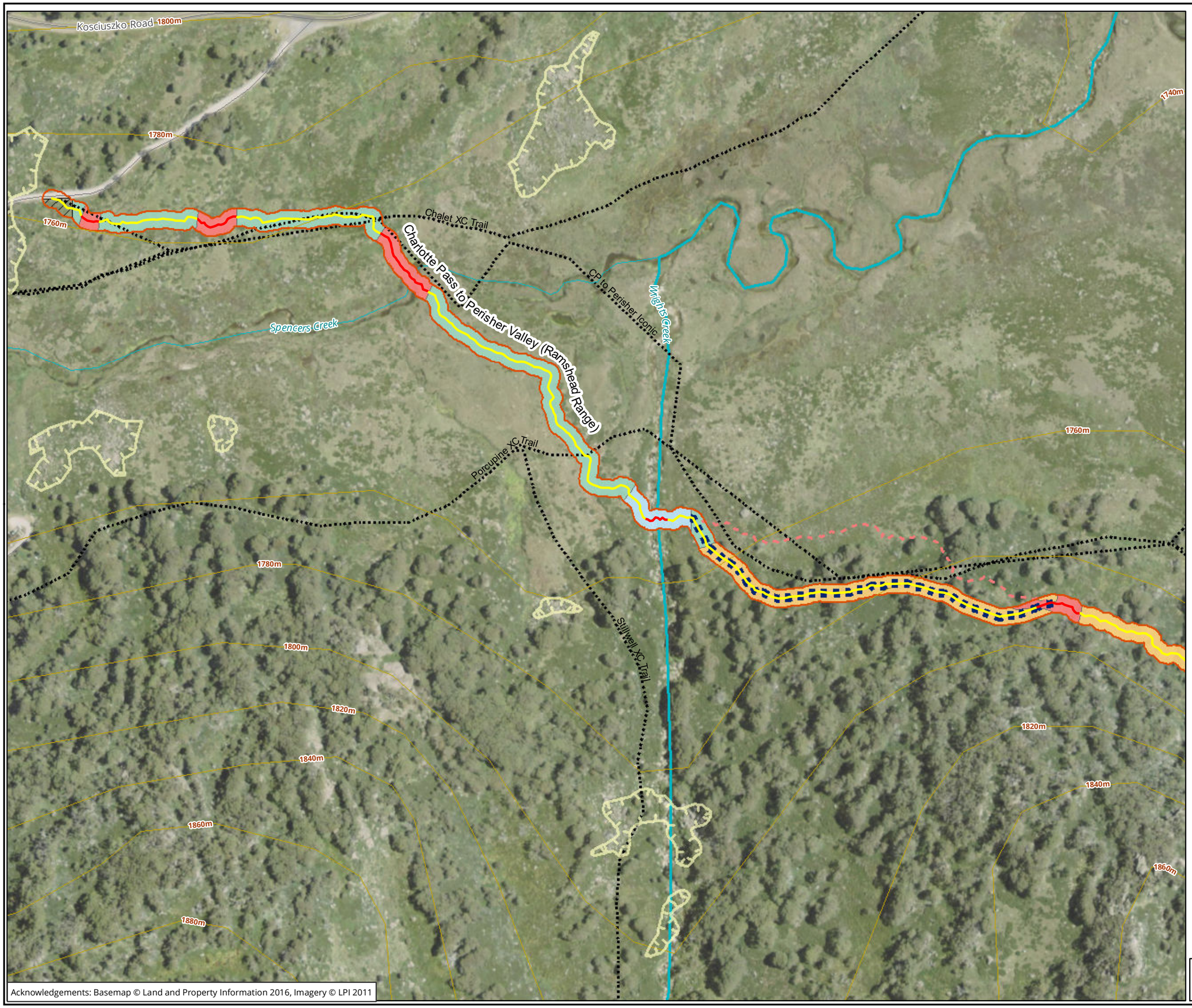

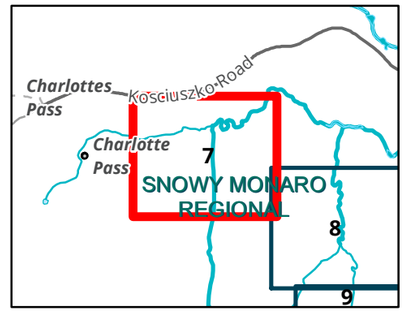

Legend

- Study area
- Existing walking tracks
- Trail realignment (Biosis)
- Previous alignments
- Contour
- Boulderfields 2014

Final alignments - construction type

- Elevated structure
- Rock paving/ Pitched rock

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 641 Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion
- PCT 643 Alpine shrubland on scree, blockstreams and rocky sites of high altitude areas of Kosciuszko National Park, Australian Alps Bioregion
- PCT 645 Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion
- Non-native vegetation / disturbed area

Figure 4.7 Impacts and mitigation methods - Charlotte Pass to Perisher Valley (Ramshead Range)

0 30 60 90 120 150

Metres
Scale: 1:3,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55

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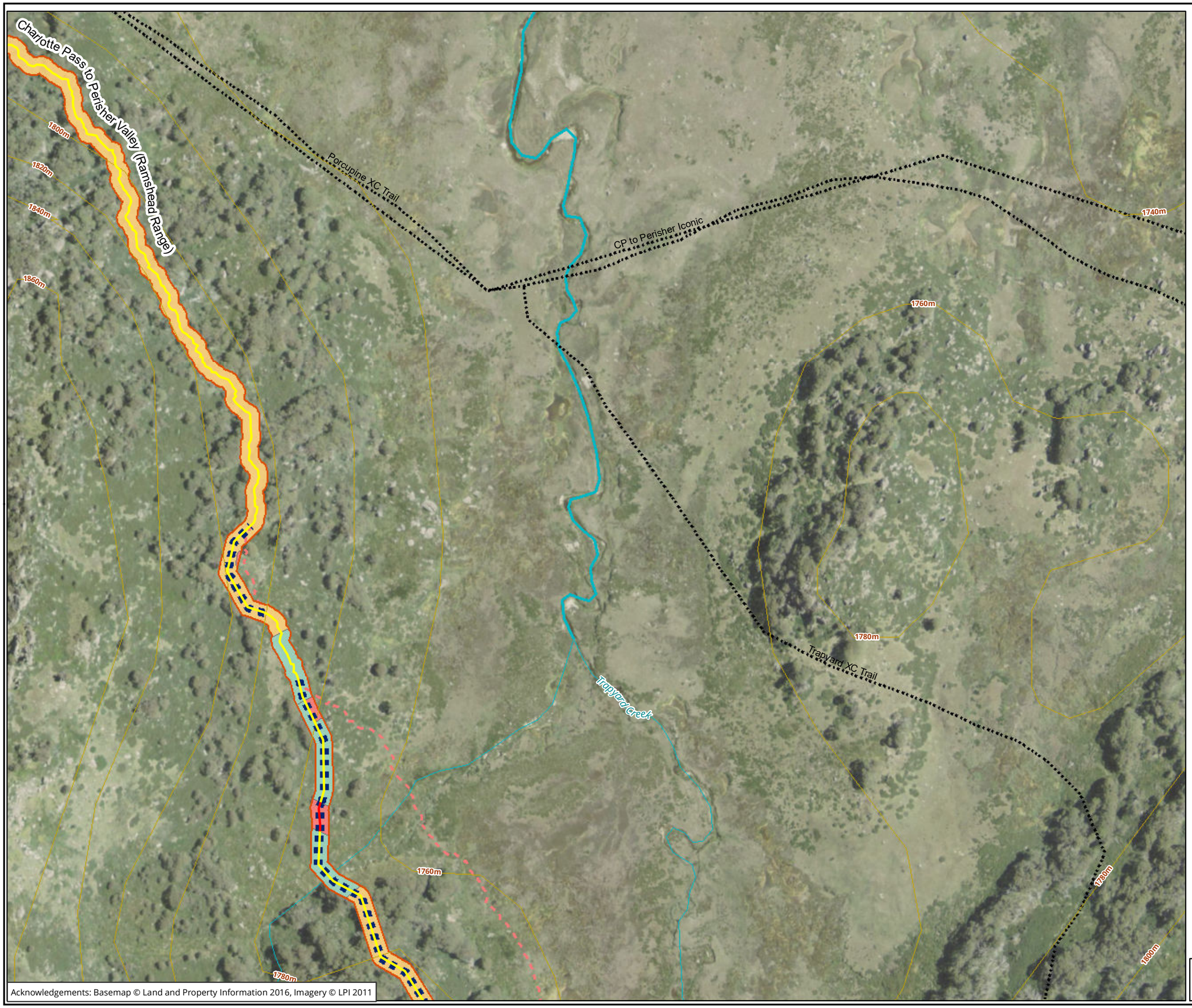

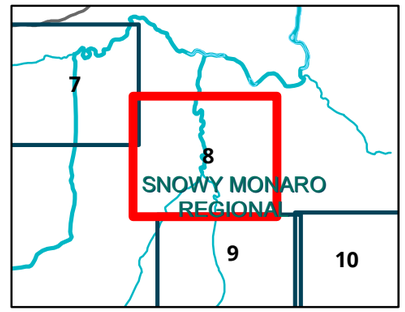

Legend

- Study area
- Existing walking tracks
- Trail realignment (Biosis)
- Previous alignments
- Contour

Final alignments - construction type

- Elevated structure
- Rock paving/ Pitched rock

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 641 Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion
- PCT 645 Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion

Figure 4.8 Impacts and mitigation methods - Charlotte Pass to Perisher Valley (Ramshead Range)

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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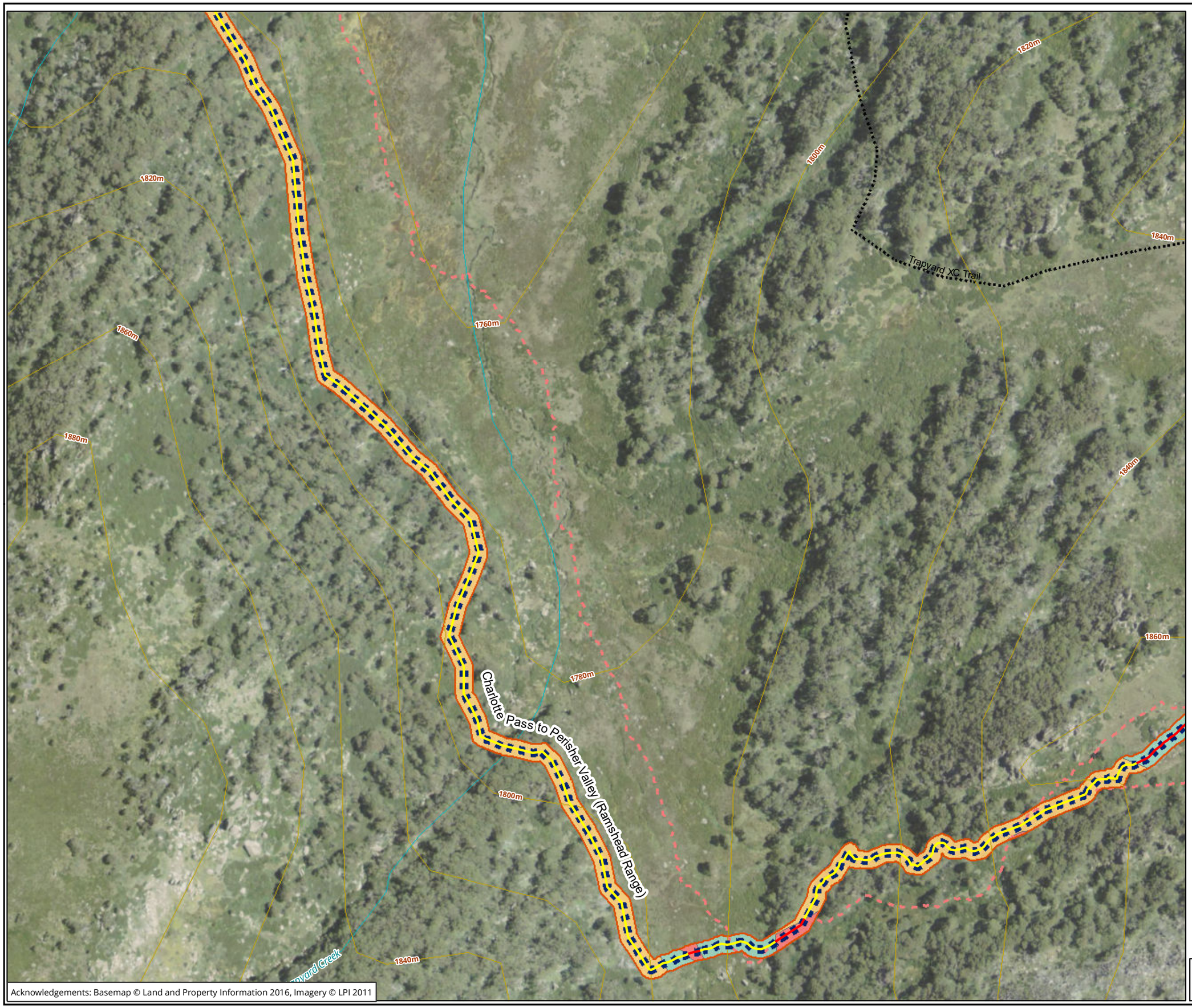
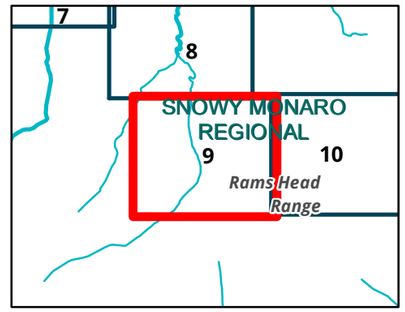
29243_FFA_F4 Impacts_Mitigation_detail





Legend

- Study area
- Existing walking tracks
- Trail realignment (Biosis)
- Previous alignments
- Contour

Final alignments - construction type

- Elevated structure
- Rock paving/ Pitched rock

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 641 Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion
- PCT 645 Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion

Figure 4.9 Impacts and mitigation methods - Charlotte Pass to Perisher Valley (Ramshead Range)

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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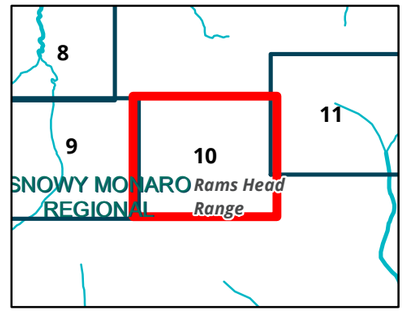

Legend

- Study area
- Existing walking tracks
- Trail realignment (Biosis)
- Previous alignments
- Contour

Final alignments - construction type

- Elevated structure
- Rock paving/ Pitched rock

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 641 Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion
- PCT 643 Alpine shrubland on scree, blockstreams and rocky sites of high altitude areas of Kosciuszko National Park, Australian Alps Bioregion
- PCT 645 Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion

Figure 4.10 Impacts and mitigation methods - Charlotte Pass to Perisher Valley

0 30 60 90 120 150

Metres
Scale: 1:3,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55

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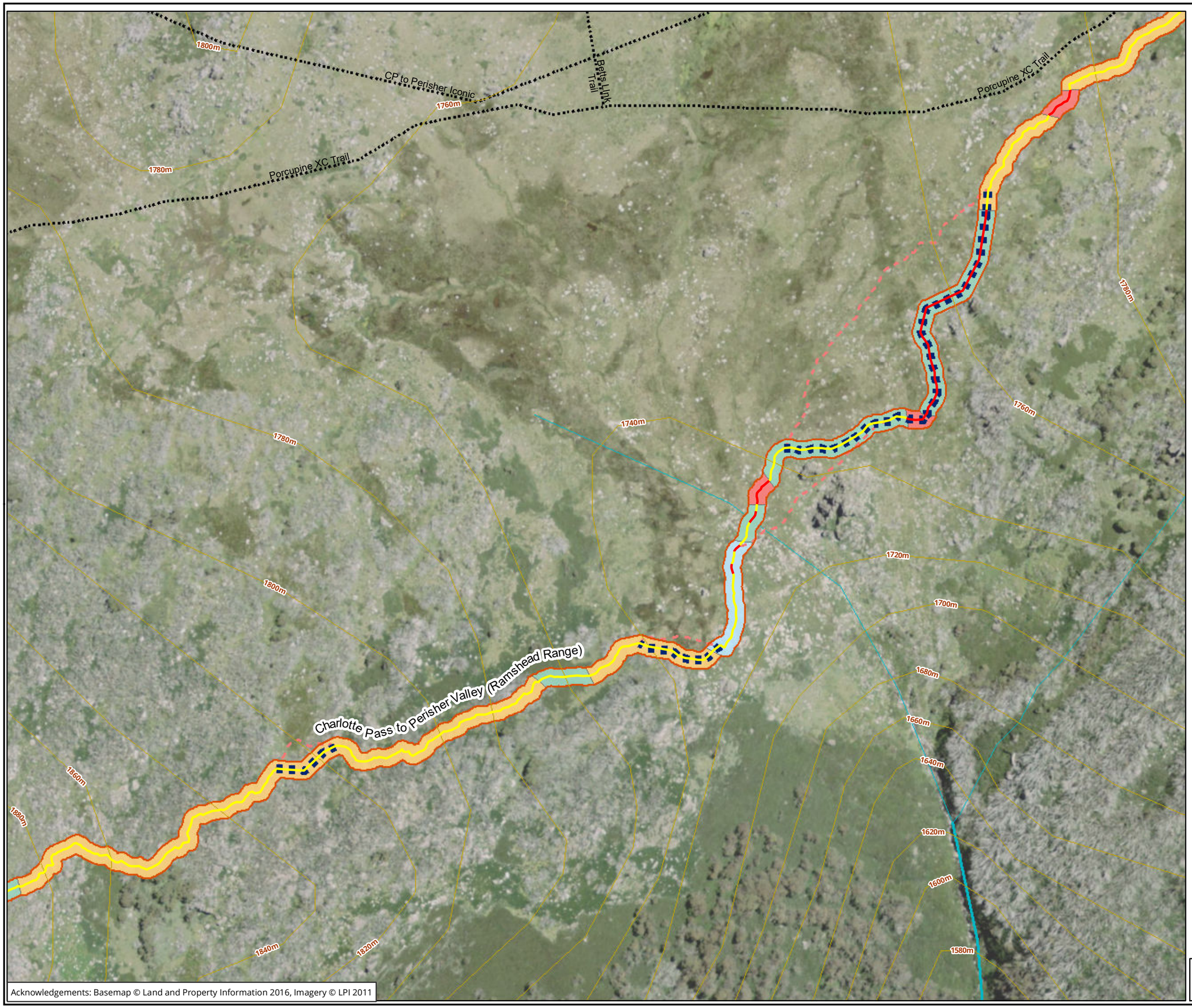

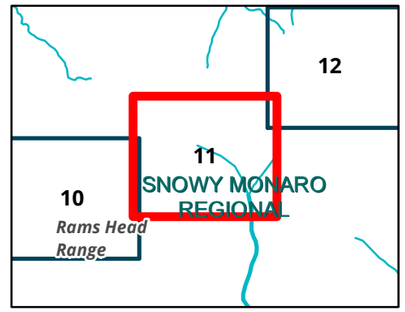

Legend

- Study area
- Existing walking tracks
- Trail realignment (Biosis)
- Previous alignments
- Contour

Final alignments - construction type

- Elevated structure
- Rock paving/ Pitched rock

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 641 Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion
- PCT 643 Alpine shrubland on scree, blockstreams and rocky sites of high altitude areas of Kosciuszko National Park, Australian Alps Bioregion
- PCT 645 Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion

Figure 4.11 Impacts and mitigation methods - Charlotte Pass to Perisher Valley

0 30 60 90 120 150

Metres
Scale: 1:3,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55

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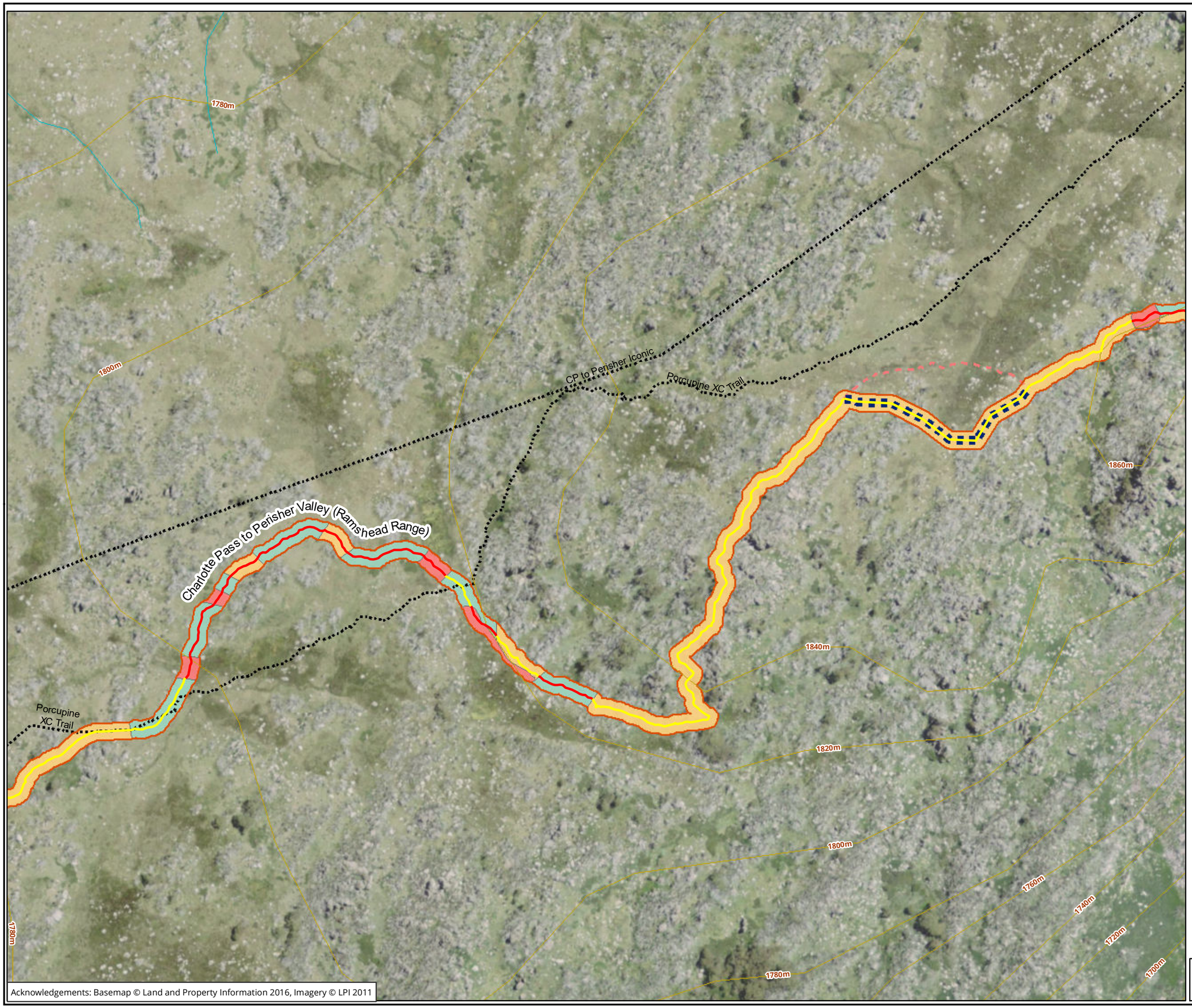
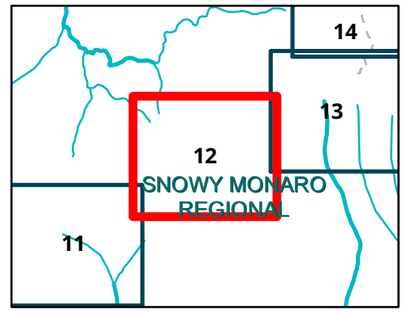
Location:P:\29200s\29243\Mapping
29243_FFA_F4 Impacts_Mitigation_detail





Legend

- Study area
- Existing walking tracks
- Trail realignment (Biosis)
- Previous alignments
- Contour

Final alignments - construction type

- Elevated structure
- Rock paving/ Pitched rock

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 641 Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion
- PCT 645 Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion

Figure 4.12 Impacts and mitigation methods - Charlotte Pass to Perisher Valley

0 30 60 90 120 150

Metres
Scale: 1:3,000 @ A3
Coordinate System: GDA 1994 MGA Zone 55

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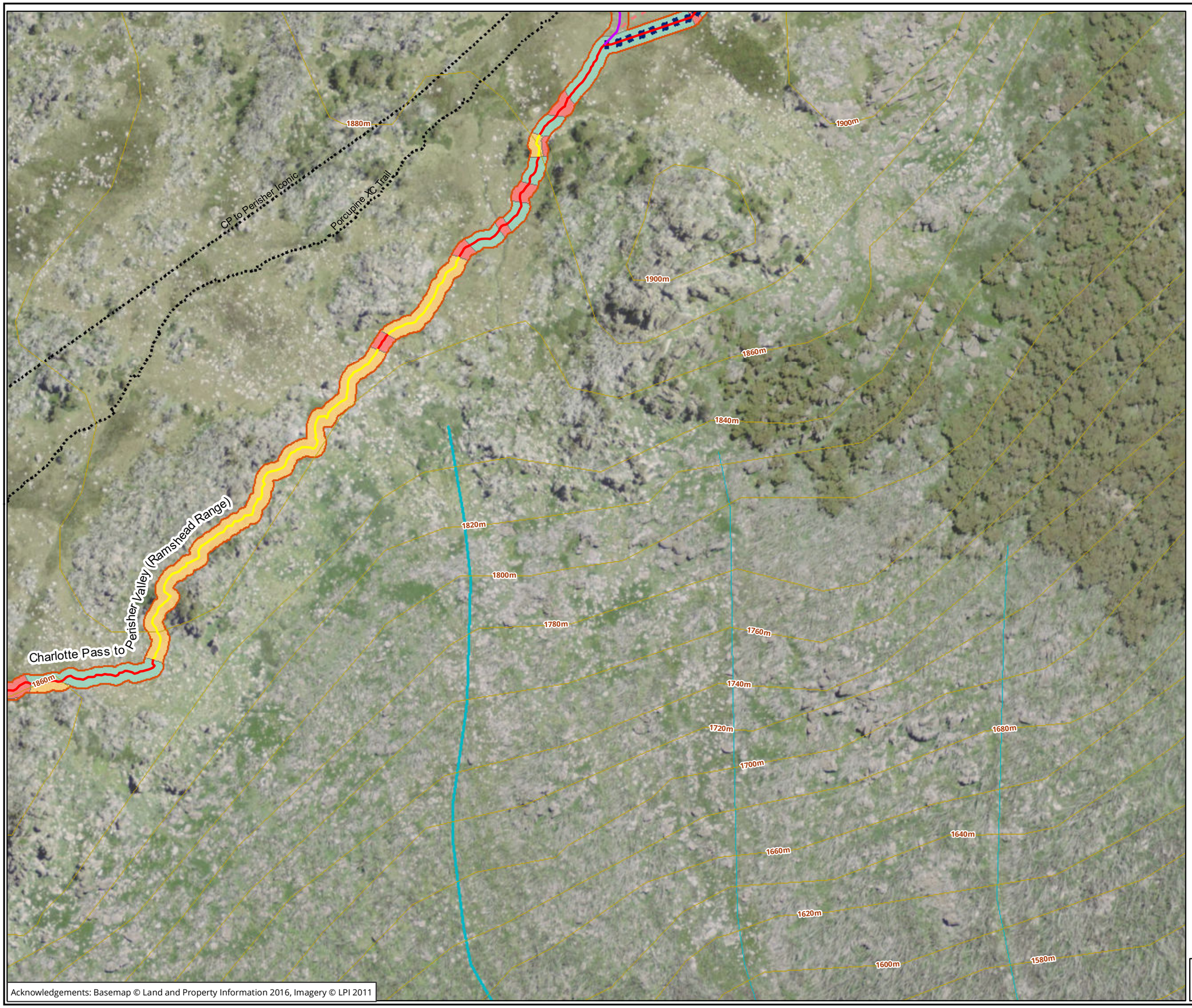

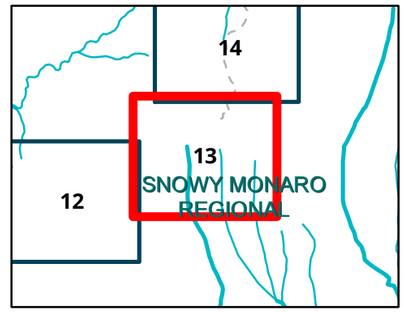

Legend

- Study area
- Existing walking tracks
- Trail realignment (Biosis)
- Previous alignments
- Contour

Final alignments - construction type

- Elevated structure
- Rock paving/ Pitched rock
- To be determined

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 641 Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion
- PCT 645 Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion

Figure 4.13 Impacts and mitigation methods - Charlotte Pass to Perisher Valley

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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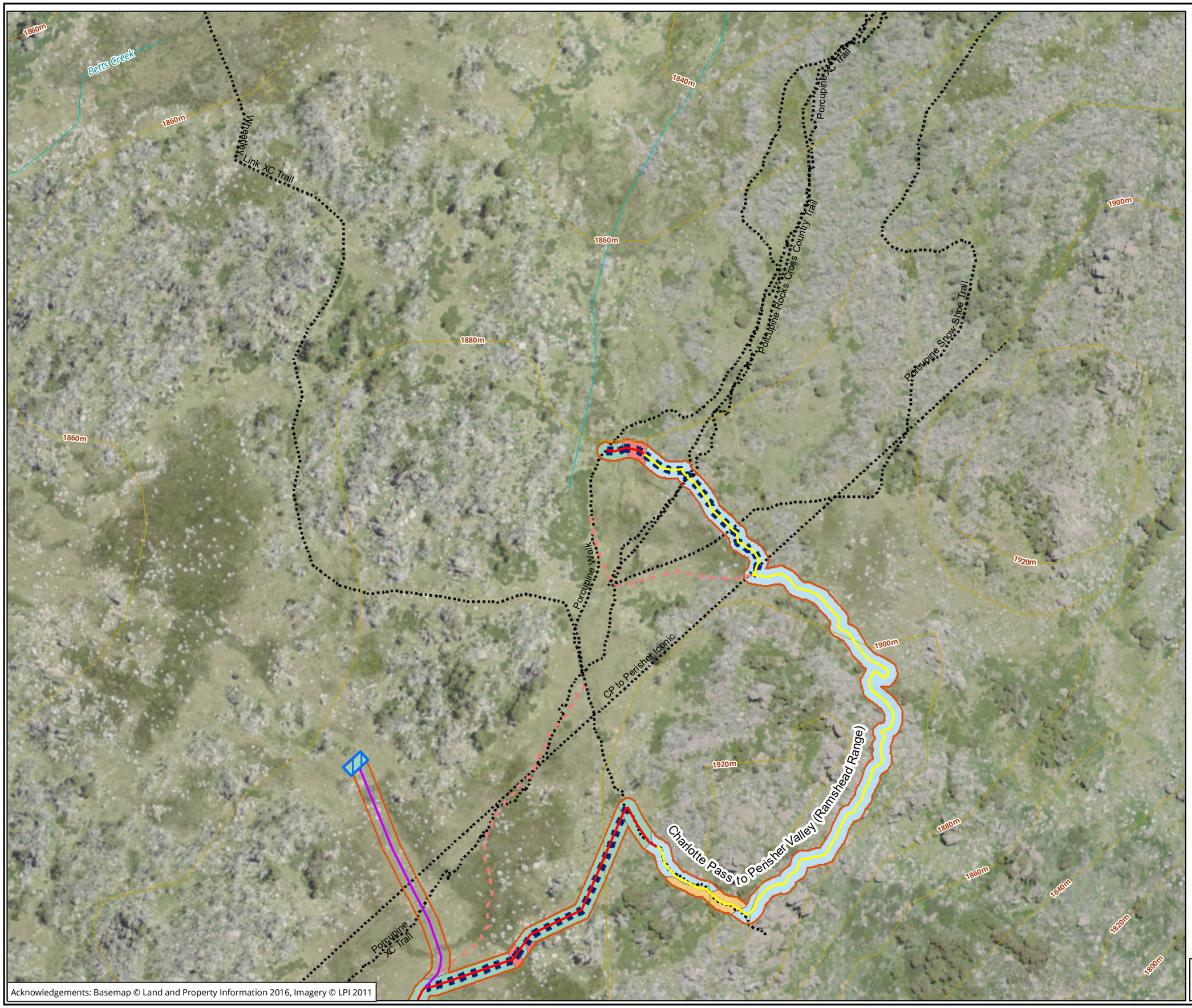

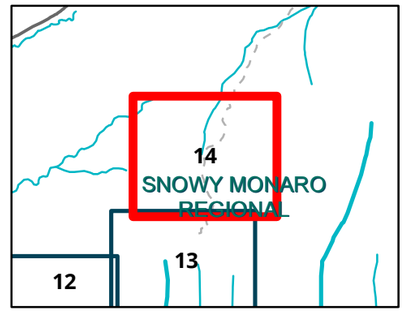

Legend

- Study area
- Proposed camp site
- Existing walking tracks
- Trail realignment (Biosis)
- Previous alignments
- Contour

Final alignments - construction type

- Elevated structure
- Rock paving/ Pitched rock
- To be determined

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 641 Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion
- PCT 643 Alpine shrubland on scree, blockstreams and rocky sites of high altitude areas of Kosciuszko National Park, Australian Alps Bioregion
- PCT 645 Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion

Figure 4.14 Impacts and mitigation methods - Charlotte Pass to Perisher Valley

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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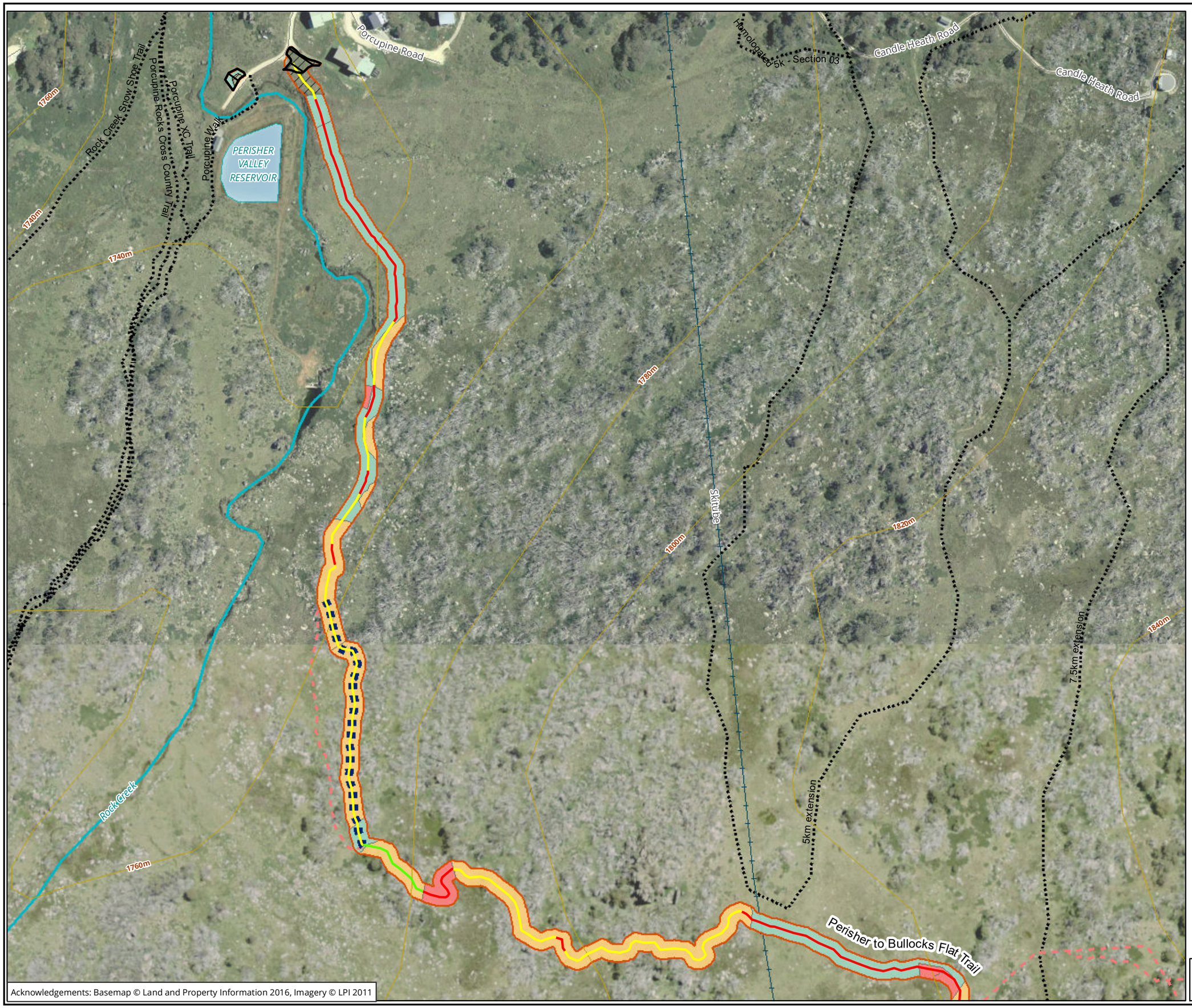

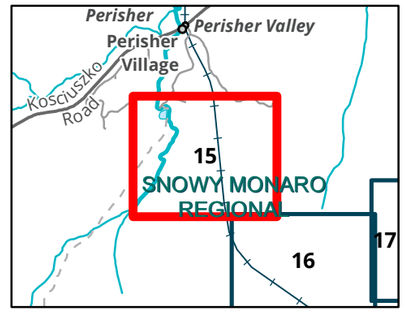

Legend

- Study area
- Proposed carpark extension
- Existing walking tracks
- Trail realignment (Biosis)
- Previous alignments
- Contour

Final alignments - construction type

- Elevated structure
- Natural surface
- Rock paving/ Pitched rock

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 641 Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion
- PCT 645 Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion
- Non-native vegetation / disturbed area

Figure 4.15 Impacts and mitigation methods - Perisher to Bullocks Flat Trail

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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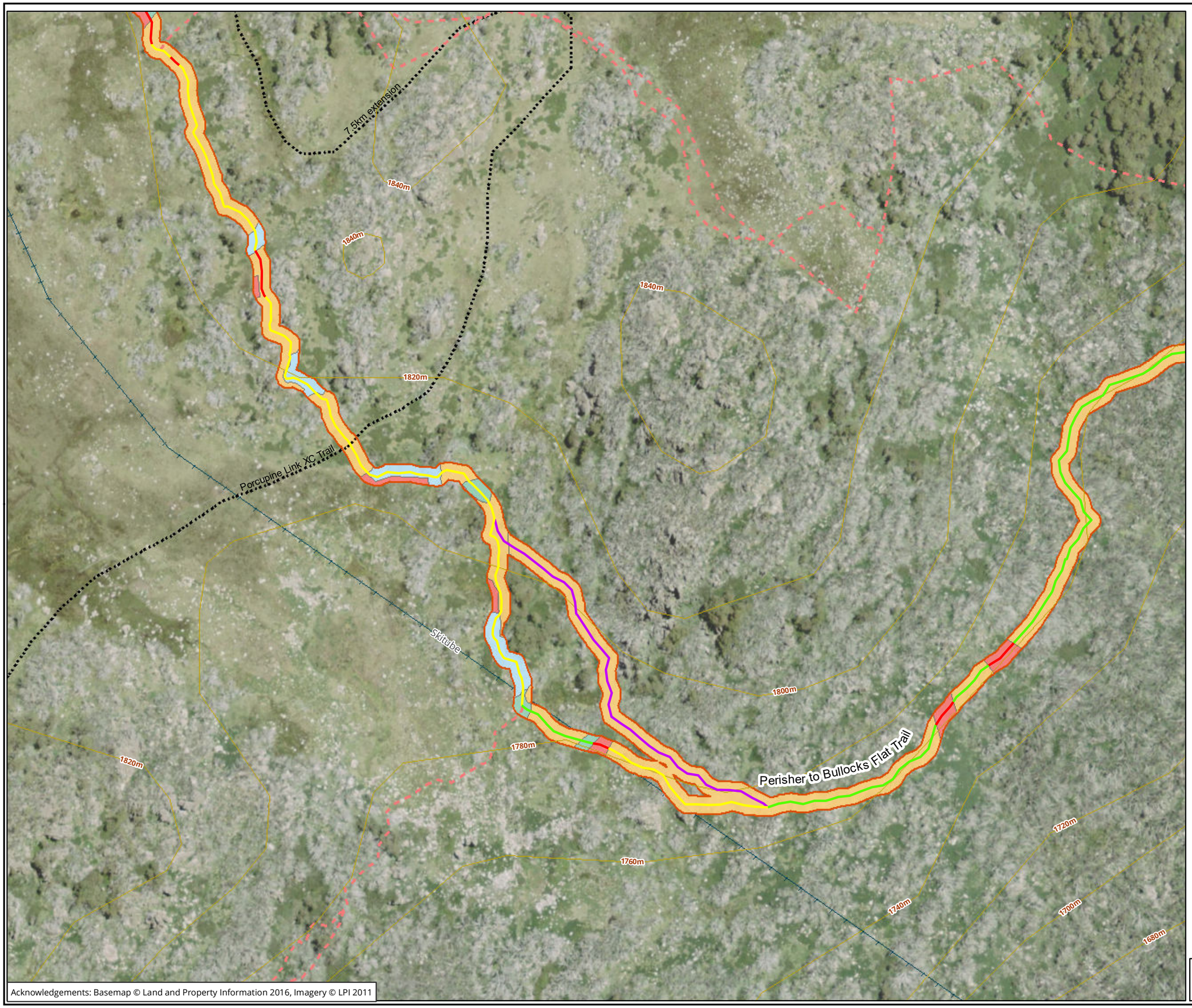

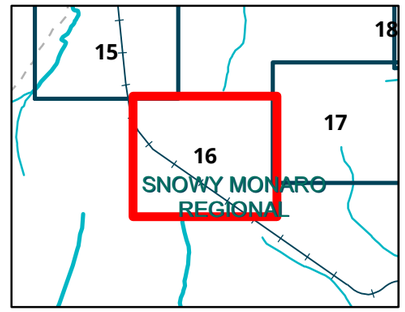

Legend

- Study area
- Existing walking tracks
- Previous alignments
- Contour

Final alignments - construction type

- Elevated structure
- Natural surface
- Rock paving/ Pitched rock
- To be determined

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 641 Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion
- PCT 643 Alpine shrubland on scree, blockstreams and rocky sites of high altitude areas of Kosciuszko National Park, Australian Alps Bioregion
- PCT 644 Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion
- PCT 645 Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion

Figure 4.16 Impacts and mitigation methods - Perisher to Bullocks Flat Trail

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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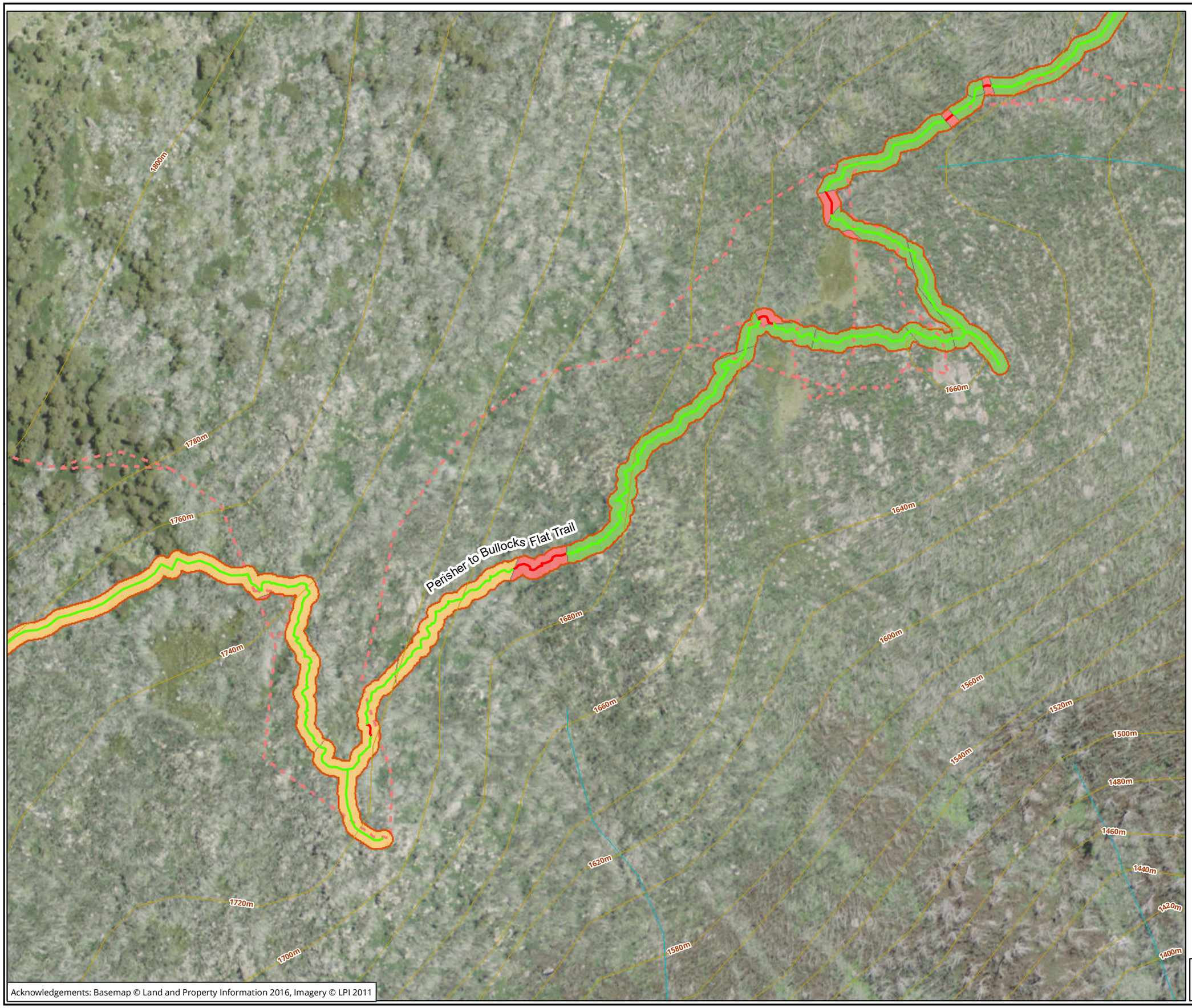

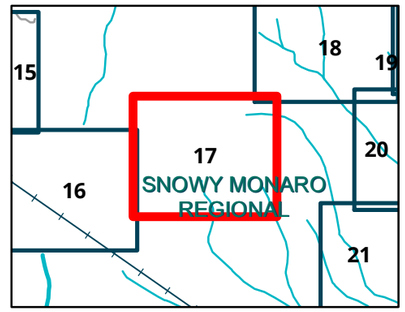

Legend

- Study area
- Previous alignments
- Contour

Final alignments - construction type

- Elevated structure
- Natural surface

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 644 Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion
- PCT 645 Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion

Figure 4.17 Impacts and mitigation methods - Perisher to Bullocks Flat Trail

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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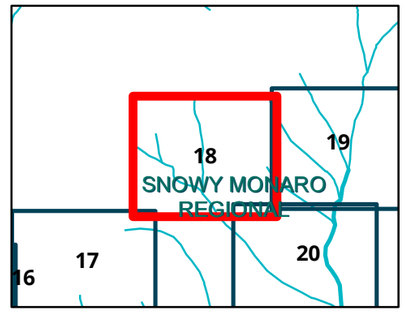

Legend

- Study area
- Contour

Final alignments - construction type

- Elevated structure
- Natural surface

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 644 Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion

Figure 4.18 Impacts and mitigation methods - Perisher to Bullocks Flat Trail

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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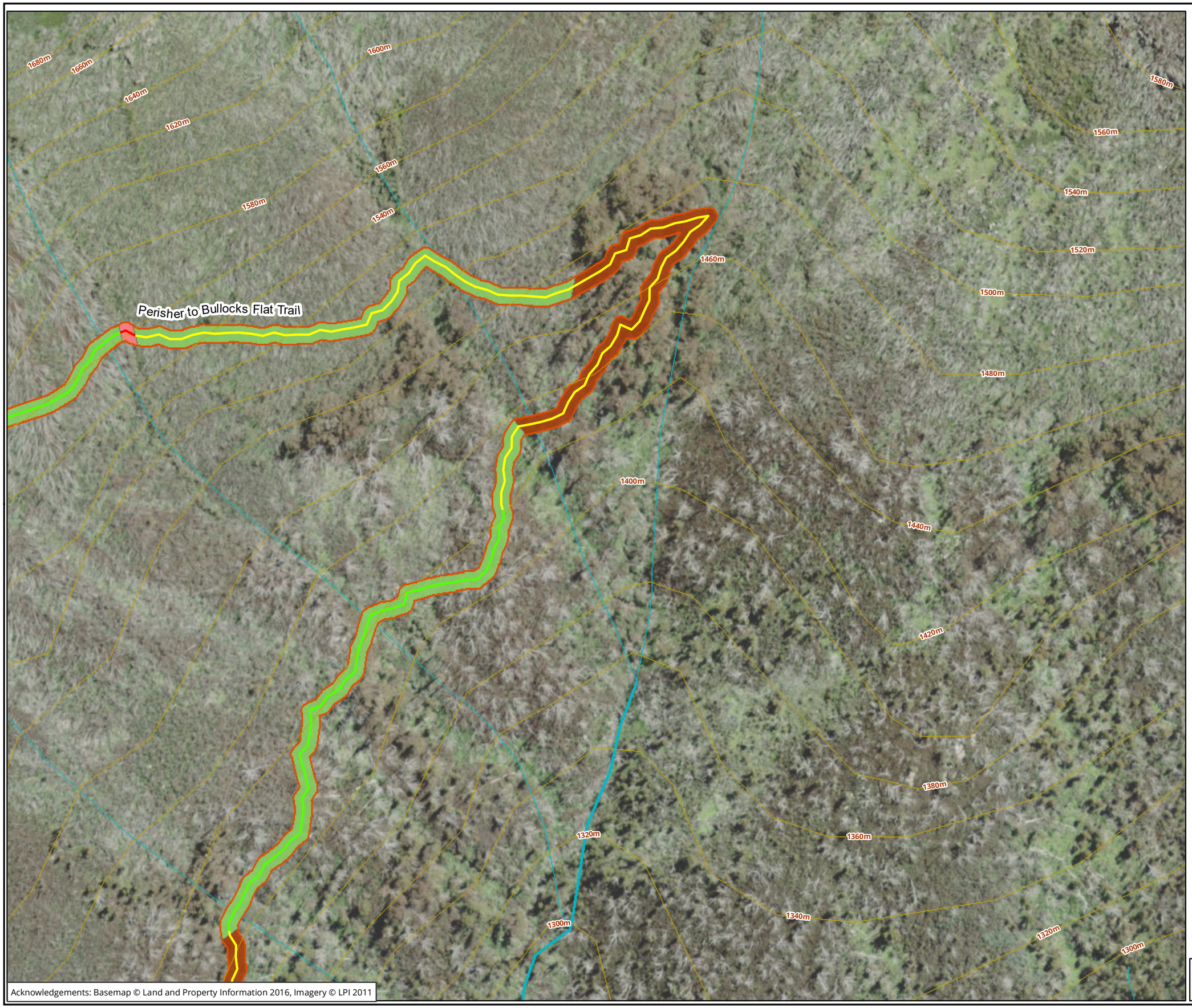

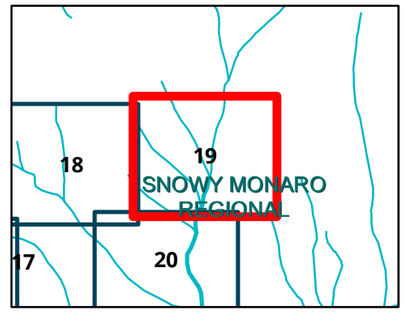

Legend

- Study area
- Contour

Final alignments - construction type

- Elevated structure
- Natural surface
- Rock paving/ Pitched rock

Plant Community Type

- PCT 637 Alpine Sphagnum Bogs EEC
- PCT 638 Alpine Ash - Mountain Gum moist shrubby tall open forest of montane areas, southern South Eastern Highlands Bioregion and Australian Alps Bioregion
- PCT 644 Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion

Figure 4.19 Impacts and mitigation methods - Perisher to Bullocks Flat Trail

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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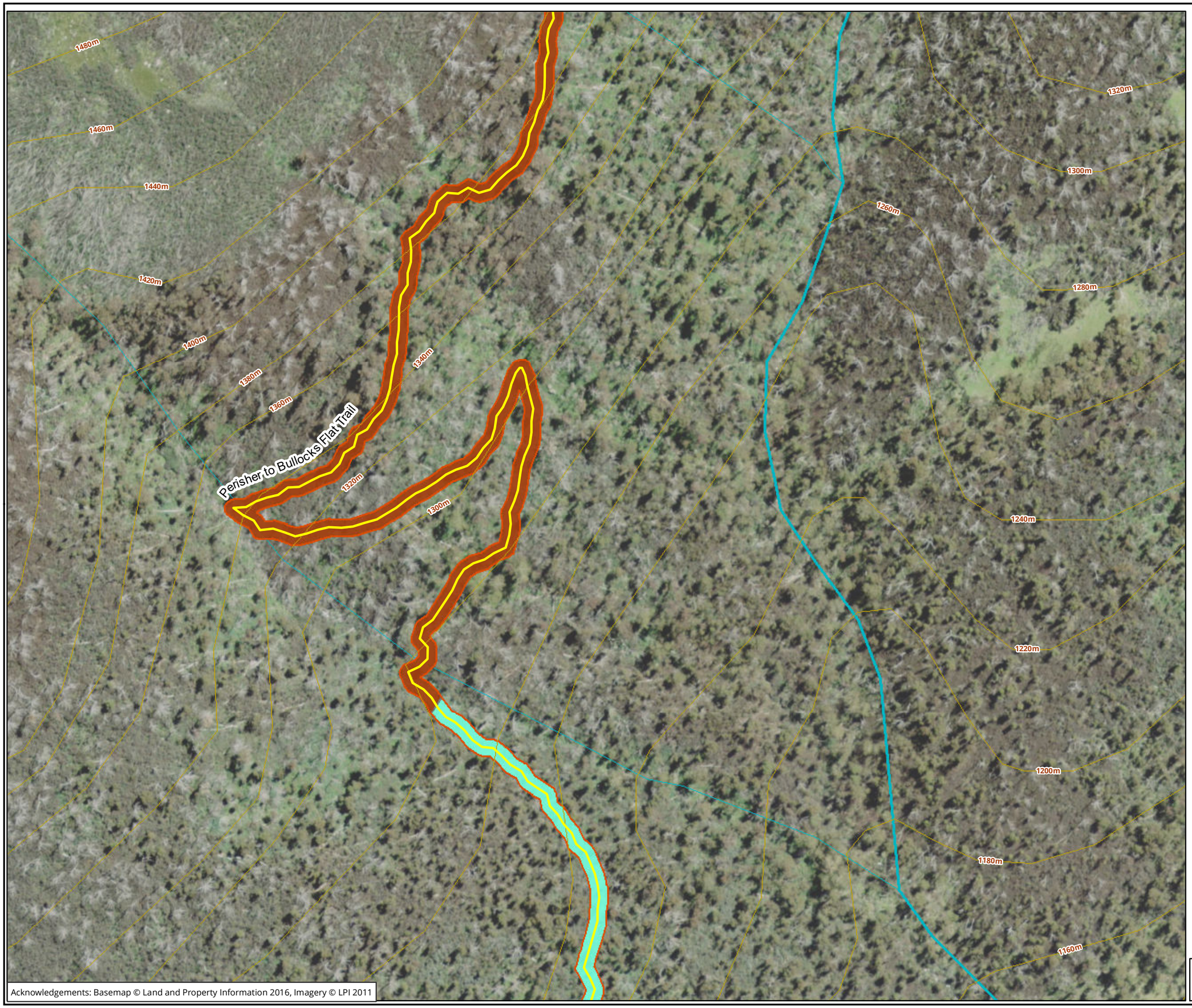

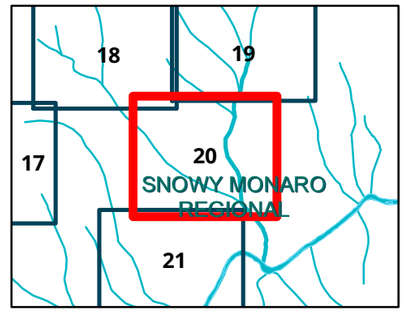

Legend

- Study area
- Contour

Final alignments - construction type

- Rock paving/ Pitched rock

Plant Community Type

- PCT 638 Alpine Ash - Mountain Gum moist shrubby tall open forest of montane areas, southern South Eastern Highlands Bioregion and Australian Alps Bioregion
- PCT 1196 Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion

Figure 4.20 Impacts and mitigation methods - Perisher to Bullocks Flat Trail

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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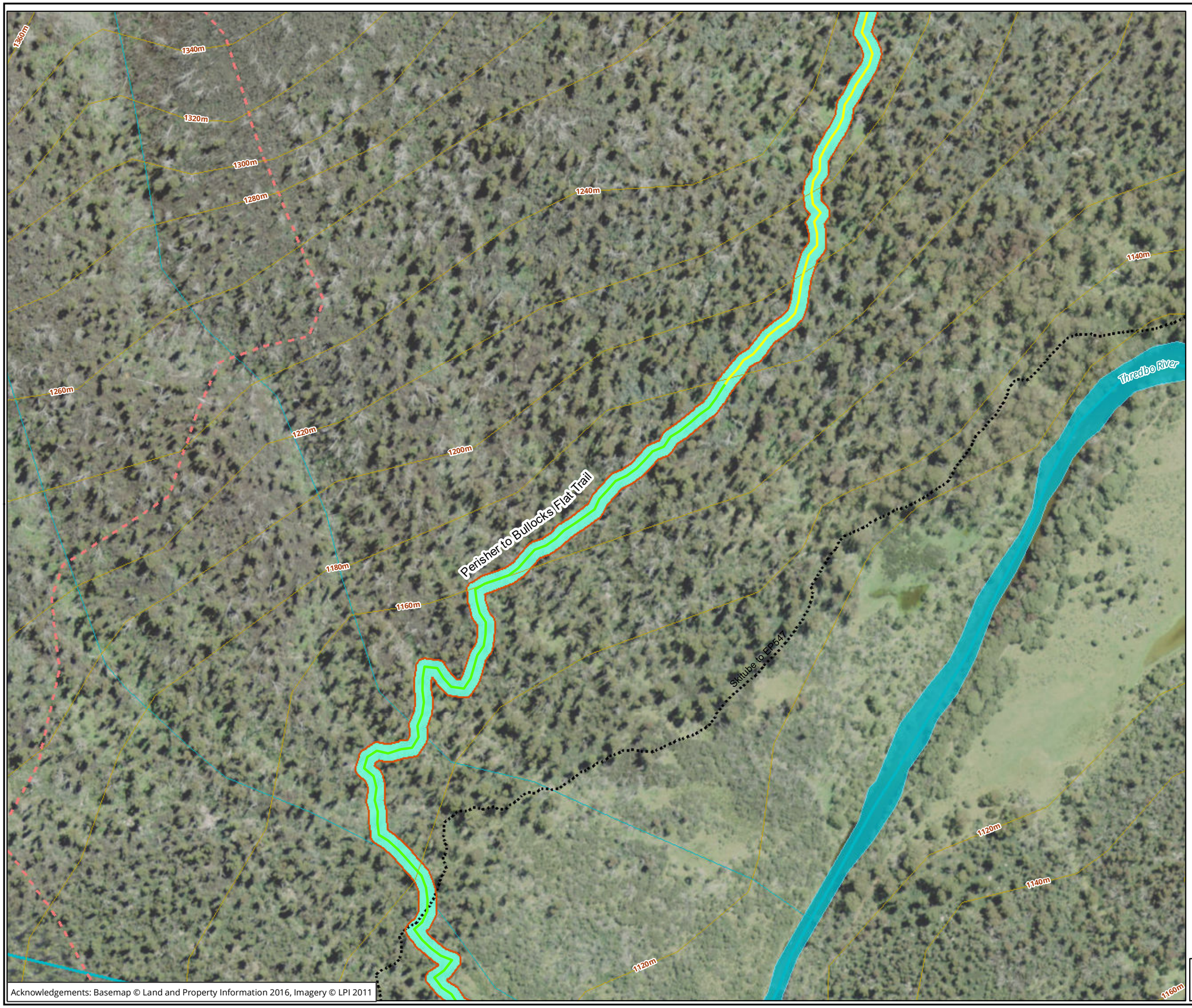

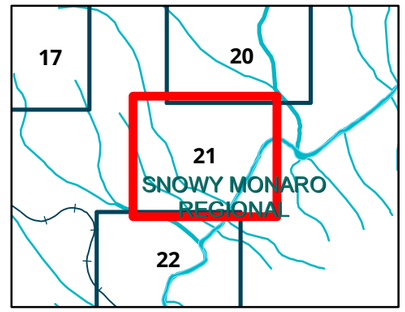

Legend

- Study area
- Previous alignments
- Contour

Final alignments - construction type

- Natural surface
- Rock paving/ Pitched rock

Plant Community Type

- PCT 1196 Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion

Figure 4.21 Impacts and mitigation methods - Perisher to Bullocks Flat Trail

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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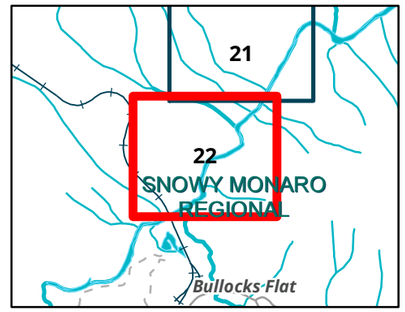

Legend

- Study area
- Existing walking tracks
- Previous alignments
- Contour

Final alignments - construction type

- Natural surface

Plant Community Type

- PCT 679 Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland
- PCT 1196 Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion

Figure 4.22 Impacts and mitigation methods - Perisher to Bullocks Flat Trail

0 30 60 90 120 150

Metres

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 55

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7 Assessment against key biodiversity legislation

7.1 Environment Protection and Biodiversity Conservation Act 1999

An assessment of the likelihood of potential impacts of the project on MNES, against heads of consideration outlined in Commonwealth of Australia (2013) was prepared to determine whether referral of the proposal to the Commonwealth Minister for the Environment may be required. Matters of NES relevant to the proposal are summarised in Table 12. Under the EPBC Act, activities that have potential to result in significant impacts on MNES must be referred to the Commonwealth Minister for the Environment for assessment. If the Minister determines that the proposal is a Controlled Action, the proposal will need approval under the EPBC Act.

Table 12 Assessment of the project against the EPBC Act

Matter of NES	Project specifics	Assessment against Commonwealth of Australia (2013)
Threatened species (flora and fauna) and ecological communities	Eight flora species and 15 fauna species have been recorded or are predicted to occur in the locality. An assessment of the likelihood of these species occurring along the final trail alignments is provided in Appendix 1 (flora) and Appendix 2 (fauna). This assessment indicates that 11 of these species occur and may be impacted by the project or have an important population in or near the final trail alignments. One threatened ecological community was recorded and occurs extensively along the final trail alignments.	The following species /communities have been recorded or are considered to have a medium or greater likelihood of occurring within the study area: • Shining Cudweed • Anemone Buttercup • Blue-tongued Greenhood • Broad-toothed Rat • Greater Glider • Koala • Mountain Pygmy-possum • Smoky Mouse • Spotted-trailed Quoll • Alpine She-oak Skink • Guthega Skink • Alpine Sphagnum Bogs and associated Fens Assessments against the Significant Impact Criteria (CoA 2013) have been prepared for all 11 species and the ecological community that are likely to occur and where some level of impact may result from the project (Appendix 3). It has been concluded that if the avoidance, minimisation and mitigation measures outlined in Section 5 of this report are implemented then a significant impact is unlikely. Given the large nature of the project and number of relevant MNES, NPWS should submit a referral for the project to provide legal certainty.
Migratory species	12 migratory species have been recorded or are predicted to occur in the locality (Appendix 2).	While some of these species would be expected to use the study area on occasions, some may do so regularly and others may be resident. The study area does not provide important habitat for an ecologically significant proportion of any of these species.

Matter of NES	Project specifics	Assessment against Commonwealth of Australia (2013)
Wetlands of international importance (Ramsar sites)	One wetland of international importance (Blue Lake) occurs upstream of the study area.	Ramsar site 68, Blue Lake (including Hedley Tarn), occurs approximately 1.5 kilometres to the north-west of the study area, however no creeks or rivers intersected by the project drain into the Blue Lake Ramsar site and a significant impact on this wetland is considered unlikely.

7.1.1 Potential for significant impacts on threatened species and communities

Based on the proposed trail surfaces and project descriptions and information provided to Biosis by NPWS, there is potential for the works to have minor and localised effects that will be will be short-term to medium term (e.g. effects will be measurable in weeks or months) on eight species of threatened fauna and three species of threatened flora listed under provisions of the EPBC Act (i.e. Matters of NES).

An assessment of the significance of potential effects against each significant impact criterion (as defined in relevant EPBC Act policy statements) is provided in Appendix 3. In summary, small areas of habitat for these species will be permanently affected by the project and larger areas will be temporarily affected but any such effects will not constitute a significant impact on any of them. If works are undertaken according to the proposed trail surface treatments (e.g. elevated structures and rock surfaces in sensitive areas) and all construction activities are strictly managed, all species are expected to re-occupy rehabilitated habitats once works are completed.

Design responses and proposed construction environmental management controls have reduced the project's impacts and can mitigate most environmental risks during construction. A self-assessment of the works and their potential to significantly impact on each of the relevant Matters of NES is provided in Appendix 3 using the relevant Significant Impact Criteria. As a result of impact avoidance and reduction measures it is considered unlikely that a significant impact on a Matter of NES will occur if all measures are implemented and strictly adhered to. However, as indicated in EPBC Act policy guidelines a referral under provisions of the Act can be made to provide legal certainty to the project and we understand it is the intention of NPWS to make a referral in the near future.

7.2 Environmental Planning and Assessment Act 1979

An assessment of the project against the relevant sections of the EP&A Act is provided below.

BC Act Test for Significance

A BC Act Test of Significance was completed for two threatened ecological communities, six flora, eight mammals, nine birds, two reptiles and two aquatic species considered to have a medium or greater likelihood of occurrence within areas likely to be disturbed or impacted through trail construction and operation (see Appendix 4). The aquatic species and aquatic EEC have been assessed in accordance with the FM Act Assessment of Significance process (Appendix 4).

These assessments indicate that a significant effect is not likely to result from the project. This conclusion is based on:

- Local populations of threatened species and the extent of threatened ecological communities occur well beyond the study area and subject site in a highly intact landscape. Therefore, the risk of local extinction is considered low especially where avoidance, minimisation and mitigation strategies for direct, indirect, short-term and long-term impacts have, and will be, implemented. Evidence also

exists for the persistence of these threatened biota in the context of current recreational land uses in the national park.

- Avoidance of high quality threatened reptile habitat has been achieved by abandoning the Mount Perisher alignments and the Guthega to Perisher Valley trail.
- The extent of permanent habitat removal or modification is estimated at 1.56 hectares of native vegetation (e.g. through clearing for rock paving, natural surface trails or through shading under elevated structures). Although some of these areas may be important habitat for some threatened biota, it is unlikely the permanent loss of these relatively small areas will negatively impact the long-term survival of these biota given the extensive nature of habitat beyond the subject site and study area.
- Minor habitat fragmentation will occur as a result of the trails. The very narrow and porous nature of walking tracks, and the extensive use of elevated structures in wet areas and above the tree-line, will maintain the ability for fauna to move freely across or under the trails and for flora to pollinate and disperse. Proposed trail surface types that minimise impacts on soil, vegetation and habitat (e.g. elevated structures) are outlined in Figure 4.
- Proposing strict controls over construction corridors and implementing mitigation and rehabilitation measures during and after construction, such as including new trails into current, or where required, project-specific strategies for erosion, sediment, pest, weed and pathogen control, will assist in managing key threatening processes.

Based on the conclusion that threatened species and communities are unlikely to be significant affected by the project and no local viable populations will be placed at risk of extinction a Species Impact Statement (SIS) is not considered necessary.

State Environmental Planning Policies

SEPP No. 44 – Koala Habitat Protection

The study area supports one tree species, Manna Gum *Eucalyptus viminalis*, which is a Koala feed tree species as defined in Schedule 2 of the SEPP. Koala feed trees, identified above, make up 15 per cent of the total number of trees in the upper or lower strata of the tree component in some areas of PCT 679 and PCT 1196 that may be impacted by the trail works above Bullocks Flat. Therefore, some areas of vegetation within the study area would be considered potential Koala habitat as defined under SEPP No. 44.

Under SEPP No. 44, as the vegetation in the works areas has been identified as potential Koala habitat, determination of whether the land constitutes core Koala habitat is required. It should be noted that no evidence of Koala was found during multiple field surveys between May 2017 and April 2019. Permanent impacts to PCT 679 and PCT 1196 will be approximately 0.12 hectares and this will be mostly limited to understorey vegetation removal, and removal of fire-killed trees for safety reasons. It is intended to retain all large living canopy trees. Therefore, impacts on Manna Gum will be very limited. No further consideration is required under SEPP No. 44 and a Koala Plan of Management is not considered necessary. A SIC and ToS for Koala have been undertaken in Appendix 3 and 4.

Local Environment Plans

The majority of the proposed trail alignment is located outside of the alpine resort boundaries, however it may cross into the Charlotte Pass Alpine Resort and Bullocks Flat Terminal where this LEP applies. Clause 25 states that development carried out on land to which the policy applies by or on behalf of the Crown or a public authority does not require consent.

7.3 Kosciuszko National Park Plan of Management 2006

The overarching aim of the Kosciuszko National Park Plan of Management (Kosciuszko NP PoM) is to *Maintain or improve the condition of the natural and cultural values that together make the park a special place.*

The Kosciuszko NP PoM management framework is guided by the following principles as outlined in the NPW Act to ensure:

- *The conservation of biodiversity, the maintenance of ecosystem function, the protection of geological and geomorphological features and natural phenomena, and the maintenance of natural landscapes;*
- *The conservation of places, objects, features and landscapes of cultural value;*
- *The protection of the ecological integrity of one or more ecosystems for present and future generations.*
- *The promotion of public appreciation and understanding of the national park's natural and cultural values.*
- *Provision for sustainable visitor use and enjoyment that is compatible with the conservation of the national park's natural and cultural values.*
- *Provision for the sustainable use (including adaptive reuse) of any buildings or structures or modified natural areas having regard to the conservation of the national park's natural and cultural values, and*
- *Provision for appropriate research and monitoring.*

The proposal adheres to the majority of the above listed principles and will promote public appreciation of the values of Kosciuszko National Park. The proposal has also been nominated in the Draft Walking Tracks Strategy for the Kosciuszko Summit Precinct (OEH 2018h) and is subject to Kosciuszko National Park Proposed Amendment to Plan of Management (OEH 2019b). The proposal will also provide for sustainable visitor use and enjoyment by ensuring that construction materials used to create the trails are durable, easily maintained, allow for ease of walking, adhere to *The Australian Standards for Walking Tracks (AS2156.1-2001)* and are strategically placed to allow scenic amenity. The proposal also demonstrates sustainable use and adaptive reuse by incorporating existing trails and features into the proposed trail alignments (e.g. Porcupine Rocks).

The proposal does not entirely align with the conservation of biodiversity, the maintenance of ecosystem function, the protection of geological and geomorphological features and natural phenomena, or the maintenance of natural landscapes. This is based on the potential for the proposal to remove native vegetation and disturb threatened species habitat. Targeted survey/detailed habitat assessments have been taken into account in the current proposal design and enabled NPWS to ensure project planning aligns with this principle. NPWS has demonstrated consideration of this principle via targeted surveys, strategic micro-siting of trails, exploration of alternative alignments and by proposing construction methods and materials which minimise fragmentation. Further mitigation and minimisation of impacts can be achieved by implementing a pest animal management program and ensuring appropriate hygiene controls are implemented during construction.

Strategic micro-siting of the trail alignment has assisted in minimising potential impacts of the proposal to Alpine Bogs and Associated Fens EEC in line with *The protection of the ecological integrity of one or more ecosystems for present and future generations*. Micro-siting has made recommendations to ensure that trail construction materials such as elevated structures are used and to ensure management strategies are in place to mitigate potential direct and indirect impacts.

7.4 Biodiversity Conservation Act 2016

An assessment of the likelihood of threatened biota occurring within the study area is provided in Appendix 1 (flora) and Appendix 2 (fauna) along with an assessment of whether the project has potential to result in a significant effect (Appendix 4). Tests of Significance indicate that a significant effect is not likely to result from the project. A SIS is not considered necessary.

7.5 Fisheries Management Act 1994

Waterways within the works areas are classified as TYPE 1 Highly sensitive key fish habitat and CLASS 1 and 2 key fish habitat. If in-stream woody debris is proposed to be removed, disturbed, moved or harmed this is considered to be dredging under Section 263 of the FM (General) Regulation 2010. Given the works are being undertaken by a public authority, Section 199 of the FM Act applies and NPWS is required to give the Minister written notice of the proposed work, and consider any matters raised by the Minister within 21 days. Any removed woody debris will be reinstated outside of the immediate works area.

DPI Fisheries will need to be consulted regarding concurrence and approvals requirements under the FM Act.

An assessment of the likelihood of threatened species and communities occurring is provided in Appendix 2. These assessments determined that two species and one EEC have a medium or greater likelihood of occurring where some impact may occur. Tests of Significance for these threatened biota, where some negative impacts may occur, are provided in Appendix 4.

Tests of Significance indicate that a significant effect is not likely to result from the proposal if proposed impact avoidance and minimisation strategies are implemented at the detailed design stage, and mitigation measures are adhered to. A Species Impact Statement is therefore not required. Tests of Significance indicate that a significant impact to the following species will not result from the project:

- River Blackfish (Snowy River endangered population)
- Alpine Redspot Dragonfly
- Snowy River Aquatic Endangered Ecological Community

7.6 Biosecurity Act 2015

No exotic species recorded within the study area are declared priority weeds within the South East Region (Snowy Monaro Regional). Exotic species resulting from past cattle grazing and/or visitor use are present within the study area in low abundance and diversity, particularly in the vicinity of established tracks and trails and around areas of development such as Perisher Resort, Kosciuszko Road, Bullocks Flat and the Illawong Trail near Guthega. Exotic species primarily consist of perennial grasses and herbaceous annual and perennial herbs.

7.7 Water Management Act 2000

Works are proposed within 40 metres of the top of the bank along several waterways in the national park.

As specified in *Water Management (General) Regulation 2011* a public authority does not need to obtain a controlled activity approval for any controlled activities that it carries out in, on or under waterfront land. It is however an expectation that the overarching objective of the WM Act, to preserve the integrity of riparian corridors, will be maintained.

8 Conclusion

The Kosciuszko Snowies Iconic Walk is a significant project set within one of the most iconic and biodiverse National Parks in Australia. Kosciuszko National Park contains a diverse array of ecological, cultural and recreational values within fragile alpine and subalpine ecosystems. NPWS has demonstrated consideration of these values throughout the early stages of project planning by actively engaging in analysis of site values, formulating design responses, changing alignments, proposing sensitive construction techniques and identifying the need to gather further information on trial alignments and their potential impacts.

This report is an assessment of the potential impact of the proposal on ecological values within Kosciuszko National Park in accordance with the EP&A Act, FM Act, BC Act and the EPBC Act.

The project is likely to result in the following adverse impacts:

- Native vegetation disturbance will be up to 9.23 hectares based on:
  - 1.56 hectares of native vegetation to be permanently lost or modified (e.g. through clearing for rock paving, natural surface trails or through shading under elevated structures).
  - 1.76 hectares of native vegetation to be modified for ongoing trail maintenance through minor pruning of taller shrubs close to the new tracks.
  - Up to 5.91 hectares of native vegetation to be temporarily disturbed through creating side cuts, machinery movements, material storage and construction access. These areas will be actively and fully rehabilitated to their pre-existing state once works are complete.
- Threatened species and ecological community impacts will occur, most of which are temporary in nature (e.g. during the construction phase) or of a relatively minor scale in the context of the extensive areas of intact habitat available in the national park, these include:
  - Possible disturbance of habitat for Shining Cudweed, Anemone Buttercup, Perisher Wallaby-grass, Blue-tongued Greenhood, Mountain Greenhood and Slender Greenhood. Known populations of Anemone Buttercup and Perisher Wallaby-grass along the final alignments have been avoided through micro-siting in 2018 and 2018.
  - Removal of grassy heathland vegetation that provides habitat for Alpine She-oak Skink. Key areas of habitat on Mount Perisher have been avoided and most other areas of open grassy heathland vegetation will be spanned with elevated structures.
  - High quality Guthega Skink habitat has mostly been avoided by abandoning the Guthega to Perisher Valley trail alignment that crossed Mount Perisher. Significant effort has been made to avoid other suitable rocky habitat with potential burrow sites along the final trail alignments during field surveys and micro-siting with NPWS staff.
  - Broad-toothed Rat occurs extensively across most of the impact area. Habitat loss for this species is consider relatively minor in the context of the extensive areas of suitable habitat across the national park and Australian Alps bioregion. Localised increases in predation may occur for this species.
  - Mountain Pygmy-possum habitat was recorded either through direct observations or reference to NPWS boulder field mapping across most trail alignments. Areas of key core habitat with podocarp shrubs were specifically avoided during trail alignment selection and micro-siting. This species still has the potential to disperse through most high elevation heathland and woodland

communities and vegetation removal will result in a minor reduction in dispersal habitat. Localised increases in predation on dispersing animals may occur for this species.

- A range of threatened forest and woodland-dependent mammals are likely to occur in forests, woodlands and heathlands. These species are generally reliant on the canopy, upper vegetation strata or hollow-bearing trees, except for Smokey Mouse and Spot-tailed Quoll, and therefore impacts to most of these species are likely to be minor given the narrow trail footprint, avoidance of large trees in forested environments and the contiguous nature of habitat availability in the national park.
- A range of threatened birds are likely to occur at most elevations and across various vegetation communities. These species utilise a range of habitat elements such as understorey vegetation, hollow-bearing trees, perching, roosting and nesting sites and fallen timber. Impacts to these species are likely to be minor and localised given the narrow trail footprint in forest and woodland environments and the contiguous nature of habitat availability in the national park.
- Two species reliant on aquatic habitats, River Blackfish and Alpine Redspot Dragonfly, may occur in high quality waterways and minor tributaries. Direct impacts to these species are likely to be avoided through use of elevated structures and bridges to cross waterways and drainage lines.
- Up to 0.13 hectares of the Alpine Sphagnum Bogs / Montane Peatland threatened ecological community will be permanently impacted by installation of elevated structures to span all occurrences of this community along the final trail alignments. It is likely construction of elevated structures will cause minor permanent loss of this community where footings are installed. Elevated structures will have an ongoing shading influence that may alter vegetation composition and structure towards shade-tolerant species.
- The Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland community occurs for the last 300 metres of the Perisher to Bullocks Flat trail in the South Eastern Highland bioregion. Impacts to this community are likely to include permanent removal of up to 0.015 hectares of already disturbed understorey vegetation along the Thredbo River. These impacts are considered minimal in the context of extensive stands of this community in the Thredbo Valley. See previous notes regarding the determination and listing of this community.
- The final alignments cross several named waterways and unnamed tributaries that flow directly into the Snowy and Thredbo Rivers, therefore all biota in these aquatic habitats are considered part of the Snowy River aquatic endangered ecological community. It is intended that all waterways will be spanned with elevated structures or bridges to avoid disturbance to the bed, banks and instream habitat features such as woody debris, rocks and pools.

The following legislative considerations have been identified:

- Although the works have been assessed as unlikely to have a significant impact on a Matter of NES listed under the EPBC Act, it is prudent that NPWS refer the project to the Commonwealth Minister for the Environment to provide legal certainty to the project.
- As the project is unlikely to result in a significant effect on BC Act or FM Act listed threatened species or communities a Species Impact Statement is not considered necessary.
- Impacts on Manna Gum trees will be limited and no Koala were recorded within the subject sites. Therefore, the sites do not constitute core Koala habitat as defined under SEPP No. 44. No further consideration of SEPP 44 is required and a Koala Plan of Management is not considered necessary.

- NPWS should consult NSW DPI Fisheries if any modification to large woody debris is proposed and Fisheries should assess all components of projects that involve structures that span the full width of a waterway or modifies the velocity or quantity of water. This consultation should consider any permitting requirements for public authorities under the *Fisheries Management Act 1994*.
- Works are proposed within 40 metres of the top of the bank along several waterway in the national park. As specified in *Water Management (General) Regulation 2011* a public authority does not need to obtain a controlled activity approval for any controlled activities that it carries out in, on or under waterfront land. It is however an expectation that the overarching objective of the WM Act, to preserve the integrity of riparian corridors, will be maintained.

The conclusion reached regarding impacts on threatened species and ecological communities are based on the description of final trail alignments, construction footprints and operational requirements provided to Biosis by NPWS and a range of proposed impact avoidance, minimisation and mitigation strategies outlined in Section 6 of this report.

Key impact avoidance and minimisation strategies, and mitigation measures include:

- Avoiding high value threatened reptile and Mountain Pygmy-possum habitats and adhering to preliminary micro-sited alignments and trail surface treatments proposed in Figure 4 of this report.
- Adhering to the construction corridors, maintenance zones and permanent vegetation removal footprints outlined in this report.
- Avoiding the removal of large hollow-bearing trees, where possible.
- Implementing best practice trail design, construction and sediment management practices.
- Committing to undertake pre-construction micro-siting for a range of threatened species and communities.
- Minimising the impacts of construction by 'building from the trail and elevated structures' and airlifting materials and personnel into construction sites, where appropriate.
- Implementing strict weed and pathogen hygiene protocols during construction and operation of trails.
- Documenting all environmental controls and mitigation measures in a detailed Construction Environmental Management Plan (CEMP) covering vegetation removal prescriptions/seasonality, work site delineation, weed/pathogen hygiene, sediment control and unexpected finds protocols and salvage protocols.
- Including all new trails in current trail maintenance programs that operate for other infrastructure in the national park, and developing project-specific programs for pest plant and animal control/monitoring, pathogen monitoring and impact and control-based monitoring of vegetation under new elevated structures.

Biosis recommends that these strategies be conferred through to the detailed design and construction phase of the project, and that the appointed construction contractor be accountable for achieving a high level of environmental compliance consistent with an endorsed CEMP that is subject to regular third party compliance monitoring.

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Appendices

Appendix 1 Flora

Flora species recorded from the study area

Notes to tables:

Status – EPBC Act: CE – Critically Endangered EN – Endangered VU – Vulnerable	**Status – BC Act:** E1 – endangered species (Part 1, Schedule 1) E2 – endangered population (Part 2, Schedule 1) E4 – presumed extinct (Part 4, Schedule 1) E4A – critically endangered V – vulnerable (Part 1, Schedule 2)
Status – Exotic # – Native species outside natural range * – priority weed species declared under the Biosecurity Act	

Table A.1 Flora species recorded from the study area

Scientific name	Common name	Commonwealth status	NSW status
Native species			
Acacia obliquinervia	Mountain Hickory		
Acaena novae-zelandiae	Bidgee-widgee		
Aciphylla glacialis	Mountain Celery		
Aciphylla simplicifolia	Mountain Aciphyll		
Acrothamnus hookeri			
Acrothamnus maccraei			
Acrothamnus montanus			
Agrostis venusta	Graceful Bent		
Argyrotegium fordianum			
Asperula conferta	Common Woodruff		
Asperula euryphylla			
Asperula gunnii	Mountain Woodruff		
Asperula pusilla	Alpine Woodruff		
Asperula spp.	Woodruff		
Asplenium flabellifolium	Necklace Fern		
Astelia alpina var. *novae-hollandiae*			
Astelia psychrocharis			
Asterolasia trymalioides	Alpine Starbush		
Australopyrum velutinum			
Baeckea gunniana	Alpine Baeckea		
Baeckea utilis	Mountain Baeckea		
Blechnum penna-marina subsp. *alpina*	Alpine Water Fern		
Bossiaea foliosa	Leafy Bossiaea		

Scientific name	Common name	Commonwealth status	NSW status
Brachyscome decipiens	Field Daisy		
Brachyscome nivalis	Snow Daisy		
Brachyscome rigidula	Hairy Cutleaf Daisy		
Brachyscome spathulata			
Brachyscome spp.			
Callistemon pityoides	Alpine Bottlebrush		
Cardamine astoniae	Spreading Bitter-cress		
Cardamine robusta			
Cardamine spp.			
Carex appressa	Tall Sedge		
Carex breviculmis			
Carex echinata	Star Sedge		
Carex gaudichaudiana			
Carex hebes			
Carex inversa	Knob Sedge		
Carex jackiana			
Carex spp.			
Carpha nivicola			
Cassinia aculeata	Dolly Bush		
Cassinia monticola			
Cassinia spp.			
Celmisia costiniana			
Celmisia pugioniformis			
Celmisia tomentella			
Chionochloa frigida	Robust Wallaby Grass		
Chionohebe densifolia			
Clematis aristata	Old Man's Beard		
Clematis microphylla	Small-leaved Clematis		
Colobanthus affinis			
Coprosma hirtella	Coffee-berry		
Coronidium monticola			
Coronidium scorpioides	Button Everlasting		
Correa lawrenceana	Mountain Correa		
Cotula alpina	Alpine Cotula		
Craspedia aurantia			
Craspedia coolaminica			
Craspedia costiniana			
Craspedia leucantha			
Craspedia maxgrayi			
Craspedia spp.	Billy Buttons		
Daviesia ulicifolia	Gorse Bitter Pea		
Deyeuxia affinis	Allied Bent-grass		

Scientific name	Common name	Commonwealth status	NSW status
Deyeuxia monticola			
Deyeuxia spp.	A Bent Grass		
Dianella tasmanica			
Echinopogon ovatus	Forest Hedgehog Grass		
Empodisma minus			
Epacris celata			
Epacris glacialis			
Epacris gunnii			
Epacris microphylla	Coral Heath		
Epacris paludosa	Swamp Heath		
Epacris petrophila	Snow Heath		
Epacris spp.			
Epilobium billardierianum			
Epilobium tasmanicum	Snow Willow-herb		
Erigeron bellidioides			
Erigeron nitidus			
Erigeron spp.			
Eucalyptus dalrympleana	Mountain Gum		
Eucalyptus dalrympleana subsp. *dalrympleana*			
Eucalyptus delegatensis subsp. *delegatensis*			
Eucalyptus niphophila			
Eucalyptus pauciflora	White Sally		
Eucalyptus rubida subsp. *rubida*			
Eucalyptus stellulata	Black Sally		
Eucalyptus viminalis	Ribbon Gum		
Euphrasia collina			
Euphrasia collina subsp. *diversicolor*			
Euphrasia collina subsp. *glacialis*			
Euphrasia collina subsp. *lapidosa*			
Euphrasia spp.			
Ewartia nubigena	Australian Edelweiss		
Gaultheria appressa	White Waxberry		
Gentianella muelleriana			
Gentianella spp.			
Geranium antrorsum			
Geranium potentilloides			
Geranium potentilloides var. *abditum*			
Geranium spp.			
Gingidia algens			
Gonocarpus micranthus			
Gonocarpus montanus			
Goodenia hederacea subsp. *alpestris*			

Scientific name	Common name	Commonwealth status	NSW status
Grevillea australis	Alpine Grevillea		
Grevillea lanigera	Woolly Grevillea		
Hakea microcarpa	Small-fruited Hakea		
Hovea montana			
Hydrocotyle laxiflora	Stinking Pennywort		
Hypericum japonicum			
Indigofera australis	Australian Indigo		
Kunzea muelleri			
Lagenophora stipitata	Common Lagenophora		
Leptinella filicula			
Leptorhynchos squamatus	Scaly Buttons		
Leptorhynchos squamatus subsp. *alpinus*	Scaly Buttons		
Leucopogon gelidus			
Lobelia pedunculata	Matted Pratia, Trailing Pratia		
Lomatia fraseri	Silky Lomatia		
Luzula acutifolia subsp. *nana*			
Luzula alpestris			
Luzula australasica subsp. *dura*			
Luzula meridionalis			
Luzula modesta			
Luzula novae-cambriae			
Luzula spp.			
Lycopodium fastigiatum	Mountain Clubmoss		
Melicytus angustifolius subsp. *divaricatus*			
Melicytus dentatus	Tree Violet		
Microseris lanceolata	Yam Daisy		
Myosotis spp.			
Nematolepis elliptica			
Nematolepis ovatifolia			
Olearia algida	Alpine Daisy-bush		
Olearia brevipedunculata			
Olearia megalophylla	Large-leaf Daisy-bush		
Olearia phlogopappa	Dusty Daisy-bush		
Oreobolus distichus			
Oreobolus pumilio			
Oreomyrrhis brevipes	Rock Carraway		
Oreomyrrhis eriopoda	Australian Carraway		
Orites lancifolius	Alpine Orites		
Oschatzia cuneifolia	Wedge Oschatzia		
Oxylobium ellipticum	Common Shaggy Pea		
Ozothamnus alpinus	Alpine Everlasting		
Ozothamnus secundiflorus	Cascade Everlasting		

Scientific name	Common name	Commonwealth status	NSW status
Pentachondra pumila	Carpet Heath		
Picris angustifolia			
Pimelea alpina			
Pimelea axiflora			
Pimelea axiflora subsp. *alpina*			
Pimelea axiflora subsp. *axiflora*			
Pimelea ligustrina			
Pimelea ligustrina subsp. *ciliata*			
Plantago alpestris			
Plantago euryphylla			
Plantago muelleri	Star Plantain		
Plantago spp.	Plantain		
Poa costiniana	Bog Snowgrass		
Poa ensiformis	Purple-sheathed Tussock-grass		
Poa fawcettiae	Smooth Blue Snowgrass		
Poa helmsii	Broad-leaved Snowgrass		
Poa hiemata	Soft Snowgrass		
Poa hothamensis	Ledge Grass		
Poa labillardierei var. *labillardierei*	Tussock		
Poa phillipsiana			
Poa saxicola	Rock Poa		
Poa sieberiana var. *sieberiana*	Snowgrass		
Poa spp.			
Podocarpus lawrencei	Mountain Plum Pine		
Podolepis robusta	Mountain Lettuce		
Podolobium alpestre	Alpine Shaggy Pea		
Polyscias sambucifolia	Elderberry Panax		
Polyscias sambucifolia subsp. *leptophylla*			
Polystichum proliferum	Mother Shield Fern		
Prasophyllum spp.			
Prostanthera cuneata	Alpine Mint-bush		
Pterostylis spp.	Greenhood		
Ranunculus acrophilus			
Ranunculus anemoneus	Anemone Buttercup	VU	VU
Ranunculus dissectifolius			
Ranunculus graniticola	Granite Buttercup		
Ranunculus gunnianus	Gunn's Alpine Buttercup		
Ranunculus spp.			
Richea continentis	Candle Heath		
Rubus parvifolius	Native Raspberry		
Rytidosperma alpicola	Alpine Grass		
Rytidosperma nivicola			

Scientific name	Common name	Commonwealth status	NSW status
Rytidosperma nudiflorum			
Rytidosperma spp.			
Rytidosperma vickeryae	Perisher Wallaby-grass		EN
Scaevola hookeri			
Schoenus calyptratus			
Scleranthus biflorus	Two-flowered Knawel		
Scleranthus pungens			
Scleranthus singuliflorus			
Senecio gunnii			
Senecio linearifolius var. *latifolius*			
Senecio pectinatus var. *major*	Alpine Groundsel		
Senecio phelleus			
Senecio pinnatifolius			
Senecio pinnatifolius var. *alpinus*			
Sphagnum spp.			
Stellaria pungens	Prickly Starwort		
Stylidium armeria			
Stylidium graminifolium	Grass Triggerplant		
Tasmannia lanceolata	Mountain Pepperbush		
Tasmannia xerophila subsp. *xerophila*	Alpine Pepperbush		
Themeda triandra			
Trachymene spp.	Trachymene		
Trisetum spicatum	Bristle Grass		
Veronica derwentiana subsp. *maideniana*			
Viola betonicifolia	Native Violet		
Wahlenbergia spp.	Bluebell		
Xerochrysum subundulatum	Alpine Everlasting		
Exotic species			
Acetosella vulgaris	Sheep Sorrel		
Agrostis capillaris	Browntop Bent		
Anthoxanthum odoratum	Sweet Vernal Grass		
Cerastium vulgare	Mouse-ear Chickweed		
Cirsium vulgare	Spear Thistle		
Festuca rubra subsp. *rubra*	Red Fescue		
Hypochaeris radicata	Catsear		
Malus domestica	Apple		
Taraxacum officinale	Dandelion		
Verbascum thapsus subsp. *thapsus*	Great Mullein		

Threatened flora species and ecological communities

The following table includes a list of the threatened flora species that have potential to occur within the study area. The list is based on database searches outlined in Section 3.

Notes to tables:

Conservation status – EPBC Act:	**Conservation status – BC Act:**
CR – Critically Endangered EN – Endangered VU – Vulnerable	E1 – endangered species (Part 1, Schedule 1) E2 – endangered population (Part 2, Schedule 1) E4 – presumed extinct (Part 4, Schedule 1) E4A – critically endangered V1 – vulnerable (Part 1, Schedule 2)
Most recent record # species predicted to occur by the PMST (not recorded on other databases). ## species predicted to occur based on natural distributional range and suitable habitat despite lack of records in the databases searched. 2017 recorded during current survey.	

Examples of criteria for determining the likelihood of occurrence for threatened biota as a guide for writing the rationale for likelihood have been listed below.

Likelihood of occurrence	Potential criteria for likely occurrence in study area
Recorded	• Recorded in the study area during current assessment. • Records in study area, as indicated by background research.
High	• Species/ecological communities recorded in study area during current or previous assessment/s. • Aquatic species recorded from connected waterbodies in close proximity to the study area during current or previous assessment/s. • Sufficient good quality habitat is present in study area or in connected waterbodies in close proximity to the study area (aquatic species). • Study area is within species natural distributional range (if known). • Species has been recorded within <five kilometres or 10 kilometres> or from the relevant catchment/basin.
Medium	• Records of terrestrial biota within <five kilometres or 10 kilometres> of the study area or of aquatic species in the relevant basin/neighbouring basin. • Habitat limited in its capacity to support the species due to extent, quality, or isolation.
Low	• No records within <five kilometres or 10 kilometres> of the study area or for aquatic species, the relevant basin/neighbouring basin. • Marginal habitat present (low quality and extent). • Substantial loss of habitat since any previous record(s).
Negligible	• Habitat not present in study area. • Habitat for aquatic species not present in connected waterbodies in close proximity to the study area. • Habitat present but sufficient targeted survey has been conducted at an optimal time of year and species wasn't recorded.

Table A.2 Threatened flora species recorded / predicted to occur within 10 kilometres of the study area

Scientific name	Common name	Conservation status		Most recent record	Other sources	Likely occurrence in study area	Potential for impact from project	Rationale
		EPBC	BC					
Argyrotegium nitidulum	Shining Cudweed	VU	V	2004#		Medium	Low	Occurrence is known along the Main Range trail, although suitable habitat more restricted at lower elevations.
Calotis glandulosa	Mauve Burr-daisy	VU	V	1900#		Low	Low	Not recorded during targeted surveys and considered unlikely to occur in high elevation areas.
Calotis pubescens	Max Mueller's Burr-daisy	-	E1	2016		Low	Low	Recent records exist in restricted areas within 10 km of study area.
Carex archeri	Archer's Carex	-	E1	1980		Low	Low	Not recorded during targeted surveys, minimal suitable habitat occurs along final trail alignments.
Carex raleighii	Raleigh Sedge	-	E1	2000		Low	Low	Creek flats and alluvial flats with sphagnum bog vegetation was searched along all final trail alignments but this species was not detected. Known populations at Spencers Creek were visited to confirm identity of unknown Carex specimens attributable to the common dryland species *Carex hebes*.
Discaria nitida	Leafy Anchor Plant	-	V	1999		Low	Low	River flats along the Thredbo River were searched adjacent to the Perisher Valley to Bullocks Flat Trail but this obvious and distinctive species was not detected.
Euphrasia scabra	Rough Eyebright	-	E1	1900		Low	Low	Very old records (100 years old) occur in the region from near Yarrangobilly Caves and Jindabyne. The species is considered unlikely to occur in the high alps and sub-alps.
Leucochrysum albicans var. *tricolor*	Hoary Sunray	EN	-	2016		Low	Low	Not recorded during targeted surveys.

Scientific name	Common name	Conservation status		Most recent record	Other sources	Likely occurrence in study area	Potential for impact from project	Rationale
		EPBC	BC					
Prasophyllum bagoense	Bago Leek Orchid	CE	E4A	#		Negligible	Low	Not recorded within 10 km of study area.
Irenepharsus magicus	Elusive Cress	-	E1			Low	Low	Only one record in NSW but is ephemeral and could occur in montane areas, most likely in rocky habitats after disturbance but is considered unlikely and was not recorded during targeted surveys along the Perisher to Bullocks Flat trail.
Pterostylis alpina	Mountain Greenhood	-	V1			Medium	Low	This species is known from the Thredbo Valley however the survey period did not coincide with flowering times making the species difficult to detect. We understand that NPWS has surveyed for the species during the appropriate survey period in spring 2018 in certain parts of Thredbo Valley.
Pterostylis foliata	Slender Greenhood	-	V1			Medium	Low	This species is known from the Thredbo Valley however the survey period did not coincide with flowering times making the species difficult to detect. We understand that NPWS has surveyed for the species during the appropriate survey period in spring 2018 in certain parts of Thredbo Valley.
Pterostylis oreophila	Blue-tongued Greenhood	CE	E4A	1972#		Medium	Low	No reliable recent records of occurrence, not recorded during targeted surveys but could occur in montane bogs and streams amongst Mountain Tea-tree thickets.
Ranunculus anemoneus	Anemone Buttercup	VU	V1	2016#		High - recorded	Low	Recorded widely across the study area during targeted surveys for all options and alignments, only recorded at one location along final alignments.

Scientific name	Common name	Conservation status		Most recent record	Other sources	Likely occurrence in study area	Potential for impact from project	Rationale
		EPBC	BC					
Rytidosperma pumilum	Feldmark Grass	VU	V1	2008		Low	Low	Recorded along Main Range trail during previous surveys in a different study area. High elevation areas near Mount Perisher and Back Perisher were searched for suitable feldmark habitat but the feldmark community and this species were not recorded. Unlikely to occur along final trail alignments.
Rytidosperma vickeryae	Perisher Wallaby-grass	-	E1	2017		High - recorded	Low	Recorded during targeted survey along Charlotte Pass to Guthega trail at Spencers Creek.
Thesium australe	Austral Toadflax	VU	V1	#		Low	Low	Not recorded during targeted surveys, not expected to occur in higher alps and sub-alps.

Table A.3 Threatened ecological communities recorded / predicted to occur within 10 kilometres of the study area

Scientific name	Conservation status		Likely occurrence in study area	Rationale for likelihood ranking
	EPBC	BC		
Alpine Sphagnum Bogs and Associated Fens	EN	-	High - recorded	Occurs extensively throughout the study area
Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions	-	E3	High - recorded	Occurs extensively throughout the study area
Natural Temperate Grassland of the South Eastern Highlands	CE	-	Low	Does not occur in high alpine and sub-alpine areas
Windswept Feldmark in the Australian Alps Bioregion	-	CE	Low	Restricted to the Main Range in highly localised environments.
Snowpatch Herbfield in the Australian Alps bioregion	-	CE	Low	Restricted to the Main Range in highly localised environments.
Snowpatch Feldmark in the Australian Alps bioregion	-	CE	Low	Restricted to the Main Range in highly localised environments.
Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions			High - recorded	Last 300 m of the Perisher Valley to Bullocks Flat Trail along the Thredbo River within the South Eastern Highlands bioregion. This TEC is not relevant in the Australian Alps bioregion. ***Status of this community in the study area to be reviewed in spring 2019 based on updated listing and determination as of 28 June 2019.

Appendix 2 Fauna

Fauna species recorded from the study area

Below is a list of fauna species recorded from the study area during the present assessment and a list of threatened fauna species recorded or predicted to occur within 10 kilometres of the study area.

Fauna species in these tables are listed in alphabetical order within their taxonomic group.

Notes to table:

Status – EPBC Act: CE – Critically Endangered EN – Endangered VU – Vulnerable	**Status – BC Act:** E1 – endangered species (Part 1, Schedule 1) E2 – endangered population (Part 2, Schedule 1) E4 – presumed extinct (Part 4, Schedule 1) E4A – critically endangered V – vulnerable (Part 1, Schedule 2)
Status – FM Act: C1 – critically endangered E1 – endangered E2 – endangered E4 – presumed extinct V1 – vulnerable	**Status – Non-indigenous species** * pest species not native to the area # established pest species

Table A.4 Vertebrate fauna recorded from the study area (current assessment)

Scientific name	Common name	Commonwealth status	NSW status
Birds			
Acanthiza lineata	Striated Thornbill		
Acanthiza pusilla	Brown Thornbill		
Acanthorhynchus tenuirostris	Eastern Spinebill		
Accipiter fasciatus	Brown Goshawk		
Alisterus scapularis	Australian King-Parrot		
Anthochaera carunculata	Red Wattlebird		
Anthus novaeseelandiae	Australian Pipit		
Callocephalon fimbriatum	Gang-gang Cockatoo		VU
Calyptorhynchus funereus	Yellow-tailed Black-Cockatoo		
Colluricincla harmonica	Grey Shrike-thrush		
Coracina novaehollandiae	Black-faced Cuckoo-shrike		
Corvus mellori	Little Raven		
Cracticus tibicen	Australian Magpie		
Dacelo novaeguineae	Laughing Kookaburra		
Eopsaltria australis	Eastern Yellow Robin		
Falco cenchroides	Nankeen Kestrel		
Falco peregrinus	Peregrine Falcon		

Scientific name	Common name	Commonwealth status	NSW status
Hirundapus caudacutus	White-throated Needletail		
Hirundo neoxena	Welcome Swallow		
Malurus cyaneus	Superb Fairy-wren		
Menura novaehollandiae	Superb Lyrebird		
Pachycephala olivacea	Olive Whistler		VU
Pardalotus striatus	Striated Pardalote		
Petroica boodang	Scarlet Robin		VU
Petroica phoenicea	Flame Robin		VU
Philemon corniculatus	Noisy Friarbird		
Phylidonyris pyrrhoptera	Crescent Honeyeater		
Platycercus elegans	Crimson Rosella		
Rhipidura albiscapa	Grey Fantail		
Sericornis frontalis	White-browed Scrubwren		
Strepera graculina	Pied Currawong		
Strepera versicolor	Grey Currawong		
Zosterops lateralis	Silvereye		
Mammals			
Pseudocheirus peregrinus	Common Ringtail Possum		
Vombatus ursinus	Common Wombat		
Mastacomys fuscus	Broad-toothed Rat	VU	VU
Reptiles			
Austrelaps ramsayi	Highland Copperhead		
Cyclodomorphus praealtus	Alpine She-oak Skink	EN	EN
Drysdalia coronoides	White-lipped Snake		
Eulamprus kosciuskoi	Alpine Water Skink		
Eulamprus tympanum	Southern Water-skink		
Liopholis guthega	Guthega Skink	EN	EN
Notechis scutatus	Tiger Snake		
Pseudemoia entrecasteauxii	Tussock Cool-skink		
Pseudemoia pagenstecheri	Tussock Skink		
Frogs			
Crinia signifera	Common Eastern Froglet		
Pest animals			
Cervus sp.	Unidentified Deer		
Cervus unicolor	Sambar		
Dama dama	Fallow Deer		
Equus caballus	Horse		
Lepus capensis	Brown Hare		
Oryctolagus cuniculus	Rabbit		
Sus scrofa	Pig		
Vulpes vulpes	Fox		

Threatened fauna species

The following table includes a list of the threatened fauna species that have potential to occur within the study area. The list is based on database searches outlined in Section 3.

Notes to tables:

Conservation status – EPBC Act: CR – Critically Endangered EN – Endangered VU – Vulnerable	**Conservation status – BC Act:** E1 – endangered species (Part 1, Schedule 1) E2 – endangered population (Part 2, Schedule 1) E4 – presumed extinct (Part 4, Schedule 1) E4A – critically endangered V1 – vulnerable (Part 1, Schedule 2)
Most recent record # species predicted to occur by the PMST (not recorded on other databases). ## species predicted to occur based on natural distributional range and suitable habitat despite lack of records in the databases searched.	

Examples of criteria for determining the likelihood of occurrence for threatened biota as a guide for writing the rationale for likelihood have been listed below.

Likelihood of occurrence	Potential criteria
High	• Species recorded in study area during current or previous assessment/s. • Aquatic species recorded from connected waterbodies in close proximity to the study area during current or previous assessment/s. • Sufficient good quality habitat is present in study area or in connected waterbodies in close proximity to the study area (aquatic species). • Study area is within species natural distributional range (if known). • Species has been recorded within <5 or 10 kilometres > or from the relevant catchment/basin.
Medium	• Records of terrestrial species within <5 or 10 kilometres > of the study area or of aquatic species in the relevant basin/neighbouring basin. • Habitat limited in its capacity to support the species due to extent, quality, or isolation.
Low	• No records within <5 or 10 kilometres > of the study area or for aquatic species, the relevant basin/neighbouring basin. • Marginal habitat present (low quality and extent). • Substantial loss of habitat since any previous record(s).
Negligible	• Habitat not present in study area • Habitat for aquatic species not present in connected waterbodies in close proximity to the study area. • Habitat present but sufficient targeted survey has been conducted at an optimal time of year and species wasn't recorded.
Transient/ Nomadic	• Migratory or nomadic fauna species/individuals that may occur in the study area from time to time, but are not considered resident.

Table A.5 Threatened fauna species recorded, or predicted to occur, within 10 kilometres of the study area

Scientific name	Common name	Conservation status			Most recent record	Likely occurrence in study area	Potential for impact from project	Rationale for likelihood ranking
		EPBC	BC	FM				
Mammals								
Burramys parvus	Mountain Pygmy-possum	EN	E1		2015#	Medium	Low	The species has been recorded within 10 km of the study area, and patches of suitable boulderfield and dispersal habitat were recorded along all trails.
Cercartetus nanus	Eastern Pygmy-possum		V		1993	Medium	Low	The species has been recorded within 10 km of the study area, and suitable habitat exists along Perisher Valley to Bullocks Flat Trail in forest environments.
Dasyurus maculatus	Spotted-tailed Quoll	EN	V		#2017	Medium	Low	The species has been recorded within 10 km of the study area, and patches of suitable habitat exist.
Dasyurus viverrinus	Eastern Quoll	EN	E1		1970	Low	Low	No recent records with 10 km of the study area. No optimal habitat present.
Falsistrellus tasmaniensis	Eastern False Pipistrelle		V		2018	High	Low	Recent records of occurrence within 5 km of the study area. Suitable habitat present.
Mastacomys fuscus	Broad-toothed Rat	VU	V		2018	High - recorded	Medium	Evidence of occurrence and suitable habitat was found extensively across the study area.
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat		V		2018	Medium	Low	Recent records within 10 km of the study area, suitable habitat present.
Petauroides volans	Greater Glider	VU			#	Medium	Low	Records within 10 km of study area exist, although not recent. Suitable habitat exists along Perisher Valley to Bullocks Flat Trail in forest environments.

Scientific name	Common name	Conservation status			Most recent record	Likely occurrence in study area	Potential for impact from project	Rationale for likelihood ranking
		EPBC	BC	FM				
Phascolarctos cinereus	Koala	VU	V		1900#	Medium	Low	No recent records within 10 km of the study area. Some suitable habitat in lower elevation forest and woodlands along the Perisher Valley to Bullocks Flat trail.
Pseudomys fumeus	Smoky Mouse	EN	E4A		#	Medium	Low	Recent records exist within 10 km of the study area, suitable habitat patches exists. Some suitable habitat in lower elevation forest and woodlands along the Perisher Valley to Bullocks Flat trail, especially in PCT 1196.
Pteropus poliocephalus	Grey-headed Flying-fox	VU	V		1995	Low	Low	No recent records exist within 10 km of study area, no optimal habitat available.
Birds								
Artamus cyanopterus cyanopterus	Dusky Woodswallow		V		1972	Low	Low	No recent records within 10 km of study area. No optimal habitat present.
Botaurus poiciloptilus	Australasian Bittern	EN	E1		#	Low	Low	No records, no suitable habitat present.
Calidris ferruginea	Curlew Sandpiper	CE	E1		##	Low	Low	No records, no suitable habitat present.
Callocephalon fimbriatum	Gang-gang Cockatoo		V		2018	High - recorded	Low	Species occurs in forest and woodland environments throughout the study area.
Chthonicola sagittata	Speckled Warbler		V		2013	Low	Low	No recent records within 10 km of study area. No optimal habitat present, may occur lower down in the Thredbo Valley.

Scientific name	Common name	Conservation status			Most recent record	Likely occurrence in study area	Potential for impact from project	Rationale for likelihood ranking
		EPBC	BC	FM				
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)		V		1978	Medium	Low	Suitable habitat present, particularly along Bullocks Flat.
Daphoenositta chrysoptera	Varied Sittella		V		1972	Low	Low	No recent records within 10 km of study area. No optimal habitat present.
Falco subniger	Black Falcon		V		1970	Low	Low	No recent records within 10 km of study area. No optimal habitat present.
Hieraaetus morphnoides	Little Eagle		V		1999	Low	Low	No recent records within 10 km of study area. No optimal habitat present.
Lalage sueurii	White-winged Triller				2007	Low	Low	No recent records within 10 km of study area. No optimal habitat present.
Neophema chrysogaster	Orange-bellied Parrot	CE	E4A		1917	Negligible	Negligible	No suitable habitat present.
Ninox strenua	Powerful Owl		V		1992	Medium	Low	No recent records within 10 km of study area. No optimal habitat present.
Numenius madagascariensis	Eastern Curlew	CE			##	Negligible	Negligible	No suitable habitat present.
Pachycephala olivacea	Olive Whistler		V		2018	High - Recorded	Low	Records within 10 km of study area are numerous although not recent. Suitable habitat is present.
Petroica boodang	Scarlet Robin		V		2013	High - recorded	Low	Recent records within 10 km of study area. Suitable habitat present.
Petroica phoenicea	Flame Robin		V		2019	High	Low	Recent records within 10 km of study area. Suitable habitat present.

Scientific name	Common name	Conservation status			Most recent record	Likely occurrence in study area	Potential for impact from project	Rationale for likelihood ranking
		EPBC	BC	FM				
Petroica rodinogaster	Pink Robin		V		2018	Medium	Low	Recent records exist within the vicinity of the study area. Some suitable habitat present.
Rostratula australis	Australian Painted Snipe	EN	E1		#	Negligible	Negligible	No suitable habitat present.
Stagonopleura guttata	Diamond Firetail		V		2007	Medium	Low	Suitable habitat present, particularly along Bullocks Flat.
Frogs								
Litoria verreauxii alpina	Alpine Tree Frog	VU	E1		2012#	Low	Low	Suitable habitat present, although the species has undergone a significant range contraction and has not been recorded since 1998.
Pseudophryne corroboree	Southern Corroboree Frog	CE	E4A		1996#	Low	Low	Only a very small population remains, and the captive bred population sites are a significant distance 20 km+ away from the proposed trail alignments.
Reptiles								
Cyclodomorphus praealtus	Alpine She-oak Skink	EN	E1		2013#	High - recorded	Possible	Observed within study area during fieldwork. Suitable habitat present.
Liopholis guthega	Guthega Skink	EN	E1		2017#	High - recorded	Low	Records within 10 km of study area. Suitable habitat present near the final alignments and the species was recorded on previous alignments.
Fish								
Gadopsis marmoratus	River Blackfish, Snowy River population			E2	#	Medium	Low	Potential habitat may be present for the River Blackfish in the Snowy and Thredbo Rivers and Spencers Creek.

Scientific name	Common name	Conservation status			Most recent record	Likely occurrence in study area	Potential for impact from project	Rationale for likelihood ranking
		EPBC	BC	FM				
Prototroctes maraena	Australian Grayling	VU		EN	#	Negligible	Negligible	No suitable habitat present.
Invertebrates								
Austropetalia tonyana	Alpine Redspot Dragonfly			V	#	Medium	Low	Habitat for this species occurs along tributaries of the Thredbo River and Lubra Creek along the southern extent of the Perisher Valley to Bullocks Flat trail.

Migratory species (EPBC Act listed)

The following table includes a list of migratory species that have potential to occur within the study area. The list is based on database searches outlined in Section 3.

Bold denotes species recorded in the study area during the current assessment.

Table A.6 Migratory fauna species recorded or predicted to occur within 10 kilometres of the study area

Scientific name	Common name	Most recent record
Actitis hypoleucos	Common Sandpiper	#
Apus pacificus	Fork-tailed Swift	2002#
Calidris acuminata	Sharp-tailed Sandpiper	#
Calidris ferruginea	Curlew Sandpiper	##
Calidris melanotos	Pectoral Sandpiper	#
Gallinago hardwickii	Latham's Snipe	2006#
Hirundapus caudacutus	White-throated Needletail	2012#
Merops ornatus	Rainbow Bee-eater	1995
Monarcha melanopsis	Black-faced Monarch	#
Motacilla flava	Yellow Wagtail	#
Myiagra cyanoleuca	Satin Flycatcher	2012#
Neophema chrysogaster	Orange-bellied Parrot	1917
Numenius madagascariensis	Eastern Curlew	##
Rhipidura rufifrons	Rufous Fantail	2005#

Appendix 3 Significant Impact Criteria assessments

This section presents the outcomes of the EPBC Act Significant Impact Criteria (SIC) Assessments. This impact assessment processes operates independently from State jurisdictions and determines if the project should be referred to the Australian Minister of Environment and Energy under the EPBC Act due to impacts on Matters of National Environmental Significance.

Shining Cudweed

Occurrence in the study area

No individual Shining Cudweed plants or populations were recorded on the final trails alignments. The study area does support high quality habitat for the species represented by open grasslands and herbfields included in the broad PCT 641 typology. Given this high quality habitat Shining Cudweed cannot be discounted from occurring throughout the trail alignment and may have remained undetected.

Significant impact assessment

Based on a reasonable understanding of the habitat requirements of Shining Cudweed in the study area, it is concluded that project impacts are unlikely to lead to a significant impact on this species. An assessment and justification is provided in Table A.7, below.

Table A.7 Shining Cudweed *Argyrotegium nitidulum*, EPBC Act vulnerable species – assessment against Significant Impact Criteria (CoA 2013)

Significant impact criteria (vulnerable species)	Likelihood of significant impact	Justification
Lead to a long-term decrease in the size of an important population of a species	Unlikely	An important population is a population that is necessary for a species' long-term survival and recovery (CoA 2013). The species' recovery plan (NPWS 2001) does not explicitly identify important populations for Shining Cudweed across its distribution in Victoria and NSW but does identify the Kosciuszko area as supporting the species. No plants were recorded along the final trail alignment, therefore, it is not anticipated that any significant numbers of plants or populations will be destroyed that could lead to a decline in the size of an important population.
Reduce the area of occupancy of an important population	Unlikely	No plants were recorded on any final trail alignments, therefore, it is not anticipated that any significant numbers of plants or populations will be destroyed, or that habitat or area of occupancy will be reduced significantly. Furthermore, the species has been observed growing along walking tracks and colonising disturbed areas in alpine regions of NSW and Victoria (NPWS 2001).
Fragment an existing important population into two or more populations	Unlikely	No plants were recorded on any final trail alignments and the existing known populations in the Kosciuszko area will not be fragmented by the walking tracks and any resultant disturbance will be a permeable narrow barrier in a discrete location that will not affect physical or functional connectivity between populations. As discussed above, the species is known to grow along walking

Significant impact criteria (vulnerable species)	Likelihood of significant impact	Justification
		tracks and colonise disturbed areas in alpine regions demonstrating its ability to respond to site-scale fragmentation (NPWS 2001).
Adversely affect habitat critical to the survival of the species	Unlikely	Critical habitat has not been declared for Shining Cudweed and the Kosciuszko population described above will not be significantly disturbed, or where disturbance does occur, it will be temporary in nature with a strong prospect of recolonisation of disturbed areas.
Disrupt the breeding cycle of an important population	Unlikely	The trails and any resultant disturbance will be a permeable narrow barrier in a discrete location that is unlikely to affect pollination, seed dispersal, gene flow or vegetative reproduction.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely	The availability and quality of habitat will not decline significantly as a result of the works. As discussed above the species is known to grow along walking tracks and colonise disturbed areas in alpine regions, demonstrating its ability to respond to site-scale fragmentation (NPWS 2001).
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Unlikely	Soil disturbance and subsequent weed invasion will be minimised through construction management and follow up weed control. The project CEMP will specifically deal with controlling the introduction and spread of weed species, especially those species associated with walking track edges in the Kosciuszko National Park. Ongoing monitoring will be required to manage the establishment of weeds once the trails are operational.
Introduce disease that may cause the species to decline	Unlikely	This is considered to be an unlikely impact. To ensure this does not occur, trail construction material to be used will be sourced from a weed and disease free locations in the National Park and hygiene protocols will be in place for construction activities.
Interfere substantially with the recovery of a species	Unlikely	Recovery actions associated with research on the species' occurrence along walking tracks in the Kosciuszko National Park will need to be considered in planning the new trail alignments. NPWS should consult with researchers working on this species to ensure the trail realignment does not disturb any research locations. If this process is followed it is considered unlikely the new trails will interfere with the species' recovery.

Anemone Buttercup

Occurrence in the study area

Extensive populations of Anemone Buttercup were recorded at multiple locations along the various options and alignments assessed, particularly on Mount Perisher and Back Perisher Mountain. As the Guthega to Perisher Valley trail option that crosses Mount Perisher has now been abandoned the large and intact populations in that location will be avoided. The species was only recorded in one location along the final trail alignments between Charlotte Pass and Guthega where it occupied an area of 3 metres x 6 metres. During micro-siting in March 2019, the trail was realigned around this population to avoid direct impacts. The study area supports high quality habitat for the species represented by damp grasslands and herbfields included in the broad PCT 641 typology, and the species may also occur in PCT 637, PCT 643 and PCT 645. It is intended to avoid any new individuals and populations during pre-construction micro-siting.

Significant impact assessment

Based on a reasonable understanding of the occurrence and habitat requirements of Anemone Buttercup in the study area, it is concluded that project impacts are unlikely to lead to a significant impact on this species. An assessment and justification is provided in Table A.8, below.

Table A.8 Anemone Buttercup *Ranunculus anemoneous,* EPBC Act Vulnerable species – assessment against Significant Impact Criteria (CoA 2013)

Significant impact criteria (vulnerable species)	Likelihood of significant impact	Justification
Lead to a long-term decrease in the size of an important population of a species	Unlikely	An important population is a population that is necessary for a species' long-term survival and recovery (CoA 2013). The species' recovery plan (NPWS 2001) does not explicitly identify important populations for Anemone Buttercup across its distribution in NSW but does identify the Kosciuszko area as supporting the species. One small population was recorded along the Charlotte Pass to Guthega trail and the trail was realigned around these plants. All individuals are expected to be avoided during a trail pre-construction micro-siting process, therefore it is not anticipated that any significant numbers of plants or populations will be destroyed that could lead to a decline in the size of an important population.
Reduce the area of occupancy of an important population	Unlikely	One small population was recorded along the Charlotte Pass to Guthega trail and the trail was realigned around these plants. All individuals are expected to be avoided during a trail pre-construction micro-siting process, therefore, it is not anticipated that any significant numbers of plants or populations will be destroyed, or that habitat or area of occupancy will be reduced significantly in the context of available habitat more broadly within the NP.
Fragment an existing important population into two or more populations	Unlikely	One small population was recorded along the Charlotte Pass to Guthega trail and the trail was realigned around these plants. All individuals are expected to be avoided during a trail pre-construction micro-siting process, therefore important populations, if present, will not be fragmented by the walking

Significant impact criteria (vulnerable species)	Likelihood of significant impact	Justification
		tracks. Any resultant disturbance from trail construction will be a permeable narrow barrier in a discrete location that will not affect physical or functional connectivity between populations, as such it is unlikely that an important population will be fragmented by the trail development.
Adversely affect habitat critical to the survival of the species	Unlikely	Critical habitat has not been declared for Anemone Buttercup, however, the vegetation to be disturbed for construction and operation of trails includes high quality alpine and sub-alpine communities that in the broader sense are critical to this species survival. The extent of vegetation removal and disturbance in PCTs 637, 641, 643 and 645 is a maximum of 1.19 hectares. Not all of this area provides suitable damp conditions for this species. This amount of habitat removal is unlikely to jeopardise the long term survival or recovery of this species given the quantity of similar high quality contiguous habitat immediately adjacent to the proposed trails.
Disrupt the breeding cycle of an important population	Unlikely	The trails and any resultant disturbance will be a permeable narrow barrier in a discrete location that is unlikely to affect pollination, seed dispersal, gene flow or vegetative reproduction.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely	The availability and quality of habitat will not decline significantly as a result of the works. While the trail development will result in the permanent removal / disturbance of up to 1.19 hectares of high quality alpine vegetation, this vegetation removal in the context of the quantity of available habitat within the study area and more broadly within the national park, will not result in a species decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Unlikely	Soil disturbance and subsequent weed invasion will be minimised through construction management and follow up weed control. The project CEMP will specifically deal with controlling the introduction and spread of weed species, especially those species associated with walking track edges in the Kosciuszko National Park. Ongoing monitoring will be required to manage the establishment of weeds once the trails are operational.
Introduce disease that may cause the species to decline	Unlikely	This is considered to be an unlikely impact. To ensure this does not occur, trail construction material to be used will be sourced from a weed and disease free locations in the National Park and hygiene protocols will be in place for construction activities.
Interfere substantially with the recovery of a species	Unlikely	The primary threat to this species appears to have been grazing from domestic livestock (NPWS 2001). The construction and operation of the walking trails is not expected to interfere with the recovery of this species nor with the recovery actions contained within NPWS (2001).

Blue-tongued Greenhood

Occurrence in the study area

No individual Blue-tongued Greenhood were recorded on or adjacent to any of the final trail alignments that were inspected on foot. The study area supports high quality habitat for the species represented by sub-alpine and montane drainage lines supporting Mountain Tea-tree *Leptospermum grandiflorum* and areas supporting sphagnum bogs included in PCT 637 and other drainage lines in PCT 638 and PCT 644. All drainage lines and sphagnum bogs will be spanned by elevated structures and impacts in these areas are expected to be kept to minor disturbance for post holes.

Significant impact assessment

Based on a reasonable understanding of the habitat requirements of Blue-tongued Greenhoods in the study area, it is concluded that project impacts are unlikely to lead to a significant impact on this species. An assessment and justification is provided in Table A.9, below.

Table A.9 Blue-tongued Greenhood *Pterostylis oreophila,* EPBC Act Critically Endangered species – assessment against Significant Impact Criteria (CoA 2013)

Significant impact criteria (critically endangered species)	Likelihood of significant impact	Justification
Lead to a long-term decrease in the size of a population	Unlikely	In NSW three extant populations are known from Kiandra, Bago and Brandy Marys Bago State forest (TSCC 2012). No individuals or populations of Blue-tongued Greenhood were recorded on or adjacent to the final trail alignments that were inspected on foot. All potential habitat for Blue-tongued Greenhoods will be spanned by elevated structures or bridges. Given the minimal level of disturbance in areas of potential habitat in PCTs 637, 638 and 644 it is not anticipated that any significant numbers of plants or populations will be destroyed that could lead to a decline in the size of a population.
Reduce the area of occupancy of the species	Unlikely	Given all areas of potential habitat will be spanned by elevated structures or bridges, the area of available habitat and therefore the area of occupancy, will remain unchanged after trail construction.
Fragment an existing population into two or more populations	Unlikely	No individuals or populations were recorded on or adjacent to the final trail alignments that were inspected on foot. All areas containing potential habitat will be spanned by elevated structures or bridges and any resultant disturbance from trail construction will be a permeable narrow barrier in a discrete location that will not affect physical or functional connectivity between populations, as such it is unlikely that a population will be fragmented by the trail development.
Adversely affect habitat critical to the survival of the species	Unlikely	Critical habitat has not been declared for Blue-tongued Greenhood, however, the vegetation to be disturbed for construction and operation of the trail includes high quality montane and sub-alpine vegetation that in the broader sense may

Significant impact criteria (critically endangered species)	Likelihood of significant impact	Justification
		be critical to this species survival. However, the extent of vegetation removal required for the elevated platform post holes will not jeopardise the long term survival or recovery of this species given the quantity of similar high quality habitat immediately adjacent to the development and in the broader national park.
Disrupt the breeding cycle of a population	Unlikely	The trails and any resultant disturbance will be a permeable narrow barrier in a discrete location that is unlikely to affect pollination, seed dispersal, gene flow or vegetative reproduction within or between populations.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely	The availability and quality of habitat will not decline significantly as a result of the works. While the trail development will result in some temporary disturbance to high quality sub-alpine and montane drainage lines, vegetation beneath elevated structures is expected to remain relatively unchanged post construction. This vegetation disturbance in the context of the quantity of available habitat within the study area and more broadly within the national park, will not result in a species decline.
Result in invasive species that are harmful to a Critically Endangered species becoming established in the Critically Endangered species' habitat	Unlikely	Soil disturbance and subsequent weed invasion will be minimised through construction management and follow up weed control. The project CEMP will specifically deal with controlling the introduction and spread of weed species, especially those species associated with walking track edges in the Kosciuszko National Park. Ongoing monitoring will be required to manage the establishment of weeds once the trails are operational.
Introduce disease that may cause the species to decline	Unlikely	This is considered to be an unlikely impact. To ensure this does not occur, trail construction material to be used will be sourced from a weed and disease free locations in the National Park and hygiene protocols will be put in place during construction works.
Interfere with the recovery of the species	Unlikely	No recovery plan has been developed for this species. The construction and operation of the walking trails is not expected to interfere with the recovery of this species given the mitigation measures proposed above.

Greater Glider

Occurrence in the study area

The habitat present within the study area provides marginal foraging and nesting habitat for the Greater Glider. Most suitable hollow bearing trees adjacent to the trail alignment were burnt in 2003 bushfires and as such hollow tree density is relatively low in the immediate vicinity of the trail alignment. More broadly montane vegetation surrounding the study area is likely to provide foraging and nesting habitat, particularly in unburnt pockets. All hollow bearing trees are expected to be avoided though a trail micro-siting process during construction. Impacts will be mostly limited to a narrow corridor of understorey vegetation in forested environments.

Significant impact assessment

Based on a reasonable understanding of the habitat requirements and likely populations of Greater Glider in the study area, it is concluded that project impacts are unlikely to lead to a significant impact. An assessment and justification is provided in Table A.10.

Table A.10 Greater Glider *Petauroides volans*, EPBC Act Vulnerable species – assessment against Significant Impact Criteria (CoA 2013)

Significant impact criteria (vulnerable species)	Likelihood of significant impact	Justification
Lead to a long-term decrease in the size of an important population of a species	Unlikely	An important population is a population that is necessary for a species' long-term survival and recovery (CoA 2013). Given the large area of contiguous habitat within the national park and this species large home range, it is unlikely that a discrete, or genetically isolated population is present on or adjacent to the final trail alignments. Given the spatially restricted nature of the impact on mostly understorey vegetation, if some individuals from within the broader population were impacted by the trail development it is unlikely that this impact would lead to a broader decline in the population as significant areas of habitat would still be available for critical activities to occur in during and post construction. Furthermore, all hollow bearing trees are expected to be avoided and as such breeding habitat should remain unchanged.
Reduce the area of occupancy of an important population	Unlikely	The removal of montane vegetation that represents suitable habitat for Greater Glider will possibly reduce the area of available habitat although most impacts will be restricted to understorey vegetation. However, the area of occupancy will remain unchanged as the trail alignment will be a discrete narrow disturbance and the canopy will remain effectively contiguous in the context of this species dispersal and movement patterns.
Fragment an existing important population into two or more populations	Unlikely	The disturbance associated with the trail construction will be a discrete narrow disturbance that will not act as a barrier for dispersal for this species as the canopy will remain effectively contiguous in the context of this species dispersal and movement patterns.

Significant impact criteria (vulnerable species)	Likelihood of significant impact	Justification
Adversely affect habitat critical to the survival of the species	Unlikely	Critical habitat has not been declared for Greater Glider.
Disrupt the breeding cycle of an important population	Unlikely	An important population is a population that is necessary for a species' long-term survival and recovery (CoA 2013). Given the large area of contiguous habitat within the national park and this species large home range, it is unlikely that a discrete, or genetically isolated population is present on or adjacent to the trail alignment. Impacts likely to disrupt the breeding cycle of Greater Glider include direct mortality, disturbance to nesting sites, loss of nesting and sheltering habitat and loss and fragmentation of foraging habitat, particularly extensive areas of continuous forest. The proposal will remove mostly understorey in montane vegetation regenerating post fire. All hollow bearing trees will be avoided during construction. The habitat to be removed is within a large area of high quality contiguous montane vegetation. It is likely that if the species uses the study area for foraging, sheltering and nesting then the local population would use the entire patch of suitable habitat. Given the spatially restricted nature of the impact in the context of the available high quality habitat more broadly within the national park it is unlikely that impacts of the trail construction will disrupt the breeding cycle of an important population as significant areas of habitat will be available for breeding activities to occur in.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely	The proposal will remove mostly understorey in montane vegetation regenerating post fire. The habitat to be removed is within a large patch (>1000 hectares) of montane vegetation. It is likely that if the species uses the study area for foraging, sheltering and nesting then the local population would use the entire area of available habitat. This level of disturbance in the context of available habitat will not lead to a broader species decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Unlikely	The proposed works will not increase the level of invasive fauna activity already operating in the area. Invasive weed species are not known to directly harm populations of Greater Glider. Invasive weed species have potential to reduce quality of habitat in the adjoining bushland and increase potential to harm the population of Greater Gliders. Soil disturbance and subsequent weed invasion will be minimised through construction management and follow up weed control. The project CEMP will specifically deal with controlling the introduction and spread of weed species, especially those species associated with walking track edges in the Kosciuszko National Park. Ongoing monitoring

Significant impact criteria (vulnerable species)	Likelihood of significant impact	Justification
		will be required to manage the establishment of weeds once the trails are operational.
Introduce disease that may cause the species to decline	Unlikely	The project will not result in the introduction of a disease that is harmful to the Greater Glider.
Interfere substantially with the recovery of a species	Unlikely	There is no accepted or adopted recovery plan associated with Greater Glider. The conservation advice gives priority to the following conservation actions. 1 Reduce the frequency and intensity of prescribed burns. 2. Identify appropriate levels of patch retention, habitat tree retention, and logging rotation in hardwood production. 3. Protect and retain hollow-bearing trees, suitable habitat and habitat connectivity Considering the above factors, the project will not interfere substantially with the recovery of Greater Glider.

Mountain Pygmy-possum

Occurrence in the study area

The habitat present along the final trail alignments provides marginal foraging and dispersal opportunities for the Mountain Pygmy-possum. All boulderfields and extensive Mountain Plum Pine *Podocarpus lawrencei* shrublands were avoided during the trail option selection and micro-siting processes. Boulderfields and individual records are present adjacent to the Ramshead Range trail. More broadly sub-alpine vegetation surrounding the study area is likely to provide foraging, breeding and dispersal habitat that is critical to this species survival.

Significant impact assessment

Based on a reasonable understanding of the habitat requirements and likely populations of Mountain Pygmy-possum in the study area, it is concluded that project impacts are unlikely to lead to a significant impact. An assessment and justification is provided in Table A.11.

Table A.11 Mountian Pygmy-possum *Burramys parvus*, EPBC Act Endangered species – assessment against Significant Impact Criteria (CoA 2013)

Significant impact criteria (endangered species)	Likelihood of significant impact	Justification
Lead to a long-term decrease in the size of a population	Unlikely	The removal of small areas of woodland and heathland that may be used as an occasional foraging or dispersal habitat will decrease the area of available habitat within the locality. The resultant disturbance will be a narrow, permeable disturbance. Habitat removal of this type and extent is unlikely to lead to a decrease in the size of a population as the habitat to be removed is unlikely to be used by a significant number of individuals, nor is it likely to be used for critical activities (breeding, shelter, hibernation etc) or be a barrier to dispersal that will inhibit critical activities. This level of disturbance is unlikely to affect foraging, dispersal or gene flow of Mountain Pygmy-possum as extensive habitat will still be available during and post construction for these activities to occur in and the trail will be permeable, meaning males moving up slope will not be isolated from female habitat. Cat and Fox scats were recorded throughout the national park during the field assessments and the construction of a new walking trail is unlikely to increase the current predation threat from feral carnivores, given the current activity level recorded.
Reduce the area of occupancy of the species	Unlikely	The removal of small areas of woodland and heathland that provide marginal foraging or dispersal habitat will reduce the area of available habitat at the locality but will not reduce the overall area of occupancy of the species as Mountain Pygmy-possum will still utilise the high quality habitat within and adjacent to the study area during and post construction.
Fragment an existing population into two or more populations	Unlikely	Core habitat for Mountain Pygmy-possum includes boulderfields and podocarp shrublands. The habitat in the Kosciuszko area will not be fragmented by the walking trails and any resultant disturbance will be a permeable narrow barrier in a discrete location or elevated structures that will not affect physical or functional connectivity between populations or breeding individuals.

Significant impact criteria (endangered species)	Likelihood of significant impact	Justification
Adversely affect habitat critical to the survival of the species	Unlikely	Habitat critical to the survival of Mountain Pygmy-possum is described as habitat that is used for feeding, nesting, hibernation, and movement corridors between male and female habitat (DELWP 2016a). Hibernation and nesting occurs in boulderfields and feeding occurs predominantly in podocarp shrublands and rock scree or boulderfields (although *Acrothamnus* and *Pimelea* seeds and berries are also food sources) (DELWP 2016a). All boulderfields and extensive podocarp shrublands were avoided during the trail selection and micro-siting processes. While the trail development will remove vegetation that could connect male habitats at the bottoms of mountains with female habitat at the tops of mountains, the resultant disturbance will be a narrow disturbance or elevated structure that will not act as a functional barrier to this species. Canopy or shrub cover will still be present to provide protective cover from predation surrounding the disturbance. Given the extent of this vegetation removal in the context of similar available habitat immediately surrounding the development area, it is unlikely the development will affect habitat critical to the survival of the species.
Disrupt the breeding cycle of a population	Unlikely	The proposed trail development will remove areas of marginal habitat including the removal of vegetation, woody debris and rocky areas from an area that may be used as a dispersal corridor between male and female habitat. Boulderfields and extensive Podocarp shrublands were avoided during the trail selection and micro-siting processes. The habitat to be removed is within a large contiguous area of high quality native alpine and sub-alpine vegetation within the broader national park. The resultant disturbance will be a permeable narrow barrier in a discrete location. This level of disturbance is unlikely to affect foraging, dispersal or gene flow of Mountain Pygmy-possum as extensive habitat will still be available during and post construction for these activities to occur in and the trail will be permeable, meaning males moving up slope will not be isolated from females. Cat and Fox scats were recorded throughout the national park during the field assessments and the construction of a new walking trail is unlikely to increase the current predation threat from feral carnivores given the current activity level recorded. Given the relatively small construction footprint and the efforts made to avoid high quality Mountain Pygmy-possum habitat during the route selection and micro-siting process, the trail development will not adversely affect breeding cycle traits of this species.

Significant impact criteria (endangered species)	Likelihood of significant impact	Justification
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely	The habitat in the Kosciuszko area will not be fragmented by the walking trail and any resultant disturbance will be a permeable narrow barrier in a discrete location or elevated structures that will not affect physical or functional connectivity between populations or breeding individuals. While the trail development will result in the removal of alpine and sub-alpine vegetation that provides marginal habitat for Mountain Pygmy-possum, this level of disturbance in the context of available habitat will not lead to a broader species decline in the Kosciusko area.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	Unlikely	The proposed trails will not increase the level of invasive fauna activity already operating in the area. Invasive weeds species can modify or simplify vegetation structure that directly harms Mountain Pygmy-possum. Soil disturbance and subsequent weed invasion will be minimised through construction management and follow up weed control. The project CEMP will specifically deal with controlling the introduction and spread of weed species, especially those species associated with walking track edges in the Kosciuszko National Park. Ongoing monitoring will be required to manage the establishment of weeds once the trails area operational.
Introduce disease that may cause the species to decline	Unlikely	The project will not result in the introduction of a disease that is harmful to the Mountain Pygmy-possum.
Interfere with the recovery of a species	Unlikely	The national recovery plan for Mountain Pygmy-possum (DELWP 2016a) describes a number of threats and management actions, and while the removal of vegetation that may provide an occasional foraging or dispersal resource is counter to those management actions, the extent and type of vegetation removal required for the trail development is unlikely to interfere with the national recovery of the species.

Spotted-tailed Quoll

Occurrence in the study area

Most vegetation types within the study area may be used for foraging, dispersal or breeding resource by Spotted-tailed Quoll on occasion. The study area is within 20 kilometres of a known stronghold population for this species in the southern Kosciuszko National Park/Snowy Mountains Byadbo area. This species has also been recorded sporadically at higher elevations including around Perisher Valley and Blue Cow.

Significant impact assessment

Based on a reasonable understanding of the habitat requirements of Spotted-tailed Quoll in the study area, it is concluded that project impacts are unlikely to lead to a significant impact. An assessment and justification is provided in Table A.12.

Table A.12 Spotted-tailed Quoll *Dasyurus maculatus,* EPBC Act Vulnerable species – assessment against Significant Impact Criteria (CoA 2013)

Significant impact criteria (vulnerable species)	Likelihood of significant impact	Justification
Lead to a long-term decrease in the size of an important population of a species	Unlikely	Given this species large, overlapping home ranges (DELWP 2016b), any individuals potentially occurring within the study area could form part of an important population. The proposed trail development will permanently remove / disturb up to 1.56 hectares of habitat across a range of alpine, sub-alpine and montane vegetation communities. The habitat to be removed is within a large contiguous area of high quality native sub-alpine and montane vegetation within the broader national park. The resultant disturbance will be a permeable narrow barrier in a discrete location. This level of disturbance is unlikely to affect foraging, dispersal or gene flow of Spotted-tailed Quoll, given this species dispersal ability and large home ranges and as extensive habitat will still be available during and post construction for these activities to occur in. Given the relatively small linear construction footprint in the context of available habitat in the broader national park, the trail development will not lead to a long term decline in the size of a population of this species.
Reduce the area of occupancy of an important population	Unlikely	The proposed trail development will permanently remove / disturb up to 1.56 hectares of habitat across a range of alpine, sub-alpine and montane habitat within a large contiguous area within the Kosciuszko National Park. The proposed trail development also has the potential to modify adjoining native vegetation by increased edge effects, sedimentation and accidental modification by workers during construction and walkers during operation of the trail. Recommendations contained within this report aim to minimise indirect impacts from construction and operation of the trails and when implemented will ensure that indirect impacts of adjoining native vegetation is minimised. While the trail development will result in the removal of native vegetation that may constitute

Significant impact criteria (vulnerable species)	Likelihood of significant impact	Justification
		habitat for this species, the overall area of occupancy of the species will remain unchanged during and post construction, as the habitat in which the trail is situated will still be suitable for this species.
Fragment an existing important population into two or more populations	Unlikely	The habitat in the Kosciuszko area will not be fragmented by the walking trails and any resultant disturbance will be a permeable narrow barrier in a discrete location that will not affect physical or functional connectivity between populations or breeding individuals.
Adversely affect habitat critical to the survival of the species	Unlikely	The national recovery plan for Spotted-tailed Quoll describes critical habitat as large patches of forest with adequate denning resources and relatively high densities of medium-sized mammalian prey (DELWP 2016b). The vegetation to be disturbed for construction and operation of the trail includes high quality montane and sub-alpine vegetation that under the definition above contains elements critical to this species survival. However, the extent of permanent vegetation removal/disturbance (up to 1.56 hectares) required for the trail development will not jeopardise the long term survival of this species given the quantity of similar high quality contiguous habitat immediately adjacent to the development.
Disrupt the breeding cycle of an important population	Unlikely	Given this species large, overlapping home ranges (DELWP 2016b), any individuals potentially occurring within the study area could for part of an important population. Given the aforementioned large home range and dispersal ability of Spotted-tiled Quoll, trail construction activities are unlikely to affect dispersal or gene flow as extensive habitat will still be available during and post construction for these activities to occur in and the trail will not act as a barrier that would interrupt gene flow between individuals or populations.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely	The habitat in the Kosciuszko area will not be fragmented by the walking trail and any resultant disturbance will be a permeable narrow barrier in a discrete location that will not affect physical or functional connectivity between populations or breeding individuals. The habitat in the Kosciuszko area will not be modified or destroyed to the point that the species is likely to decline, given the extent and quality of adjacent habitats.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Unlikely	The proposed works will not increase the level of invasive fauna activity already operating in the area. Invasive weeds species can modify or simplify vegetation structure that may indirectly influence Spotted-tailed Quoll as the habitat becomes unsuitable for preferred prey species. Soil disturbance and subsequent weed invasion will be minimised through construction

Significant impact criteria (vulnerable species)	Likelihood of significant impact	Justification
		management and follow up weed control. The project CEMP will specifically deal with controlling the introduction and spread of weed species, especially those species associated with walking track edges in the Kosciuszko National Park. Ongoing monitoring will be required to manage the establishment of weeds once the trail is operational.
Introduce disease that may cause the species to decline	Unlikely	The project will not result in the introduction of a disease that is harmful to Spotted-tailed Quoll.
Interfere substantially with the recovery of a species	Unlikely	The national recovery plan for Spotted-tailed Quoll (DELWP 2016b) describes a number of threats and management actions, and while the removal of vegetation that provide foraging or dispersal resource is counter to those management actions, the extent and type of vegetation removal required for the trail development is unlikely to interfere with the national recovery of the species.

Broad-toothed Rat

Occurrence in the study area

The habitat present within the study area provides high quality foraging, breeding, nesting and dispersal habitat for Broad-toothed Rat. Broad-toothed Rat scats and runways were recorded throughout most areas along final trail alignments but most frequently in PCT 637, PCT 641 and PCT 643 where there was a moderate to dense shrub cover and a prevalence of grass and sedge species. The species is likely to use suitable micro-habitats in all PCTs in the study area.

Significant impact assessment

Based on a reasonable understanding of the habitat requirements of Broad-toothed Rat in the study area, it is concluded that project impacts are unlikely to lead to a significant impact. An assessment and justification is provided in Table A.13.

Table A.13 Broad-toothed Rat *Mastacomys fuscus*, EPBC Act Vulnerable species – assessment against Significant Impact Criteria (CoA 2013)

Significant impact criteria (vulnerable species)	Likelihood of significant impact	Justification
Lead to a long-term decrease in the size of an important population of a species	Unlikely	The proposed trail development will permanently remove or disturb up to 1.56 hectares of high quality habitat including the removal of vegetation, woody debris and rocky areas. Broad-toothed Rat favour sedge dominated wet areas with a moderate to dense shrub cover. Elevated structures will be used to cross all drainage lines and wet areas and these structures will be permeable to Broad-toothed Rat. The habitat to be removed is within a large contiguous area of high quality native alpine and sub-alpine vegetation within the broader national park. The resultant disturbance will be a permeable narrow barrier in a discrete location. This level of disturbance is unlikely to affect foraging, dispersal or gene flow of Broad-toothed Rat as extensive habitat will still be available during and post construction for these activities to occur in. Cat and Fox scats were recorded throughout the national park during the field assessments and the construction of walking trails is unlikely to increase the current predation threat from feral carnivores, given the current activity level recorded. Given the relatively small construction footprint in the context of available habitat in the broader national park, the trail development will not lead to a long term decline in size of an important population.
Reduce the area of occupancy of an important population	Unlikely	The habitat present within the study area provides high quality foraging, breeding, nesting and dispersal habitat for Broad-toothed Rat. Broad-toothed Rat scats and runways were recorded throughout most areas but in higher densities in PCTs 637, 641 and 645 were there was a moderate to dense shrub cover and a prevalence of sedge species. While the area of available habitat will be reduced as a result of construction of the trails, the overall area of occupancy of the species will remain unchanged as the habitat in which the trails sit will still be

Significant impact criteria (vulnerable species)	Likelihood of significant impact	Justification
		suitable for this species.
Fragment an existing important population into two or more populations	Unlikely	Whisson *et al*. (2015) demonstrates that Broad-toothed Rat freely disperses through and around significantly fragmented and disturbed landscapes and utilises drains, pipes and introduced vegetation to move through inhospitable landscapes. As such the habitat in the Kosciuszko area will not be fragmented by the walking trails and any resultant disturbance will be a permeable narrow barrier in a discrete location or elevated structures that will not affect physical or functional connectivity between populations or breeding individuals.
Adversely affect habitat critical to the survival of the species	Unlikely	The vegetation to be disturbed for construction and operation of the trails includes high quality alpine and sub-alpine vegetation that in the broader sense is critical to this species survival. However, the extent of vegetation removal/disturbance (1.56 hectares) required for the trail development will not jeopardise the long term survival of this species given the quantity of similar high quality contiguous habitat immediately adjacent to the development.
Disrupt the breeding cycle of an important population	Unlikely	Construction activities are unlikely to influence the breeding cycle of a population. Any disturbance would be pervious to this species and easily dispersed through or around should individuals be moving between populations. Significant areas of native vegetation are present adjacent to the construction area in which critical breeding activities can occur.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely	The habitat in the Kosciuszko area will not be fragmented by the walking trail and any resultant disturbance will be a permeable narrow barrier in a discrete location that will not affect physical or functional connectivity between populations or breeding individuals. The habitat in the Kosciuszko area will not be modified or destroyed to the point that the species is likely to decline, given the extent and quality of adjacent habitats.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Unlikely	The proposed works will not increase the level of invasive fauna activity already operating in the area. Invasive weeds species can modify or simplify vegetation structure that may influence Broad-toothed Rat. Soil disturbance and subsequent weed invasion will be minimised through construction management and follow up weed control. The project CEMP will specifically deal with controlling the introduction and spread of weed species, especially those species associated with walking track edges in the Kosciuszko National Park. Ongoing monitoring will

Significant impact criteria (vulnerable species)	Likelihood of significant impact	Justification
		be required to manage the establishment of weeds once the trails are operational.
Introduce disease that may cause the species to decline	Unlikely	The project will not result in the introduction of a disease that is harmful to Broad-toothed Rat.
Interfere substantially with the recovery of a species	Unlikely	The removal of high quality habitat in the form sub-alpine and alpine vegetation is counter to the recovery of this species, however, the extent and nature of the vegetation removal in the context of available high quality habitat within the broader national park will not interfere with the recovery of this species.

Koala

Occurrence in the study area

Montane vegetation adjacent to the Perisher Valley to Bullocks Flat trail where Manna Gum occurs may be used as a foraging, dispersal and breeding resource by Koala.

Significant impact assessment

Based on a reasonable understanding of the habitat requirements of Koala in the study area, it is concluded that project impacts are unlikely to lead to a significant impact. An assessment and justification is provided in Table A.14.

Table A.14 Koala, *Phascolarctos cinereus,* EPBC Act Vulnerable species – assessment against Significant Impact Criteria (CoA 2013)

Significant impact criteria (vulnerable species)	Likelihood of significant impact	Justification
Lead to a long-term decrease in the size of an important population of a species	Unlikely	An important population is a population that is necessary for a species' long-term survival and recovery (CoA 2013). Given the large area of contiguous montane habitat within the national park and this species large home range, it is unlikely that a discrete, or genetically isolated population is present on or adjacent to the trail alignment. Given the spatially restricted nature of the impact, if some individuals from within the broader population were impacted by the trail development it is unlikely that this impact would lead to a broader decline in the population within Kosciusko National Park as significant areas of habitat would still be available for critical activities to occur in during and post construction.

Significant impact criteria (vulnerable species)	Likelihood of significant impact	Justification
Reduce the area of occupancy of an important population	Unlikely	The removal of montane vegetation will mostly be restricted to understorey species. The area of occupancy will remain unchanged as the trail alignments will be a discrete narrow disturbance. The trails will not act as a barrier to this species' dispersal as canopy continuity will not be significantly disrupted.
Fragment an existing important population into two or more populations	Unlikely	The disturbance associated with the trail construction will be a discrete narrow disturbance that will not act as a barrier for dispersal for this species as Koalas will move from one side of the trail to the other.
Adversely affect habitat critical to the survival of the species	Unlikely	Critical habitat has not been declared for Koala.
Disrupt the breeding cycle of an important population	Unlikely	An important population is a population that is necessary for a species' long-term survival and recovery (CoA 2013). Given the large area of contiguous habitat within the national park and this species large home range, it is unlikely that a discrete, or genetically isolated population is present on or adjacent to the trail alignment. Impacts likely to disrupt the breeding cycle of Koala include direct mortality and loss and fragmentation of foraging habitat particularly extensive areas of continuous forest. The proposal will remove montane vegetation regenerating post fire. The habitat to be removed is within a large area of high quality contiguous montane vegetation. It is likely that if the species uses the study area for foraging and breeding activities then the local population would use the entire patch of suitable habitat. Given the spatially restricted nature of the impact in the context of the available high quality habitat more broadly within the national park it is unlikely that impacts of the trail construction will disrupt the breeding cycle of an important population as significant areas of habitat will be available for breeding activities to occur in.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely	The proposal will remove up to 0.12 hectares of montane vegetation with feed tree species and this will mostly be restricted to understorey vegetation. The habitat to be removed is within a large patch (>1000 hectares) of montane vegetation. It is likely that if the species uses the study area for foraging, sheltering and breeding then the local population would use the entire area of available habitat. This level of disturbance in the context of available habitat will not lead to a broader species decline.

Significant impact criteria (vulnerable species)	Likelihood of significant impact	Justification
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	Unlikely	The proposed works will not increase the level of invasive fauna activity already operating in the area. Invasive weeds species are not known to directly harm populations of Koala. Soil disturbance and subsequent weed invasion will be minimised through construction management and follow up weed control. The project CEMP will specifically deal with controlling the introduction and spread of weed species, especially those species associated with walking track edges in the Kosciuszko National Park. Ongoing monitoring will be required to manage the establishment of weeds once the trails are operational.
Introduce disease that may cause the species to decline	Unlikely	The project will not result in the introduction of a disease that is harmful to the Koala.
Interfere substantially with the recovery of a species	Unlikely	The removal of potential habitat is counter to the recovery of this species, however, the extent and nature of the vegetation removal (mostly understorey) in the context of available high quality habitat within the broader national park will not interfere with the recovery of this species.

Smoky Mouse

Occurrence in the study area

PCT 1196 within the study area provides potential foraging, breeding and sheltering habitat for Smoky Mouse in the form of montane vegetation. This species is known to be cryptic and have low detectability (Burn et al. 2015) and the national recovery plan for Smoky Mouse describes any vegetation with a diversity of heath and bush-pea species, combined with potential shelter sites in the form of woody debris or rocks as being potential habitat within the species range (Menkhorst & Broome 2006). Recent investigations within the northern part of the Kosciusko National Park for the Snowy 2.0 Project recorded Smoky Mouse within PCT 1196 at 1100 metres elevation. A conservative estimate of habitat impacts within the subject site, based on the extent of PCT 1196, equates to approximately 0.07 hectares of permanent habitat removal.

Significant impact assessment

Based on a reasonable understanding of the habitat requirements of Smoky Mouse in the study area, it is concluded that project impacts are unlikely to lead to a significant impact. An assessment and justification is provided in Table A.15.

Table A.15 Smoky Mouse *Pseudomys fumeus*, EPBC Act Endangered species – assessment against Significant Impact Criteria (CoA 2013)

Significant impact criteria (endangered species)	Likelihood of significant impact	Justification
Lead to a long-term decrease in the size of a population	Unlikely	The trail development will permanently remove up to 0.07 hectares of potential Smoky Mouse habitat in the form PCT 1196 near Bullocks Flat. Given the broad habitat requirements outlined above and the cryptic nature of this species, it could be reasonably assumed that if a population of the species was present within or adjacent to the trail alignment, the population would utilise the extensive areas of available habitat adjacent to the development. Under this assumption the removal of 0.07 hectares of habitat from within a large, contiguous, high quality patch would not lead to a direct decline in the size of a population as extensive habitat would still be available for critical activities to occur in. Predation from introduced carnivores is a key threatening process to Smoky Mouse. Cat and Fox scats were recorded throughout the national park during the field assessments, the construction of new walking trails is unlikely to increase the current predation threat from introduced carnivores, given the current activity level recorded.
Reduce the area of occupancy of the species	Unlikely	The permanent removal of 0.07 hectares of potential habitat in PCT 1196 will reduce the area of available habitat within the study area, however habitat surrounding and within the trail (elevated structures) may still be utilised by Smoky Mouse, should they be present, as such the overall area of occupancy will remain unchanged post construction.
Fragment an existing population into two or more populations	Unlikely	There is no record of a population from within or adjacent to the study area. The habitat in the Kosciuszko area will not be fragmented by the walking trails and any resultant disturbance will be a permeable narrow barrier in a discrete location or elevated structures that will not affect physical or functional connectivity between populations or breeding individuals.
Adversely affect habitat critical to the survival of the species	Unlikely	There is no declared critical habitat for the Smoky Mouse.

Significant impact criteria (endangered species)	Likelihood of significant impact	Justification
Disrupt the breeding cycle of a population	Unlikely	Impacts likely to disrupt the breeding cycle of Smoky Mouse include direct mortality, disturbance to breeding sites, loss of breeding and sheltering habitat, loss and fragmentation of foraging habitat and fragmentation of movement corridors. The proposal will remove/disturbance of 0.07 hectares of potential habitat. The habitat to be removed is within a large patch (>1000 hectares) of high quality vegetation extending throughout the Kosciuszko National Park. It is likely that if the species uses the study area for foraging, breeding and sheltering then the local population would use the entire patch of bushland.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely	The proposal will permanently remove/disturb up to 0.07 hectares of potential habitat. The habitat to be removed is within a large patch (>1000 hectares) of high quality vegetation. It is likely that if the species uses the study area for foraging, sheltering or breeding then the local population would use the entire area of available habitat. This level of disturbance in the context of available habitat will not lead to a broader species 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	Unlikely	The proposed works will not increase the level of invasive fauna activity already operating in the area. Invasive weeds species are known to directly harm populations of Smoky Mouse through reductions in habitat complexity and suitability. Soil disturbance and subsequent weed invasion will be minimised through construction management and follow up weed control. The project CEMP will specifically deal with controlling the introduction and spread of weed species, especially those species associated with walking track edges in the Kosciuszko National Park. Ongoing monitoring will be required to manage the establishment of weeds once the trails are operational.
Introduce disease that may cause the species to decline	Unlikely	Cinnamon Fungus *Phytophthora cinnamomi* is known to impact plant families that are characteristic of Smoky Mouse habitat. The project CEMP will specifically deal with controlling the introduction and spread of plant pathogens, especially Cinnamon Fungus through vehicle and contractor hygiene protocols. Ongoing monitoring will be required to manage the establishment and spread of Cinnamon Fungus once the trail is operational.

Significant impact criteria (endangered species)	Likelihood of significant impact	Justification
Interfere with the recovery of a species	Unlikely	The removal of high quality habitat in the form PCT 1196 is counter to the recovery of this species, however, the extent and nature of the vegetation removal in the context of available high quality habitat within the broader national park will not interfere with the recovery of this species.

Alpine She-oak Skink

Occurrence in the study area

During surveys of the various trail options Alpine She-oak Skink was recorded three times (March 2018, February 2019 and April 2019) on the eastern and southern slopes of Mount Perisher in high quality open grassy heathland habitat (PCT 641). Due to the presence of this species and Guthega Skink on Mount Perisher, NPWS abandoned the Guthega to Perisher Valley track option in favour of a lower impact option between Charlotte Pass and Perisher Valley. Although high quality habitat for this species on Mount Perisher has now been avoided there are still areas of potential habitat along the final trail alignments of all trails. These areas have been mapped and it is intended to install elevated structures in these locations to minimise ground and vegetation disturbance (Figures 3 and 4).

Permanent removal or disturbance of grassy heathland vegetation that provides habitat for Alpine She-oak Skink will occur. This habitat generally aligns with PCT 641 and it is estimated up to 0.49 hectares of this vegetation will be permanently lost or modified. Not all areas of PCT 641 are suitable Alpine She-oak Skink habitat mainly due to structural variation (i.e. some areas are very dense heathland). It is proposed to elevate the trail across 0.24 hectares of PCT 641, especially where vegetation structure is open and grassy. This will further reduce permanent loss of this habitat type down to 0.25 hectares. Temporary short-term impacts could extend out to 2.29 hectares in PCT 641 during construction.

Significant impact assessment

Based on a reasonable understanding of the habitat requirements of Alpine She-oak Skink in the study area, it is concluded that project impacts are unlikely to lead to a significant impact. An assessment and justification is provided in Table A.16.

Table A.16 Alpine She-oak Skink *Cyclodomorphus praealtus*, EPBC Act Endangered species – assessment against Significant Impact Criteria (CoA 2013)

Significant impact criteria (endangered species)	Likelihood of significant impact	Justification
Lead to a long-term decrease in the size of a population	Unlikely	The trail will remove or modify up to 0.49 hectares of high quality habitat in the form of PCT 641, noting that not all areas of this PCT are suitable for the species due to structural variation (e.g. taller dense heath). The trail alignments have been selected with the criteria of minimising critical habitat loss for Alpine She-oak Skink by avoiding habitat where possible and where habitat cannot be avoided using elevated structures to retain vegetation integrity. Nonetheless, vegetation removal for the proposed trail alignment will result in habitat loss for the species. While the direct result of trail building activities on Alpine She-oak Skink remain poorly understood, it could be reasonably assumed that if individuals were utilising vegetation within the trail alignment they could be expected to utilise the similar extensive habitat adjacent and surrounding the development. The habitat removal in the context of the broader available habitat is relatively minimal and would be unlikely to lead to a long term decrease in the size of a population, as this population would have significant habitat available in which critical activities could occur.
Reduce the area of occupancy of the species	Unlikely	The trail development will result in the removal/disturbance of a small area of high quality habitat. However, this area will not become entirely unsuitable for Alpine She-oak Skink as habitat will still remain adjacent to and beneath the trail (for elevated structures). As such the quantity and quality of available habitat within the species overall area of occupancy will decrease but the overall area of occupancy of the species will remain unchanged.
Fragment an existing population into two or more populations	Unlikely	Vegetation removal and disturbance for the proposed trail alignment will, in some cases, break the continuity of open grassy heathland habitat for the species. Alpine She-oak Skinks have poor long-distance dispersal ability (Koumoundouros et al. 2009). However, given the narrow area of clearing for trail construction, and the use of elevated structures where possible, it is anticipated that animals will still be able to move freely from one side of the trail alignments to the other. The species can continue to occupy habitat within the alignment itself, particularly in sections where elevated platforms and rock paving are used and habitat is reinstated beneath structures or between rocks.

Significant impact criteria (endangered species)	Likelihood of significant impact	Justification
Adversely affect habitat critical to the survival of the species	Unlikely	Tussock grasses and low shrubs constitute important habitat for Alpine She-oak Skinks in regards to shelter, foraging opportunities and protection from predators. These lifeforms provide individuals with access to microclimates that buffer against the thermal extremes of alpine environments (Sato et al. 2014). Loss of these habitat components may constitute loss of critical habitat but the extent of this in the context of available habitat post construction is unlikely to adversely affect the survival of the species.
Disrupt the breeding cycle of a population	Unlikely	The proposed trails may affect an unknown number of breeding individuals within and in close proximity to the construction footprint through direct mortality and potential disturbance during construction works, however this is considered unlikely to result in a disruption to the breeding cycle within the broader population as potential habitat is quite extensive in the surrounding area and breeding activities in the broader area should not be affected by the trail construction. Provided construction works proceed in the manner specified by NPWS it is envisaged that the trail will not disrupt future breeding of the species following the completion of construction.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely	The proposed trails will result in the destruction and removal of potential habitat for the species in the form of alpine vegetation. Although the summed loss of vegetation across all proposed trail alignments may amount to a large area of vegetation removal (including many non-suitable woodland, dense heathland and forest habitat types), localised habitat loss in a particular area will remain negligible relative to adjacent intact habitat. It is therefore anticipated that habitat removal will not cause the species 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	Unlikely	The proposed trail works are unlikely to result in new weeds or pests becoming established and the current suitable vegetation communities are very open and subject to predation by native and introduced predators. A CEMP and rehabilitation plan will need to be prepared to ensure that no transfer of weeds or pests occur as a result of the proposed works. Ongoing monitoring will be required to manage the establishment of weeds once the trails are operational.

Significant impact criteria (endangered species)	Likelihood of significant impact	Justification
Introduce disease that may cause the species to decline	Unlikely	There are no known diseases that have been transmitted to this species as a result of previous development in alpine areas, therefore it is considered highly unlikely that the proposed works will introduce disease that may cause the species to decline.
Interfere with the recovery of a species	Unknown	In the absence of a Commonwealth recovery plan for Alpine She-oak Skink, it is difficult to assess whether the proposed works would result in interference with the recovery of the species. There are no known recovery actions currently being undertaken within or adjacent to the study area.

Guthega Skink

Occurrence in the study area

Four individual Guthega Skinks (three adults and one juvenile) were observed during the April 2019 site investigation at Mount Perisher. Trail development proposals in the Mount Perisher area have now been abandoned by NPWS to avoid impact on this species. By comparison with Mount Perisher, the final trail alignments chosen and surveyed in February, March and April 2019 are considered less important habitat for the species owing to the scattered and widely spaced occurrence of suitable rocky habitat and relative paucity of Guthega Skink burrows beneath rocks and shrubs.

There is still potential for this species to occur in isolated locations along all final trail alignments. The species was documented by Atkins (2019) at two locations along the Charlotte Pass to Guthega Trail (Figure 3). The trail alignment at these locations has been changed to avoid areas of suitable habitat and burrow sites identified by Atkins (2019) and as recommended in his report. Significant effort has also been made during field surveys and micro-siting with NPWS staff to avoid other known burrow sites and suitable rocky habitat with potential burrow sites.

Significant impact assessment

Based on a reasonable understanding of the habitat requirements of Guthega Skink in the study area, it is concluded that project impacts are unlikely to lead to a significant impact. An assessment and justification is provided in Table A.17.

Table A.17 Guthega Skink *Liopholis guthega*, EPBC Act Endangered species – assessment against Significant Impact Criteria (CoA 2013)

Significant impact criteria (endangered species)	Likelihood of significant impact	Justification
Lead to a long-term decrease in the size of a population	Unlikely	Guthega Skinks have high fidelity to a small area within which they construct burrows beneath rocks and shrubs. Removal of such habitat will reduce the availability of shelter opportunities and therefore decrease the carrying capacity of these areas for Guthega Skinks. Given the extremely long timeframes over which granitic rock exfoliates and thus provide more loose rock to shelter beneath, it is anticipated that substantial removal of rock habitat will effect a long-term decrease in the size of local populations, as such, all areas identified as containing potential Guthega Skink rock habitat have been avoided during the micro-siting process as have areas of high quality habitat on Mount Perisher. Given this avoidance, disturbance to Guthega Skink habitat is expected to be limited to vegetation that may provide an occasional foraging or dispersal resource for individuals moving between meta-populations.
Reduce the area of occupancy of the species	Unlikely	The trail development will result in the removal of high quality alpine vegetation. However, core habitat in the form of rocky outcroppings will be avoided. As such the quantity and quality of available dispersal habitat between core habitats will decrease but the overall area of occupancy of the species will remain unchanged.
Fragment an existing population into two or more populations	Unlikely	As with other small reptiles, Guthega Skinks have poor dispersal capacity. It has been demonstrated that Guthega Skink colonies are separated by a minimum distance of 300 metres (Atkins et al. 2015). It is unlikely that the relatively narrow trail construction will present a barrier to dispersal, particularly if trail construction avoids removal of rocky habitats.
Adversely affect habitat critical to the survival of the species	Unlikely	Burrows beneath rocks and shrubs provide individuals with access to microclimates that buffer against predation and extremes of alpine environments (Atkins et al 2015). Loss of these habitat components will constitute loss of critical habitat for survival. As such all suitable rocky outcrops have been avoided during the trail micro-siting process. The resulting habitat loss is expected to be restricted to habitat that may provide an occasional dispersal or foraging corridor between meta-populations.

Significant impact criteria (endangered species)	Likelihood of significant impact	Justification
Disrupt the breeding cycle of a population	Unlikely	Despite the avoidance of critical habitat, the proposed trail may affect an unknown number of breeding individuals in close proximity to the construction footprint through direct mortality and potential indirect disturbance during construction works. However, the level of impact required for trail construction is considered unlikely to result in a disruption to the breeding cycle within the broader population as potential habitat is extensive in the surrounding area. Provided construction works and avoidance and minimisation measures proceed in the manner specified by NPWS it is envisaged that the trail will not disrupt future breeding of the species following the completion of construction.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely	Critical habitat in the form of rocky outcrops has been avoided during the trail micro-siting process. The trail will result in disturbance to vegetation that may provide an occasional dispersal resource for individuals moving between meta-populations. Disturbance to this habitat type is unlikely to result in a broader species decline at Kosciuszko National Park.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	Unlikely	The proposed trail works are unlikely to result in new weeds or pests becoming established and the current vegetation communities are very open and subject to predation by native and introduced predators. A CEMP and rehabilitation plan will need to be prepared to ensure that no transfer of weeds or pests occur as a result of the proposed works. Ongoing monitoring will be required to manage the establishment of weeds once the trail is operational.
Introduce disease that may cause the species to decline	Unlikely	There are no known diseases that have been transmitted to this species as a result of previous development in alpine areas, therefore it is considered highly unlikely that the proposed works will introduce disease that may cause the species to decline.
Interfere with the recovery of a species	Unknown	In the absence of a Commonwealth recovery plan for Guthega Skink, it is difficult to assess whether the proposed works would result in interference with the recovery of the species. There are no known recovery actions currently being undertaken within or adjacent to the study area.

Alpine Bogs and Associated Fens

Occurrence in the study area

Extensive areas containing the Alpine Bogs and Associated Fens (Alpine Bogs) community were recorded on and adjacent to all final trail alignments and significant areas were subsequently avoided during the trail micro-siting process. Where areas of Alpine Bogs could not be avoided elevated structures will be used to minimise disturbance to the Alpine Bog community. The above avoidance and minimisation principles have resulted in the likely disturbance of up to 0.13 hectares of the Alpine Sphagnum Bogs (PCT 637) community by installation of elevated structures. It is likely construction of elevated structures will cause minor permanent loss of this community where footings are installed. Elevated structures will have an ongoing shading influence that may alter vegetation composition and structure towards shade-tolerant species. Temporary short-term impacts could extend out to 0.45 hectares in PCT 637.

Significant impact assessment

Based on a reasonable understanding of the extent of the Alpine Bogs EEC in the study area, it is concluded that project impacts are unlikely to lead to a significant impact. An assessment and justification is provided in Table A.18.

Table A.18 Alpine Sphagnum Bogs and Associated Fens, endangered - assessment against Significant Impact Criteria (CoA 2013)

Significant impact criteria (endangered community)	Likelihood of significant impact	Justification
Reduce the extent of an ecological community.	Unlikely	The trail development will result in the permanent disturbance of up to 0.13 hectares of the Alpine Bogs EEC. A further 0.32 hectares may be temporarily impacted during construction or by maintenance activities. All Alpine Bogs impacted by the trail development form part of an extensive bog network that occupies valley floors, saddles and drainage networks throughout the study area. This occurrence is in the centre of the community's geographic distribution in the mainland alps. Given the localised scale of the vegetation removal and the extent of the Alpine Bog network in the broader national park, the permanent disturbance of 0.13 hectares will not lead to a broader decline that will reduce the overall geographic extent of the EEC.
Fragment or increase fragmentation of an ecological community.	Unlikely	All Alpine Bogs will be spanned by elevated structures that will allow gene flow beneath the structures and will not impede physical or hydrological functioning. As such the trail will be permeable and the Alpine Bogs EEC will not become fragmented or isolated as a result of the trail construction. The elevated structures will not affect physical or functional connectivity between occurrences of the community.
Adversely affect habitat critical to the survival of an ecological community.	Unlikely	The vegetation to be disturbed for construction and operation of the trail includes high quality Alpine Bogs that in the broader sense is critical to the community's survival. However, the extent of permanent vegetation disturbance (up to 0.13 hectares)

Significant impact criteria (endangered community)	Likelihood of significant impact	Justification
		required for the trail development will not jeopardise the long term survival of this EEC in the locality given the quantity of similar high quality contiguous habitat immediately adjacent to the development. The use of elevated structures will also allow for continued functioning of the community at the trail location.
Modify or destroy abiotic factors necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns.	Unlikely	Trail development and trampling by walkers can cause disruption in hydrology, gene flow and the breaking up of sphagnum and peat. This process can lead to the degradation and ultimately collapse of the community as the peatlands collapse. To mitigate these impacts all occurrences of the Alpine Bogs EEC on the trail alignment will be spanned by elevated structures. This will limit the disruption to hydrology and will allow gene flow and species persistence beneath the structures, which will be permeable to sunlight and rainfall. Given this level of mitigation it is considered unlikely that the trail development will lead to a destruction of abiotic factors that would lead to a broader community decline within the subject site.
Cause a substantial change in the species composition of an occurrence of an ecological community, including a decline or loss of functionally important species, for example through regular burning or flora and fauna harvesting.	Unlikely	As mentioned above, all areas containing the Alpine Bogs EEC will be spanned by elevated structures. Damage to the EEC outside of the construction footprint will be managed through construction techniques, including building structures sequentially off the platform, to avoid driving machines on the EEC. Species will be allowed to persist and recolonise beneath the elevated structures. Provided these mitigation measures are adhered to the proposed trail development is unlikely to significantly alter the composition of the EEC.
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including but not limited to: - ***Assisting invasive species establishment*** ***- 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.***	Unlikely	Soil disturbance and subsequent weed invasion will be minimised through construction management and follow up weed control. The project CEMP will specifically deal with controlling the introduction and spread of weed species in ecologically sensitive areas, especially those species associated with walking track edges in the Kosciuszko National Park. Ongoing monitoring will be required to manage the establishment of weeds once the trails are operational.

Significant impact criteria (endangered community)	Likelihood of significant impact	Justification
Interfere with the recovery of an ecological community.	Unlikely	Several bog rehabilitation programs have been implemented across the national park. The national recovery plan for sphagnum bogs identifies a range of generic strategies and actions for bog recovery (DoE 2015). These actions are focussed on restoring hydrological patterns and vegetation cover disrupted by historical cattle grazing and more recent severe fire events. The bog systems crossed by the trails have not been subject to restoration activities and would not be considered a priority for rehabilitation as they are all relatively intact. The intention of installing elevated structures would be to maintain bog functioning and integrity.

Appendix 4 Tests of Significance

The following section provides for Tests of Significance as outlined in Section 7.3 of the BC Act and OEH (2018a) for all species listed as a medium likelihood or greater in Appendix 1 and Appendix 2. Species descriptions, information on life cycles and key threats, and occurrence along final trail alignments can be found in Section 4.6 and Figures 2 and 3. Threatened species have been grouped for the purpose of impact assessment where they have similar ecology, life cycles or habitat requirements within the study area and subject site.

Interpretation of key terms (adapted from OEH 2018a)

***Study area**: the study area consists of the proposed trail centrelines buffered by 7.5 metres on each side to create a 15 metre wide assessment corridor. This corridor is considered to cover all areas likely to be subject to direct and indirect impact.*

***Subject site:** The subject site sits within the study area in accordance with OEH (2018a) and consists of the trail construction footprint and future maintenance corridor. This is the area likely to be directly impacted by construction and operation of the trails. Ancillary areas include proposed camping sites and additional car parking were also considered as part of the impact area within the subject site.*

The expected disturbance to soil and vegetation associated with trail construction and maintenance has been defined by NPWS based on their extensive experience with track building in the Park. Key trail surface types proposed are rock paving (including pitched rock), natural/gravel surface, elevated structures and bridges.

***Direct impacts**: are those that directly affect the habitat and individuals. They include, but are not limited to, death through predation, trampling, poisoning of the animal/plant itself and the removal of suitable habitat. When applying each factor, consideration must be given to all of the likely direct impacts of the proposed activity or development.*

***Indirect impacts**: occur when project-related activities affect species, populations or ecological communities in a manner other than direct loss. Indirect impacts can include loss of individuals through starvation, exposure, predation by domestic and/or feral animals, loss of breeding opportunities, loss of shade/shelter, deleterious hydrological changes, increased soil salinity, erosion, inhibition of nitrogen fixation, weed invasion, fertiliser drift, or increased human activity within or directly adjacent to sensitive habitat areas. As with direct impacts, consideration must be given, when applying each factor, to all of the likely indirect impacts of the proposed activity or development.*

***Life cycle**: the series or stages of reproduction, growth, development, ageing and death of an organism.*

***Viable**: the capacity to successfully complete each stage of the life cycle under normal conditions.*

***Local Population / Locality:** the population that occurs in the study area. The assessment of the local population may be extended to include individuals beyond the study area if it can be clearly demonstrated that contiguous or interconnecting parts of the population continue beyond the study area, according to the following definitions.*

- *The local population of a threatened fauna species comprises those individuals occurring in the study area or the cluster of individuals that extend into habitat adjoining and contiguous with the study area that could reasonably be expected to be mating and utilising the same area for foraging/breeding with those in the study area.*
- *Locality has the same meaning as ascribed to local population of a species*

- ***Risk of extinction**: the likelihood that the local population will become extinct either in the short-term or in the long-term as a result of direct or indirect impacts on the viability of that population.*

***Habitat**: the area occupied, or periodically or occasionally occupied, by any threatened species, population or ecological community and includes all the different aspects (both biotic and abiotic) used by species during the different stages of their life cycles.*

***Extent:** the physical area removed and/or to the compositional components of the habitat and the degree to which each is affected.*

***Importance:** related to the stages of the species' life cycles and how reproductive success may be affected.*

***Locality**: the same meaning as ascribed to local population of a species or local occurrence of an ecological community.*

Tests of Significance are included for the threatened following biota:

- Shining Cudweed
- Mountain Greenhood (grouped as greenhood orchids)
- Slender Greenhood (grouped as greenhood orchids)
- Blue Tongued Greenhood (grouped as greenhood orchids)
- Anemone Buttercup
- Perisher Wallaby-grass
- Montane Peatland EEC (syn. Alpine Sphagnum Bogs and associated Fens)
- Tablelands Snow Gum, Black Sallee and Ribbon Gum Grassy Woodland
- Broad-toothed Rat
- Eastern Pygmy-possum
- Eastern False Pipistrelle (grouped as threatened microbats)
- Eastern Bentwing Bat (grouped as threatened microbats)
- Koala
- Mountain Pygmy-possum
- Smoky Mouse
- Spotted-tailed Quoll
- Gang-gang Cockatoo
- Powerful Owl
- Olive Whistler (grouped with threatened passerine birds)
- Scarlet Robin (grouped as threatened passerine birds)
- Flame Robin (grouped as threatened passerine birds)
- Pink Robin (grouped as threatened passerine birds)
- Diamond Firetail (grouped as threatened passerine birds)
- Brown Treecreeper (grouped as threatened passerine birds)
- Alpine She-oak Skink
- Guthega Skink
- Snowy River endangered aquatic ecological community
- Alpine Red-spot Dragonfly
- River Blackfish (Snowy River endangered population).

Table A.19 Test of Significance for Shining Cudweed

ToS Criteria	Outcome
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.	Impacts likely to have an adverse effect on the life cycle of Shining Cudweed include disturbance to pollinators, seed dispersal, vegetative reproduction of individuals or fragmentation and genetic bottlenecking or interruption of gene flow between populations. The proposed trail development will permanently remove or disturb up to 1.06 hectares of potential habitat represented by PCTs 641, 643 and 645. Not all areas of these PCTs are suitable habitat as many examples are dominated by dense ground layer vegetation where Shining Cudweed is unlikely to establish and flourish. The habitat to be removed is within a large contiguous patch of high quality native alpine and sub-alpine vegetation within the broader national park. No populations of Shining Cudweed were recorded on any of the final trail alignments during the targeted surveys or micro-siting. The walking trails and any resultant disturbance will be a permeable narrow barrier in a discrete location that is unlikely to affect pollination, seed dispersal, vegetative reproduction or gene flow of Shining Cudweed as extensive habitat will still be available post construction for these activities to occur in, meaning local populations, if present, are likely to remain viable. The species has been observed growing along walking tracks and colonising disturbed areas in alpine regions of NSW and Victoria (NPWS 2001) indicating that local populations of this species tolerate some disturbance and are unlikely to become extinct if they are present.

ToS Criteria	Outcome
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.***	Not relevant to threatened species.

ToS Criteria	Outcome
c) In relation to the habitat of a threatened species or ecological community: ***(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and*** ***(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and*** ***(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,***	The proposed trail development will permanently remove or disturb up to 1.06 hectares of potential habitat represented by PCTs 641, 643 and 645. Not all areas of these PCTs are suitable habitat as many examples are dominated by dense ground layer vegetation where Shining Cudweed is unlikely to establish and flourish. The proposed trail development also has the potential to modify adjoining native vegetation by increased edge effects, sedimentation and accidental modification by workers during construction and walkers during operation of the trail. Recommendations contained within this report aim to minimise indirect impact from construction and operation of the trails and when implemented will ensure that indirect impacts of adjoining native vegetation is minimised. The existing populations in the Kosciuszko area will not be fragmented by the walking trail and any resultant disturbance will be a permeable narrow barrier in a discrete location that will not affect physical or functional connectivity between populations. As discussed above the species is known to grow along walking tracks and colonise disturbed areas in alpine regions demonstrating its ability to respond to site-scale fragmentation (NPWS 2001). No plants were recorded along the final trail alignments during targeted surveys or micro-siting, therefore it is not expected that a significant number of individuals or population will be impacted by construction activities. The vegetation to be disturbed for construction and operation of the trail includes high quality alpine and sub-alpine vegetation that in the broader sense is critical to this species survival. However, the extent of permanent vegetation removal/disturbance (1.06 hectares) required for the trail development will not jeopardise the long term survival of this species in the locality given the quantity of similar high quality contiguous habitat immediately adjacent to the development.
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),	The area is not part of a declared area of outstanding biodiversity value.

ToS Criteria	Outcome
*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.***	Clearing of native vegetation is identified as a key threatening process on the Schedules of the BC Act. The disturbance of up to 1.06 hectares of alpine and sub-alpine native vegetation during construction of the trails is not considered a significant amount of disturbance in the context of broader areas of alpine and sub-alpine vegetation in the national park.

Conclusion for Shining Cudweed

In consideration of the above five factors (a-e), the proposed activity is not likely to significantly impact Shining Cudweed within the study area or broader locality, as:

- The proposal will remove or disturb a relatively small area (up to 1.06 hectares) of potential habitat, from within an area containing large contiguous patches of similar habitat.
- The extent of the vegetation removal in the context of the broader national park will not significantly disrupt the lifecycle of Shining Cudweed.
- While some of the habitat to be removed or disturbed is considered important to the survival of the species, the extent of the removal within the national park is not considered important to the survival of the species.
- The proposal does not significantly contribute to a KTP for this species.

Table A.20 Test of Significance for Anemone Buttercup

ToS Criteria	Outcome
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.	Impacts likely to have an adverse effect on the life cycle of Anemone Buttercup include disturbance to pollinators, seed dispersal, vegetative reproduction of individuals or fragmentation and genetic bottlenecking or interruption of gene flow between populations. The extent of vegetation removal and disturbance in PCTs 637, 641, 643 and 645 that provide potential habitat for this species is a maximum of 1.19 hectares. Extensive populations of Anemone Buttercup were recorded at multiple locations along the various options and alignments assessed, particularly on Mount Perisher and Back Perisher Mountain. As the Guthega to Perisher Valley trail option that crosses Mount Perisher has now been abandoned the large and intact populations in that location will be avoided. The species was only recorded in one location along the final trail alignments between Charlotte Pass and Guthega where it occupied an area of 3 metres x 6 metres. During micro-siting in March 2019, the trail was realigned around this population to avoid direct impacts. The potential habitat to be removed is within a large contiguous patch of high quality native alpine and sub-alpine vegetation within the broader national park. The walking trail and any resultant disturbance will be a permeable narrow barrier in a discrete location that is unlikely to affect pollination, seed dispersal, vegetative reproduction or gene flow of Anemone Buttercup as extensive habitat will still be available post construction for these activities to occur in, meaning local populations are likely to remain viable. Grazing by domestic stock is likely to have been the single biggest threat to Anemone Buttercup and with the reduction in this threat through the removal of cattle form the national park, this species has been observed to be recovering within the Kosciuszko area. The trail development will not interrupt this recovery and will not adversely affect lifecycle traits of this species to the point that a viable local population will be placed at risk of extinction.

ToS Criteria	Outcome
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.***	Not relevant to threatened species.

ToS Criteria	Outcome
c) In relation to the habitat of a threatened species or ecological community: ***(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and*** ***(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and*** ***(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,***	The extent of vegetation removal and disturbance in potential habitat is a maximum of 1.19 hectares within a large contiguous patch within the Kosciuszko National Park. The proposed trail development also has the potential to modify adjoining native vegetation by increased edge effects, sedimentation and accidental modification by workers during construction and walkers during operation of the trail. Recommendations contained within this report aim to minimise indirect impact from construction and operation of the trails and when implemented will ensure that indirect impacts of adjoining native vegetation is minimised. The existing populations in the Kosciuszko area will not be fragmented by the walking trail and any resultant disturbance will be a permeable narrow barrier in a discrete location that will not affect physical or functional connectivity between populations. One population was recorded along the final trail alignment during targeted surveys and the trail was realigned to avoid these plants. The vegetation to be disturbed for construction and operation of the trail includes high quality alpine and sub-alpine vegetation that in the broader sense is critical to this species survival. However, the extent of potential permanent habitat removal/disturbance (1.06 hectares) required for the trail development will not jeopardise the long term survival of this species in the locality given the quantity of similar high quality contiguous habitat immediately adjacent to the development. As discussed above, the species has been observed in multiple locations in multiple vegetation types and as such high quality available habitat is not limited at the locality.
d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),	The area is not part of a declared area of outstanding biodiversity value.
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.	Clearing of native vegetation is identified as a key threatening process on the Schedules of the BC Act. The disturbance of up to 1.06 hectares of potential habitat in alpine and sub-alpine native vegetation during construction of the trails is not considered a significant amount of disturbance in the context of broader areas of alpine and sub-alpine vegetation in the national park.

ToS Criteria	Outcome
Conclusion for Anemone Buttercup	
In consideration of the above five factors (a-e), the proposed activity is not likely to significantly impact Anemone Buttercup within the study area or broader locality, as: • The proposal will permanently remove or disturb a relatively small area of potential habitat (up to 1.06 hectares) from within an area containing large contiguous patches of similar habitat. • The extent of the potential habitat removal in the context of the broader national park will not significantly disrupt the lifecycle of Anemone Buttercup. • While the potential habitat to be removed is considered important to the survival of the species, the extent of the removal within the national park is not considered important to the survival or recovery of the species. • The proposal does not significantly contribute to a KTP for thisspecies.	

Table A.21 Test of Significance for Perisher Wallaby-grass

ToS Criteria	Outcome
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.	Impacts likely to have an adverse effect on the life cycle of Perisher Wallaby-grass include disturbance to seed dispersal, vegetative reproduction of individuals or fragmentation and genetic bottlenecking or interruption of gene flow between populations. Perisher Wallaby-grass was recorded near the crossing of Spencers Creek on the Charlotte Pass to Guthega track. One plant was recorded on the stream bank amongst sphagnum hummocks and sedges in typical habitat. The creek crossing at this location can be aligned / constructed to avoid this plant and immediate areas along the creek were surveyed for other populations without any detected. The species was not recorded in other suitable habitat along the Charlotte Pass to Perisher Valley track (e.g. Spencers Creek headwater) but was found in the Betts Creek Valley 700 metres north of the final trail alignment in suitable habitat. Areas containing habitat for Perisher Wallaby-grass will be spanned by bridges or elevated structures and impacts are expected to be restricted to post holes and some disturbance during construction. The resultant disturbance will be a permeable narrow barrier or elevated structure with contiguous native vegetation beneath, in a discrete location. This level of disturbance is unlikely to affect seed dispersal, vegetative reproduction or gene flow of Perisher Wallaby-grass as extensive habitat will still be available during and post construction for these activities to occur in, meaning local populations are likely to remain viable. The trail development will not adversely affect lifecycle traits of this species to the point that a viable local population will be placed at risk of extinction.

ToS Criteria	Outcome
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.***	Not relevant to threatened species.

ToS Criteria	Outcome
c) In relation to the habitat of a threatened species or ecological community: ***(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and*** ***(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and*** ***(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,***	Perisher Wallaby-grass is most likely to occur in examples of PCT 637 on very wet flat valley floors or along permanent streams. Not all areas of PCT 637 mapped in the study area provide these specific habitat requirements. As a precautionary quantification the extent of PCT 637 to be permanently disturbed or removed (i.e. 0.13 hectares) could be used as a measure of worst case impacts on this species' habitat. The proposed trail development also has the potential to modify adjoining native vegetation by increased edge effects, sedimentation and accidental modification by workers during construction and walkers during operation of the trail. Recommendations contained within this report aim to minimise indirect impact from construction and operation of the trails and when implemented will ensure that indirect impacts of adjoining native vegetation is minimised. The existing populations in the Kosciuszko area will not be fragmented by the walking trail and any resultant disturbance will be a permeable narrow barrier in a discrete location or elevated structures that will not affect physical or functional connectivity between populations. The worst case extent of vegetation removal and disturbance (0.13 hectares) required for the trail development will not jeopardise the long term survival of this species in the locality given the quantity of similar high quality contiguous habitat immediately adjacent to the development.
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),	The area is not part of a declared area of outstanding biodiversity value.
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.	Clearing of native vegetation is identified as a key threatening process on the Schedules of the BC Act. The disturbance of up to 0.13 hectares of bog vegetation that may provide habitat for this species during construction of the trails is not considered a significant amount of disturbance in the context of broader areas of alpine and sub-alpine vegetation in the national park.

ToS Criteria	Outcome
Conclusion for Perisher Wallaby-grass	
In consideration of the above five factors (a-e), the proposed activity is not likely to significantly impact Perisher Wallaby-grass within the study area or broader locality, as: • The proposal will remove or disturb a relatively small area (up to 0.13 hectares) of potential bog habitat for this species and the one plant recorded at Spencers Creek will be avoided by use of a bridge to cross habitat in that location. • The extent of the vegetation removal or disturbance in the context of the broader national park will not significantly disrupt the lifecycle of Perisher Wallaby-grass. • While some of the potential habitat to be removed is considered important to the survival of the species, the extent of the removal within the national park is not considered important to the survival or recovery of the species. • The proposal does not significantly contribute to a KTP for this species.	

Table A.22 Test of Significance for Blue-tongued Greenhood, Mountain Greenhood and Slender Greenhood

ToS Criteria	Outcome
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.	Impacts likely to have an adverse effect on the life cycle of greenhood orchids include disturbance to seed dispersal, vegetative reproduction of individuals or fragmentation and genetic bottlenecking or interruption of gene flow between populations. No individual Blue-tongued Greenhood, Mountain Greenhood or Slender Greenhood were recorded on or adjacent to any of the final trail alignments that were inspected on foot. The study area supports high quality habitat for the Blue-tongued Greenhood represented by sub-alpine and montane drainage lines supporting Mountain Tea-tree and sphagnum hummocks included in PCT 637, and other drainage lines in PCT 638 and PCT 644. Mountain Greenhood and Slender Greenhood occur at montane elevations and PCTs 638, 644, 679 and 1196 all provide potential habitat. All drainage lines and sphagnum bogs will be spanned by elevated structures and impacts in these areas are expected to be kept to minor disturbance for post holes. The habitat to be removed or disturbed is within a large contiguous patch of high quality native sub-alpine and montane vegetation within the broader national park. All areas containing habitat will be spanned by bridges or elevated structures and impacts in these areas are expected to be restricted to vegetation removal required for post holes and some minor disturbance during construction activities. The resultant disturbance will be a permeable elevated structure with contiguous native vegetation beneath, in a discrete location. This level of disturbance is unlikely to affect seed dispersal, vegetative reproduction or gene flow as extensive habitat will still be available during and post construction for these activities to occur in, meaning local populations are likely to remain viable. The trail development will not adversely affect lifecycle traits of this species to the point that a viable local population of these greenhoods will be placed at risk of extinction.

ToS Criteria	Outcome
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.***	Not relevant to threatened species.

ToS Criteria	Outcome
c) In relation to the habitat of a threatened species or ecological community: ***(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and*** ***(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and*** ***(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,***	Given the very specific habitat requirements of Blue-tongued Greenhood in montane bog communities and along drainage systems that do not always conform to a mappable PCT it is not possible to accurately estimate the extent of potential habitat beyond the estimated extent of PCT 637. The key areas of habitat for Blue-tongued Greenhood are on the slopes above Bullocks Flat and the trail here will cross approximately 20 drainage lines, some of which have Mountain Tea-tree and Sphagnum hummocks. Mountain Greenhood and Slender Greenhood occur at montane elevations and PCTs 638, 644, 679 and 1196 all provide potential habitat and the extent of permanent removal and disturbance in these PCTs is up to 0.37 hectares. The proposed trail development also has the potential to modify adjoining native vegetation by increased edge effects, sedimentation and accidental modification by workers during construction and walkers during operation of the trail. Recommendations contained within this report aim to minimise indirect impact from construction and operation of the trails and when implemented will ensure that indirect impacts of adjoining native vegetation is minimised. No existing populations were recorded during targeted surveys for Blue-tongued Greenhood and NPWS have previous survey some suitable habitat for the other two greenhoods above Bullocks Flat. If populations of Blue-tongued Greenhood are present on the alignment and undetected they will not be fragmented by the walking trail as the use of elevated structures will not affect physical or functional connectivity between populations. The worst case extent of vegetation removal and disturbance for Blue-tongued Greenhood will be at up to 20 drainage line crossing locations above Bullocks Flat, and 0.37 hectares of habitat for the other two greenhoods. It is unlikely trail development will jeopardise the long term survival of these species in the locality given the quantity of similar high quality contiguous habitat immediately adjacent to the development and the use of elevated structures.
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),	The area is not part of a declared area of outstanding biodiversity value.

ToS Criteria	Outcome
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.***	Clearing of native vegetation is identified as a key threatening process on the Schedules of the BC Act. The disturbance of small areas of montane vegetation during construction of the trails is not considered a significant amount of disturbance in the context of broader areas of alpine and sub-alpine vegetation in the national park.

Conclusion for greenhood orchids

In consideration of the above five factors (a-e), the proposed activity is not likely to significantly impact greenhood orchids within the study area or broader locality, as:

- The proposal will remove or disturb small areas of suitable habitat from within an area containing large contiguous patches of similar habitat.
- The extent of the vegetation removal in the context of the broader national park will not significantly disrupt the lifecycle of these greenhood orchids.
- While the potential habitat to be removed is considered important to the survival of these species, the extent of the removal within the national park is not considered important to the survival or recovery of the species.
- The proposal does not significantly contribute to a KTP for these species.

Table A.23 Test of Significance for Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions (Alpine Bogs)

ToS Criteria	Outcome
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.	Not applicable to threatened ecological communities.
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.***	The trail development will result in the permanent removal or disturbance of up to 0.13 hectares of this community. All bogs impacted by the trail development form part of an extensive bog network that occupies valley floors, saddles and drainage networks throughout the study area. Given the localised scale of the vegetation removal and the extent of the bog network in the broader national park, the permanent removal or disturbance 0.13 hectares will not lead to a broader decline to the point where local occurrences of the community would be placed at risk of extinction. Trail development and trampling by walkers can cause disruption in hydrology, gene flow and the breaking up of sphagnum and peat. This process can lead to the degradation and ultimately collapse of the community as the peatlands collapse. To mitigate these impacts all occurrences of the community on the trail alignments will be spanned by elevated structures. This will limit the disruption to hydrology and will allow gene flow and species persistence beneath the structures, which will be permeable to sunlight and rainfall. Provided these mitigation measures are adhered to the proposed trail development is unlikely to significantly alter the composition of the ecological community such that a local occurrence is likely to be placed at risk of extinction.

ToS Criteria	Outcome
c) In relation to the habitat of a threatened species or ecological community: ***(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and*** ***(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and*** ***(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,***	The proposed development activity will result in the permanent removal or disturbance of 0.13 hectares of the community. The proposed trail development also has the potential to modify adjoining native vegetation by increased edge effects, sedimentation and accidental modification by workers during construction and walkers during operation of the trail. Recommendations contained within this report aim to minimise indirect impact from construction and operation of the trails and when implemented will ensure that indirect impacts of adjoining native vegetation is minimised. All bogs will be spanned by elevated structures that will allow the dispersal of plants and animals beneath the structures and maintain physical and hydrological connectivity. As such the trail will be permeable and the community will not become fragmented or isolated as a result of the trail construction and the elevated structures will not affect physical or functional connectivity between populations. The vegetation to be disturbed for construction and operation of the trail includes high quality Alpine Bogs that in the broader sense is critical to the community's survival. However, the extent of vegetation removal (0.13 hectares) required for the trail development will not jeopardise the long term survival of this EEC in the locality given the quantity of similar high quality contiguous habitat immediately adjacent to the development and the use of elevated structures will allow for continued functioning of the community at the trail location.
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),	The area is not part of a declared area of outstanding biodiversity value.
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.	Clearing of native vegetation is identified as a key threatening process on the Schedules of the BC Act. The disturbance of up to 0.13 hectares of the Alpine Bogs EEC during construction of the trail is not considered a significant amount of disturbance in the context of broader areas of the Alpine Bog EEC in the national park.

ToS Criteria	Outcome
Conclusion for Alpine Bogs	
In consideration of the above five factors (a-e), the proposed activity is not likely to significantly impact Alpine Bogs within the study area or broader locality, as: • The proposal will remove or disturb a relatively small area (up to 0.13 hectares) of high quality habitat, from within an area containing large contiguous patches of similar habitat. • The extent of the vegetation removal in the context of the broader national park will not significantly disrupt the composition of Alpine Bogs at the location. • While the habitat to be removed contributes to the survival of the EEC, the extent of removal within the national park is not considered significant to the survival or recovery of the EEC. • The proposal will not significantly contribute to a KTP for this EEC if all construction and operational mitigation measures are implemented.	

Table A.24 Test of Significance for Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions ***to be updated in spring 2019 once a review of the amended listing of this community is undertaken: https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Scientific-Committee/Determinations/2019/monaro-tableland-final-determination-CEEC.pdf?la=en&hash=08778611BB71929B4B80EAE429060ABA50664030

ToS Criteria	Outcome
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.	Not applicable to threatened ecological communities.
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.***	This community occurs for the last 300 metres of the Perisher to Bullocks Flat trail in the South Eastern Highland bioregion. Impacts to this community are likely to include permanent removal of up to 0.015 hectares of already disturbed understorey vegetation along the Thredbo River. The examples of the community impacted by the trail development form part of an extensive contiguous patch of the community along the Thredbo River valley. Given the localised scale of the vegetation removal and the extent of the community in the broader area, the removal of 0.015 hectares will not lead to a broader decline to the point where local occurrences of the EEC would be placed at risk of extinction. Across this community's natural range it occurs in fragmented landscapes where introduced vegetation cover is significant, grazing pressures are high and intensive land clearing has taken place over the past 150 years. Land use impacts from clearing, cropping and grazing have reduced community integrity and functionality in southern NSW (e.g. loss of small native mammals, reduced flora species richness, reduced genetic exchange across the community due to fragmentation). Clearing of the scale and extent required for the trail development is unlikely to further modify the composition of the community, as the adjacent areas of the community within the study area will remain intact and are unlikely to suffer changes in community composition.

ToS Criteria	Outcome
c) In relation to the habitat of a threatened species or ecological community: ***(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and*** ***(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and*** ***(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,***	The proposed development activity will result in the removal of 0.015 hectares of the community. The proposed trail development also has the potential to modify adjoining native vegetation by increased edge effects, sedimentation and accidental modification by workers during construction and walkers during operation of the trail. Recommendations contained within this report aim to minimise indirect impact from construction and operation of the trails and when implemented will ensure that indirect impacts of adjoining native vegetation is minimised. The walking trail and any resultant disturbance will be a permeable narrow barrier in a discrete location that is unlikely to affect gene flow or movement of species within the community. Therefore, the EEC at the location will not become further fragmented or isolated as a result of the proposed development. The vegetation to be disturbed for construction and operation of the trail includes moderate quality examples of this community that in the broader sense is critical to the community's survival. However, the extent of vegetation removal (0.015 hectares) required for the trail development will not jeopardise the long term survival of this EEC in the locality given the quantity of similar high quality contiguous habitat immediately adjacent to the development.
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),	The area is not part of a declared area of outstanding biodiversity value.
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.	Clearing of native vegetation is identified as a key threatening process on the Schedules of the BC Act. The disturbance of up to 0.015 hectares of the community during construction of the trail is not considered a significant amount of disturbance in the context of broader areas of alpine and sub-alpine vegetation in the national park.

ToS Criteria	Outcome
Conclusion for Tablelands Snow Gum Grassy Woodlands	
In consideration of the above five factors (a-e), the proposed activity is not likely to significantly impact Tablelands Snow Gum Grassy Woodlands within the study area or broader locality, as: • The proposal will remove a small area (up to 0.015 hectares) of moderate quality examples of this community from within an area containing large contiguous patches of similar habitat along the Thredbo River valley. • The extent of the vegetation removal in the context of the broader national park will not significantly disrupt the composition of the community at the location. • While the example of this community is considered important, the extent of the removal within the national park is not considered important to the survival or recovery of the EEC. • The proposal does not significantly contribute to a KTP for this EEC.	

Table A.25 Test of Significance for Mountain Pygmy-possum

ToS Criteria	Outcome
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.***	Impacts from the trail development which have potential to have an adverse effect on the life cycle of Mountain Pygmy-possum include direct mortality during construction, loss of potential breeding and foraging habitat, increased predation risks as a result of predators entering the area along trails and fragmentation of dispersal corridors. The proposed trail development will remove small areas of moderate quality habitat including the removal of vegetation, woody debris and rocky areas. The species may disperse through habitats associated with PCTs 641, 643 and 645. Boulderfields and extensive Podocarp shrublands were avoided during the trail route selection and micro-siting processes. The habitat to be removed is within a large contiguous area of high quality native alpine and sub-alpine vegetation within the broader national park. The resultant disturbance will be a permeable narrow barrier in a discrete location. This level of disturbance is unlikely to affect foraging, dispersal or gene flow of Mountain Pygmy-possum as extensive habitat will still be available during and post construction for these activities to occur in and the trail will be permeable, meaning males moving up slope will not be isolated from females. Cat and Fox scats were recorded throughout the national park during the field assessments, the construction of a new walking trail is unlikely to increase the current predation threat from feral carnivores, given the current activity level recorded. Given the relatively small construction footprint and the efforts made to avoid high quality Mountain Pygmy-possum habitat during the micro-siting process, the trail development will not adversely affect lifecycle traits of this species to the point that a viable local population will be placed at risk of extinction.

ToS Criteria	Outcome
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.***	Not relevant to threatened species.

ToS Criteria	Outcome
c) In relation to the habitat of a threatened species or ecological community: ***(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and*** ***(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and*** ***(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,***	The dispersal habitat to be disturbed has not been definitively mapped but it is likely this species may disperse and use habitat in PCTs 641, 643 and 645. The proposed trail development will permanently remove or disturb up to 1.06 hectares of potential habitat represented by these PCTs but not all areas of these PCTs are suitable as many examples are very open grassland communities or lack suitable cover. The proposed trail development also has the potential to modify adjoining native vegetation by increased edge effects, sedimentation and accidental modification by workers during construction and walkers during operation of the trail. Recommendations contained within this report aim to minimise indirect impact from construction and operation of the trails and when implemented will ensure that indirect impacts of adjoining native vegetation is minimised. High quality habitat such as boulder field and podocarp shrublands were avoided during the trail micro-siting process. Core habitat for Mountain Pygmy Possum includes boulderfields and podocarp shrublands. The habitat in the Kosciuszko area will not be fragmented by the walking trails and any resultant disturbance will be a permeable narrow barrier in a discrete location or elevated structures that will not affect physical or functional connectivity between populations or breeding individuals. Core important habitat for Mountain Pygmy Possum includes boulderfields and podocarp shrublands and areas connecting male habitats at the bottoms of mountains with female habitat at the tops of mountains. All boulderfields and extensive podocarp shrublands were avoided during the trail micro-siting process. The vegetation to be disturbed for construction and operation of the trail includes high quality alpine and sub-alpine vegetation that in the broader sense is critical to this species survival but would predominantly be used as an occasional dispersal or foraging resource. However, the extent of potential dispersal habitat removal (1.06 hectares) required for the trail development will not jeopardise the long term survival of this species in the locality given the quantity of similar high quality contiguous habitat immediately adjacent to the development.

ToS Criteria	Outcome
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),	The area is not part of a declared area of outstanding biodiversity value.
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.	Clearing of native vegetation is identified as a key threatening process on the Schedules of the BC Act. The disturbance of up to 1.06 hectares of potential dispersal habitat during construction of the trail is not considered a significant amount of disturbance in the context of broader areas of alpine and sub-alpine vegetation in the national park. Predation by foxes and cats are also relevant KTPs.

Conclusion for Mountain Pygmy Possum

In consideration of the above five factors (a-e), the proposed activity is not likely to significantly impact Mountain Pygmy-possum within the study area or broader locality, as:

- The proposal will remove potential habitat for this species (up to 1.06 hectares that includes areas of unsuitable open grassy habitat). These areas represent an occasional dispersal or foraging resource, from within an area containing large contiguous patches of similar habitat. Core boulderfield habitat has been avoided through route selection and micro-siting.
- The extent of the vegetation removal in the context of the broader national park will not significantly disrupt the lifecycle of Mountain Pygmy-possum.
- While the habitat to be removed contributes to the survival of the species, the extent of removal within the national park is not considered significant to the survival or recovery of the species.
- The proposal may increase predation by feral cat and red fox but this can be managed through a project-specific predator management program.

Table A.26 Test of Significance for Broad-toothed Rat

ToS Criteria	Outcome
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.	Impacts from the trail development may have potential to have an adverse effect on the life cycle of Broad-toothed Rat include direct mortality during construction, loss of potential breeding and foraging habitat (through changes to vegetation structure), increased predation risks as a result of predators entering the area along trails and fragmentation of dispersal corridors. The species is likely to use suitable micro-habitats in all PCTs in the study area but scats and runways were recorded most frequently in PCT 637, PCT 641 and PCT 643. The proposed trail development will permanently remove or disturb up to 1.56 hectares of habitat including the removal of vegetation, woody debris, sedge and rocky areas. Broad-toothed Rat occupies a range of habitats including heathlands, grassland adjacent to boulder fields, swamps sedge land and sometimes forest with a grassy understorey. Elevated structures will be used to cross all drainage lines and wet areas and these structures will be permeable to Broad-toothed Rat. The habitat to be removed or disturbed is within a large contiguous area of high quality native alpine and sub-alpine vegetation within the broader national park. The resultant disturbance will be a permeable narrow barrier in a discrete location. This level of disturbance is unlikely to affect foraging, dispersal or gene flow of Broad-toothed Rat as extensive habitat will still be available during and post construction for these activities to occur in. Cat and Fox scats were recorded throughout the national park during the field assessments indicating these species currently occupy habitats to be impacted. The construction of a new walking trail is unlikely to increase predator incursion at a landscape scale, as feral predators are already widespread, but the new trails may increase predation of Broad-toothed Rat at a site level where vegetation cover is reduced. Given the relatively small construction footprint in the context of available habitat in the broader national park, the trail development will not adversely affect lifecycle traits of this species to the point that a viable local population will be placed at risk of extinction.

ToS Criteria	Outcome
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.***	Not relevant to threatened species.

ToS Criteria	Outcome
c) In relation to the habitat of a threatened species or ecological community: ***(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and*** ***(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and*** ***(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,***	The proposed development will require the removal or disturbance of up to 1.56 hectares of alpine, sub-alpine and montane habitat within a large contiguous area within the Kosciuszko National Park. The proposed trail development also has the potential to modify adjoining native vegetation by increased edge effects, sedimentation and accidental modification by workers during construction and walkers during operation of the trail. Recommendations contained within this report aim to minimise indirect impact from construction and operation of the trails and when implemented will ensure that indirect impacts of adjoining native vegetation is minimised. The habitat in the Kosciuszko area will not be fragmented by the walking trail and any resultant disturbance will be a permeable narrow barrier in a discrete location or elevated structures that will not affect physical or functional connectivity between populations or breeding individuals. The vegetation to be disturbed for construction and operation of the trail includes high quality alpine, sub-alpine and montane vegetation that in the broader sense is critical to this species survival. However, the extent of permanent habitat removal and disturbance (up to 1.56 hectares) required for the trail development will not jeopardise the long term survival of this species in the locality given the quantity of similar high quality contiguous habitat immediately adjacent to the development.
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),	The area is not part of a declared area of outstanding biodiversity value.
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.	Clearing of native vegetation is identified as a key threatening process on the Schedules of the BC Act. The permanent disturbance of up to 1.56 hectares of alpine, sub-alpine and montane native vegetation during construction of the trails is not considered a significant amount of disturbance in the context of broader areas of alpine and sub-alpine vegetation in the national park. Predation by foxes and cats are also relevant KTPs.

ToS Criteria	Outcome
Conclusion for Broad-toothed Rat	
In consideration of the above five factors (a-e), the proposed activity is not likely to significantly impact Broad-toothed Rat within the study area or broader locality, as: • The proposal will permanently remove or disturb up to 1.56 hectares of native vegetation that may represent a dispersal, breeding or foraging resource, from within an area containing large contiguous patches of similar habitat. • The extent of the vegetation removal in the context of the broader national park will not significantly disrupt the lifecycle of Broad-toothed Rat as large areas of similar habitat will still be available for critical activities to occur in post construction. • While the habitat to be removed contributes to the survival of the species, the extent of removal within the national park is not considered significant to the survival or recovery of the species. • The proposal may increase predation by feral cat and red fox but this can be managed through a project-specific predator management program.	

Table A.27 Test of Significance for Smoky Mouse

ToS Criteria	Outcome
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.***	Impacts from the trail development which have potential to have an adverse effect on the life cycle of Smoky Mouse include direct mortality during construction, loss of potential breeding and foraging habitat, increased predation risks as a result of predators entering the area along trails and fragmentation of dispersal corridors. PCT 1196 provides potential foraging, breeding and sheltering habitat for Smoky Mouse in the form of montane vegetation. A conservative estimate of habitat impacts within the subject site, based on the extent of PCT 1196, equates to approximately 0.07 hectares of permanent habitat removal. The habitat to be removed is within a large contiguous area of high quality native alpine and sub-alpine vegetation within the broader national park. The resultant disturbance will be a permeable narrow barrier in a discrete location. This level of disturbance is unlikely to affect foraging, dispersal or gene flow of Smoky Mouse as extensive habitat will still be available during and post construction for these activities to occur in. Cat and Fox scats were recorded throughout the national park during the field assessments, the construction of a new walking trail is unlikely to increase the current predation threat from feral carnivores, given the current activity level recorded. Given the relatively small construction footprint in the context of available habitat in the broader national park, the trail development will not adversely affect lifecycle traits of this species to the point that a viable local population will be placed at risk of extinction.

ToS Criteria	Outcome
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.***	Not relevant to threatened species.

ToS Criteria	Outcome
c) In relation to the habitat of a threatened species or ecological community: ***(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and*** ***(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and*** ***(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,***	The habitat requirements of Smoky Mouse are unclear (Menkhorst & Broome 2008), however, recent studies in the northern section of the national park have recorded Smoky Mouse occurring in PCT 1196. Under the assumption that PCT 1196 provides potential habitat, the proposed development will require the permanent removal of up to 0.07 hectares of habitat within a large contiguous area within the national park. The proposed trail development also has the potential to modify adjoining native vegetation by increased edge effects, sedimentation and accidental modification by workers during construction and walkers during operation of the trail. Recommendations contained within this report aim to minimise indirect impact from construction and operation of the trails and when implemented will ensure that indirect impacts of adjoining native vegetation is minimised. The habitat in the Kosciuszko area will not be fragmented by the walking trail and any resultant disturbance will be a permeable narrow barrier in a discrete location or elevated structures that will not affect physical or functional connectivity between populations or breeding individuals. The vegetation to be disturbed for construction and operation of the trail includes high quality montane vegetation that in the broader sense is critical to this species survival. However, the extent of vegetation removal (0.07 hectares) required for the trail development will not jeopardise the long term survival of this species in the locality given the quantity of similar high quality contiguous habitat immediately adjacent to the development.
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),	The area is not part of a declared area of outstanding biodiversity value.
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.	Clearing of native vegetation is identified as a key threatening process on the Schedules of the BC Act. The permanent disturbance of up to 0.07 of native vegetation during construction of the trail is not considered a significant amount of disturbance in the context of broader areas of alpine, sub-alpine and montane vegetation in the national park.

ToS Criteria	Outcome
Conclusion for Smoky Mouse	
In consideration of the above five factors (a-e), the proposed activity is not likely to significantly impact Smoky Mouse within the study area or broader locality, as: • The proposal will permanently remove a small area (up to 0.07 hectares) of potential dispersal, breeding or foraging habitat, from within an area containing large contiguous patches of similar habitat. • The extent of the vegetation removal in the context of the broader national park will not significantly disrupt the lifecycle of Smoky Mouse as large areas of similar habitat will still be available for critical activities to occur in post construction. • While the habitat to be removed contributes to the survival of the species, the extent of removal within the national park is not considered significant to the survival or recovery of the species. • The proposal does not significantly contribute to a KTP for this species.	

Table A.28 Test of Significance for Eastern Pygmy-possum

ToS Criteria	Outcome
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.	Impacts from the trail development which have potential to have an adverse effect on the life cycle of for Eastern Pygmy-possum include direct mortality during construction, loss of potential breeding and foraging habitat, increased predation risks as a result of predators entering the area along trails and fragmentation of dispersal corridors. The species may occupy forest and woodland habitats along the Perisher Valley to Bullocks Flat trail in PCTs 638, 644, 645, 679 and 1196. Trail development will permanently remove or disturb up to 0.88 hectares in these PCTs and most of these impacts will be limited to understorey vegetation. The habitat to be removed is within a large contiguous area of high quality native montane vegetation within the broader national park. Hollow bearing trees, critical for breeding, will be avoided through micro-siting during the construction process. Noise pollution during construction may affect hollow occupancy immediately adjacent to the trail but these impacts are expected to be temporary (in the order of weeks). The resultant disturbance will be a permeable narrow barrier in a discrete location. This level of disturbance is unlikely to affect foraging, dispersal or gene flow of Eastern Pygmy-possum as extensive habitat will still be available during and post construction for these activities to occur in. Cat and Fox scats were recorded throughout the national park during the field assessments, the construction of a new walking trail is unlikely to increase the current predation threat from feral carnivores, given the current feral activity level recorded. Given the relatively small construction footprint in the context of available habitat in the broader national park, the trail development will not adversely affect lifecycle traits of this species to the point that a viable local population will be placed at risk of extinction.

ToS Criteria	Outcome
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.***	Not relevant to threatened species.

ToS Criteria	Outcome
c) In relation to the habitat of a threatened species or ecological community: ***(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and*** ***(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and*** ***(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,***	Trail development will permanently remove or disturb up to 0.88 hectares in PCTs that provide habitat for this species and most of these impacts will be limited to understorey vegetation. The proposed trail development also has the potential to modify adjoining native vegetation by increased edge effects, sedimentation and accidental modification by workers during construction and walkers during operation of the trail. Recommendations contained within this report aim to minimise indirect impact from construction and operation of the trails and when implemented will ensure that indirect impacts of adjoining native vegetation is minimised. The habitat in the Kosciuszko area will not be fragmented by the walking trail and any resultant disturbance will be a permeable narrow barrier in a discrete location that will not affect physical or functional connectivity between populations or breeding individuals. The maximum width of the walking trail is unlikely to cause significant canopy fragmentation and as such, the trail will not form a barrier to this species' dispersal. The vegetation to be disturbed for construction and operation of the trail includes high quality montane vegetation that in the broader sense is critical to this species survival. However, the extent of permanent vegetation and disturbance (up to 0.88 hectares) will not jeopardise the long term survival of this species in the locality given the quantity of similar high quality contiguous habitat immediately adjacent to the development.
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),	The area is not part of a declared area of outstanding biodiversity value.
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.	Clearing of native vegetation is identified as a key threatening process on the Schedules of the BC Act. The permanent disturbance of up to 0.88 hectares of montane native vegetation for construction of the trails is not considered a significant amount of disturbance in the context of broader areas of native vegetation in the national park.

ToS Criteria	Outcome
Conclusion for Eastern Pygmy-possum	

In consideration of the above five factors (a-e), the proposed activity is not likely to significantly impact Eastern Pygmy-possum within the study area or broader locality, as:

- The proposal will permanently disturb or remove a relatively small area (up to 0.88 hectares) of potential dispersal or foraging resource, from within an area containing large contiguous patches of similar habitat. Hollow-bearing trees are expected to be avoided through micro-siting during the construction process.
- The extent of the vegetation removal in the context of the broader national park will not significantly disrupt the lifecycle of Eastern Pygmy-possum as large areas of similar habitat will still be available for critical activities to occur in post construction.
- While the habitat to be removed contributes to the survival of the species, the extent of removal within the national park is not considered significant to the survival or recovery of the species.
- The proposal does not significantly contribute to a KTP for this species.

Table A.29 Test of Significance for Koala

ToS Criteria	Outcome
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.	Impacts from the trail development which have potential to have an adverse effect on the life cycle of Koala include direct mortality during construction, loss of potential breeding and foraging habitat and fragmentation of dispersal corridors. The proposal will permanently remove or disturb up to 0.12 hectares of montane vegetation with feed tree species (Manna Gum) but this will mostly be restricted to understorey vegetation. The habitat to be removed or disturbed is within a large contiguous area of high quality native montane vegetation within the broader national park. Large trees will be avoided through micro-siting during the construction process. The resultant disturbance will be a permeable narrow barrier in a discrete location. This level of disturbance is unlikely to affect foraging, dispersal or gene flow of Koalas as extensive habitat will still be available during and post construction for these activities to occur in. Given the relatively small construction footprint in the context of available habitat in the broader national park, the trail development will not adversely affect lifecycle traits of this species to the point that a viable local population will 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.***	Not relevant to threatened species.

ToS Criteria	Outcome
c) In relation to the habitat of a threatened species or ecological community: ***(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and*** ***(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and*** ***(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,***	The proposal will permanently remove or disturb up to 0.12 hectares of montane vegetation with feed tree species (Manna Gum) and this will mostly be restricted to understorey vegetation. The proposed trail development also has the potential to modify adjoining native vegetation by increased edge effects, sedimentation and accidental modification by workers during construction and walkers during operation of the trail. Recommendations contained within this report aim to minimise indirect impact from construction and operation of the trails and when implemented will ensure that indirect impacts of adjoining native vegetation is minimised. The habitat in the Kosciuszko area will not be fragmented by the walking trail and any resultant disturbance will be a permeable narrow barrier in a discrete location that will not affect physical or functional connectivity between populations or breeding individuals. The vegetation to be disturbed for construction and operation of the trail includes potential habitat that in the broader sense is critical to this species survival. However, the extent of vegetation permanent removal/disturbance (0.12 hectares) required for the trail development will not jeopardise the long term survival of this species in the locality given the quantity of similar high quality contiguous habitat immediately adjacent to the development.
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),	The area is not part of a declared area of outstanding biodiversity value.
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.	Clearing of native vegetation is identified as a key threatening process on the Schedules of the BC Act. The permanent disturbance of up to 0.12 hectares of montane native vegetation during construction of the trails is not considered a significant amount of disturbance in the context of broader areas of forested areas in the national park.

ToS Criteria	Outcome
Conclusion for Koala	
In consideration of the above five factors (a-e), the proposed activity is not likely to significantly impact Koala within the study area or broader locality, as: • The proposal will permanently remove or disturb a small area (up to 0.12 hectares) of potential habitat in montane vegetation and most of this disturbance will be restricted to understorey species. Large trees are expected to be avoided through micro-siting during the construction process. • The extent of the vegetation removal in the context of the broader national park will not significantly disrupt the lifecycle of Koala as large areas of similar habitat will still be available for critical activities to occur in post construction. • While the habitat to be removed contributes to the survival of the species, the extent of removal within the national park is not considered significant to the survival or recovery of the species. • The proposal does not significantly contribute to a KTP for this species.	

Table A.30 Test of Significance for Spotted-tailed Quoll

ToS Criteria	Outcome
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.***	Impacts from the trail development are likely to be minimal for this species but could include loss of potential foraging habitat, fragmentation of dispersal corridors and secondary impacts such as noise disturbance during trail construction. The species potentially occurs across all vegetation communities in the study area with and all areas may be used for foraging, dispersal or breeding resources on occasion. The proposed trail development will permanently remove / disturb up to 1.56 hectares of habitat across all vegetation communities. The habitat to be removed is within a large contiguous area of high quality native vegetation within the broader national park. The resultant disturbance will be a permeable narrow barrier in a discrete location. This level of disturbance is unlikely to affect foraging, dispersal or gene flow of Spotted-tailed Quoll, given this species dispersal ability and large home ranges and as extensive habitat will still be available during and post construction for these activities to occur in. Given the relatively small linear construction footprint in the context of available habitat in the broader national park, the trail development will not adversely affect lifecycle traits of this species to the point that a viable local population will be placed at risk of extinction.

ToS Criteria	Outcome
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.***	Not relevant to threatened species.

ToS Criteria	Outcome
c) In relation to the habitat of a threatened species or ecological community: ***(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and*** ***(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and*** ***(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,***	The proposed trail development will permanently remove / disturb up to 1.56 hectares of habitat within a large contiguous area within the Kosciuszko National Park. The proposed trail development also has the potential to modify adjoining native vegetation by increased edge effects, sedimentation and accidental modification by workers during construction and walkers during operation of the trail. Recommendations contained within this report aim to minimise indirect impact from construction and operation of the trails and when implemented will ensure that indirect impacts of adjoining native vegetation is minimised. The habitat in the Kosciuszko area will not be significantly fragmented by the walking trails and any resultant disturbance will be a permeable narrow barrier in a discrete location that will not affect physical or functional connectivity between populations or breeding individuals. The vegetation to be disturbed for construction and operation of the trail includes high quality habitats that in the broader sense is critical to this species survival. However, the extent of permanent habitat removal / disturbance (1.56 hectares) required for the trail development will not jeopardise the long term survival of this species in the locality given the quantity of similar high quality contiguous habitat immediately adjacent to the development.
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),	The area is not part of a declared area of outstanding biodiversity value.
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.	Clearing of native vegetation is identified as a key threatening process on the Schedules of the BC Act. The permanent disturbance of up to 1.56 hectares of native vegetation during construction and operation of the trail is not considered a significant amount of disturbance in the context of broader areas of habitat in the national park.

ToS Criteria	Outcome
Conclusion for Spotted-tailed Quoll	
In consideration of the above five factors (a-e), the proposed activity is not likely to significantly impact Spotted-tailed Quoll within the study area or broader locality, as: • The proposal will permanently remove or disturb up to 1.56 hectares of potential habitat that may represent a dispersal or foraging resource, from within an area containing large contiguous patches of similar habitat. • The extent of the vegetation removal in the context of the broader national park will not significantly disrupt the lifecycle of Spotted-tailed Quoll as large areas of similar habitat will still be available for critical activities to occur in post construction. • While the habitat to be removed is considered important to the survival of the species, the extent of the removal within the national park is not considered important to the survival or recovery of the species. • The proposal does not significantly contribute to a KTP for this species.	

Table A.31 Test of Significance for threatened microbats

ToS Criteria	Outcome
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.***	Impacts from the trail development which have potential to have an adverse effect on the life cycle of threatened microbats include disturbance to roosting and breeding sites, loss of roosting habitat- primarily hollow-bearing eucalypts and crevices or caves, loss and fragmentation of foraging habitat particularly extensive areas of continuous forest or woodland. These bat species (Eastern False Pipistrelle and Eastern Bentwing-bat) may occupy forest and woodland habitats along the final trail alignments in PCTs 638, 644, 645, 679 and 1196. Trail development will permanently remove or disturb up to 0.88 hectares in these PCTs and most of these impacts will be limited to understorey vegetation. The habitat to be removed is within a large contiguous area of high quality native sub-alpine and montane vegetation within the broader national park. The resultant disturbance will be a permeable narrow barrier in a discrete location. It is likely that if the species uses the study area for foraging and roosting then the local population would use the entire patch of contiguous habitat. Hollow-bearing trees and large rocky outcrops, crevices and caves will be avoided during the trail construction process. Given this avoidance, this level of disturbance is unlikely to affect foraging, dispersal or gene flow of threatened microbats given their dispersal ability and large home ranges and as extensive habitat will still be available during and post construction for these activities to occur in. Given the relatively small linear construction footprint in the context of available habitat in the broader national park, the trail development will not adversely affect lifecycle traits of these species to the point that viable local populations will be placed at risk of extinction.

ToS Criteria	Outcome
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.***	Not relevant to threatened species.

ToS Criteria	Outcome
c) In relation to the habitat of a threatened species or ecological community: ***(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and*** ***(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and*** ***(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,***	Trail development will permanently remove or disturb up to 0.88 hectares in sub-alpine or montane habitats likely to be used by microbat species. Most of these impacts will be limited to understorey vegetation within a large contiguous area within the Kosciuszko National Park. The proposed trail development also has the potential to modify adjoining native vegetation by increased edge effects, sedimentation and accidental modification by workers during construction and walkers during operation of the trail. Recommendations contained within this report aim to minimise indirect impact from construction and operation of the trails and when implemented will ensure that indirect impacts of adjoining native vegetation is minimised. The microbat habitat in the Kosciuszko area will not be fragmented by the walking trail and any resultant disturbance will not act as a barrier for these aerial species. The vegetation to be disturbed for construction and operation of the trail includes high quality montane and sub-alpine vegetation that in the broader sense is important habitat for these species. However, the extent of vegetation removal (0.88 hectares) required for the trail development will not jeopardise the long term survival of these species in the locality given the quantity of similar high quality contiguous habitat immediately adjacent to the development.
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),	The area is not part of a declared area of outstanding biodiversity value.
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.	Clearing of native vegetation is identified as a key threatening process on the Schedules of the BC Act. The permanent disturbance of up to 0.88 hectares of sub-alpine and montane native vegetation during construction and operation of the trail is not considered a significant amount of disturbance in the context of broader areas of montane sub-alpine vegetation in the national park.

ToS Criteria	Outcome
Conclusion for threatened microbats	
In consideration of the above five factors (a-e), the proposed activity is not likely to significantly impact threatened microbats within the study area or broader locality, as: • The proposal will permanently remove or disturb a small area (up to 0.88 hectares) of high quality vegetation that may represent a foraging resource from within an area containing large contiguous patches of similar habitat. • The extent of the vegetation removal in the context of the broader national park will not significantly disrupt the lifecycles of threatened microbats as large areas of similar habitat will still be available for critical activities to occur in post construction. • The proposal does not significantly contribute to a KTP for these species.	

Table A.32 Test of Significance for Gang-gang Cockatoo

ToS Criteria	Outcome
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.***	Impacts from the trail development which have potential to have an adverse effect on the life cycle of Gang-gang Cockatoo include disturbance to nesting and breeding sites, loss of habitat - primarily hollow-bearing eucalypts, loss and fragmentation of foraging habitat particularly extensive areas of continuous forest or woodland. The species may occupy forest and woodland habitats along all final trail alignments and was recorded at a number of locations either flying overhead or foraging in eucalypts. Forest and woodland PCTs 638, 644, 645, 679 and 1196 all provide potential habitat for this species. Trail development will permanently remove or disturb up to 0.88 hectares in these PCTs and most of these impacts will be limited to understorey vegetation. The habitat to be removed is within a large contiguous area of high quality native sub-alpine and montane vegetation within the broader national park. The resultant disturbance will be a permeable narrow barrier in a discrete location that will not impact the dispersal of this highly mobile avian species. It is likely that if the species uses the study area for foraging, nesting and breeding then the local population would be reasonably expected to use the entire patch of contiguous habitat. Hollow-bearing trees will be avoided during the trail construction process. Given this avoidance, this level of disturbance is unlikely to affect foraging, dispersal or gene flow of Gang-gang Cockatoo given this species dispersal ability and large home range and as extensive habitat will still be available during and post construction for these activities to occur in. Given the relatively small linear construction footprint in the context of available habitat in the broader national park, the trail development will not adversely affect lifecycle traits of this species to the point that a viable local population will be placed at risk of extinction.

ToS Criteria	Outcome
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.***	Not relevant to threatened species.

ToS Criteria	Outcome
c) In relation to the habitat of a threatened species or ecological community: ***(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and*** ***(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and*** ***(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,***	Trail development will permanently remove or disturb up to 0.88 hectares in forest and woodland PCTs likely to be used by this species. Most of these impacts will be limited to understorey vegetation within a large contiguous area within the Kosciuszko National Park. The proposed trail development also has the potential to modify adjoining native vegetation by increased edge effects, sedimentation and accidental modification by workers during construction and walkers during operation of the trail. Recommendations contained within this report aim to minimise indirect impact from construction and operation of the trails and when implemented will ensure that indirect impacts of adjoining native vegetation is minimised. The Gang-gang Cockatoo habitat in the Kosciuszko area will not be fragmented by the walking trail and any resultant disturbance will not act as a barrier for these highly mobile avian species. The vegetation to be disturbed for construction and operation of the trail includes high quality montane and sub-alpine vegetation that in the broader sense is important habitat for this species. However, the extent of permanent habitat removal/disturbance (0.88 hectares) required for the trail development will not jeopardise the long term survival of this species in the locality given the quantity of similar high quality contiguous habitat immediately adjacent to the development.
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),	The area is not part of a declared area of outstanding biodiversity value.
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.	Clearing of native vegetation is identified as a key threatening process on the Schedules of the BC Act. The permanent disturbance of up to 0.88 hectares of sub-alpine and montane native vegetation during construction the trails is not considered a significant amount of disturbance in the context of broader areas of montane and sub-alpine vegetation in the national park.

ToS Criteria	Outcome
Conclusion for Gang-gang Cockatoo	
In consideration of the above five factors (a-e), the proposed activity is not likely to significantly impact Gang-gang Cockatoo within the study area or broader locality, as: • The proposal will permanently remove or disturb a small area (up to 0.88 hectares) of high quality vegetation that may represent a dispersal or foraging resource from within an area containing large contiguous patches of similar habitat. • The extent of the vegetation removal in the context of the broader national park will not significantly disrupt the lifecycle of Gang-gang Cockatoo as large areas of similar habitat will still be available for critical activities to occur in post construction. • While the habitat to be removed is considered important to the species, the extent of the removal within the national park is not considered important to the survival or recovery of the species. • The proposal does not significantly contribute to a KTP for this species.	

Table A.33 Test of Significance for Powerful Owl

ToS Criteria	Outcome
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.	Impacts from the trail development which have potential to have an adverse effect on the life cycle of Powerful Owl include direct mortality, loss of nesting, roosting and sheltering habitat, loss and fragmentation of foraging habitat particularly extensive areas of continuous forest or woodland. The species may occupy forest and woodland habitats along all final trail alignments. Forest and woodland PCTs 638, 644, 645, 679 and 1196 all provide potential habitat for this species. Trail development will permanently remove or disturb up to 0.88 hectares in these PCTs and most of these impacts will be limited to understorey vegetation. The resultant disturbance will be a permeable narrow barrier in a discrete location that will not impact the dispersal of this highly mobile avian species. It is likely that if the species uses the study area for foraging, roosting and breeding then the local population would be reasonably expected to use the entire patch of contiguous habitat. Hollow-bearing trees will be avoided during the trail construction process. Given this avoidance, this level of disturbance is unlikely to affect foraging, dispersal or gene flow of Powerful Owl given this species dispersal ability and large home range and as extensive habitat will still be available during and post construction for these activities to occur in. Given the relatively small linear construction footprint in the context of available habitat in the broader national park, the trail development will not adversely affect lifecycle traits of this species to the point that a viable local population will be placed at risk of extinction.

ToS Criteria	Outcome
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.***	Not relevant to threatened species.

ToS Criteria	Outcome
c) In relation to the habitat of a threatened species or ecological community: ***(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and*** ***(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and*** ***(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,***	Trail development will permanently remove or disturb up to 0.88 hectares in forest and woodland PCTs likely to be used by this species. Most of these impacts will be limited to understorey vegetation within a large contiguous area within the Kosciuszko National Park. The proposed trail development also has the potential to modify adjoining native vegetation by increased edge effects, sedimentation and accidental modification by workers during construction and walkers during operation of the trail. Recommendations contained within this report aim to minimise indirect impact from construction and operation of the trails and when implemented will ensure that indirect impacts of adjoining native vegetation is minimised. The Powerful Owl habitat in the Kosciuszko area will not be fragmented by the walking trail and any resultant disturbance will not act as a barrier for these highly mobile avian species. The vegetation to be disturbed for construction and operation of the trail includes high quality montane vegetation that in the broader sense is important habitat for this species. However, the extent of permanent vegetation removal/disturbance (0.88 hectares) required for the trail development will not jeopardise the long term survival of this species in the locality given the quantity of similar high quality contiguous habitat immediately adjacent to the development.
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),	The area is not part of a declared area of outstanding biodiversity value.
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.	Clearing of native vegetation is identified as a key threatening process on the Schedules of the BC Act. The permanent disturbance of up to 0.88 hectares of forest and woodland native vegetation during construction and operation of the trail is not considered a significant amount of disturbance in the context of broader areas of montane vegetation in the national park.

ToS Criteria	Outcome
Conclusion for Powerful Owl	
In consideration of the above five factors (a-e), the proposed activity is not likely to significantly impact Powerful Owl within the study area or broader locality, as: • The proposal will permanently remove or disturb a small area (up to 0.88 hectares) of high quality vegetation that may represent a foraging resource from within an area containing large contiguous patches of similar habitat. • The extent of the vegetation removal in the context of the broader national park will not significantly disrupt the lifecycle of Powerful Owl as large areas of similar habitat will still be available for critical activities to occur in post construction. • While the habitat to be removed is considered important to the species, the extent of the removal within the national park is not considered important to the survival or recovery of the species. • The proposal does not significantly contribute to a KTP for this species.	

Table A.34 Test of Significance for threatened passerine birds

ToS Criteria	Outcome
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.	Impacts from the trail development which have potential to have an adverse effect on the life cycle of threatened passerine birds (Olive Whistler, Scarlet Robin, Flame Robin, Pink Robin, Diamond Firetail, Brown Treecreeper) include direct mortality, loss of nesting, perching and sheltering habitat, loss and fragmentation of foraging habitat particularly extensive areas of continuous forest or woodland and indirect impacts including clutch failure due to noise disturbance. The bird species considered here may use a range of PCTs therefore the total permanent habitat removal/disturbance area is considered to be the likely extent of long term impacts on native vegetation (i.e. up to 1.56 hectares). The habitat to be permanently removed or disturbed is within a large contiguous area of high quality native alpine, sub-alpine and montane vegetation within the broader national park. The resultant disturbance will be a permeable narrow barrier in a discrete location that will not impact the dispersal of these mobile avian species. It is likely that if these species use the study area for foraging, nesting and breeding then the local populations would be reasonably expected to use the entire patch of contiguous habitat. Removal of vegetation on this scale in the context of the available habitat adjacent to the development will not adversely affect the life cycle of threatened passerine bird species such that local populations would be placed at risk of extinction. This is based on the quantity and quality of suitable breeding and nesting habitat immediately adjacent to the development, the dispersal ability of these mobile avian species and the abundance of these species in the local area (many of which are locally common such as robins).

ToS Criteria	Outcome
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.***	Not relevant to threatened species.

ToS Criteria	Outcome
c) In relation to the habitat of a threatened species or ecological community: ***(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and*** ***(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and*** ***(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,***	The proposed trail development will permanently remove / disturb up to 1.56 hectares of passerine bird habitat within a large contiguous area within the Kosciuszko National Park. The proposed trail development also has the potential to modify adjoining native vegetation by increased edge effects, sedimentation and accidental modification by workers during construction and walkers during operation of the trail. Recommendations contained within this report aim to minimise indirect impact from construction and operation of the trails and when implemented will ensure that indirect impacts of adjoining native vegetation is minimised. The threatened passerine bird habitat in the Kosciuszko area will not be fragmented by the walking trail and any resultant disturbance will not act as a barrier for these highly mobile avian species. The vegetation to be disturbed for construction and operation of the trail includes high quality alpine, sub-alpine and montane vegetation that in the broader sense is important habitat for these species. However, the extent of permanent vegetation removal/disturbance (1.56 hectares) required for the trail development will not jeopardise the long term survival of these species in the locality given the quantity of similar high quality contiguous habitat immediately adjacent to the development and the local abundance of some of these threatened species. The cumulative impacts of incremental habitat loss is a key concern for passerine bird species but given the scale of the impact in the context of the available habitat at the location, this is not seen as a significant issue in this case. Habitat removal of this type and extent will not adversely influence the long term survival of any threatened passerine birds given the quality and quantity of similarly habitat immediately adjacent to the development.
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),	The area is not part of a declared area of outstanding biodiversity value.

ToS Criteria	Outcome
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.***	Clearing of native vegetation is identified as a key threatening process on the Schedules of the BC Act. The permanent disturbance of up to 1.56 hectares of native vegetation during construction of the trail is not considered a significant amount of disturbance in the context of broader areas of montane vegetation in the national park.

Conclusion for threatened passerine birds

In consideration of the above five factors (a-e), the proposed activity is not likely to significantly impact threatened passerine birds within the study area or broader locality, as:

- The proposal will remove a small area (up to 1.56 hectares) of high quality vegetation that may represent a dispersal, nesting or foraging resource from within an area containing large contiguous patches of similar habitat.
- The extent of the vegetation removal in the context of the broader national park will not significantly disrupt the lifecycle of threatened passerine birds as large areas of similar habitat will still be available for critical activities to occur in post construction. Some of the species consider here readily move through the landscape and undertake seasonal migration between alpine and lowland environments while others are sedentary but capable of short distance dispersal.
- While the habitat to be removed is considered important to these species, the extent of the removal within the national park is not considered important to the survival or recovery of any of these species.
- The proposal does not significantly contribute to a KTP for these species.

Table A.35 Test of Significance for Alpine She-oak Skink

ToS Criteria	Outcome
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.	Impacts from the trail development which have potential to have an adverse effect on the life cycle of Alpine She-oak Skink include direct mortality, loss of breeding and sheltering habitat, loss and fragmentation of foraging habitat particularly areas of continuous alpine grassland and herbfields and indirect impacts including increased predation rates due to loss of cover or increase in predator numbers immediately adjacent to the trails. During surveys of the various trail options Alpine She-oak Skink was recorded three times (March 2018, February 2019 and April 2019) on the eastern and southern slopes of Mount Perisher in high quality open grassy heathland habitat (PCT 641). Due to the presence of this species and Guthega Skink on Mount Perisher, NPWS abandoned the Guthega to Perisher Valley track option in favour of a lower impact option between Charlotte Pass and Perisher Valley (Ramshead Range). Although high quality habitat for this species on Mount Perisher has now been avoided there are still areas of potential habitat along the final trail alignments of all trails. These areas have been mapped and it is intended to install elevated structures in these locations to minimise ground and vegetation disturbance (Figures 3 and 4). The habitat to be removed is within a large contiguous area of high quality alpine and sub-alpine vegetation within the broader national park. The resultant disturbance will be a permeable narrow barrier in a discrete location that will not significantly impact the dispersal of this species as individuals will be able to move across or under the trail. The proposed works may result in decreased population size, reduced area of occupancy, and adverse change to critical habitat for Alpine She-oak Skink. However, given the extent of the clearing footprint in the context of available habitat more broadly in the national park, these effects that may manifest at small spatial scales are unlikely to occur to the extent that they would place local populations of the species at risk of extinction. Viable populations occurring within the study area will still occupy habitat directly adjacent to the walking trail and will maintain foraging, breeding and its seasonally active life cycle.

ToS Criteria	Outcome
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.***	Not relevant to threatened species.

ToS Criteria	Outcome
c) In relation to the habitat of a threatened species or ecological community: ***(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and*** ***(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and*** ***(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,***	Permanent removal or disturbance of grassy heathland vegetation that provides habitat for Alpine She-oak Skink will occur. This habitat generally aligns with PCT 641 and it is estimated up to 0.49 hectares of this vegetation will be permanently lost or modified. Not all areas of PCT 641are suitable Alpine She-oak Skink habitat mainly due to structural variation (i.e. some areas are very dense heathland). It is proposed to elevate the trail across 0.24 hectares of PCT 641, especially where vegetation structure is open and grassy. This will further reduce permanent loss of this habitat type down to 0.25 hectares. Temporary short-term impacts could extend out to 2.29 hectares in PCT 641 during construction. The proposed trail development also has the potential to modify adjoining native vegetation by increased edge effects, sedimentation and accidental modification by workers during construction and walkers during operation of the trail. Recommendations contained within this report aim to minimise indirect impact from construction and operation of the trails and when implemented will ensure that indirect impacts of adjoining native vegetation is minimised. The trail realignment works will not disrupt continuity of habitat as animals will still be able to move freely from one side of the trail alignment to the other, and can continue to occupy habitat adjacent to the alignment itself. The vegetation to be disturbed for construction and operation of the trail includes high quality alpine and sub-alpine vegetation that in the broader sense is critical habitat for this species survival. There is insufficient quantitative data available to judge whether the species' long-term survival is effected by linear trail construction. However, without this data the extent of permanent vegetation removal/disturbance (0.49 hectares) required for the trail development is assumed not to jeopardise the long term survival of this species in the locality given the quantity of similar high quality contiguous habitat immediately adjacent to the development. The cumulative impacts of incremental habitat loss is a key concern for threatened species but given the scale of the impact in the context of the available habitat at the location and the ability of this species to disperse across the trail alignment, this is not seen as a significant issue in this case.

ToS Criteria	Outcome
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),***	The area is not part of a declared area of outstanding biodiversity value.
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.***	Clearing of native vegetation is identified as a key threatening process on the Schedules of the BC Act. The permanent disturbance of up to 0.49 hectares of alpine and sub-alpine habitat for this species during construction of the trails is not considered a significant amount of disturbance in the context of broader areas of montane vegetation in the national park.

Conclusion for Alpine She-oak Skink

In consideration of the above five factors (a-e), the proposed activity is not likely to significantly impact Alpine She-oak Skink within the study area or broader locality, as:

- The proposal will permanently remove or disturb a relatively small, narrow and linear area (up to 0.49 hectares) of potential habitat that may represent a dispersal, breeding and foraging resource from within an area containing large contiguous patches of similar habitat.
- The extent of the vegetation removal and disturbance in the context of the broader national park will not significantly disrupt the lifecycle of Alpine She-oak Skink as large areas of similar habitat will still be available for critical activities to occur in post construction.
- While the habitat to be removed contributes to the survival of the species, the extent of removal within the national park is not considered significant to the survival or recovery of the species.
- The proposal does not significantly contribute to a KTP for this species.

Table A.36 Test of Significance for Guthega Skink

ToS Criteria	Outcome
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.	Impacts from the trail development which have potential to have an adverse effect on the life cycle of Guthega Skink include direct mortality, loss of breeding and sheltering habitat/burrow sites, loss and fragmentation of foraging habitat particularly areas in rocky areas and indirect impacts including increased predation rates due to loss of cover or increase in predator numbers immediately adjacent to the trails. Four individual Guthega Skinks (three adults and one juvenile) were observed during the April 2019 site investigation at Mount Perisher and Atkins (2019) observed this species and burrow sites more broadly across the study area. Trail development proposals in the Mount Perisher area have now been abandoned by NPWS to avoid impact on this species. By comparison with Mount Perisher, the final trail alignments chosen and surveyed in February, March and April 2019 are considered less important habitat for the species owing to the scattered and widely spaced occurrence of suitable rocky habitat and relative paucity of Guthega Skink burrows beneath rocks and shrubs. There is still potential for this species to occur in isolated locations along all final trail alignments. The species was documented by Atkins (2019) at two locations along the Charlotte Pass to Guthega Trail (Figure 3). The trail alignment at these locations has been changed to avoid areas of suitable habitat and burrow sites identified by Atkins (2019) and as recommended in his report. Significant effort has also been made during field surveys and micro-siting with NPWS staff to avoid other known burrow sites and suitable rocky habitat with potential burrow sites. Areas containing suitable rocky habitat or outcrops have been avoided during a micro-siting process and will be further avoided during the construction process. The habitat to be removed is therefore restricted to dispersal habitat between core rocky habitats, within a large contiguous area of high quality native alpine and sub-alpine vegetation within the broader national park. The resultant disturbance will be a permeable narrow barrier in a discrete location that will not significantly impact the dispersal of this species as individuals will be able to move across or under the trail. If rocky habitats are not avoided the proposed works may result in decreased population size, reduced area of occupancy, and adverse change to critical habitat for Guthega Skink. Given the assumption that this habitat will be avoided, and the extent of the clearing footprint in the context of this species habitat usage, it is unlikely these effects will manifest at scales that are likely to place local populations of the species at risk of extinction. Viable populations occurring within the study area will still occupy habitat directly adjacent to the walking trail and will maintain foraging, breeding and its seasonally active life cycle.

ToS Criteria	Outcome
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.***	Not relevant to threatened species.
c) In relation to the habitat of a threatened species or ecological community: ***(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and*** ***(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and*** ***(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the***	The dispersal habitat to be disturbed has not been definitively mapped but it is likely Guthega Skink may disperse between colonies and use habitat in PCTs 641, 643 and 645. The proposed trail development will permanently remove or disturb up to 1.06 hectares of potential dispersal habitat represented by these PCTs but not all areas of these PCTs are suitable as many examples are taller closed heathlands or lack suitable structure. The proposed trail development also has the potential to modify adjoining native vegetation by increased edge effects, sedimentation and accidental modification by workers during construction and walkers during operation of the trail. Recommendations contained within this report aim to minimise indirect impact from construction and operation of the trails and when implemented will ensure that indirect impacts of adjoining native vegetation is minimised. Due to the narrow nature of the proposed trail, it is unlikely that works will isolate habitat, as Guthega Skinks can disperse between rocky habitats of up to 300 metres apart (Atkins et al. 2015). Animals will still be able to move freely from one side of the trail alignment to the other, if they occur in the area, and can continue to occupy

ToS Criteria	Outcome
species, population or ecological community in the locality,	habitat within the alignment itself. Therefore, it is unlikely that gene flow will be effected by the trail development such that populations will become genetically isolated from one another as a result of the trail construction. The vegetation to be disturbed for construction and operation of the trail includes high quality alpine and sub-alpine vegetation that in the broader sense is critical habitat for this species survival. However, within this broad vegetation grouping areas of rocky habitat are the critical habitat indicator for this species. The NSW distribution of the species is entirely restricted to the Main Range of Kosciusko National Park, which means that all Guthega Skink habitats within the park are of high importance for the long-term survival of the species. The extent of vegetation removal from dispersal habitat required for the trail development is assumed not to jeopardise the long term survival of this species in the locality given all potential rocky habitats within this vegetation will be avoided during the construction and micro-siting process.
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),	The area is not part of a declared area of outstanding biodiversity value.
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.	Clearing of native vegetation is identified as a key threatening process on the Schedules of the BC Act. The disturbance of up to 1.06 hectares of potential dispersal habitat during construction of the trail is not considered a significant amount of disturbance in the context of broader areas of alpine and sub-alpine vegetation in the national park.
Conclusion for Guthega Skink	
In consideration of the above five factors (a-e), the proposed activity is not likely to significantly impact Guthega Skink within the study area or broader locality, as: • The proposal will remove potential dispersal habitat for this species (up to 1.06 hectares that includes areas of unsuitable densely vegetation habitat). These areas represent a dispersal or foraging resource, from within an area containing large contiguous patches of similar habitat. Core rocky outcrop habitat has been avoided through route selection and micro-siting.	

ToS Criteria	Outcome
	• All rocky habitats, critical to this species survival, will be avoided during the construction and micro-siting process. If animals are detected realignment will continue to occur as part of trail development. • While the habitat to be removed contributes to the survival of the species, the extent of removal within the national park is not considered significant to the survival or recovery of the species. • The proposal does not significantly contribute to a KTP for this species.

Aquatic fauna and ecological communities

In accordance with the EP&A Act species listed under the FM Act are currently required to be assessed under the impact assessment process for that, which requires the project to be tested against a series of 7 questions. The following threatened biota have been assessed accordingly:

- EEC of the Snowy River Catchment in NSW
- River Blackfish (Snowy River endangered population)
- Red Spot Dragonfly.

EEC of the Snowy River Catchment in NSW

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

The Aquatic ecological community is listed as an endangered community not a threatened species.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

The Aquatic ecological community is listed as an endangered community not an endangered population.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

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

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

The extent of the aquatic ecological community includes all native fish and aquatic invertebrates within all rivers, creeks and streams of the Snowy River catchment (DPI 2012). The final trail alignments cross several named waterways and unnamed tributaries that flow directly into the Snowy and Thredbo Rivers, therefore all biota in these aquatic habitats are considered part of the listed community's extent. These crossings are described in Section 4.5 of this report. It is intended that all waterways will be spanned with elevated structures or bridges to avoid disturbance to the bed, banks and instream habitat features such as woody debris, rocks and pools. These structures will be single span in most instances and are unlikely to change water flow, velocity, turbidity or seasonality.

Impacts to localised sections of riparian vegetation are required in order to facilitate the project works such as trail clearing and structure installation. Where impacts will occur they will be temporary in nature, with a commitment to undertake best practice in-stream rehabilitation works following construction, if required around structure footings.

Recommendations have been made to limit impacts to riparian vegetation wherever possible, as well as undertaking erosion and sediment control during construction and trail operation. As such it is not expected that the project will adversely affect the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

Impacts to localised sections of riparian vegetation are likely to occur in order to facilitate the trail construction works. The limited potential for impacts to riparian vegetation are not considered to be important to the long term survival of the ecological community in the locality, given their small scope in the context of the large and interconnected waterways of the Snowy River catchment.

All impacts to in-stream aquatic habitat and stream connectivity will be avoided and minimised through use of elevated structures and bridges to cross creeks and tributaries.

Recommendations have been made to limit impacts to riparian vegetation wherever possible, as well as undertaking erosion and sediment control to reduce the risk of water quality impacts through sediment laden run-off. As such it is not expected that the works will significantly modify habitat, fragment or isolate an area of habitat within the ecological community such that its local occurrence is likely to be placed at risk of extinction.

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

No areas of critical habitat have been declared for the Aquatic ecological community on the register of critical habitat.

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

To date no published recovery plan has been developed for the Aquatic ecological. DPI Fisheries has prepared a Priorities Action Statement for the community (https://www.dpi.nsw.gov.au/fishing/threatened-species/what-current/endangered/snowy-river/priorities-action-statement-actions-for-snowy-river-aquatic-endangered-ecological-community). It outlines prioritised actions under 11 groupings with the most relevant medium priority actions being to protect and rehabilitate riparian vegetation and to address water quality issues such as sedimentation, algal blooms, salinity and agricultural chemical pollution. If vegetation removal is undertaken to the minimum extent necessary to construct and operate the trails, and appropriate erosion and sediment control measures are implemented for construction and operation as planned by NPWS, the project will be consistent with these recovery actions.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The project works are unlikely to result in the operation of, or increase the impact of any key threatening processes.

River Blackfish (Snowy River endangered population)

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

River Blackfish is an endangered population not a threatened species.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Impacts to in-stream aquatic habitat and fish passage within the broader Snowy River catchment and the national park are largely avoided due to the localised nature of disturbance. Where impacts will occur they will be temporary in nature, with a commitment to undertake best practice in-stream rehabilitation works following construction, if required around structure footings. As such, the project works are not anticipated to result in any adverse effect on the life cycle of River Blackfish such that a viable local population of the species is likely to be placed at risk of extinction.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

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

(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

River Blackfish is an endangered population not an endangered or critically endangered community.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

Impacts to in-stream aquatic habitat and fish passage within the broader Snowy River catchment and the national park are largely avoided due to the localised nature of disturbance. Where impacts will occur they will be temporary in nature, with a commitment to undertake best practice in-stream rehabilitation works following construction, if required around structure footings. As such, the project works are not anticipated to result in any adverse effect on the life cycle of River Blackfish such that a viable local population of the species is likely to be placed at risk of extinction.

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

No areas of critical habitat have been declared for the endangered population of River Blackfish.

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

To date no published recovery plan has been developed for the endangered population of the River Blackfish.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The project works are unlikely to result in the operation of, or increase the impact of any key threatening processes.

Alpine Red Spot Dragonfly

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction

Impacts to in-stream aquatic habitat and the aquatic invertebrate community within the broader Snowy River catchment and the national park are largely avoided due to the localised nature of disturbance and the use of elevated structures and bridges to cross waterways. Where impacts will occur they will be temporary in nature, with a commitment to undertake best practice in-stream rehabilitation works following construction, if required around structure footings. As such, the project works are not anticipated to result in any adverse effect on the life cycle of Alpine Redspot Dragonfly such that a viable local population of the species is likely to be placed at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Alpine Redspot Dragonfly is listed as a vulnerable species and is not listed as an endangered population.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

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

(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

Alpine Redspot Dragonfly is listed as vulnerable and is not an endangered or critically endangered community.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

Impacts to in-stream aquatic habitat and the aquatic invertebrate community within the broader Snowy River catchment and the national park are largely avoided due to the localised nature of disturbance and the use of elevated structures and bridges to cross waterways. Where impacts will occur they will be temporary in nature, with a commitment to undertake best practice in-stream rehabilitation works following construction, if required around structure footings. As such, the project works are not anticipated to result in any adverse effect on the life cycle of Alpine Redspot Dragonfly such that a viable local population of the species is likely to be placed at risk of extinction.

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

No areas of critical habitat have been declared for Alpine Redspot Dragonfly.

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

To date no published recovery plan has been developed for Alpine Redspot Dragonfly.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

The project works are unlikely to result in the operation of, or increase the impact of any key threatening processes.

Appendix 5 Full descriptions of PCTs and habitat types

PCT 637 – Alpine and sub-alpine peatlands, damp herbfields and fens	
PCT full name	PCT 637 - *Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion*
Extent within study area	Widespread in the study area and subject site on upper slopes, valley floors, plateaux and slopes with low to moderate gradients that are subject to permanent or seasonal waterlogging along seepage zones and watercourses.
Description	This community varies from alpine valley peatland systems to lower elevation thickets along steeper drainage lines and seepage zones. The defining characteristic is the presence of Sphagnum moss *Sphagnum* spp. and other moisture dependent/tolerant species. Fen pools are characteristic of this community on valley floors at higher elevations. Characteristic species include Sphagnum moss, Alpine Baeckea *Baeckea gunniana*, Mountain Baeckea *Baeckea utilis*, Swamp Heath *Epacris paludosa*, Candle Heath *Richea continentis*, Alpine Daisy-bush *Olearia algida*, Bog Snowgrass *Poa costiniana, Poa phillipsiana*, Mountain Clubmoss *Lycopodium fastigiatum*, Fen Sedge *Carex gaudichaudiana, Astelia alpina*, *Carpha nivicola*, *Celmisia tomentella* and *Empodisma minus.*
Condition	Most examples of this community are in high condition with some areas near ski resorts, such as Charlotte Pass, having high weed cover. Montane thickets were all severely burnt in the 2003 alpine fires and are in a dense regrowth condition state. Deer wallowing is common in this community.
Associated soils, rainfall and landscape position	Occurs in areas with poor drainage from the montane to the alpine zone. This community occurs in peaty soils overlaying volcanic or fine-grained sedimentary substrates or, occasionally, granite (TSSC 2008; NSW Scientific Committee 2011a).
Threatened ecological community	The naming and description of this community differs between state and federal listings. **EPBC Act:** Endangered Ecological Community (*Alpine Sphagnum Bogs and Associated Fens*). **Justification:** Alpine Sphagnum Bogs EEC meets EPBC Act listing criteria (TSSC 2008) according to the following parameters: presence of *Sphagnum* spp., species composition (11 indicative species including *Sphagnum* spp.), landscape position (plateaus and slopes of low relief with impeded drainage), soils (peat), elevation (above 1000 metres) and presence of fen pools (e.g. near Spencers Creek). **BC Act:** Endangered Ecological Community (*Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions*). **Justification:** Alpine Sphagnum Bogs EEC meets BC Act listing criteria (NSW Scientific Committee 2011a) according to the following parameters: species composition (eight indicative species), landscape position (plateaus and slopes with impeded drainage), soils (peat) and elevation (above 400 - 500 m).
Threatened species habitat	Provides potential habitat for Blue-tongued Greenhood in sub-alpine and montane drainage lines and seepage zones where Mountain Tea-tree *Leptospermum grandifolium* is present, and Perisher Wallaby-grass *Rytidosperma vickeryae* and Raleigh Sedge *Carex raleighii* on wet alluvial flats near fen pools and creeks. Is known high quality breeding, foraging and dispersal habitat for Broad-toothed Rat *Mastacomys fuscus mordicus*.

PCT 637 – Alpine and sub-alpine peatlands, damp herbfields and fens

Photograph(s)

High elevation example of PCT 637, Charlotte Pass to Perisher Valley trail

Sub-alpine/Montane example of PCT 637, Perisher Valley to Bullocks Flat trail

PCT 641 – Alpine grassland/herbfield and open heathlands	
PCT full name	PCT 641 – Alpine grassland/herbfield and open heathlands in Kosciuszko National Park, Australian Alps Bioregion
Extent within study area	A broad PCT covering many treeless vegetation communities described by other authors (e.g. McDougall and Walsh 2007; Ecology Australia 2003). Occurs extensively on alpine plains, slopes and below inverted tree-lines from dry sites to seasonally damp soils.
Description	This PCT varies from grassland to moderately dense heathland to 1 metre tall. Characteristic species include: Alpine Grevillea *Grevillea australis*, Alpine Shaggy Pea *Oxylobium ellipticum, Hovea montana, Kunzea muelleri*, *Celmisia pugioniformis*, Smooth Blue Snowgrass *Poa fawcettiae*, Carpet Heath *Pentachondra pumila*, Tree Violet *Melicytus dentatus*, Mountain Clubmoss *Lycopodium fastigiatum*, Yam Daisy *Microseris lanceolata*, *Craspedia coolaminica*, *Euphrasia collina* subsp. *diversicolor*, *Oreomyrrhis eriopoda* and *Scleranthus singuliflorus*. Note: this PCT warrants further subdivision into multiple communities to cover its observed structural and floristic variations.
Condition	Most examples of this community are in high condition with some areas subject to grazing impacts and soil disturbance by feral deer and pigs.
Associated soils, rainfall and landscape position	This community occurs mainly on well-drained slopes between 1600 and 2200 m. This community occurs on substrates of granite, basalt, metasediments and Quaternary alluvium.
Threatened ecological community	Not listed
Threatened species habitat	This community provides habitat for Anemone Buttercup *Ranunculus anemoneus* and Shining Cudweed *Argyrotegium nitidulus*. Anemone Buttercup was recorded on several of the trail options assessed (e.g. Mount Perisher) but was not recorded on the final trail alignments. The open grassy heathland examples of this community provide high quality habitat for Alpine She-oak Skink. Guthega Skink is associated with this PCT where rocky outcrops and burrow sites occur). Broad-toothed Rat, Flame Robin and Scarlet Robin are also likely to use this habitat type. Mountain Pygmy-possum may disperse through this PCT and Spotted-tailed Quoll *Dasyurus maculatus* may disperse or forage in habitats provided by this PCT.

PCT 641 – Alpine grassland/herbfield and open heathlands

Photograph(s)

Open grassy example of PCT 641 near Back Perisher Mountain

Taller grassy heathland example of PCT 641 near Charlotte Pass/Snowy River

Closed low heathland example of PCT 641 between Mount Perisher and Back Perisher Mountain

Alpine shrubland on scree, blockstreams and rocky sites	
PCT full name	PCT 643 – Alpine shrubland on scree, blockstreams and rocky sites of high altitude areas of Kosciuszko National Park, Australian Alps Bioregion.
Extent within study area	Scattered amongst rocky outcrops and boulderfields along ridgelines at high elevations.
Description	This community is a moderately tall closed heathland to 1.5 m in height. Characteristic species include *Nematolepis ovatifolia*, Alpine Mint-bush *Prostanthera cuneata*, Alpine Grevillea *Grevillea australis*, Mountain Plum Pine *Podocarpus lawrencei*, Alpine Orites *Orites lancifolia*, Smooth Blue Snowgrass *Poa fawcettiae*, Australian Edelweiss *Ewartia nubigena*, Mountain Woodruff *Asperula gunnii*, Rock Carraway *Oreomyrrhis brevipes*, *Carex breviculmis*, *Celmisia pugioniformis*, *Craspedia aurantia*, *Empodisma minus* and *Viola betonicifolia* subsp. *betonicifolia*.
Condition	Most examples of this community are in high condition.
Associated soils, rainfall and landscape position	This community occurs in rocky areas above 1300 m in the sub-alpine and alpine areas. This community occurs on substrates of granite, basalt, metasediments and Quaternary alluvium.
Threatened ecological community	Not listed
Threatened species habitat	This community provides potential habitat for Shining Cudweed *Argyrotegium nitidulus*. Closed rocky heathland rocky areas with Mountain Plum Pine provide potential habitat for Mountain Pygmy Possum. Guthega Skink may occur where rocky outcrops and burrow sites occur. Broad-toothed Rat, Flame Robin and Scarlet Robin are also likely to use this habitat type. Spotted-tailed Quoll *Dasyurus maculatus* may disperse, den or forage in habitats provided by this PCT.

Alpine shrubland on scree, blockstreams and rocky sites

Photograph(s)

Example of PCT 643 between Mount Perisher and Back Perisher Mountain

Example of PCT 643 near Porcupine Rocks

Alpine Ash-Mountain Gum moist shrubby tall open forest	
PCT full name	PCT 638 – Alpine Ash - Mountain Gum moist shrubby tall open forest of montane areas, southern South Eastern Highlands Bioregion and Australian Alps Bioregion.
Extent within study area	Widespread on the upper elevations of the Perisher Valley to Bullocks Flat track on southern aspects between elevations of 1200 and 1500 m.
Description	This tall forest community was burnt extensively in the 2003 alpine fires and consists of dense regrowth with fire-killed trees and some areas of live mature canopy cover. Characteristic species include Alpine Ash *Eucalyptus delegatensis*, Mountain Gum *Eucalyptus dalrympleana* subsp. *dalrympleana*, Mountain Hickory Wattle *Acacia obliquinervia*, Coffee-berry *Coprosma hirtella*, Dusty daisy-bush *Olearia phlogopappa* var. *flavescens*, Elderberry Panax *Polyscias sambucifolia*, *Leucopogon gelidus*, Tasman Flax-lily *Dianella tasmanica*, Mother Shield Fern *Polystichum proliferum*, Purple-sheathed Tussock-grass *Poa ensiformis*, Small-leaved Clematis *Clematis microphylla*, *Geranium potentilloides* var. *abditum* and Prickly Starwort *Stellaria pungens*.
Condition	This community is in high condition albeit recovering from a severe fire event 16 years ago.
Associated soils, rainfall and landscape position	This community occurs in mountainous areas at montane elevations on moderate to steep slopes of various geological origins including granite, basalt, metasediments and Quaternary alluvium.
Threatened ecological community	Not listed
Threatened species habitat	Provides potential habitat for Blue-tongued Greenhood in montane drainage lines and seepage zones where Mountain Tea-tree *Leptospermum grandifolium* is present. May provide lower elevation habitat in drainage lines for Broad-toothed Rat and Alpine Redspot Dragonfly. Other species that may use this habitat type include Eastern False Pipistrelle, Eastern Pygmy-possum, Flame Robin, Gang-gang Cockatoo, Olive Whistler, Pink Robin, Scarlet Robin and Spotted-tailed Quoll.

Alpine Ash-Mountain Gum moist shrubby tall open forest	
Photograph(s)	 **Example of PCT 638 on the slopes above Bullocks Flat**

Alpine Snow Gum shrubby open woodland at intermediate altitudes	
PCT full name	PCT 644 – Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion.
Extent within study area	Widespread at sub-alpine elevations on the steep slopes of the Perisher Valley to Bullocks Flat track between elevations of 1500 and 1650 m.
Description	A tall woodland community that was severely burnt in the 2003 alpine fires and is now dominated by dense to impenetrable canopy and understorey regrowth. All mature canopy trees were killed and are regenerating from basal lignotubers. Characteristic species include: Snow Gum *Eucalyptus pauciflora* subsp. *pauciflora* with an understorey of Leafy Bossiaea *Bossiaea foliosa*, Mountain Hickory Wattle *Acacia obliquinervia*, Coffee-berry *Coprosma hirtella*, Dusty daisy-bush *Olearia phlogopappa* var. *flavescens*, Mountain Pepper *Tasmannia xerophila*, Prickly Starwort *Stellaria pungens* and Bidgee-widgee *Acaena novae-zelandiae*.
Condition	Most examples of this community are in high condition despite being burnt in 2003. Some areas are subject to grazing impacts and soil disturbance by feral deer.
Associated soils, rainfall and landscape position	Occurs on steep slopes and spurs on substrates of granite, basalt, metasediments and Quaternary alluvium.
Threatened ecological community	Not listed
Threatened species habitat	May provide lower elevation habitat in drainage lines for Broad-toothed Rat and Alpine Redspot Dragonfly. Other species that may use this habitat type include Eastern False Pipistrelle, Eastern Pygmy-possum, Flame Robin, Gang-gang Cockatoo, Olive Whistler, Pink Robin, Scarlet Robin and Spotted-tailed Quoll.

Alpine Snow Gum shrubby open woodland at intermediate altitudes	
Photograph(s)	 **Example of PCT 644 on the slopes above Bullocks Flat severely burnt in 2003 with dead canopy trees and dense regeneration of the overstorey and shrub vegetation**  **Oblique aerial view of PCT 644 on the slopes above Bullocks Flat/Thredbo Valley**

Alpine Snow Gum shrubby open woodland at high altitudes	
PCT full name	PCT 645 – Alpine Snow Gum shrubby open woodland at high altitudes in Kosciuszko NP, Australian Alps Bioregion
Extent within study area	Occurs on sub-alpine plains and slopes above 1650 m elevation extensively throughout the study area on a range of aspects.
Description	A woodland community with a grassy to densely shrubby understorey. Most examples where burnt in the 2003 alpine fires but small pockets of unburnt woodland with a live canopy remain. Characteristic species include: Snow Gum *Eucalyptus pauciflora* subsp. *niphophila*/*Eucalyptus niphophila* with an understorey of Alpine Shaggy Pea *Oxylobium ellipticum*, *Hovea montana*, Alpine Everlasting *Ozothamnus alpinus*, Cascade Everlasting *Ozothamnus secundiflorus*, Tree Violet *Melicytus dentatus*, *Pimelea axiflora* subsp. *alpina*, *Olearia phlogopappa* var. *flavescens*, Alpine Mint-bush *Prostanthera cuneata*, *Nematolepis ovatifolia*, Smooth Blue Snowgrass *Poa fawcettiae*, *Rytidosperma nudiflorum*, Bidgee-widgee *Acaena novae-zelandiae*, Mountain Lettuce *Podolepis robusta*, *Luzula modesta*, *Senecio gunnii* and *Oreomyrrhis eriopoda*.
Condition	Most examples of this community are in high condition despite being burnt in 2003. Some areas are subject to grazing impacts and soil disturbance by feral deer and pigs. Dieback from insect attack is also evident in trees throughout this community.
Associated soils, rainfall and landscape position	Occurs on slopes, ridges and spurs on substrates of granite, basalt, metasediments and Quaternary alluvium.
Threatened ecological community	Not listed
Threatened species habitat	Open high elevation examples of this community may provide habitat for Shining Cudweed *Argyrotegium nitidulum*. Very open grassy examples of this community provide potential habitat for Alpine She-oak Skink. Broad-toothed Rat is also uses this habitat type. Where associated with rocky outcrops and suitable burrow sites Guthega Skink may also occur. Flame Robin, Gang-gang Cockatoo, Olive Whistler, Scarlet Robin and Spotted-tailed Quoll may also use this community. Mountain Pygmy-possum may disperse through this PCT.

Alpine Snow Gum shrubby open woodland at high altitudes	
Photograph(s)	 **Unburnt open grassy example of PCT 645 on Ramshead Range**  **Example of PCT 645 on Ramshead Range burnt in 2003 with dead canopy trees and dense regeneration of the overstorey and shrub vegetation**

Black Sallee - Snow Gum low woodland	
PCT full name	PCT 679 – Black Sallee - Snow Gum low woodland of montane valleys, South Eastern Highlands Bioregion and Australian Alps Bioregion
Extent within study area	Occurs on the river flats and lower slopes adjacent to Thredbo River below 1100 m near Bullocks Flat.
Description	An open woodland with a grassy to densely shrubby understorey. Characteristic species include Black Sally *Eucalyptus stellulata*, Candlebark *Eucalyptus rubida* subsp. *rubida*, Ribbon Gum *Eucalyptus viminalis*, Leafy Bossiaea *Bossiaea foliosa*, Small-fruited Hakea *Hakea microcarpa*, *Acrothamnus hookeri,* Woolly Grevillea *Grevillea lanigera*, Kangaroo Grass *Themeda triandra*, Common Woodruff *Asperula scoparia*, *Carex breviculmis*, Tussock grass *Poa labillardierei* var. *labillardierei*, Broad-leaved Snowgrass *Poa helmsii*, Snowgrass *Poa sieberiana* var. *sieberiana*, Mountain Lettuce *Podolepis robusta* and Scaly Buttons *Leptorhynchos squamatus*.
Condition	The community is in moderate condition along the Thredbo River due to historical disturbance, heavy deer grazing and weed invasion.
Associated soils, rainfall and landscape position	This community occurs in frost hollow drainage lines in montane and tableland areas on substrates of granite, basalt, metasediments and Quaternary alluvium (NSW Scientific Committee 2011b).
Threatened ecological community	**Commonwealth EPBC Act:** not listed **NSW BC Act:** Endangered Ecological Community where this PCT occurs in the South Eastern Highlands bioregion near Bullocks Flat, to be reviewed based on new determination for this community as of 28 June 2019. **Justification:** This PCT meets the BC Act listing criteria within the parts of the study area that occur in the South Eastern Highlands bioregion only (NSW Scientific Committee 2011b) according to the following parameters: species composition (10 indicative species including four canopy species), landscape position (footslope), geology (granodiorite) and elevation.
Threatened species habitat	This community may provide habitat for Blue-tongued Greenhood *Pterostylis oreophila* (drainage lines in this community) and Leafy Anchor Plant *Discaria nitida*. May provide lower elevation habitat in drainage lines for Broad-toothed Rat and Alpine Redspot Dragonfly. Other species that may use this habitat type include Koala, Eastern False Pipistrelle, Eastern Pygmy-possum, Flame Robin, Gang-gang Cockatoo, Olive Whistler, Pink Robin, Scarlet Robin and Spotted-tailed Quoll.

Black Sallee - Snow Gum low woodland	
Photograph(s)	 **Example of PCT 679 along the Thredbo River**

Snow Gum - Mountain Gum shrubby open forest	
PCT full name	PCT 1196 – Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion.
Extent within study area	Widespread on the upper elevations of the Perisher Valley to Bullocks Flat track on southern aspects between elevations of 1100 and 1300 m.
Description	This tall mixed-species forest community was burnt extensively in the 2003 alpine fires but dominant eucalypt species are generally epicormic re-sprouters so canopy is in intact in most places. Characteristic species include Mountain Gum *Eucalyptus dalrympleana* subsp. *dalrympleana*, Candlebark *Eucalyptus rubida*, Manna Gum *Eucalyptus viminalis*, Snow Gum *Eucalyptus pauciflora* subsp. *pauciflora,* Leafy Bossiaea *Bossiaea foliosa*, Gorse Biter-pea *Daviesia ulicifolia*, Coffee-berry *Coprosma hirtella*, Silver Wattle *Acacia dealbata*, Tussock grasses *Poa* spp., Prickly Starwort *Stellaria pungens* and Bidgee-widgee *Acaena novae-zelandiae*.
Condition	This community is in high condition except for signs of grazing and vegetation damage by feral deer.
Associated soils, rainfall and landscape position	This community occurs in mountainous areas on moderate to steep slopes of various geological origins including granite, basalt, metasediments and Quaternary alluvium.
Threatened ecological community	Not listed
Threatened species habitat	May provide lower elevation habitat in drainage lines for Broad-toothed Rat and Alpine Redspot Dragonfly. Other species that may use this habitat type include Smoky Mouse, Koala, Eastern False Pipistrelle, Eastern Pygmy-possum, Flame Robin, Gang-gang Cockatoo, Olive Whistler, Pink Robin, Scarlet Robin and Spotted-tailed Quoll.
Photograph(s)	 **Example of PCT 1196 on the slopes above Bullocks Flat/Thredbo River**