BlueGreen

Mananui Sand Mine: Indigenous Restoration/Rehabilitation Programme.

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1.0 Introduction

The Mananui Indigenous Restoration and Rehabilitation Programme proposes remedial actions for the removal of 4.2ha of indigenous treeland and grazed forest. The application also proposes the restoration/return of 4.75ha of forest and the creation of 3 new indigenous wetlands (summing to 2.37ha). Making a grand sum of 7.12ha of indigenous habitat restoration.

Note: the 7.12ha of indigenous habitat restoration mentioned above excludes additional landscape and visual mitigation planting as shown in the Landscape Mitigation Plan (LMP) for the Project (prepared by Glasson Huxtable, October 2023). The LMP proposes additional boundary planting on the western bunds (1.08ha) and infill planting in between them (0.18ha). Planting is also proposed along the length of the northern boundary (0.54ha). While not targeting ecological remediation or mitigation gains, these plantings of native species, have both a resource and a landscape movement benefit for the local indigenous species.

Together, the indigenous habitat restoration and wetlands (7.12ha) plus the landscape mitigation (1.80ha) will provide 8.92ha of new planting areas across the Project site.

The restoration process will be accumulative. As sections of the existing pasture forests are removed and the mining process travels along the eastern border, the trailing area will be restored. This allows transfer of the removed habitat features without the need for storage (generally). By the end of the first pass of the mining process, the restoration area will be underway. For the next 10 or so years, the restoration will be about management of the development of native plant cover, weeds, and pests. This provides a Ca. 10-year restoration management time frame while the mine progresses.

In essence the programme is about the correct set up to enable natural processes, followed by monitoring and active restoration responses.

1.1 General Outline

A new boundary of the escarpment bush will be developed (rehabilitated) and fenced which is 30m in width (and wider in the north where it takes in the proposed wetland also) projecting out from the current eastern escarpment bush edge (Figure 1). This 30m area of land over approximately 1.7km (summing to 5.1ha (of which 4.75ha will be forest plus the additional wetlands and a possible walking track)) will be revegetated using salvaged plants, salvaged material (seed bank soil and wood from the pasture fragments to be cleared) and additional nursery grown plants (with additional planting determined by monitoring the natural regeneration), with the goal of achieving canopy closure of appropriate species.

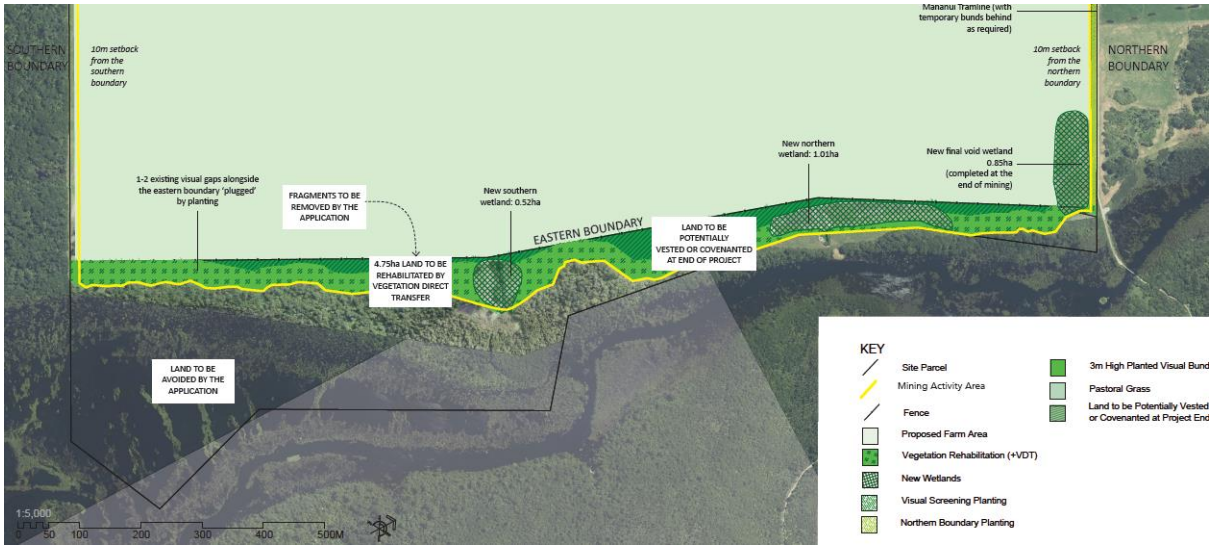

Figure 1: Restoration areas along the eastern escarpment bush edge

In addition, three wetland areas totalling approximately 2.37ha will be included for diversity but also looking to the future as filters for the long term continued farming practices on the remaining land after the mining is complete. There may be areas beyond the forest restoration that are included in a wider programme

From a technical aspect the wetlands are bonus ecological gain as no natural wetlands are being affected, but the inclusion of farming land use discharge filters (fully vegetated wetlands) prior to the Tūwharewhare and wetlands, makes good ecological sense.

The ecological benefits are consistent with the new directions of the National Policy Statement for Indigenous Biodiversity (NPSIB) to maintain indigenous biological diversity and Policy 13 within this, which promotes restoration of IB.

The benefits of this restoration rehabilitation programme include:

- Protection of the high value eastern wetland and escarpment, including the forest/wetland restoration area (ca. 20ha).
- Physical protection of the above systems via cessation of livestock access to the escarpment and wetland through fencing the forest/wetland restoration area off from the farm.
- Animal pest control in the escarpment forests (Ca 12ha for possum, mustelids, and feral cats) and new restored forest edges during the consent period.
- No “loss of extent” of forest through an equivalent area of new (replacement) forest of the same composition along the western edge of the of escarpment forest immediately adjacent and in part on the removed forest fragments.

    - That forest will be created through a range of techniques including: direct transfer of materials (roots, logs, duff (and thus seeds), small whole plants), use of nursery grown species, and managed natural regeneration from the overhanging escarpment forest.
- There will be, due to the revegetation area, an increase in the resilience of the escarpment forest and increases of functional performance of that forest to buffer the eastern wetland.
- Three new indigenous wetlands involving the propagation and planting of four or five sedge taxa and *Juncus* and *Machaerina* species from nursery stock and translocation of raupo and harakeke from local sources.

2.0 Restoration Plan Details

2.1 Purpose

To revegetate at least 4.75ha of indigenous broadleaf-podocarp forest to a point of self-sustaining vegetation cover (80%) which includes prominent numbers of hinau, kamahi, kahikatea, rimu and totara in a subcanopy of *Coprosma, Pittosporum, Quintina, Pseudopanax, Myrsine, Griselinia* and *Melicytus* (all species that characterise the local forest structure and species).

The Rehabilitation techniques described in this document focus on maximising the quantity and quality of viable plants, seeds and soils salvaged and re used in rehabilitation from the existing vegetation.

To create and revegetate three areas of indigenous wetland (fully vegetated, not open water ponds) using, as required, earthworks and revegetation through eco sourced Carex, Juncus, harakeke, and Manchuria species.

2.2 Revegetation Mitigation (Remedy) Outcomes

The requirements are 4.75ha of typical kamahi/hinau/podocarp forest:

- A level of natural seed disbursal, germination, and growth across the site.
- Confirmation of correct species planted in correct patterns.
- Species survival, growth (height) and canopy cover development (80%).
- Correct species replacements in the absence of survival of particular species.
- Limited/no pest animal damage.
- Level and type of weed infestation and the minimisation of weed presence.
- That stable surfaces and suitable land forms are maintained (avoid erosion)

The forest areas are to be monitored with thresholds of success or management and include:

- Pre restoration weed and pest checks, and corrective actions.
- Pre restoration ground preparation and check.
- Post planting area checks (correct species, correctly planted).
- Through development - walking transects with observational notes and photographs and through fixed vegetation plots in both natural restoration and active planted areas.

The establishment of a series of fixed 20m by 20m vegetation plots (2 every 200m), one focused in an area left to natural processes and one planted, will allow

measurement of plant survival, rates of growth, rates of germination and eventually canopy cover and composition data.

Success, after site establishment and correct plant material and planting will depend upon maintenance which largely entails managing pests.

Ultimately the test of success will be 80% canopy cover in all monitoring plots, of the correct species in good health and as an average canopy cover over the entire 4.75ha of forest with no obvious areas < 50% cover. We anticipate that with progressive re-establishment of the 30m mined forest edge, success will have occurred for the entire requirement length (affected in the first year) by the time the mining operation is complete (10 years).

And that the canopy cover includes in all plots at least 10% of either hinau, kamahi, totara, kahikatea or rimu.

2.3 The Process – Remedial Forest Restoration

At its most basic, the following is the process to be followed:

- Prepare the ground to be restored - clear weeds, remove animal pests, rip or open the soil from the grass sward,
- Direct transfer all material from the forest fragment being cleared and lay appropriately in the prepared section,
- Interplant with species prepared (eco sourced) as indicated in the below tables and plans,
- Monitor and maintain.
- Test for success and manage until success (see section 2.2 above).

2.4 Natural verses Active Revegetation

While most restoration managers would like to leave most of the work to nature, the return from pasture grasses to forest woody species can take some time. This is because seed material must penetrate often rank grass swards and out compete those grasses and weeds on mass, before a shading canopy and height ensures progress. For this reason, active remedial mitigation must include continual interventions to limit weeds and grass sward dominance as well as accelerate the progression of woody species cover. Naturally this is often through early successional experts such as gorse. On this site, the eastern escarpment forest edge is undergoing this process now (with natives amongst gorse) and there is clearly seed from the forest edge.

The restoration programme proposed for this Project will manage dual processes (natural and active) as natural processes are better at subtle micro site correct species placement than human planting regimes. We note that the eastern most

10m band – that which is hard up against the existing eastern escarpment forest will likely be first and most abundance in natural seed germination, while the western edge may be slower. The planted density reflects this process.

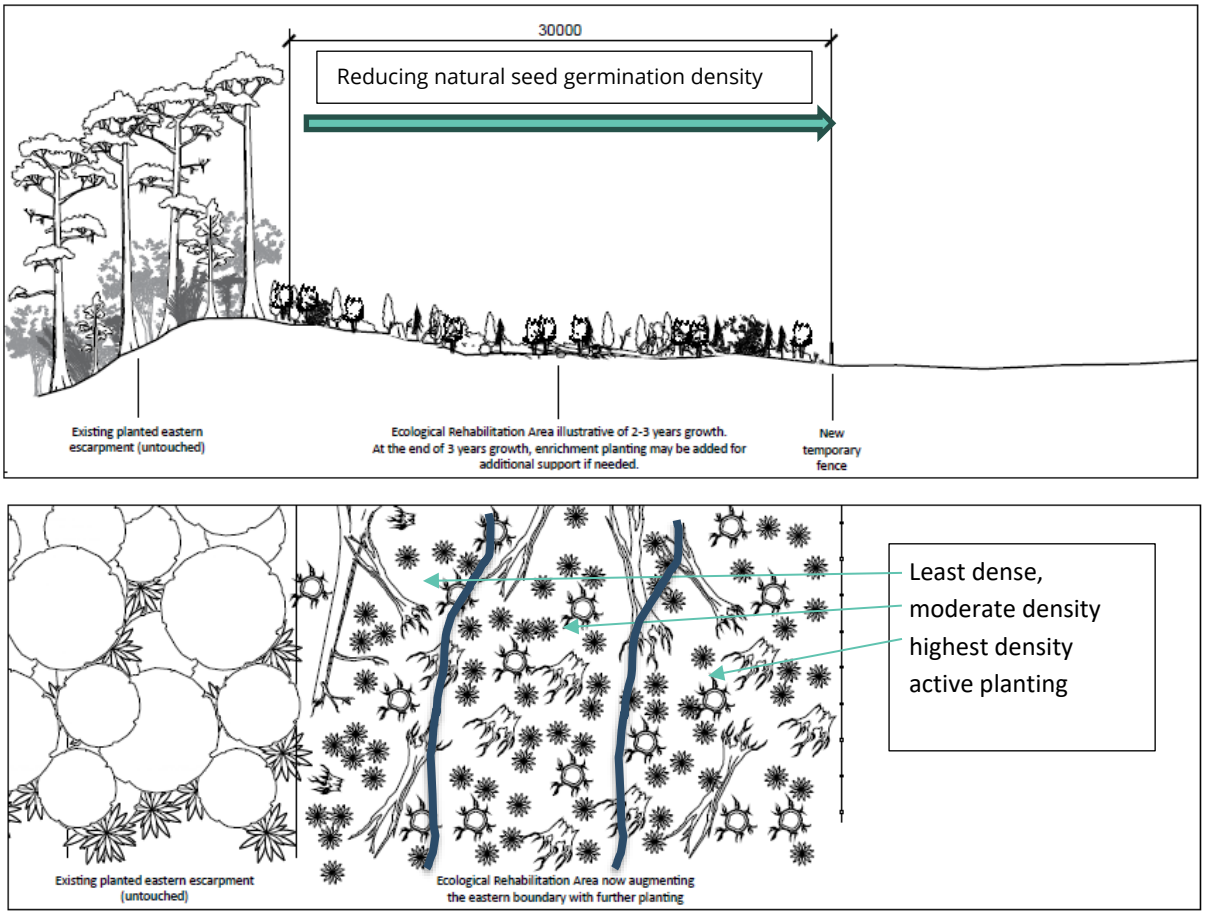

Figure 2: Restoration illustrative of 2-3 years growth

The eastern most 10m band (Ca 1.58ha) will, after site preparation and lay down of salvage etc, receive a typical active planted density of 1 plant per 5m^2 (724 plants), the middle 10m (1.58ha) a typical density of 3m^2 (2,012 plants) and the western most 10m (1.59ha) a destiny of 1 m^2 (18,105 plants).

This makes active planting of some 20,000 native plants in the remedial forest restoration action area.

2.5 Revegetation Site Preparation

A range of actions should be considered prior to revegetation efforts:

2.5.1 Soil Preparation

Successful plant growth is dependent on:

- A suitable growing medium (soil),
- Nutrients,
- Sunlight, and
- Water.

Of these, water and sunlight levels are largely a result of uncontrollable climate – mitigated by controlling what time of year seedlings are planted. However, soil properties and nutrient levels can be manipulated to encourage establishment of desired vegetation.

The physical element of soil that is manipulated relates to compaction. Highly compacted soil strongly inhibits root growth, especially the deeper root growth of taller woody species. Increasing the porosity of the soil allows more space for water to be stored, roots to grow and a greater surface area for nutrient exchange to occur. Therefore, any consolidated or older soils will need to be reworked by a suitable machine to uncompact the soil. After this, there should be no vehicle movement over the uncompacted soil.

In addition, the surface of the soil needs to be left unsmooth – this further encourages a community of diverse colonising species through creating a range of different microclimates for a range of seedlings to regenerate. Salvaged logs and branches (although not willow and other adventurous rooting and regenerating woody species) should be laid throughout the planting area to increase physical diversity and texture of the environment.

This program of soil uncompacting (cattle cause compaction) also disrupts the grass sward and creates open soils for colonisation.

Because the area has been farmed, we assume nutrient levels are higher than expected in an indigenous forest and will afford appropriate colonising plant growth without nutrient enhancement.

An object of restoration is not only to restore indigenous vegetation species, but the functions of a working ecosystem. Nutrient cycles are one of these functions, which are predominantly driven through the decomposition of organic material at a site.

Therefore, after soil replacement post mining and ensuring that the surface has not been compacted, the salvaged duff and seed bank soils under the forest fragment being removed should be transferred and laid over the immediate restoration area (avoiding compaction) followed by the woody material being salvaged (tree foliage canopy and upper wood).

2.5.2 Salvage of Organic Material (VDT Methodology)

VDT is a system of vegetation direct transfer. It includes direct transfer (the digging up and replanting of) small root mass vegetation including those of smaller shrub

species and tree saplings and ferns. It also includes collection and relaying of forest floor duff (leaf litter) woody debris and the trunks and foliage of larger trees that must be felled. Sometimes it includes the sod, depending on the condition and requirements of the receiving site. These processes preserve the seed bank and introduce those seeds into the new receiving site.

The salvage and relocation of habitat or native vegetation removed in advance of mining should be carried out when the receiving site preparations have been made. E.g. once there is enough area levelled and contoured to receive the VDT material. Also, Autumn is typically the best season in terms of weather and hydrology to undertake VDT.

The salvage (for replanting) is to include sufficiently small saplings and shrubs as well as native sedges. In addition logs, root balls, loose topsoil (seed bank), duff (leaf litter), woody vegetation (including large branches and canopy foliage and stem) and logs with epiphytes are to be transferred. Where possible live vegetation that is 3 to 6 metres in height is removed intact in advance of the mining. This material is transferred to the receiving area and replanted. Where this isn't possible, trees (larger than 6 metres) are felled at chest height and the root balls and surrounding material (soil, left litter, small plants and trees) are removed and placed in clumps standing upright.

Trees that can be felled and limbed can be utilised in two ways:

1. Logs and branches are used as slash and placed within the receiving area both on top and within the soil to create varied micro habitats. Also useful in controlling erosion.

2. Logs and branches are mulched and distributed within the receiving area. This can create micro habitats, but care is needed so that mulched areas aren't too dense and stop other growth.

Given the proximity of the vegetation being removed to the receiving area. Traditional earth moving equipment could be utilised to undertake VDT. A front end loaded could be utilised to pick up standing material in its bucket and transport it to the receiving area where it can be placed. While logs and slash can be transported via dump trucks and placed as appropriate in the receiving area.

These materials are transferred to the revegetation zone and spread appropriately (see diagram above) not piled or dumped, so as to provide habitat improvement to restored areas as well as carry over ferns, spores, invertebrates, epiphytes etc.

2.5.3 Eco-sourcing and Propagation for Plant Supply

Plant propagation material should be sourced from as close to the planting site as possible (The Mahinapua Scenic Reserve to the south may be a good seed collection option). The material must be eco-sourced from stock living in a similar condition to that being planted into, and the material needs to have records that allow verifiable seed stock (i.e. collection certification and propagation documentation). This increases the ecological values of the site in keeping true to the local population genetics and increases the establishment success of the plantings, as they are more adapted to local conditions.

The collection, storage and propagation of plant material will require specialist skills and local knowledge about locations of species, timing, and methods. Seed storage, propagation and growing-on will likely need to be done off-site in nurseries built for this purpose. Plants may not be available in the numbers and species required for reasons such as seed not being ripe, available, or present. To avoid widespread failure of one or any combination of species, more than one nursery should be nominated to supply the plants.

Procurement of stock will require a lead-in time of at least 18 months to obtain seed and propagate plants to meet required grades for planting if not currently held in a nursery. Some eco-sourced stock may be available from specialised nurseries that already have seed or plants in stock, but it is unlikely that all the species will be available or in the quantities required. The required size for planting in this case will be revegetation grade plants e.g. plugs, RX90 or 1L sized plants.

2.5.4 Timing of Planting with Construction Works and Planting Season

On the West Coast near the coast there is typically not the issues of summer drought and servere winter frost that inhibit many parts of New Zealand. The growing season for Greymouth is 329 days of the year (24th July to 18th June (MfE 2022). This suggests planting should avoid June and July but otherwise follow predicted weather forecasts at any other time for the year to ensure no long-term drought or cold temperature predictions prior to planting.

2.5.5 Plant Condition

All plant material will be well hardened off and acclimatised to the proposed site conditions prior to planting. Plants shall be free from pests and diseases, materially undamaged, healthy, and vigorous.

All plants shall be true to botanical name and grade as specified in the plant schedule. All plants shall be of the size stated and supplied in the container size as specified.

2.5.6 Pre-Planting Pruning

Immediately prior to delivery, shrubs should be pruned (as necessary) by skilled staff to conform to the best horticultural practice appropriate to the type of plant. If removal of excess top foliage is required, the excess material shall be in proportion to the overall plant growth and root ball size, with generally only half or the top third material being removed.

Pruning shall remove all damaged twigs and branches and shall compensate for any loss of roots during planting operations. Pruning shall be carried out without any bruising or tearing of the bark. Operations are to be carried out using sharp clean implements to give a clean sloping cut with one flat face. Ragged edges of bark or wood are to be trimmed with a sharp knife.

2.5.7 Plant Guards

Usually, all woody species would be planted with a combi-guard cell. They allow for better maintenance (easier recognition in the field) and a dense canopy to form more quickly, suppressing weed species. Establishment and survival rates are increased by using combi-guards by acting as a mulch mat, preventing browse from rabbits and hares, preventing spray damage, frost damage and the sleeve which the plant sits within also creates a humid environment conducive to plant growth. In this scenario we leave it to the restoration manager to determine if they are to be used.

2.5.8 Drought Conditions

Should the area of recently planted material undergo a period of drought in the summer season following planting, it is likely to result in death of some plant species. We recommend having a suitable water supply available for delivery to the plants by way of irrigation. However, watering should not be undertaken during the hottest part of the day. Watering nozzles shall use fine rose or sprinkler heads to prevent damage to plants or topsoil scouring around roots. Plant Material, Numbers and Setting Out

The focus is on a site responsive approach.

A suitably qualified person (plant ecologist or experienced revegetation specialist) should be on site during the set out of plants to ensure the location of plants within the area to be planted follows the best hydrological, soil and topographical locations for species. The overall objective is to plant in a manner and in places where plants will have the best chance of survival and healthy growth, but also to reflect natural species mix patterns.

The following tables are the recommended species and proportions for each zone. While the lists are similar and reflect hardy species and the end canopy species there are a small number of differences related to the level of exposure expected.

It is recommended that planting be revegetation grade e.g. plugs, RX90 or 1L sized plants.

In each zone a number of crown fern are also to be planted (distributed across the zone) acknowledging the difficulty in fern recovery but ensuring a sturdy fern is chosen with reasonable chance of success.

Zone 1 - Eastern most 10m	**Area (ha)**	**Density**	
	1.58	1/5m^2	
Species	**Common Name**	**Proportion in mix (%)**	**Number**
			724
Elaeocarpus dentatus var. dentatus	hinau	0.15	110
Dacrydium cupressinum	Rimu	0.05	37
Pterophylla racemosa	kamahi	0.2	145
Aristotelia serrata	makomako, wineberry	0.1	72
Pseudopanax crassifolius	lancewood	0.1	72
Melicytus ramiflorus	mahoe	0.1	72
Coprosma areolata	Thin-leaved coprosma	0.1	72
Hedycarya arborea	porokaiwhiri	0.1	72
Quintinia acutfolia	Westland Quintinia	0.1	72
Lomaria discolor	petipeti (crown fern)		100

Zone 2 - Middle 10m	**Area (ha)**	**Density**	
	1.58	1/3m2	
Species	**Common Name**	**Proportion in mix (%)**	**Number**
			2012
Elaeocarpus dentatus var. dentatus	hinau	0.1	200
Dacrydium cupressinum	Rimu	0.05	100
Pterophylla racemosa	kamahi	0.15	305
Myrsine australis	mapou	0.1	201
Pseudopanax crassifolius	lancewood	0.15	301
Melicytus ramiflorus	mahoe	0.1	201
Carpodetus serratus	putaputaweta, marbleleaf	0.15	302
Hedycarya arborea	porokaiwhiri	0.1	201
Quintinia acutfolia	Westland Quintinia	0.1	201
Lomaria discolor as ground cover	petipeti (crown fern)		500

Zone 3 - Western most 10m	**Area (ha)**	**Density**	
	1.58	1/1m2	
Species	**common name**	**Proportion in Mix (%)**	**Number**
			18105
Elaeocarpus dentatus var. dentatus	hinau	0.1	1810
Pterophylla racemosa	kamahi	0.1	1810
Pittosporum eugenioides	Lemonwood	0.2	3625
Myrsine australis	mapou	0.2	3625
Pseudopanax crassifolius	lancewood	0.1	1810
Griselinia lucida	puka, akapuka	0.1	1810
Coprosma lucida	shining karamu	0.1	1810
Coprosma rhamnoides		0.05	905
Quintinia acutfolia	Westland Quintinia	0.05	905
Lomaria discolor as ground cover	petipeti (crown fern)		500

2.5.9 Planting Generally

It is recommended planting is performed by experienced workers in accordance with the recognised best horticultural practice and under the supervision of a skilled site manager.

All plants shall be placed with the main stem vertical and at such a depth that the soil, when firmed down is at the same height as the earth marks on the stem from the soil level of the container. Loose roots shall be spread out in a natural fashion;

the soil being carefully placed under and amongst them to fill all voids and firmed in. The bottom of each hole shall be pierced to a depth of 200mm with the tines of a fork or similar implement to ensure compactions are loosened for root penetration and free drainage. The sides of the hole shall be roughened to remove any glazing of the surface.

Container grown plants shall have the container removed immediately prior to planting. Care shall be taken to ensure that the root ball is not disturbed during container removal or planting. Any major roots that become accidentally broken off or frayed shall be cleanly cut off from the plant.

3.0 Wetlands

While not part of the required remedial actions the new wetlands are part of the new remedial forest habitat and environment and need to be appropriately constructed and vegetated. We assume these will be fully vegetated damp to surface wet seasonally variable depression that may at times be fully inundated (following heavy rain). The species chosen to reflect that assumption and also how they fit into the forested area.

The area of the features themselves will be developed to ensure their RL's and contour are close to the average ground water level and rising at the sides gentle, allowing for species sequences.

In essence the features will be:

Wetland 1 (southern)	**Area (ha)**	**Density**	**Number**
	0.52	1/1m2	5959
Species	common name	proportion in mix (%)	
Juncus edgariae	wiwi	0.1	596
Austroderia toetoe	toetoe	0.05	298
Carex virgata	Swamp sedge	0.2	1192
Carex secta	purei	0.1	596
Carex geminata	rautahi	0.2	1192
Machaerina rubignosa	baumea	0.05	298
phormium tenax	harakeke	0.2	1192
Coprosma propinqua	mingimingi	0.05	298
Cordyline australis	tī kōuka	0.05	298

Wetland 2 (central)	Area (ha)	Density	Number
	1.01	1/1m2	11460
Species	common name	proportion in mix (%)	
Juncus edgariae	wiwi	0.1	1146
Austroderia toetoe	toetoe	0.05	573
Carex virgata	Swamp sedge	0.2	2292
Carex secta	purei	0.1	1146
Carex geminata	rautahi	0.2	2292
Machaerina rubignosa	baumea	0.05	573
phormium tenax	harakeke	0.2	2292
Coprosma propinqua	mingimingi	0.05	573
Cordyline australis	tī kōuka	0.05	573

Wetland 2 (northern (void))	Area (ha)	Density	Number
	0.85	1/1m2	9740
Species	common name	proportion in mix (%)	
Juncus edgariae	wiwi	0.2	1948
Austroderia toetoe	toetoe	0.1	974
Carex virgata	Swamp sedge	0.3	2922
phormium tenax	harakeke	0.3	2922

Cordyline australis	tī kōuka	0.1	974

4.0 Monitoring Success and Triggering Management Actions

Monitoring must be carried out to ensure development is on track and to establish success. Additional monitoring is required to identify pest issues on site (plant and animal).

4.1 Revegetation Monitoring

The vegetation development monitoring will be by way of 2 X 20m by 20m vegetation plots fixed by "permanent" stakes at each corner every 200m along the 1.7km restoration area. This means nine sets of paired vegetation plots. One plot in the 10m east band, the other off set between the middle and western 10m band.

The plot data should be established immediately after completion of the plantings of each 200m section is complete. Collection of data should be biannual (and is additional to any maintenance the planter might chose to do). It proceeds for as long as the section does not meet the success criteria of 80% canopy cover of the correct species with the appropriate final canopy species representation in the canopy (10%).

The plot data will record the species present (including weed species) and their aerial cover estimates and the total vegetation cover of indigenous species. The saplings of all woody native species (including those planted) in the plot will be measured for height (height above ground of the main stem to apex).

This will provide a record of species richness, weed species presence, evidence of seedling germination, woody species height and canopy cover and so closure.

The plots can be distributed at 200m intervals from the first set (which are randomised in the first 200m set) rather than randomised in each 200m section (Figure 3).

In addition, each 10m band will be walked and descriptive notes made of averaged cover in the 200m section, species recorded with 1m either side of the transect, photographs taken, and any issues (such as weeds or animal damage) recorded, and GPS located. It is this monitoring regime that is most likely to alert section wide issues or issues of planted plant failures.

These monitoring transects and plots will also be used to check for erosion. The causes of any erosion will be identified, and remedial action undertaken where required:

- Over sowing or replanting
- Mulching

- Recontouring
- Armouring.

Then amendments will be made to rehabilitation methodology (slope, surface roughness, timing)

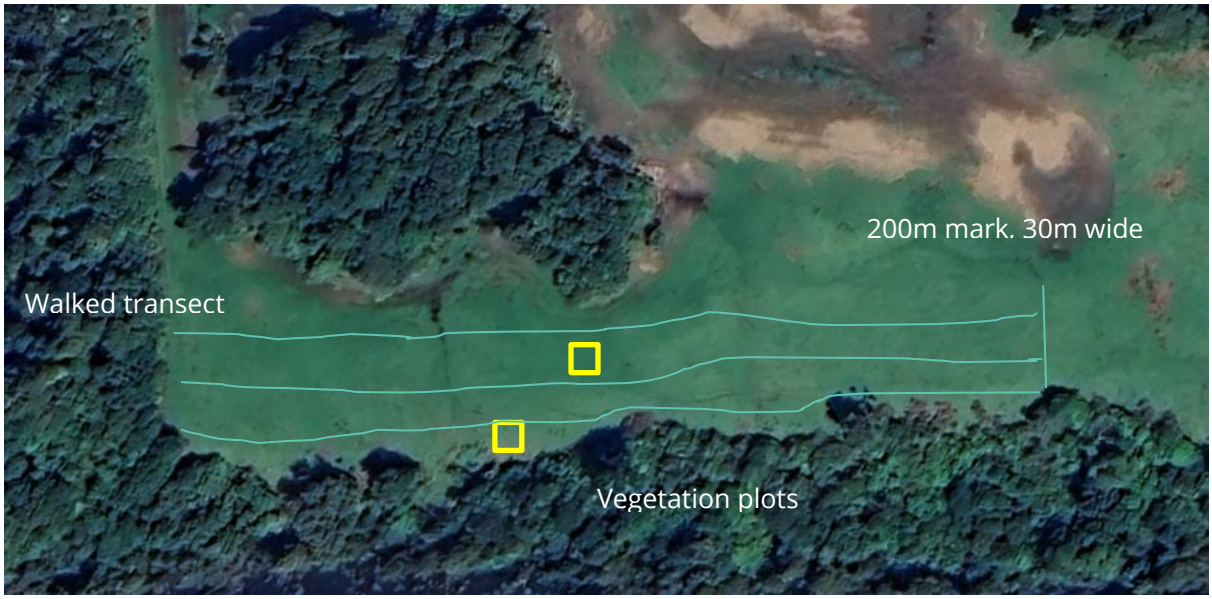

Figure 3: Diagrammatic depiction of monitoring process in a 200m restored section

4.2 Wetland monitoring

While not for mitigation of adverse effects, the wetlands need to form a natural functioning wetland as part of the entire escarpment band. As with the terrestrial vegetation the target is a full cover of sedges and ruches across the entire wet area but a figure of 80% is raised as a threshold of success as some areas may still be open water at the time of measure.

The measure will be via three 5m by 5m plots, one central, and two on the wetland edges (within 2m of the edge). Plus 4 fixed photo points looking into the system (and northern, southern, eastern and western point). The plots will allow testing of weed species presence, and cover establishment of the planted species.

5.0 Pest Plant and Weed control.

5.1 Pest Assessment

The Installer will undertake an assessment of pest plants prior to planting. This assessment shall outline the pest populations to be controlled and include a list of pest species including priority pests. Based on this assessment the site manager will have a pest management program prepared. The area to be controlled will be the full extent of the mitigation planting areas as shown on the planting plans and the protection area of the eastern escarpment forest and wetland.

5.2 Methodology and Programme

The site manager shall have prepared a methodology and programme statement to address pests identified in the pest assessment, including the following:

- A plan or map detailing the extent of the site preparation/clearance areas to be managed.
- Strategies used to avoid contamination of sensitive areas. This could include specific application techniques, no-spray buffer zones, and a list of people who need to be informed of spraying operations.
- The identity of the person likely to be undertaking the work and confirmation of their current qualifications/ certifications.
- Recording of the time and type and extent of control events.
- A schedule of monitoring and techniques used to establish the further need of control.

5.2.1 Pest Plant Removal

Pest plant control shall be undertaken during site preparation and prior to planting, with all planting areas being cleared of pest plants prior to planting.

5.2.2 Disposal

Unless otherwise specified, the Installer is responsible for the disposal off site all pest plant materials in a safe and legal manner.

5.2.3 Other Maintenance actions and timing

The fencing off of the restoration area is presumed to be staged as the first run of the mine progresses down the eastern boundary. A temporary lateral fence may be required to ensure the current restoration stage is protected but a better solution is a temporary fence the entire length of the site on the west side of the mine. This is then replaced by the permeant fence down the entire "reserve" west boundary. We suggest two gates for maintained access, one north and one south. that fence must be maintained in stock proof condition.

5.3 Completion of "maintenance"

Typically, a revegetation programme runs for a three-year maintenance period (3-5 years depending on cover level achievement). Prior to issue of the Defects Liability Certificate, the Installer supplies the following:

- Written summary of all maintenance visits, and actions undertaken to rectify any issues found or reported.

In this case the cessation of maintenance is not installer time bound but related to success measures of canopy cover and weed extent derived by monitoring. Regardless the Consent holder must supply the above information to Council if requested.

We note that it is appropriate that the restoration works may be inspected from time to time by accredited representative of the local authorities in relation to consent conditions. Should such representatives request information in connection to pest weed and animal control, the Installer shall provide the information to them willingly, to the details of their knowledge.

5.4 Pest Monitoring and Pest Control

Pest management will include:

- Two rounds of weed control prior to planting/restoration efforts.
- Pre planting animal pest control (rabbits, possum, hare, pukeko).
- Quarterly weed and animal monitoring and control for 3 years after each area is planted and monitoring and reaction yearly for the following 3 years until the canopy cover threshold is reached.

While the transect inspections may alert observers to animal pest issues on site a more direct pest animal monitoring tool is suggested.

The principal animals of issue include rabbit, possum, and hares. It is noted that where skink salvage and transfer does occur the target pest management will need to also include rats and hedgehogs.

Rats and hedge hogs can be site wide monitored by tracking tunnels and or chew cards.

With respect to rabbits and hares' and possum night counts (using the Modified McLean Rabbit Infestation Scale 2012 for rabbits and hare) may be the best choice. The Modified McLean Scale is ideally suited to establish whether some control threshold has been reached.

Modified McLean Rabbit Infestation Scale 2012

1	No sign found. No rabbits seen.
2	Very infrequent sign present. Unlikely to see rabbits.
3	Pellet heaps spaced 10m or more apart on average. Odd rabbits seen; sign and some pellet heaps showing up.
4	Pellet heaps spaced between 5 m and 10 m apart on average. Pockets of rabbits; sign and fresh burrows very noticeable.
5	Pellet heaps spaced 5 m or less apart on average. Infestation spreading out from heavy pockets
6	Sign very frequent with pellet heaps often less than 5m apart over the whole area. Rabbits may be seen over the whole area.
7	Sign very frequent with 2-3 pellet heaps often less than 5 m apart over the whole area. Rabbits may be seen in large numbers over the whole area.
8	Sign very frequent with 3 or more pellet heaps often less than 5 m apart over the whole area. Rabbits likely to be seen in large numbers over the whole area.

When measuring the presence of rabbits, the assessor should undertake to score a number of plots across the site. The observer should cover all parts of the site to a point where all potential rabbit habitat can be scored. The minimum number of plots scored should be 20 per block/property to allow for a robust assessment to be made.

5.4.1 Pest Control Methods

The site manager shall have prepared a methodology and programme statement to address pests identified in the pest assessment, including the following:

- A plan or map detailing the extent of the site preparation/clearance areas to be managed.

- Types of chemicals (herbicide, fungicide, baits) or shooting or traps that are likely to be used and the times of year that any control operations are likely to occur.
- Recording of the time and type and extent of control events.
- A schedule of monitoring and techniques used to establish the further need of control.

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