

Appendix 15: Planting Plan

Boffa Miskell



Whitehall Quarry Long-Term Expansion Planting Plan

Prepared for Winstone Aggregates





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1.0 Introduction

1.1 Background

Winstone Aggregates Ltd (Winstone) proposes to plant approximately 30 ha of the Whitehall Quarry site (Waipā, Waikato) in native forest and scrub, providing ecological connectivity between three isolated and fragmented Significant Natural Areas (District Plan reference SNA WP527, SNA WP530 & SNA WP532). The planted areas and connected SNAs will create approximately 86 ha of contiguous native vegetation (Figure 1), providing enhanced habitat for native fauna.

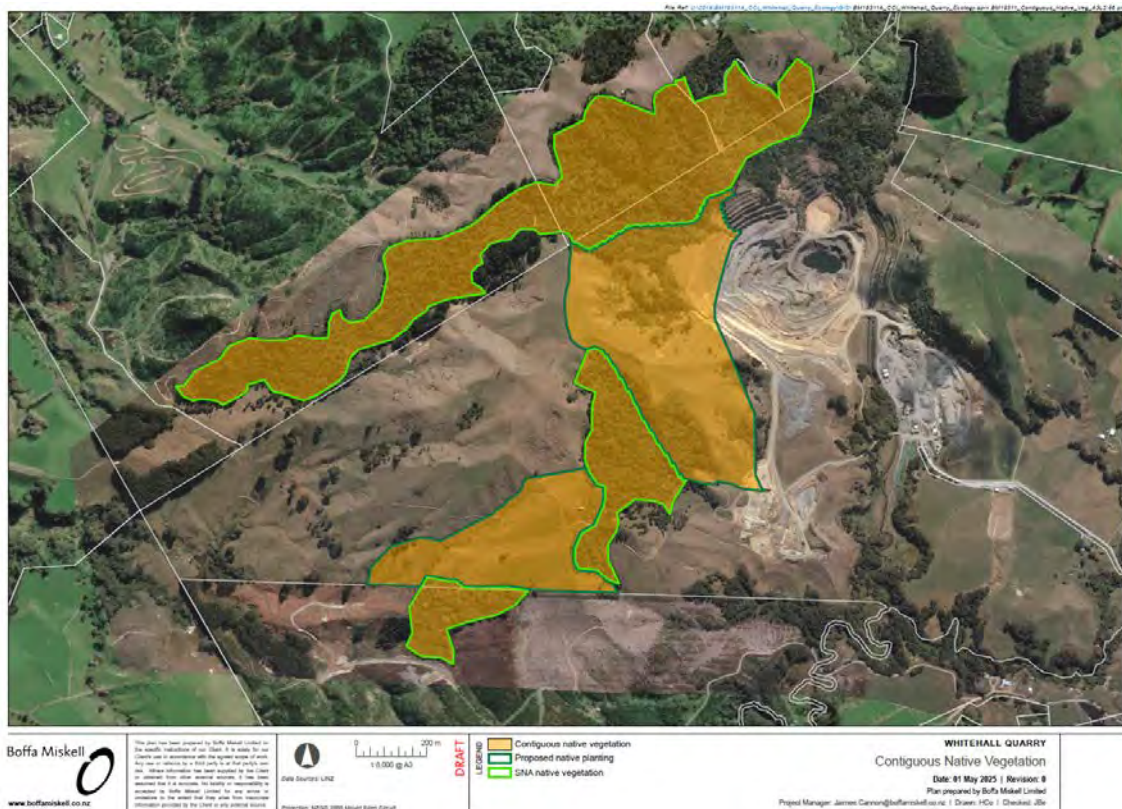


Figure 1. Extent of proposed contiguous native vegetation consisting of three SNAs and 30 ha of proposed native vegetation planting areas (86 ha in total).

Winstone is seeking resource consent to expand the existing authorised extraction area (Long-Term expansion) of the Whitehall Quarry by approximately 15.5 ha in a westerly direction (Figure 2) which will help facilitate the formation of the 86 ha of contiguous native vegetation (Figure 1). The proposed quarry expansion will result in the removal of some 5.46 ha of native forest within Significant Natural Areas (District Plan reference SNA WP527 and SNA WP530) (Figure 2) and some 0.22 ha of kanuka-scrub vegetation within 10 m of a 'natural inland wetland' (Figure 4). To mitigate the loss of native vegetation and visual impacts, 12.5 ha of Enhancement Planting (Figure 2) and 1.25 ha of Ridgeline planting (Figure 3) are proposed. In addition, 16.4 ha of Quarry Bench planting (Figure 3) will be undertaken as quarry remediation once the expansion area is retired.

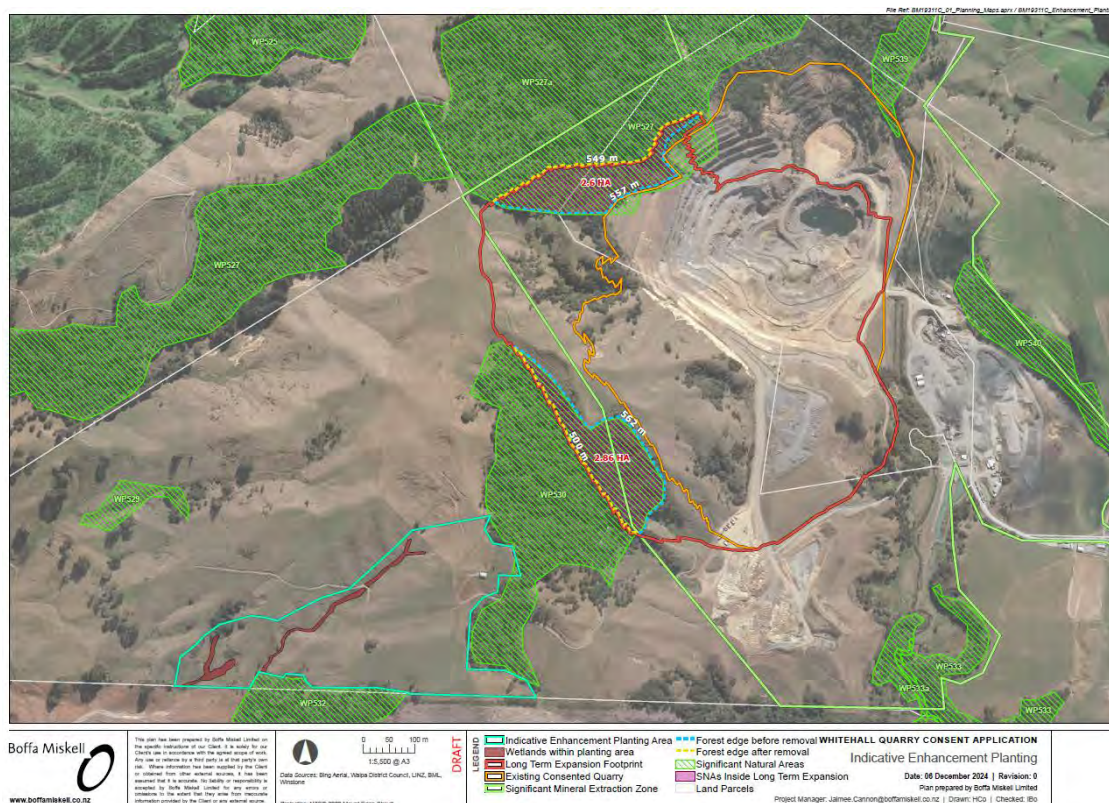


Figure 2. The proposed Whitehall Quarry expansion area, surrounding SNAs and the Enhancement Planting area.

Enhancement Planting - To manage against the loss of 5.68 ha of native vegetation communities, detailed in the Boffa Miskell Whitehall Quarry Long-Term Expansion AECE (2025) and Section 1.3 it is recommended that 12.5 ha of predominantly pasture to the southwest of the quarry site (Figure 2) be planted in native pioneer species (mix of native shrubs and trees) appropriate for the location, and legally and physically protected. Once a suitable canopy cover is established, canopy enrichment planting can commence as part of the long-term enhancement of the area. The Enhancement Planting and protections have been calculated to provide a net biodiversity gain to offset the loss of native vegetation, with details provided in the BM Whitehall Quarry Long-Term Expansion AECE (2025). The Enhancement Planting will also enhance ecological connections between existing SNAs (Figure 2) on the property and provide habitat for native fauna.

Ridgeline Planting – To reduce visual effects of the quarry expansion and strengthen the legibility of the ridgeline, a 1.25 ha area of predominantly pasture (Figure 2), on the northwest ridgeline of the quarry expansion area, will be planted in native pioneer species (mix of native shrubs and trees) appropriate for the location and protected both legally and physically. Once a suitable canopy cover is established, canopy enrichment planting can commence as part of the long-term enhancement of the area. A secondary benefit is that the Ridgeline Planting will also enhance ecological connections between existing SNAs (Figure 3) on the property and provide habitat for native fauna.

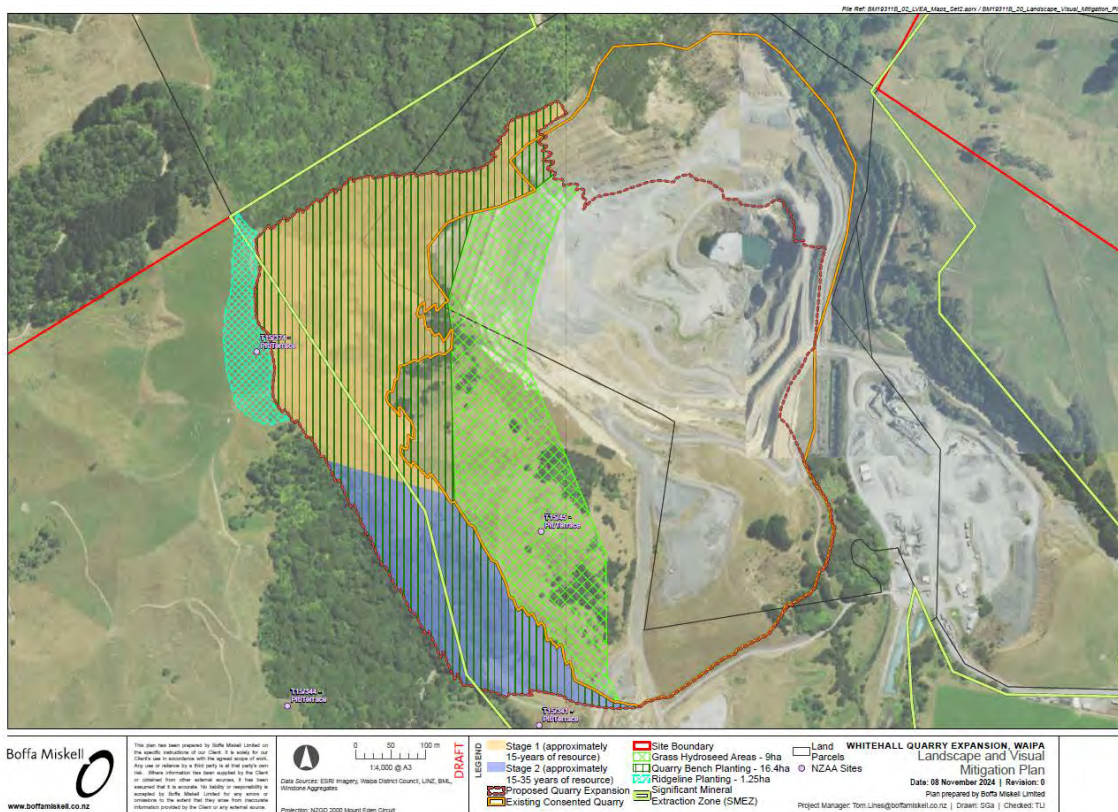


Figure 3. Ridgeline and Bench Planting areas at the proposed Whitehall Quarry expansion site.

Bench Planting – Once the proposed quarry expansion area is retired, approximately 16.4 ha on quarry benching (Figure 3) to the north and west of the expansion area will be planted in native mānuka (*Leptospermum scoparium*) and kānuka (*Kunzea ericoides*) as part of the quarry remediation program. The native planting will provide visual mitigation for vertical cuts in the quarry face and ecological connectivity between existing SNAs and habitat for native fauna. Over time, other native plant species will self-establish within the Bench Planting area.

1.2 Scope

This Planting Plan outlines the proposed areas and management requirements for Enhancement, Ridgeline and Bench Planting areas of native vegetation for the proposed Whitehall Quarry expansion.

For all areas of planting, this plan will cover the:

- Location of planting area.
- Site preparation.
- Planting and maintenance methods.
- Physical and legal protections.
- Work schedule.
- Planting schedules.

The ecological management requirements are aligned with the recommendations provided in the BM Whitehall Quarry Long-Term Expansion AECE (2005).

1.3 Quarry Expansion Vegetation Loss

In total, 5.68 hectares of predominantly indigenous vegetation are proposed to be cleared as part of the quarry expansion, 5.46 hectares of tawa forest and 0.22 hectares of kanuka scrub within a 10 m setback of a natural wetland (Figure 4). In addition, an area of predominantly pasture with patches of gorse and kanuka scrub will be removed as a permitted activity (Figure 4). Although the proposed clearance of the southern SNA is not anticipated to take place for approximately 15 to 20 years, mitigating planting would take place immediately as part of the Enhancement Planting.

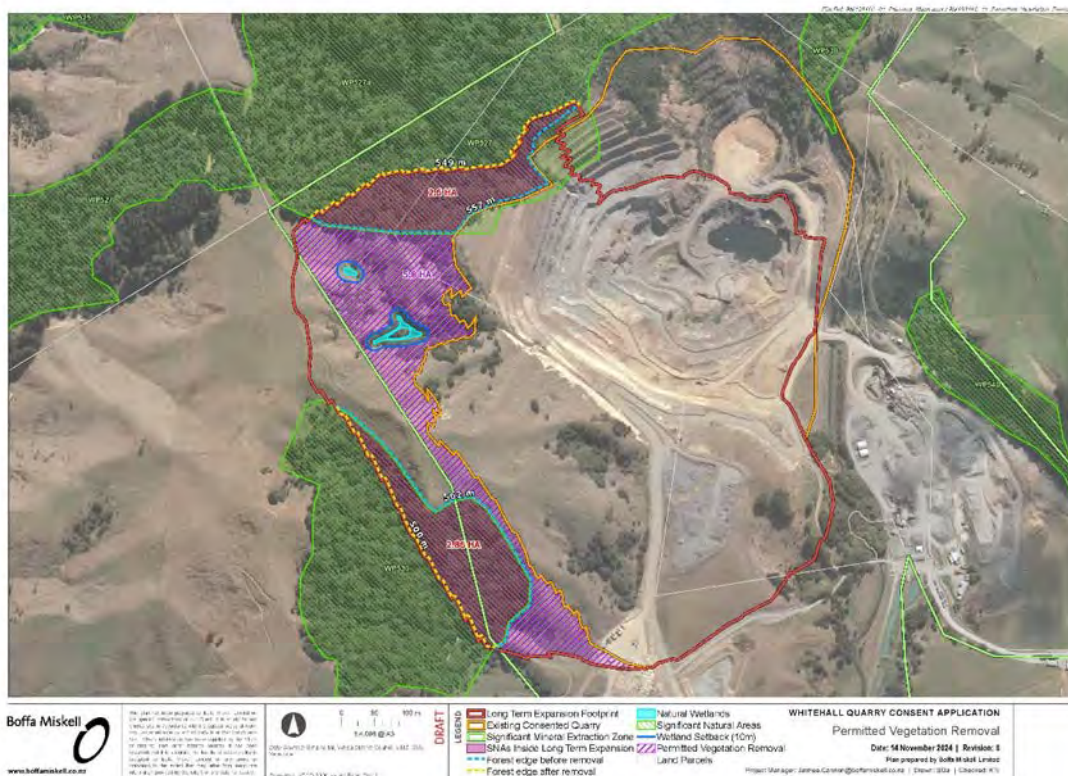


Figure 4. Proposed vegetation and wetland loss in the Whitehall Quarry expansion area.

A description of the proposed vegetation communities to be cleared is as follows:

Tawa Forest - Two tawa forests areas partially within the proposed quarry expansion zone (Figure 3) are SNAs: SNA WP527 (northern) and SNA WP530 (western). Tawa (*Beilschmiedia tawa*) is the dominant species in the canopy. Pukatea (*Laurelia novae-zelandiae*), mangeao (*Litsea calicaris*), and silver fern (*Cyathea dealbata*) also form dominant components within the upper height tiers (canopy and sub-canopy). Other species such as rimu (*Dacrydium cupressinum*), rewarewa (*Knightia excelsa*), miro (*Pectinopitys ferruginea*), mahoe (*Melicytus ramiflorus*), nikau (*Rhopalostylis sapida*), mamaku (*Cyathea medullaris*), and kānuka (*Kunzea robusta*) are present in the upper height tiers, but at low densities.

The understorey is generally limited, often void of vegetation due to the browsing pressure from mammal pests, primarily deer (and potentially goats). Small pockets of dense undergrowth remain, dominated mainly by kawakawa (*Piper excelsum*) and small ferns (Hen and chicken – *Asplenium bulbiferum*, thread fern – *Icarus filiformis*). Occasional basket grass (*Oplismenus hirtellus* subsp. *imbecillis*), pigeonwood (*Hedycarya arborea*), and hangehange (*Geniostoma ligustrifolium*) are also scattered in the understorey. Numerous seedlings (< 10 cm) of native vegetation, including of tall canopy trees (rewarewa, mangeao, pukatea) were noted. These young seedlings make up a tiny fraction of the vegetation cover in the Tawa forests and are unlikely to reach maturity due to ongoing browsing pressure.

Kānuka scrub - Kānuka scrub (3 – 4 m tall) is present within the proposed quarry expansion zone and dominates the canopy and sub-canopy. Most of the scrub within the area can be removed as a permitted activity (Figure 3). However, a small portion is within 10 m of a natural wetland (Figure 3). Mahoe and kawakawa are occasionally present in the upper height tiers. The canopy is incomplete, as several gaps are present throughout the kanuka scrub. Natural regeneration of native vegetation is limited to a few species occurring in low densities. Creek fern (*Cranfillia fluviatilis*), rasp fern (*Doodia australis*), bracken (*Pteridium esculentum*), kānuka, silver fern, basket grass, and kawakawa were the only native understorey/ground cover species recorded. Native species diversity and abundance is limited in the kanuka scrub habitats. Exotic pasture grass is abundant, covering most of the ground within the kanuka scrub.

Gorse patch - A large patch of gorse (*Ulex europaeus*) is adjacent to the kānuka scrub (Figure 1). As gorse makes up most of the vegetation cover, species diversity is limited. Pasture grass was common within gaps, and other species such as kanuka and rasp fern were occasionally noted.

Pasture grass - Pasture grass dominates with little species diversity. Occasional growth of other species such as kānuka, ragwort, and gorse was noted.

2.0 Enhancement Planting

2.1 Enhancement Planting Area

To mitigate loss of native vegetation communities (5.46 ha tawa forests and 0.22 ha of kanuka scrub), it is proposed 12.5 ha of predominantly pasture to the southwest of the quarry is planted with native vegetation, with the size of the area derived from biodiversity modelling outcomes described in BM's Whitehall Quarry Long-Term Expansion AECE (2025). The southwest-facing gully system contains occasional mature exotic and native trees (including small stands), wetlands (mostly exotic-dominated), and the headwaters of tributaries. The selected area sits outside the Significant Mineral Extraction Zone (Figure 2) to ensure any future quarrying activities do not impact it.

The proposed Enhancement Planting area is between two SNAs (Figure 5). Planting native vegetation between the SNAs will improve ecological connections and provide a more extensive and contiguous habitat for native forest fauna.

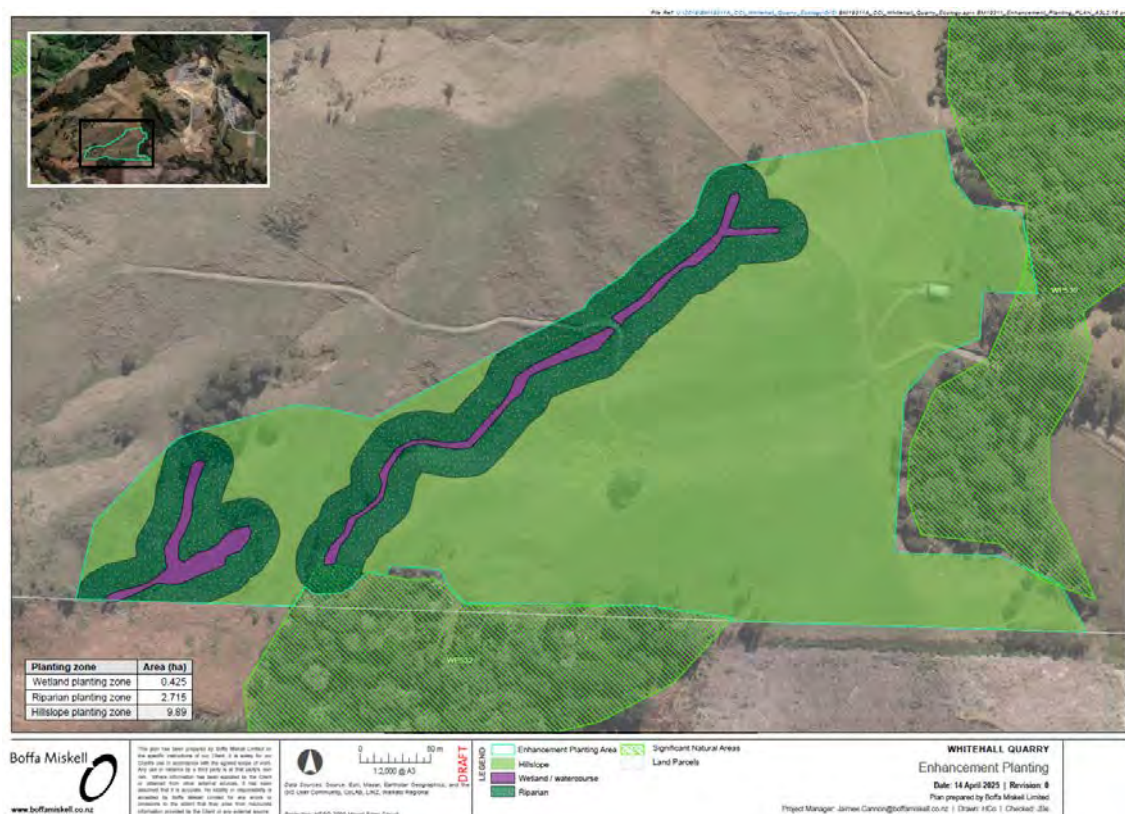


Figure 5. Proposed 12.5 ha Enhancement Planting area at the Whitehall Quarry site situated between Significant Natural Areas, WP232 and WP530. The area contains three planting zones: Hillslope, Wetland/watercourse and Riparian.

2.2 Enhancement Planting Objectives

The objectives for the Enhancement area are as follows:

- The Enhancement Planting area is permanently legally protected by covenants;
- The Enhancement Planting area is fenced, and permanent exclusion of all livestock, wild deer and goats is maintained to allow continued natural regeneration of native plant species;
- Pest plants are monitored and controlled to ensure they do not inhibit the natural regeneration of native species in the Enhancement Planting area;
- An appropriate native plant cover is established within the Enhancement Planting area;
- Animal pest control occurs, aligned with the requirements of the yet-to-be-written Pest Management Plan;
- The Enhancement Planting is climate change resilient.

2.3 Enhancement Planting Zones

The enhancement planting area will have three planting zones (Figure 5):

- **Wetland/Watercourse** - existing wetlands currently dominated by exotic hydrophytes.
- **Riparian** - A 20 m buffer around the Wetland zones, the Riparian zone is currently dominated by exotic pasture with some small patches of indigenous vegetation.
- **Hillslope** - will cover the remaining areas not covered by the Wetland and Riparian zones. The Hillslope zone is currently dominated by exotic pasture with some small patches of indigenous vegetation.

2.4 Enhancement Planting Area Measures

2.4.1 Legal Protection

The Enhancement Planting area will be legally protected in perpetuity by a covenant. The covenant will protect native vegetation within the area from any future clearance, except to maintain surrounding fences.

2.4.2 Fencing

Fencing is required around the perimeter of the enhancement planting area to exclude livestock, wild deer, and goats and will be built before enhancement planting takes place. All fencing will follow the Department of Conservation Perimeter Deer Fence and Gate guidelines¹ and where cattle have access to the outside of the fence, there will be a live wire on the fence at 0.9 m from the ground.

¹ <https://www.doc.govt.nz/nature/pests-and-threats/animal-pests-and-threats/deer/deer-farming-requirements-in-the-auckland-region/>

The fence line will be checked at least every three months and after any storm events to ensure that it is not damaged (e.g., from tree fall, slips, and wear and tear) and potentially allows deer, goats and stock entry into the enhancement planting area. Any damage to fencing shall be fixed as soon as practicable, and stock shall be excluded from adjacent paddocks until fencing is repaired.

2.4.3 Pest Animals

Possums, rats, deer, goats, rabbits, and hares have been identified as pest animals that will likely pose a risk to the planting success and future growth on the site. These species will be managed by fencing (Section 2.4.1) and culling before enhancement planting is undertaken. Details on pest animal control will be outlined in a Pest Management Plan.

2.4.4 Pest Plants

Weed species in the enhancement planting area, such as gorse, woolly nightshade, pampas, and privet, will be removed mechanically or with appropriate herbicides before planting. Exotic pasture species within the area will be sprayed with appropriate herbicides such as Glyphosate. The use of herbicides in wetlands, watercourses and their margins will be kept to a practicable minimum. A qualified and experienced contractor will handle and apply any herbicide.

Exotic trees will be removed from the enhancement planting area; however, if suitable habitat features are present on large stature (<5m) exotic trees, they may be retained, and their offspring are to be controlled with weeding efforts.

Naturally regenerating indigenous vegetation will be retained, and herbicide use under and directly around the indigenous vegetation will be kept to a practical minimum.

2.5 Planting

2.5.1 Timing

General plantings will be carried out between May and September. However, planting could be done near the end of summer when water levels are lowest in wetland/watercourse areas that are consistently wet. Section 6.0 provides further information on the timing for planting.

Canopy enrichment planting should occur once at least 80% canopy closure is achieved, to prevent premature planting of sensitive species such as tawa and rimu.

2.5.2 Plant sourcing, numbers, and density

The property is located within the Maungatautari Ecological District; therefore, native plants shall be eco-sourced from an appropriate Ecological District² and representative of the tawa-dominated forest type that will be lost due to the quarry expansion. Plants are to be planted at an average of 1.5 m spacing in the Hillslope and Riparian zones with a density of 4,444 stems

² Where plants are not able to be sourced from the Maungatautari Ecological District, they should be sourced from the nearest ecologically similar habitat in a neighbouring ecological district.

per ha, and 0.5 m spacing in the Wetland/watercourse zone with 10,000 stems per ha. Individual plants will be planted in groups of 3 to 5 of the same species. Planting in general, within the Hillslope and Riparian zones, will focus on fast-growing indigenous pioneer species. Planting indigenous flax, sedges and rushes is required within the wetland/watercourse zones. To further enrich planting zones, frost and sun-tender species will be planted once 80% cover has been achieved at a rate of 200 plants per hectare.

Eco-sourced plants need to be healthy, true to type of the species, and be:

- Free from apparent signs of disease and pests.
- 0.5 to 1 L pot grade for wetland sedges and rushes.
- 0.5 to 1 L pot grade for mānuka and kānuka
- 1 to 1.5 L pot grade for all other non-wetland sedges and rushes.
- Well established within the pot with roots just reaching the outer extent of the pot.
- Not root-bound³.

The amount of indigenous planting required differs between the planting zones (Riparian, Wetland and Hillslope zones). **Planting schedules** for each zone are provided in **Appendix 1**, with plant selection aligning with plants from the SNA clearance areas, which are recommended for planting within the ED by WRC⁴ and are commonly available from local plant nurseries. If the recommended plant species and/or numbers cannot be sourced, the species should be substituted for another species appropriate for the site (subject to confirmation by an ecologist). Note that the number of plants recommended for each gully area and habitat zone is an estimate to guide the quantity of plants required. Further species and abundance guidance, if needed, can be found in the Maungatautari Ecological District Planting Guide⁵.

2.5.3 Planting and Maintenance

Each planting hole will be dug larger than the pot size and backfilled. The plant is then secured in the ground by filling the space surrounding the roots with soil and lightly heeling the plant into the soil. After planting, there should be no voids in the planting hole. Fertiliser is not anticipated to be required.

Plantings will be maintained thrice yearly for the first two years and twice for the following three years. Maintenance will include clearing competing grass and weeds around each plant. This can be done manually or with glyphosate-based herbicide (utilising a spray guard to avoid non-target damage). The timing of this maintenance will follow the works programme in Section 6.0.

Plants that do not survive are to be replaced the following planting season. Replacement plants will be of the same species as that lost, unless it is noticed that all individuals of one species have failed throughout the planting or in specific locations. These individuals shall be replaced with another appropriate species successfully established within the planting area. Additionally,

³ However, it is typical of sedge and flax species to have rapid root growth and it is uncommon to have these types of plants entirely free from root binding. As such, loosening the root ball prior to planting is often required and recommended. Warning – only loosen roots balls for these species as several native species severely resent root disturbance.

⁴ <https://www.waikatoregion.govt.nz/environment/biodiversity/planting-guides/what-to-plant-in-maungatautari-ecological-district/>

⁵ <https://www.waikatoregion.govt.nz/assets/WRC/Maungatautari-planting-guide-part-1.pdf>

fertiliser can be used when replacing plants if poor soil nutrients are a potential reason for plant mortality / poor health.

3.0 Ridgeline Planting

3.1 Ridgeline Planting Area

The Ridgeline Planting area is approximately 1.25 ha of pasture-dominated land between two SNAs, northwest of the quarry expansion area and is situated on a west-facing ridgeline. The selected area sits outside the Significant Mineral Extraction Zone (Figure 1) to ensure any future quarrying activities do not impact it. The proposed Ridgeline Planting area is between two SNAs (Figure 2). Planting native vegetation between the SNAs will improve ecological connectivity and provide a more extensive and contiguous habitat for forest fauna.

3.2 Ridgeline Planting Objectives

The objectives for the Ridgeline Planting area will be the same as those described in Section 2.3 and will also provide visual mitigation for the quarry.

3.3 Ridgeline Planting Area Measures

The same measures as described in Section 2.4 will apply to the Ridgeline Planting area.

In addition to deer fencing the Ridgeline Planting area, the two connected SNAs (Figure 2) to the north and south will also be deer fenced (Section 2.4.2). The northern SNA spans outside the Whitehall Quarry property; fencing will follow the boundary line unless notified otherwise.

3.4 Planting

The timing, sourcing, numbers, density of plants, planting and maintenance in the Ridgeline area will largely follow the descriptions provided in Sections 2.6. The Ridgeline Planting area will have an average plant spacing of 1.5 m and a density of 4,444 stems per ha. Enrichment planting of frost and sun-tender species will be planted once 80% cover has been achieved at a rate of 200 plants per hectare. Tawa trees will not be planted within 10 m of the vertical cut of the quarry face, as there is concern, they may not tolerate the dry ground and stronger wind conditions because of climate change close to the vertical cut of the quarry face, which will be to the east of the planting area. A **planting schedule** for the Ridgeline Planting Area is provided in **Appendix 2**.

4.0 Quarry Bench Planting

4.1 Quarry Bench Planting Area

The Quarry Bench Planting area is approximately 16.4 ha, mainly within the proposed Quarry Expansion (Figure 3) with a small portion within the existing consented quarry. The area will be split into two planting stages:

Stage 1 will be approximately 11 ha and consist of the northern half of the Quarry Expansion area and some pockets of the existing consented quarry (Figure 3). The area is anticipated to be retired and remediated 15 – 20 years after quarrying in the expansion area has commenced.

Stage 2 will be approximately 5.4 ha and comprise the southern half of the Quarry Expansion area (Figure 3). The area is anticipated to be retired and remediated 35 – 40 years after quarrying in the expansion area has commenced.

The benching is anticipated to mostly step down to the quarry pit in a west-to-east direction.

4.2 Quarry Bench Planting Objectives

The objectives for the Quarry Bench Planting will be to provide visual mitigation for the quarry once retired, with appropriate native plant cover established.

4.3 Quarry Bench Planting Area Measures

Benches within the planting areas will have a layer of soil at least 300 mm deep and will be sprayed with an appropriate herbicide for pest plants before planting.

Possums, rats, deer, goats, rabbits, and hares have been identified as pest animals that will likely pose a risk to the planting success and future growth on the site. Because fencing of a benched quarry area is impractical, planting will consist of larger grade (1.5 – 2 L) mānuka and kānuka that are unpalatable to most identified pest animals. Other native plant species will self-introduce from adjacent native vegetation over time.

4.4 Planting

4.4.1 Timing

Plantings will be carried out between May and September.

4.4.2 Plant sourcing, numbers, and density

A mix of mānuka and kānuka will eco-sourced from the Maungatautari Ecological District and planted at 1.5 m spacing with a density of 4,444 stems per ha. **Planting schedules** for each stage are provided in **Appendix 3**.

4.4.3 Planting and Maintenance

Planting and maintenance will follow the description provided in Section 2.5.3.

5.0 Works Programme

The work programme for management is summarised below in Table 1 and is indicative of a general schedule approach.

A significant amount of restoration effort is required, given the scale of the proposed works and the presence of invasive pest plants (which may require several rounds of treatment to be controlled). As a result, it may take a considerable amount of time (> 5 years) to achieve 80% cover before enrichment planting is conducted in the Enhancement and Ridgeline Planting areas.

Table 1. The work schedule for the planting areas (Enhancement, Ridgeline and Quarry Bench Planting) indicates the time of year each action is undertaken.

Action	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Planting site preparation												
Planting (including replacement and enrichment planting)												
Planting maintenance (Years 1 and 2)												
Planting maintenance (Years 3 to 5)												
Pest plant survey and control (once per year – ideally during November – March)												
Pest animal control maintain bait in bait stations*												
Pest animal control. Check traps*												

*Will be detailed in a pest management plan

Detail of yearly activities

Year 1:

- Establish fit for purpose fencing. Survey for fence integrity and maintain as required. Storm events will be followed by a fence check.
- Prepare planting sites.
- Spot spraying planting locations where required.
- Begin planting native species. Planting will be conducted within the recognised planting season (from May to September), although planting within wet areas may be suitable outside of this period, depending on site conditions.
- Maintain planted natives – release from competition by manually clearing vegetation from the plant or spraying around the plant. It may be required two to three times this year.
- Conduct survival monitoring every six months for the first year after planting.

- Survey for and control pest plant species across the planting areas. Surveillance required.
- Establish pest animal control devices and a trapping/baiting network. Begin checks of the bait stations and trap network⁶.
- Establish photo points to document the progress of planting.

Year 2:

- Survey for fence integrity and maintain as required. Storm events will be followed by a fence check.
- Maintain planted natives – release from weed competition by manually clearing vegetation from the plant or spraying around the plant. It may be required two to three times this year.
- Monitor planting for survival.
- Replace any failed or sick native plant species. Planting will be conducted within the recognised planting season (from May to September), although planting within wet areas may be suitable outside of this period, depending on site conditions.
- Survey for and control pest plant species across the planting areas. Surveillance is required twice per year.
- Carry out checks of bait stations and trap network.
- Re-photograph photo point locations to monitor changes in vegetation cover.

Year 3 – 5:

- Survey for fence integrity and maintain as required. Storm events will be followed by a fence check.
- Maintain planted natives – if required, release from weed competition by manually clearing vegetation from the plant or spraying around the plant.
- Monitor plantings for survival.
- Replace any failed or sick native plant species. Planting will be conducted within the recognised planting season (beginning of May to start of September), although planting within wet areas may be suitable outside of this period, depending on site conditions.
- After 5 years, canopy closure should be achieved; if not, continue maintenance and replacement planting until at least 80% canopy closure has occurred over the planted areas.
- Survey for and control pest plant species across the planting areas. Surveillance is required once per year⁷.
- Carry out checks of the bait stations and trap network.
- Re-photograph photo point locations to monitor changes in vegetation cover.
- Begin canopy enrichment planting.

⁶ Will be detailed in a pest management plan

⁷ If pest plant presence not significantly reduced, conduct pest plant survey twice per year.

Year 6 and ongoing requirements:

- Survey for fence integrity and maintain as required. Storm events will be followed by a fence check.
- Survey for and control pest plant species across the planting areas. Surveillance is required once per year.
- Carry out checks of the bait stations and trap network.
- Continue canopy enrichment planting and maintenance until a higher diversity of canopy species is established.
- Continue to re-photograph photo point locations until planting areas are well established.

6.0 Adaptive management

The methods outlined within this Planting Plan will be continually assessed for their efficacy towards ensuring the ongoing protection of the planting areas and their long-term ecological viability. Methods failing to achieve desired objectives will be reassessed and improved based on learnings from current operations and the input of suitably experienced and qualified restoration ecologists.

The protection and enhancement of the planting areas will significantly improve the site's ecological value and provide broader ecological benefits within the surrounding landscape of the Maungatautari Ecological District.

7.0 References

Boffa Miskell Ltd. (2025). *Whitehall Quarry Long-Term Expansion: Assessment of Terrestrial Ecological Effects* (AEcE). Prepared by Boffa Miskell Ltd. for Winstone Aggregates Ltd.

Appendix 1: Enhancement Planting Schedule

Wetland/watercourse Zone

Table 2. Plant species and abundance requirements for the Wetland/watercourse Zone in the Enhancement Area. It is estimated that 100% of the Wetland/watercourse zone in the Enhancement area (0.425 ha) is exotic-dominated and requires planting.

Plant spacing: 1 m Plant density (per ha): 10,000 Area (m ²): 4,250		
Botanical Name	Common name	Quantity
<i>Carex secta</i>	Purei	450
<i>Carex geminata</i>	Cutty grass	470
<i>Carex virgata</i>	Swamp sedge	350
<i>Cyperus ustulatus</i>	Giant umbrella sedge	500
<i>Eleocharis acuta</i>	Sharp spike sedge	700
<i>Juncus australis</i>	Leafless rush/wiwi	570
<i>Juncus edgariae</i>	Wiwi	530
<i>Phormium tenax</i>	Flax	680
Total		4250

Table 3. Enrichment planting of the Wetland/watercourse Zone within the Enhancement Area (0.425 ha). Planting at a rate of 200 plants per hectare.

Botanical Name	Common Name	Quantity
<i>Coprosma propinqua</i>	Mingimingi	15
<i>Coprosma tenuicaulis</i>	Swamp coprosma	20
<i>Cordyline australis</i>	Cabbage tree	20
<i>Dacrycarpus dacrydioides</i>	Kahikatea	10
<i>Laurelia novae-zelandiae</i>	Pukatea	10
<i>Syzygium maire</i>	Swamp maire	5
Total		85

Riparian Zone

Table 4. Plant species and abundance requirements for the Riparian Zone in the Enhancement Area. It is estimated that 95% of the Riparian zone in the Enhancement Area (2.715 ha) is exposed and requires planting. + indicates species that can be planted under an existing canopy.

Plant spacing: 1.5 m Plant density (per ha): 4,444 Area (m²): 27,150		
Botanical Name	Common name	Quantity
<i>Austroderia fulvida</i>	Toetoe	600
<i>Aristotelia serrata</i>	Wineberry	500
<i>Coprosma robusta</i>	Karamu	1395
<i>Cordyline australis</i> +	Cabbage tree	600
<i>Hoheria sexstylosa</i>	Lacebark	500
<i>Kunzea robusta</i>	Kānuka	1700
<i>Leptospermum scoparium</i>	Mānuka	2240
<i>Melicytus ramiflorus</i> +	Mahoe	800
<i>Myrsine australis</i> +	Mapou	600
<i>Phormium tenax</i>	Flax	350
<i>Pittosporum eugenoides</i>	Lemonwood	350
<i>Pittosporum tenuifolium</i> +	Kohuhu	380
<i>Plagianthus regius</i>	Ribbonwood	380
<i>Podocarpus totara</i>	Totara	290
<i>Pseudopanax arboreus</i>	Five-finger	690
<i>Veronica stricta</i> var. <i>stricta</i>	Koromiko	690
Total		12,065

Table 5. Enrichment planting of the Riparian Zone within the Enhancement Area (2.715 ha).

Botanical name	Common name	Quantity
<i>Asplenium bulbiferum</i>	Hen and chicken fern	70
<i>Beilschmiedia tawa</i>	Tawa	40
<i>Cyathea dealbata</i>	Silver fern	30
<i>Cyathea medullaris</i>	mamaku	30
<i>Dacrycarpus dacrydioides</i>	Kahikatea	50
<i>Dacrydium cupressinum</i>	Rimu	30
<i>Knightia excelsa</i>	Rewarewa	40
<i>Laurelia novae-zelandiae</i>	Pukatea	20
<i>Litsea calicaris</i>	Mangeao	50
<i>Pectinopitys ferruginea</i>	Miro	40
<i>Piper excelsum</i>	Kawakawa	73
<i>Prumnopitys taxifolia</i>	Matai	40
<i>Rhopalostylis sapida</i>	Nikau	30
Total		543

Hillslope Zone

Table 6: Plant species and abundance requirement for the Hillslope Zone in the Enhancement Area. It is estimated that 98% of the Hillslope Zone in the Enhancement Area (9.89 ha) is exposed and requires planting. + indicates species that can be planted under an existing canopy.

Plant spacing: 1.5 m Plant density (per ha): 4,444 Area (m ²): 98,900		
Botanical Name	Common name	Quantity
<i>Austraderia fulvida</i>	Toetoe	2400
<i>Aristotelia serrata</i>	Wineberry	2400
<i>Coprosma robusta</i>	Karamu	5500
<i>Hoheria sexstylosa</i>	Lacebark	2400
<i>Kunzea robusta</i>	Kānuka	5625
<i>Leptospermum scoparium</i>	Mānuka	8626
<i>Melicytus ramiflorus</i> +	Mahoe	4000
<i>Myrsine australis</i> +	Mapou	2800
<i>Pittosporum eugenioides</i>	Lemonwood	1300
<i>Pittosporum tenuifolium</i> +	Kohuhu	1300
<i>Plagianthus regius</i>	Ribbonwood	1300
<i>Podocarpus totara</i>	Totara	1500
<i>Pseudopanax arboreus</i>	Five-finger	2400
<i>Veronica stricta</i> var. <i>stricta</i>	Koromiko	2400
Total		43,951

Table 7. Enrichment planting of the Hillslope Zone within the Enhancement Area (9.89 ha).

Botanical name	Common name	Quantity
<i>Asplenium bulbiferum</i>	Hen and chicken fern	250
<i>Beilschmiedia tawa</i>	Tawa	275
<i>Cyathea dealbata</i>	Silver fern	120
<i>Cyathea medullaris</i>	mamaku	120
<i>Dacrydium cupressinum</i>	Rimu	175
<i>Knightia excelsa</i>	Rewarewa	175
<i>Laurelia novae-zelandiae</i>	Pukatea	155
<i>Litsea calicaris</i>	Mangeao	155
<i>Piper excelsum</i>	Kawakawa	253
<i>Pectinopitys ferruginea</i>	Miro	150
<i>Prumnopitys taxifolia</i>	Matai	150
Total		1978

Appendix 2: Ridgeline Planting Schedule

Table 8. Plant species and abundance requirements for the Ridgeline Planting area. It is estimated that 100% of the area (1.25 ha) is exposed and requires planting.

Plant spacing: 1.5 m Plant density (per ha): 4,444 Area (m ²): 5,555		
Botanical Name	Common name	Quantity
<i>Austroderia fulvida</i>	Toetoe	320
<i>Aristotelia serrata</i>	Wineberry	320
<i>Coprosma robusta</i>	Karamu	420
<i>Hoheria sexstylosa</i>	Lacebark	320
<i>Kunzea robusta</i>	Kānuka	720
<i>Leptospermum scoparium</i>	Mānuka	1150
<i>Melicytus ramiflorus</i>	Mahoe	685
<i>Myrsine australis</i>	Mapou	320
<i>Pittosporum eugenoides</i>	Lemonwood	160
<i>Pittosporum tenuifolium</i>	Kohuhu	160
<i>Plagianthus regius</i>	Ribbonwood	160
<i>Podocarpus totara</i>	Totara	180
<i>Pseudopanax arboreus</i>	Five-finger	320
<i>Veronica stricta</i> var. <i>stricta</i>	Koromiko	320
Total		5,555

Table 9. Enrichment planting within the Ridgeline Planting Area (1.25 ha).

Botanical name	Common name	Quantity
<i>Asplenium bulbiferum</i>	Hen and chicken fern	33
<i>Beilschmiedia tawa</i> *	Tawa	20
<i>Cyathea dealbata</i>	Silver fern	20
<i>Cyathea medullaris</i>	mamaku	20
<i>Dacrydium cupressinum</i>	Rimu	25
<i>Knightia excelsa</i>	Rewarewa	18
<i>Laurelia novae-zelandiae</i>	Pukatea	19
<i>Litsea calicaris</i>	Mangeao	18
<i>Piper excelsum</i>	Kawakawa	36
<i>Pectinopitys ferruginea</i>	Miro	20
<i>Prumnopitys taxifolia</i>	Matai	21
Total		250

* *Beilschmiedia tawa* (Tawa) will not be planted within 10 m of the vertical cut of the quarry face to the east of the planting area.

Appendix 3: Quarry Bench Planting Schedule

Stage 1

Table 10. Plant species and abundance requirements for Stage 1 of the Quarry Bench Planting area (11 ha).

Plant spacing: 1.5 m Plant density (per ha): 4,444 Area (m ²): 110,000		
Botanical Name	Common name	Quantity
<i>Kunzea robusta</i>	Kānuka	18,884
<i>Leptospermum scoparium</i>	Mānuka	30,000
Total		48,884

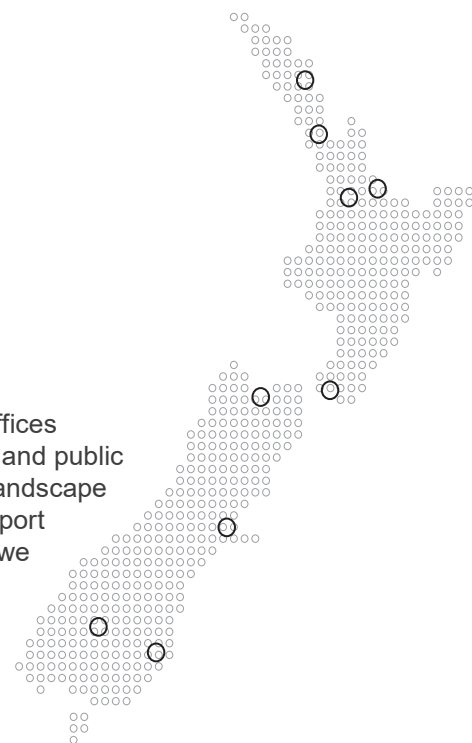
Stage 2

Table 11. Plant species and abundance requirements for Stage 2 of the Quarry Bench Planting area (5.4 ha).

Plant spacing: 1.5 m Plant density (per ha): 4,444 Area (m ²): 54,000		
Botanical Name	Common name	Quantity
<i>Kunzea robusta</i>	Kānuka	10,000
<i>Leptospermum scoparium</i>	Mānuka	13,998
Total		23,998

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