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Mount Buller Sustainable Water Security Project – Off-stream Storage

Ecological Rehabilitation Plan

FINAL REPORT

Prepared for the Mount Buller and Mount Stirling Alpine Resort Management Board

8 December 2016

Tract

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- ERM: Alicia Burnett and Jon Brock.
- Mount Buller and Mount Stirling Alpine Resort Management Board: John Huber, Paul McNamara and Louise Perrin.

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Abbreviations

Alpine Bogs	Both the EPBC Act threatened ecological community (Alpine Sphagnum Bogs and Associated Fens) and the FFG Act threatened community (Alpine Bog Community)
DELWP	Victorian Government Department of Environment, Land, Water and Planning
DEPI	Victorian Government Department of Environment and Primary Industries, now DELWP
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
ERP	Ecological Rehabilitation Plan
EVC	Ecological Vegetation Class
FFA	Flora and Fauna Assessment
FFG Act	Victorian *Flora and Fauna Guarantee Act 1988*
HEMAMP	Hydrological and Ecological Monitoring and Adaptive Management Program
PCF	Project Construction Footprint for the proposed Mount Buller Water Storage
project	The Mount Buller Sustainable Water Security Project, including the water storage and ancillary infrastructure
rehabilitation area	The 8.60 hectares of the PCF that will be temporarily disturbed during the construction process and not occupied by permanent infrastructure but subject to post-construction rehabilitation
RFI	Request for Further Information
RMB	Mount Buller and Mount Stirling Alpine Resort Management Board
water storage	The proposed 100 megalitre water storage at Mount Buller

1. Introduction

1.1 Project background

Biosis Pty Ltd (Biosis) and Tract Consultants Pty Ltd (Tract) were commissioned by the Mount Buller and Mount Stirling Alpine Resort Management Board (RMB) to prepare an Ecological Rehabilitation Plan (ERP) for the proposed Mount Buller Water Storage Project (the project).

The proposed project would involve the construction of a 100-megalitre water storage and ancillary infrastructure within a 10.347-hectare Project Construction Footprint (PCF) in the Mount Buller Alpine Resort. A planning permit application for the project was submitted to the Victorian Government Department of Environment, Land, Water and Planning (DELWP) in August 2016.

In September 2016, DELWP requested further information regarding the permit application, including (among other items) a detailed Project Rehabilitation Plan (Appendix 1). This Ecological Rehabilitation Plan (ERP) addresses this aspect of DELWP's Request for Further Information (RFI). In the permit application documentation, this ERP has been referred to variously as a Project Rehabilitation Plan, Project Revegetation Plan and Habitat Creation Program. All references to these documents are references to this ERP.

1.2 Related documents

As part of the planning permit application, Biosis and GHD jointly produced two technical reports that are relevant to the current rehabilitation plan: a Flora and Fauna Assessment (FFA) and a Hydrological and Ecological Monitoring and Adaptive Management Program (HEMAMP). The FFA outlines the pre-construction condition of the PCF (Biosis and GHD 2016a). The HEMAMP specifies the requirements for monitoring and managing Alpine Bogs that are downslope of the PCF (Biosis and GHD 2016b).

1.3 The rehabilitation area

The proposed project would be within the Mount Buller Alpine Resort at a site known as the 'Control Centre'. The site is located on a gently to moderately sloping plateau, 700 metres east of the Mount Buller summit and 250 metres west of Mount Buller village.

The proposed PCF covers an area of 10.347 hectares. Upon construction completion, approximately 1.75 hectares of the PCF would be permanently occupied by new or existing infrastructure, such as the water storage body, tanks, pipes, pumps, the Summit Road and associated access tracks. The remaining 8.60 hectares will be temporarily disturbed during the construction process and subject to post-construction rehabilitation. These 8.60 hectares are collectively known as the rehabilitation area.

Approximately 5.29 hectares of the rehabilitation area will be revegetated using three different revegetation treatments (or rehabilitation zones), as outlined in Section 2. Re-establishment of native vegetation within these zones will replace the 5.278 hectares of native vegetation removed during the construction phase. The remaining 3.31 hectares of the rehabilitation area will be treated with amenity landscaping, as detailed in Section 4. Amenity landscaping will provide passive recreational and educational opportunities near the new water storage and will assist in satisfying key rehabilitation requirements e.g. by ensuring that no bare ground is left exposed.

1.3.1 Ecological values

The FFA identifies the following key ecological values within the PCF (Biosis and GHD 2016a):

- 5.278 hectares of native vegetation (comprising 5.194 hectares of Alpine Grassy Heathland and 0.085 hectares of Alpine Woodland), all of which would require removal for construction of the project.
- Habitat supporting small populations of Broad-toothed Rat *Mastacomys fuscus mordicus* (EPBC Act: vulnerable; FFG Act: threatened) and Alpine Bog Skink *Pseudemoia cryodroma* (FFG Act: threatened).

1.3.2 Landscape context

Key ecological values in the surrounding landscape outside the PCF (and therefore not directly affected by the proposed water storage) include (Biosis and GHD 2016a):

- 2.007 hectares of the Alpine Bog ecological community (EPBC Act: endangered; FFG Act: threatened) downslope of the PCF.
- Core and non-core habitat for Mountain Pygmy-possum *Burramys parvus* (EPBC Act: endangered; FFG Act: threatened) approximately 200 metres from the PCF (at its nearest point).

The HEMAMP defines a program for monitoring and managing the Alpine Bogs downslope of the PCF to ensure that their pre-construction extent and condition are maintained (Biosis and GHD 2016b). Importantly, this ERP responds to the requirements of the HEMAMP.

Mountain Pygmy-possum has been the subject of an ongoing monitoring and management program at Mount Buller since the discovery of the species there in 1996. Implementation of this ERP will result in the creation of new habitat suitable for Mountain Pygmy-possum.

1.3.3 Engineering considerations

All rehabilitation works, but particularly works around the water storage embankment, will be designed with geotechnical stability, surface water management and erosion minimisation as a priority. These are both a rehabilitation and an engineering requirement – they are as important for successful rehabilitation of the PCF as they are for the structural integrity of the water storage infrastructure. This means that all ground preparation (topography reshaping, drainage, sediment controls and positioning of natural features such as boulders) will be designed and engineered in accordance with project construction parameters during the detailed design phase.

1.4 Aims of this document

The aims of this ERP are to:

- Define the performance criteria against which rehabilitation of the PCF will be assessed.
- Explain the requirements for successful rehabilitation of the PCF, including resourcing, planting and ongoing management requirements.
- Specify a robust and repeatable monitoring protocol, which will gather data to allow revegetation and habitat creation to be assessed against the performance criteria.
- Outline the how amenity landscaping will contribute to overall rehabilitation of the PCF.
- Propose a timeline for rehabilitation of the PCF, with milestones.

1.5 Performance criteria

The performance criteria outlined below will be used to assess the short-term and long-term outcomes of the rehabilitation. For any references to time in this ERP, Year 1 is taken to be spring to winter of the year of construction, with most revegetation work planned for the autumn of Year 1. This matches the terminology of the HEMAMP (Biosis and GHD 2016b).

1.5.1 Short-term outcomes

Before the start of the first winter (before the first significant snowfall of Year 1), the RMB will ensure that an erosion resistant ground condition has been achieved and is maintained within the rehabilitation area. The ground condition within the rehabilitation area will be considered erosion resistant if:

- There is no bare soil.
- Mulch, jute mesh and other sediment controls are properly in place and functional.

1.5.2 Long-term outcomes

Within five years of construction commencing (by the end of Year 5), the following outcomes will have been achieved within the PCF:

- No overall loss of key pre-construction ecological values:
  - A dense cover of native vegetation will be re-established over at least 5.278 hectares of the rehabilitation area, meaning that there will be no net decrease in the area of native vegetation within the PCF.
  - As a result of the revegetation works, there will be no net decrease in the area of habitat for Broad-toothed Rat or Alpine Bog Skink within the PCF.
- The rehabilitation area will be linked with ecological values in the broader landscape outside the PCF:
  - New habitat for Mountain Pygmy Possum will be created within the PCF (no habitat currently exists within the PCF).
  - There will be improved connectivity of native vegetation outside the PCF as a result of revegetation of areas of the PCF that currently support introduced vegetation.

2. Rehabilitation requirements

This rehabilitation plan has been prepared with close reference to the following key documents:

- The Rehabilitation Field Guide for the Australian Alps (MacPhee 2013).
- The Australian Alps Rehabilitation Manual (Good 2006).
- The Vegetation Management Plan for Mount Buller Ski Field (Biosis 2013).
- The Revegetation and Habitat Restoration Plan for Mountain Pygmy-possum on Mount Buller (Biosis 2007).

These documents are invaluable sources of information and provide more details about specific rehabilitation and management techniques.

2.1 Resourcing requirements

2.1.1 No bare ground

This rehabilitation plan is formulated with the fundamental rehabilitation principle of 'NO BARE GROUND'. Within the rehabilitation area, the protection of soil and the control of sediment movement will be imperative so that the project does not affect surrounding ecological communities, such as Alpine Bogs. Soil will remain covered and protected at all times post-construction.

To assist in maintaining no bare ground, resources that are removed from the PCF during construction should, as far practicable, be re-used in the rehabilitation process and in the amenity landscaping (see Section 4). Resources are identified as:

- Topsoils and sods from zones that have a low or negligible weed load. If re-used, topsoils and sods will provide a suite of microflora for planted rehabilitation species and will improve rehabilitation outcomes. More specific details of sod and soil storage can be found in the Rehabilitation Field Guide (MacPhee 2013). In summary, topsoils and/or sods must be:
  - Stockpiled in areas that have no weeds
  - Periodically watered
  - Protected from wind erosion.
- Vegetation removed within the PCF during construction, such as tree trunks, branches and shrub canopies, and fine litter scraped from the surface of the PCF, such as bark, twigs and leaf litter. These materials will augment introduced mulches within the rehabilitation area. When re-used, they will provide micro-climates for seedling establishment and recruitment and contribute to re-establishing the soil seedbank. The retention of carbon in this form will improve ecological function and rehabilitation outcomes.
- Rocks and boulders extracted from the PCF during construction. Rocks and boulders of all sizes are essential for the creation of habitat for a range of vertebrate and invertebrate fauna, including Alpine Bog Skink, Broad-toothed Rat and Mountain Pygmy-possum. Rocks also provide microclimates for the establishment of planted seedlings.

2.1.2 Rehabilitation zones

The rehabilitation area has been divided into three rehabilitation zones (Figure 1), which have been defined according to their current ecological values and their future management requirements based on the ecological and recreational outcomes intended for each zone.

The three zones are defined as follows:

- **Zone A**: This zone currently has sections of Sub-alpine Woodland (EVC 43) and Alpine Grassy Heathland (EVC 1004). Zone A covers approximately 1.99 hectares of the PCF. This zone is currently classified as having 'high' ecological values and will require the highest level of ecological rehabilitation. Rehabilitation of Zone A will focus on establishing dense and diverse native vegetation equivalent to the pre-construction EVC and on creating fauna habitat with logs, rocks and boulders.
- **Zone B**: This zone currently has some sections of Alpine Grassy Heathland (EVC 1004) but has been previously disturbed, which is evident from the presence of introduced vegetation and bare ground. Zone B covers approximately 2.52 hectares of the PCF. This zone is currently classified as having 'medium' ecological value. The rehabilitation of Zone B will focus on protecting soil by the use of mulches, increasing native vegetation cover by planting indigenous heath species and inhibiting the potential spread of introduced species into Zone A from surrounding areas.
- **Zone C**: This zone currently consists mostly of introduced vegetation over disturbed areas (ski slopes, tracks and set down areas). Zone C covers approximately 0.78 ha of the PCF. This zone is currently classified as having 'low' ecological value. The rehabilitation of Zone C will focus on protecting and buffering higher value areas by preventing soil erosion and limiting the spread of introduced species.

Collectively, Zones A, B and C cover 5.29 hectares of the rehabilitation area. Re-establishment of native vegetation within these zones will replace the 5.278 hectares of native vegetation removed during the construction phase.

Resourcing requirements will vary for each rehabilitation zone (as outlined below) but the following general principles apply (and are summarised in Table 1):

- All plant material will be sourced from Mount Buller provenance material.
- Tubestock estimates are based on a planting density of approximately 1-2 plants per square metre.
- Seed quantity estimates are based on a rate of 15 grams per square metre for native *Poa* mix and 5 grams per square metre for native forb mix.
- Species have been selected based on:
  - The known characteristics of the pre-construction native vegetation (Sub-Alpine Woodland and Alpine Grassy Heathland).
  - Species that are easily propagated.
  - Species that are regarded as colonising species for Sub-Alpine Woodland and Alpine Grassy Heathland.
- All tubestock should have a small handful (about 25 grams) of slow release organic fertiliser introduced to the base of a planting hole.
- During the construction phase, all exposed soil must be covered as soon as practicable with jute mesh (if required) and organic mulch.

- Organic mulch in the form of straw bales will be required for all zones. Rice, sorghum and sugarcane mulch are all suitable for Mount Buller as any crop or weed seed potentially in the mulch will not persist in sub-alpine conditions. Small bales should be used for ease of handling and will cover 20 square metres. Straw mulch can be secured with jute mesh, stored logs and canopies of any removed vegetation.

Table 1 Resources required for all zones

Zone	Tubestock Required	Seed Required	Straw Bales Required	Other Resources
A	25080 (see Table 2)	50 kg mixed forbs and 150 kg *Poa fawcettiae* (see Table 3)	1000	625 kg slow release organic fertiliser
B	7000 (see Table 4)	350 kg *Poa fawcettiae*	1260	175 kg slow release organic fertiliser
C	3000 (see Table 5)	Sterile Rye Corn (if required) and 70 kg *Poa fawcettiae*	400	175 kg slow release organic fertiliser and jute mesh

Zone A

- Excavated material will be stockpiled and re-used in Zone A. This will need to be clearly defined by the project manager. Stockpiling areas for Zone A resources should be clearly identified prior to any excavation or vegetation removal.
- Within areas that are currently Sub-Alpine Woodland, three vegetation strata will be rehabilitated: tree canopy, shrub layer and grass sward. Within areas that are currently Alpine Grassy Heathland, two vegetation strata will be rehabilitated: medium shrub layer and herbaceous grass/forb layer.
- To augment the rehabilitation of Zone A, seed of *Poa fawcettiae* and mixed native forbs will be sown between planted tubestock. Seed will therefore be required for approximately half of Zone A (the other half being occupied by tubestock).
- Tables 2 and 3 outline the plant species to be used for revegetation and the numbers of tubestock or quantity of seed required for Zone A.

Table 2 Tubestock required for Zone A

Species	EVC Type	Numbers Required	Propagation Method
Alpine Baeckea ***Baeckea gunniana***	Alpine Grassy Heathland	1000	Cuttings
Alpine Grevillea ***Grevillea australis***	Alpine Grassy Heathland	3000	Cuttings
Alpine Mint-bush ***Prostanthera cuneata***	Alpine Grassy Heathland	3000	Cuttings
Alpine Rice-flower ***Pimelea alpina****	Alpine Grassy Heathland	1000	Cuttings
Alpine Star-bush ***Asterolasia trymalioides***	Alpine Grassy Heathland	500	Cuttings
Alpine Pepper ***Tasmannia xerophila****	Sub-alpine Woodland	10	Cuttings
Alpine Podolobium ***Podolobium alpestre***	Sub-alpine Woodland	1000	Seed
Dusty Daisy-bush ***Olearia phlogopappa*** **var. *flavescens***	Sub-alpine Woodland	2000	Seed and cuttings
Orange Everlasting ***Xerochrysum subundulatum***	Sub-alpine Woodland	500	Seed
Small-leaf Bramble ***Rubus parvifolius****	Sub-alpine Woodland	10	Cuttings
Snow Gum ***Eucalyptus pauciflora***	Sub-alpine Woodland	50	Seed

Species	EVC Type	Numbers Required	Propagation Method
Alpine Rusty-pods ***Hovea montana***	Alpine Grassy Heathland and Sub-alpine Woodland	5000	Seed
Kerosene Bush ***Ozothamnus cupressoides***	Alpine Grassy Heathland and Sub-alpine Woodland	3000	Seed and cuttings
Snow Grasses ***Poa* spp. (*fawcettiae, helmsii, ensiformis*)***	Alpine Grassy Heathland (*P. fawcettiae* only) and Sub-alpine Woodland (all)	5000	Seed
Sub-alpine Beard-heath ***Acrothamnus maccraei****	Alpine Grassy Heathland and Sub-alpine Woodland	10	Cuttings

** These species are know to be significant to Indigenous Australians and may be the focus of interpretive cultural heritage signs for visitors to the resort (Zola and Gott 1992). Refer to Section 4.*

Table 3 Seed required for Zone A

Species	EVC Type	Seed Required (kg)
Alpine Wallaby-grass ***Rytidosperma nudiflorum***	Alpine grassy Heathland	10
Alpine Yam-daisy ***Microseris lanceolata****	Alpine Grassy Heathland	5
Ashen Billy-buttons ***Craspedia coolaminica***	Alpine Grassy Heathland	15
Common Trigger-plant ***Stylidium armeria***	Alpine Grassy Heathland	5
Granite Buttercup ***Ranunculus graniticola***	Alpine Grassy Heathland	5
Slender Snow-daisy ***Celmisia pugioniformis***	Alpine Grassy Heathland	10
Horny Snow-grass ***Poa fawcettiae***	Alpine Grassy Heathland and Sub-alpine Woodland	150

** This species is know to be significant to Indigenous Australians and may be the focus of interpretive cultural heritage signs for visitors to the resort (Zola and Gott 1992). Refer to Section 4.*

Zone B

- Most of Zone B is Alpine Grassy Heathland with some areas of introduced vegetation. All excavated sods that have little or no weeds should be re-used in the rehabilitation of Zone B (but preferably not used in Zone A). Shrub canopies and *Poa* grass tussocks will contribute to mulch in this zone. As far as practicable, Zone B material should be stockpiled separately from Zone A material to minimise the movement of weed seed to Zone A.
- Two vegetation strata will be rehabilitated: low shrub layer and herbaceous grass/forb layer.
- Most of Zone B will be rehabilitated using *Poa fawcettiae* seed covered with organic mulch but some tubestock will also be required.
- A large amount of *Poa fawcettiae* seed will be required to rehabilitate Zone B. Most of the exotic species that occur in this zone are broadleaved species and by sowing *Poa fawcettiae*, management of weeds can be facilitated by the use of specific herbicides that target dicotyledons and do not kill monocotyledons.
- Table 4 outlines the tubestock required for Zone B. Tubestock of dominant heath species should be preferentially planted in areas of connectivity with existing native vegetation and areas where the angle of repose of slopes is greater than 30 degrees.

Table 4 Tubestock required for Zone B

Species	Numbers Required	Propagation Method
Alpine Baeckea ***Baeckea gunniana***	1000	Cuttings
Alpine Grevillea ***Grevillea australis***	2000	Cuttings
Alpine Mint-bush ***Prostanthera cuneata***	1000	Cuttings
Alpine Rice-flower ***Pimelea alpina****	500	Cuttings
Alpine Rusty-pods ***Hovea montana***	1000	Seed
Alpine Star-bush ***Asterolasia trymalioides***	500	Cuttings
Kerosene Bush ***Ozothamnus cupressoides***	1000	Cuttings and seed

** This species is know to be significant to Indigenous Australians and may be the focus of interpretive cultural heritage signs for visitors to the resort (Zola and Gott 1992). Refer to Section 4.*

Zone C

- Zone C includes parts of the PCF that are highly disturbed and have low ecological value in regard to vegetation or habitat. The primary goal of rehabilitation in this zone is to inhibit the spread of exotic species into other zones and to protect soil from erosion by the use of organic mulch.
- Hard stand areas, tracks, roads, stockpiles and other construction areas must be formed and bunded so the spread of seed and soil is limited to that zone. Sediment control must be in place across all possible gradients and discharge areas.
- All bare ground must be covered with mulch as soon as practicable after disturbance. Areas where the angle of repose of slopes is greater than 30 degrees must be mulched and secured with jute mesh soil saver.
- Two vegetation strata will be established: low shrub layer and herbaceous grass/forb layer.
- Most of Zone C will be rehabilitated using *Poa fawcettiae* seed covered with organic mulch but some tubestock of low shrubs and *Poa fawcettiae* will also be required.
- Table 5 outlines the tubestock required for Zone C. Tubestock will be preferentially planted in jute mesh in areas where the angle of repose of slopes is greater than 30 degrees.
- If deemed necessary to control gross sediment movements, Sterile Rye Corn can be sown as a 'living mulch'.

Table 5 Tubestock required for Zone C

Species	Numbers Required	Propagation Method
Alpine Rice-flower ***Pimelea alpina****	500	Cuttings
Alpine Rusty-pods ***Hovea montana***	1000	Seed
Horny Snow-grass ***Poa fawcettiae***	1000	Seed
Kerosene Bush ***Ozothamnus cupressoides***	500	Cuttings and seed

** This species is know to be significant to Indigenous Australians and may be the focus of interpretive cultural heritage signs for visitors to the resort (Zola and Gott 1992). Refer to Section 4.*

2.1.3 No-go zones and signage

The delineation of the PCF must be clearly identified with signs, temporary fences and roads before construction commences. The delineation of the PCF needs to be included in the induction process for all construction personnel. No works, whether rehabilitation works or otherwise, are to extend beyond the PCF. It is very important that all staff know the location and requirements of the different rehabilitation zones, to minimise potential contamination of the 'clean' zones with introduced plant propagules. Signs, temporary barrier fencing and maps can be used to make this clear to all personnel involved.

2.2 Planting requirements

Successful rehabilitation is highly dependent on the coordination of multiple resources, including plants and planting and is often dependent on overcoming complex logistical issues. It is imperative that tubestock is from local provenance, is well grown and is primed for planting when put in the ground. It is also imperative that the seed picked and sown is of known provenance and has a high level of viability. The following information will identify all that is required in the planting and sowing of seed for this project to achieve successful rehabilitation.

2.2.1 Ground preparation

General principles

Within the construction parameters, the following principles will guide the preparation of the rehabilitation area for revegetation:

- Reshape the topography so that it is integrated with the surrounding landscape and has as many natural features as possible, whilst retaining stability and minimising erosion.
- Design drainage lines to slow movement of water across the rehabilitation area, distribute sediment-free flows towards downslope Alpine Bogs and mimic pre-construction hydrology.

These basic principles of ground preparation will assist in re-establishing natural processes and in the recruitment of seedlings and germination of seed. They will ultimately contribute to habitat creation within the rehabilitation area.

Reshaped topography and natural features

Wherever possible, the topography should be re-shaped to:

- Reduce all angles of batters to less than 30 degrees.
- Reduce all lengths of batters to less than 10 metres.
- Rip compacted spoil/soil to a depth of at least 30 centimetres (preferably up to 60 centimetres).

Natural features (micro-niches, depression and soil surface roughness) will be incorporated into the topography (whether steep or flat) to act as habitat and 'resource sinks' – places where surface water slows down and collects and deposits resources in the form of sediment, seed and organic materials. Natural features can be achieved by:

- Running the teeth of an excavator bucket across the contour.
- Leaving small depressions (by hand or machine) that are stable but act as micro-niches.
- Placing boulders and rocks in the landscape where water can potentially collect.
- Covering ground with organic mulches and vegetation removed from the site during construction.

Rocks and boulders will form an integral part of habitat (re-)creation for Alpine Bog Skink and Mountain Pygmy-possum. They will be preferentially placed across contours and drainage lines to serve a dual function as habitat for these threatened species and as a resource sink to minimise erosion and promote re-establishment of native vegetation.

Drainage and sediment controls

For all batters longer than 10 metres and with an angle of repose greater than 30 degrees, it is recommended that cross drains be formed across contours of the slopes to minimise erosive processes and maximise water infiltration.

Cross drains act as small collection areas for water, soil, seed and any other biota that may move down gradient at a site. They are usually installed in areas where rocky slopes are to be stabilised. The aim of the cross drains is to collect water on the site and promote its movement through the rock slope rather than over the top of the slope.

Cross drains can be formed using a shovel and mattock in a spoon shape or a small excavator and must have a higher lip at the front. They can be 5 to 8 metres apart and are designed to capture any runoff, leaf litter and/or sediment, which will accelerate the rate of recruitment on the slope face.

Drains should be U-shaped. The depth and width will depend on the angle of slope and whether constructed by machine or mattock, but they need to be proportional to the expected surface flows. They should be designed to accommodate 1 in 100 year flows. Frequent small drains are preferred to widely spaced, large drains. Drains should have 1-2% grade angles into a slope.

While the aim of cross drains is to slow and hold water until it has percolated into the subsoil, they may need to discharge water at times. If water must be discharged, it should be discharged into existing intact vegetation and/or the pits of the environmental watering system for Alpine Bogs. Discharge points should not exceed a 2% fall and should distribute water over a broad area. Cleanable sediment traps (straw bales and/or sediment fence fabric) must be installed at all discharge points. Sediment traps should be made of straw bales and/or silt fence fabric anchored with stakes or star pickets.

2.2.2 Tubestock management

For the planting of tubestock to be successful, it is essential that healthy and vigorous plants be used. Grasses should be tillering rapidly and have over 10 blades. Forbs need to have strong rhizomatous or rosette growth (depending on their natural growth form). For shrubs and trees, a sturdy stem is desirable as this will provide the plant with adequate carbohydrate to withstand transplant shock.

Plants with elongated internodal spaces and/or pale leaves should be avoided because these are signs that the plant has been produced with inadequate light and/or lacks chlorophyll. It is recommended that tubestock have root systems that are actively growing (i.e. have white tips), fill their container and not in too tight a spiral arrangement. These issues can be overcome by using known reputable nurseries for plant production.

All nursery tubestock needs care to ensure it remains in good condition for the best results when it is planted out. All tubestock to be planted must be 'hardened off' for 4-6 weeks in a holding bay at an equivalent altitude to the planting site. The holding bay for the tubestock must:

- Be in full sun. If high temperatures are experienced (i.e. in summer), the plants may need some protection. A removable 30% shade cloth cover is ideal but should be used sparingly as it defeats the purpose of the hardening off process.
- Be in a weed free site. If weeds are present at the holding site, they should be treated with an appropriate herbicide prior to the site being used as a holding bay. Weed matting, jute mesh and/or geotextile are all suitable. A 2-metre weed free buffer around the holding bay is essential to stop weed seed infiltrating tubestock.
- Be open to some wind. This helps to harden the plants as well as regulate the temperature of the black plastic tubes.

- Have a good spray watering system, which reaches all the tubes. This needs to be checked twice weekly to ensure the system is working and tubestock is receiving enough water for the conditions.
- Be placed in 10 centimetres of gravel or elevated on tables to lift the plants off the ground. Bricks and boards can also be used temporarily.

Tubestock must not be:

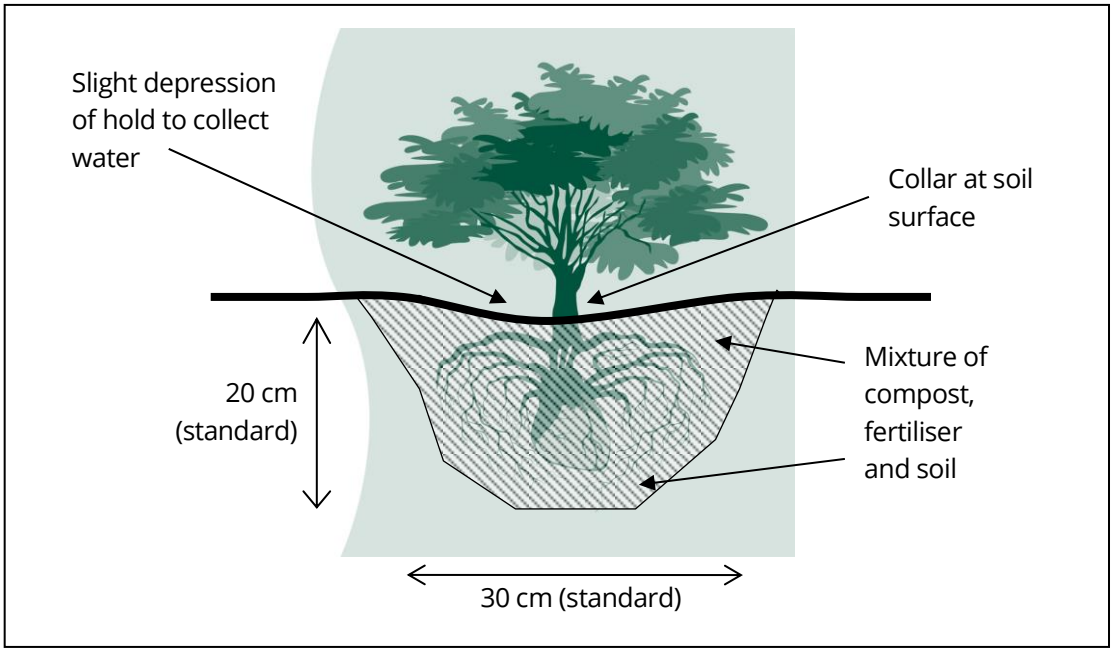
- Sited near buildings or any structure that will radiate heat.
- Ignored. It is important to check the tubes that are on the outside edge, as these will dry out more quickly.
- Over watered. As part of the hardening off process, the tubestock must not be wet all the time.

2.2.3 Planting technique

Approximately 1-2 tubestock will be planted per square metre to assist in establishing a dense cover of native vegetation. This will be crucial for habitat (re-)creation for Alpine Bog Skink, Broad-toothed Rat and Mountain Pygmy-possum.

Tubestock must be planted properly and with care so that they have the best chance of survival. Typically, a standard planting hole is dug to an approximate depth of 30 centimetres and width of 20 centimetres. Large materials, such as rocks, are removed from the planting hole as they risk trapping air within the hole. If planting on the side of steep slopes, use a small deep hole that has a front lip for catching water and not too big a face at the back of the planting hole, otherwise this will collapse onto the plant.

If soil is inadequate for planting, reputable compost can be used to augment planting. It is very important that no pathogens are introduced in the compost. A mixture of compost (if required) and slow release fertiliser mixed with the soil from the hole will provide a fertile, aerated substrate for successful seedling establishment.



Fertiliser addition to each hole will occur at the rate of approximately 25 grams per hole. This is about half a large handful of fertiliser for each planting hole. Fertilisers need to be mixed with compost or local soils on back filling of the hole. These fertilisers protect against phytotoxic response by the seedlings. Direct incorporation into the planting holes reduces the amount of available nutrients to weed species during the site rehabilitation phase.

Planted tubestock needs to be mulched after planting and before watering in. One straw bale can spread as a 10-centimetre deep layer over approximately 20 square metres. Straw needs to be wetted down after it has been spread to help secure it and 'stick' it to the ground. Straw can also be secured with wood thatch and native plant material removed from the rehabilitation zone prior to construction. Thatch needs to be spread thicker in areas exposed to prevailing winds.

If jute mesh soil saver is required, it is important that it is anchored properly. Matting can be anchored by digging a trench at least 20 centimetres deep at the top of the batter that the matting will be used on. The matting is then rolled around a star picket or long stick and placed in the trench. The trench can then be back filled and the mat rolled down the slope. It needs to have the edges placed so that the prevailing wind pushes the edge of the matting down. Segments of jute mesh should overlap each other by at least 10 centimetres and be pinned with the appropriate pins for the soil type.

Plants **must** be watered on the day of planting at a rate of 4-5 litres per plant. This also pushes soil around the root system preventing air pockets forming. The initial watering in phase is very important because lack of water is one of the most common reasons for death amongst seedlings.

2.2.4 Seeding technique

The following factors need to be considered for the direct seeding component of this rehabilitation plan:

- Sites need to be weed free before sowing seed for native grasses, forbs and/or shrubs.
- To assist in weed control, only broad leaved species should be used in areas that are predominantly invaded by introduced grasses and only native grasses should be sown in areas that are predominantly invaded by broad leaved weeds. Selective herbicides can then be used for weed control.
- Only sow seed where there is some organic layer (soil or compost) for the seedlings to establish in.
- Use a thin layer of organic mulch to cover the soil and seed. Mulch that is too thick will inhibit seed germination.
- After covering seed with an organic mulch, water in the seed with a fine spray. Seed may wash away if water is applied too vigorously.
- Only sow seed on slopes with gradients less than 25% to reduce the loss of seed through gravity.

2.2.5 Timing of planting and seeding

There are two seasons a year for planting and seeding in the sub-alpine areas of Australia: autumn (mid-March to mid-May) and spring (late September to late November). Mid-winter and mid-summer are not suitable as it is usually too cold and snowy or too hot and dry. If planting is done out of these seasons, more maintenance (e.g. watering) will be required and it will make the rehabilitation more expensive and more likely to fail.

Since construction of the water storage is planned over one summer, autumn would be the most suitable time for planting and seeding of the rehabilitation area. Most of revegetation work is therefore planned for the autumn of Year 1. Replacement planting and/or seeding may be required in subsequent spring or autumn periods (see Section 2.3).

2.2.6 Grazing protection

Grazing of tubestock and germinating seedlings can result in the failure of rehabilitation. Rabbits, deer and native herbivores are present at Mount Buller and may graze on the planted tubestock and/or seedlings. It is recommended that tubestock and seedlings be monitored for at least 6 months and up to 12 months for any grazing damage. This will give tubestock and seedlings time to further harden off and become less palatable to herbivores.

A small amount of grazing can be tolerated. However, if the grazing pressure is causing high rates of seedling mortality, tubestock must be protected. Biodegradable plastic mesh tree guards with 3 stakes per guard are recommended. If possible, temporary fences may be more cost effective and provide better protection to seedlings emerging from sown seed. The chosen technique will be at the discretion of the project manager.

2.2.7 Weed management

Zones B and C have existing areas of introduced vegetation. These introduced species and their propagules will need to be managed as part of the rehabilitation process. After disturbance, it is common for many weed species to respond positively and to start spreading and out-competing native species. The use of mulch, targeted planting and selective herbicides will be the main tools used to control the spread of weeds during the construction process.

The following recommendations will further actively control weeds in the rehabilitation area after construction disturbance:

- Only sods with little or no weeds present in them will be re-used in the rehabilitation.
- All excavated weed infested soil and sods will be stockpiled together (not mixed with 'clean' soil or sods) or taken off-site (to avoid contaminating 'clean' zones).
- Bare ground will be covered by organic mulch as soon as practicable after exposure.
- Any weeds remaining within the rehabilitation area will be controlled prior to planting and seeding work. Mechanical control will be take preference over chemical control but chemical control may be necessary.
- Native *Poa* seed will be sown in areas with broadleaf weeds and weeds controlled with a selective herbicide (e.g. Fusilade) as part of the ongoing maintenance program (see Section 2.3).

2.2.8 Personnel

It is important for this project that there is a suitably qualified and experienced site supervisor employed that can coordinate all aspects of the rehabilitation, including planting crews. Multiple planting crews of 6-10 people need to be used for each rehabilitation zone so that the rehabilitation is completed before the first frosts and very cold temperatures of Year 1.

It is also essential that the rehabilitation needs of the site, such as storage of organic materials, maintenance of access tracks and final topography shaping are included and integrated into the construction phase. This will require the cooperation and acknowledgment of the managers and staff of the construction contractor.

2.3 Ongoing management requirements

2.3.1 Short-term maintenance and management

Watering

Additional watering of tubestock may be required if follow up rain does not occur within 4 weeks of planting.

Monitoring of grazing

Seedlings will need to be monitored closely in the first few weeks after planting to assess whether there is any grazing damage occurring. It is recommended that contingency measures be in place for the installation of tree guards.

Sediment controls

The persistence of mulch and other sediment control measures will need to be monitored in the first 6 months, particularly after heavy rain and strong winds, to ensure that soil protection measures are successful and maintained.

2.3.2 Long-term maintenance and management

Weed control

Weed control in the first 5 years is imperative for successful rehabilitation, otherwise weeds will proliferate and out-compete newly establishing native seedlings. Weeds that are close to newly planted seedlings may need to be removed by hand or the relevant selective herbicide. Ultimately, weed management of the rehabilitation area should be incorporated into the existing resort-wide weed control program and funded accordingly.

Fence and tree guard maintenance and removal

All tree guards should be removed within 2 years of planting i.e. by the end of Year 3 for tubestock planted in Year 1.

Replacement planting

All seedlings that did not survive in the first planting should be replaced in the following planting season, unless the rehabilitation manager considers that seedling establishment is futile and a different approach is needed. Replacement seedlings will be the same species or local lifeform as the original seedling.

Fertiliser augmentation

Plant health and growth rates need to be monitored. This is of particular importance in areas where a known soil deficiency exists. Yellow shoots, pale leaf laminas or retarded growth are often an indicator of a deficiency of a macro element (nitrogen, phosphorous or potassium). Additional slow release organic fertiliser will be applied if required. It is usually one of these elements that are insufficient in soils as opposed to any of the trace elements.

Re-mulching

If mulch is very thin or no longer present in any given area, re-mulching with weed free straw will be required as soon as possible. Re-applications of mulch should continue on a regular basis until seedlings are sufficiently mature to provide their own biomass i.e. until the no bare ground principle is self-sustaining.

3. Monitoring

Monitoring of the rehabilitation area will take place annually at the start of summer, commencing in Year 2 (the first summer after construction, planting and seeding) and finishing in Year 6 at the earliest (depending on rehabilitation success). Monitoring will collect both qualitative and quantitative data.

3.1 Qualitative monitoring: inspections and photo points

Annual inspections will focus on:

- The presence of bare soil or potential for bare soil to establish, by:
  - Examining the stability of earthworks and drainage lines.
  - Inspecting the condition of mulch, jute mesh and other sediment controls e.g. sediment fences and straw bales.
  - Recording disturbance and grazing by herbivores.
  - Noting areas of seedling mortality and/or poor seed germination.
- The creation of habitat for Alpine Bog Skink, Broad-toothed Rat and Mountain Pygmy-possum, by:
  - Active searches for the species or traces (e.g. scats or tunnels) of the species in the rehabilitation area.
  - Setting up camera traps if appropriate.

A photographic record of annual inspections will be collected at permanent photo point locations throughout the PCF. Photo monitoring points will provide valuable information to assess gross changes to vegetation over time.

3.2 Quantitative monitoring: Landscape Function Analysis

Developed by the CSIRO, Landscape Function Analysis (LFA) is a well-established objective method of assessing the success of ecological rehabilitation and identifying areas where management actions are required. The method will follow the standards outlined by Tongway and Hindley (2005).

3.2.1 Indicators and indices

Eleven indicators will be measured and three indices will be calculated to:

- Ascertain and track the extent and density of native vegetation cover.
- Estimate the percentage mortality of seedlings and percentage seed germination success.
- Ultimately, determine whether a self-sustaining biophysical system has been restored.

The 11 indicators measured will include:

1. Soil cover
2. Perennial grass basal and tree and shrub foliage cover
3. Litter cover

4. Litter origin and degree of composition
5. Cryptogram cover
6. Crust brokenness
7. Erosion type and severity
8. Surface roughness
9. Surface resistance to disturbance
10. Slake test
11. Soil texture.

The indicators are assessed on a 1 metre mini-transect, which (with practice) takes approximately 1 minute to assess. The 11 indicators will be used to calculate stability, infiltration and nutrient cycling indices over two scales: the hill-slope and the patch scale. On a hill-slope, the landscape is divided into patches, where resources tend to be retained or accumulated, and inter-patches, where resources are lost or transported. This reflects any landscape's organisation.

A functional (or successfully rehabilitated) landscape is one that tends to conserve resources, whilst a dysfunctional system is one that leaks resources. The indices will objectively reveal to what extent the rehabilitation has been successful (establishment of a dense and functional cover of native vegetation) and what trajectory the rehabilitation is taking.

3.3 Monitoring reports

Annual monitoring reports will summarise the results of all rehabilitation monitoring.

4. Amenity landscaping

While the majority (5.29 hectares) of the rehabilitation area is designated for habitat restoration and revegetation, this ERP also outlines carefully sited amenity, recreational and place-making features over the remainder of the rehabilitation area. They ensure that the water storage project is an ecologically sustainable attraction, not just a functional asset.

4.1 Site context

There are two major existing destinations in the vicinity of the rehabilitation area – the ABOM lift and an existing gravel carpark (Figure 2).

The ABOM lift station and maintenance/storage facility sit directly to the east of the proposed water storage facility. The ABOM lift is one of the more popular ski lifts and, throughout winter, skiers and snowboarders constantly pulse out of the top station, making it a highly trafficked area. There is also the possibility that the ABOM lift could operate in summer to service the needs of sightseers, walkers and mountain bike riders.

The gravel track to the south of the proposed facility leads to a gravel car park that sits directly to the west of the water storage facility. In summer, this area is a destination for visitors hiking to the Mount Buller summit and visitors looking for an afternoon BBQ (to be installed within the carpark in 2016-2017). Additionally, the popular Summit Loop Trail cuts through the carpark.

The proposed water storage would sit between these two destinations. The opportunity exists to tie the entire precinct together and develop it as an additional and important recreational destination at Mount Buller.

4.2 Challenges and opportunities

4.2.1 A small recreational footprint

Since the majority of the PCF is dedicated to habitat restoration and revegetation, the aim of any amenity works will be to create high-quality but small and focused areas dedicated to passive recreation and education.

4.2.2 Maximising habitat values

Rehabilitation zones have taken precedence over opportunities for recreation, identity and place-making. Recreational and place-making features:

- Are sympathetic to the overall need to restore dense native vegetation cover and (re-)create habitat for Alpine Bog Skink, Broad-toothed Rat, Mountain Pygmy-possum and other fauna.
- Have been designed to complement revegetation and habitat creation works where possible.

4.2.3 Place-making opportunities

The 'Control Centre' location is currently a thoroughfare where hikers, bikers, skiers and snowboarders pass through on their way to somewhere else. The water storage project provides an opportunity to create a destination with its own visual and functional identity and, with that, a series of places for people. The design considers places to stop, to rest, to orient oneself, to interpret the site's history, ecological values and function and to enjoy the spectacular scenery.

4.2.4 Interpretation opportunities

Along with recreational pursuits, the opportunity exists for the water storage setting to provide opportunities for visitors to learn about the site's cultural history, alpine fauna and flora, the purpose for the water storage facility itself, and climate change and its impact on alpine regions. Interpretation panels will be included at points along the proposed walking trails and within the lookouts and viewing deck areas (similar to existing interpretive panels along trails at Mount Stirling). The exact detail and content of these panels will be refined at the detailed design phase. There is also an opportunity to include sculptural features within specific parts of the trail, extending the existing sculptural elements which exist within the Mount Buller Village and elsewhere on the mountain.

4.2.5 Summer and winter recreation

Winter activities within the rehabilitation area will include skiing and snowboarding. Topography reshaping and placement of natural features such as rocks and boulders (see Section 2.2) will provide added interest for skiers and snowboarders. Summer activities would cater for hikers and visitors looking for a greater understanding of the culture and environment of Mount Buller, a trail or mountain biking experience or an afternoon BBQ and place to view the scenery.

4.3 Landscape Master Plan

A Landscape Master Plan has been created to address the need to manage the challenges and opportunities of the water storage project (Figure 3).

4.3.1 Blending into the landscape

More than half of the PCF will be subject to ecological rehabilitation (revegetation and habitat creation). To further blend the engineered structure into the landscape, topography shaping across the batters will create a more nuanced landform, to provide subtle grade changes, to distribute sediment-free surface water to downslope Alpine Bogs and to minimise erosion by managing runoff (see Section 2.2).

4.3.2 Trails, tracks and trailheads

A lakeside trail would surround the water storage. In places, it will be located near the edge of the water body and in other places it will veer away from the edge to provide a different recreational experience.

The trail along the south side of the lake is designed as part of the gravel drive track. On the north, east and west side of the lake the trail will be a narrow (maximum 1.2 metres wide) path designed to meander unobtrusively through the landscape (Zone A). It will wind its way down the batter in a series of switchbacks and join up with the existing Summit Loop Trail. Outcrops of logs and boulders along the trail and throughout the batter will be functional (acting as 'resource sinks', as documented in Section 2), provide fauna habitat and act as educational and recreational features in summer and winter.

The gravel carpark at the end of the gravel drive track is home to an important trailhead to the Summit. Trailhead amenities including seating, interpretive signage, a map, shelter, bike racks and summer-time BBQs will be located here.

4.3.3 Interpretation

There is significant opportunity to provide interpretive signage along the trails and at the trailheads. Each segment of trail will focus on a different aspect of alpine and sub-alpine culture and environment. The Summit Loop Trail may feature Indigenous cultural history. The trail along the eastern side of the water storage may feature information about alpine and sub-alpine flora and fauna, while the viewing deck may feature information about the water storage facility and the effects of climate change on alpine regions.

4.3.4 Safety and security

Opportunities exist to allow visitors to get close to the water's edge. An all year round decorative security fence will surround the water storage facility and address water safety. Taller, winter-only fencing will be temporarily installed for the winter months to prevent snow-seekers from accidentally accessing the lake.

4.3.5 ABOM beach, boardwalk and viewing deck

This combination of recreational and place-making features might be described as the new heart of this precinct (Figures 4, 5, 6 and 10).

The 'beach' is a shallow rock-pool or wading area, less than 10 centimetres deep, for unsupervised water play. It would be fed by water from the storage facility and would be a 'natural' play area in combination with outcrops of boulders mixed with pockets of water-tolerant locally indigenous plants, such as Sedges *Carex* spp. and Rushes *Juncus* spp.. A reed-inspired security fence would separate the 'beach' from the water storage facility and blend with the indigenous plants.

A sculpted boardwalk would cut through the 'beach', leading to a large viewing deck. The viewing deck would provide opportunities for interpretation/site information panels, ample seating for lounging in the sun or shade, a shade structure, space for a summer time coffee cart and bike racks.

In the future, the western façade of the ABOM maintenance building may be architecturally treated in a style similar to that of the shade structure to dramatically improve the aesthetics of the building and visually enclose the back side of the viewing deck area.

4.3.6 The Snow Queen's Turret

Landscapes are not only concerned with ecological values and functions – and they do not have to be boring! They can also symbolise a story or an idea about a place that plays with people's imaginations to create something more than infrastructure.

The Hans Christian Anderson fairy story is a playful theme that is developed through a series of stone features at the western end of the lake (Figures 7, 8 and10). The sculptural stacked stone lookout and stairway feature would extend over the water's edge, providing a lookout point for visitors walking the trail edge, a visual landmark that would help skiers and walkers to get their bearings and a special place that tells a special winter story (through words carved into stone) that might be familiar to some and an intriguing invitation to others.

The meandering lake trail would pass this location on its way down the batter to the Summit Loop Trail.

4.3.7 Lakeside Lookout

Another opportunity for a lake edge experience is located on the northern edge (Figures 7 and 9). The visitor has the chance to detour up a set of stone steps to a lookout set into the lake edge looking back to the ABOM 'beach' and across to the Snow Queen's Turret.

5. Timeline

The timeline outlined in Table 6 uses the same nomenclature as the HEMAMP (Biosis and GHD 2016b). That is, Year 1 is taken to be spring to winter of the year of construction, with the construction phase taking place in the summer of Year 1. Planting and seeding will therefore commence in autumn of Year 1.

Table 6 Rehabilitation timeline

Year	0				1							2
Month	Feb – Mar	Apr	May	June – Aug	Sept	Oct – Dec	Jan	Feb	Mar	Apr	May	Sept – Nov
Collect seed	X							X	X			
Collect cutting material		X	X									
Engage plant producer(s)		X	X									
Begin plant propagation of shrubs and Snow Gum			X									
Sow grass and forb seed for seedling production				X								
Order straw					X							
Liaise with project managers on rehabilitation areas					X			X				
Check on tubestock production with nurseries						X						
Construct holding bay (HB)							X					
Deliver straw to PCF							X	X				
Deliver tubestock to HB								X	X			
Hard landscaping (boulder placement and amenities)								X	X			
Engage planting crews								X	X			
Plant, sow and mulch									X	X		
Monitor, maintain and manage										X	X	X

6. Conclusion

This Ecological Rehabilitation Plan outlines the revegetation, habitat creation and amenity landscaping within the Project Construction Footprint for the Mount Buller water storage project. This Plan aims to achieve the following key performance criteria:

- Soil will remain covered and protected throughout the rehabilitation area at all times.
- There will be no overall loss of key pre-construction ecological values (cover of native vegetation and habitat for Alpine Bog Skink and Broad-toothed).
- New habitat for Mountain Pygmy Possum will be created within the PCF (no habitat currently exists within the PCF).
- There will be improved connectivity of native vegetation outside the PCF as a result of revegetation of areas of the PCF that currently support introduced vegetation.

Importantly, the rehabilitation program described herein makes the most of the recreational and place-making features of the proposed water storage without compromising the overall goal of ecological restoration.

Figures

Revegetation Zones

Zone A

This zone has sections of Sub-alpine Woodland (EVC 43) and Alpine Grassy Heathland (EVC 1004). Zone A covers approximately 1.99 hectares of the PCF. This zone is currently classified as having 'high' ecological values and will require the highest level of ecological rehabilitation. Rehabilitation of Zone A will focus on establishing dense and diverse native vegetation equivalent to the pre-construction EVC and on creating fauna habitat with logs, rocks and boulders.

Zone B

This zone has some sections of Alpine Grassy Heathland (EVC 1004) but has been previously disturbed, which is evident from the presence of introduced vegetation and bare ground. Zone B covers approximately 2.52 hectares of the PCF. This zone is currently classified as having 'medium' ecological value. The rehabilitation of Zone B will focus on protecting soil by the use of mulches, increasing native vegetation cover by planting indigenous heath species and inhibiting the spread of introduced species into Zone A.

Zone C

This zone consists mostly of introduced vegetation over disturbed areas (ski slopes, tracks and set down areas). Zone C covers approximately 0.78 ha of the PCF. This zone is currently classified as having 'low' ecological value. The rehabilitation of Zone C will focus on protecting and buffering higher value

Zone A Revegetation Species

Alpine Baeckea	*Baeckea gunniana*
Alphine Grevillea	*Grevillea australis*
Alpine Mint-bush	*Prostanthera cuneate*
Alpine Rice-flower	*Pimelea alpina**
Alpine Star-bush	*Asterolasia trymalioides*
Alpine Pepper	*Tasmannia xerophila**
Alpine Podolobium	*Podolobium alpestre*
Alpine Wallaby-grass	*Rytidosperma nudiflorum*
Alpine Yam-daisy	*Microseris lanceolata**
Ashen Billy-buttons	*Craspedia coolaminica*
Common Trigger-plant	*Stylidium armeria*
Dusty Daisy-bush	*Olearia phlogopappa* var. *flavescens*
Granite Buttercup	*Ranunculus graniticola*
Horny Snow-grass	*Poa fawcettiae*
Orange Everlasting	*Xerochrysum subundulatum*
Small-leaf Bramble	*Rubus parvifolius**

Zone A Revegetation Species cont.

Snow Gum	*Eucalyptus pauciflora*
Alpine Rusty-pods	*Hovea montana*
Kerosene Bush	*Ozothamnus cupressoides*
Slender Snow-daisy	*Celmisia pugioniformis*
Snow Grasses	*Poa spp. (fawcettiae, helmsii, ensiformis)**
Sub-alpine Beard-heath	*Acrothamnus maccraei**

Zone B Revegetation Species

Alpine Baeckea	*Baeckea gunniana*
Alpine Grevillea	*Grevillea australis*
Alpine Mint-bush	*Prostanthera cuneata*
Alpine Rice-flower	*Pimelea alpina**
Alpine Rusty-pods	*Hovea montana*
Alpine Star-bush	*Asterolasia trymalioides*
Horny Snow-grass	*Poa fawcettiae*
Kerosene Bush	*Ozothamnus cupressoides*

Zone C Revegetation Species

Alpine Rice-flower	*Pimelea alpina**
Alpine Rusty-pods	*Hovea montana*
Horny Snow-grass	*Poa fawcettiae*
Kerosene Bush	*Ozothamnus cupressoides*

CONSTRUCTION FOOTPRINT (PCF)

CONSTRUCTION FOOTPRINT (PCF)

CONSTRUCTION FOOTPRINT (PCF)

REFER FIGURE 3 FOR LANDSCAPE MASTER PLAN

PROJECT CONSTRUCTION FOOTPRINT (PCF)

EARTH EMBANKMENT FOOTPRINT

WATER STORAGE FACILITY FOOTPRINT

EXTENT OF REVEGETATION (5.29 HA)

SCALE 1:3200(A3)

0 32 64 160

PROPOSED REVEGETATION ZONES

ZONE A

ZONE B

ZONE C

ECOLOGICAL VEGETATION CLASSES (GHD)

EVC 1004 - ALPINE GRASSY HEATHLAND

EVC 43 - SUB-ALPINE WOODLAND

1 EXISTING ABOM LIFT BUILDINGS

2 EXISTING GRAVEL CARPARK

3 EXISTING GRAVEL DRIVE TRACK

NOTES

All rehabilitation works, but particularly works around the water storage embankment, will be designed with geotechnical stability, surface water management and erosion minimisation as a priority.

*These species are known to have Indigenous cultural significance and may be the focus of interpretive signage.

Figure 1 Revegetation & Habitat Rehabilitation Plan

Mt Buller Sustainable Water Security Project

PROJECT_DRG NO 0316-0738-01_D003-03 REV 05 DRWN ML/MG CHKD MG APPROV AH DATE 08.12.2016

biosis

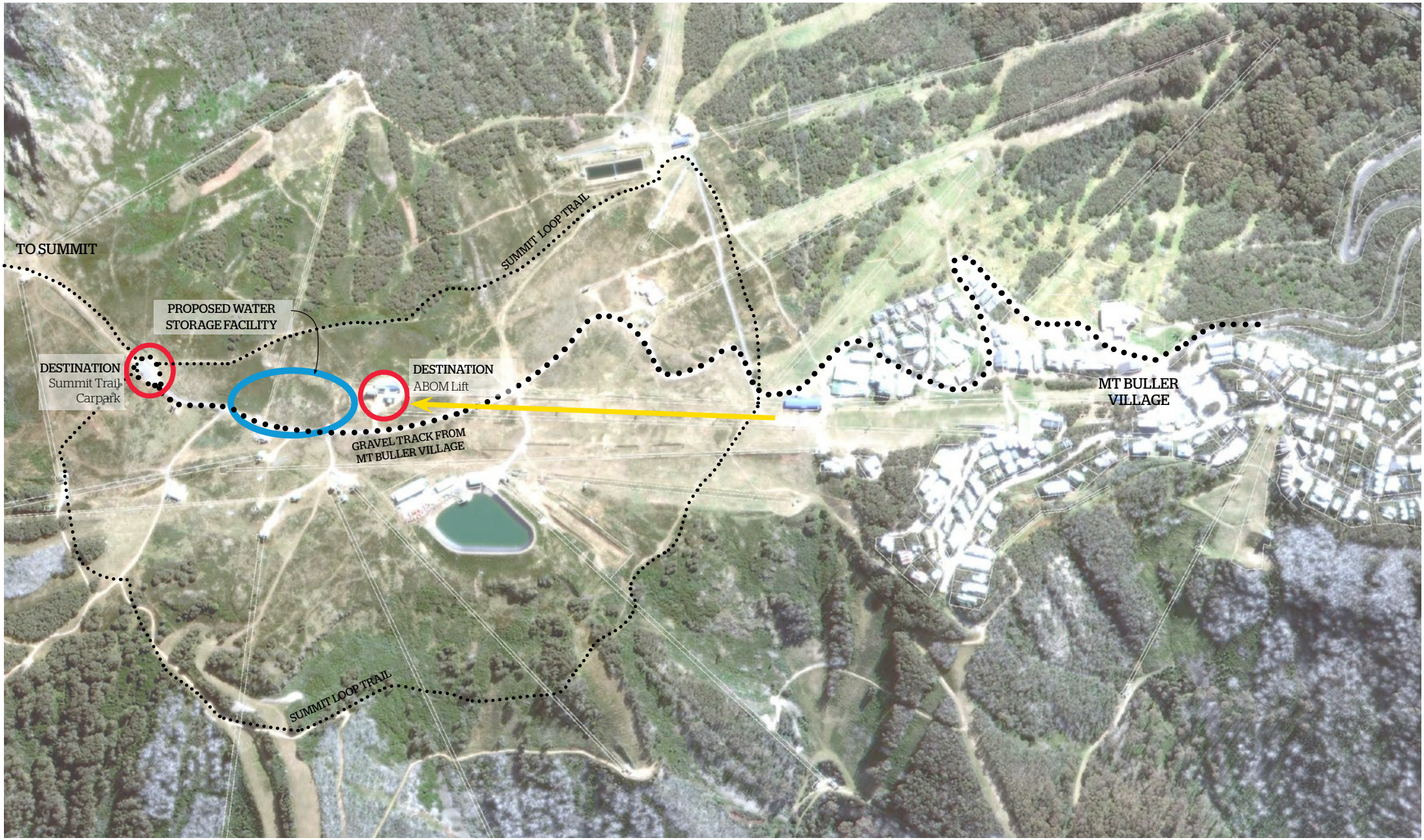
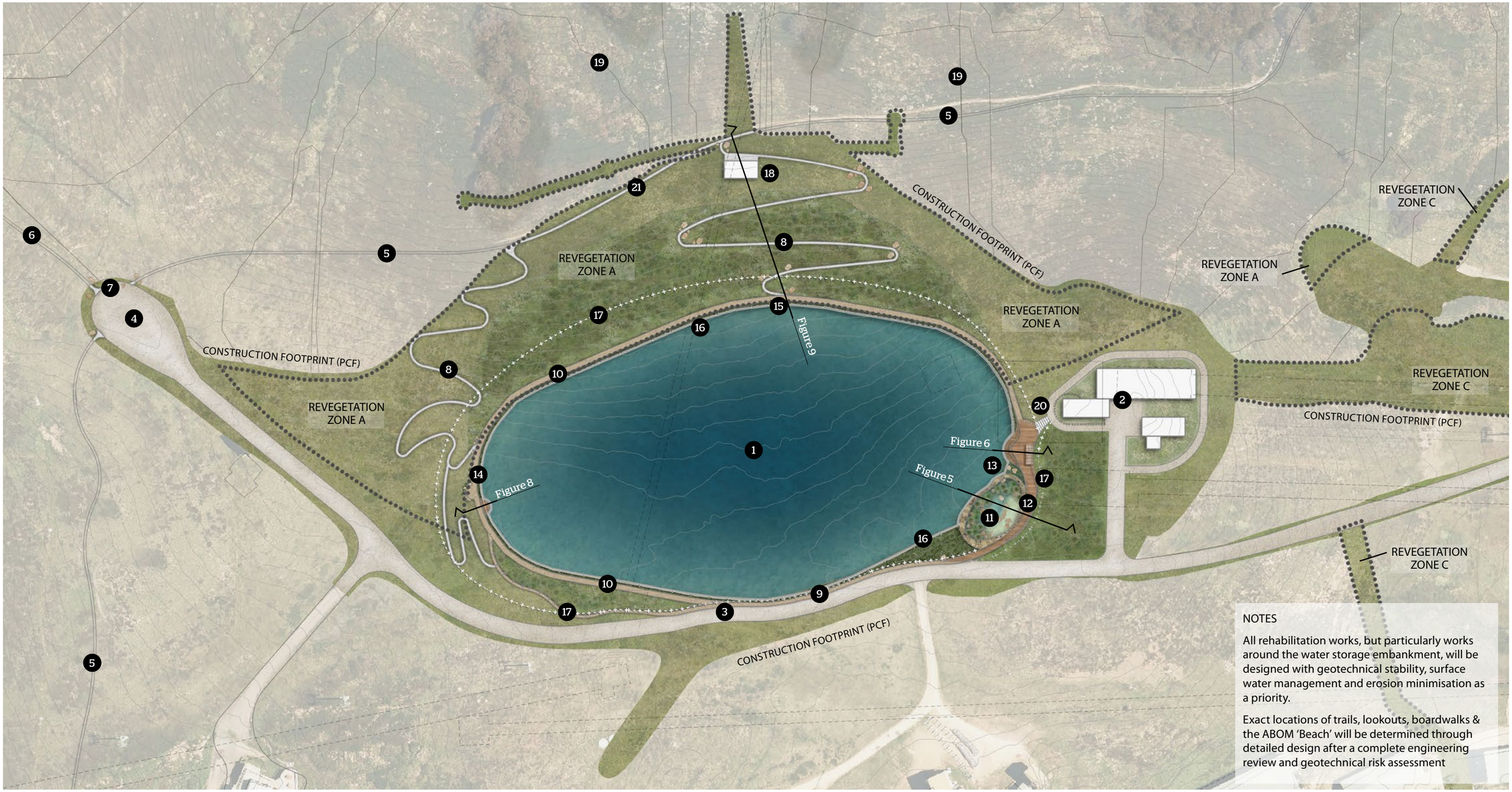


Figure 2 Landscape Master Plan Context Plan

Mt Buller Sustainable Water Security Project

PROJECT_DRG NO 0316-0738-01_D003-02 REV 05 DRWN RF CHKD RF APPROV MR DATE 08.12.2016

Tract



1. WATER STORAGE FACILITY
2. ABOM LIFT & MAINTENANCE FACILITY
3. REALIGNED GRAVEL DRIVE TRACK
4. EXISTING SUMMIT GRAVEL CARPARK
5. EXISTING SUMMIT LOOP TRAIL (WILL ALSO PROVIDE MAINTENANCE ACCESS TO PUMPHOUSE FROM CARPARK)
6. TRAIL TO SUMMIT
7. SUMMIT TRAILHEAD (SEATING, INTERPRETIVE SIGNAGE, MAP, SHELTER, BIKE RACKS & BBQS ON/IMMEDIATELY ADJACENT TO CARPARK INSIDE CONSTRUCTION FOOTPRINT)
8. LAKE SIDE TRAIL - NARROW, MEANDERING PEDESTRIAN ONLY TRAIL. OUTCROPS OF LOGS & BOULDERS PROVIDE HABITAT & WINTER RECREATION
9. LAKE SIDE TRAIL - ALIGNED WITH LAKE EDGE & GRAVEL DRIVE TRACK
10. LAKESIDE MAINTENANCE TRAIL
11. ABOM 'BEACH' - SHALLOW ROCK POOL/ WADING/ PLAY AREA
12. ABOM BOARDWALK (WITH SEATING)
13. ABOM VIEWING DECK (SHELTER, SEATING, BIKE RACKS, INTERPRETIVE PANELS, SIGNAGE)
14. SNOW QUEEN'S TURRET (LOOKOUT)
15. LAKESIDE LOOKOUT
16. ALL YEAR DECORATIVE SECURITY FENCE (1.2M)
17. WINTER ONLY SAFETY FENCING (3.5M)
18. PROPOSED PUMPHOUSE
19. ALPINE BOGS CATCHMENT BOUNDARIES
20. ARCHITECTURAL IMPROVEMENT TO ABOM BUILDING FACADE AT WESTERN END
21. INTERPRETATIVE SIGNAGE ALONG EACH TRAIL WILL FOCUS ON A DIFFERENT ASPECT OF ALPINE CULTURE/ENVIRONMENT

• • • REVEGETATION ZONES A, B & C (SEE FIGURE 1 FOR DETAIL)

SCALE1:1500 (A3)

0 27 53 133

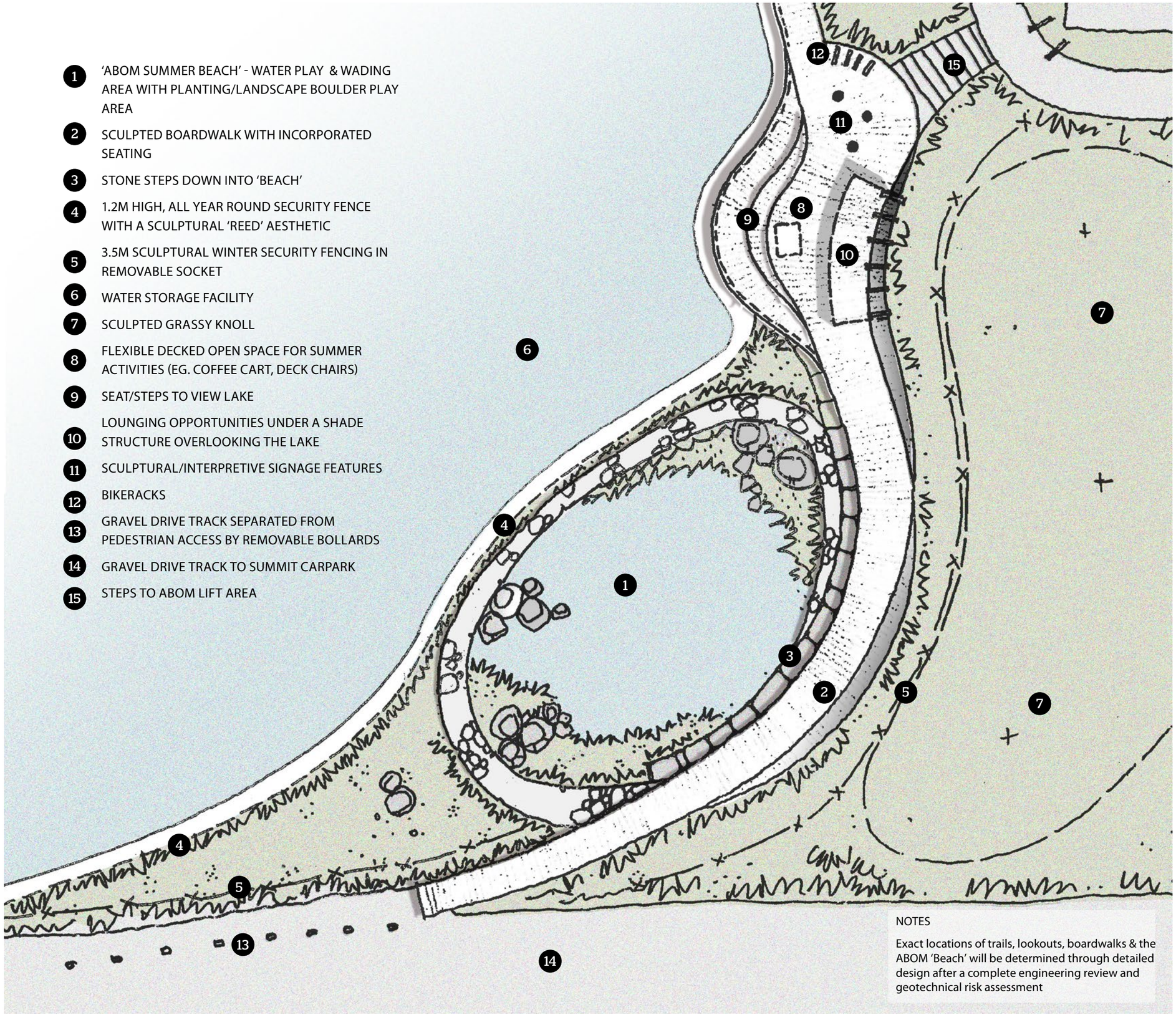
Figure 3 Landscape Master Plan

Mt Buller Sustainable Water Security Project

PROJECT_DRG NO 0316-0738-01_D003-04 REV 05 DRWN BC/ML CHKD RF APPROV RF DATE 08.12.2016

Tract

1. 'ABOM SUMMER BEACH' - WATER PLAY & WADING AREA WITH PLANTING/LANDSCAPE BOULDER PLAY AREA
2. SCULPTED BOARDWALK WITH INCORPORATED SEATING
3. STONE STEPS DOWN INTO 'BEACH'
4. 1.2M HIGH, ALL YEAR ROUND SECURITY FENCE WITH A SCULPTURAL 'REED' AESTHETIC
5. 3.5M SCULPTURAL WINTER SECURITY FENCING IN REMOVABLE SOCKET
6. WATER STORAGE FACILITY
7. SCULPTED GRASSY KNOLL
8. FLEXIBLE DECKED OPEN SPACE FOR SUMMER ACTIVITIES (EG. COFFEE CART, DECK CHAIRS)
9. SEAT/STEPS TO VIEW LAKE
10. LOUNGING OPPORTUNITIES UNDER A SHADE STRUCTURE OVERLOOKING THE LAKE
11. SCULPTURAL/INTERPRETIVE SIGNAGE FEATURES
12. BIKERACKS
13. GRAVEL DRIVE TRACK SEPARATED FROM PEDESTRIAN ACCESS BY REMOVABLE BOLLARDS
14. GRAVEL DRIVE TRACK TO SUMMIT CARPARK
15. STEPS TO ABOM LIFT AREA



NOTES

Exact locations of trails, lookouts, boardwalks & the ABOM 'Beach' will be determined through detailed design after a complete engineering review and geotechnical risk assessment

SCALE 1:250 (A3)

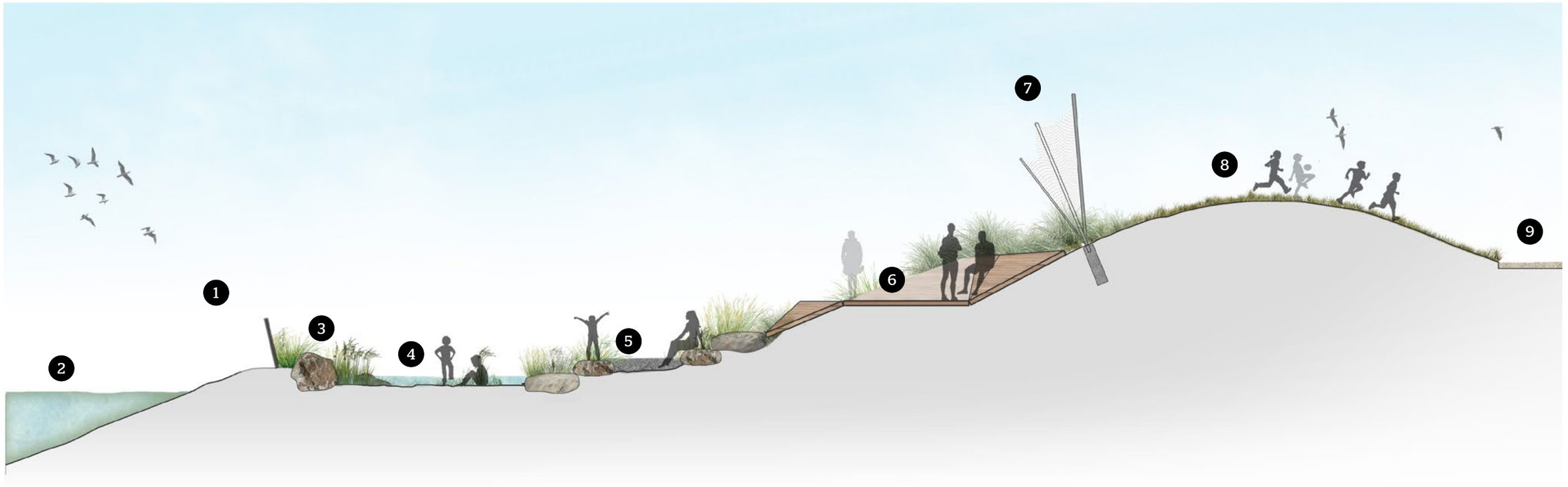
0 25 50 125

Figure 4 ABOM 'Beach', Boardwalk & Viewing Deck

Mt Buller Sustainable Water Security Project

PROJECT_DRG NO 0316-0738-01_D003-04 REV 05 DRWN RF CHKD RF APPROV MR DATE 08.12.2016

Tract



1. 1.2M HIGH, ALL YEAR ROUND SECURITY FENCE
2. WATER STORAGE FACILITY
3. LOW VEGETATION AND BOULDERS FOR ACCESS
4. 'ABOM SUMMER BEACH' - WATER PLAY & WADING AREA
5. PLANTING/LANDSCAPE BOULDER PLAY AREA
6. SCULPTED BOARDWALK WITH INCORPORATED SEATING
7. 3.5M SCULPTURAL WINTER SECURITY FENCING IN REMOVABLE SOCKET
8. SCULPTED GRASSY KNOLL
9. GRAVEL ROAD ACCESS TO ABOM LIFT

NOTES

Exact locations of trails, lookouts, boardwalks & the ABOM 'Beach' will be determined through detailed design after a complete engineering review and geotechnical risk assessment

SCALE 1:10 A3

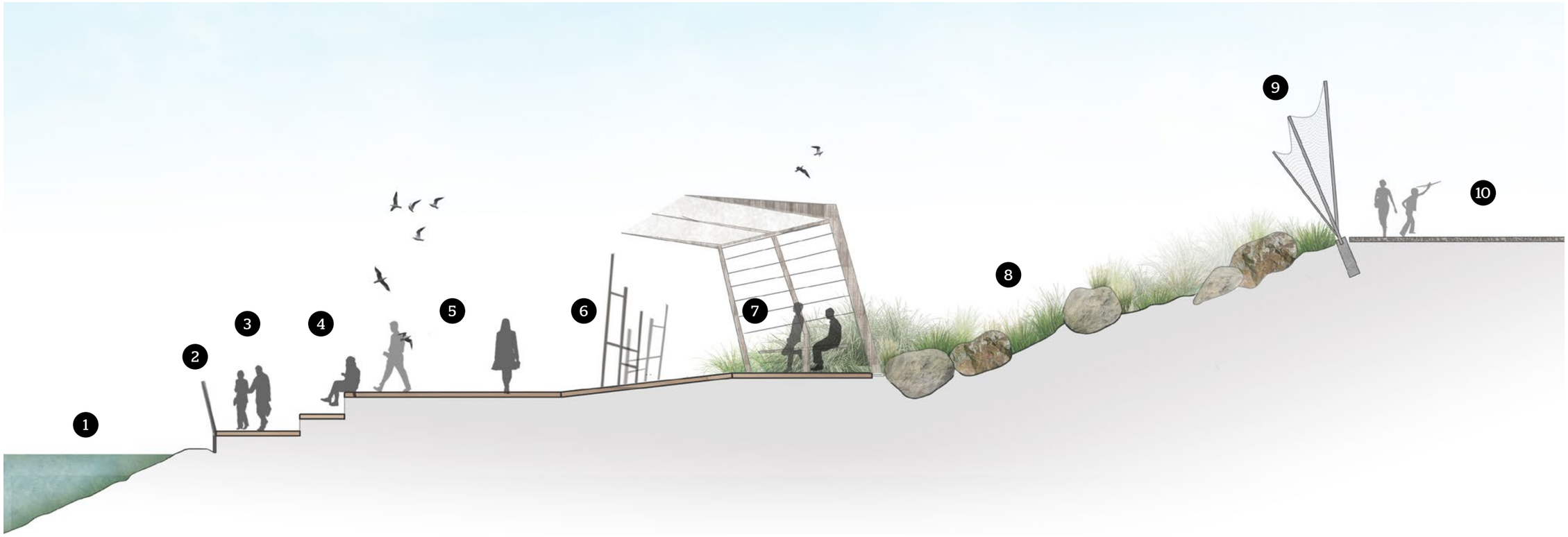
0 2 4 10

Figure 5 ABOM 'Beach' - Landscape Section

Mt Buller Sustainable Water Security Project

PROJECT_DRG NO 0316-0738-01_D003-05 REV 05 DRWN BE CHKD RF APPROV RF DATE 08.12.2016

Tract



1. WATER STORAGE FACILITY
2. ALL YEAR ROUND 1.2M SECURITY FENCE
3. LAKESIDE TRAIL
4. SEAT/STEPS TO VIEW LAKE
5. FLEXIBLE DECKED OPEN SPACE FOR SUMMER ACTIVITIES (EG. COFFEE CART, DECK CHAIRS)
6. SCULPTURAL/INTERPRETIVE SIGNAGE FEATURES
7. LOUNGE OPPORTUNITIES UNDER A SHADE STRUCTURE OVERLOOKING THE LAKE
8. PLANTED/BOULDER EMBANKMENT
9. 3.5M HIGH WINTER SECURITY FENCING IN REMOVABLE SOCKET
10. GRAVEL ACCESS TO ABOM LIFT

NOTES

Exact locations of trails, lookouts, boardwalks & the ABOM 'Beach' will be determined through detailed design after a complete engineering review and geotechnical risk assessment

SCALE 1:10 A3

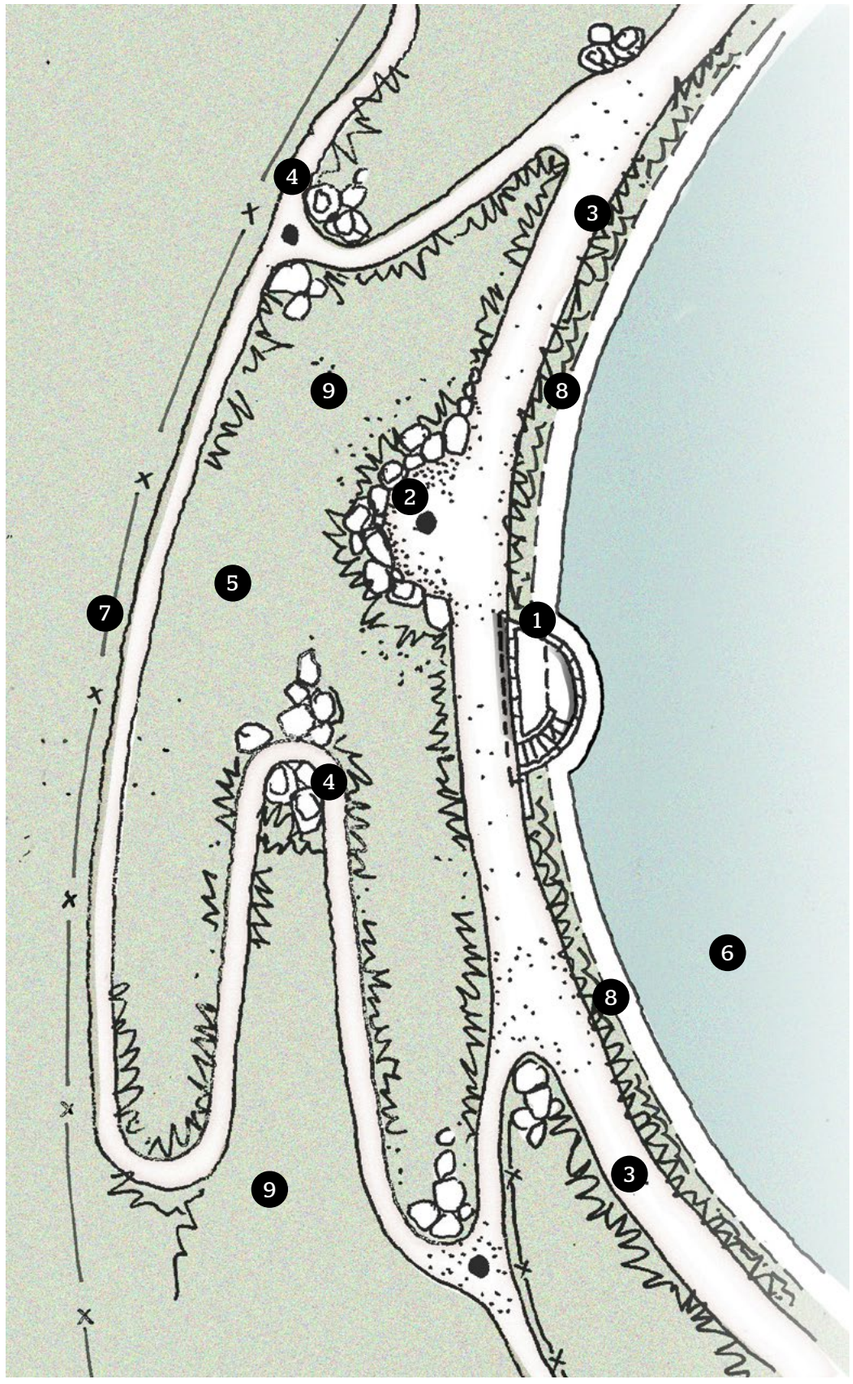
0 2 4 10

Figure 6 ABOM Boardwalk & Viewing Deck- Landscape Section

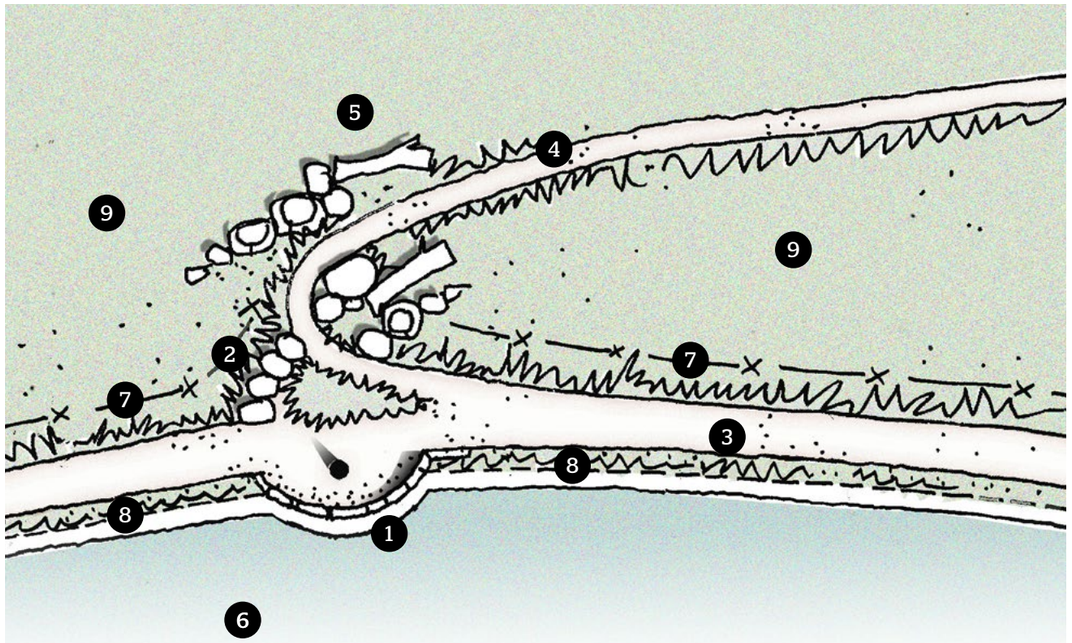
Mt Buller Sustainable Water Security Project

PROJECT_DRG NO 0316-0738-01_D003-06 REV 05 DRWN BE CHKD RF APPROV RF DATE 08.12.2016

Tract



SNOW QUEEN'S TURRET



LAKESIDE LOOKOUT

1. SNOW QUEEN'S TURRET LOOKOUT. A MEANS OF WAYFINDING AND ORIENTATION. FEATURES STONE STEPS UP TO A LOOKOUT POINT.
2. SNOW QUEEN'S GARDEN SEATING AREA & INTERPRETIVE PANELS
3. LAKESIDE PEDESTRIAN TRAIL /MAINTENANCE TRAIL
4. MEANDERING PEDESTRIAN ONLY TRAIL
5. PLANTED EMBANKMENT WITH BOULDERS AND LOGS
6. WATER STORAGE FACILITY
7. 3.5M HIGH WINTER SECURITY FENCING IN REMOVABLE SOCKET
8. ALL YEAR ROUND 1.2M SECURITY FENCE
9. PROPOSED REVEGETATION ZONE A

LAKESIDE LOOKOUT

1. LAKE LOOKOUT POINT AND OPPORTUNITIES FOR CULTURAL INTERPRETATION THROUGH SCULPTURE AND WAYFINDING
2. STONE STEPS UP TO LOOKOUT POINT
3. LAKESIDE PEDESTRIAN TRAIL /MAINTENANCE TRAIL
4. MEANDERING PEDESTRIAN ONLY TRAIL
5. PLANTED EMBANKMENT WITH BOULDERS AND LOGS
6. WATER STORAGE FACILITY
7. 3.5M HIGH WINTER SECURITY FENCING IN REMOVABLE SOCKET
8. ALL YEAR ROUND 1.2M SECURITY FENCE
9. PROPOSED REVEGETATION ZONE A

NOTES

All rehabilitation works, but particularly works around the water storage embankment, will be designed with geotechnical stability, surface water management and erosion minimisation as a priority.

Exact locations of trails, lookouts, boardwalks & the ABOM 'Beach' will be determined through detailed design after a complete engineering review and geotechnical risk assessment

SCALE 1:250 (A3)

0 25 50 125

Figure 7 Snow Queen's Turret & Lakeside Lookout - Plan Enlargement

Mt Buller Sustainable Water Security Project

PROJECT_DRG NO 0316-0738-01_D003-07 REV 05 DRWN RF CHKD RF APPROV MR DATE 08.12.2016

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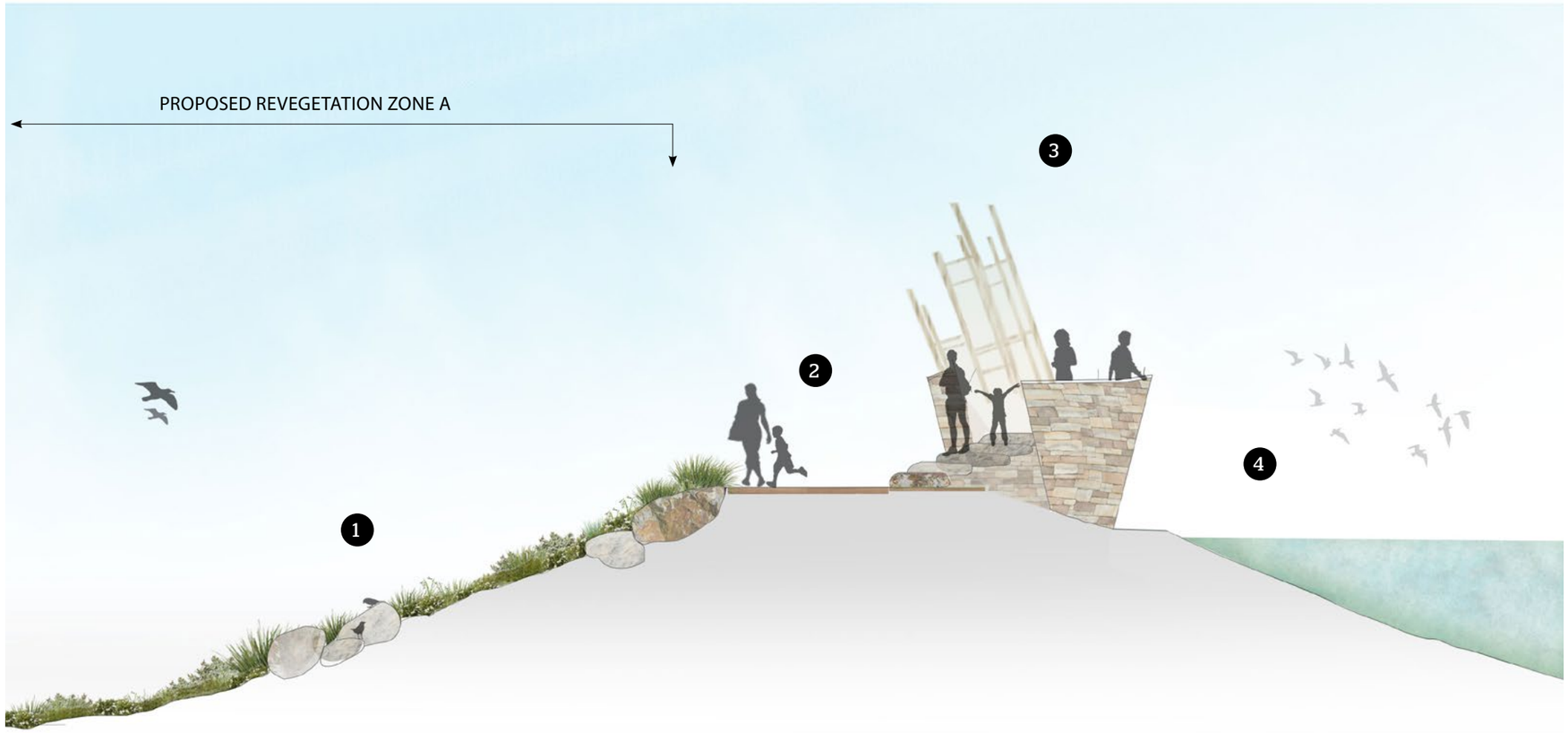

1. PLANTED EMBANKMENT WITH BOULDERS AND LOGS
2. LAKESIDE PEDESTRIAN TRAIL
3. SNOW QUEEN'S TURRET LOOKOUT. A MEANS OF WAYFINDING AND ORIENTATION
4. WATER STORAGE FACILITY

NOTES

All rehabilitation works, but particularly works around the water storage embankment, will be designed with geotechnical stability, surface water management and erosion minimisation as a priority.

Exact locations of trails, lookouts, boardwalks & the ABOM 'Beach' will be determined through detailed design after a complete engineering review and geotechnical risk assessment

SCALE 1:10 A3

0 2 4 10

Figure 8 Snow Queen's Turret - Landscape Section

Mt Buller Sustainable Water Security Project

PROJECT_DRG NO 0316-0738-01_D003-08 REV 05 DRWN BE CHKD RF APPROV RF DATE 08.12.2016

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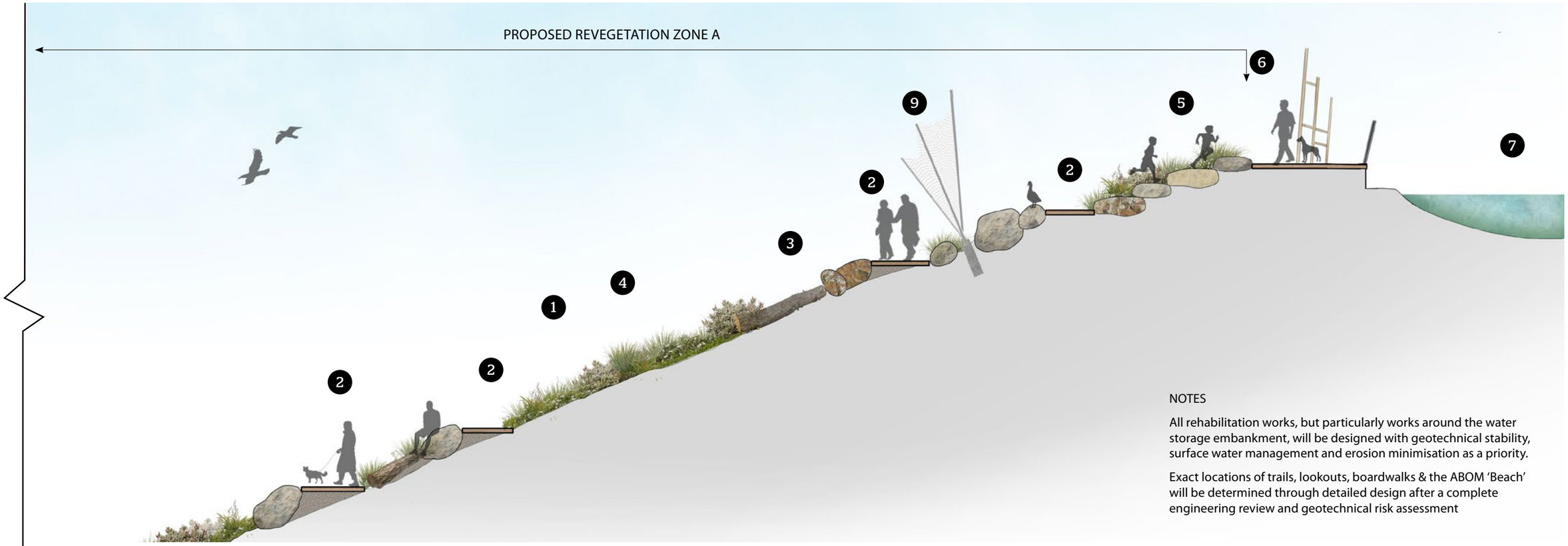
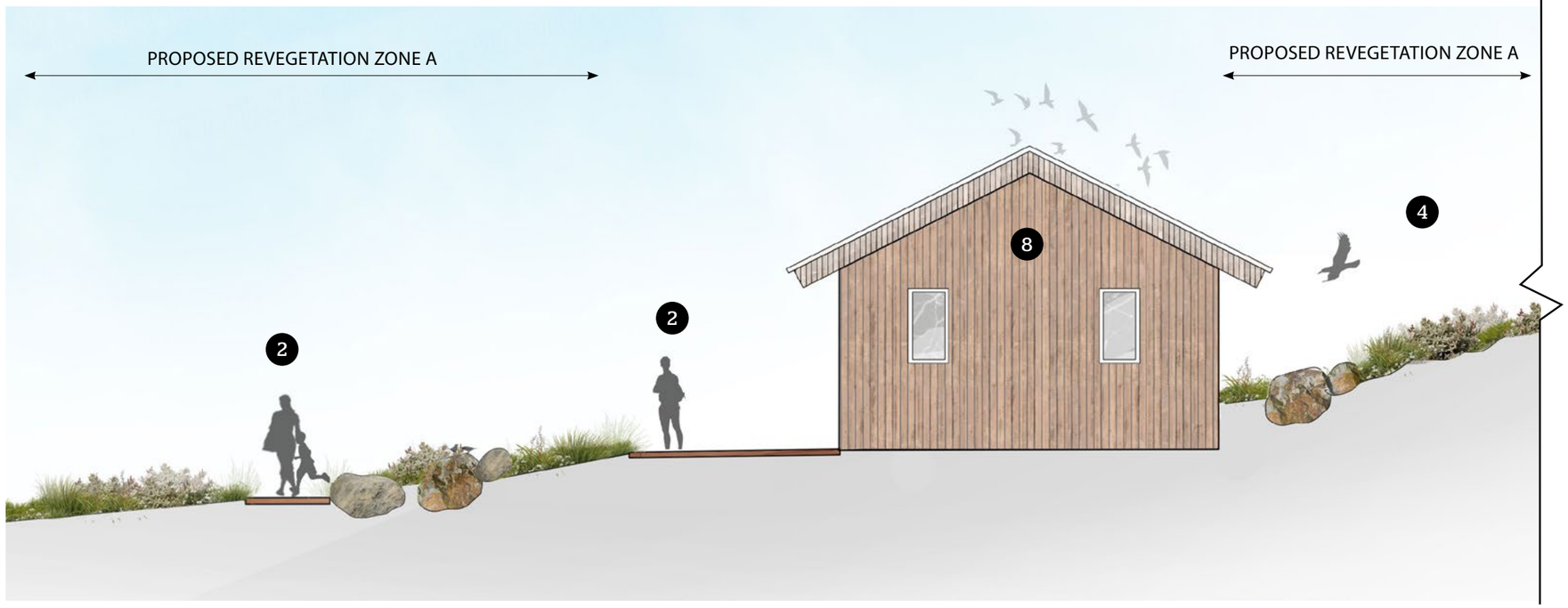


1. EARTH EMBANKMENT/ CONSTRUCTED BATTER
2. 1.2M WIDE PEDESTRIAN TRAIL MEANDERING DOWN THE EMBANKMENT
3. BOULDERS AND LOGS CREATE PLAY OPPORTUNITIES FOR WINTER PLAY & HABITAT RESTORATION
4. LARGE AREAS OF EARTH EMBANKMENT DEDICATED TO THE HABITAT RESTORATION AND REVEGETATION
5. STONE STEPS TO LAKE LOOKOUT
6. LAKE LOOKOUT AND OPPORTUNITIES FOR CULTURAL INTERPRETATION THROUGH SCULPTURE AND WAYFINDING TECHNIQUES
7. WATER STORAGE FACILITY
8. PROPOSED PUMPHOUSE - HARDWOOD CLAD TIMBER STRUCTURE TO REFLECT THE FORM OF HISTORIC ALPINE HUTS. REFER GHD DETAILS.
9. 3.5M HIGH WINTER SECURITY FENCING IN REMOVABLE SOCKET



SCALE 1:10 A3

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Figure 9 Lakeside Lookout - Landscape Section

Mt Buller Sustainable Water Security Project

PROJECT_DRG NO 0316-0738-01_D003-09 REV 05 DRWN BE CHKD RF APPROV RF DATE 08.12.2016

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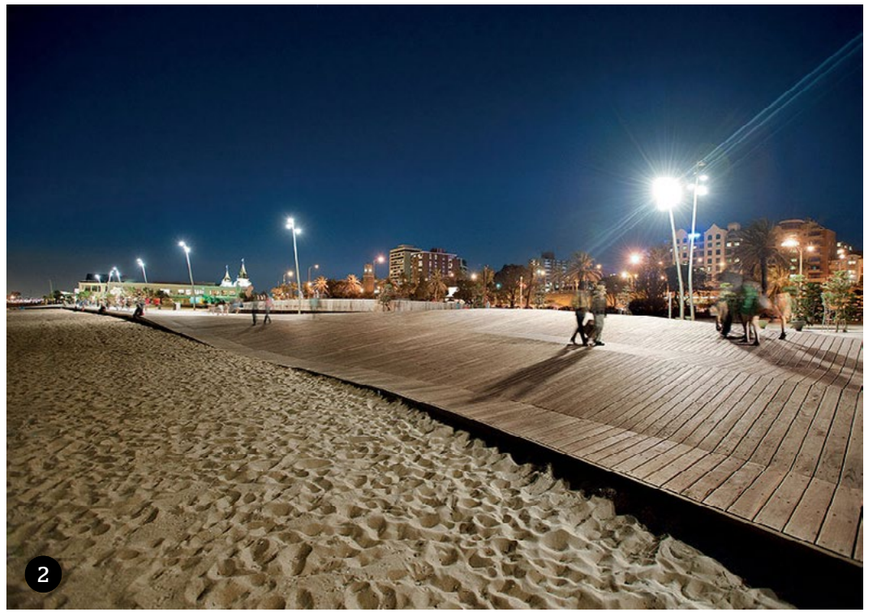

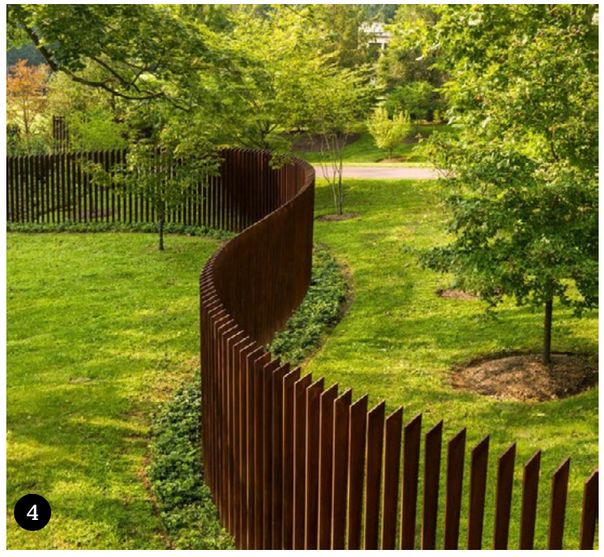

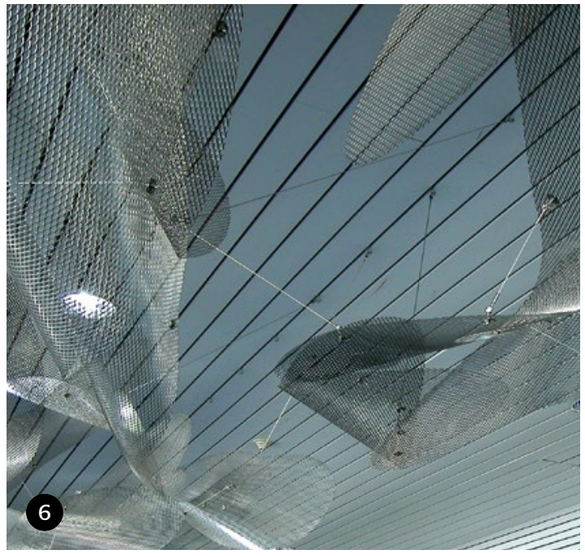

1. THE SNOW QUEEN'S TURRET
2. SCULPTED TIMBER BOARDWALK
3. THE SNOW QUEEN
4. 'REED' INSPIRED FENCING
5. FENCING ALONG BOARDWALK
6. WINTER FENCING - DRAPED METAL BETWEEN POSTS

Figure 10 Design Inspiration

Mt Buller Sustainable Water Security Project

References

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Biosis and GHD 2016b. Mount Buller Sustainable Water Security Project – Off-stream Storage: Hydrological and Ecological Monitoring and Adaptive Management Program. Report for Mount Buller and Mount Stirling Alpine Resort Management Board. Authors: Goddard M, Gibson M and Harvey A of Biosis Pty Ltd and Jones G, Anderson T, Wills T and Dahl S of GHD Pty Ltd, Melbourne. Project no. 22610.

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Zola N and Gott B 1992. Koorie Plants Koorie People: Traditional Aboriginal Food, Fibre and Healing Plants of Victoria. Globe Press, Melbourne.

Appendices

Appendix 1 DELWP's request for further information

Department of Environment,
Land, Water & Planning

8 Nicholson Street
East Melbourne
Victoria 3002
Australia
Telephone: 03 9208 3333
www.delwp.vic.gov.au
DX210098

File Ref. :FOL/16/31250
Appl. Ref.:PA1600138

23 September 2016

Alicia Burnett
Meinhardt
Level 12, 501 Swanston Street
MELBOURNE VIC 3000

Dear Ms Burnett,

ALPINE RESORTS PLANNING SCHEME
APPLICATION FOR PLANNING PERMIT NO. PA1600138
MT BULLER ALPINE RESORT, MT BULLER

I refer to the above application submitted to the Minister for Planning C/- Department of Environment, Land, Water and Planning (DELWP) on 24 August 2016.

A preliminary assessment of the application has revealed that further information pursuant to section 54(1) of the *Planning and Environment Act 1987* is required in order to properly consider your application.

Further Information

The further information required is:

1. A copy of *The Mountain Pygmy-possum (Burramys parvus) and the Mount Buller Sustainable Water Project – Overview*, Appendix H as referred to in the planning application.

2. Confirmation that a Cultural Heritage Management Plan (CHMP) or amended CHMP has approved for the revised construction footprint. Note, whilst the application can be lodged and may continue processing, the counting of any statutory days will not commence until an approved CHMP for the activity has been provided.

3. A detailed Project Rehabilitation Plan (or similar), as referred to in the *Flora and Fauna Assessment* and *Hydrological and Ecological Monitoring and Adaptive Management Plan*. Please refer to preliminary assessment comments below for further explanation.

4. Confirmation or verification of the development costs of the proposal. Should the development costs be greater than $7,000,0000 additional application fees will apply.

This request for further information is made pursuant to section 54 of the *Planning and Environment Act 1987* (the Act) and must be received **on or before 2 December 2016**.

If you do not respond in writing to the entire content of this request for further information **on or before 2 December 2016**, your application will proceed with the information submitted to date. You are able to extend this deadline for the submission of further information but only if you make such a request before the date specified in this correspondence. The Minister for Planning must then either consent or refuse an extension of time to the further information lapse date in writing and appeal rights apply to any refusal of an extension of time for the further information date.

Preliminary comments

A detailed Project Rehabilitation Plan (or similar) is required up-front to assess all post construction impacts and ensure any competing objectives are considered during the course of the application. This plan would benefit from detailing both the project rehabilitation, revegetation and landscape outcomes. The plan should incorporate and build on the revegetation and rehabilitation components of the *Flora and Fauna Assessment* and the Landscape Masterplan in the *Landscape and Visual Impact Assessment*. It should also have regard for any relevant control measures of the *Geotechnical Risk Assessment* and *Hydrological and Ecological Monitoring and Adaptive Management Plan* (i.e any drainage impacts revegetation may have on the Alpine Bogs).

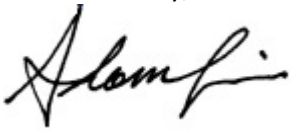
DELWP is likely to seek an independent review of the *Geotechnical Risk Assessment* during the course of the application. It is noted that the quantitative risk assessment has not been carried out on hazards with a 'low to moderate' residual risk. Given majority of the 'low to moderate' residual risks relate to post construction hazards, this review will not be progressed until further rehabilitation and landscape details are provided as it may have relevance to these hazards.

We advise the application will proceed to be referred under section 55 of the Act with a copy of this further information request. This will help determine any other additional information that may be required whilst you address this request. As the proposed development is within the ski field lease area, we note that further information may be requested in relation to the vegetation removal sought by this proposal and other current applications for ski field development.

We also understand you are engaging with DELWPs Impact Assessment unit which may explore any responsibilities under other legislation for the proposal. We encourage you to continue this approach concurrent to the planning application.

Should you have any further queries in relation to this matter please do not hesitate to contact Louisa Smith on telephone 8392 5484 or email louisa.smith@delwp.vic.gov.au.

Yours sincerely,



Adam Crupi
Manager, Development Approvals and Urban Design