



**Canterbury Coal Mine Wetland
Management Plan, Malvern Hills,
Coalgate.**

PREPARED FOR:

Bathurst Coal Limited
17 March 2021

TABLE OF CONTENTS

EXECUTIVE SUMMARY	3
1. INTRODUCTION	4
1.1 BACKGROUND	4
1.2 GOAL AND OBJECTIVES	6
2. BACKGROUND	7
2.1 ECOLOGICAL CONTEXT	7
2.2 SITE DESCRIPTION	8
2.2.1 North Property wetland	8
2.2.2 Bush Gully wetland	10
2.3 AREA TO BE PLANTED	12
2.4 PLANT SELECTION	12
3. SITE PREPARATION	14
3.1 FENCING	14
3.2 PEST PLANT CONTROL	14
3.3 ANIMAL PEST CONTROL	15
3.4 PLANT SELECTION	15
3.5 PLANTING DENSITY AND LAYOUT	15
3.6 PLANTS REQUIRED	16
3.7 PLANTING METHOD	19
4. MONITORING AND MAINTENANCE	20
4.1 MONITORING	20
4.1.1 Plant Establishment	20
4.1.2 Wetland Quality	20
4.2 MAINTENANCE	21
4.3 PLANT REPLACEMENT	21
4.4 ANIMAL PEST MONITORING	22
4.5 WEED MONITORING	22
4.6 WEED MANAGEMENT	22
5. PROPOSED TIMELINE	24
6. LEGAL PROTECTION	26
7. REFERENCES	27

APPENDICES:

Appendix 1: Sample Restoration Planting Monitoring Sheet

Appendix 2: Sample Weed Monitoring Sheet

EXECUTIVE SUMMARY

Bathurst Resources Limited has recently announced the closure of Canterbury Coal Mine with coal mining expected to cease around 30 June 2021. Rehabilitation work would continue for another 6 – 12 months after coal mining ends. As part of preparing for mine closure, BCL are seeking retrospective resource consents from Environment Canterbury and the Selwyn District Council to permit mining operations which have already been completed at the site, including removal of wetlands.

BCL proposes an integrated approach to compensate for wetland loss focussed on enhancement and restoration of two areas of wetland nearby. These areas include a raised seepage bog known as the North Property Wetland and a palustrine wetland adjoining Bush Gully Stream, as well as buffer plantings at both locations. Together the restoration sites occupy approximately 1.52ha, approximately 0.71ha of wetland and the balance comprising riparian and dryland habitats. It is considered that ecological restoration of these two sites would achieve the best overall environmental outcome at mine closure and compensate for the historic loss of wetlands and alteration to natural catchments within the mine footprint.

This wetland management plan has been prepared to guide the restoration efforts at the two sites. The overall goal is to establish a self-sustaining native vegetation community at the restoration sites which is ecologically appropriate and once established, requires minimal further management to persist in perpetuity. This management plan provides for:

- Revegetation planting of 10,480 plants comprising at least 22 species within the stream riparian, wetland and dryland parts of the restoration sites with planting to be completed by spring 2023. The revegetation target is 75% indigenous vegetation cover.
- Removal of unwanted plant pests. The outcome of weed control is a woody weed presence of <5%.
- Promoting ecological succession through the use of appropriate colonising species and use of local stock;
- Monitoring and active control of plant and animal pests within the areas intended for restoration as required (when plant losses or damage due to rabbits or hares exceed 1% or due to other species exceed 5%); and
- Annual monitoring of plant survival and wetland condition for five years to inform whether the objectives of this management plan have been achieved.

Plantings will be maintained for the life of this plan and management will be reviewed regularly in response to monitoring outcomes. This plan will be reviewed in 2023 as part of a review of mine closure.

1. INTRODUCTION

1.1 BACKGROUND

Bathurst Coal Limited (**'BCL'**, a wholly owned subsidiary of Bathurst Resources Limited, **'BRL'**) owns and operates the Canterbury Coal Mine (**'CCM'**) in the Malvern Hills near Coalgate in North Canterbury. The CCM is a long-standing, existing mine which supplies thermal coal to major agricultural businesses such as Fonterra. Bathurst Resources Limited has recently announced the closure of CCM with coal mining operations ceasing around 30 June 2021 and rehabilitation ongoing until all closure criteria have been met.

As part of mine closure BCL are seeking retrospective resource consents from Environment Canterbury and the Selwyn District Council to permit mining operations which have already been completed at the CCM site. The current suite of consent applications includes applications to both ECan and SDC for disturbance of wetlands over a total area of 1.2ha.

In order to address the retrospective loss of wīwī rush wetlands and the loss of a small part of the surface water catchment which feeds an area of undisturbed wīwī rush wetland near the raised bog on the north side of the former N02 pit, BCL proposes an integrated approach focussed on enhancement and restoration of two areas of wetland nearby: a raised seepage bog known as the North Property Wetland and a palustrine wetland adjoining Bush Gully Stream. The location of these two sites is shown in Figure 1. It is considered that ecological restoration of these two sites, combined with protection in perpetuity by way of a covenant for land owned by BCL, would achieve the best overall environmental outcome at mine closure and compensate for the historic loss of wetlands within the mine footprint.

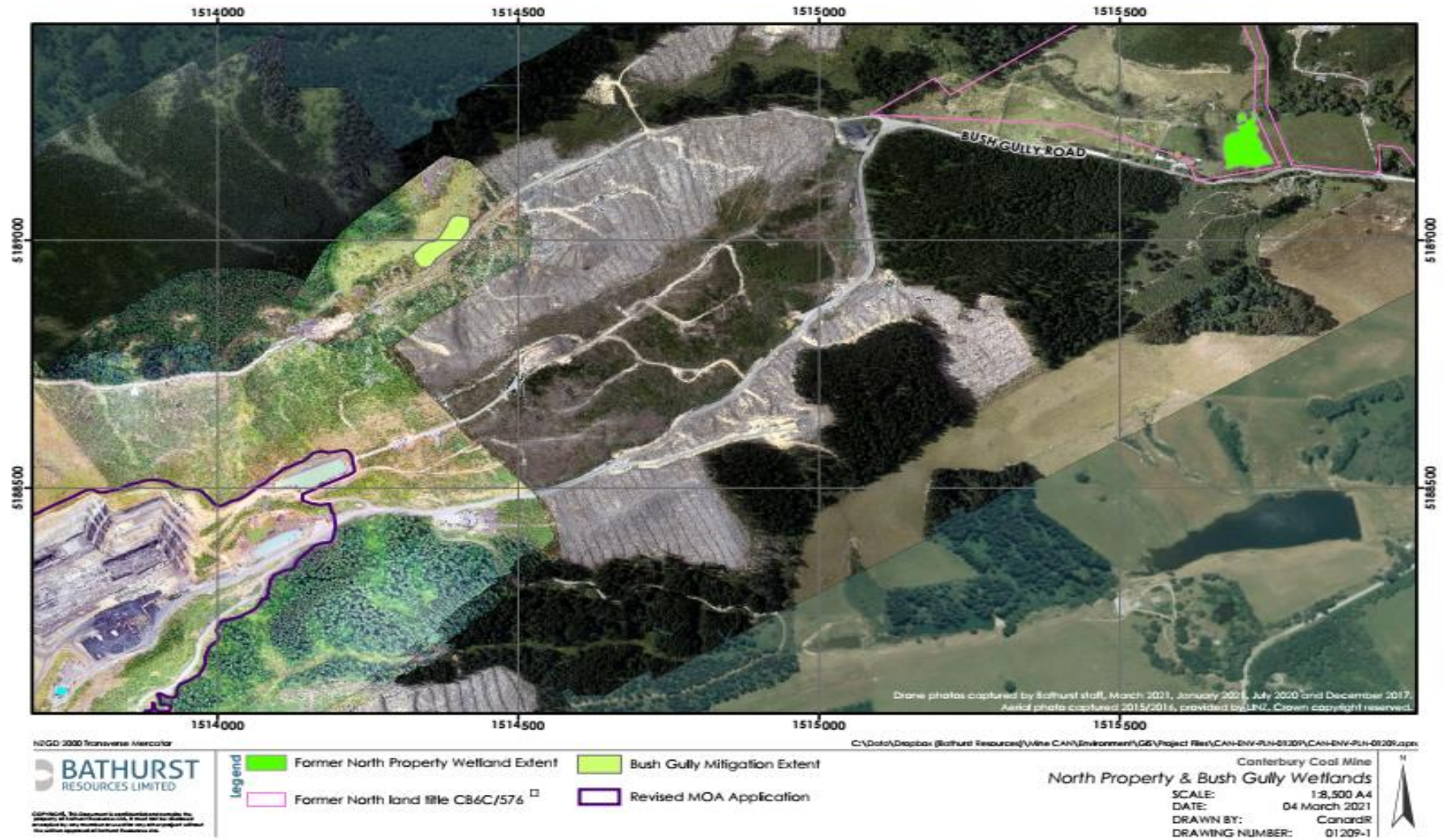


Figure 1: Location of North Property Wetland and Bush Gully Stream wetland, Malvern Hills, Coalgate.

Some ecological restoration work has already been undertaken at Bush Gully Stream wetland, including local removal of crack willow (*Salix fragilis*) and grey willow (*S. cinerea*). This management plan has been prepared to guide the ecological restoration of these two sites and includes wetland restoration methodology for both sites including a planting plan, weed control, planting methods, timing of works and maintenance and monitoring.

1.2 GOAL AND OBJECTIVES

The goal of this wetland management plan is to establish a self-sustaining native vegetation community at the restoration sites which is ecologically appropriate and once established, requires minimal further management to persist in perpetuity.

The objectives of this planting plan are as follows:

- To revegetate the North Property wetland and Bush Gully Stream wetland with ecologically appropriate species and restore indigenous vegetation to at least 70% cover at 1m height as demonstrated in plots across both wetland sites.
- Manage exotic pest plants (particularly woody weeds identified in this plan) over the restoration sites to a level of less than 5% cover as demonstrated in plots across both wetland sites.
- Improve terrestrial and wetland habitat quality and create corridors for wildlife movement.
- Encourage natural ecosystem processes including the regeneration and dispersal of indigenous fauna and flora.
- Improve aquatic habitats for Canterbury mudfish (*Neochanna burrowsius*) within Bush Gully Stream and associated habitats.

These objectives will be achieved by:

- Removal of unwanted plant pest species from within the areas identified for restoration.
- Revegetating the areas intended for restoration with eco-sourced, pioneer plants to establish a nurse crop into which light and moisture sensitive species will spread and establish via natural means of dispersal.
- Promoting ecological succession by including in the revegetation areas a selection of eco-sourced “diversity” or terminal plant species to initiate and promote successional processes in conjunction with natural dispersal.
- Monitoring and active control of plant and animal pests within the areas intended for restoration as required.

Plantings will be maintained for the life of this plan and management will be reviewed regularly in response to monitoring outcomes. This plan will be reviewed in 2023 as part of a review of mine closure activities at the site.

2. BACKGROUND

2.1 ECOLOGICAL CONTEXT

CCM is located within the Whitecliffs Ecological District and Canterbury Foothills Ecological Region (McEwen 1987). The Whitecliffs Ecological District comprises hill country and plains generally between 300m and 900m elevation and situated between the Waimakariri and Rakaia Rivers (McEwen 1987). The climate of the Whitecliffs district includes moderate (average 1200mm) annual rainfall, warm summers and cool winters with frequent frosts and occasional light snowfalls. The occasional foehn north westerly winds can give rise to temperatures exceeding 32°C (McEwen 1987). Pre-human natural vegetation included a mixture of lowland short tussock grasslands and a mosaic of forest and shrubland including black beech (*Fuscopora solandri*), occasional matai (*Prumopitys taxifolia*) and kahikatea (*Dacrydium dacrydioides*) (McEwen 1987). Most of the district is now farmed and there are extensive plantation forests.

Indigenous vegetation in the 400 – 800m elevation (montane) zone within the Canterbury Region has been reduced by approximately 60% and only 12% of the land within that zone has been legally protected (Canterbury Biodiversity Strategy 2008). This loss of indigenous cover in the montane zone has not been as extensive as in the lowland and coastal areas and some forest remnants, tussock grasslands, and ecological corridors remain. However, some parts of the hill country and inland basins have experienced rapid rates of land use change and intensification, which poses an increasing threat to remaining indigenous habitats and ecosystems (Canterbury Biodiversity Strategy 2008).

CCM is located near the headwaters of the Waikirikiri (Selwyn) River. The CCM site is drained by Oyster Gully Creek, Tara Stream and Bush Gully Stream which all drain to Waianiwaniwa River before entering Waikirikiri River, as well as Surveyors Gully Creek which drains directly to Waikirikiri River near Glentunnel. Three non-migratory indigenous fish species occur in Bush Gully Stream:

- Upland bully (*Gobiomorphus breviceps*) (Not threatened);
- Kōwaro, (Canterbury mudfish, *Neochanna burrowsius*) (Threatened (nationally critical));
- Canterbury galaxias (*Galaxias vulgaris*) (At risk (declining)).

Bush Gully Stream is recognised as being an important stronghold for Canterbury mudfish in particular. No migratory fish, such as eels, and no salmonids are known to be present.

Macroinvertebrate community index scores from sampling undertaken upstream of the Bush Gully wetland indicated that the stream's water quality and habitat were in poor condition in 2016 (Waterways Ltd., 2016). The National Institute of Water and Atmospheric Research - Taihoro Nukurangi ('NIWA') commenced a two-year aquatic ecology monitoring programme to assess and monitor the effects of mining activities on macroinvertebrates and fish in Tara Stream and Bush Gully Stream in November 2020.

The wetlands removed were identified from historic aerial photographs after their removal and their extent and ecological values were never quantified. They appeared to comprise wīwī rushland and were probably similar in nature and quality to the rushlands remaining on

surrounding farmland. These wetlands exhibit low species diversity and low overall ecological value.

2.2 SITE DESCRIPTION

2.2.1 North Property wetland

The North Property wetland is fed by ground water from at least three locations near the top of the slope and a stream which flows on the eastern margin and joins the wetland prior to entering Bush Gully Stream as well as rainfall. The wetland extends from near Bush Gully Road to Bush Gully Stream as shown in Figure 1. The area is currently part of a farm paddock and has been episodically grazed with cattle prior to BCL ownership

Vegetation at North Property wetland included an area of shallow open water near the top of the slope (nearest Bush Gully Road). Surrounding the open water were occasional native species such as purei (*Carex secta*) and swamp kiokio (*Parablechnum minus*) and frequent exotic species such as gorse (*Ulex europaeus*) and broom (*Cytisus scoparius*). Downslope native and exotic rushes such as *Juncus sarophorus*, *J. articulatus*, *J. amabilis*, *J. pallidus*, *J. effusus*, *Isolepis prolifera*, *Eleocharis gracilis*, rautahi (*Carex geminata*) and *Luzula picta* were common and interspersed with exotic grasses such as Yorkshire fog (*Holcus lanatus*), sweet vernal (*Anthoxanthum odoratum*) and creeping bent (*Agrostis stolonifera*) as well as herbs including creeping buttercup (*Ranunculus repens*), grassland buttercup (*R. multiscapus*) and monkey musk (*Erythranthe guttata*).

The wetland extends downslope covering an area of approximately 5,645m² and joins with Bush Gully Stream. This restoration plan includes a buffer surrounding the wetland and covers a total area of approximately 1.09ha adjoining the riparian margins of Bush Gully Stream as shown in Figure 2. Because of uncertainties in relation to the position of the boundary on the ground in relation to the existing legal roads, Figure 2 should be regarded as indicative only.

The vegetation outside the wetland and buffer area is low producing exotic pasture with common pasture herbs such as creeping buttercup and red clover (*Trifolium pratense*).

The North Property is owned by BCL. The wetland area is not legally protected and is not identified as a Significant Natural Area within the Selwyn District Plan.



Figure 2: Indicative location of the proposed North Property wetland restoration site, Malvern Hills, Coalgate.

2.2.2 Bush Gully wetland

Bush Gully wetland is a large wetland mosaic associated with Bush Gully Stream that extends both upstream and downstream of the restoration site shown in Figure 1.

The part of Bush Gully wetland complex identified for restoration includes approximately 0.42ha and comprises part of a large palustrine valley floor swamp and marsh wetland situated on a relatively flat floodplain up to 70m wide. Vegetation on both sides of the restoration area comprises plantation pine forest which forms part of Coalgate Forest, with the area on the true right having recently been harvested. Bush Gully Road lies immediately south of the restoration area and separates the restoration site from the pine plantation. There is no livestock access to this part of Bush Gully Stream.

The restoration site is shown in Figure 3 and includes two areas of crack willow (*Salix fragilis*) forest totalling approximately 2,900m², as well as existing areas of harakeke (lowland flax, *Phormium tenax*) and mikimiki (*Coprosma propinqua*) which will not require planting. The willow trees at the site have been killed with herbicide by BCL and left in place to decay. Planting will commence underneath these areas in late winter/spring 2021.

The existing understorey comprised a mix of indigenous and exotic plant species including harakeke and rautahi with less frequent purei, karamu (*Coprosma robusta*), mikimiki and occasional patete (*Schefflera digitata*), koromiko (*Veronica salicifolia*), makomako (wineberry, *Aristotelia serrata*), horoeka (lancewood, *Pseudopanax crassifolius*) and ferns such as swamp kiokio, kiwikipiwi (creek fern, *Cranfillia fluviatilis*) and little hard fern (*Austroblechnum pennamarina*). Exotic understorey plants included sapling crack willow plants, Himalayan honeysuckle (*Leycestria formosa*) and exotic grasses and herbs including tall fescue (*Lolium arundinaceum*), creeping bent, Yorkshire fog, creeping buttercup, cleavers (*Galium aparine*) and lotus (*Lotus pedunculatus*). Gorse and blackberry (*Rubus fruticosus* agg.) and elder (*Sambucus nigra*) were common on the immediate margins of the restoration site.

Much of the surrounding wetland area outside the restoration site was dominated by rautahi – tall fescue sedgeland with scattered gorse and Himalayan honeysuckle. Areas of dense harakeke and purei sedgeland occurred in wetter parts of the wetland complex, particularly downstream of the restoration site.

Matariki Forests owns the Bush Gully wetland site and surrounding land. Matariki have allowed BCL to undertake the wetland restoration outlined within this plan within the area shown in Figure 1. The area is not legally protected and is not identified as a Significant Natural Area within the Selwyn District Plan.

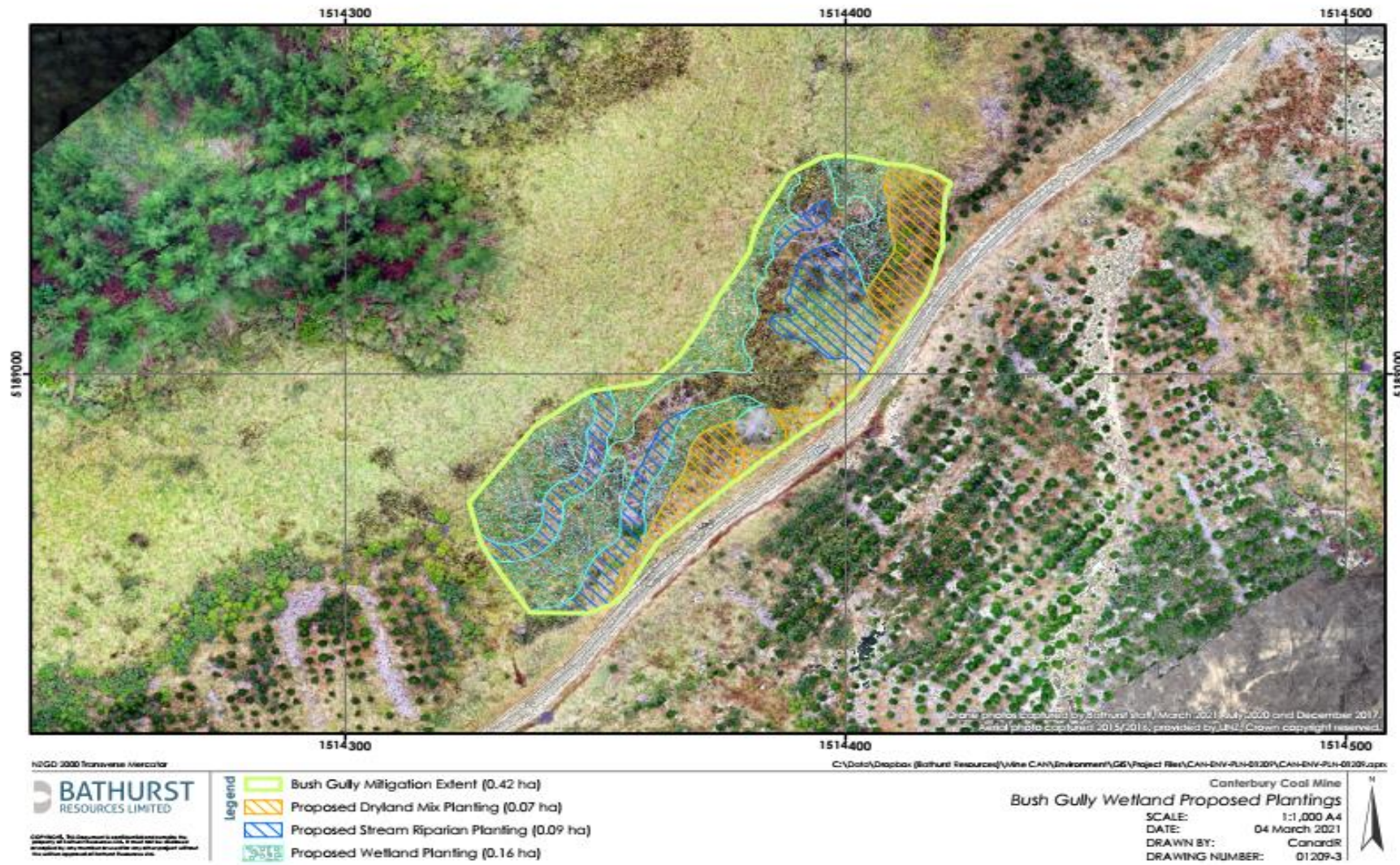


Figure 3: Indicative location of the proposed Bush Gully wetland restoration site, Malvern Hills, Coalgate.

2.3 AREA TO BE PLANTED

The area to be planted is shown in Figures 2 and 3 and comprises 15,100m² (1.51ha), including 1.09ha at the North Property and 0.42ha at Bush Gully wetland. At the North Property wetland this is divided into approximately 5,645m² of wetland planting and 5,255m² of dryland planting. At Bush Gully wetland it includes 900m² of riparian stream planting, 1,600m² of wetland planting and 700m² of dryland planting. The approach taken at these sites is to plant at a density of 10,000 stems/hectare or 1/m² in the riparian and dryland areas and 1 plant per 2m² in the wetland areas. A total of 10,480 plants comprising at least 23 species will be required.

2.4 PLANT SELECTION

The plant species proposed to be used are shown in Table 1, although other species may be used in addition to those listed (e.g. if they germinate from litter and duff collected nearby). Plant species known to have occurred within the site, that occur in similar habitats nearby and that would most likely have historically occurred on the site have been selected, including some that have already been propagated from locally collected seed and/or cuttings. The species mix has been designed to take into account the natural characteristics and variations across the site (e.g., in drainage, aspect, shelter, contour, etc.) and the plants available. Sufficient species diversity is present in the mix to allow the person doing the planting to use their knowledge and experience to locate plants in their preferred 'micro-zone'. Guidance for each 'micro-zone' is included in the comment section of the species list tables.

In order to make use of locally collected seed for dryland plantings in particular, forest litter and duff has been collected from a beech forest remnant in Bush Gully (approximately 2km west of Bush Gully wetland). Native seeds that germinate from this duff and litter will be used as appropriate in the revegetation plantings.

Plants have been considered for each area based on their ability to:

- Establish quickly and provide a suitable nursery crop to allow natural revegetation/ecological succession to develop;
- Grow in a high or low light situation;
- Tolerate the flooding and other water / drainage regime expected;
- Reliably establish in revegetation plantings elsewhere; and
- Contribute to natural ecological processes such as bird dispersal.

Table 1: Plant species proposed for use at CCM wetland restoration sites, Malvern Hills, Coalgate.

Scientific Name	Common Name
<i>Aristotelia serrata</i>	makomako, wineberry
<i>Austroderia richardii</i>	toetoe
<i>Carex geminata</i>	rautahi
<i>Carex secta</i>	purei

<i>Carex virgata</i>	pukio
<i>Carpodetus serratus</i>	putaputaweta, marbleleaf
<i>Coprosma robusta</i>	karamu
<i>Coprosma propinqua</i>	mikimiki
<i>Cordyline australis</i>	ti kouka, cabbage tree
<i>Dacrycarpus dacrydioides</i>	kahikatea
<i>Fuchsia excorticata</i>	kotukutuku, tree fuchsia
<i>Fuscospora solandri</i>	black beech
<i>Griselinia littoralis</i>	broadleaf
<i>Isolepis prolifera</i>	
<i>Juncus edgariae</i>	Edgar's rush
<i>Juncus spp.</i>	locally sourced native rushes
<i>Leptospermum scoparium</i> agg.	mānuka
<i>Myrsine australis</i>	mapou, matipo
<i>Phormium tenax</i>	harakeke, korari, New Zealand flax
<i>Schefflera digitata</i>	patete, seven-finger
<i>Pseudopanax arboreus</i>	whauwhaupaku, five-finger
<i>Pseudopanax crassifolius</i>	horoeka, lancewood
<i>Veronica salicifolia</i>	koromiko

The wettest areas would include a high proportion of species such as rushes and sedges (*Juncus spp.*, *Carex spp.*, *Isolepis prolifera*), with the wet edge including toetoe, harakeke, kahikatea (*Dacrycarpus dacrydioides*), tī kouka (cabbage tree *Cordyline australis*) and mānuka. Further from the wet margins, species such as mānuka, makomako, koromiko (*Veronica salicifolia*), putaputawētā (marbleleaf, *Carpodetus serratus*), mapou (matipo, *Myrsine australis*), broadleaf, patete (*Schefflera digitata*), horoeka and black beech would be used. Across the different zones the species would be intergraded to create a natural progression from wetter areas to dry.

3. SITE PREPARATION

3.1 FENCING

At the North Property existing deer fencing will be used to exclude livestock prior to the commencement of planting. At Bush Gully Livestock do not have access to the site and fencing to exclude livestock is not required.

3.2 PEST PLANT CONTROL

Any pest plants identified in the Canterbury Regional Council's Regional plan as well as any pest plant species known to occur either within or near the restoration sites will be controlled. Crack willow has already been killed at Bush Gully wetland and along the edges of Bush Gully Stream at the North property.

Table 2: Plant species to be controlled within and immediately adjacent to the wetland restoration areas.

Scientific Name	Common Name	Control method
<i>Leycesteria formosa</i>	Himalayan honeysuckle	Cut and paint stumps or dig out and leave on site to rot
<i>Pinus radiata</i>	radiata pine	Hand pull seedlings, drill and fill saplings or trees
<i>Rubus fruticosus</i> agg.	blackberry	dig out small patches or stem scrape and paint with glyphosate or cut and paint stumps
<i>Salix cinerea</i>	grey willow	Cut and paint stumps of saplings
<i>Salix fragilis</i>	crack willow	Drill and fill trees with undiluted glyphosate, cut and paint stumps of saplings
<i>Sambucus nigra</i>	elder	Dig out seedlings and small pants. Cut and paint stems near ground level
<i>Solanum dulcamara</i>	bittersweet	Hand pull
<i>Ulex europaeus</i>	gorse	Cut and paint stumps or spray with herbicide

The area subject to planting will need to be free of weeds and invasive grasses in preparation for successful plant establishment and subsequent weed control.

If required (i.e. if dense vegetation cover is already present), establishment of a suitable planting area will be achieved by either applying weed mat at the time of planting or applying commercial herbicides at prescribed rates (either Roundup (glyphosate) at 1% or Galant (haloxyfop) at 0.5%) to control grasses

and herbaceous weeds. Planting locations will be spot sprayed within the area to be planted with an area of up to 1m² treated for each individual plant. Full foliar cover with herbicide will be achieved.

Weed spaying operators will need to take appropriate precautions to protect non-target plants.

3.3 ANIMAL PEST CONTROL

Hares (*Lepus europaeus*) and rabbits (*Oryctolagus cuniculus*) both have the potential to adversely affect newly establishing plants. Native birds such as pūkeko (*Porphyrio melanotus*) can also reduce planting success by removing or browsing newly planted plants.

Use of plant protectors is proposed to protect establishing plants from these browsing pests as required. It remains unknown whether control of herbivores such as rabbits and hares would be required in addition to the use of plant protectors in order to protect plantings and this decision can be informed via monitoring of newly planted areas. If required hares and rabbits will be controlled by shooting, spotlighting or poisoning.

Pigs and possums are also known to be present at the restoration site. If their presence is confirmed as detrimental to the restoration plantings then appropriate control will be undertaken.

If required pest animal control should aim to:

- Maintain low numbers of rabbits and hares so that loss of planted plants due to interference by these species is less than 1%.
- Reduce pūkeko, pig or possum interference or damage to less than 5%.

If plant damage exceeds these thresholds, pre-control monitoring will be carried out to establish a baseline for pest numbers and to track the impact of pest control measures. The results of control outcomes will be measured via kill data and plant survival rates. Assessing both aspects will provide a strong justification for whether management actions are cost-effective and achieving their goals. Monitoring of plant survival is provided for in Section 4.1 below.

3.4 PLANT SELECTION

All plants selected are to be sourced from the Whitecliffs Ecological District (or the Canterbury Foothills Ecological Region in order of preference) and true to their name and species, healthy and free of disease and / or injury at the time of planting. Plant numbers and species indicated may vary depending on availability and the number and type of seedlings to germinate from the litter and duff collected.

Plants will be well-hardened root trainer ('RT'), ½ L, 1L, PB2 or PB3 in size (i.e., 20 – 60 cm tall at the time of planting) with no visible weed contamination.

Any myrtle species should be certified free of myrtle rust. It is noted that a high proportion of the proposed plantings are mānuka (a Myrtaceous species with an unknown susceptibility to myrtle rust). The use of these species will be reviewed as required.

3.5 PLANTING DENSITY AND LAYOUT

Planting density will determine a number of factors such as the overall number of plants required and the ability to establish canopy cover quickly and eliminate weed species. Higher planting densities do incur a higher cost upfront, but will need less ongoing management costs in subsequent years. Low

density plantings spread the cost out, with lower upfront costs but more ongoing maintenance required in later years, but also delay the time taken to achieve an ecologically sound and visually appealing planting.

BCL are seeking to establish these plantings and achieve self-sustainability as soon as is reasonably practicable. A final planting density of 1/m² with common colonist species (including a high proportion of mānuka) is proposed for riparian plantings and dryland (buffer) plantings, whilst a planting density of 1 plant per 2m² is proposed for wetland areas as shown in Table 3. This may be achieved by planting at lower densities initially, followed by in-fill planting later. The plantings will be spread over up to three years to minimise the risk of adverse weather events in any one year compromising planting success. Plantings will be supported by weed control and implementing supplementary planting amongst the established plantings after Year 1.

In order to facilitate natural regeneration and quickly achieve a natural / unmanaged aesthetic for the planting, the planting layout should mimic a natural planting regime as much as possible. In particular, large native trees (e.g., kahikatea) should be planted in small groups (3 – 5 trees) within the wider plantings. For these groups, allow larger spaces between them to provide room for them to spread as they grow and ensure they are not overtopped.

3.6 PLANTS REQUIRED

A total of 10,480 plants is required as shown in Table 3.

Colonising plants are typically different from those which come to dominate the canopy over time, in part because they are adapted to growing in different environments (high light versus low light). Plant numbers and species indicated may vary depending on availability.

Table 3: Plant species proposed for use at CCM wetland plantings, Malvern Hills, Coalgate divided by location.

Scientific Name	Common Name	Percentage of Planting	Habitat	Number required
Wetland Areas				
<i>Austroderia richardii</i>	toetoe	5	margins	181
<i>Carex geminata</i>	rautahi	20	wet soils	725
<i>Carex secta</i>	purei	20	wet soils	725
<i>Carex virgata</i>	pukio	15	wet soils	544
<i>Coprosma propinqua</i>	mikimiki	5	margins	182
<i>Cordyline australis</i>	ti kouka, cabbage tree	5	margins	181
<i>Dacrydium dacrydioides</i>	kahikatea	1	margins	36
<i>Fuchsia excorticata</i>	kotukutuku, fuchsia tree	1	margins	36
<i>Isolepis prolifera</i>		5	wet soils	181

<i>Leptospermum scoparium</i> agg.	mānuka	8	margins	290
<i>Juncus</i> spp.	wīwī	10	wet soils	363
<i>Phormium tenax</i>	harakeke, lowland flax	5	margins	181
Total wetland plants		100		3,625
Stream Riparian Areas				
<i>Carex secta</i>	purei	40	Stream edge	360
<i>Carex virgata</i>	pukio	20	Stream edge	180
<i>Juncus</i> spp.	wīwī	40	Stream edge	360
Total Riparian Plants		100		900
Dryland areas				
<i>Aristotelia serrata</i>	makomako, wineberry	13	Damp areas	785
<i>Carpodetus serratus</i>	putaputaweta, marbleleaf	2	Damp areas	105
<i>Coprosma propinqua</i>	mikimiki	13	Throughout	785
<i>Coprosma robusta</i>	karamu	13	Throughout	785
<i>Fuscospora solandri</i>	black beech	0.9	Dry areas	53
<i>Griselinia littoralis</i>	broadleaf	4.4	Dry areas	262
<i>Leptospermum scoparium</i> agg.	mānuka	42	Throughout	2,500
<i>Myrsine australis</i>	mapou, matipo	2	Dry areas	105
<i>Pseudopanax arboreus</i>	whauwhaupaku, five finger	2	Damp areas	105
<i>Pseudopanax crassifolius</i>	horoeka, lancewood	2	Dry areas	105
<i>Schefflera digitata</i>	patete, seven finger	2	Damp areas	105
<i>Veronica salicifolia</i>	koromiko	4.4	Dry areas	262
Total Dryland Plants		100		5,955
Grand Total				10,480

The number of plants required divided by species is shown in Table 4.

Table 4: Plant species proposed for use at CCM wetland plantings, Malvern Hills, Coalgate, divided by species.

Scientific Name	Common Name	Number required
<i>Aristotelia serrata</i>	makomako, wineberry	785
<i>Austroderia richardii</i>	toetoe	181
<i>Carex geminate</i>	rautahi	725
<i>Carex secta</i>	purei	1,085
<i>Carex virgata</i>	pukio	724
<i>Carpodetus serratus</i>	putaputaweta, marbleleaf	105
<i>Coprosma propinqua</i>	mikimiki	967
<i>Coprosma robusta</i>	karamu	785
<i>Cordyline australis</i>	ti kouka, cabbage tree	181
<i>Dacrydium dacrydioides</i>	kahikatea	36
<i>Fuchsia excorticata</i>	kotukutuku, tree fuchsia	36
<i>Fuscospora solandri</i>	black beech	53
<i>Griselinia littoralis</i>	broadleaf	262
<i>Isolepis prolifera</i>		181
<i>Juncus</i> spp.	wīwī	723
<i>Leptospermum scoparium</i> agg.	mānuka	2,790
<i>Myrsine australis</i>	mapou, matipo	105
<i>Phormium tenax</i>	harakeke, lowland flax	181
<i>Pseudopanax arboreus</i>	whauwhaupaku, five finger	105
<i>Pseudopanax crassifolius</i>	horoeaka, lancewood	105
<i>Schefflera digitata</i>	patete, seven finger	105
<i>Veronica salicifolia</i>	koromiko	262
Grand Total		10,480

3.7 PLANTING METHOD

All dryland and riparian margin plants will be planted with a slow-release fertiliser tablet beneath the root mass as shown in Figure 4. Wetland plants will be planted in a similar way without a fertiliser tablet.



Soak the plant before removing from the bag / pot. Ensure the hole is 3x the diameter of the root mass and the depth is 1.5x the root mass. Place a fertiliser tablet in the hole (Dryland and Riparian areas only).

Ensure the fertiliser tablet does not directly touch the plant's root mass (cover with dirt). Ensure dirt is not sitting around the base of the plant's stem.

Figure 4: Proposed planting method.

All plants will be planted to the same depth as their growing container and care will be taken to avoid damaging roots during planting.

Plants may be mulched with coarse sawdust, bark or other material to a depth of 100mm at the time of planting in order to control sediment runoff, conserve moisture and suppress weeds. Alternatively, weed mat may be used. Once planted, plant protectors will be installed as required.

Within the planting zones outlined, species should be targeted towards the most favourable microsites possible for establishment.

4. MONITORING AND MAINTENANCE

4.1 MONITORING

4.1.1 Plant Establishment

The aim of monitoring plant survival is to ensure that sufficient plants survive (or are replaced) to ensure that the ecological outcomes (75% canopy cover, ecological connection restored) will be achieved and provide an informed basis for ongoing management (e.g., implementation of pest control or supplementary planting).

Plants will be inspected three months after planting to determine their initial survival and establishment. Any plants which fail to establish will be replaced as required, although they may not be replaced at exactly the same microsite or with the same species. Replacement plants will be planted according to the guidelines provided above in the period between May and August following the discovery of dead plants.

Once plantings have established (after six months), monitoring will be undertaken at least twice annually for the next year (during spring and autumn) and then once annually thereafter for a period of five years.

Monitoring shall include, but not be limited to, the following:

- Success rates, including growth rate and the number of plants lost.
- Achievement of canopy closure, including notes on natural ecological processes such as the use of the area by birds and presence of natural native seedling establishment. The target for closure is 75%.
- Plant health, noting any indicators of ungulate, insect or disease damage or presence.
- Consideration of any follow-up maintenance required in terms of weed control, animal pest control, plant replacement, plant disease control and fence maintenance. Monitoring will continue at least annually for five years or until canopy closure is achieved (expected to take 3 – 5 years at the planting densities proposed).

BRL is already registered with “Trees that Count”. These plantings will be registered and recorded and the monitoring summarised in an annual summary sheet to provide for any later reporting.

4.1.2 Wetland Quality

The aim of the wetland monitoring is to provide quantitative and repeatable data to ensure that the proposed wetland restoration is resulting in improved ecological condition and progressing towards self-sustainability, as well as provide a basis for ongoing management.

Wetland quality monitoring will consist of four 5m by 5m monitoring plots based on the methodology described in “A Handbook for Monitoring Wetland Condition” (Clarkson et al. 2004), where vegetation is estimated over different wetland tiers depending on complexity (i.e., canopy, sub-canopy, ground cover). The location of the plots will be selected at random using a method of random point generation. Discretion will be used on site to shift monitoring plots if required (e.g., if a particular location is unsafe or if a particular site would provide biased results). The monitoring will exclude soil core and foliage laboratory analysis.

A minimum of four permanent photo points will be established at appropriate locations to visually demonstrate the restoration over time.

Baseline monitoring will be undertaken before restoration works commence. Monitoring will then be undertaken six months after the initial planting has been undertaken (before 1 May 2022). Monitoring of wetland condition and photographs at photo points will then be undertaken annually until 2026, when this plan will be reviewed. Review of this plan will include consideration of whether the objectives set out in Section 1.3 have been achieved or if further actions are required.

A Wetland Condition Assessment, including one Wetland Record Sheet for each site and two Wetland Plot sheets for each site will inform a brief monitoring report to be prepared after each monitoring occasion detailing results, outlining conclusions and providing recommendations as necessary.

4.2 MAINTENANCE

General plant maintenance may involve the following (depending on requirements):

- Watering of all new plants at the frequency and amount required to sustain healthy development.
- Control of insects and disease by treatment with an appropriate chemical.
- Removal of any damaged or diseased plant material (to prevent further spread).
- Fill of any soil compaction and sinkage around plants (common post planting once the soil has settled).
- Plant releasing as required.

Plant releasing is the process of releasing young plants from competition due to surrounding growth of grasses and weeds until they can either compete effectively, or have over topped less desirable species.

Plants will be released using the following methods:

- Hand/manual releasing, which can involve the use of a scrub bar or hand tools to cut back grass and weed growth around plants which have or are at risk of becoming suppressed. This method is labour intensive but low risk to plant health.
- Spray releasing with herbicide, this method depends on the herbicide to be used and the skill of the contractor. Typically, selective herbicides such as Galant™ are able to be applied safely around/over most native species (excluding monocots such as cabbage tree, flax and *Carex*, *Juncus* and *Cyperus* species). In the instance where spray releasing can reduce labour, incompatible species can be manually cleared as per manual release above.
- Non-selective herbicides (such as glyphosate) will not be used due to the high risk of spray drift and associated non-target mortality.

If spray releasing with herbicide is the method selected, operators will be required to have completed the relevant GROWSAFE course.

4.3 PLANT REPLACEMENT

A 5–10% mortality rate is typical in the first year following revegetation plantings due to natural causes such as insect damage, frosts and drought along with mortality from animal pest damage and spray drift. Plant mortality of 5% is expected in the first year post planting, followed by 3% in the second year,

and a further 2% after the third year. Species used to replace dead plants will be consistent with the species selection and proportions noted in Tables 2 and 3 respectively.

4.4 ANIMAL PEST MONITORING

Animal impacts on plants will be monitored during each monitoring round. If plant losses to herbivore or other animal damage exceed 1% (in the case of rabbits and hares) or 5% (for all other species) then appropriate animal control or other methods of pest exclusion will be instigated.

4.5 WEED MONITORING

The goal of weed monitoring is to ensure that undesirable plants are identified as quickly as possible and removed before establishing a local population. In most plantings woody weeds (i.e. shrubs and trees) are of more concern than grasses or herbaceous weeds.

Monitoring of woody weeds is to be carried out twice annually in spring and autumn (at the same time as weed control) and will involve walking across as much of the restoration sites as practicable (including all tracks and the parts of the site without established tracks) ensuring that as much of the area is visited as possible and looking for weeds, recording their presence and where possible removing or otherwise treating them immediately.

In order to ensure consistent monitoring coverage, the restoration sites will be systematically searched for woody weeds by walking around the sites and looking for weeds either as new arrivals (at ground level) or as more established examples (within the canopy or emerging from it). Those doing the monitoring will either carry a GPS or plot the track walked on an aerial image or map of the property so as to record the survey coverage and allow any areas missed to be identified and visited later. The location of any weeds encountered will be recorded as they cross the site. A sample data sheet which can be adapted for the site is included as Appendix 1.

All woody weed species found will be recorded, along with the approximate size of the population (either number of plants or area covered) and the management treatment applied. Where herbicide is applied a follow-up visit will be planned to confirm that it has been effective and to note whether additional applications might be required (e.g. due to regrowth).

4.6 WEED MANAGEMENT

The objectives of this plan relating to weed management are to:

- Prevent the establishment of new woody weed species which would impair natural succession of native vegetation within the planted areas of the restoration sites.
- Minimise the spread of existing woody weeds within or into the restoration sites.
- Maintain the distribution and abundance of weeds at the sites at low levels so that weeds do not impair natural succession of native vegetation cover in the medium to long term.

Weed control measures are based on four principles:

1. Preventing establishment of new weed species and populations. This involves site hygiene and measures to prevent propagules arriving on site and site management to reduce suitable habitat for weeds that breach the borders.

-
2. Minimising the spread of weed populations within the site. This involves systematically monitoring the spread of weed populations and preventing their growth and reproduction.
 3. The planting of desirable (including native) species or non-invasive species into previously cleared or unused areas allowing them to get a “head start” over the weeds and prevent them colonising.
 4. Monitoring to ensure weeds are not compromising the desired outcomes.

Effective weed control requires identification of weed species, locating individual colonies and then extermination of the weeds using appropriate methods, followed by revegetation with desirable plants and monitoring to ensure the weeds do not return. There are a number of management techniques that improve the success of weed control and provide a degree of certainty about the outcome of a weed control programme. The spread of weed populations within the property will be minimised by:

- i. Use of appropriate methods (including herbicide, manual or mechanical techniques) for the target species. Advice on control methods for particular species is available at www.weedbusters.org.nz.
- ii. Regular systematic recording of known weed colonies and control efforts throughout the planted areas.
- iii. Monitoring of weeds and undertaking weed control before seeding.
- iv. Undertaking regular (twice yearly) monitoring and inspection of planted areas. In order to minimise the establishment of wilding pine, gorse, elder, willow species and other weeds, inspection staff will routinely carry herbicide wands or backpacks, so that, weather permitting, any plants that cannot be manually removed are treated as they are identified. The location of these plants will be recorded as part of the monitoring programme to allow identification of at-risk areas.
- v. Annual checks for weeds and hand pulling or spraying will be carried out as appropriate on the undisturbed ground near roads and working areas.

The amount of time taken to carry out weed control and monitoring will decrease over time as target species are eradicated and replaced by desirable vegetation.

5. PROPOSED TIMELINE

It is proposed to spread plantings over a period of up to three years, although the majority of the planting will be completed within the first two planting seasons. This will ensure that the entire planting crop is not lost if there is a bad drought or other unforeseen circumstance in any particular year. A suggested planting regime over the course of the next few years is suggested in Table 4 below.

In addition, in order to be most successful, planting and weed control should be undertaken at particular times throughout the year. For example, planting is best undertaken in late autumn and winter so that plants are well established before the summer dry period arrives, whilst weed control is best undertaken in autumn (when plants are most visible because they are often flowering or fruiting) and spring (when plants are most actively growing and before they set seed).

Table 4 sets out the window of time annually within which particular management actions relating to weed control, planting and monitoring should be completed over the life of this plan and slightly beyond (to be confirmed when the plan is reviewed in 2023).

Table 4: Proposed programme of works for restoration at CCM wetland sites, Malvern Hills, Coalgate.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2021	-	SC	SC	SC	SP	SP	-	P	P PM APC PM	OP M APC PM	OP M APC PM	-
2022	-	SC	SC PM WC	SC PM WC	SP PR	SP PR	-	P	P OP PM	OP APC PM WC	OP WC	-
2023	-	APC M	WC PM M	WC PM M	PM SP	-	-	P PR WC	P WC M PM APC	M PM APC	M PM WC	-
2024	-	M APC PM WC	M APC PM WC	WC M PM APC	-	-	-	-	M PM APC WC	M PM APC WC	M PM WC APC	-
2025	-	M PM WC APC	M PM WC APC	PM APC WC M	-	-	-	-	M PM APC WC	M PM APC WC	M PM APC WC	-
2026	-	M PM WC APC	M PM WC APC	M PM WC APC	-	-	-	-	M PM APC WC	M PM APC WC	M PM APC WC	-

OP = Order any plants required

SC = Collect seed or other propagules as required and commence propagation

SP = Site preparation, includes initial weed control and any required earthworks

P = Planting as per species lists

M = Monitoring- assess plant survival in order to respond to any required actions such as weed or animal control

APC = Animal pest control (of rabbits, hares, pukeko and/or possum if required)

PM = Plant maintenance, including manual releasing (if required)

WC = Weed control (if required)

PR = Replacement planting (if required).

6. LEGAL PROTECTION

As set out in Section 2.2, BCL owns the North Property and Bush Gully Wetland is owned by Matariki Forests. We note that activities within the wetland would be a prohibited activity under the National Environmental Standards (Freshwater) which took effect in September 2020. BCL will also investigate placing a suitable legal instrument on the North land to preserve the offset area in perpetuity and will ensure such protection is in place before the property changes hands.

7. REFERENCES

Canterbury Biodiversity Strategy 2008. Available at <https://www.ecan.govt.nz/your-region/plans-strategies-and-bylaws/canterbury-biodiversity-strategy/>

Clarkson, B.R., Sorrell, B.K., Reeves, P.N., Champion, P.D., Partridge, T.R., Clarkson, B.D. 2003. Handbook for Monitoring Wetland Condition. Revised edition 2004. Landcare Research, Hamilton, New Zealand.

McEwen, W.M. 1987. (Editor). Ecological Regions and Districts of New Zealand (third revised edition in four 1:500,000 maps). New Zealand Biological Resources Centre publication no. 5. Department of Conservation, Wellington.

Waterways Limited 2016. Canterbury Coal: ELF Project, Bush Gully Assessment. Unpublished report number 35-2016-A prepared for Bathurst Resources Limited. 13 pp.

APPENDIX 1 – Sample Restoration Planting Monitoring Sheet

MONITORING FIELD SHEET FOR RESTORATION PLANTING

Sample field sheet for completion annually to inform annual report.

Date (d/m/y) _____ Date of last monitoring _____

Consent number _____

Address _____

Property owner and contact details:

Has property changed owners in the last year? YES / NO

If yes, who was previous owner?

Survival Rate

Percentage survival _____

Growth estimate (cm/year) _____

Percent ground cover _____

Canopy closure achieved YES / NO

Approximate canopy cover _____

Fertilizer

Date applied _____

Product used _____

Areas applied _____

Quantity used _____

Weed control

Date undertaken _____

Sprays used _____

Application Rate _____

Weeds targeted _____

Areas targeted _____

Replacement planting

Date undertaken _____

Species being replaced _____

Species planted _____

Number of plants replaced _____

Problems

Are certain weeds proving difficult to control and detrimental to the planting, are animal pests causing significant problems?

Nature of problem(s):

Possible solutions:

Analysis of plant losses

Are losses greater than expected, are there any obvious reasons, are losses in certain areas, are certain species showing high losses, what are possible solutions?

State of fence

Is the fence still secure? Has any maintenance of the fence been undertaken? Is any required?

APPENDIX 2 - Sample Weed Monitoring Sheet

Document Reference	:	c:\BRL\0395CanterburyCoalMine\Reports 2021\Final Management Plan
Report Revision	:	3
Report Status	:	Final
Prepared by	:	Dr Gary Bramley
Reviewed by	:	
Approved by	:	Dr Gary Bramley
Date Created	:	20 February 2021
Date Issued	:	Draft 1: 28 February 2021 Draft 2: 3 March 2021 Final: 17 March 2021

AUTHOR:

Dr Gary Bramley – Ecologist

Dr Gary Bramley has a BSc (Zoology) and MSc (First Class Honours in Ecology) from Massey University and a PhD (Ecology) from the University of Waikato. He has worked as an ecological consultant since 2000. Prior to that he lectured at the University of Waikato and Waikato Polytechnic. He is a member of the Ecological Society of New Zealand, the Environment Institute of Australia and New Zealand Incorporated, Birds New Zealand and the New Zealand Plant Conservation Network. He is also a qualified Independent Hearing Commissioner under the Resource Management Act (1991). Gary has a generalist ecological background with extensive experience in vegetation, birds, pest mammals, invertebrates, lizards and bats throughout New Zealand, from Ngataki in the north to Te Anau in the south. His work has included assessments of effects and development, implementation and monitoring of consent conditions, preparation of restoration plans, management plans (including iwi and hapū management plans) and peer review. He has published ten peer reviewed papers and more than 250 unpublished reports for clients. Previous clients have included central government (including the Environmental Protection Agency and Ministry for Business Innovation and Employment), iwi and hapū groups, local government, energy generators, mining and quarrying companies, infrastructure developers, landowners, land developers, marine farmers, forestry companies, farmers and non-government conservation organizations. Gary has been at the forefront of some of the nationally significant projects with respect to terrestrial ecology and has long standing experience carrying out projects involving ecological restoration, site remediation, biodiversity offsetting and ecological mitigation throughout New Zealand.

DISCLAIMER:

The Ecology Company Limited (The Ecology Company) has prepared this report for the exclusive use of Bathurst Resources Limited in accordance with the usual care and thoroughness of the consulting profession and in accordance with the standards of the Environment Institute of Australia and New Zealand. The concepts and information contained in this document are the property of The Ecology Company. Use or copying of this document in whole or in part without the written permission of The Ecology Company constitutes an infringement of copyright.

This report was prepared in accordance with the scope of work and for the purpose agreed between the parties. This report was prepared between 10 February 2021 and 17 March 2021 and is based on the information obtained and conditions encountered at that time. The Ecology Company disclaims responsibility for any changes that may have occurred after this time. This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal or specific planning advice.

