PATH

Vegetation assessment & general comments on terrestrial environmental impacts

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Background

PATH is based on a close engagement experience with the natural environment through offering environmentally sustainable accommodation in the Eglinton Valley, in a way that minimises impacts on the existing ecology. This report provides an overview of the vegetation of the site and discusses an approach to developing the facility that minimises impacts on this vegetation. I also comment briefly on some of the fauna likely to be present. PATH can be viewed as an exemplar for sustainable development within a national park. The focus is on a small high-quality development, accommodating 40 guests, with minimal environmental impact both in construction and in operation. This philosophy has guided the preparation of this report.

The proposed development is located in the Eglinton Valley between Knobs Flat and Eglinton Flat (Figure 1). The site is on the north side of a low gently undulating ridge between the Eglinton River and the Te Anau-Milford road. This ridge is the remains of a moraine formed as a glacier retreated from the Eglinton Valley at the end of the last glacial period. Similar moraine landforms are present on Knobs Flat to the south of the site.

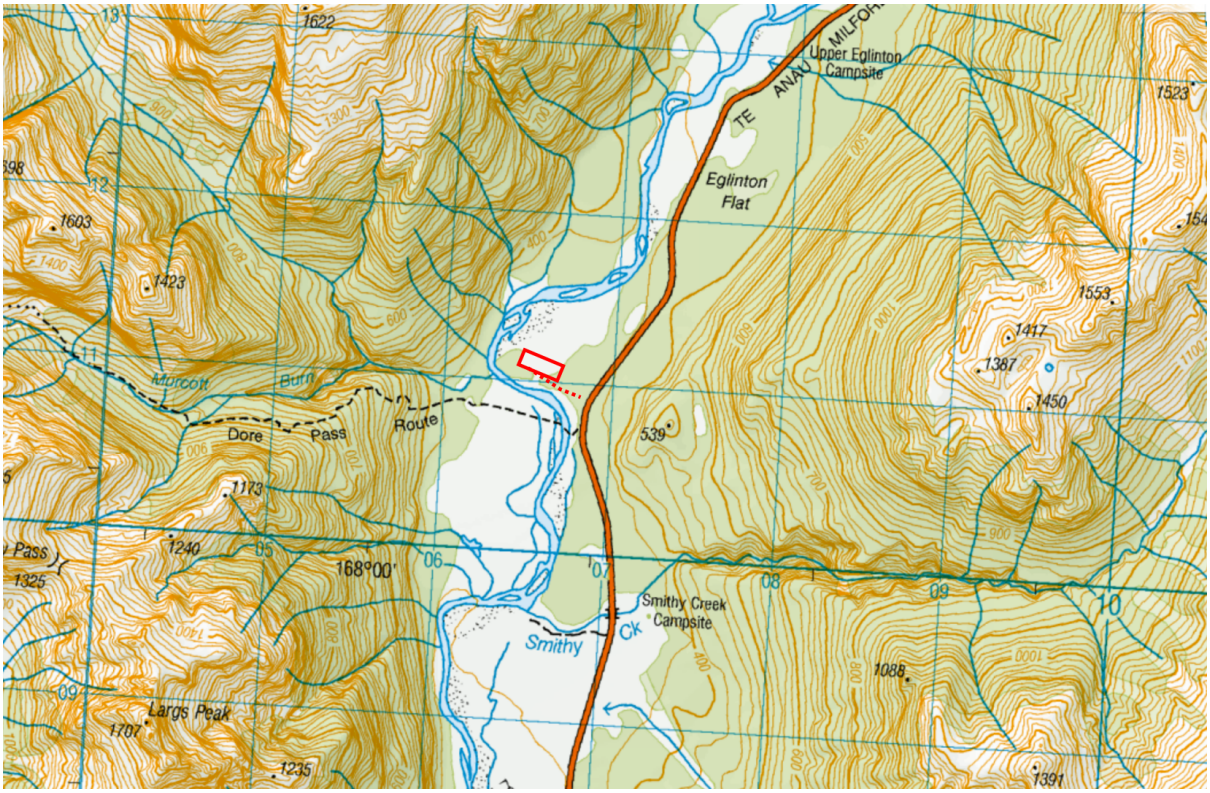

Figure 1. *Location of proposed PATH development (red square) and access track (dotted red line). Eglinton Valley.*

The development comprises a number of elements (Figure 2) including an access track, accommodation pods, lodge, staff facilities and service structures (water reservoir, header tank and shed). The approximate location of these is indicated on the attached plan, but the final location has not been confirmed (see discussion later in this report). These elements are used as the basis for the vegetation description below. In addition to the elements described here, it is also proposed to develop a short loop nature trail which will traverse forest between the development and the Eglinton River.

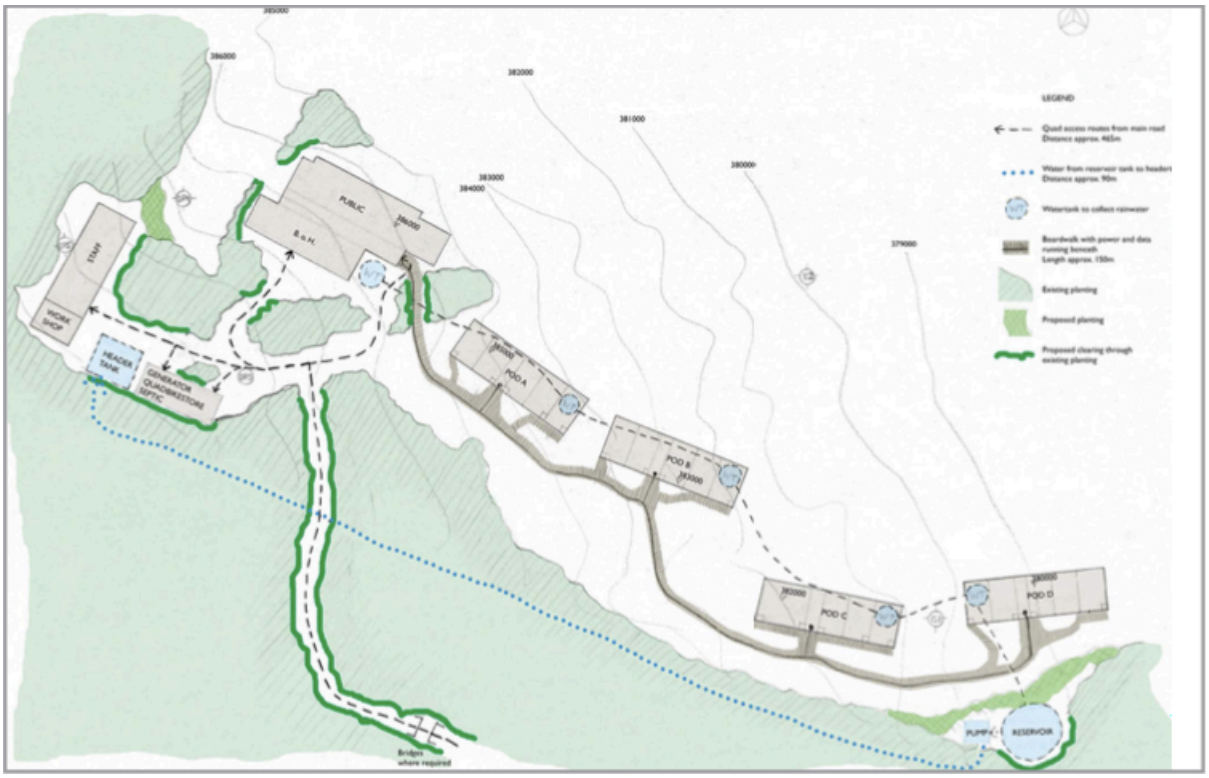

Figure 2. *Site contour plan showing location of different elements of the project.*

Vegetation assessment

This assessment was based on a visit to the site in July 2017. While the weather was fine, it was very frosty and because it was mid-winter, it was not possible to identify some plants, especially in the grassland/herb field communities. Notwithstanding this, I am confident that I have been able to provide a good summary of the vegetation at the site and the options for minimising environmental impacts associated with developing the project. Exotic plant species are indicated with an asterisk the first time they are mentioned.

The main elements of the proposed development (accommodation pods, lodge, staff facilities, service structures) are largely located in open areas away from the forest, with only the proposed water reservoir located fully under the forest canopy. The access track and nature trail will, however, traverse through forest. Some services (e.g. the water pipe from the reservoir to the header tank) will also be located within the forest.

Accommodation pods: These comprise four separate pods located in an open area slightly downslope from the forest edge (Figure 3). The individual pods will be accessed by a path located behind them. The site comprises a mossy herbfield grading downslope into a grassland dominated by exotic grass species. The mossy herbfield is dominated by woolly moss (*Racomitrium* species) and lichens (e.g. *Cladia* species). Vascular plant species are a minor component and include *Gonocarpus micranthus*, patotara (*Leucopogon fraseri*), creeping clubmoss (*Lycopodium scariosum*), alpine clubmoss (*Lycopodium fastigiatum*) and sparse sweet vernal grass (*Anthoxanthum odoratum**). The grassland is dominated by a dense sward of browntop (*Agrostis capillaris**) and sweet vernal grass, but blue tussock was also occasionally present. Other species seen include a species of hookgrass (possibly *Carex penalpina*) and little hard fern (*Blechnum penna-marina*). No shrubs were present. The

mossy herbfield has a very high richness of native species while the grassland is dominated by exotic species, mainly grasses.

Figure 3. *Location of proposed accommodation pods with mossy herbfield grading into grassland dominated by exotic grasses.*

Common area: This is proposed to be located in a clearing surrounded by shrubland. The woody vegetation around the margin of the clearing is a mixed species shrubland 2-3 m tall with 4-5 m tall thin-barked tōtara (*Podocarpus laetus*) emerging above this (Figure 4). The shrubland includes weeping matipo (*Myrsine divaricata*), snow tōtara (*Podocarpus nivalis*), *Coprosma dumosa*, mountain toatoa (*Phyllocladus alpinus*) and inaka (*Dracophyllum longifolium*), with bush lawyer (*Rubus schmidelioides*) scrambling through. One silver beech (*Lophozonia menziesii*) was present and the understorey was bare, except for sparse little hard fern.

The clearing itself is quite diverse with a substantial cover of bracken fern (*Pteridium esculentum*). The ground layer is a mix of grasses (including sweet vernal, browntop, blue tussock), subshrubs (pinatoro [*Pimelea prostrata*], patotara, creeping pohuehue [*Muehlenbeckia axillaris*]), herbs (grassland buttercup, [*Ranunculus* species], harebell [*Wahlenbergia albomarginata*]), and mosses and lichens (with *Racomitrium* and *Cladia* species dominant). There are likely to be more species present, native and exotic, but it was difficult to identify them because of time of the year.

Establishment of the common area will require some vegetation clearance as the footprint is larger than the size of the clearing. This is discussed further at the end of this report.

Figure 4. *Location of proposed common area which will be largely located within the clearing but will involve some clearance of the margin woody vegetation.*

Figure 5. *Clearing where it is proposed to locate staff quarters.*

Staff quarters: These are to be located in a clearing west of the common area. The vegetation is lichen and moss dominated with sparse bracken (Figure 5). The marginal silver beech trees are small and some will need to be removed during construction.

Service structures and access tracks between elements: Service structures will be located in clearings, although the proposed water reservoir will be located under the forest canopy behind and below the accommodation pods. Tracks will be required to link the different elements and while their locations are indicated in Figure 2, it should be possible to minimise clearance of woody vegetation by following natural gaps and openings.

Nature trail: The route of the proposed loop nature trail (200-300 m long) runs through mature red beech (*Fuscospora fusca*) forest with spare silver beech (Figure 6), and is similar to that traversed by other valley-floor walking tracks in the Eglinton Valley. The understory is very open with mountain toatoa and occasional thin barked tōtara and *Raukaua simplex.* The forest appears to have been heavily impacted by deer based on browse damage and an absence of regeneration of palatable species. Both scarlet mistletoe (*Peraxilla colensoi*) and red mistletoe (*Peraxilla tetrapetala*) are present, especially on host trees near the forest edge.

Figure 6. *Mature red beech forest with an open understorey where the nature trail is proposed to traverse.*

Access track: The final element of the development is the track that will provide access back to the Te Anau-Milford road. This track will traverse through gently undulating red beech-silver beech forest (Figure 7) that is typical of valley floor forests through the Eglinton Valley. These forests have a more diverse understorey than those where the nature trial is proposed and include several small tree and shrub species (*Coprosma* species, lancewood [*Pseudopanax crassifolius*], mountain toatoa etc), with various ferns and herbs present on the forest floor. Crown fern (*Blechnum discolor*), prickly shield fern (*Polystichum vestitum*) and bush lily (*Astelia fragrans*) are conspicuous as forest floor plants, together with a rich ground bryophyte flora. The route will need to cross two incised channels (up to 2 m below the

general surface level) which support a rich fern flora on their banks. It is proposed that these will be bridged. There are also occasional thickets of red beech regeneration. Both red and scarlet mistletoe are present, especially near the forest edge, and two individuals of yellow mistletoe (*Alepis flavida*) were seen.

Figure 7. *Mixed red beech-silver beech forest along the proposed access route.*

General comments on vegetation: Because of the time of year that the site was inspected and the conditions on the day (fine but very cold), not all of the plant species present would have been recorded, especially in the short stature grassland and herb field communities. Notwithstanding this, a total of 61 native vascular plant species were recorded (Appendix 1). In addition, a number of non-vascular plants were seen but not identified to species, including mosses such as *Racomitrium* species and lichens such as *Cladia* species.

No national threatened plant species (de Lange et al. 2013) were recorded, although the three mistletoe species present are all ranked as 'At Risk, Declining' in the national ranking of threatened and at risk vascular plants. Interestingly, both scarlet and red mistletoe were found growing on silver beech, with both seen twice on the same host individual (Figure 8). Although not observed, it is likely that red mistletoe was also parasitising red beech as this is its usual host in these forests (Norton & de Lange 1999). Yellow mistletoe was only seen on red beech. Although a few mountain beech trees were present, this species was rare and no mistletoes were seen parasitising it at this site. Scarlet and red mistletoe were most commonly seen on large silver beech trees along forest edges, while yellow mistletoe was observed high in red beech canopies in the forest interior.

Figure 8. *Scarlet mistletoe (the larger leaved plant in the middle) and red mistletoe (the smaller leaved plant) parasitising a silver beech host tree.*

All of the plant communities present at this site and likely to be impacted by the proposed PATH development occur widely in the Eglinton Valley. The grasslands are dominated by exotic species, a legacy of a long history of pastoral farming dating back to the 1850s (Peat & Patrick 1996) and are a distinctive feature of the Eglinton Valley. Red beech and silver beech are the dominant species in the forests at the proposed development site and are similar to other forests through the valley. The mossy herbfield communities at this site also occur around forest edges through the valley.

The vegetation of the site appears to have been severely impacted by deer over many years, with marked antler rubbing on the stems of some species (e.g. mountain toatoa) and a general lack of young plants of known palatable species (e.g. broadleaf [*Griselinia littoralis*] and *Raukaua simplex*). Some recently dead mountain toatoa were seen, with death a result of bark

stripping by deer. However, the healthy condition of the mistletoes suggests that possum numbers are low.

Fauna

Fauna were not directly observed in this assessment and apart from invertebrate species associated with soils and plants that will be directly impacted by the development, are unlikely to affected in any significant way. The valley is regarded as highly productive (Peat & Patrick 1996), in part a reflection on the extent of forest edge habitat. Invertebrate populations are abundant and as a result so too are populations of insectivorous birds and bats. We heard or saw several common forest birds including bellbird, tomtit, robin and greywarbler, notwithstanding it being a very cold day. The valley is home to a number of threatened animal species (O'Donnell et al. 2013, Robertson et al. 2017) including mohua (Recovering), kaka (Nationally Vulnerable) and long-tailed bat (Nationally Critical), as well as supporting good populations of other bird species. The persistence, and in fact recovery of threatened species in the Eglinton Valley is the result of a sustained animal pest control programme undertaken by the Department of Conservation. It is highly unlikely that the proposed PATH development will have any impact on these species because of its limited extent.

Project development and minimizing environmental impacts

In this section I discuss the way this project can be developed while minimizing impacts on the environment. Where development projects have an impact on the environment, it is common to follow an hierarchy of steps in order to minimize and ultimately offset impacts. These steps are as follows (DOC 2014):

- *Avoidance: Measures taken to avoid creating impacts from the outset, such as careful spatial or temporal placement of elements of infrastructure, in order to completely avoid impacts on certain components of biodiversity. This results in a change to a 'business as usual' approach; for example, re-routing of roads to avoid the most sensitive areas.*
- *Minimization: Measures taken to reduce the duration, intensity and/or extent of impacts that cannot be completely avoided, as far as is practically feasible; for example, retaining wildlife corridors to reduce impacts of roads.*
- *Rehabilitation/restoration (remedying): Measures taken to rehabilitate degraded ecosystems or restore cleared ecosystems following exposure to impacts that cannot be completely avoided and/or minimized; for example, replanting roads that are no longer required or were widened to accommodate trucks carrying construction materials.*
- *Offset: Measures taken to compensate for any residual significant, adverse impacts that cannot be avoided, minimized and/or rehabilitated or restored, in order to achieve no net loss or a net gain of biodiversity.*

This project has been developed with the intention to avoid impacts, to minimize those impacts that do occur and then restore any areas that have been disturbed. The project accepts that there will be some impact, but careful consideration has been made in decision making around siting, design, servicing and operation in order to reduce disturbance as much as possible. In particular, in considering potential sites, site selection has taken into account any potential impacts on biodiversity values as well and potential visual impacts.

The following notes provide comment on how the project will further avoid and minimize environmental impacts for each of the elements described above and then outline a method to ensure avoidance and minimization occurs.

Accommodation pods: Aside from the areas immediately under each of the accommodation pods, impacts from these will be minimal. However, in order to further reduce impacts, it is proposed that the pods and their access tracks (which will be located behind the pods) will be sited within the exotic grassland community as much as possible thus reducing impacts on the mossy herbfield. The access tracks/boardwalks between the pods and the common area will themselves mitigate environmental impacts by guiding people so that they stay on the track/boardwalk and not impact the surrounding vegetation.

Common area: This will require some clearance of woody vegetation as the foot print for the common area is larger than the size of the clearing. Clearance will be minimized as much as possible through orientating the footprint to avoid woody vegetation but recognising that this is constrained by the bank at bottom of this site.

Staff quarters: These are to be located in a clearing west of the common area and will require some clearance of small silver beech trees at the forest edge but again this will be kept to a minimum through careful siting.

Service structures and access tracks between elements: Service structures will be located in sites that require minimal woody vegetation clearance and tracks between the elements will be routed through existing gaps in the woody vegetation to reduce and if possible avoid any woody vegetation clearance. All tracks will be surfaced to reduce substrate damage.

Nature trail: This will wind through the forest with no clearance of woody vegetation apart from occasional seedlings and saplings. Ground disturbance through track formation will be kept to a minimum and the track will be surfaced to avoid soil erosion. This track will be no more than 1 m wide.

Access track: The access track will also wind through the forest to avoid large trees and where possible to avoid removing any saplings and trees >5 cm diameter. The track will be surfaced with gravel and will be wide enough to allow a quad bike and trailer to traverse it but not a 4x4 vehicle. Two steel and timber bridges will be built with concrete foundations to span the two streams.

Process to be followed to minimize impacts: The following process is proposed in order to minimize impacts on the terrestrial environment during construction.

- The footprint of all elements including the access track will be clearly marked on the ground prior to construction commencing and adjusted as appropriate to minimize impacts (e.g. to reduce cutting of woody vegetation). An ecologist and/or Department of Conservation officer will be present and part of the decision making when the footprints are marked.
- The access track will be built first and will form the only access route to the site which will be by foot or quad bike.
- Construction material will be transported to the site by helicopter and either landed within the actual building footprint, or deposited in a defined area of the exotic grassland below the site (avoiding any wetland areas).
- Tracks linking the different elements of the project will be constructed next and will be used for access between them during construction.
- In building the different elements, a 1 m buffer around each footprint will be included in the construction contracts, with penalties included should damage occur beyond this.

- Restoration using locally sourced species appropriate to the individual disturbed sites will be undertaken for all areas disturbed during construction.
- All lighting will be kept to a minimum and external lighting will all be downward facing to minimise any potential disturbance on fauna and to minimise the visibility of the development.

Offsetting impacts: No specific biodiversity offset is proposed as the residual impacts of this development are small. However, the permanent presence of people at this site will reduce deer numbers and the staff at the lodge will assist in maintaining pest trap and bait lines in the area in collaboration with the Department of Conservation. In addition, the focus of PATH in offering a close engagement with the natural environment, including through appropriate interpretative material in the facility, will hopefully lead to a longer-term commitment to biodiversity conservation by guests. Finally, the lodge will be run following environmental sustainability best practice principles which will also offset any residual impacts.

Literature cited

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Appendix 1. List of native vascular plant species recorded from the site.

Species	**Common name**
Trees and shrubs	
Aristotelia serrata	wineberry
Carpodetus serratus	marbleleaf
Coprosma dumosa	
Coprosma foetidissima	stinkwood
Coprosma propinqua	
Coprosma pseudocuneata	
Coprosma rhamnoides	
Coprosma rigida	
Coprosma rotundifolia	
Coriaria sarmentosa	tutu
Dracophyllum longifolium	inaka
Fuchsia excorticata	tree fuchsia
Fuscospora cliffortioides	mountain beech
Fuscospora fusca	red beech
Gaultheria crassa	
Griselinia littoralis	broadleaf
Hebe salicifolia	koromiko
Lophozonia menziesii	silver beech
Myrsine divaricata	weepting matipo
Phyllocladus alpinus	mountain toatoa
Podocarpus laetus	thin-barked tōtara
Podocarpus nivalis	snow tōtara
Pseudopanax colensoi	five-finger
Pseudopanax crassifolius	lancewood
Pseudowintera colorata	horopito
Raukaua simplex	
Vines and mistletoes	
Alepis flavida	yellow mistletoe
Muehlenbeckia australis	pohuehue
Peraxilla colensoi	scarlet mistletoe
Peraxilla tetrapetala	red mistletoe
Rubus cissoides	bush lawyer
Rubus schmidelioides	bush lawyer
Sub-shrubs	
Leucopogon fraseri	patotara
Muehlenbeckia exillaris	creeping pohuehue
Pimelea prostrata	pinatoro

Ferns and fern allies	
Asplenium flaccidum	drooping spleenwort
Blechnum discolor	crown fern
Blechnum fluviatile	kiwikiwi
Blechnum novae-zelandia	kiokio
Blechnum penna-marina	little hard fern
Blechnum procerum	small kiokio
Histiopteris incisa	water fern
Hymenophyllum multifidum	filmy fern
Hymenophyllum sanguenolentum	filmy fern
Lycopdoium fastigiatum	alpine clubmoss
Lycopodium scariosum	creeping clubmoss
Microsorum pustulatum	hounds tongue fern
Notogrammitis billardierei	strap fern
Polystichum vestitum	prickly shield fern
Pteridium esculentum	bracken
Pyrrosia eleagnifolia	leather-leaf fern
Sedges and grasses	
Carex coriacea	sedge
Carex penalpina	hookgrass
Carex secta	purei
Carex uncinata	hookgrass
Poa colensoi	blue tussock
Herbs	
Astelia fragrans	bush lily
Gonocarpus micranthus	
Nertera villosa	
Ranunculus multiscapus	grassland buttercup
Wahlenbergia albomarginata	harebell