



**Shadow Basin
Terrestrial Ecological
Assessment**

NZSki Limited

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Shadow Basin Terrestrial Ecological Assessment

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1 Introduction

1.1 Overview

NZSki Limited (NZ Ski) is currently seeking consent to install a new Shadow Basin chairlift, undertake trail development and upgrade the access trail in Shadow Basin. (see Figure 1). Clearance of indigenous vegetation is proposed, however much of the vegetation that is present within the study areas is to be uplifted and relocated back onto a side batter or appropriate location once the new contour has been established. To assess the potential impacts of the proposed vegetation clearance, NZ Ski commissioned e3Scientific Limited (e3s) to undertake an ecological assessment of the area proposed to be modified. This ecological assessment describes the terrestrial ecological values of the area and reviews the ecological implications of the proposal. e3s understands this report will be lodged with both the QLDC and the Department of Conservation (DOC) for their review. A separate freshwater ecological assessment has been completed for instream works proposed adjacent to the lower station.

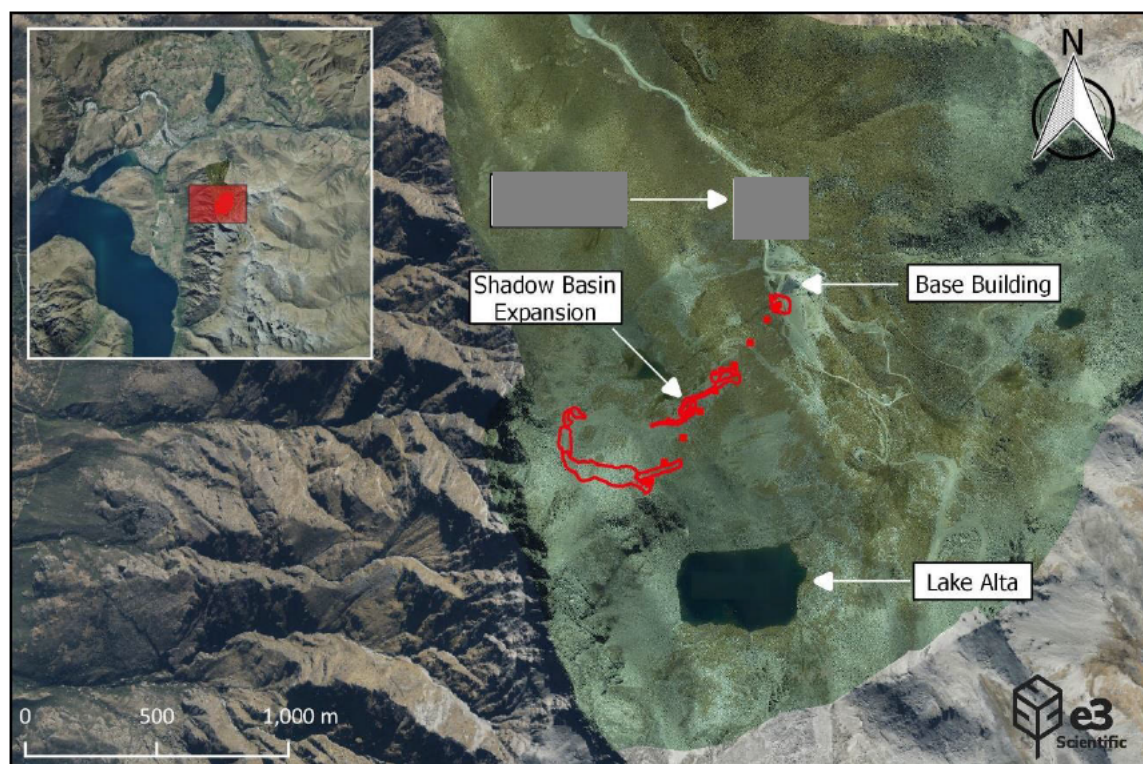


Figure 1: Site Location Plan.

1.2 Ecological Report Structure

The report is structured as follows:

- Section 2: Description of the environmental context, the proposed vegetation clearance and associated earthworks.
- Section 3: The methodology employed during the ecological assessment.
- Section 4: Description of the terrestrial flora and faunal values present within the subject areas.
- Section 5: Assessment of the significance of the ecological values.
- Section 6: Ecological Impact Assessment.
- Section 7: Conclusions and recommendations.

1.3 Limitations

e3s performed the services in a manner consistent with the normal level of care and expertise exercised by members of the environmental science profession. No warranties, express or implied, are made. The confidence in the findings is limited by the Scope of Work, and limited data due to the site visit being at one time of year. A full range of biota that are present at this site may not have been seen or recorded, however, desktop research was utilised to aid the assessment.

The results of this assessment are based upon site inspections conducted by e3s personnel, and information provided in scientific literature. All conclusions and recommendations regarding the properties are the professional opinions of e3s personnel involved with the project, subject to the qualifications made above. While normal assessments of data reliability have been made, e3s assumes no responsibility or liability for errors in any data obtained from regulatory agencies, statements from sources outside e3s, or developments resulting from situations outside the scope of this project.



2 Description of the Activity and Existing Environment

2.1 Environmental Context

The majority of the proposed development is located within the Shadow Basin cirque on the western side of the ski field. Within this basin, two new trails, a new top lift station and lift towers are proposed, as well as an upgrade to the access road. The replacement lift will originate from the same lower station location near the base building, however the top station is proposed near the top of the ridge, to the south of the existing station, where the two additional trails are proposed from the unload area (see Figure 2). The subject areas are located in the Rastus Burn Recreation Reserve, within the Remarkables Ecological District of the Lakes Ecological Region (DOC, 2022). Under the Queenstown Lakes District Plan the area is zoned Remarkables Ski Area Sub-Zone (QLDC, 2017). The area for the ecological review is presented in Figure 2 and henceforth referred to collectively as the 'study area', or individually as labelled on Figure 2.

2.1.1 Physical Environment

Shadow Basin has varying slopes and aspects due to the nature of the cirque basin that it is found in. The upper basin, where the trails and top lift station are proposed, comprises a moderate sized lake surrounded by wetlands, with bluffs and rock fields that rise to the ridge crests, where cushionfields are present. The trails and top station are located predominantly within a north facing rock field and cushionfield. These works are proposed at an elevation from approximately 1900 to 2000 m asl. The lower station located at 1612 m asl is proposed to replace the existing station, however the footprint will be increased. The lower lift towers are located on steep eastern facing tussock grassland slopes, changing to northern rockfield slopes closer to the top station. The access road is proposed through steep north facing tussock grassland and rockfield. The geology of the area is basement metamorphic rocks which is typically schist that is well foliated psammitic and pelitic with incipient segregation; minor greenschist and metachert. quartz veins common (GNS, 2022).



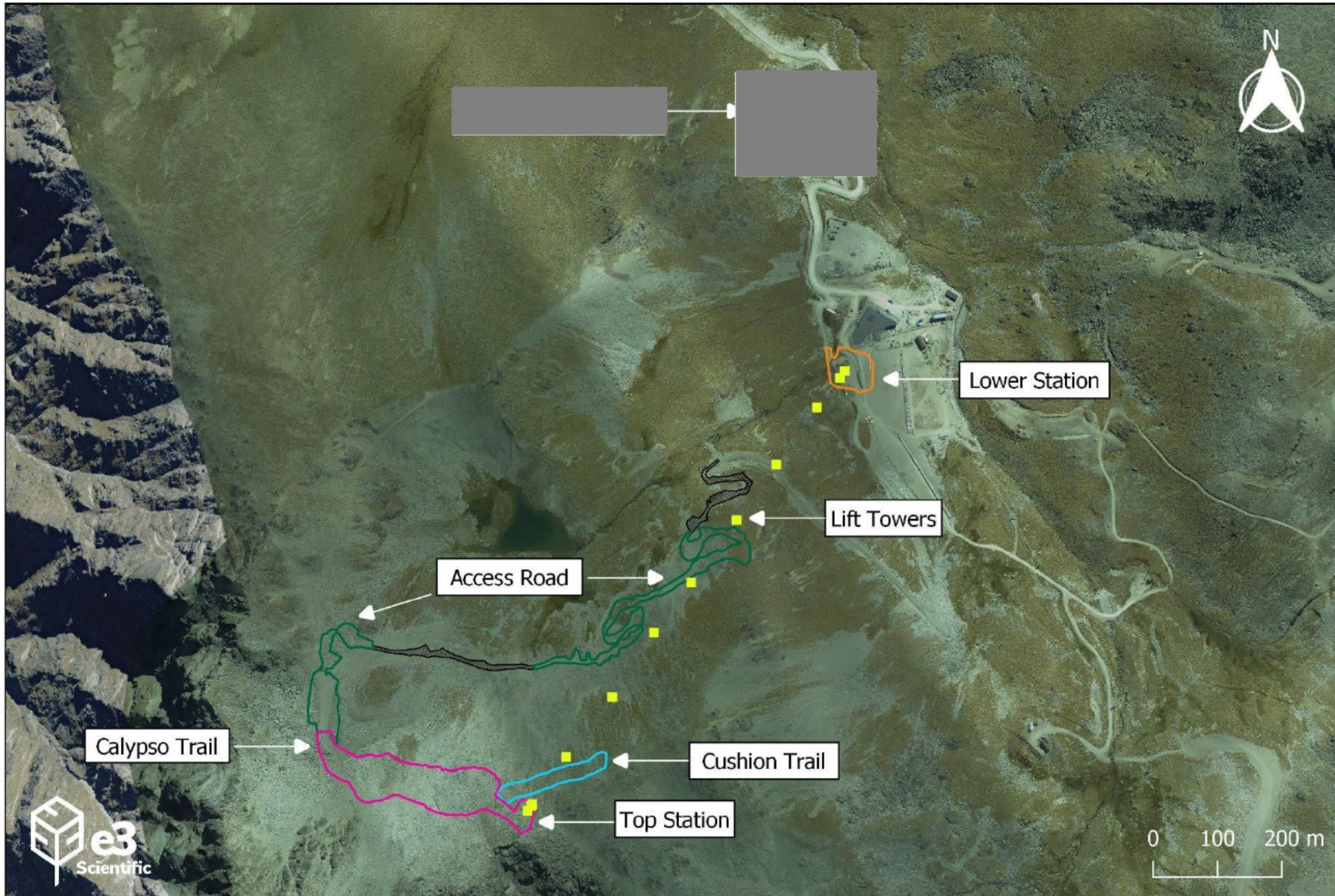


Figure 2: Site Layout.

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2.1.2 Biological Environment

Flora

The vegetation and habitats present within the study area (with the exception of the lower station and parts of the access track) are typically representative of unmodified communities found throughout the Remarkables Ski field area. The area surrounding the existing lower Shadow Basin lift station is highly modified and typically consists of bare ground, exotic species and regenerating early colonising natives. The remainder of the study areas consist predominantly of rockfield, tussock grassland, short tussock grassland, fellfield, and cushionfield.

Fauna

The bird species which are known to be found within the Remarkables alpine environments include the eastern falcon (*Falco novaeseelandiae novaeseelandiae*), paradise shelduck (*Tadorna variegata*), kea (*Nestor notabilis*), Southern black-backed gull (*Larus dominicanus dominicanus*) and New Zealand pipit (*Anthus novaeseelandiae novaeseelandiae*). These species have all been observed in the Shadow Basin area.

Four lizard species are known from the Rastus Burn Recreation Reserve area. These include the McCann's skink, short-toed gecko, korero gecko, and cryptic skink. NZ Ski have commissioned an independent lizard survey. Lizards are therefore not assessed further in this report.

2.2 Description of Activity

NZ Ski propose to expand the ski area predominantly within the Shadow Basin section of the Remarkables Ski Field. The expansion is proposed by installing a new chairlift, creating two new trails from the off load area, and upgrading the access road. It is also proposed to lower the existing terrace on which the lower Shadow lift station is positioned to be level with the learners' slope.

The Calypso trail is proposed to be a 30 m wide trail that goes from the off load area of the new station down towards the existing Shadow basin top station and



connects into the existing Calypso trail. The total area of disturbance for the new section of the Calypso trail and the new top station, including batters is 19,166 m². The majority of this area is rockfield, with areas of mixed fellfield and cushionfield.

Below the new Shadow Basin top station and part way down the new Calypso trail, the Cushion trail is proposed, which runs parallel with the ridge line. This trail will provide access into the chute trails towards Lake Alta. This trail is proposed to be up to 15 m wide with a total area of disturbance, including batters of 4,074 m². This trail contains a mixture of rockfield and cushionfield.

The new Shadow Basin bottom station is proposed to replace the existing station. The terrace that has been previously built for the existing station is proposed to be removed and the ground level lowered to align with the learners' slope. The earthworks footprint is proposed over 3,924 m², however the majority of this area has previously been modified as this area only includes approximately 80 m² of unmodified tussock grassland. As part of the original works to create the terrace, a rock wall was installed within the watercourse which flows immediately to the north of the lift station. This rock wall has allowed vehicle access to be formed across the stream to the station. It is proposed to move the rock wall back to the upstream edge of the road, removing the vehicle access across the stream, and reinstate the stream bed where the existing rock wall and road currently are. These works are assessed separately in a freshwater ecological assessment.

NZ Ski are proposing to install a Doppelmayr lift line, which will include seven lift towers (outside of the towers associated with the stations). Lift towers will have a footprint of 3 m x 3 m. Temporary access to install these towers will be required. The potential access to each tower has not yet been assessed.



To construct and allow ongoing maintenance of the new lift line and top station, it is proposed to upgrade the access road. At present, only 4wd vehicles can access the top station, therefore it is proposed to lessen the current gradient of the road to allow for service vehicles. The gradient required for these vehicles on the existing access road is not achievable without modifying wetlands, therefore a new access trail is proposed. The new access trail is proposed in parts over the existing trail, and in parts through unmodified, and modified tussock grassland, and rockfield. Earthworks are not proposed to occur within 10 m of the wetlands which are located on the down slope of the existing access road. Earthworks for the access road upgrade are proposed over 19,291 m². Please note that only the lower mid-section of 8,648 m², and upper section of 6,386 m² has been assessed. The lower 2,193 m² section and the upper mid-section of 2,064 m² of the access road shown by the black hashed lines in Figure 2 has not been surveyed or assessed as part of this report.

The vegetation communities within each of the areas defined above are described in Section 4.1.



3 Methodology

The ecological assessment for the proposed Shadow Basin expansion works is based on a desktop study, and site visits completed on 6 December 2021, 24 and 25 January, 14 February, and 18 May 2022.

3.1 Desktop Research and Site Visit

The desktop and site visit included:

- Review of existing ecological information to determine terrestrial ecological habitats and species likely present on the site.
- Establish the representativeness of the ecological habitats present, and the significance of those habitats, through a site visit and a review of the expected pre-disturbance vegetation and Land Environments of New Zealand (LENZ) classification (Landcare, 2022).
- Establish the presence and significance of plant species through a site visit and the Department of Conservation's threat classification for New Zealand indigenous vascular plants (de Lange, *et al.*, 2018).
- Establish the likely presence and significance of native avifauna species through a site visit, existing scientific knowledge and the Department of Conservation's threat classification for New Zealand birds (Robertson, *et al.*, 2021).

3.2 Impact Assessment

The assessment of ecological effects for the study area has been completed using the Environment Institute of Australia and New Zealand Ecological Impact Assessment (EclIA) guidelines (Roper-Lindsay *et al.*, 2018). The impact assessment follows the steps outlined below:

- Ecological values have been assigned a score on a continuum scale of Negligible to Very High. These scores are based on an assessment against criteria which are set out in section 5.2 of the EclIA guidelines and are incorporated into and elaborated on in the QLDC Proposed District Plan in Chapter 33 (Indigenous Vegetation and Biodiversity) policy 33.2.1.8. The



ecological scores assigned to each criterion then feed into a scoring system to give an overall value for each area assessed or the full project site.

- Determine the magnitude of the effect that the project has on the ecological values. The scale of the magnitude also ranges from Negligible to Very High.
- The overall level of effect is then determined by a combination of value and the magnitude of the effect. Level of effect categories include Net Gain, Very Low, Low, Moderate, High and Very High.



4 Ecological Values

4.1 Vegetation

The vegetation present within the study areas can be classified into different communities. These are tussock grassland, short tussock grassland, herbfield, cushionfield, rockfield and fellfield. The different communities present within each of the areas are described in their relevant sections below. Representative photos are provided where possible.

4.1.1 Top Lift Station

Rockfield

The top lift station is predominantly located within rockfield (see Plate 1), where the vast majority of the time no vegetation is present. However, a few very small, scattered patches of fellfield are present where soil has accumulated around larger boulders. These small areas of fellfield can be seen in the photographs provided in Plate 1. Species present within these patches include blue tussock (*Poa colensoi*), *Hectorella caespitosa*, *Luzula pumila*, *Colobanthus buchananii*, *Dracophyllum muscoides*, *Raoulia grandiflora* and *Epilobium tasmanicum*.



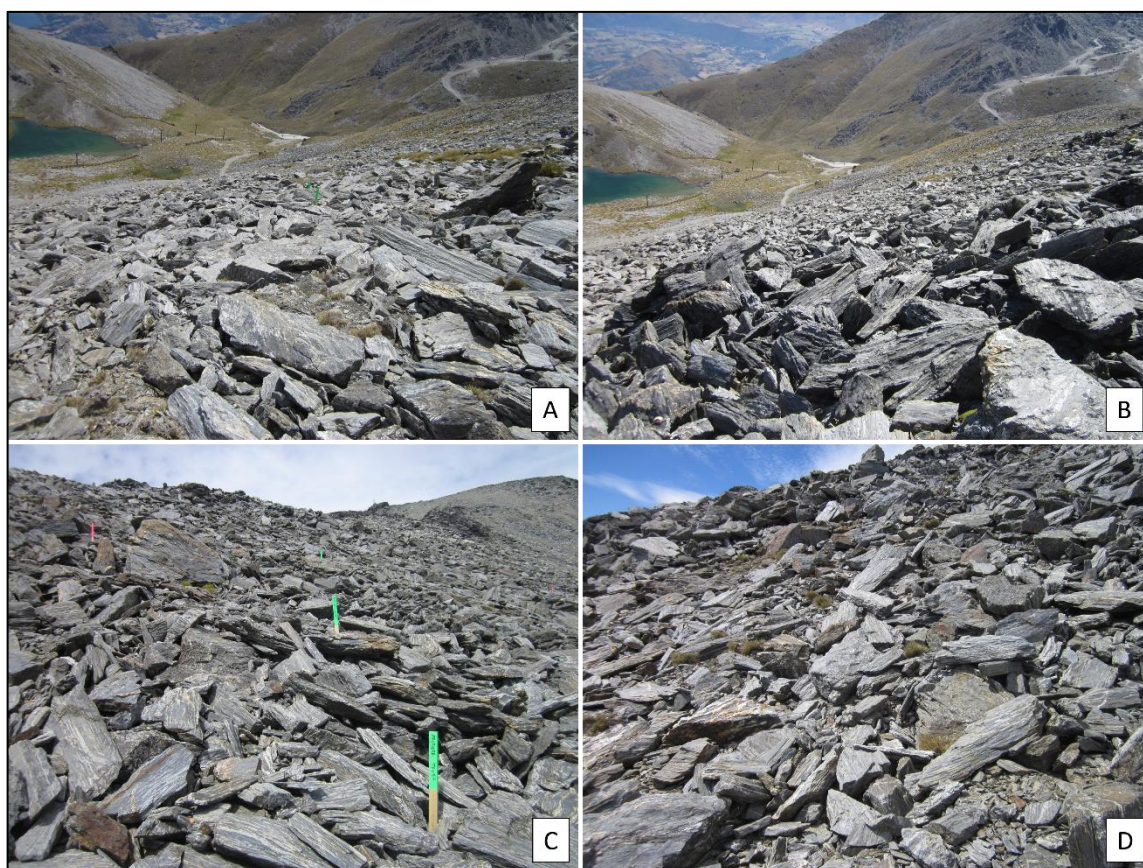


Plate 1: Photographs showing the location of the top station. A and B – looking down slope at the station location. C and D – looking upslope at the station location shown by the green pegs.

4.1.2 Calypso Trail

The Calypso trail is also predominately rockfield with the vast majority (as with the top station) unoccupied by vegetation, however, patches of varying sizes of fellfield and cushionfield are present within this proposed trail. Within the proposed trail two areas of 1,788 m² and 95 m² of mixed fellfield and cushionfield (see Figure 3) are to be relocated.

The largest area of mixed fellfield and cushionfield (Area 1 – Figure 3) is located approximately one third of the way up the trail slope and has formed where shallow soils have accumulated. The dominant species include blue tussock, *Luzula pumila*, *Hectorella caespitosa*, *Colobanthus buchananii*, *Dracophyllum muscoides*, *Raoulia grandiflora*, *Abrotanella inconspicua*, *Anisotome imbricata* var. *imbricata*, *Epilobium tasmanicum*, *Leptinella goyenii* and *Kelleria childii* along with scattered plants and patches of *Celmisia sessiliflora*, *Aciphylla kirkii*, *Carex pyrenaica* var. *cephalotes*, and *Chionochoa macra*.



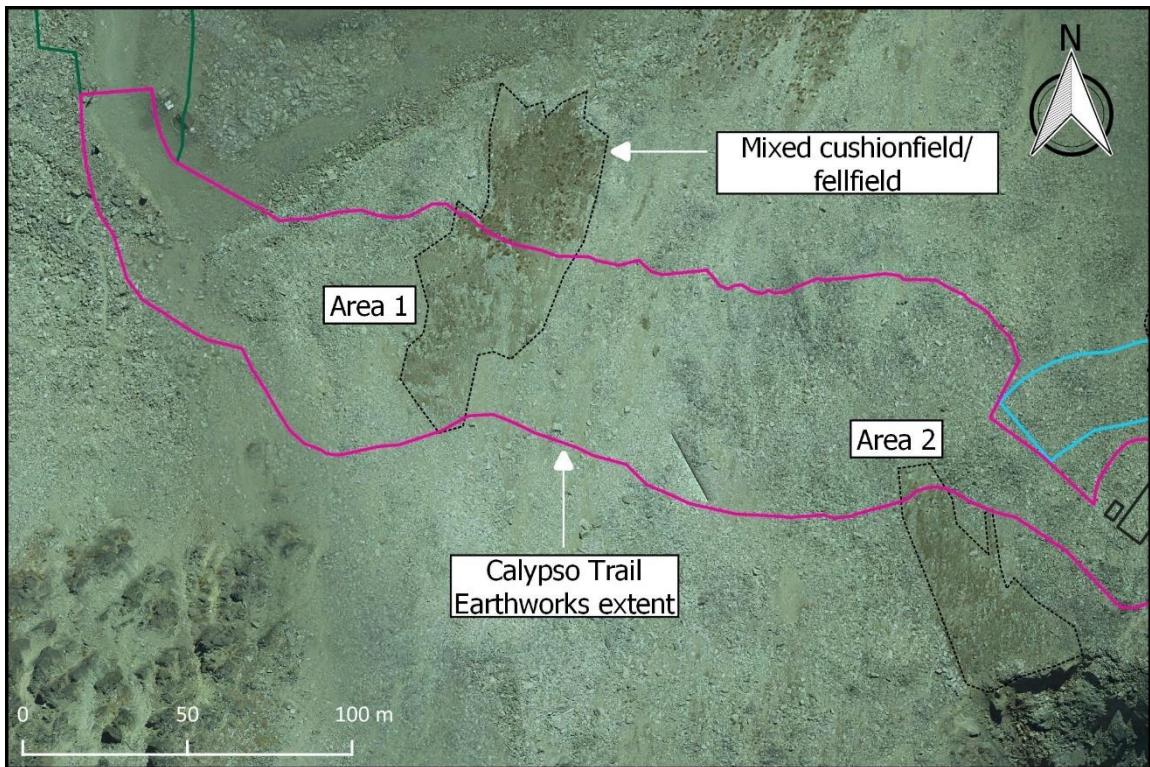


Figure 3: Location of mixed cushionfield and fellfield within the Calypso Trail.

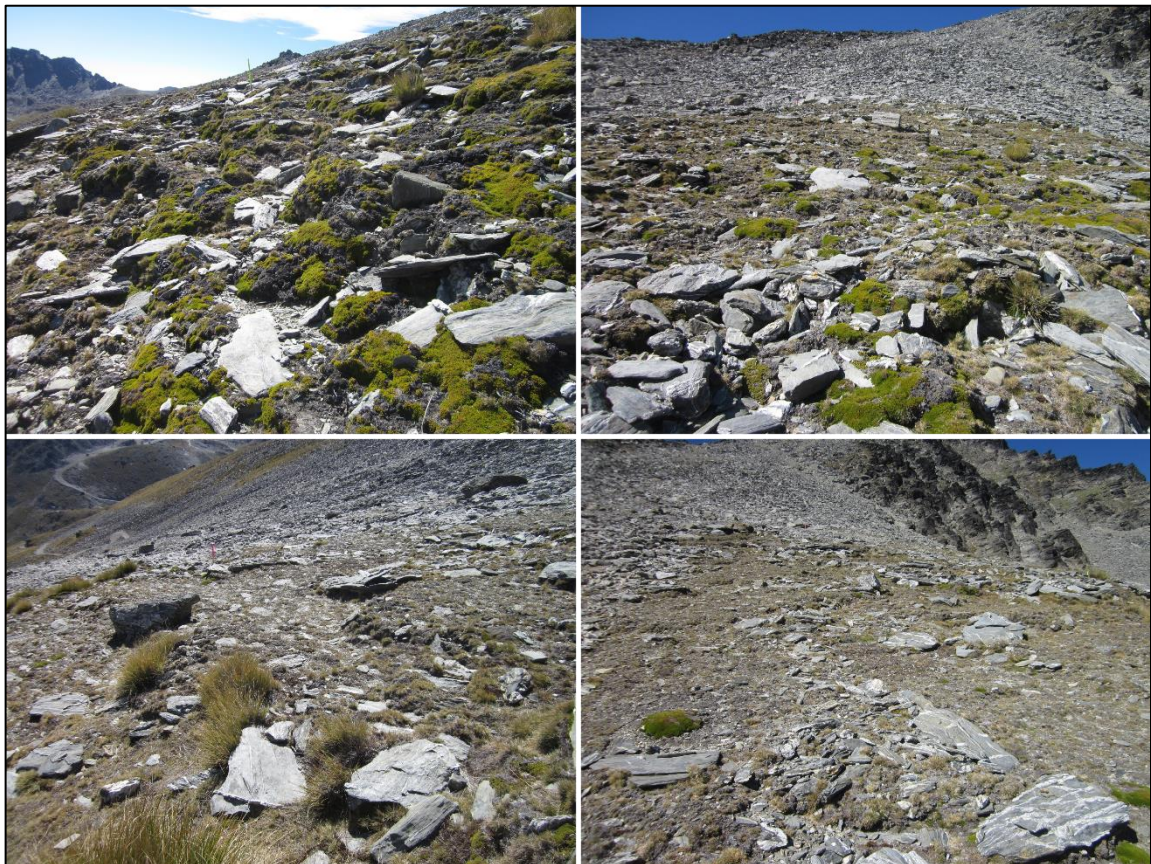


Plate 2: Photographs showing the mixed fellfield and cushionfield within Area 1 of the Calypso Trail.



The smaller mosaic area of fellfield and cushionfield (Area 2 – Figure 3) is located near the upper extent of the trail. The area proposed to be relocated is the bottom extent of the finger of vegetation that extends downslope (see Plate 3). Species present within this area include *Hectorella caespitosa*, *Luzula pumila*, blue tussock, *Abrotanella inconspicua*, *Colobanthus buchananii*, *Kelleria childii*, *Raoulia grandiflora*, *Leptinella goyenii*, *Aciphylla kirkii*, *Dracophyllum muscoides*, and *Epilobium tasmanicum*.



Plate 3: Left: Small mosaic area of fellfield and cushionfield located near the upper extent of the trail (Area 2). Right: Example of a patch of fellfield found within the trail.

Small, scattered patches of fellfield are found throughout the trail where soil has been able to accumulate around larger boulders or on finer scree slopes (Plate 3). These patches of fellfield appear to be more common near the bottom and top of the trail. Along with these scattered patches of fellfield, *Aciphylla simplex* plants were recorded amongst the rockfield at the lower end of the trail and the very top of the trail near the top station.

At the lower end of the trail, where the new trail is proposed to join the existing Calypso trail, regenerating fellfield is located on the already modified trail terrain. The regenerating vegetation is dominated by blue tussocks, *Epilobium tasmanicum*, *Epilobium porphyrium*, *Luzula pumila*, *Hectorella caespitosa*, *Colobanthus buchananii*, and the occasional *Veronica epacridea*.



4.1.3 Cushion Trail

The Cushion Trail contains areas of both rockfield and mixed cushionfield (see Figure 4). The areas of cushionfield that the trail is proposed through are fingers of cushionfield which extend down from the main area of mixed cushionfield located along the ridgeline. The three main areas of cushionfield, Area 3, Area 4, and Area 5 (see Figure 4) have areas of 68 m², 438 m², and 541 m² respectively. These areas are proposed to be relocated onto the batters of the trail slopes. The area to the east of Area 5 at the end of the trail is proposed to be avoided as the trail will be shortened.

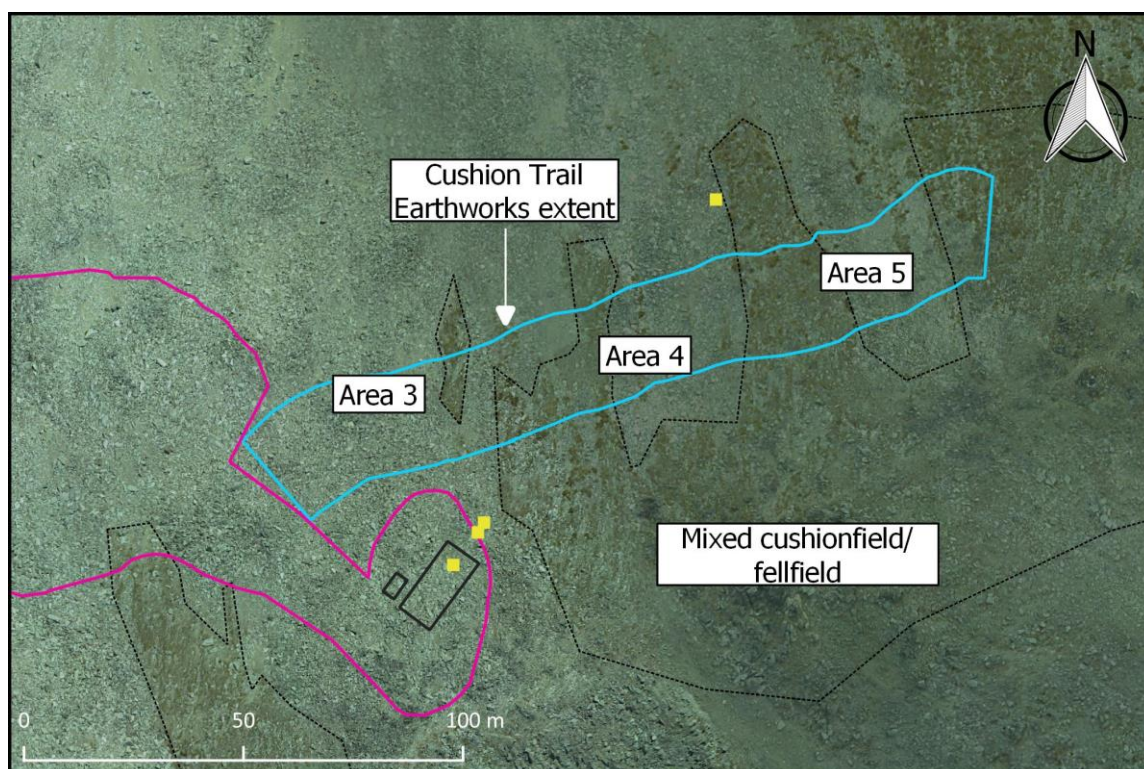


Figure 4: Location of cushionfield within the Cushion Trail.

Species present within these three main areas of mixed cushionfield include (see Plate 4) *Raoulia hectorii*, *Dracophyllum muscoides*, *Raoulia grandiflora*, *Hectorella caespitosa*, *Abrotanella inconspicua*, *Kelleria childii*, *Leptinella goyenii*, *Veronica thomsonii*, *Anisotome imbricata* var. *imbricata*, *Aciphylla kirkii*, *Epilobium tasmanicum*, *Carex pyrenaica* var. *cephalotes*, *Luzula pumila*, blue tussock, *Rytidosperma pumilum*, *Chionochoa macra*, *Agrostis muelleriana*, *Colobanthus buchananii* with the occasional *Veronica buchananii*, *Anisotome lanuginosa* and *Taraxacum magellanicum*.



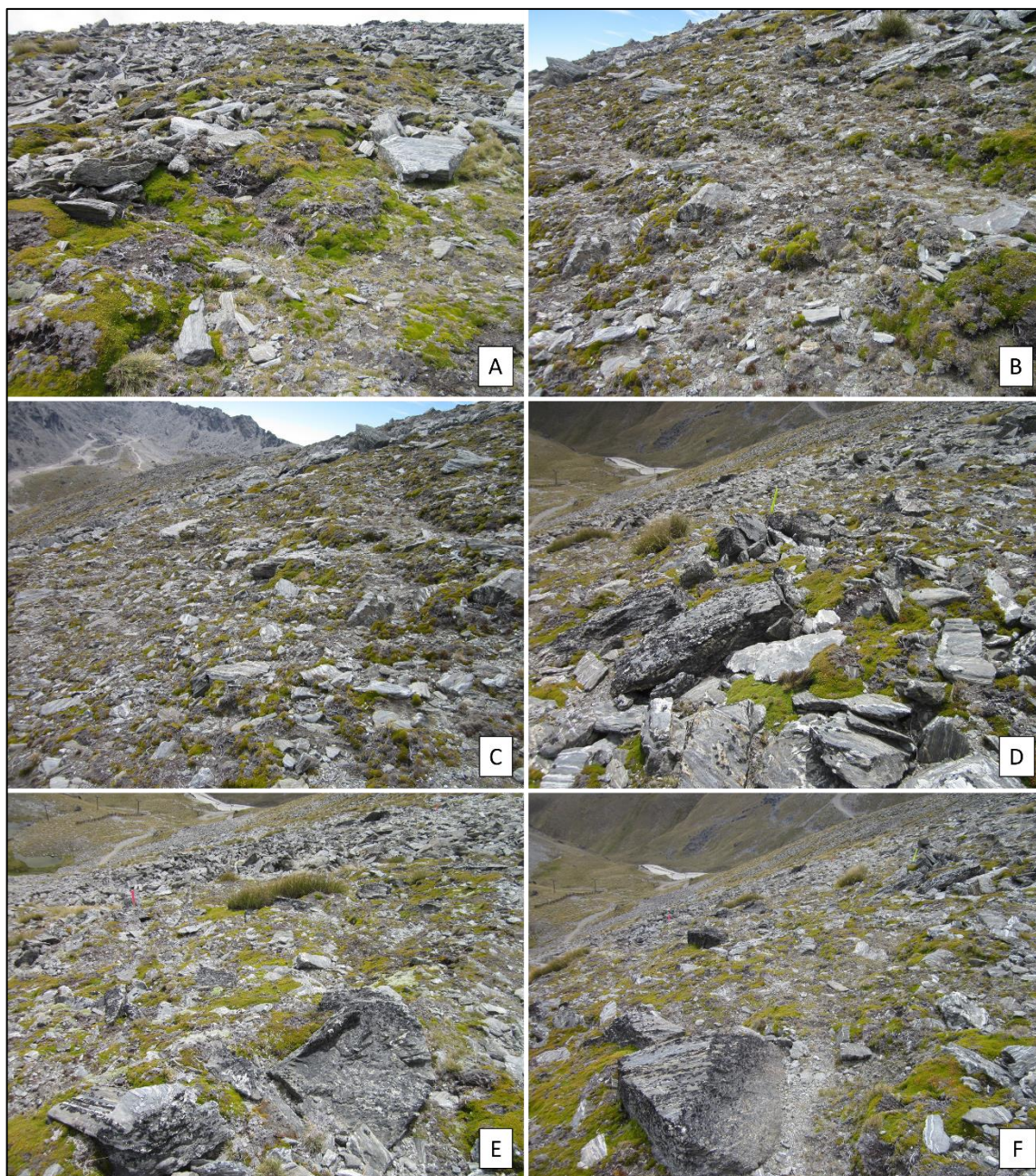


Plate 4: Photographs showing the vegetation within the Cushion Trail. A – photograph of Area 3. B and C – photographs of Area 4. D, E and F – photographs of Area 5.

The plants located within these three areas are well integrated with the rocky terrain that they are present on, particularly within Area 5. This may make the proposed relocation of the vegetation challenging as it will be difficult to pick the vegetation up due to the complex uneven and rocky surface.

Rockfield is present at the beginning of the proposed trail and then present between the fingers of cushionfield (see Figure 4). The area of rockfield at the start of the trail is predominately rock with very little vegetation present. The areas of



rockfield between the three main cushionfield areas do contain small patches of cushionfield, however these have not been able to be mapped at a visible scale.

4.1.4 Lower Lift Station

The new lower lift station is proposed to replace the existing station. The terrace that has been previously built for the existing station is predominantly bare ground, or a mixture of exotic herbaceous weed and grass species with scattered regenerating natives. Tussock grassland is present on the constructed batter slope to the terrace, as well as on the slope beneath the lift line. The rock wall which forms a portion of the batter slope, and the area of learners slope, which forms the proposed ground level for the new station platform also contains a mixture of regenerating natives and exotic species. The earthworks footprint is proposed over 3,924 m², however this area only includes approximately 80 m² of unmodified tussock grassland, with the remainder of the area being previously modified.

Exotic species dominate within the open bare ground areas ((see Plate 5). Species present included brown top (*Agrostis capillaris*), white clover (*Trifolium repens*), sheep's sorrel (*Rumex acetosella*), mouse ear chickweed (*Cerastium fontanum*), mouse ear hawkweed (*Pilosella officinarum*), cats ear (*Hypochaeris radicata*), yarrow (*Achillea millefolium*), red sand spurrey (*Spergularia rubra*), suckling clover (*Trifolium dubium*), and pearlwort (*Sagina procumbens*). However, native species are scattered throughout the area and include *Acaena saccaticupula*, blue tussock, *Raoulia tenuicaulis*, *Anaphalioides bellidioides*, *Carex wakatipu*, *Wahlenbergia albomarginata*, *Luzula rufa*, *Epilobium melanocaulon*, *Colobanthus apetalus*, *Epilobium brunnescens*, *Chionochloa macra*, *Raoulia subsericea* and *Rytidosperma pumilum*. *Raoulia apicinigra*, *Raoulia grandiflora*, and *Scleranthus uniflorus* are present on the learners slope area.

Within the northern end of the rock wall (see Plate 5), native species present include *Anaphalioides bellidioides*, *Acaena saccaticupula*, *Raoulia tenuicaulis*, *Colobanthus apetalus*, *Epilobium brunnescens*, *Epilobium melanocaulon*, blue tussock and *Ozothamnus vauvilliersii*. Exotic species present include brown top, sheep's sorrel, mouse ear chickweed, mouse ear hawkweed, white clover and yarrow. At the southern end of the rock wall (see Plate 5), tussocks have been relocated onto the batter slope. The areas between the tussock plants are largely dominated by the exotic species listed above.





Plate 5: Photographs of the Lower Lift station location. A – general overview. B – photograph showing general cover of disturbed areas. C – northern end of the rock wall. D – Southern end of the rock wall.

The area of tussock grassland on the slope below the existing lift line (see Plate 6) includes *Chionochloa macra*, *Raoulia subsericea*, *Austroblechnum pennamarina* subsp. *alpina*, blue tussock, *Geranium brevicaule*, *Anaphalioides bellidioides*, *Leptinella pectinata* var. *villosa*, *Acaena saccaticupula*, *Viola cunninghamii*, *Carex wakatipu*, and *Aciphylla* 'Lomond', as well as the exotics browntop, mouse ear hawkweed, sheep's sorrel and yarrow.



Plate 6: Photographs showing the area of tussock grassland below the lift line.



Along the toe of the rock wall an overland flow path is present (see Plate 7). Within this area along with most species listed above, *Epilobium macropus* and one patch of *Carex talbotii* are present. Along the toe of the tussock grassland slope there is another constructed overland flow path. A grey willow seedling is present within this channel.



Plate 7: Left: overland flow path at the toe of the rock wall. Right: Overland flow path at the toe of the tussock grassland slope.

4.1.5 Lift Towers

NZ Ski propose to install a Doppelmayr lift line and stations. The location of the lift towers are shown in Figure 5 and Plate 8. Each tower footprint is proposed to be approximately 3 m x 3 m. The location for each lift tower was surveyed, however, the towers described below are those that are outside the footprint of the lift stations. Towers within the footprint of the stations have been included within the station sections.

Tower 3

Tower 3 (see Plate 8 and Figure 5) is located on the edge of both tall tussock grassland and short tussock grassland. However, it is proposed to move the tower to be entirely within the tall tussock grassland community. Species present would therefore include *Chionochloa rigida*, blue tussock, *Raoulia subsericea*, *Carex wakatipu*, *Geum leiospermum*, mosses, *Plantago lanigera*, *Viola cunninghamii*, *Coprosma atropurpurea*, sheep's sorrel, tussock hawkweed, and mouse ear hawkweed.



Tower 4

Tower 4 (see Plate 8 and Figure 5) is located on the edge of the existing access road above a steep rock retaining wall. Most of this area is already disturbed, however species including blue tussock, *Chionochloa macra*, *Rytidosperma pumilum*, *Luzula pumila*, *Acaena saccaticupula*, *Ozothamnus vauvilliersii*, *Carex wakatipu*, *Agrostis muelleriana*, *Luzula traversii* var. *traversii* and browntop are regenerating or present.

Tower 5

Tower 5 (see Plate 8 and Figure 5) is located within tall tussock grassland with scattered rocks. Species present include *Chionochloa rigida*, *Chionochloa macra*, blue tussock, *Plantago lanigera*, *Carex penalpina*, *Viola cunninghamii*, *Carex wakatipu*, *Myrsine nummularia*, *Raoulia subsericea*, *Rytidosperma pumilum*, and sheep's sorrel.

Tower 6

Tower 6 (see Plate 8 and Figure 5) is located entirely within rockfield. No plants are present.

Tower 7

The footprint of tower 7 (see Plate 8 and Figure 5) is currently located half within rockfield and half within mixed tussock grassland and herffield. Species present include *Chionochloa macra*, *Raoulia grandiflora*, *Acaena saccaticupula*, *Pimelea notia*, *Melicytus alpinus*, *Austroblechnum penna-marina* subsp. *alpina*, blue tussock, *Carex wakatipu*, *Viola cunninghamii*, and *Rytidosperma pumilum*. This tower is proposed to be moved entirely within rockfield, therefore these species will be avoided.

Tower 8

Tower 8 (see Plate 8 and Figure 5) is located within rockfield with scattered blue tussocks present. This tower location is close to, but should avoid the edge of the patch of cushionfield that extends downslope.

Tower 9

Tower 9 (see Plate 8 and Figure 5) is located within rockfield with scattered blue tussocks, *Agrostis muelleriana*, *Hectorella caespitosa* and *Raoulia grandiflora*



plants present. This tower location is close to the edge of patch of cushionfield that extends downslope, however this area should also be avoided.

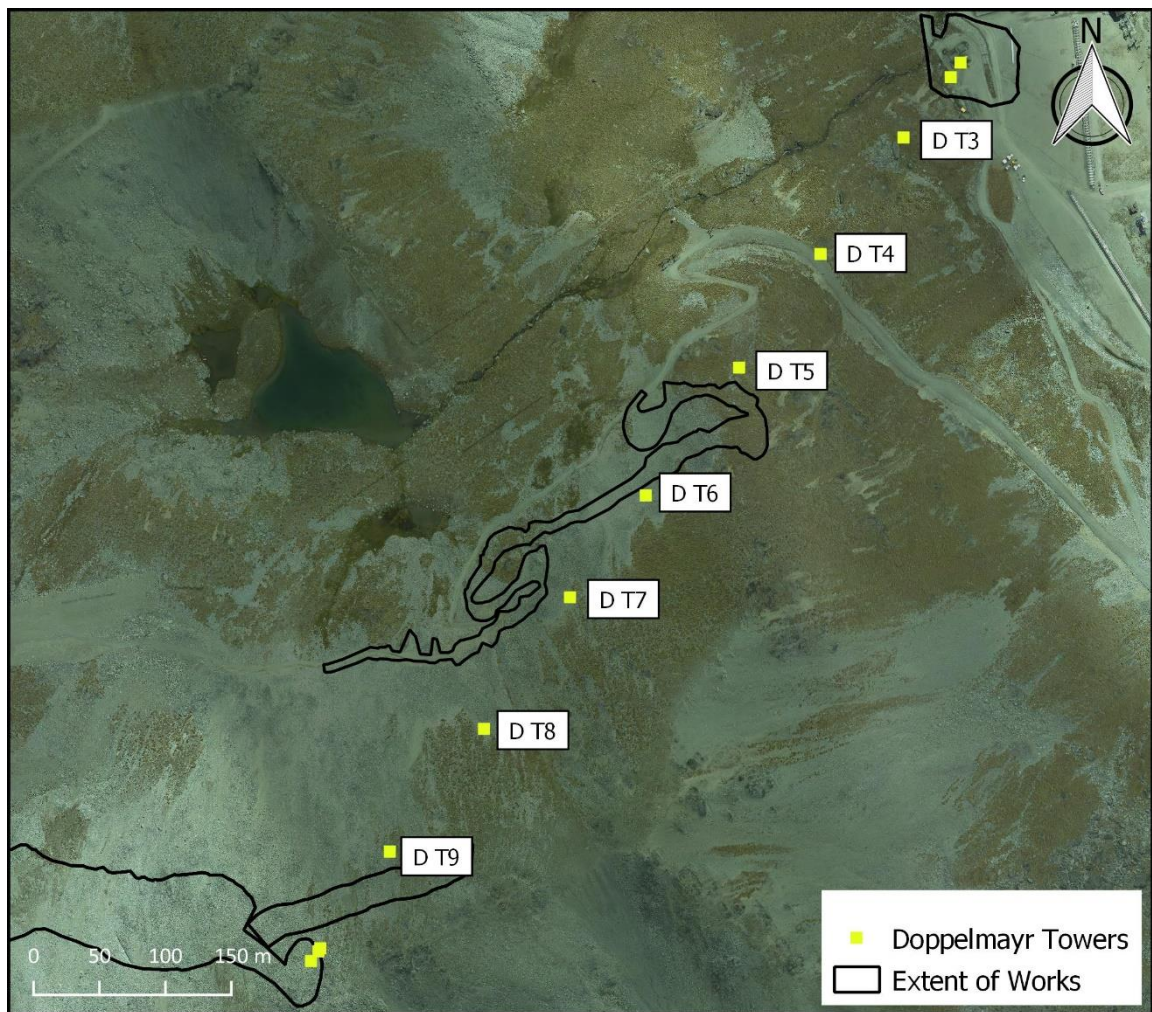


Figure 5: Location of the proposed Doppelmayr lift towers.



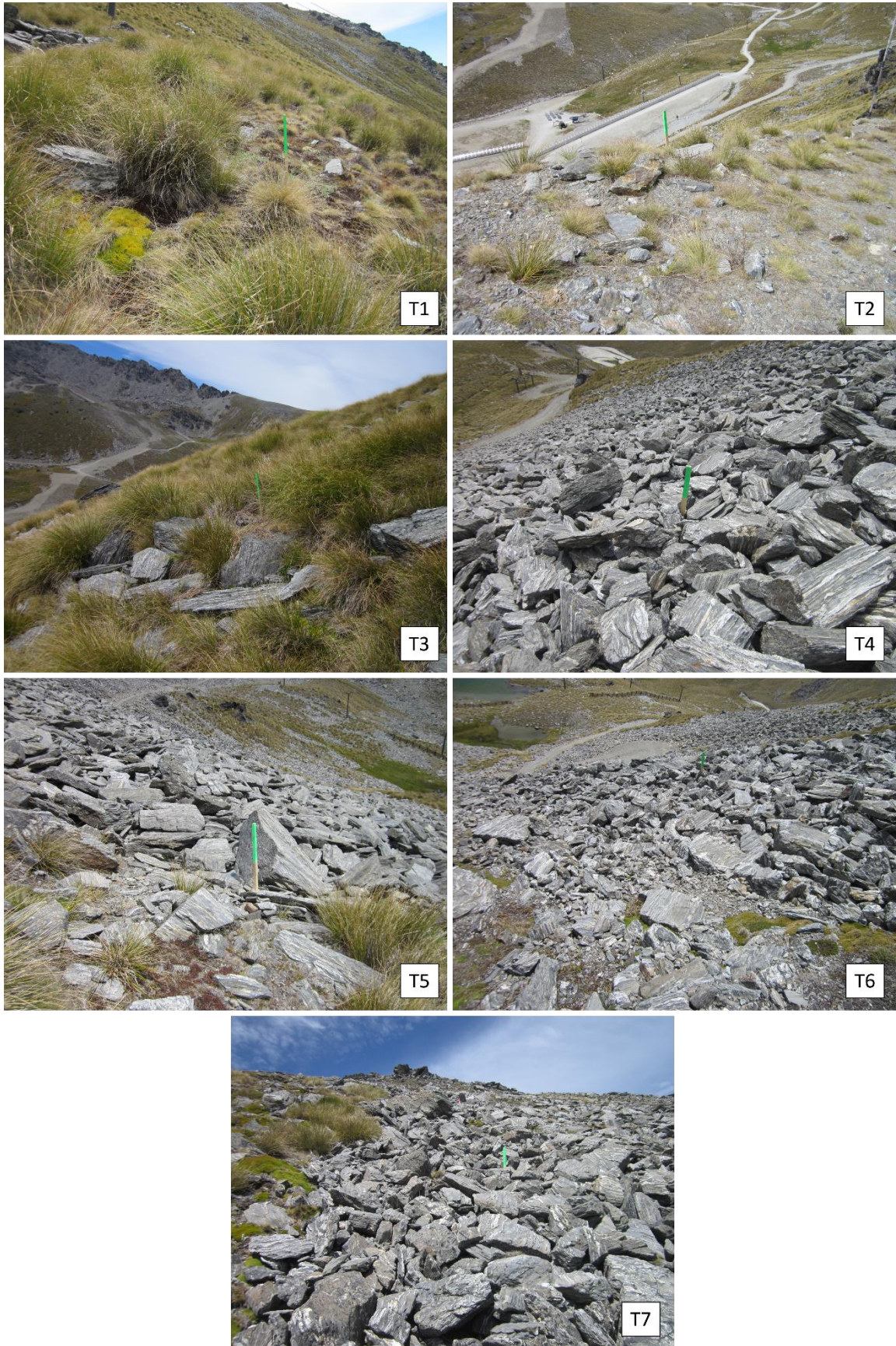


Plate 8: Photographs of the proposed Doppelmayr lift tower locations.











buchananii, *Agrostis muelleriana* and *Melicytus alpinus*. One *Aciphylla simplex* plant was observed next to a small rocky outcrop within the proposed access road.

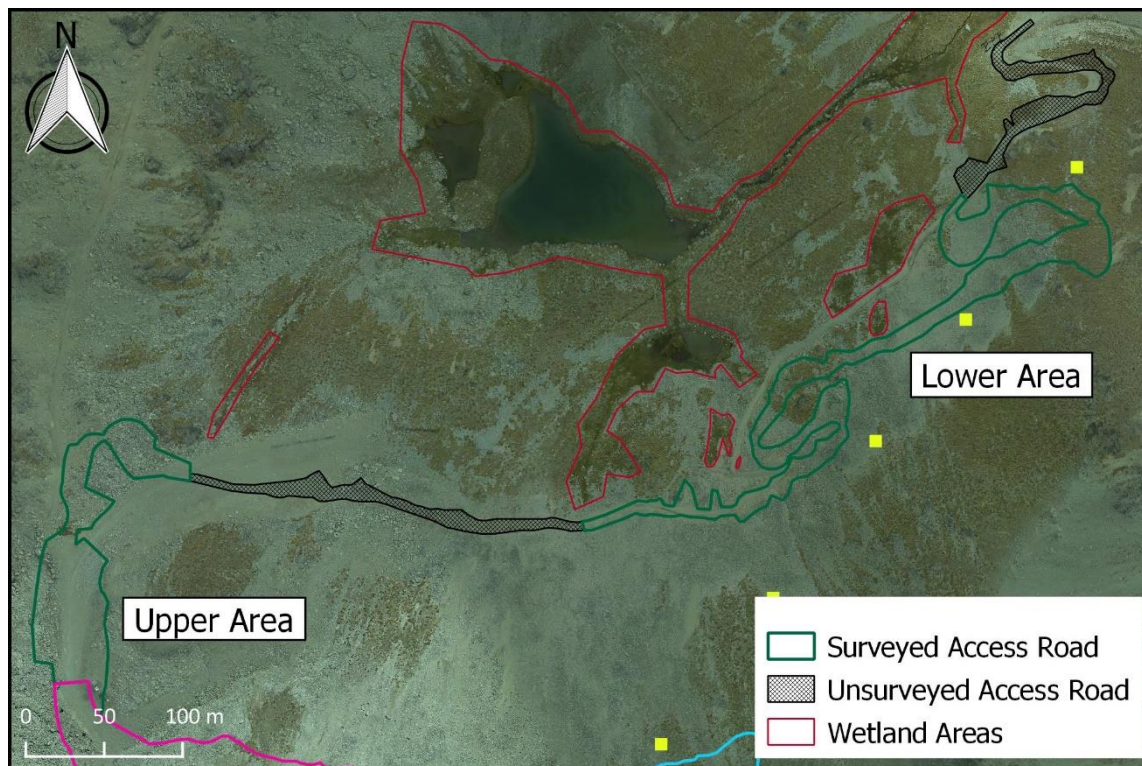


Figure 6: Location of the proposed access road and neighbouring wetlands.



Plate 12: Photographs of the main rockfield within the lower access road area.

Within the mixed tall tussock grassland and herbfield areas (see Plate 13) species present included *Chionochoila macra*, *Acaena saccaticupula*, *Brachyscome montana*, *Luzula pumila*, *Rytidosperma pumilum*, *Carex wakatipu*, *Raoulia grandiflora*, *Pimelia notia*, *Austroblechnum penna-marina*, *Gaultheria depressa* var. *novae-zealandiae*, *Celmisia haastii* var. *haastii*, *Dracophyllum rosmarinifolium*, *Uncinia divaricata*, *Viola cunninghamii*, moss, *Huperzia*



australiana, *Luzula rufa*, *Anaphalioides bellidioides*, *Polystichum vestitum*, *Aciphylla kirkii*, *Melicytus alpinus*, *Geranium brevicaule*, *Uncinia fuscovaginata*, *Aciphylla* 'Lomond', *Argyrotegium mackayi*, *Plantago lanigera*, *Leptinella pectinata* subsp. *villosa*, *Celmisia lyalii*, *Myrsine nummularia*, and *Hectorella caespitosa*. Rocks are also scattered amongst the tussock grassland areas.



Plate 13: Photographs of the tussock grassland within the lower surveyed area of the access road.

Species that have regenerated within the existing access road (see Plate 14) include *Agrostis muelleriana*, *Epilobium tasmanicum*, *Epilobium porphyrium*, *Epilobium melanocaulon*, *Rytidosperma pumilum*, *Hectorella caespitosa* and *Colobanthus buchananii*.





Plate 14: Photographs of the modified areas within the proposed access road and regenerating species.

Upper Access Road

The current alignment of the upper access road is proposed to avoid numerous switchbacks. Within the rockfield (see Plate 15) are areas of fellfield and relocated tussock grassland, however the majority of this area does not contain any vegetation, or if present are scattered in nature. Species within the rockfield included *Poa colensoi*, *Luzula pumila*, *Epilobium tasmanicum*, *Hectorella caespitosa*, *Raoulia grandiflora*, *Colobanthus buchananii*, *Agrostis muelleriana*, *Haastia sinclairii* var. *fulvida*, and *Aciphylla simplex*. *Aciphylla simplex* plants are located throughout the entire rockfield area.



Plate 15: Photographs of the main rockfield within the upper access road area.

A small area of relocated tall tussock grassland is located near the intersection of the existing Calypso Trail and The Highway (see Plate 16). Species present included *Chionochoa macra*, *Poa colensoi*, *Carex wakatipu*, *Raoulia grandiflora*, *Luzula pumila*, *Dracophyllum muscoides*, *Rytidosperma pumilum*, *Kelleria childii*, *Hectorella caespitosa*, and *Aciphylla kirkii*. Hare poo was noted throughout this tussock area.





Plate 16: Photographs of the relocated tall tussock grassland within the upper access road.

Two main areas of fellfield are present within this upper access road. These are located to the west of the intersection of the existing Calypso Trail and The Highway down in a depression within the rockfield, and adjacent to the area of relocated tall tussock grassland (see Plate 17). Species present included *Kelleria childii*, *Carex pyrenaica* var. *cephalotes*, *Ourisia caespitosa*, *Polystichum cystostegia*, *Poa colensoi*, *Raoulia grandiflora*, *Raoulia youngii*, *Hectorella caespitosa*, *Epilobium tasmanicum*, *Colobanthus buchananii*, moss, *Dracophyllum muscoides*, *Luzula pumila*, *Aciphylla kirkii*, and *Aciphylla simplex*.



Plate 17: Photographs of the two main fellfield areas within the upper access road.

Along the existing Calypso ski trail, fellfield species are regenerating (see Plate 18). These include *Veronica epacridea*, *Poa colensoi*, *Epilobium porphyrium*, *Epilobium tasmanicum*, *Rytidosperma pumilum*, *Agrostis muelleriana*, *Colobanthus buchananii*, *Hectorella caespitosa*, *Raoulia youngii*, *Acaena saccaticupula* and small *Aciphylla simplex*.





Plate 18: Photographs of the modified trail areas within the upper access road and regenerating species.

4.1.8 At Risk or Threatened Plants

No threatened plants are located within the study area, however a range of At Risk or Data Deficient (de Lange, *et al.*, 2018) plants are present. These include:

Data Deficient

Brachyscome montana

At Risk – Naturally Uncommon

Aciphylla simplex

Anisotome lanuginosa

At Risk – Declining

Carex talbotii (*Carex berggrenii*)

Myosotis drucei, although Not Threatened, is not considered common. *Myosotis drucei* is only known from a handful of locations within the Rastus Burn.

4.2 Fauna

4.2.1 Avifauna

NZ pipits were seen throughout the study area utilising a range of habitats from carpark 2 to the top station. Southern black-backed gulls were seen flying over the upper study area, however, were not noted within the study area. The habitat present is suitable for both eastern falcon and kea.



4.2.2 Invertebrates

Invertebrate species that were observed during the site visits were alpine grasshoppers, and a range of spiders and butterflies. No specific invertebrate sampling or analysis has been completed for this assessment.

4.2.3 Lizards

An independent lizard survey has been completed for the survey area.

4.2.4 Other

Hare poo was seen throughout most of the vegetated areas.

4.3 Summary of Ecological Values

The areas of ecological value are associated with the cushionfield, fellfield, tussock grassland, short tussock grassland, rocky outcrops, and rockfield communities, as well as individual species. The communities present range from relocated, regenerating and natural.



5 Ecological Significance and Value

5.1 Vegetation and Habitat Ecological Values

The assessment of the significance of the ecological values associated with the study area are based on the following:

- The QLDC District Plan Chapter 33 Criteria for assessing ecological significance.
- The Ecological Impact Assessment (EclA) EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems, 2nd edition (Roper-Lindsay *et al.*, 2018).
- New Zealand's Department of Conservation threatened flora and fauna series.

A separate significance and value assessment has been completed for each of the individual areas of proposed disturbance. These areas are the top lift station, Calypso trail, Cushion Trail, lower lift station, lift towers and the upper and lower access road. Within each of these areas, where possible the significance and value of each different community and habitat have been assessed. This method will allow the impact of the proposal for each of the areas to be determined in Section 6.



5.1.1 Top Lift Station

Table 1: Assessment of the vegetation with the Top Lift Station using the ecological criteria in the EIANZ Guidelines and the QLDC District Plan.

Top Lift Station						
Matter	Rockfield			Fellfield		
	Reasoning	EIANZ Score	QLDC Criteria	Reasoning	EIANZ Score	QLDC Criteria
Representativeness	Rockfield communities are typical of the alpine habitat within the ecological district, however the rockfield does not contain the typical assemblage of plants and is therefore not considered to be representative.	Low	No	Fellfield communities are typical of the alpine habitat, however these areas are very small and only scattered plants are present where soil has managed to accumulated downslope of larger boulders. The patches of fellfield within the top lift station footprint are not considered to be representative of high alpine fellfield.	Low	No
Rarity	The rockfield habitat is not considered to be a rare ecosystem and the study area does not contain any threatened or at-risk species. The study area is within a Land Environment where there is > 30% indigenous cover left and > 20% protected. Surrounding the lift station, but outside the study area is the At Risk – Naturally Uncommon <i>Aciphylla simplex</i> , which should be avoided.	Low	No	The fellfield patches are not considered to be a rare ecosystem and these patches do not contain any threatened or at-risk species. The study area is within a Land Environment where there is > 30% indigenous cover left and > 20% protected.	Low	No
Diversity and Pattern	The level of natural diversity within the rockfield is low and did not contain the typical species that are known to be found within the surrounding rockfield areas.	Low	No	The level of natural diversity within these patches is moderate as the common, typical species that are known to be found within fellfield areas are present.	Moderate	No
Distinctiveness	The rockfield within the top lift station area does not contain species at their distributional limit or has developed as a result of unique environmental factors.	Low	No	The fellfield patches within the station footprint do not contain species at their distributional limit or have developed as a result of unique environmental factors.	Low	No
Ecological Context	The rockfield within this area does not have important connectivity for dispersal or as a buffering function to adjacent areas.	Low	No	The fellfield patches within this area do not have important connectivity for dispersal or as a buffering function to adjacent areas due to their very small size.	Low	No
Overall EIANZ Ecological Value Score and QLDC Significance Criteria		Low	No		Low	No



5.1.2 Calypso Trail

Table 2: Assessment of the vegetation with the Calypso Trail using the ecological criteria in the EIANZ Guidelines and the QLDC District Plan.

Calypso Trail						
Matter	Rockfield			Mixed Fellfield and Cushionfield		
	Reasoning	EIANZ Score	QLDC Criteria	Reasoning	EIANZ Score	QLDC Criteria
Representativeness	Rockfield communities are typical of the alpine habitat within the ecological district, however the rockfield contains very few plants.	Low	No	The two areas of mixed fellfield and cushionfield are considered to be representative of this community in the high alpine environment. These areas have received little disturbance, indigenous species dominate, and the typical structure and composition of species found within this community are present.	High	Yes
Rarity	The rockfield habitat is not considered to be a rare ecosystem, however, the rockfield along this proposed trail does contain the occasional At Risk – Naturally Uncommon <i>Aciphylla simplex</i> . The study area is within a Land Environment where there is > 30% indigenous cover left and > 20% protected.	Low/Moderate*	No	Mixed fellfield and cushionfield communities are not considered to be a rare ecosystem, and these areas do not contain any threatened or at risk species. This community is within a Land Environment where there is > 30% indigenous cover left and > 20% protected.	Low	No
Diversity and Pattern	The level of natural diversity within the rockfield is low.	Low	No	The level of natural diversity within this community is high as all species expected to be present were found. The patterns and distribution of species within this area are typical of the soil structure present.	High	Yes
Distinctiveness	The rockfield within the trail area does not contain species at their distributional limit or has developed as a result of unique environmental factors.	Low	No	This community does not contain species at their distributional limit or has developed as a result of unique environmental factors.	Low	No
Ecological Context	The rockfield within this area does not have important connectivity for dispersal or as a buffering function to adjacent areas.	Low	No	These large areas of mixed fellfield and cushionfield will act as a seed source for this community to the wider shadow basin area, in particular the modified ski trails and terrain downslope.	Moderate	Yes
Overall EIANZ Ecological Value Score and QLDC Significance Criteria		Low	No		High	Yes

* Moderate for the areas containing *Aciphylla simplex*, Low for the remainder of the rockfield area.



5.1.3 Cushion Trail

Table 3: Assessment of the vegetation with the Cushion Trail using the ecological criteria in the EIANZ Guidelines and the QLDC District Plan.

Cushion Trail						
Matter	Rockfield			Cushionfield		
	Reasoning	EIANZ Score	QLDC Criteria	Reasoning	EIANZ Score	QLDC Criteria
Representativeness	Rockfield communities are typical of the alpine habitat within the ecological district, however the rockfield along the Cushion Trail contained very few plants.	Low	No	The areas of cushionfield along the Cushion Trail are considered to be representative of this community in the alpine environment. These areas of cushionfield have received little disturbance, indigenous species dominate, and the typical structure and composition of species found within this community are present.	High	Yes
Rarity	The rockfield habitat is not considered to be a rare ecosystem and the Cushion Trail rockfield does not contain any threatened or at-risk species. The study area is within a Land Environment where there is > 30% indigenous cover left and > 20% protected.	Low	No	Cushionfield communities are not considered to be an uncommon ecosystem, and this area is found within a Land Environment where there is > 30% indigenous cover left and > 20% protected. However, these areas do contain the At Risk – Naturally Uncommon <i>Anisotome lanuginosa</i> .	Moderate	Yes
Diversity and Pattern	The level of natural diversity within the rockfield is low and did not contain the typical species that are known to be found within the surrounding rockfield areas.	Low	No	The level of natural diversity within this community is high as all species expected to be present were found. The complex patterns and distribution of species within this area are typical of the soil structure present.	High	Yes
Distinctiveness	The rockfield within the trail area does not contain species at their distributional limit or has developed as a result of unique environmental factors.	Low	No	These areas of cushionfield do not contain species at their distributional limit or have developed as a result of unique environmental factors.	Low	No
Ecological Context	The rockfield within this area does not have important connectivity for dispersal or as a buffering function to adjacent areas.	Low	No	The areas of cushionfield along the Cushion Trail, although they are sections of the fingers which extend downslope, are still part of the wider area of cushionfield community which runs along the ridge crest.	High	Yes
Overall EIANZ Ecological Value Score and QLDC Significance Criteria		Low	No		High	Yes



5.1.4 Lower Lift Station

Table 4: Assessment of the vegetation with the Lower Lift Station using the ecological criteria in the EIANZ Guidelines and the QLDC District Plan.

Lower Lift Station#						
Matter	Tall Tussock Grassland			Modified Terrain		
	Reasoning	EIANZ Score	QLDC Criteria	Reasoning	EIANZ Score	QLDC Criteria
Representativeness	The area of tussock grassland on the slope above the lift station is only partially representative of the tall tussock grassland within the wider area. The expected species are present, however exotic species are beginning to dominate underneath and between the tussocks.	Moderate	No	The remainder of the terrestrial area within the lower lift station contains highly modified communities. These areas vary from bare ground, a mixture of exotic herbaceous weed and grass species with scattered regenerating natives, or relocated tussock grassland that has a large number of exotic species. The communities are not considered to be representative.	Low	No
Rarity	The tall tussock grassland habitat is not considered to be an uncommon ecosystem and this area does not contain any threatened or at-risk species. The study area is within a Land Environment where there is > 30% indigenous cover left and > 20% protected.	Low	No	On the edge of the overland flow path below the rock retaining wall, one patch of the At Risk – Declining <i>Carex talbotii</i> is present. The remainder of the areas do not contain any threatened or at-risk species.	High*/Low	No
Diversity and Pattern	The level of natural diversity within the tussock grassland community is moderate, however exotic species are present.	Moderate	No	The areas of modified terrain consist of a wide range of exotic species, however native species are present and regenerating.	Low	No
Distinctiveness	The tussock grassland within the lower lift station area does not contain species at their distributional limit or has developed as a result of unique environmental factors.	Low	No	The communities within the lower lift station area do not contain species at their distributional limit and have developed as a result of terrain modification.	Low	No
Ecological Context	This area of tall tussock grassland although becoming dominated by exotic species is acting as the buffer to the area of the indigenous vegetation upslope.	Moderate	No	The modified areas do not have import connectivity, lifecycle or buffering functions. This area is a source of weeds species which are spreading into surrounding areas.	Low	No
Overall EIANZ Ecological Value Score and QLDC Significance Criteria		Moderate	No		Low	No

Note that the 1 m each side of the stream is assessed in the freshwater assessment as riparian margin.

* High for the *Carex talbotii*, Low for the remainder of the area.



5.1.5 Doppelmayr Lift Towers

Table 5: Assessment of the vegetation with the Doppelmayr Lift Towers using the ecological criteria in the EIANZ Guidelines and the QLDC District Plan.

Doppelmayr Lift Towers						
Matter	Rockfield			Tall Tussock Grassland and Herbfield		
	Reasoning	EIANZ Score	QLDC Criteria	Reasoning	EIANZ Score	QLDC Criteria
Representativeness	The rockfield communities located where lift towers are proposed are typical of the alpine habitat within the ecological district. Only scattered plants are present in these locations.	Low	No	The tall tussock grassland and herbs within the lift tower locations is considered to be representative of the tussock communities that have formed over the ecological district. The typical species structure and composition are present and indigenous species dominate.	High	Yes
Rarity	The rockfield habitat is not considered to be an uncommon ecosystem and the areas of rockfield where towers are proposed do not contain any threatened or at-risk species.	Low	No	The tall tussock grassland habitat is not considered to be an uncommon ecosystem and no threatened or at-risk species are present within the proposed footprints of the towers.	Low	No
Diversity and Pattern	The level of natural diversity within the rockfield tower locations is very low, with some areas not containing any plants.	Low	No	The level of natural diversity within the tussock grassland areas is moderate, with the typical, common species present.	Moderate	No
Distinctiveness	The rockfield within the tower footprints does not contain species at their distributional limit or has developed as a result of unique environmental factors.	Low	No	The tall tussock grassland and herbfield within the tower footprints does not contain species at their distributional limit or has developed as a result of unique environmental factors.	Low	No
Ecological Context	The rockfield within this area does not have important connectivity for dispersal or as a buffering function to adjacent areas.	Low	No	The areas of tall tussock grassland are part of large continuous areas of these communities within the wider shadow basin area. Although the proposed footprint is small, these areas are generally well buffered by surrounding indigenous vegetation.	High	Yes
Overall EIANZ Ecological Value Score and QLDC Significance Criteria		Low	No		High	Yes









5.1.7 Access Road

Table 7: Assessment of the vegetation with the Lower and Upper Access Road using the ecological criteria in the EIANZ Guidelines and the QLDC District Plan.

Lower and Upper Access Road (1 of 3)						
Matter	Rockfield (Lower and Upper Access Road)			Mixed Tall Tussock Grassland and Herbfield (Lower Access Road)		
	Reasoning	EIANZ Score	QLDC Criteria	Reasoning	EIANZ Score	QLDC Criteria
Representativeness	Rockfield communities are typical of the alpine habitat within the ecological district, however the rockfield along the access road contains only scattered plants.	Low	No	The tall tussock grassland and herbs within the lower access road is considered to be representative of the tussock communities that have formed over the ecological district. The typical species structure and composition are present and indigenous species dominate.	High	Yes
Rarity	The rockfield habitat is not considered to be a rare ecosystem, however, the rockfield along this proposed access road does contain At Risk – Naturally Uncommon <i>Aciphylla simplex</i> , especially the upper area. The study area is within a Land Environment where there is > 30% indigenous cover left and > 20% protected.	Low/Moderate*	No	The tall tussock grassland habitat is not considered to be an uncommon ecosystem and no threatened or at-risk species are present, however Data Deficient – <i>Brachyscome montana</i> plants are present.	Moderate	No
Diversity and Pattern	The level of natural diversity within the rockfield is low.	Low	No	The level of natural diversity within the tussock grassland areas is moderate, with a wide range of the typical species that are associated with these communities present.	Moderate	Yes
Distinctiveness	The rockfield within the access road does not contain species at their distributional limit or has developed as a result of unique environmental factors.	Low	No	The tall tussock grassland and herbfield within the lower access road does not contain species at their distributional limit or has developed as a result of unique environmental factors.	Low	No
Ecological Context	The rockfield within this area does not have important connectivity for dispersal or as a buffering function to adjacent areas.	Low	No	The areas of tall tussock grassland, particularly on the eastern end of the lower access road are part of large continuous areas of these communities within the wider shadow basin area.	High	Yes
Overall EIANZ Ecological Value Score and QLDC Significance Criteria		Low	No		High	Yes

* Moderate for the areas containing *Aciphylla simplex*, Low for the remainder of the rockfield area.



Upper and Lower Access Road (2 of 3)						
Matter	Relocated Tall Tussock Grassland (Upper Access Road)			Fellfield (Upper Access Road)		
	Reasoning	EIANZ Score	QLDC Criteria	Reasoning	EIANZ Score	QLDC Criteria
Representativeness	The area of relocated tall tussock grassland within the upper access road has successfully been repositioned, with understorey herb species now regenerating. However, this area is not yet considered to be representative of a typical tall tussock grassland community.	Moderate	No	The two areas of fellfield are considered to be representative of this community in the high alpine environment. These areas have received little disturbance, indigenous species dominate, and the typical structure and composition of species found within this community are present.	High	Yes
Rarity	The tall tussock grassland habitat is not considered to be an uncommon ecosystem and no threatened or at-risk species are present.	Low	No	Fellfield communities are not considered to be a rare ecosystem, however these areas of fellfield contain the At Risk – Naturally Uncommon <i>Aciphylla simplex</i> .	Moderate	Yes
Diversity and Pattern	The level of natural diversity within the tussock grassland areas is low, due to herb species likely being lost during relocation. However, the typical species that are associated with tall tussock grassland are starting to regenerate between the tussocks.	Low - Moderate	No	The level of natural diversity within this community is moderate to high as species expected to be present were found. The patterns and distribution of species within this area are typical of the soil structure present.	Moderate	Yes
Distinctiveness	The tall tussock grassland within this area does not contain species at their distributional limit or has developed as a result of unique environmental factors.	Low	No	This community does not contain species at their distributional limit or has developed as a result of unique environmental factors.	Low	No
Ecological Context	This area of tall tussock grassland is one of the higher elevation tussock grasslands in Shadow basin. This area will act as a seed source for the surrounding and downslope area, however, is small in size. This area is also currently free of exotic weed species.	Moderate	Yes	These areas of fellfield, although relatively small in size will act as a seed source for this community to the wider shadow basin area, in particular the modified ski trails and terrain downslope.	Moderate	Yes
Overall EIANZ Ecological Value Score and QLDC Significance Criteria		Moderate	Yes		Moderate	Yes

* Moderate for the areas containing *Aciphylla simplex*, Low for the remainder of the rockfield area.



Upper and Lower Access Road (3 of 3)				
Matter	Modified Terrain (Lower and Upper Access Road)			
	Reasoning	EIANZ Score	QLDC Criteria	
Representativeness	Parts of the proposed access road follows areas of already modified terrain in the form of an existing road or ski trails. These areas are modified, however in patches there are regenerating early colonising species. The remainder of the area is bare, crushed rock. The communities are not yet considered to be representative.	Low	No	
Rarity	The majority of the modified access road does not contain any threatened or at-risk species. However, near the top of the access road, small At Risk – Naturally Uncommon <i>Aciphylla simplex</i> plants are regenerating within the coarser rocks.	Low/Moderate*	No	
Diversity and Pattern	The areas of modified terrain consist of a range of native species, however, the diversity of these species is typically low.	Low	No	
Distinctiveness	The communities within the access road areas do not contain species at their distributional limit and have developed as a result of terrain modification.	Low	No	
Ecological Context	The modified areas do not have import connectivity, lifecycle or buffering functions.	Low	No	
Overall EIANZ Ecological Value Score and QLDC Significance Criteria		Low	No	

* Moderate for the areas containing *Aciphylla simplex*, Low for the remainder of the modified area.



Table 8: Ecological value and significance summary.

Area	Community Type	Overall EIANZ Ecological Value Score	Significant under the QLDC District Plan
Top Lift Station	Rockfield	Low	No
	Fellfield	Low	No
Calypso Trail	Rockfield	Low	No
	Fellfield / Cushionfield	High	Yes
Cushion Trail	Rockfield	Low	No
	Cushionfield	High	Yes
Lower Lift Station	Tall Tussock Grassland	Moderate	No
	Modified Terrain	Low	No
Doppelmayr Lift Towers	Rockfield	Low	No
	Tall Tussock Grassland and Herbfield	High	Yes

Access Road	Rockfield	Low	No
	Tall Tussock Grassland and Herbfield	High	Yes
	Modified Tall Tussock Grassland	Moderate	Yes



	Fellfield	Moderate	Yes
	Modified Terrain	Low	No

5.2 Avifauna Ecological Values

The range of vegetation communities and habitats found within the study areas provide suitable feeding, foraging, and breeding habitat for the NZ Pipit, kea, and eastern falcon. The unmodified areas provided higher value than the modified areas. The assigned ecological value under the EIANZ (Roper-Lindsay *et al.*, 2018) guidelines for species that are At Risk – Declining (NZ Pipit) is High, Threatened – Nationally Vulnerable (falcon) is Very High, and Threatened – Nationally Endangered (kea) is Very High (Robertson *et al.*, 2021).

5.3 Summary of Ecological Significance and Values

The vegetation and habitat within the study area has been assessed using the criteria outlined in the 2018 EIANZ Guidelines and the significance criteria in the Queenstown Lakes District Plan. The ecological value and significance for the range of study areas and communities present has been summarised in Table 8. The habitat and vegetation within the site are likely to be utilised by the NZ Pipit which has high ecological value, and kea and eastern falcon which have Very High ecological value.



6 Ecological Impact Assessment

6.1 Ecological Impact Assessment Methodology

The ecological impact assessment follows the EIANZ Guidelines. The guidelines are based on the assessment of the ecological values present within the study area (see Section 5) and the magnitude of the effect within the affected area, individual species populations and the extent of remaining vegetation and habitat. The spatial scale and extent that this impact assessment has used in the Rastus Burn Catchment. The magnitude of effect of the proposal has been considered at this scale.

6.2 Vegetation Clearance

The proposed development of the Shadow Basin lift, trails and access road will result in the disturbance of indigenous vegetation. These include areas of natural rockfield, and natural, regenerating or relocated vegetation. The total area of disturbance over all of the surveyed areas will be approximately 42,442 m² (an additional 4,257 m² of the access road has not been surveyed, and the access paths to the towers have not yet been finalised). Within this total area of disturbance of 42,442 m², approximately 28,322 m² is unmodified areas which includes rockfield and natural vegetation, and 14,120 m² is modified, which includes disturbed areas and relocated vegetation.

Top Lift Station

The predominant habitat within the top lift station footprint is natural rockfield which contains very small (1 to 2 m²) areas of fellfield. The magnitude of the effect of disturbing the rockfield areas is Moderate as there will be a partial shift in the baseline conditions as part of the rockfield will be lost to buildings and the composition and size of the rocks for the remainder of the surface area will be smaller. The level of effect on the rockfield is assessed as being Low (a Low ecological value and a Moderate magnitude of effect). The magnitude of the effect of disturbing the fellfield areas is Low as these areas are small and scattered in nature, therefore there will only be a minor shift away from baseline conditions. The level of effect on the fellfield is assessed as being Very Low (a Low ecological



value and a Low magnitude of effect). The fellfield vegetation is proposed to be removed and relocated back onto the finished surface.

Calypso Trail

The main habitat within the Calypso Trail footprint is natural rockfield. The magnitude of the effect of disturbing the rockfield areas is Moderate as there will be a partial change in the baseline conditions of the rockfield as the size of the rocks will be reduced to enable a trail to be formed. The level of effect on the rockfield is assessed as being Low (a Low ecological value and a Moderate magnitude of effect). This view assumes that the *Aciphylla simplex* plants will be relocated prior to disturbing the rockfield.

The magnitude of the effect of disturbing the mixed fellfield and cushionfield areas is Moderate. These areas will be relocated to the batters adjacent to the existing areas to ensure the connectivity and size of the areas is not reduced. However, the success of relocating cushion and fellfield vegetation is still in the trial phase, therefore it is unclear whether this mitigation will reduce the level of impact. Based on our view that the mitigation is experimental the level of effect on the cushionfield and fellfield is assessed as being High (a High ecological value and a Moderate magnitude of effect). The fellfield and cushionfield vegetation will be relocated, however due to the shallow soils and rocky terrain a suitable methodology will need to be determined.

Cushion Trail

The Cushion Trail has an approximate equal mix of rockfield and cushionfield. Both habitats are natural and have received little modification. The rockfield is present at the beginning of the proposed trail and then present between the fingers of cushionfield. The areas of rockfield between the three main cushionfield areas do contain small patches of cushionfield. The level of effect on the rockfield is assessed as being Low (a Low ecological value and a Moderate magnitude of effect). This is due to there being a partial change in the baseline conditions of the rockfield as the size of the rocks will be reduced to enable a trail to be formed.

The magnitude of the effect of disturbing the mixed cushionfield areas is High. Similarly, to the Calypso Trail these areas will be relocated to the batters adjacent to the existing areas, however on the Cushion Trail there will be fragmentation of these areas as the trail cuts through the fingers and no plants are proposed on the surface of the trail. The plants located within these three areas are well



integrated within the rocky terrain that they are present on, which may make the proposed relocation of the vegetation challenging as it will be difficult to pick the vegetation up due to the complex, uneven and rocky surface. Given the uncertain and experimental nature of relocating the cushionfield, the assessed level of effect on the cushionfield to be High (a High ecological value and a High magnitude of effect).

Lower Lift Station

The lower lift station is proposed within almost the same footprint as the existing lift. The terrace that has been previously built for the existing station is predominantly modified terrain with a small area of tussock grassland. The magnitude of the effect of disturbing the already modified areas is Low as these areas are already highly modified. The level of effect on these communities is assessed as being Very Low (a Low ecological value and a Low magnitude of effect). However, the *Carex talbotii* plant will need to be relocated prior to disturbance occurring.

A small area of tussock grassland is present on the slope above the terrace. This tussock area will be relocated back onto the contoured slope in the same location. NZ Ski have a methodology that works well for relocating tussock grassland, therefore the level of effect of relocating this small area is assessed as being Low (a Moderate ecological value and a Low magnitude of effect).

Doppelmayr Lift Towers

The Doppelmayr lift tower platforms are proposed in both rockfield, and mixed tall tussock grassland. The footprint of each lift tower is small at approximately 9 m². The magnitude of the effect of disturbing the rockfield areas is Low as there will be a minor shift in the baseline conditions, even though the rockfield at the tower locations will be permanently removed. The level of effect on the rockfield is assessed as being Very Low (a Low ecological value and a Low magnitude of effect).

Lift tower platforms are also proposed within tall tussock grassland. The magnitude of the effect of disturbing these areas is Low as the tall tussock grassland can be relocated to a suitable habitat nearby. The removal of 9 m² patches within the tussock grassland will only result in a minor shift away from baseline conditions. The level of effect is therefore assessed as being Low (a High ecological value and a Low magnitude of effect).





Access Road

The dominant habitat within the access road is natural rockfield. The magnitude of the effect of disturbing the rockfield areas is Moderate as there will be a partial change in the baseline conditions of the rockfield as the size of the rocks will be substantially reduced to enable a road to be formed. The level of effect on the rockfield is assessed as being Low (a Low ecological value and a Moderate magnitude of effect). This view assumes that any *Aciphylla simplex* plants will be relocated prior to disturbing the rockfield.

The magnitude of the effect of disturbing the unmodified tall tussock grassland areas in the lower section of the access road, and the already relocated tall tussock grassland in the upper access road area is Low as these plants can be relocated onto the contoured batter slopes. The level of effect on the tall tussock grassland communities is assessed as being Low (a High / Moderate ecological value and a Low magnitude of effect). However, the magnitude of effect of disturbing and relocating the patches of herbfield in between the tussocks, is Moderate as there is likely to be loss of species from within these communities. The level of effect on the herbfield is therefore assessed as High (a High ecological value and a Moderate magnitude of effect).

The magnitude of the effect of disturbing and relocating the fellfield areas is Moderate, as there is likely to be loss of species from within these communities, resulting in the partial change of the composition of the community. These communities will be relocated to the batters along the access road. However, the success of relocating fellfield vegetation is still in the trial phase, therefore it is unclear whether this mitigation will reduce the level of impact. Based on our view that the mitigation is experimental the level of effect on the fellfield is assessed as being Moderate (a Moderate ecological value and a Moderate magnitude of effect).

Part of the access road are proposed along the existing access road and ski trail. The magnitude of disturbing the regenerating vegetation in these already modified areas is Low. As there is currently only sparse vegetation present along these areas, the change will not be discernible. The level of effect on these communities is assessed as being Very Low (a Low ecological value and a Low magnitude of effect). However, the *Aciphylla simplex* plants will need to be relocated prior to disturbance occurring.



6.3 Habitat Loss

The removal of the vegetation, rockfield and rocky outcrops will result in permanent habitat loss for bird species that utilise the alpine environment. The kea, falcon and NZ pipit have a Very High, Very High, and High ecological value, respectively, however there is abundant habitat that these species can use within the Remarkables area. The removal of the habitat will therefore have a Low magnitude of effect, as there will only be a minor shift away from the base line conditions, in relation to habitat that these birds utilise. The ecological effect on the permanent removal of habitat is therefore Moderate for the kea and falcon, and Low for the NZ pipit.

6.4 Weed Introduction

A potential ecological effect of the proposed development work is the introduction and spread of exotic weed species. At present, the unmodified areas within the proposed study area are relatively weed free, compared to the modified areas and areas of relocated vegetation. The level of effect of weed spread, without management measures is Very High, as the introduction and spread of exotic weed species will result in competition with the indigenous vegetation, resulting in a fundamental change in the composition of the vegetation within these areas.

This effect can be managed by ensuring that any machinery or equipment that is used during the proposed works is free of soil that could contain seeds or plants that could contaminate the area. No soil is to be moved upslope and no areas of already relocated tussock grassland are to be mixed with areas of unmodified vegetation.

6.5 Fragmentation and Weed Corridors

The proposed works will result in the fragmentation of vegetation communities, in particular cushionfield along the Cushion Trail, and tussock grassland along the access road. The fragmentation of vegetation and creation of new surfaces, using material such as fine gravels, and open edges along the vegetation areas will allow for exotic weed species to migrate to places where they likely otherwise would not. The migration of weeds along these trails is likely to be aided by the increase in use of these areas. The level of effect of this, without management



measures is Very High as the introduction of exotic species will fundamentally change the composition and character of the communities.

A weed management plan for the edges of all relocated vegetation is to be prepared to ensure that as weeds establish, they are removed annually to prevent further spread into the vegetation.

6.6 Sedimentation

Sedimentation from the vegetation removal and earthworks could result in the mobilisation of sediment onto neighbouring vegetation habitats, regionally significant wetlands and watercourses. This effect is most prevalent during and immediately following the earthworks phase. The potential level of effect of the sedimentation on the wetlands and neighbouring vegetation without management is Very High (Very High ecological value and Moderate magnitude of effect). Sedimentation into these habitats creates areas where exotic species can easily colonise without competition. A specific sediment and erosion control management plan to mitigate the risk of runoff into wetlands, watercourses, and onto neighbouring vegetation is to be implemented. This management plan is to include a drainage plan, which will ensure that as the topography is altered, long term sediment runoff is also managed.

6.7 Cumulative Effects

Within the Remarkables Ski field area there has been progressive modification and fragmentation of natural alpine areas. While the majority of the works proposed are within the Shadow Basin, which has not received as much development and modification as other areas within the ski field, this proposal adds to the previous and ongoing disturbance.

6.8 Recommended Management Measures

The removal of indigenous vegetation, alongside adherence to the management measures recommended below will help to control the effects from the proposal. However, not all effects will be able to be fully mitigated upfront due to the uncertain nature of the relocation of these communities.



1. The tall tussock grassland vegetation (regenerating, relocated and natural) is to be uplifted, stored upright and reinstated onto the newly contoured terrain, as soon as possible after the earthworks are complete. Modified tussock grassland that has a high number of exotic species should not be mixed with currently unmodified, weed free tussock grassland.
2. Relocated rockfield is to mimic the terrain and habitat that it was taken from. Rocks are not to be crushed or made smaller.
3. The methodology for relocating vegetation within the cushionfield, fellfield, herbfield, short tussock grassland and from rocky outcrop communities is to be developed and approved by a suitably qualified ecologist and the Department of Conservation prior to any works commencing within these areas.
4. The relocated and reinstated areas of native plants is to be independently monitored for at least five years, to determine successful reinstatement and growth of all communities. Methodologies may include photo monitoring points, survival rate counts, transects or quadrats. Further mitigation measures are to be implemented if the cover and survival achieved is not sufficient to achieve a no net loss. Reporting is to be provided annually to the Department of Conservation.
5. All *Aciphylla simplex*, *Anisotome lanuginosa* and *Carex talbotii* are to be identified and relocated prior to works commencing.
6. No disturbance to vegetation or terrain outside the surveyed areas within this report is to occur.
7. The areas of access road not surveyed (as shown in Figure 6) are to be surveyed to identify the communities and habitat present, as well as determine the impacts of the proposed works and any mitigation required.
8. The access routes to each lift tower platform are to be determined and surveyed.
9. Depending on the timing of works, all areas are to be surveyed by a suitably qualified ecologist or ornithologist for nesting pipit, falcon or kea. Any recommendations from this survey are to be implemented.
10. To minimise the potential for the spread of exotic weeds, no soil from outside the study area is to be brought onto the site, and no soil is to be moved upslope, particularly from the Lower Lift Station.
11. Prior to any machinery or equipment entering the study area it must be cleaned and checked for soil that could potentially contain seeds or exotic



plants that could further contaminate the site. This is particularly important when working in the upper Shadow Basin area where weeds are not yet as prevalent.

12. A weed management plan for the edges of all relocated vegetation, trails, roads and tracks is to be prepared to ensure that as weeds establish, they are removed annually to prevent further spread into the vegetation. Reporting on the spread and removal of weeds is to be provided annually to the Department of Conservation.
13. The trail surface within the Cushion Trail and Calypso Trail is to be finished with large coarse rock rather than fine gravels.
14. All earthworks are to be managed to mitigate the risk of runoff and sedimentation into adjacent watercourses, wetlands and vegetation. A specific sediment and erosion control management plan to mitigate the risk of runoff into wetlands, watercourses, and onto neighbouring vegetation is to be prepared and approved prior to works commencing. This management plan is to include a drainage plan, which will ensure that as the topography is altered, long term sediment runoff is also managed.
15. No disturbance to any regionally significant wetlands is to occur. No alteration to the existing flow path, flow direction and the hydrological connection of any wetland is to occur.

6.9 Summary

The ecological values present within and surrounding the study area means that consent conditions are required to manage the effects of removing the vegetation and undertaking the proposed works. The uncertain nature of relocating vegetation within the cushionfield, fellfield, herbfield, short tussock grassland and from rocky outcrop communities means that not all effects can be mitigated upfront. A suitable methodology would need to be developed, implemented and monitored before the impacts could be determined. Retrospective measures would have to be applied if the cover and survival achieved is not sufficient to achieve a no net loss within these communities.



7 Conclusion

Based on the ecological assessment the following conclusions are made:

1. NZSki is currently seeking consent to undertake earthworks and clear native vegetation for ski field expansion within Shadow Basin, install a new lift line [REDACTED]
2. The total area of disturbance over all of the surveyed areas is approximately 42,442 m². An additional 4,257 m² of the access road has not been surveyed, and the access paths to the towers have not yet been confirmed and surveyed.
3. Within this total area of disturbance approximately 28,322 m² is unmodified and includes rockfield and natural vegetation. Approximately 14,120 m² is modified, which includes disturbed areas and relocated vegetation.
4. Communities present included cushionfield, fellfield, tussock grassland, short tussock grassland, herbfield, rocky outcrops, and rockfield.
5. No Threatened plants are present within the study area, however At Risk, Data Deficient and uncommon plants are present.
6. Habitat for kea, falcon and the NZ pipit is present within the study area.
7. The vegetation and habitat within the study area has been assessed using the criteria outlined in the 2018 EIANZ Guidelines and the significance criteria in the Queenstown Lakes District Plan.
8. The ecological value and significance for the range of study areas and communities present has been summarised in Table 8 and varies from Low to High.
9. The proposed development will result in a range of level of effects from Low to Very High, depending on the level of mitigation implemented.
10. Cumulative effects are likely to result from this proposal as there will be further modification and fragmentation of natural alpine areas.



8 References

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