Ecology and Landscape Management Plan

Waihi Area

2025

OCEANAGOLD WAIHI

ECOLOGY AND LANDSCAPE MANAGEMENT PLAN - WAIHI NORTH PROJECT (WAIHI AREA)

3 March 2025

Certified on [date] as part of the Fast Track Approvals Act substantive application for the Waihi North Project.

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1. INTRODUCTION

1.1 OVERVIEW

OceanaGold New Zealand Limited's ("**OGNZL**") mining operation at Waihi has had a prolonged presence in Waihi, and during that time has played a significant role in influencing the ecology and landscape values of the area.

To sustain its ongoing operation, OGNZL is proposing the Waihi North Project ("**WNP**") to extend the life of its Waihi operation. WNP comprises several components, being:

- The mining of a new pit near the existing Processing Plant;
- A new tailings storage facility to the east of existing tailings storage facilities;
- A new rock stockpile area north of and adjacent to the existing tailings storage facilities;
- Changes to the layout of the existing Processing Plant;
- Upgrades to the existing Water Treatment Plant and reconsenting of the existing discharge of treated water to the Ohinemuri River;
- A new Wharekirauponga Underground Mine ("**WUG**"), under the Coromandel Forest Park ("**CFP**") north of Waihi; and
- Site infrastructure supporting the mine, located on farmland located at the end of Willows Road.

These components are shown in the following figure:

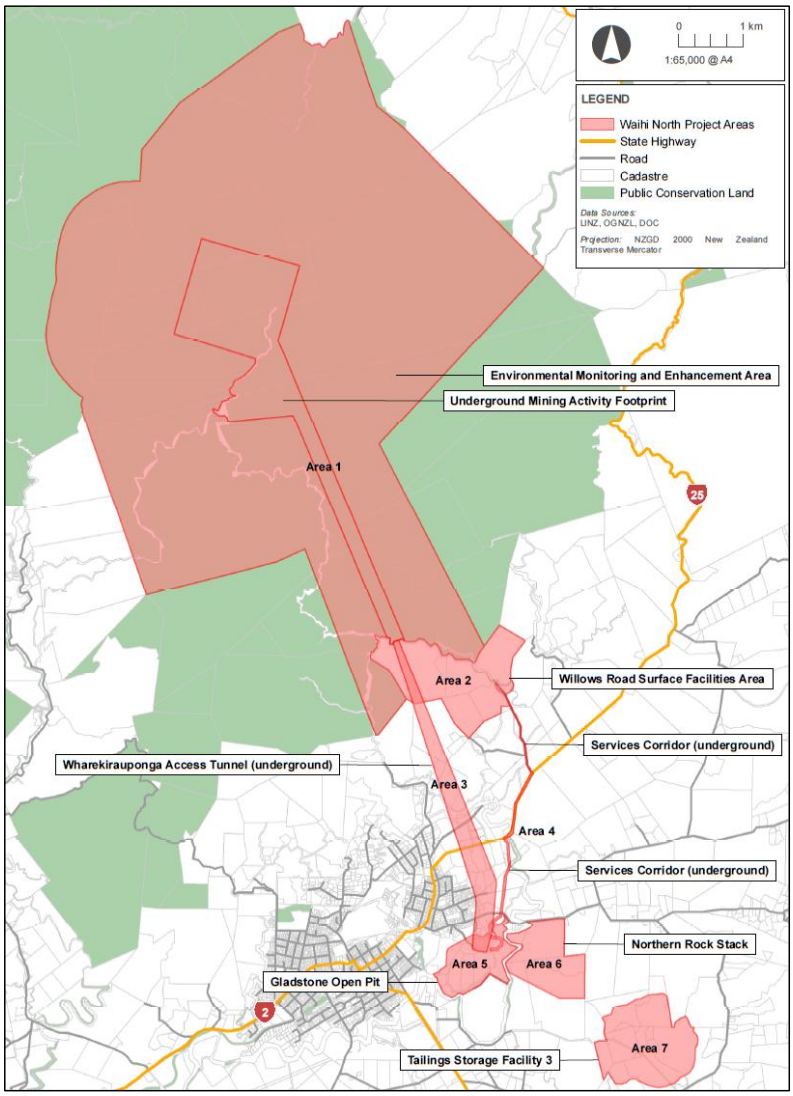


Figure 1: Waihi North Project Areas 1-7

This management plan addresses the components of the WNP within the Waihi area. This plan does not address the ecological management of the WUG (activities in the CFP and in Area 2), as these are addressed in a separate management plan (ELMP-WUG)

Several reports been compiled to assess the ecology and landscape effects of the WNP and recommend actions to avoid, mitigate, remedy, compensate or offset (as appropriate)

potential impacts to a level such that a Net Ecological Gain is the anticipated outcome. This Ecology and Landscape Management Plan ("**Plan**") does not seek to replicate the assessments contained within those reports; rather this Plan seeks to collate the management actions required to manage the actual and potential ecology and landscape effects of the WNP.

1.2 INTEGRATED LANDSCAPE AND ECOLOGICAL RESPONSE

The proposed mitigation for the Project has been developed as an integrated package of complementary measures that encompasses all landscape and ecological management initiatives and enhancements, with the intention that this coordinated effort achieves more than simply the 'sum of its respective components'. This Plan therefore largely addresses the ecological matters, as landscape management is included within the ecological management approach.

1.3 PLAN OBJECTIVE

The objective of this Plan is to identify how the potential adverse effects of the WNP (Waihi Area) on the ecological, landscape and biodiversity values within the WNP Area and its surrounds will be avoided, remedied, mitigated and offset for

(a) Vegetation;

(b) Habitats;

(c) Herpetofauna (lizards and frogs);

(d) Bats; and

(e) Avifauna.

This Plan details the methods to be used by OGNZL to comply with the relevant conditions of the authorisations for the WNP.

1.4 PLAN STRUCTURE

This Plan is split into several sections to address the various requirements of the proposed consent conditions, as follows:

Part A: Is this Introduction, which includes a high level description of the WNP.

Part B: Contains the overarching Integrated Landscape and Ecological Response Plan.

Part C: Contains the Residual Effects Offset Plan.

Part D: Contains the Planting Plan.

Part E: Contains the Plant Pathogen and Weed Management Plan.

Part F: Contains Pest Animal Management Plan.

Part G: Contains the Lizard Management Plan.

Part H: Contains the Avifauna Management Plan.

Part I: Contains the Bat Management Plan.

Part J: Contains the Aquatic Fauna Salvage and Relocation Plan.

Part K: Contains the Stream Diversion and Development Plan.

Part L: Contains the Stream Enhancement Riparian Planting Plan.

Part M: Contains the Landscape and Visual Mitigation Plan.

~~This Plan should be read in conjunction with the Stream Enhancement Riparian Planting Plan (Boffa Miskell, 2025) and the Stream Diversion and Development Plan (Boffa Miskell, 2025).~~

Commented [MD1]: Added to reflect additional sections linked into the document.

Commented [MD2]: These plans have now been linked into this ELMP.

2. EXISTING SYSTEMS

OGNZL already has significant systems in place to manage the ecology and landscape impacts of its activities. Through the existing operational consents and OGNZL's environmental philosophy, key controls have been established.

2.1 SITE RESPONSIBILITIES

Table 1 summarises the primary OGNZL responsibilities for landscape and ecological management.

Table 1: Responsibilities

Role	Responsibilities
General Manager	Approval of resources for ecology and landscape management.
Manager - Sustainability	Review and approval of all Ecology and Landscape Management Plans and reports. Management of resources to respond to biodiversity initiatives.
Senior Environmental Advisor / Planner	Author and reviewer of Ecology and Landscape Management Plans and reports, including the closely aligned Rehabilitation and Closure Plan. Coordination of initiatives and monitoring. Coordination of investigations into landscape and ecological impacts, both for existing projects and for new projects to enhance the sustainability of the operation.
Environmental Advisor / Officers	Monitoring of ecology and landscape management values as required. Supervision of contractors / consultants.
All employees	Avoidance of unnecessary detrimental impact on ecology and landscape values. Reporting of potential ecology and landscape impacts. Implementation, where appropriate, of relevant components of management plans.

PART B: INTEGRATED LANDSCAPE AND ECOLOGICAL RESPONSE PLAN

3. INTEGRATED LANDSCAPE AND ECOLOGICAL RESPONSE PLAN

The following table provides an overview of the planting required to manage the ecological and landscape effects of the WNP within the Waihi Area. Figure 2 and Figure 3 provide~~s~~ the locations and visual representation of the extent of these areas.

Table 2: Planting Referred to in Condition ~~165~~195 of the Hauraki District Council Conditions

Area	Trigger Activity	Objective	Treatment	Timeframe / Performance Indicators
Offset Planting				
Lizard Habitat Enhancement Area	> Vegetation removal in Area 7	> To enhance an existing 1.3 ha area of known habitat for Nationally 'At Risk' moko skinks (Oligosoma moco). > To provide a safe (pest managed) refuge for relocated lizards. > General ecological and landscape enhancement with additional habitat creation of 4.04 ha adjacent to SNA166 (including the 1.3 ha of known habitat listed above).	> Stock exclusion; > Pine tree removal; > Provision of permanent lizard refuge structures; > Standard mass planting of targeted lizard habitat species, for example flax (*Phormium tenax*), Pohuehue (*Muehlenbeckia complexa*), Toetoe (*Austroderia toetoe*), Mingimingi (*Leucopogon fasciculatus*), Pohutukawa (*Metrosideros excelsa*)	> Pine tree removal before any vegetation removal in Areas 5, 6 or 7. > Pioneer planting is complete by end of first planting season following vegetation removal in Area 7. > Enrichment planting undertaken once the pioneer plantings have reached a sufficient size to shelter enrichment species (likely to be between 3 and 5 years following pioneer planting).

Commented [MD3]: Amended to reflect condition numbering change.

Area	Trigger Activity	Objective	Treatment	Timeframe / Performance Indicators
			and Cabbage Tree (*Cordyline australis*). > Weed control. > Mammalian pest control (until mine closure).	
Waihi Biodiversity Offset Planting Area	> Vegetation removal in Area 7	> 17.5 ha of new planting in, adjacent to, and in the wider landscape of the SNA to offset loss of 8.3 ha of SNA vegetation. > 20 ha of new planting in wider WNP area to offset loss of 10.1 ha of site-wide indigenous vegetation. > General ecological and landscape enhancement	> Stock exclusion; > Site preparation; > Standard mass planting using native pioneer species; > Enrichment with WF11 future canopy species once the pioneer plantings have reached a sufficient size to shelter enrichment species; > Weed control. > Mammalian pest control.	> Pioneer planting is complete by end of first planting season following vegetation removal in Area 7. > Enrichment planting undertaken once the pioneer plantings have reached a sufficient size to shelter enrichment species (likely to be between 3 and 5 years following pioneer planting).
Waihi Biodiversity Offset Enhancement Area	> Vegetation removal in Area 7	> 20 ha of enhancement actions within pine-dominant areas of SNA 166 to offset loss of 1.2 ha of non-SNA native vegetation.	> Stock exclusion; > Pine tree removal or poison, top & delimb; > Infill planting SNA Enrichment species at 5 m spacing where	> Pine tree management, SNA enhancement planting (pine tree areas) is complete by end of first planting season following vegetation removal in Area 7.

Area	Trigger Activity	Objective	Treatment	Timeframe / Performance Indicators
		> General ecological and landscape enhancement.	pine trees are removed; > Weed control. > Mammalian pest control.	> Enrichment planting undertaken once the pioneer plantings have reached a sufficient size to shelter enrichment species (likely to be between 3 and 5 years following pioneer planting).
TSF Buffer Area	> Vegetation removal in Area 7	> To rapidly buffer the edges of SNA166 to reduce weed reinvasion and other edge effects following vegetation removal. > General ecological and landscape enhancement.	> Buffer planting a minimum of 10 m wide along the southern boundary of the Southern Fragment of SNA 166 with fast growing native shrubs. > Weed control. > Mammalian pest control.	> Pioneer planting is complete by end of first planting season following vegetation removal in Area 7.
Replacement Planting Zones 1, 2 and 4	> Vegetation removal in Areas 5, 6 or 7	> Replacement planting for -unprotected planted vegetation (including pine) that would be removed. > Provide for and enhance ecological connectivity.	> Stock exclusion; > Site preparation; > Standard mass planting using native pioneer species; > Enrichment with WF11 future canopy species once the pioneer plantings have	> Pioneer planting is complete by end of fifth planting season following vegetation removal in Areas 5, 6 or 7. > Enrichment planting undertaken once the pioneer plantings have reached a sufficient size to shelter enrichment

Area	Trigger Activity	Objective	Treatment	Timeframe / Performance Indicators
		> Provide ecological buffers to existing ecological values > General ecological and landscape enhancement.	reached a sufficient size to shelter enrichment species; > Weed control. > Mammalian pest control.	species (likely to be between 3 and 5 years following pioneer planting).
Replacement Planting Zones 5 – 9	> Vegetation removal in Areas 5, 6 or 7			> Pioneer planting is complete by end of seventh planting season following vegetation removal in Areas 5, 6 or 7. > Enrichment planting undertaken once the pioneer plantings have reached a sufficient size to shelter enrichment species (likely to be between 3 and 5 years following pioneer planting).
Replacement Planting Zone 3	> Commencement of works at GOPTSF			> Existing pine trees retained whilst Gladstone Pit is in operation. > Pine tree management and pioneer planting completed within the first planting season following completion of surface mining in Gladstone Pit. This requires planting to

Area	Trigger Activity	Objective	Treatment	Timeframe / Performance Indicators
				occur before or whilst GOPTSF is in operation. > Enrichment planting undertaken once the pioneer plantings have reached a sufficient size to shelter enrichment species (likely to be between 3 and 5 years following pioneer planting).
Replacement Planting Zone 10	> Vegetation removal in Areas 5, 6 or 7			> Pioneer planting complete by end of second planting season following vegetation removal in Areas 5, 6 or 7. > Enrichment planting undertaken once the pioneer plantings have reached a sufficient size to shelter enrichment species (likely to be between 3 and 5 years following pioneer planting).
Screen Planting	> As above	> To screen temporary stockpiles and Northern Rock Stack	> Establishment of fast growing native planting.	> Planting complete within the first planting season following the

Area	Trigger Activity	Objective	Treatment	Timeframe / Performance Indicators
		from Golden Valley Road.		commencement of the consent
Other Terrestrial Planting on OGNZL owned land	> As above	> General ecological and landscape enhancement.	> Stock exclusion; > Site preparation; > Standard mass planting using native pioneer species; > Enrichment with WF11 future canopy species once the pioneer plantings have reached a sufficient size to shelter enrichment species; > Weed control. > Mammalian pest control	> As soon as practicable but no more than 10 years following commencement of activities within Areas 5, 6 or 7.
Other Terrestrial Planting on land owned by others	> Vegetation removal in Areas 5, 6 or 7	> General ecological and landscape enhancement.	> Stock exclusion; > Site preparation; > Standard mass planting using native pioneer species; > Enrichment with WF11 future canopy species once the pioneer plantings have reached a sufficient size to	> As soon as practicable but no more than 10 years following commencement of activities within Areas 5, 6 or 7.

Area	Trigger Activity	Objective	Treatment	Timeframe / Performance Indicators
			shelter enrichment species; > Weed control. > Mammalian pest control	

Table 3: Planting Referred to in Condition G24

Area	Trigger Activity	Objective	Treatment	Timeframe
Offset Planting				
Riparian Planting of Diversion	> Commencement of construction in Area 7.	> To offset for stream diversions > To recreate and enhance instream habitat and ecological function of diverted watercourse. > To protect and enhance aquatic ecological values.	> Stock exclusion. > Low stature riparian planting to prevent bank erosion and provide bank stability > High stature riparian planting to provide approximately 70% shade to stream channel. > Weed and pest browse control until riparian area matures (up to five-years).	> As soon as practicable but within one year of the completion of construction works on the diversion.
Waihi Riparian Planting	> Commencement of construction in Area 7.	> To offset for stream diversions	> Stock exclusion.	> As soon as practicable but within one year after commencement of construction in Areas 5, 6 or 7.

within OGNZL owned Land		> To protect and enhance aquatic ecological values > To enhance stream condition and connectivity throughout stream and river network of the Ohinemuri River catchment	> Low stature riparian planting to prevent bank erosion and provide bank stability > High stature riparian planting to provide approximately 70% shade to stream channel. > Weed and pest browse control until riparian area matures (up to five-years).	
Waihi Riparian Planting on land owned by others	> Commencement of construction in Area 7.	> To offset for stream diversions > To protect and enhance aquatic ecological values > To enhance stream condition and connectivity throughout stream and river network of the Ohinemuri River catchment	> Stock exclusion. > Low stature riparian planting to prevent bank erosion and provide bank stability > High stature riparian planting to provide approximately 70% shade to stream channel. > Weed and pest browse control until riparian area matures (up to five-years).	> As soon as practicable but within one year after commencement of construction in Areas 5, 6 or 7.

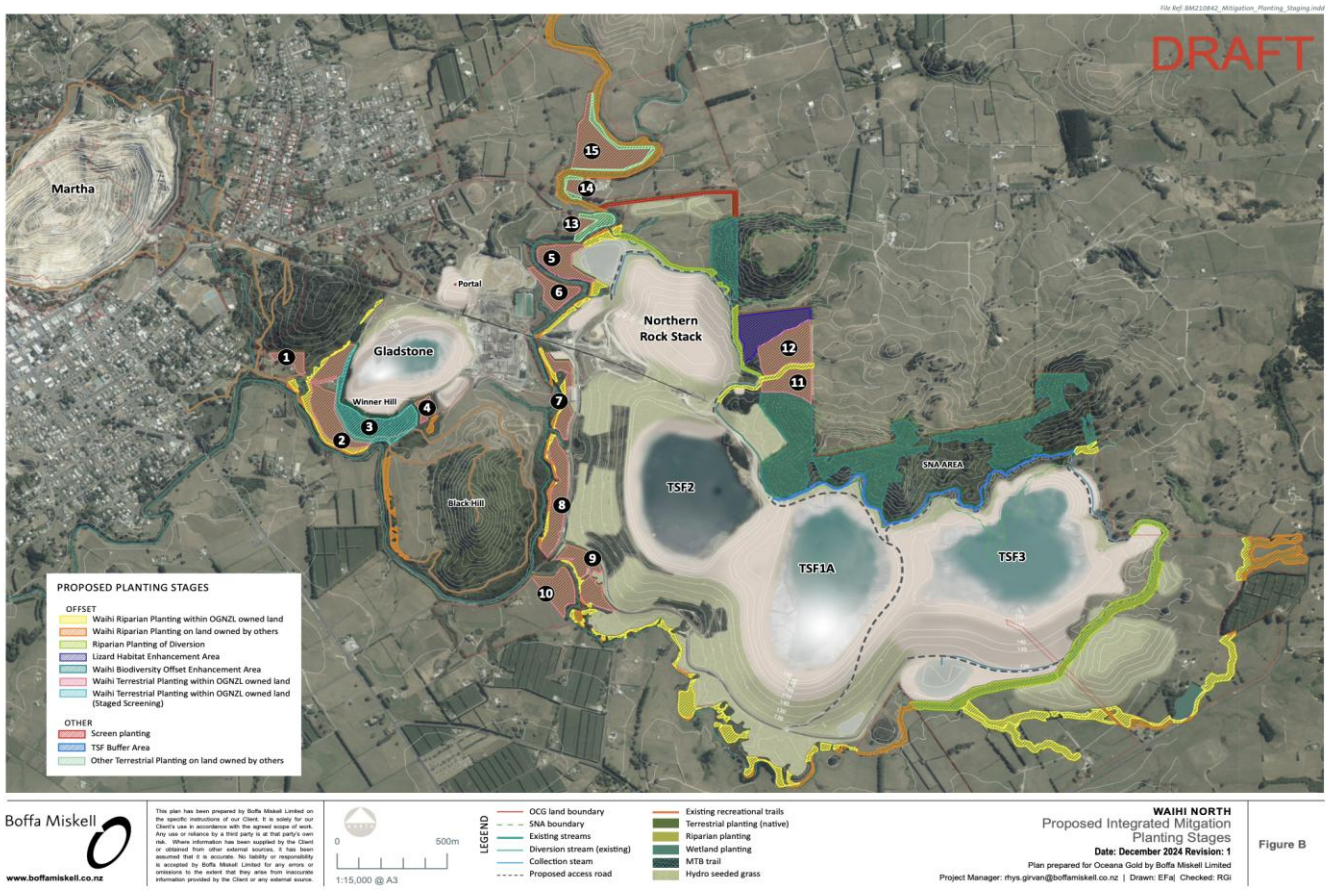


Figure 2: Proposed Integrated Mitigation Planting Plan

Figure 3: Proposed Closure Planting Locations

PART C: RESIDUAL EFFECTS OFFSET PLAN

4. RESIDUAL EFFECTS OFFSET PLAN

4.1 INTRODUCTION

4.1.1 Overview

OGNZL is proposing the WNP to extend the life of its Waihi operation. WNP (Waihi area) will comprise three components, being:

- A new open pit at Gladstone (Gladstone Open Pit, GOP),
- An expansion of the Northern Rock Stack (NRS) and
- A new tailings storage facility (Tailings Storage Facility 3, TSF3), including two borrow pits within the footprint of the TSF3.

Modifications are also proposed to the existing processing plant, but as these will occur within the existing processing plant footprint and a small area of pastoral farmland to its west, the potential effects associated with this component are not considered.

The activities associated with the WNP (Waihi area) are expected to have direct and indirect effects on ecological values at each of the three components of the WNP (Waihi area). Where adverse effects on ecological values are expected to incur 'Moderate' or 'High' 'Level of Effects' as a result of a project, actions are considered necessary to minimise and mitigate them.

Within the WNP (Waihi area) expected effects on terrestrial ecology, including loss of vegetation and habitats, are generally considered to be no more than 'Low', except at TSF3 where vegetation and habitat removal will result in a moderate level effect. Most of the vegetation and habitats that are expected to be affected are planted compositions.

Together, the three components of the WNP considered in this report would require the removal of approximately 25.7 ha of native and exotic (planted and naturally occurring) vegetation. An assessment of terrestrial ecological values and effects identified that the loss of vegetation would result in moderate to very low levels of effects.

4.1.2 Purpose of Plan

The purpose of this Residual Effects Offset Plan is to determine the quantum of conservation actions (revegetation of new habitats and enhancement of existing habitats) required to offset the effects on terrestrial ecology values within the three Waihi components of the WNP, in order to demonstrate an overall Net positive outcome for ecological values. Those actions are quantified and measured against losses and modelled, using a Biodiversity

Offset Accounting Model ("**BOAM**"), developed by Maseyk and others (Maseyk et al. 2015; 2018) to achieve overall net biodiversity gain.

Biodiversity Offsetting is a recognised tool for counterbalancing significant residual effects on ecological values in New Zealand, as long as it aligns with the Effects Management Hierarchy (National Policy Statement for Indigenous Biodiversity (NPSIB)). A summary of the Project's application of the Effects Management Hierarchy is detailed later in this report. This Residual Effects Offset Plan should therefore be read in conjunction with other reports and management plans that detail measures that will be taken to avoid, minimize, and remedy effects prior to offsetting. Mitigation measures such as fauna management plans are presented separately and should be considered as part of the wider terrestrial ecological management package.

4.1.3 Site Overview

The existing environment within which the proposed activities will occur is a modified rural landscape and comprises property blocks held by OGNZL and other private landowners around the operation. Vegetation cover within the WNP project area includes pasture, exotic forestry, exotic and native scrub, and 10– 25-year-old native plantings undertaken through time by the operation (not for mitigation purposes).

Two Hauraki District Plan-recognised Significant Natural Areas ("**SNA**") are in the immediate landscape; SNA 165, (Ngatikoi Domain) and SNA 166 (two separate fragments Northeast of the current tailings storage facility ("**TSF**"). These features, along with the key components of the WNP, are shown on the following figure:

Figure ~~4~~43: WNP components; GOP, NRS and TSF 3, including proposed borrow pit sites and SNA habitats

4.1.4 Summary of Ecological Values and Effects

Overall, the WNP (Waihi area) will require the removal of approximately 25.7 ha of vegetation, including 11.3 ha of native vegetation (including voluntary plantings), 6.1 ha of pines, and 8.3 ha of SNA.

Terrestrial ecological values within the WNP are generally moderate (SNA 166) to low, with the exception of the presence of 'high value' copper skinks (*Oligosoma aeneum*, 'At Risk-declining). Fauna habitats and are associated with young (15-25 years old), planted or natural but low-diversity regenerating vegetation.

Some areas of planted vegetation provide buffer and connectivity functions, and habitat for planted kauri trees, localised copper skinks and common native birds.

Naturally occurring vegetation at TSF3 is of moderate value where it comprises part of the southern fragment of SNA 166, a large (57 ha) fragment of young, predominantly native vegetation that supports few 'At-Risk – Declining' kauri. Smaller vegetation fragments to the east of the SNA 166 southern fragment, within TSF3, are naturally regenerating and have low value.

The main values of planted areas associated with the proposed GOP and NRS are determined in part by ecological context whereby some of those areas provide buffer services to other ecological values, such as freshwater systems, or where they support 'High Value' copper skinks.

The removal of planted vegetation within the WNP (Waihi area) will result in very low-level effects and is a permitted activity under the Hauraki District Plan ("**HDP**"). However, OGNZL intends for the WNP to achieve an overall net gain following mitigation and offset actions, and therefore the values of these plantings are provided for within this Residual Effects Offset Plan.

Despite being low level, OGNZL will also offset the effects of the loss of SNA vegetation (through enhancement and revegetation efforts that improve its integrity (enrichment, weed and pest control, connectivity etc) and through dense buffer planting to strengthen its edges.

The removal of vegetation and construction activities associated with the WNP are expected to result in direct and indirect adverse effects on the ecological values, which the provisions outlined in this Plan will offset to a net environmental gain.

Expected direct effects include:

- Vegetation and habitat loss through vegetation removal and earthworks.
- The creation of habitat edge effects, altering the composition and health of adjacent vegetation (i.e. habitat degradation), which may affect habitat suitability for flora and fauna.
- Direct mortality or injury to less mobile biodiversity (eggs and unfledged chicks of native birds, high-value lizards) during vegetation clearance or earthworks activities.
- Low-level habitat fragmentation and isolation, largely associated with the loss of plantings and associated habitats.

Potential indirect effects are expected to include:

- Edge effects at newly created edges (weed incursion, light & desiccation to habitats)
- Indirect damage to tree root networks that may reduce the long-term health of adjacent trees.
- Displacement of native fauna (reduced resources, competitive exclusion, increased susceptibility to predation);
- Construction related noise, vibration and dust effects.

4.1.5 National Policy Statement for Indigenous Biodiversity

The NPS-IB requires that identified adverse effects within SNAs are avoided, except where provided for under Clause 3.11, which identifies significant national or regional benefit that cannot otherwise be achieved using resources within New Zealand (NPSIB, 3.11(1(aii))). An explanation of the Project proposal with respect to this exception is provided with the application, however where adverse effects are managed pursuant to subclause 3, the following is required to be demonstrated:

- How each step of the effect's management hierarchy will be applied;
- If biodiversity offsetting or biodiversity compensation is applied, how the proposal has complied with principles 1 to 6 in Appendix 3 has had regard to the remaining principles, as appropriate. These principles are identified in Table 7 ~~**Error! Reference source not found.**~~ and with an explanation of how the proposed offset for WNP will satisfy them.

The effects management hierarchy is an approach to managing the adverse effects of an activity on indigenous biodiversity that requires that:

- Adverse effects are avoided where practicable; then
- Where adverse effects cannot be avoided, they are minimised where practicable; then

- Where adverse effects cannot be minimised, they are remedied where practicable; then
- Where more than minor residual adverse effects cannot be avoided, minimised, or remedied, biodiversity offsetting is provided where possible; then
- Where biodiversity offsetting of more than minor residual adverse effects is not possible, biodiversity compensation is provided; then
- If biodiversity compensation is not appropriate, the activity itself is avoided.

In respect to the approach that the WNP (Waihi area) is taking to the implementation of the effects management hierarchy, the loss of the areas of native vegetation proposed within the WNP (Waihi area) will result in low to high (loss of copper skink habitat) levels of effects. These effects will be managed in accordance with the effects management hierarchy (NPS-IB):

Adverse effects that are avoided:

Early design adjustments removed the Northern Rock Stack footprint out of a low-lying area south of the northern fragment of SNA 166, which has avoided potential impact on identified moko skink (*Oligosoma moco*). Several management plans have been developed to manage the effects of the WNP on local flora and fauna – which are included later in this ELMP. Unnecessary vegetation clearance will also be avoided through the physical delineation of the footprint boundary.

Adverse effects that are minimised:

Species-specific adverse effects, particularly mortality to indigenous lizards, would be minimised as far as practicable with the implementation of a site-specific lizard management plan. The lizard management plan will provide details on how injury and mortality to any high-value lizards within the footprint will be minimised to ensure that there is no overall reduction in the size of populations of At-Risk lizard species (copper skink and other potentially-present species) and occupancy across their natural ranges. The native lizard management plan will provide methods for capture, including trapping and / or search effort, timing of implementation, an assessment of the release locations, any habitat enhancement required and monitoring methods.

Pre-vegetation clearance during the bird breeding season (September to February inclusive) should be preceded by a nest check by a suitably qualified and experienced ecologist or ornithologist to minimise adverse effects to avifauna.

DOCs protocols for minimising the risk of felling occupied bat roosts should be followed to minimise adverse effects to bats.

All newly created edges at the abutment of TSF3 and SNA 166, will additionally be buffered with dense plantings of indigenous shrubs to minimise edge effects, such as weed incursion, light, wind exposure and desiccation effects on habitats at exposed edges.

Adverse effects that are remediated:

No adverse effects are proposed to be remediated, because all vegetation and habitat values that are proposed to be removed, would be within the proposed pit and associated structures. However, all such losses, where they cannot be avoided, will be avoided, minimised, offset or compensated.

Residual adverse effects that are offset:

Offset planting and enhancement actions will be undertaken to achieve an overall Net Gain Project outcome. To achieve this, all native plantings, naturally occurring vegetation and pine throughout the Project will be offset, including where the losses are a permitted baseline and assessed as low-level effects. This approach is consistent with the objective of the NPSIB to maintain indigenous biodiversity across Aotearoa New Zealand so that there is at least no overall loss in indigenous biodiversity.

The proposed biodiversity offsets are modelled using the Department of Conservation's BOAM (Maseyk et al. 2015) to provide a detailed and transparent analysis of biodiversity components that would be lost, against measurable, like-for-like gains that provide for short term (habitat enhancement actions) and longer term (revegetation) outcomes.

Residual adverse effects that are compensated:

At GOP: Revegetation and pest control will be modelled to ensure that the high level of effect expected as a result of copper skink habitat loss will be compensated. The quantum of revegetation and pest control is guided by a qualitative biodiversity compensation model (BOAM), which recognises important areas of habitats for high value copper skinks (*Oligosoma aeneum*) and provides recommendations to offset/compensate for adverse effects.

Table 4: Summary of vegetation removal, values and effects within the WNP (Waihi area).

Location	Vegetation type	Ecological value	Level of effect (without mitigation)	Area of removal (ha)	Proposed mitigation	Proposed offset / Compensation	Level of effect (with mitigation or offset)
Gladstone Open Pit	Native plantings	Moderate	Low	1		20 ha of **offset** restoration plantings (for loss of 10.1 site-wide indigenous vegetation)	**Net Gain**
	Naturally occurring native	Moderate	Low	0.4			
	Pine	Very Low	Very Low	5.1		6.5 ha **compensation** for Copper skink habitat loss (includes pine)	
Total indigenous vegetation removal at Gladstone Open Pit				**6.5**			
Northern Rock Stack	Native plantings	Moderate	Low	8.1	**1.** Timing of vegetation removal to avoid the main bird breeding season (or preclearance nesting surveys). **2.** Implementation of a lizard management plan. **3.** Adoption of bat tree-felling protocols. **4.** Buffer plant new SNA edge **5**. Planting Plan **6.** Plant pathogen and weed management **7.** Pest Animal Management Plan	20 ha of **offset** restoration plantings (for loss of 10.1 site-wide indigenous vegetation)	**Net Gain**
	Pine	Low	Very Low	1		No offset for pine	
Total indigenous vegetation removal at Northern Rock Stack				**8.1**			
Tailings Storage Facility 3	SNA	Moderate	Moderate	8.3		17.5 ha **offset** restoration plantings (for loss of 8.3 ha SNA vegetation)	
	Naturally occurring native (Western Fragment)	Low	Very Low	1.2		20 ha offset enhancement of SNA 166	**Net Gain**
	Naturally occurring native (Eastern Fragment)	Low	Very Low	0.3		20 ha of offset restoration plantings (for loss of 10.1 site-wide indigenous vegetation)	
	Native planting (Southern Fragment)	Low	Very Low	0.3			
Total indigenous vegetation removal at Tailings Storage Facility 3				**10.1**			
Total indigenous vegetation removal site-wide:				**24.7**			

*This figure excludes the SNA and Western Fragment areas.

Table 5: Summary of vegetation loss, gains and enhancement

Vegetation type / location	LOSS (ha)	OFFSET: revegetation (ha)	OFFSET: Enhancement (ha)
Native plantings & naturally occurring / site wide (excluding Western Fragment)	10.1	20	
Pine / site wide:	6.1	0	
Total non-protected vegetation for offset 1:	**10.1**	**20**	
TSF3 SNA 166	8.3	17.5	
Western Fragment	1.2		20
Total TSF3 vegetation for offset 2:	**9.5**	**17.5**	**20**
Total WNP Waihi area	**30.4**	**37.5**	**20**

Table 6: Summary of habitat compensation for 'At Risk' copper skink at Gladstone Open Pit

Copper skink habitat compensation at Gladstone Pit	LOSS (ha)	COMPENSATION: revegetation with pest control (ha)	COMPENSATION: pest control existing habitat (ha)
Native plantings	1		
Rock outcrop	0.4	11.2	4.45
Pine	5.1		
Total	**6.5**	**11.2**	**4.45**

4.2 SUITABILITY OF VEGETATION AND HABITAT VALUES FOR OFFSETTING

The vegetation and habitats within the Waihi North project, where they occur within the footprints of GOP, NRS and TSF3 are suitable for using the DOC's Biodiversity Offset Accounting Model ("**BOAM**") because the existing values represent components of young, regenerating, simple systems. The key attributes of these systems can be described in terms of vegetation height, structure and diversity (canopy and understorey levels) and the diversity of indigenous avifauna these support as habitat.

The Department of Conservation (DOC, 2014) and Local Government New Zealand (Maseyk et al. 2018) provide guidance for offset design. These offset design guidelines represent current good practice for achieving a net environmental gain, as is the intention in this case (rather than 'no net loss'). Important aspects of offset design include:

- Restoration, enhancement and protection actions undertaken as a biodiversity offset are demonstrably additional to what will otherwise occur, including that they are additional to any avoidance, remediation or mitigation undertaken in relation to the adverse effects of the activity.
- Offset actions should be undertaken close to the location of loss, where this will result in the best ecological outcome.
- The values to be lost through the activity to which the offset applies are counterbalanced by the proposed offsetting activity, which is at least commensurate with the adverse effects on indigenous biodiversity. Where possible the overall result should be no net loss, and preferably a net gain in ecological values.
- The offset is applied so that the ecological values being achieved through the offset are the same or similar to those being lost ('like for like').
- The offset is legally protected in perpetuity, such as via a conservation covenant. Covenanted areas are required to have stock exclusion fences.

For additional confidence in achieving a Net Environmental Gain, the BOAM for loss of protected SNA and adjacent western fragment was cross-checked using a Biodiversity Compensation Model (BCM, Baber et al. 2021). While a different model, the BCM is functionally the same, and predicted that a 10% Net Gain outcome for biodiversity loss would be exceeded through the proposed actions, i.e. the compensation score is 43.6% higher than the impact score. The results and explanation of this model are presented in Appendix 4B.

4.2.1 Principles of Biodiversity Offsetting

The NPSIB provides specific principles that underpin Biodiversity Offsetting. These principles are listed in Table 7 as well as an explanation of how proposed offset for the WNP will satisfy them. The NPSIB requires that a biodiversity offset, or biodiversity compensation must comply with principles 1 to 6 and has regard to the remaining principles.

The effects management hierarchy requires that Biodiversity Offsetting is carried out where possible, and Biodiversity Compensation is only used in circumstances, where the principles of Biodiversity offsetting are not met. Here, we follow this hierarchy, and compensation is only used when considering the loss of copper skink habitat within the GOP area.

Table 7: Principles of biodiversity offsetting (NPS-IB, appendix III) and how these are achieved for WNP.

Principles / Criteria of biodiversity offsetting	How these principles are achieved
Adherence to effects management hierarchy: A biodiversity offset is a commitment to redress more than minor residual adverse effects and should be contemplated only after steps to avoid, minimise, and remedy adverse effects are demonstrated to have been sequentially exhausted.	The TSF3 footprint **avoids** key features of SNA 166 that trigger its ecological significance, being the known moko skink location and a kauri tree stand. Precautionary, pre-felling bat surveys and implementation of bat roost tree protocols, where bats are identified, will also ensure avoidance of mortality to potentially present roosting bats. A separate Ecological Management Plan ("**EMP**") proposes to **minimise** potential mortality to other native fauna through management actions around timing of vegetation removal, to preworks surveys and associated capture and relocation (lizards) or avoidance actions where species are detected (active native bird nests, bats). Edge effects at TSF3 will be **minimised** through dense buffer planting. Following these measures, residual adverse effects associated with the loss of vegetation and habitats will be **offset**, and habitat loss to high value copper skinks is **compensated**.
When biodiversity offsetting is not appropriate: Biodiversity offsets are not appropriate in situations where indigenous biodiversity values cannot be offset to achieve a net gain. Examples of an offset not being appropriate include where:	The biodiversity values (relatively young, planted, exotic or regenerating ecosystems) are suitable for offsetting because they are structurally simple and largely support low species richness, reflective of young, regenerating systems. Therefore, the values are well understood, measurable and there is high certainty of predicted outcomes, based on well-practiced restoration methods. It is acknowledged that some values cannot be replaced

Principles / Criteria of biodiversity offsetting	How these principles are achieved
(a) residual adverse effects cannot be offset because of the irreplaceability or vulnerability of the indigenous biodiversity affected: (b) effects on indigenous biodiversity are uncertain, unknown, or little understood, but potential effects are significantly adverse or irreversible: (c) there are no technically feasible options by which to secure gains within an acceptable timeframe.	or offset, such as the habitat capacity provided by mature tree cavities (particularly those provided by exotic pines, and epiphytes supported by some individual (relict) trees. Therefore, while these attributes are not modelled, the restoration actions are proposed within the same landscape where proximity to seed source will support natural recolonization of indigenous biodiversity, as evidenced in some of the existing plantings in the landscape. Further, artificial bat roost provision is acknowledged by DOC as still requiring more research (DOC (2021) advisory note -6734955) and therefore it is difficult to predict performance of such provisions.
Net gain: This principle reflects a standard of acceptability for demonstrating, and then achieving, a net gain in indigenous biodiversity values. Net gain is demonstrated by a like-for-like quantitative loss/gain calculation of the following, and is achieved when the indigenous biodiversity values at the offset site are equivalent to or exceed those being lost at the impact site: (a) types of indigenous biodiversity, including when indigenous species depend on introduced species for their persistence; and (b) amount; and (c) condition (structure and quality).	The BOAM (Maseyk et al, 2015) is used here to demonstrate a net biodiversity gain for a range of biodiversity attributes, disaggregated to demonstrate gains for fauna (bird) diversity and habitat resources, and flora diversity at canopy and understory structural tiers. All of the biodiversity offset actions will be undertaken *in situ*, within the OGNZL landholdings in the immediate landscape, where the net gains are expected to apply to the same flora and fauna communities. Annual and five-yearly monitoring is provided to measure the offset outcomes against modelled and indicative targets. Adaptive management options are provided to respond to any outcomes that may fall short of modelled values, if identified from monitoring. Where targets are not met, contingency actions (such as additional planting, wider pest management area) would be presented, based on recalibrated offset models, to ensure offset success is not compromised and a final Net Gain is achieved.
Additionality: A biodiversity offset achieves gains in indigenous biodiversity above and beyond gains that would have occurred in the absence of the offset, such as gains that are additional to any minimisation and remediation undertaken in relation to the adverse effects of the activity.	There are no current or future plans to undertake any of the proposed revegetation or enhancement actions. The proposed revegetation planting would be undertaken in areas currently occupied by pasture. Revegetation areas will be protected where they currently have no protections.

Principles / Criteria of biodiversity offsetting	How these principles are achieved
Leakage: Biodiversity offset design and implementation avoids displacing harm to other indigenous biodiversity in the same or any other location.	The biodiversity offset actions (revegetation and enhancement) will not cause harm to indigenous biodiversity at the site or other locations. All actions are well established methods for making net gains in biodiversity. And are predicted to benefit biodiversity within the same landscape.
Long-term outcomes: A biodiversity offset is managed to secure outcomes of the activity that last at least as long as the impacts, and preferably in perpetuity. Consideration must be given to long-term issues around funding, location, management and monitoring.	All restoration actions (restoration planting and areas of enhancement) will be legally protected in perpetuity by way of covenant and monitored for a minimum 20 years to ensure offset targets are achieved at the modelled point of net gain. Pest control of planting and enhanced environments will be maintained for at least the life of the operation.
Landscape context: Biodiversity offsetting is undertaken where this will result in the best ecological outcome, preferably close to the impact site or within the same ecological district. The action considers the landscape context of both the impact site and the offset site, taking into account interactions between species, habitats and ecosystems, spatial connections, and ecosystem function.	All of the biodiversity offset actions will be undertaken *in situ*, within the OGNZL landholdings in the immediate landscape, where the net gains are expected to apply to the same flora and fauna communities.
Time lags: The delay between loss of, or effects on, indigenous biodiversity values at the impact site and the gain or maturity of indigenous biodiversity at the offset site is minimised so that the calculated gains are achieved within the consent period or, as appropriate, a longer period (but not more than 35 years).	The BOAM models account for time lags between loss of biodiversity values at the impact site and gains at the offset sites. While pest control in parts of SNA 166 will likely have an immediate improvement on some values such as bird breeding success, the presented BOAM has taken a conservative approach, with consideration to removal of exotic pines.

Principles / Criteria of biodiversity offsetting	How these principles are achieved
Science and mātauranga Māori: The design and implementation of a biodiversity offset is a documented process informed by science and mātauranga Māori.	The design of the biodiversity offset is based on established and best practice methods for revegetation and restoration. Data used in the model are based on vegetation Recce plot data and fauna surveys and database reviews.
Tangata whenua and stakeholder participation: Opportunity for the effective and early participation of tangata whenua and stakeholders is demonstrated when planning biodiversity offsets, including their evaluation, selection, design, implementation, and monitoring.	OGNZL recognises the special relationship that iwi have with the indigenous biodiversity, and that this relationship is important to spiritual and cultural wellbeing. Māori cultural values, interests and associations with indigenous biodiversity within the project area, and the potential impacts of the Waihi North Project on these, will be identified through iwi led Cultural Impact Assessments. Ngāti Hako, Ngāti Maru, Ngāti Hei, Ngāti Porou ki Hauraki, Ngāti Puu, Ngāti Tamaterā, Ngāti Rāhiri Tumutumu, Ngāti Tara Tokanui Ngāti / Koi and Ngaati Whanaunga have all communicated to OGNZL that they have cultural interests and associations within the proposed project area. OGNZL is active in the Waihi community and has well established, long-term relationships that are built on dialogue and collaboration.
Transparency: The design and implementation of a biodiversity offset, and communication of its results to the public, is undertaken in a transparent and timely manner.	OGNZL will deliver the biodiversity offset and document its key targets and outcomes through provision of regular monitoring reports and compliance meetings in liaison with Hauraki District Council, and where appropriate, the Department of Conservation. Contingency reports are part of this plan to ensure that if biodiversity offset objectives are not met in keeping with the BOAM parameters, further ecological enhancement/offset activities as remodelled, will be reported to ensure that net gain outcomes are achieved.

4.3 ECOLOGICAL RESTORATION AND OFFSET PLAN

4.3.1 Overview

A Planting Plan has been prepared to identify how the WNP will address actual and potential adverse effects resulting from the loss of vegetation and habitats through strategic revegetation, enhancement, and fauna management. Specifically, this Plan sets out procedures for how OGNZL will minimise, remediate, and offset adverse effects associated with vegetation removal, including:

- A total of 20 ha of planting to offset the loss of 16.2 ha of not-protected vegetation (mostly voluntary plantings and pine) that will be removed;
- 17.5 ha of new planting adjacent to, and in the wider landscape of the SNA to offset loss of 9.5 ha of SNA vegetation;
- 20 ha of enhancement actions (pine removal and infill planting) within pine-dominant areas of SNA 166 to offset loss of 1.2 ha of non-SNA native vegetation;
- Full planting schedule comprising species diversity, plant grade and spacing, provision of flower and fruit resources for birds;
- Monitoring and maintenance of offset outcomes; and
- Legal protection of all replanted areas.

4.3.2 Proposed Restoration Activities: Revegetation and Enhancement

This Plan adopts a comprehensive approach to offset planting, targeting areas within the WNP landscape that will preserve and enhance ecological values and integrity by reinforcing existing natural assets and improving habitat connectivity across the surrounding environment. Weed and animal pest control and stock exclusion fencing (where appropriate) will be provided for all restoration plantings.

A vegetation offset plan will ensure that the terrestrial ecological effects of the WNP (Waihi area) will be effectively managed to achieve an overall net ecological gain by providing best practice methods for the establishment and enhancement of vegetation and habitat resources. The plan provides for the following:

(a) Within SNA 166: Pine removal and revegetation, long-term pest animal and weed control as calculated using a biodiversity offset accounting system, for the loss of 8.3 ha of SNA and 1.2 ha of Western Fragment. The resulting revegetation and enhancement will:

i. Be contiguous with SNA166 where possible, or ~~within the~~ within the immediate landscape where it enhances ecological integrity through buffering and connecting existing biodiversity values;

ii. Where practicable, enhance significant values of SNA 166, including as kauri trees and moko skink.

(b) At GOP: Revegetation and pest control to compensate for the high level of effect expected as a result of loss of habitat for high value copper skinks. The quantum of revegetation and pest control should be guided by a biodiversity compensation model and resulting actions be contiguous with existing copper skink habitat.

(c) Offset planting to achieve and overall Net Gain Project outcome, for the loss of 10.1 ha of indigenous vegetation and other low to moderate value vegetation. Planting will be undertaken within the immediate landscape where it enhances ecological integrity through buffering and connecting existing biodiversity values

(d) Buffer planting in and adjacent to SNA 166 to minimise newly created edge effects along the southern edge of SNA 166 (Southern Fragment).

(e) Legal protection of all replanted areas

4.3.3 Offset Planting for Loss of Non-Protected Indigenous Vegetation

A total of 37.5 ha will be planted throughout the WNP with a focus on buffering the Ohinemuri River wildlife corridor where it runs between SNA 166 and SNA 165 (Ngatikoi Domain).

The locations of the plantings have been identified in general proximity to areas of loss GOP but also provide for and enhance ecological connectivity and provide ecological buffers to existing ecological values.

Figure ~~55~~4: Areas (38.6 ha) available for 37.5 ha of offset replanting within OGNZL landholdings to offset the loss of 10.1 ha of non-protected indigenous vegetation and 8.3 ha of SNA 166

4.3.4 Biodiversity Offset for Vegetation Removal at SNA 166 and Western Fragment

The affected vegetation within the southern fragment of SNA 166 consists of 8.3 ha mixed seral rewarewa forest with areas of emergent pines and treefern dominant scrub. There are three smaller (non-SNA) fragments south and east of the southern SNA fragment that will also be affected. These are: Western Fragment, Eastern Fragment and Southern Planted Fragment (Figure 65). While none of these smaller fragments are protected, the Western Fragment supports similar vegetation values to the higher value parts of SNA 166, and therefore its values are incorporated into the proposed offset.

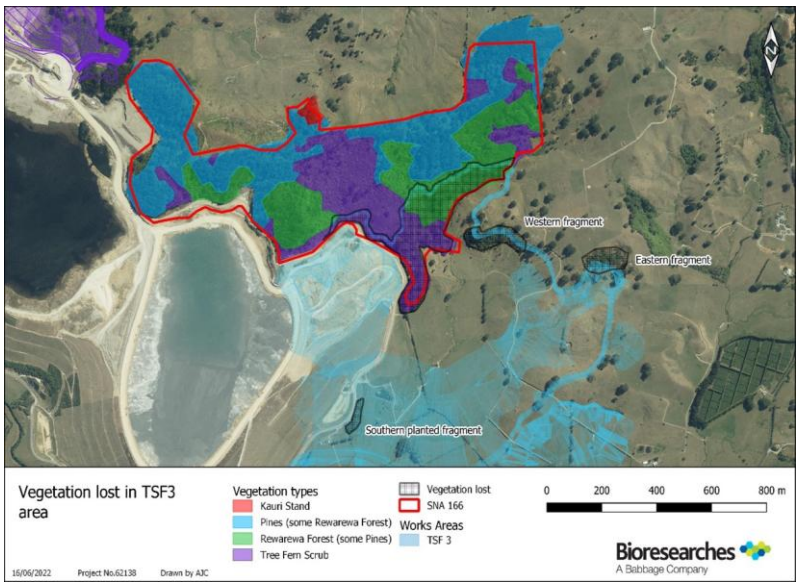


Figure 665: Areas of vegetation at TSF that will be affected by the WNP

4.4 EXPLANATION OF BOAM: ACCOUNTING MODEL FEATURES

4.4.1 Overview

The Biodiversity Offset Accounting Model (BOAM) compares the biodiversity features at the impact site(s) to a 'benchmark'. The benchmark provides a reference point for a similar biodiversity type in a 'natural' condition, against which to evaluate the biodiversity losses and gains. Due to historical land use practices, the affected ecosystem type (broadleaved species scrub- VS5, (Singers & Rogers 2014)) within the southern SNA166 fragment is a highly modified seral community that will be expected to naturally transition to its original cover, (kauri, podocarp, broadleaved forest, Type WF11, Singers & Rogers 2014). The broadleaved species scrub within the WNP is generally deficient of many elements of a

future WF11 forest (such as future canopy saplings). Therefore, a key conservation objective for the BOAM actions is to facilitate succession of SNA 166 towards its historic state (in addition to counterbalancing loss in extent of protected vegetation). The benchmarks for broadleaved species scrub are explained here.

4.4.2 Biodiversity Type and Benchmarks

The biodiversity type is classified as 'broadleaved species scrub'- VS5, (Singers & Rogers 2014). This is a regenerating ecosystem type - a community of pioneer flora and fauna that occur or regenerate following disturbance (human or natural). Diversity of broadleaved species scrub is highly variable, and is influenced by many factors, including fragment isolation, topography and seed source. It can be dominated by a mosaic of species commonly found in the subcanopy and edges of more mature forests. It can also be dominated by few species, such as tree ferns (e.g. SNA 165 / Ngatikoi Domain), kāmahi, māpou or kōhūhū (Singers et al. 2017). Given the highly fragmented, isolated and poor condition of many naturally occurring, regenerating ecosystems throughout both the Waikato Region and Waihi Ecological District, a benchmark for broadleaved species scrub with similar bioclimatic and topographic influences is not known. Therefore, a conservative model is described here, whereby a very good condition example of a broadleaved species scrub will support a high species richness, with future kauri podocarp broadleaved canopy species present in the understorey.

4.4.3 Biodiversity Component

The biodiversity components are based on the two dominant vegetation communities within the broadleaved species scrub / forest (rewarewa dominant scrub and tree fern dominant scrub). These have been measured separately but share the same benchmark. A third component of the offset considers the non-SNA Western fragment, which supports a mixture of rewarewa scrub and pōhutukawa trees, as distinct from the composition of the adjacent SNA vegetation.

4.4.4 Biodiversity Attributes

Five biodiversity attributes ('Currencies') were selected for the Accounting Model for vegetation and habitats that collectively describe the key values of the biodiversity components. These attributes are canopy height, native canopy diversity, winter fruiting and flowering species, native canopy cover, native canopy diversity, native understorey diversity, and avifauna diversity.

4.5 ACCOUNTING MODEL RESULTS

4.5.1 TSF3

The biodiversity values of SNA 166 and the Western Fragment are described in detail in Bioresearches (2025a). The differences in structure and diversity of the components of the different vegetation types (rewarewa dominant, treefern dominant, Western Fragment) are recognised in three separate BOAMs. These models demonstrate that, for each biodiversity component, there will be a net biodiversity gain at 20 years as the restoration matures.

The values presented within each BOAM are explained in subsequent tables, as informed by planting schedules and vegetation plots undertaken at existing plantings (comprised of similar species composition) in the surrounding Waihi landscape (up to 20 years old).

The outcomes of the BOAMs indicate, with high confidence, that a total of 17.5 ha of revegetation will offset the loss of 3.6 ha of rewarewa forest and 4.6 ha of treefern scrub within SNA 166. This revegetation does not include a further 20 ha of revegetation, which will offset the loss of 10.1 ha of voluntary plantings which occur predominantly beyond TSF3.

A further 20 ha of enhancement within SNA 166, by way of pine tree management and infill planting, will offset the complete loss of 1.2 ha of the Western Fragment.

4.5.2 Site-wide voluntary plantings and pine

The modelling undertaken indicates, with high confidence, that 10.1ha of voluntary plantings (14-25 years old) would be offset with 20 ha of new plantings. The attributes modelled in the BOAM, for existing plantings, apply a conservative dataset to describe their value, being total indigenous diversity recorded throughout all plantings in different locations (various areas support substantially lower diversity) and maximum height, as observed from the oldest plantings (8 m – 25 years, with many of the planted compositions being 5-6 m tall). With this approach, and the performance of those plantings within the Waihi landscape, a very high level of confidence that a diverse, ecosourced community of new plantings will similarly perform to a high standard will achieve a net gain outcome within 20 years. While it is difficult to determine the specific time of impact, offset actions would be timed with those losses, and average age of those existing plantings (17 years) are not expected to be substantially different at the time of impact, from the conservative attributes of the 25-year old plantings modelled.

Table 8: Explanation table for BOAM for SNA 166 Broadleaved scrub: Rewarewa component.

Biodiversity attribute	Benchmark and justification	Impact value	Action and confidence	Biodiversity value by 20 years	Justification for confidence (References / data)	Attribute Net Biodiversity Value
Indigenous Canopy height (m)	**15 m** Height of typical VS5 canopy species more or less, based on expected heights at 50 years – the approximate age of the SNA area (generally pioneer trees and shrubs, e.g. kānuka- 18m, mahoe- 15m, mapou- 6m; kowhai- 20m). At maximum height, VS5 could be expected to be transitioning to a mature forest type.	**7.75m** Measured from RECCE plots: rewarewa dominant plots	**Revegetation 9 ha** Confidence 75-90%	**7m** Within the parameters of measured trees from four plots of 14-25-year-old restoration plantings at Waihi (heights 6-8 m)	Well-established approach to revegetation with known success over numerous projects.	**0.06**
Winter fruit and flower resources	**17** The benchmark of at least 17 species that fruit or flower during winter months, and based on seral broadleaved species that occur within the Waikato Region: *Alectryon excelsus* *Alseuosmia macrophylla* *Brachyglottis repanda* *Coprosma arborea* *Coprosma autumnalis* *Entelea arborescens* *Geniostoma ligustrifolium* *Hedycarya aborea*	**5** Species recorded throughout SNA 166 (southern fragment) *Brachyglottis repanda* *Hedycarya aborea* *Leptecophylla juniperina* *Veronica stricta* *Myrsine australis*	**Revegetation 9 ha** Confidence >90%	**13 species (increase 8)** *Brachyglottis repanda* *Coprosma arborea* *Entelea arborescens* *Geniostoma ligustrifolium* *Hedycarya aborea* *Hoheria sexstylosa* *Pennantia corymbosa* *Plagianthus regius* *Pseudopanax arboreus* *Leptospermum scoparium* *Myrsine australis* *Veronica stricta*	Revegetation is well established approach to restoration (as evidenced across the landscape). Selected species on pioneer and buffer planting lists. This is a conservative count, which gives strong confidence. Species from the recommended planting list that flower or fruit during winter months (June-August) are: tītoki, rangiora, whau, hoheria, mānuka, mapou, kaikomako, whauwhaupaku, kōwhai, koromiko, māmangi, kohekohe, hangehange, porokaiwhiri, nīkau and pūriri (16 species). However, not all of these will be producing flowers/fruit within 15/20 years (eg nīkau) and not all of these produce good food sources - eg kōwhai	**2.58**

Biodiversity attribute	Benchmark and justification	Impact value	Action and confidence	Biodiversity value by 20 years	Justification for confidence (References / data)	Attribute Net Biodiversity Value
	Hoheria sexstylosa *Pennantia corymbosa* *Plagianthus regius* *Pseudopanax arboreus* *Pseudowintera axillaris* *Leptospermum scoparium* *Myrsine australis* *Rhabdothamnus solandri* *Veronica stricta*			*Vitex lucens*	seeds. Some species have been excluded from this list (eg kawakawa) because while they do flower during winter, their flowers are wind pollinated and are not known to provide a food resource for birds or insects.	
Indigenous canopy species richness (count)	**15** Up to 15 native canopy species could be expected in VS5 scrub / forest, based on reviews (e.g. Singers et al. 2017).	**3** Measured from 20m x 20m RECCE plots within rewarewa-dominant vegetation.	**Revegetation 9 ha** Confidence 75-90%	**8** Expected with maintenance of planted species.	Planting schedule includes 18 pioneer and 19 enrichment species, of which 14 could be expected to have a canopy presence at 20 years.	**1.47**
Indigenous understorey species richness (count)	**25** Up to 25 native canopy species could be expected in VS5 scrub / forest, based on reviews (e.g. Singers et al. 2017).	**9** Measured from 20m x 20m RECCE plots rewarewa-dominant vegetation within SNA 166	**Revegetation 9 ha** Confidence 75-90%	**20** Expected with maintenance of planted species.	Planting schedule includes 18 pioneer species as well as 19 enrichment species to be planted after 5 years. While some of these may not remain in the understory layer, a large portion are expected to be present either through mixed growth rates, or self-seeding. Some colonisation through bird and wind dispersal also expected (e.g. Sullivan et al. 2005).	**2.52**

Biodiversity attribute	Benchmark and justification	Impact value	Action and confidence	Biodiversity value by 20 years	Justification for confidence (References / data)	Attribute Net Biodiversity Value
Diversity of native avifauna (count)	**15 spp** Five additional native species, to those observed within the WNP area, could be expected for a VS5 scrub / forest benchmark in the Waihi area, given consideration of species that may have potential to colonise from the Coromandel and Kaimai Ranges (e.g. tomtit, whitehead, kereru, falcon & bellbird)	**10 spp** Maximum total native species diversity recorded from site visits to SNA166 and 5 MBCs	**Revegetation 9 ha** Confidence 75-90%	**12 species (increase 2 spp)** Bellbird and kereru have been recorded in the surrounding landscape but not from SNA 166. These species will be expected within 20 years.	Bellbird and kereru have been recorded in the surrounding landscape but not from SNA 166. Food plants have been provided for in the planting schedule. It is anticipated that these species be become regular visitors by 20 years, resident thereafter.	**0.89**

Table 9: Explanation table for BOAM for SNA 166 Broadleaved scrub: Treefern-dominant component.

Biodiversity attribute	Benchmark and justification	Impact value	Action and confidence	Biodiversity value by 20 years	Justification for confidence (References / data)	Attribute Net Biodiversity Value
Indigenous Canopy height (m)	**15 m** Height of typical VS5 canopy species more or less (generally pioneer trees and shrubs, e.g. kānuka- 18m, mahoe- 15m, mapou- 6m; kowhai- 20m). At maximum height, VS5 could be expected to be transitioning to a mature forest type.	**7m** Measured from recce plots: tree fern dominant plots	**Revegetation 8.5 ha** Confidence >90%	**7m** Within the parameters of measured trees from four plots of 14-25-year-old restoration plantings at Waihi (heights 6-8 m)	Well-established approach to revegetation with known success over numerous projects.	**-1.87**
Winter fruit and flower resources	**17** The benchmark of at least 17 species that fruit or flower during winter months, and based on seral broadleaved species that occur within the Waikato Region:	**5** Species recorded throughout SNA 166 (southern fragment).	**Revegetation 8 ha** Confidence >90%	**13 species (increase 8)** *Brachyglottis repanda* *Coprosma arborea* *Entelea arborescens*	Revegetation is well established approach to restoration (as evidenced across the landscape). Selected species on pioneer and buffer planting lists. This is a conservative count, which gives strong confidence. Species from the	**2.08**

Biodiversity attribute	Benchmark and justification	Impact value	Action and confidence	Biodiversity value by 20 years	Justification for confidence (References / data)	Attribute Net Biodiversity Value
	Alectryon excelsus *Alseuosmia macrophylla* *Brachyglottis repanda* *Coprosma arborea* *Coprosma autumnalis* *Entelea arborescens* *Geniostoma ligustrifolium* *Hedycarya aborea* *Hoheria sexstylosa* *Pennantia corymbosa* *Plagianthus regius* *Pseudopanax arboreus* *Pseudowintera axillaris* *Leptospermum scoparium* *Myrsine australis* *Rhabdothamnus solandri* *Veronica stricta*	*Brachyglottis repanda* *Hedycarya aborea* *Leptecophylla juniperina* *Veronica stricta* *Myrsine australis*		*Geniostoma ligustrifolium* *Hedycarya aborea* *Hoheria sexstylosa* *Pennantia corymbosa* *Plagianthus regius* *Pseudopanax arboreus* *Leptospermum scoparium* *Myrsine australis* *Veronica stricta* *Vitex lucens*	recommended planting list that flower or fruit during winter months (June-August) are: tītoki, rangiora, whau, hoheria, mānuka, mapou, kaikomako, whauwhaupaku, kōwhai, koromiko, māmangi, kohekohe, hangehange, porokaiwhiri, nīkau and pūriri (16 species). However, not all of these will be producing flowers/fruit within 15/20 years (eg nīkau) and not all of these produce good food sources - eg kōwhai seeds. Some species have been excluded from this list (eg kawakawa) because while they do flower during winter, their flowers are wind pollinated and are not known to provide a food resource for birds or insects.	
Indigenous canopy species richness (count)	**15** Up to 15 native canopy species could be expected in VS5 scrub / forest, based on reviews (e.g. Singers et al. 2017).	**2** Measured from 20m x 20m RECCE plots within treefern-dominant vegetation.	**Revegetation 8.5 ha** Confidence >90%	**8** Expected with maintenance of planted species.	Planting schedule includes 18 pioneer and 19 enrichment species, of which 14 could be expected to have a canopy presence at 20 years.	**1.76**
Indigenous understorey species richness (count)	**25** Up to 25 native canopy species could be expected in VS5 scrub / forest, based on reviews (e.g. Singers et al. 2017).	**5** Measured from 20m x 20m RECCE plots tree fern-dominant	**Revegetation 8.5 ha** Confidence >90%	**20** Expected with maintenance of planted species.	Planting schedule includes 18 pioneer species as well as 19 enrichment species to be planted after 5 years. Some colonisation through bird and	**2.68**

Biodiversity attribute	Benchmark and justification	Impact value	Action and confidence	Biodiversity value by 20 years	Justification for confidence (References / data)	Attribute Net Biodiversity Value
		vegetation within SNA 166 TSF3			wind dispersal also expected (e.g. Sullivan et al. 2005).	
Diversity of native avifauna (count)	**15 spp** Five additional native species, to those observed within the WNP area, could be expected for a VS5 scrub / forest benchmark in the Waihi area, given consideration of species that may have potential to colonise from the Coromandel and Kaimai Ranges (e.g. tomtit, whitehead, kereru, falcon & bellbird)	**10 spp** Maximum total native species diversity recorded from site visits to SNA166 and 5 MBCs	**Revegetation 8.5 ha** Confidence 75-90%	**12 species (increase 2 spp)** Bellbird and kereru have been recorded in the surrounding landscape but not from SNA 166. These species will be expected within 20 years.	Bellbird and kereru have been recorded in the surrounding landscape but not from SNA 166. Food plants have been provided for in the planting schedule. It is anticipated that these species will be regular visitors by 20 years, resident thereafter.	**0.04**

Table 10: Explanation table for BOAM for: Western fragment Broadleaved scrub.

Biodiversity attribute	Benchmark and justification	Impact value	Action and confidence	Biodiversity value by 20 years	Justification for confidence (References / data)	Attribute Net Biodiversity Value
Indigenous Canopy height (m)	**15 m** Height of typical VS5 canopy species more or less (generally pioneer trees and shrubs, e.g. kānuka- 18m, mahoe- 15m, mapou- 6m; kowhai- 20m). At maximum height, VS5 could be expected to be transitioning to a mature forest type.	**12 m** Measured onsite: mixture of pole tree fern, rewarewa and pōhutukawa	**Enhancement of SNA166: 20 ha** Confidence 75-90%	**15 m** Current indigenous spp. Heights are approximately 12 m tall, requires an additional 5 m growth over 20 years.	Tanes Tree trust: average growth 30-39 cm per year. Enhancement is within existing VS5 vegetation, which is currently around 6m tall. The existing rewarewa and tōwai making up the subcanopy under pines (which are being removed for enhancement) are expected to grow 9m in 20 years.	**0.87**

Biodiversity attribute	Benchmark and justification	Impact value	Action and confidence	Biodiversity value by 20 years	Justification for confidence (References / data)	Attribute Net Biodiversity Value
Indigenous Canopy cover (%)	**85%** The benchmark of at least 85% canopy cover considers best case scenario whereby colonising weeds will be shaded out between plantings.	**60%** Measured onsite: Canopy patchy / discontinuous	**Enhancement of SNA166: 20 ha** Confidence 75-90%	**80%** By 20 years from pine removal, rewarewa / towai expected to spread canopies and existing understorey growth (e.g. mahoe, pidgeonwood, currently >5 m) fill light gaps within 20 years.	The current canopy continuity is discontinuous due to emergent pines. By 20 years post pine removal vigorous growth from both newly planted species and the current subcanopy is expected, which will fill gaps, albeit with some variation in canopy height where younger trees replace pines.	**1.16**
Indigenous canopy species richness (count)	**15** Up to 15 native canopy species could be expected in VS5 scrub / forest, based on reviews (e.g. Singers et al. 2017).	**3** Recorded onsite: mixture of pole tree fern, rewarewa and pōhutukawa	**Enhancement of SNA166: 20 ha** Confidence >75-<90%	**5** Expected with maintenance of planted species with natural regeneration over some understory diversity	Measured diversity onsite, supported by additional plant species list for pine replacement	**0.98**
Indigenous understorey species richness (count)	**25** Up to 25 native canopy species could be expected in VS5 scrub / forest, based on reviews (e.g. Singers et al. 2017).	**17** 17 spp recorded onsite (Bioresearches 2025a). Model provides conservative approach	**Enhancement of SNA166: 20 ha** Confidence >90%	**20** Expected with ongoing pest control and enrichment planting.	Planting schedule includes 10 additional enrichment species to be planted after 5 years. At least 12 species already present at and some colonisation through bird and wind dispersal also expected (e.g. Sullivan et al. 2005). Measure considered conservative.	**0.45**
Diversity of native avifauna (count)	**15 spp** Five additional species could be expected for a VS5 scrub / forest benchmark in the Waihi area, given consideration of species that may have potential to colonise from the Coromandel and Kaimai Ranges (e.g. tomtit, whitehead, kereru, falcon & bellbird)	**10 spp** Maximum total native species diversity recorded from site visits to SNA166 and 5 MBCs	**Enhancement of SNA166: 27 ha** Confidence 75-90%	**12 species (increase 2 spp)** Bellbird and kereru have been recorded in the surrounding landscape but not from SNA 166. These species are expected within 20 years.	Bellbird and kereru have been recorded in the surrounding landscape but not from SNA 166. Additional food plants have been provided for in the SNA enrichment planting schedule. It is anticipated that these bird species be become regular visitors by 20 years, resident thereafter.	**0.61**

Table 11: Explanation table for BOAM for: Voluntary Plantings

Biodiversity attribute	Benchmark and justification	Impact value	Action and confidence	Biodiversity value by 20 years	Justification for confidence (References / data)	Attribute Net Biodiversity Value
Average height (m)	**7 m** Benchmarked against existing voluntary plantings on site that are 20 years old	**7 m**	Revegetation (28ha): Confidence >90%	**7 m** Average height of existing voluntary plantings.	Existing plantings aged 20 years have been measured at between 7-8m height. Revegetation planting will be located close by, indicating that soil and microclimate conditions will be similar, giving strong confidence in achieving the same height within the 20 year time frame.	**-1.39**
Indigenous Canopy cover (%)	**70%** Benchmarked against existing voluntary plantings of between 15 - 20 years age.	**70%** Measured onsite: Canopy patchy / discontinuous	Revegetation (28ha): Confidence >90%	**70%** Expected with maintenance of planted areas.	Revegetation is a well-established approach to restoration (as evidenced across the landscape). Evidence of strong growth and canopy formations is shown by existing voluntary plantings. Canopy density is expected to peak between 10-20 years before shorter lived pioneer species (such as manuka) begin to die off and create canopy gaps.	**3.70**
Diversity (count)	**22** Benchmarked against diversity surveyed in existing voluntary plantings (Bioresearches 2025a).	**22** Recorded on site	Revegetation (28ha): Confidence >90%	**30** Expected with maintenance of planted species	Revegetation planting list has 18 pioneer and 19 enrichment species. Natural colonisation through wind and bird dispersal is also expected, based on evidence from existing voluntary plantings. Conservative estimate.	**3.70**
Winter flower/fruit resources	**4** Benchmarked against existing voluntary plantings.	**4** 4 spp recorded onsite in existing voluntary plantings	Revegetation (28ha): Confidence >90%	**6** Expected with maintenance of planted species	Six species are calculated to be providing flower/fruit resources to birds 20 years after planting based on restoration pioneer and enhancement lists.(these are expected to be pūriri, which can flower after 15 years, hebe, whauwhaupaku, kaikomako, mapou,	**-1.39**

Biodiversity attribute	Benchmark and justification	Impact value	Action and confidence	Biodiversity value by 20 years	Justification for confidence (References / data)	Attribute Net Biodiversity Value
		(Bioresearches 2025a). Model provides conservative approach			houhere) Others (eg nikau, kohekohe, titoki) will take longer to mature to fruiting age so were not included. As potential winter flower/fruit providing species in these lists are higher than 6 and caution was taken to exclude species that would not provide food resources before 20 years, confidence is very high that this number will be met after 20 years. Note that not all species that flower or fruit over the winter period produce food resources for birds - eg Coprosma and kawakawa flowers are wind pollinated simple structures that are not considered food sources for birds, or insects.	
Diversity of native avifauna (count)	**8 spp** Benchmarked against indigenous birds detected in current voluntary planting areas using 5 minute bird counts and opportunistic encounters.	**8 spp** Maximum total native species diversity recorded from site visits to voluntary plantings and 5 MBCs	Revegetation (28ha): Confidence 75-90%	**10 species (increase 2 spp)** Expected with maintenance of planted areas and full suite of recommended species planted.	The particular provision of plant species that will provide winter food resources will help ensure year-round food is present. A greater diversity of plant species is included in pioneer and enrichment planting lists than the voluntary plantings and this is expected to provide food and habitat requirements for birds in the wider landscape, in particular kereru and bellbirds, which are present in the surrounding area, but have not yet been detected within current planting areas.	**-1.37**

4.5.3 Modelled Offsetting Actions

It is proposed that a minimum of 17.5 ha of offset planting and 20 ha of offset enhancement planting (via pine removal and replacement with future native canopy trees) is to be undertaken to offset the loss of protected terrestrial ecological values with respect to the TSF incursion into SNA 166.

The 17.5 ha of offset planting is proposed to be undertaken within and adjacent to the existing southern SNA 166 fragment. Particular focus of offset revegetation is to:

- Improve connectivity between the northern and southern fragments of SNA 166; and
- Provide enrichment species that will ensure succession to a future WF11 forest type which will have historically occurred there.

4.5.4 Description of Offset

Target habitat-specific revegetation (e.g. vineland, flaxland) around known habitat for moko skink (*Oligosoma moco*) a Nationally 'At Risk' species, with densely growing and fruit producing ground cover vegetation that will facilitate population growth and expansion beyond existing, isolated areas.

The species composition for the proposed restoration planting is based on the kauri, podocarp, broadleaved forest ecosystem type (WF11, Singers & Rogers 2014) and includes 31 species, including a minimum of 15 canopy species and 25 understorey species.

All planting undertaken for the WNP (including 20ha of area for offset of mostly voluntary planting and pines, 17.5 ha offset planting and 20 ha enhancement planting) will have legal protection in perpetuity (via covenant or similar), pest and weed control.

The BOAM for offsetting SNA loss demonstrates that 17.5 ha of revegetation for the loss of 8.3 ha of SNA scrub will deliver biodiversity gains in 20 years with a high level of confidence (>90%). A further 20 ha of pine tree removal within SNA 166 and replacement with future WF11 forest canopy trees for the loss of a 1.2 ha fragment of 'not protected', naturally occurring pōhutukawa / rewarewa vegetation will deliver biodiversity gains in 20 years with confidence (75-90%).

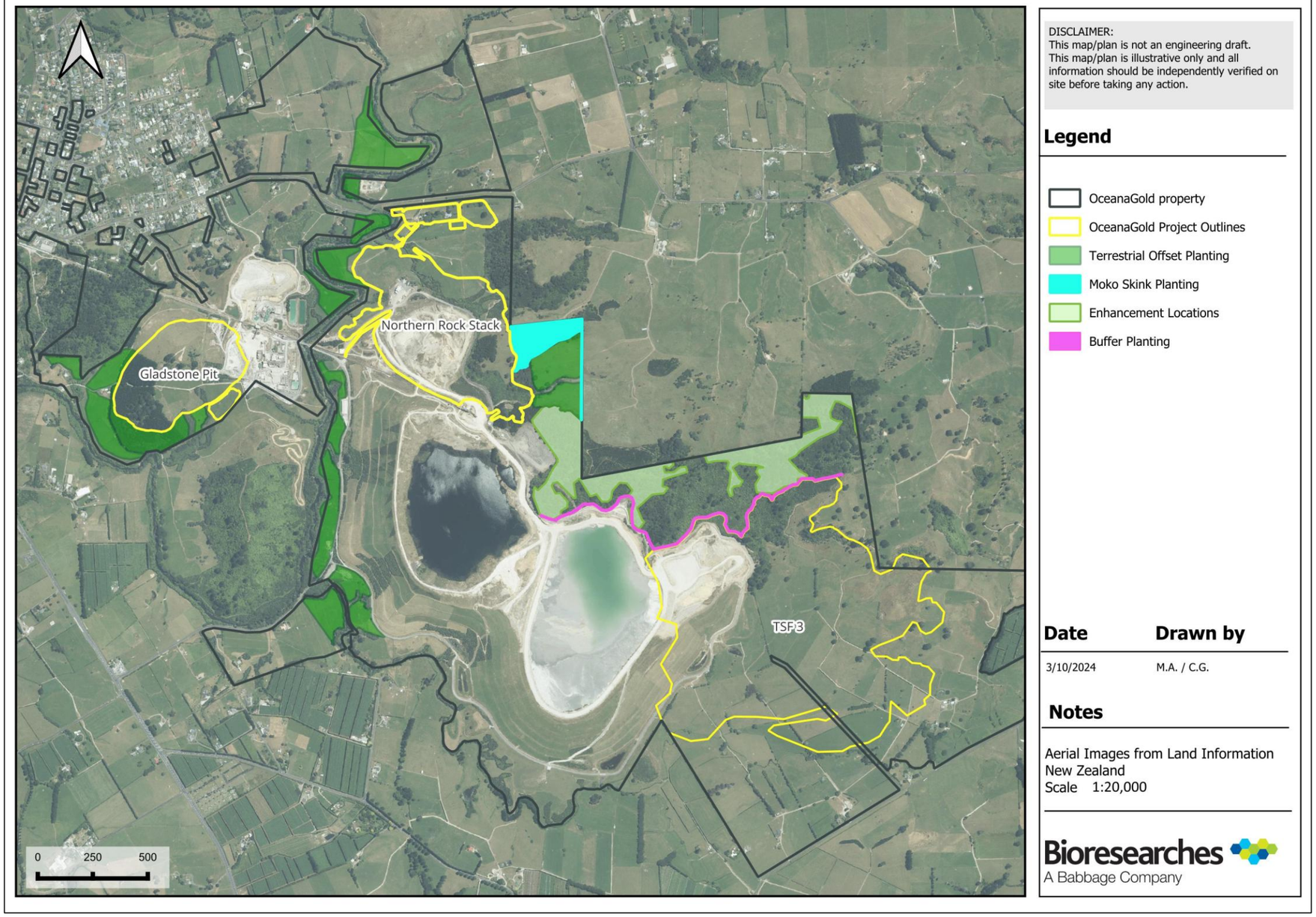
The lower level of confidence in enhancement actions (compared to >90%), despite the much larger area over which enhancement actions will be undertaken, is due in part to the habitat value that pine trees may already provide to fauna. Therefore, their initial removal will reduce the ecological uplift (amount gained by improving existing values) that could otherwise be achieved by planting an area where biodiversity attributes are nearer to zero.

However, it is important to note that, while enhancement measures may not provide as much ecological uplift within the 20-year timeframe to measure the offset outcome, pine trees will continue to gradually spread throughout the SNA beyond this time if not properly managed. The Department of Conservation estimates that wildling pines spread at an estimated rate of 5% per year, where they outcompete native vegetation and reduce habitat resources for indigenous wildlife (and hence reduce biodiversity). Therefore, it is expected that the large existing areas of pine-dominant vegetation within the southern SNA 166 fragment will require ongoing management to prevent this spread, if not captured in the proposed actions. Further, the direction of resources to provide such management (removal, replant, monitoring and maintenance) may not be a priority to stakeholders, given that the existing values within the SNA are not high. Therefore, it is reasonable to expect that the large areas of pine-dominant vegetation will continue to spread over time and continue to reduce the ecological integrity of the SNA if pines are not removed and/or managed.

The restoration planting and vegetation enhancement is proposed to be undertaken within the site adjacent to the remaining SNA to decrease the overall edge effects and increase ecological connectivity.

It is also proposed that legal protection (or vesting) and ongoing pest and weed control for all SNA vegetation and new plantings within the site is undertaken.

The offsetting sites for revegetation are located directly adjacent to SNA 166 where there is space to do so, while the enhancement sites are located within the SNA. The revegetation sites are currently predominantly bare grazing land with a small number of mature specimen trees. They currently present limited value as vegetation, avifauna or lizard habitat.



DISCLAIMER:
This map/plan is not an engineering draft.
This map/plan is illustrative only and all information should be independently verified on site before taking any action.

Legend

- OceanaGold property
- OceanaGold Project Outlines
- Terrestrial Offset Planting
- Moko Skink Planting
- Enhancement Locations
- Buffer Planting

Date	Drawn by
3/10/2024	M.A. / C.G.

Notes

Aerial Images from Land Information New Zealand
Scale 1:20,000

Bioresearches
A Babbage Company

Figure ~~7~~6: Site-wide offset locations of terrestrial offset planting and enhancement actions.

4.5.5 Biodiversity Compensation for Copper Skink Habitat at Gladstone Pit

Management measures for native lizards, including copper skinks, are detailed in a separate Lizard Management Plan. However, the loss of known habitat for high-value copper skinks within the proposed GOP, including 1 ha of native plantings, 5.1 ha of pine plantation and 0.4 ha of rocky outcrop would represent a high-level residual effect (high value, moderate magnitude).

Therefore, in addition to management, a biodiversity compensation model for the loss of native and exotic habitat has been developed (BCM, Baber et al. 2021).

Terrestrial revegetation and habitat enhancement, with pest control: 11.2 ha of native revegetation on OGNZL land at GOP, where it is contiguous with retained and protected habitats that are known to support copper skinks. All native plantings would be subject to 20 years of pest control (rats, possums, mustelids). In addition, rock substrate from outcrops that will be removed through GOP development will be relocated to the revegetation area prior to planting to enhance copper skink habitat. Rodent traps will be spaced no more than 50m apart and possum/mustelid traps will be spaced no more than 100m apart, and cat traps 100-200m apart.

Pest animal control: 4.45 ha of retained and protected habitats that support copper skinks on OGNZL land at GOP, where they are contiguous with terrestrial revegetation for habitat compensation (above). Table 12~~Table 12~~~~Table 12~~ below describes the data inputs into the BCM. The BCM predicts that a 10% Net Gain outcome for effects on copper skink habitat will be exceeded through the proposed compensation actions, i.e. the compensation score is 39% higher than the impact score.

Table 12: Copper skink habitat Biodiversity Compensation input / output and weighted score table

Model Inputs			
Input descriptors	Input data		
Project/reference name	Waihi North		
Biodiversity type	Copper skink habitat		
Technical expert(s) input	C Wedding, D van Winkel		
Benchmark	5		
How many habitat types OR sites are impacted	3		
Number of proposed compensation actions	2		
Net gain target	10%		
Habitat/Site Impact(s)	Plantings	Pine	Rocky outcrop
Impact risk contingency:	3	3	3
Impact uncertainty contingency:	1	1	1
Areal extent of impact (ha):	1	5.1	0.4
Value score prior to impact:	2.5	1.5	3.5
Value score after impact:	0.001	0.001	0.001
Compensation Action(s)	Revegetation & pest control	Pest control existing habitat	
Discount rate:	3.0%	3.0%	
Finite end point (years):	10	1	
Compensation confidence contingency:	2	3	
Areal extent (ha) of compensation type:	11.2	4.45	
Value score prior to compensation:	0.001	2.5	
Value score after compensation:	2.5	3	

Model outputs				
	Total impact score	Plantings	Pine	Rocky outcrop
Impact score	-2.66655	-0.57727	-1.76597	-0.32331
	Total compensation score	Revegetation & pest cont	Pest control existing habit	
Compensation score	3.70636	3.43634	0.27002	
Net gain outcome	39.0%			

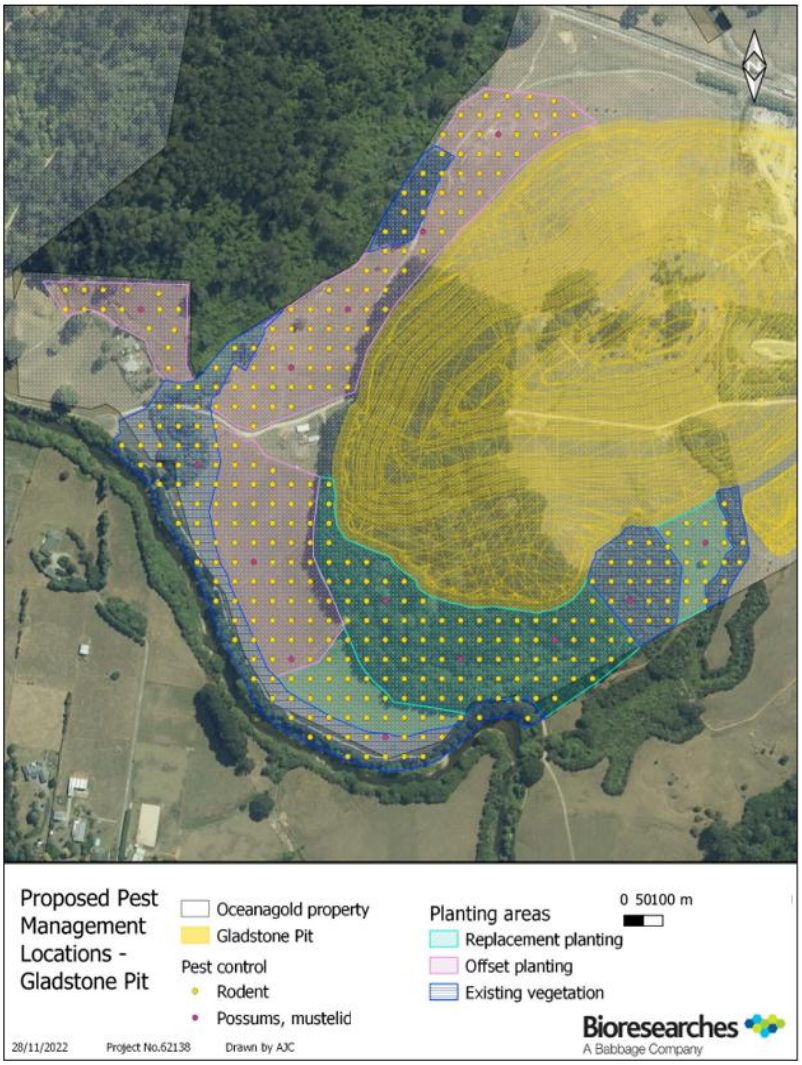


Figure ~~887~~: **Restoration planting (for offsets), and pest control would compensate for copper skink habitat loss at Gladstone Open Pit. Trap locations are indicatively spaced; rodent traps will be placed 50m apart, and 100m apart for possum, mustelid traps and 100-200m apart for cats**

Table 13: Copper skink habitat BCM data inputs and explanation

Model inputs	Explanation
Biodiversity type	Copper skink habitat
Technical expert inputs(s)	Chris Wedding, Dylan van Winkel
Benchmark	**A benchmark of 5 equates to high value mature native forest margin** where bordered by rank grassland wetland or riparian margins. This habitat would include high ground-habitat complexity, including refugia, and ground vegetative cover or leaf little, be sunny or only partially shaded and have been subject to long-term pest management and at carrying capacity.
How many habitat types OR sites are impacted	3 Native plantings, pine forest, rocky outcrop
Number of proposed compensation measures	2 Revegetation (with pest control), pest control of existing contiguous habitats
Net Gain target	Ground-habitat complexity, including refugia, and ground vegetative cover or leaf little, be sunny or only partially shaded and have been subject to long-term pest management and at carrying capacity.
Impact model inputs and descriptions	
Habitat/site impacted	**Native plantings**
Impact contingency risk (uncertainty)	3: High risk/high value (calculated impact score is multiplied by 1.1 (+10%)) Copper skinks are classified as nationally At Risk (Declining) which equates to a 'high' ecological value under EcIAG (Roper Lindsay et al. 2018).
Areal extent of impact (ha)	1 ha
Value score prior to impact	2.5 Relatively simple plantings, 10-15 years old
Value score after impact	0.001 There will be a permanent and complete loss of habitat within the footprint (noting that the formula cannot work with 0).
Habitat/site impacted	**Pine plantation**
Impact contingency risk (uncertainty)	3: High risk/high value (calculated impact score is multiplied by 1.1 (+10%)) Copper skink are classified as nationally At Risk (Declining) which equates to a 'high' ecological value under EcIAG (Roper Lindsay et al. 2018).
Areal extent of impact (ha)	5.1 ha
Value score prior to impact	1.5 Exotic pine plantation with some rough grass, relatively simple habitat heterogeneity

Model Inputs	Explanation
Value score after impact	0.001 There will be a permanent and complete loss of habitat within the footprint (noting that the formula cannot work with 0).
Habitat/site impacted	**Rocky outcrop**
Impact contingency risk (uncertainty)	3: High risk/high value (calculated impact score is multiplied by 1.1 (+10%)) Copper skink are classified as nationally At Risk (Declining) which equates to a 'high' ecological value under EcIAG (Roper Lindsay et al. 2018).
Areal extent of impact (ha)	0.4 ha
Value score prior to impact	3.5 Naturally occurring area with habitat heterogeneity
Value score after impact	0.001 There will be a permanent and complete loss of habitat within the footprint (noting that the formula cannot work with 0)
Compensation model inputs	
Compensation type 1	**Native revegetation with pest control**
Discount rate	+3 % (the default discount score as per Maseyk et al. (2015); Baber et al. (2021a). The discount rate addresses the temporal time lag between the impact occurring and the biodiversity gains being generated by the conservation action(s).
Finite end-point	10 years
Compensation contingency (confidence)	2 High confidence: copper skinks readily detectable in existing 10 year-old plantings without pest control
Areal extent (ha) of compensation type	11.2 ha
Value score prior to compensation measure (relative to benchmark)	0.001 No existing habitat in planting areas
Value score after compensation measure (relative to benchmark)	2.5
Compensation model inputs	
Compensation type 1	**Pest control existing contiguous habitat**
Discount rate	+3 % (the default discount score as per Maseyk et al. (2015); Baber et al. (2021a). The discount rate addresses the temporal time lag between the impact occurring and the biodiversity gains being generated by the conservation action(s).
Finite end-point	1 year

Model Inputs	Explanation
Compensation contingency (confidence)	3 Moderate confidence: Control not targeting mice, but some benefits expected from rat, mustelid control
Areal extent (ha) of compensation type	4.45
Value score prior to compensation measure (relative to benchmark)	2.5 habitat generally consists of other similar age plantings
Value score after compensation measure (relative to benchmark)	3

4.6 OFFSET MONITORING

Offset monitoring is required to determine the success of the modelled offset outcomes, within the set time frame. Monitoring will confirm if the attributes are being met and ensure a response for further planting/enhancement/management, should the attributes not be met.

Offset outcomes would be measured at least every two years at each of the offset sites: The purpose of the monitoring is to:

1. Track the progress of identified biodiversity attributes.
2. Provide feedback with recommendations for any additional management required to ensure the offset meets its target on or before 20 years.
3. Identify any requirements for contingency actions early, where any shortfalls could affect offset outcomes.
4. Provide a monitoring report, following each monitoring occasion, to demonstrate that:
    a. the offset is developing as expected
    b. is being appropriately managed and maintained.
    c. If offset maturity is short of targets, then adaptive management actions will be modelled, using a BOAM, and implemented to ensure that a net gain outcome is achieved.

4.6.1 Monitoring Targets and Contingencies

Monitoring targets are provided in Table 14. While ultimate success will be determined at 20 years, the targets provide an indication of expected values for attributes at each 5-yearly intervals with the gradual development and maturation of the offset vegetation. Failure to meet biodiversity attribute targets prior to 20 years may not necessarily result in failure of the offset, however monitoring outcomes that result in values that are short of the targets would inform adaptive management actions, such as additional planting, provision of fertilisers, or wind protection.

This section addresses monitoring targets and contingencies as modelled for each BOAM.

Table 14. Five-yearly monitoring targets for offset planting areas – Note: Offset success measured at 20 years. Targets prior to offset outcome are indicative only and should prompt management response.

Biodiversity attribute	Offset action	5 years	10 years	15 years	20 years
Indigenous Canopy height (m)	Revegetation	2 m	4 m	6 m	7 m
Winter fruit and flower resources (count)	Revegetation	2	10	13	13 spp.
Indigenous canopy species richness	Revegetation	5	6	8	8 spp.
Indigenous understorey species richness	Revegetation	2	10	15	20 spp.
Native avifauna diversity	Revegetation	4	10	12	12 spp.
Canopy height	SNA Enhancement	12	13	14	15 m
Indigenous canopy cover	SNA Enhancement	60	65	75	80%
Indigenous canopy species richness	SNA Enhancement	3	3	4	5 spp.
Indigenous understorey species richness	SNA Enhancement	17	18	19	20 spp.
Native avifauna diversity	SNA Enhancement	10	11	12	12 spp.

4.6.2 Monitoring Targets and Contingencies

Outcome monitoring for the biodiversity offset shall include:

> Monitoring to occur once every five years, commencing five years after the canopy species have been planted and continue for at least 20 years (note- separate from plant maintenance). At 20 years, if all attributes have been met, monitoring may cease.

> At five yearly monitoring, if attributes are more than 15% behind predicted targets from year 10, adaptive management requirements will be detailed in the monitoring report (such as whether additional planting, pest control over greater area is required). These actions would be modelled, using a biodiversity offset accounting model to demonstrate that Net Gain outcomes will be achieved at 20 years.

Monitoring is to be completed by suitably experienced ecologists.

> Vegetation monitoring within 20m x 20m plots

> Four plots within SNA enhancement planting, three plots within each of the two offset restoration plantings, being the SNA offset and non-protected vegetation offset.). The final locations of monitoring plots will be determined during first monitoring period. GPS coordinates and/or permanent marks will be used to establish boundaries.

Identify all shrub and tree species at the canopy and understorey levels.

> Record percentage canopy cover.

> Determine canopy height.

Bird monitoring at same locations as vegetation plots

> 5-minute bird count at each location, replicated four times.

Reporting of monitoring

> Results of all aspects monitored including how they are tracking against the biodiversity attributes.

Records of any weeds encountered during monitoring.

Records of any dead/dying plants encountered.

> Recommendations as a result of the monitoring.

Report to be provided to OGNZL, Hauraki District Council and Waikato Regional Council.

Monitoring of lizards is addressed within the sperate Ecological Management Plan.

4.7 KEY PERFORMANCE INDICATORS

For the Residual Effects Offset Plan, the key performance indicators comprise:

- Five-yearly monitoring, commencing five years after initial revegetation and enhancement canopy species have been planted, is to demonstrate progress towards a net biodiversity gain between the impact sites and the offset sites. The net biodiversity gain is to be achieved with regard to canopy height, native canopy diversity, winter fruiting and flowering species, native canopy cover, native canopy diversity, native understorey diversity, and avifauna diversity in accordance with the targets set out in Table 14.
- If monitoring demonstrates that biodiversity attributes are more than 15% behind predicted targets from year 10, adaptive management requirements will be detailed in the monitoring report. These requirements would be modelled, using a biodiversity offset accounting model to demonstrate that net gain outcomes will be achieved at 20 years.
- 20 years following the commencement of the consented activities a net biodiversity gain is to be achieved, and is to include as a minimum:
  - 17.5 ha of revegetation within and adjacent to the existing southern SNA 166 fragment (offsetting the loss of 3.6 ha of rewarewa forest and 4.6 ha of treefern scrub within SNA 166);
  - 20 ha of revegetation throughout the wider Waihi North Project area (offsetting the loss of 10.1 ha of voluntary plantings which occur predominantly beyond TSF3);
  - 20 ha of enhancement planting within SNA 166 (offsetting the loss of 1.2 ha of the western fragment of SNA 166).

Commented [MD4]: Linked in to more clearly identify how it will be determined if management measures are functioning as they are intended to.

~~4.7~~4.8 REFERENCES

Baber, M, Dickson, J, Quinn, J, Markham, J, Ussher, G, Heggie-Gracie, S, and Jackson, S. (2021). A Biodiversity Compensation Model for New Zealand – A User Guide (Version 1). (Tonkin and Taylor, October 2021)

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Beresford, R.; Smith, G.; Ganley, B.; Campbell, R. (2019). Impacts of myrtle rust in New Zealand since its arrival in 2017. *New Zealand Garden Journal*, 22 (2): 5-10.

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Hitchmough, R.; Barr, B.; Knox, C.; Lettink, M.; Monks, J.; Pattreson, G.; Reardon, J.; van Winkel, D.; Rolfe, J.; Michel, P. 2021. *Conservation status of New Zealand reptiles, 2021*. New Zealand Threat Classification Series 35. Department of Conservation, Wellington.

Maseyk, F., Martine, M., Seaton, R., Duton, G. (2015). A Biodiversity Offsets Accounting Model for New Zealand. The Catalyst Group Contract Report No: 2014-008. Prepared For the New Zealand Department of Conservation. 73 pp.

~~4.84.9~~ APPENDIX 4A - BAIT TAKE AND TRAP CATCH RECORDING TEMPLATE

The below are some suggestions of the basic info you should record each time a trap and / or station is checked.

Bait Take Record

Location					
Person					
Date			*Time*		
Bait name					
Safety issues identified					
		record bait in 1/4 blocks, eg 1 1/4, 1 1/2, etc			
Line #	Station ID #	Estimate how much bait is still in station? (blocks)	How much bait did you remove? (blocks)	How much bait did you put in? (whole blocks)	Other comments eg. birds seen/heard, lizards seen, slug/snail damage, bait station condition

Trap catch record

Location					
Person					
Date			*Time*		
Safety issues identified					
Line #	Trap ID #	Has the trap caught anything? (Y/N)	Species caught	How much bait did you put in? (whole blocks)	Other comments eg. Nothing caught but lure gone; notes of trap / station damage etc

~~4.9~~4.10 APPENDIX 4B – BIODIVERSITY OFFSET MODELS

Table 15.: BOAM Output for loss of southern SNA 166 fragment: Rewarewa forest. Model indicates a net biodiversity gain (1.42).

OFFSET MODEL

Key

	User Input		Dropdown list
	Auto-filled		Not Required

	BIODIVERSITY TYPE	DISCOUNT RATE
1	Broadleaved scrub	0.03

READ ME:
Step 1: Biodiversity Attributes must be entered into the Impact Model prior to commencing input into the Offset Model.
Step 2: Input the Biodiversity Type identifier (e.g. 1 if it the first Biodiversity Type, 2, if it is the second etc.) into Cell B11. The same identifying number needs to be used for the same Biodiversity Type within the Impact and Offset Models. The Biodiversity Type (Cell C11) will be auto-populated.
Step 3: Input time preference Discount Rate (Cell E11)
Step 4: Biodiversity Components will be auto-populated once Cell B11 is populated.
Step 5: Biodiversity Attributes will be auto-populated once Cell B11 is populated.
Step 6: Work through accounting model for each Biodiversity Attribute entering values into light brown cells. At Column K choose method of accounting for time and follow instructions. If using a finite end point, continue on this sheet. If calculating the offset as accrued over time use the Offset Model_5 yearly worksheet.
Step 7: Repeat for additional Biodiversity Components (scrolling down the sheet)
Step 8: Use a new workbook for each Biodiversity Type

	This section captures which elements of biodiversity are to be accounted for, and the benchmark value for the Attribute. The information matches that in the Impact Model				These cells provide information about the proposed Offset Actions			Calculations can be made for a finite end point, or at five yearly time-steps over 35 years. Indicate preference in Column K and Follow the instructions in Column L		This section is where the marginal change in the measure of Biodiversity Attribute due to the Offset Action is quantified. Inputs are derived from direct measure, existing data or models where available, or expert estimated predictions. Attribute Biodiversity Value at the Offset Site is compared to the Attribute Biodiversity Value at the Impact Site to calculate the Net Present Biodiversity Value for each Attribute					This is the average Net Present Biodiversity Value for the Biodiversity Component
	Biodiversity Component	Biodiversity Attribute		Measurement Unit	Benchmark	Proposed Offset Actions	Offset area (ha)	Confidence in Offset Actions			Measure prior to Offset	Measure after Offset	Time till endpoint (years)	Biodiversity Value at Offset Site	Biodiversity Value at Impact Site	Attribute Net Present Biodiversity Value	Component Net Present Biodiversity Value
1.1	SNA Rewarewa dominant	1.1a	Native canopy height	Height (m)	15	Revegetation, weed and pest control	9	Confident 75-90%	Finite end point	Continue to Column M	0	7	20	1.92	-1.86	0.06	1.42
		1.1b	Winter fruit & flower resources	Count (#)	17	Revegetation, weed and pest control	9	Very confident >90%	Finite end point	Continue to Column M	0	13	20	3.64	-1.06	2.58	
		1.1c	Native canopy species richness	Count (#)	15	Revegetation, weed and pest control	9	Confident 75-90%	Finite end point	Continue to Column M	0	8	20	2.19	-0.72	1.47	
		1.1d	Native understorey species	Count (#)	25	Revegetation, weed and pest control	9	Confident 75-90%	Finite end point	Continue to Column M	0	20	15	3.81	-1.73	2.08	
		1.1e	Native avifauna diversity	Count (#)	15	Revegetation, weed and pest control	9	Confident 75-90%	Finite end point	Continue to Column M	0	12	20	3.29	-2.40	0.89	

Table 16: BOAM output for loss of southern SNA166 fragment: Tree fern scrub. Model indicates a net biodiversity gain (0.94).

	This section captures which elements of biodiversity are to be accounted for, and the benchmark value for the Attribute. The information matches that in the Impact Model					These cells provide information about the proposed Offset Actions			Calculations can be made for a finite end point, or at five yearly time-steps over 35 years. Indicate preference in Column K and Follow the instructions in Column L		This section is where the marginal change in the measure of Biodiversity Attribute due to the Offset Action is quantified. Inputs are derived from direct measure, existing data or models where available, or expert estimated predictions. Attribute Biodiversity Value at the Offset Site is compared to the Attribute Biodiversity Value at the Impact Site to calculate the Net Present Biodiversity Value for each Attribute					This is the average Net Present Biodiversity Value for the Biodiversity Component
	Biodiversity Component	Biodiversity Attribute		Measurement Unit	Benchmark	Proposed Offset Actions	Offset area (ha)	Confidence in Offset Actions			Measure prior to Offset	Measure after Offset	Time till endpoint (years)	Biodiversity Value at Offset Site	Biodiversity Value at Impact Site	Attribute Net Present Biodiversity Value	Component Net Present Biodiversity Value
1.2	SNA treefern dominant	1.2a	Native canopy height	Height (m)	15	Revegetation, weed and pest control	8.5	Confident 75-90%	Finite end point	Continue to Column M	0	7	20	1.81	-3.68	-1.87	0.94
		1.2b	Winter fruit & flower resources	Count (#)	17	Revegetation, weed and pest control	8.5	Very confident >90%	Finite end point	Continue to Column M	0	13	20	3.44	-1.35	2.08	
		1.2c	Native canopy species richness	Count (#)	15	Revegetation, weed and pest control	8.5	Confident 75-90%	Finite end point	Continue to Column M	0	8	20	2.07	-0.31	1.76	
		1.2d	Native understorey species	Count (#)	25	Revegetation, weed and pest control	8.5	Confident 75-90%	Finite end point	Continue to Column M	0	20	15	3.60	-0.92	2.68	
		1.2e	Native avifauna diversity	Count (#)	15	Revegetation, weed and pest control	8.5	Confident 75-90%	Finite end point	Continue to Column M	0	12	20	3.11	-3.07	0.04	

Table 17: BOAM output for loss of Western (not protected) Fragment: SNA 166 enhancement. Model indicates a net biodiversity gain (1.40).

	This section captures which elements of biodiversity are to be accounted for, and the benchmark value for the Attribute. The information matches that in the Impact Model					These cells provide information about the proposed Offset Actions			Calculations can be made for a finite end point, or at five yearly time-steps over 35 years. Indicate preference in Column K and Follow the instructions in Column L		This section is where the marginal change in the measure of Biodiversity Attribute due to the Offset Action is quantified. Inputs are derived from direct measure, existing data or models where available, or expert estimated predictions. Attribute Biodiversity Value at the Offset Site is compared to the Attribute Biodiversity Value at the Impact Site to calculate the Net Present Biodiversity Value for each Attribute					This is the average Net Present Biodiversity Value for the Biodiversity Component
	Biodiversity Component	Biodiversity Attribute		Measurement Unit	Benchmark	Proposed Offset Actions	Offset area (ha)	Confidence in Offset Actions			Measure prior to Offset	Measure after Offset	Time till endpoint (years)	Biodiversity Value at Offset Site	Biodiversity Value at Impact Site	Attribute Net Present Biodiversity Value	Component Net Present Biodiversity Value
1.3	Western pohutukawa fragment	1.3a	Native canopy height	Height (m)	15	Enhancement of pine areas in SNA 166 with future WF11 canopy trees within	21	Confident 75-90%	Finite end point	Continue to Column M	8	15	20	4.48	-0.96	3.52	1.40
		1.3b	Canopy cover	Percentage cover (%)	70	Enhancement of pine areas in SNA 166 with future WF11 canopy trees within	21	Confident 75-90%	Finite end point	Continue to Column M	60	80	20	1.37	-1.20	0.17	
		1.3c	Native canopy species	Count (#)	15	Enhancement of pine areas in SNA 166 with future WF11 canopy trees within	21	Confident 75-90%	Finite end point	Continue to Column M	3	5	20	1.28	-0.24	1.04	
		1.3d	Native understorey species	Count (#)	25	Enhancement of pine areas in SNA 166 with future WF11 canopy trees within	21	Very confident >90%	Finite end point	Continue to Column M	15	20	20	2.22	-0.62	1.60	
		1.3e	Native avifauna diversity	Count (#)	15	Enhancement of pine areas in SNA 166 with future WF11 canopy trees within	21	Very confident >90%	Finite end point	Continue to Column M	10	12	20	1.48	-0.80	0.68	

Table 18: BOAM Output for loss of 10.1 ha of site-wide, predominantly planted native vegetation.

	This section captures which elements of biodiversity are to be accounted for, and the benchmark value for the Attribute. The information matches that in the Impact Model					These cells provide information about the proposed Offset Actions			Calculations can be made for a finite end point, or at five yearly time-steps over 35 years. Indicate preference in Column K and Follow the instructions in Column L		This section is where the marginal change in the measure of Biodiversity Attribute due to the Offset Action is quantified. Inputs are derived from direct measure, existing data or models where available, or expert estimated predictions. Attribute Biodiversity Value at the Offset Site is compared to the Attribute Biodiversity Value at the Impact Site to calculate the Net Present Biodiversity Value for each Attribute						This is the average Net Present Biodiversity Value for the Biodiversity Component
	Biodiversity Component	**Biodiversity Attribute**		**Measurement Unit**	**Benchmark**	**Proposed Offset Actions**	**Offset area (ha)**	**Confidence in Offset Actions**			**Measure prior to Offset**	**Measure after Offset**	**Time till endpoint (years)**	**Biodiversity Value at Offset Site**	**Biodiversity Value at Impact Site**	**Attribute Net Present Biodiversity Value**	**Component Net Present Biodiversity Value**
0.1	voluntary plantings	0.1a	Average height	metres	7	revegetation	20	Confident 75-90%	Finite end point	Continue to Column M	0	7	20	9.14	-10.10	-0.96	1.65
		0.1b	Canopy cover	%	70	revegetation	20	Very confident >90%	Finite end point	Continue to Column M	0	70	10	14.21	-10.10	4.11	
		0.1c	Diversity	count	22	revegetation	20	Very confident >90%	Finite end point	Continue to Column M	0	30	10	14.21	-10.10	4.11	
		0.1d	Avifauna diversity	Count	12	revegetation	20	Confident 75-90%	Finite end point	Continue to Column M	0	12	15	10.59	-10.10	0.49	
		0.1e	Winter flower/fruit resources	Count	4	revegetation	20	Very confident >90%	Finite end point	Continue to Column M	0	6	20	10.58	-10.10	0.48	

~~4.10~~4.11 APPENDIX 4B – BIODIVERSITY COMPENSATION MODEL

Table 19: BCM Model inputs / outputs for SNA 166 and Western Fragment.

Model Inputs			
Input descriptors	Input data		
Project/reference name	Waihi North		
Biodiversity type	Regenerating broadleaf		
Technical expert(s) input	C Wedding		
Benchmark	5		
How many habitat types OR sites are impacted	3		
Number of proposed compensation actions	2		
Net gain target	10%		
Habitat/Site Impact(s)	Rewarewa	Treefern	Western fragment
Impact risk contingency:	2	1	1
Impact uncertainty contingency:	2	1	2
Areal extent of impact (ha):	3.6	4.6	1.2
Value score prior to impact:	2.5	1.5	2
Value score after impact:	0.001	0.001	0.001
Compensation Action(s)	Revegetation & pest control	Enhance SNA via ine removal, pest control	
Discount rate:	3.0%	3.0%	
Finite end point (years):	20	20	
Compensation confidence contingency:	2	2	
Areal extent (ha) of compensation type:	17.5	20	
Value score prior to compensation:	0.001	2	
Value score after compensation:	2.5	3	

Model outputs				
	Total impact score	Rewarewa	Treefern	Western fragment
Impact score	-4.05394	-2.07817	-1.44803	-0.52774
	Total compensation score	Revegetation & pest control	Enhance SNA via ine removal, pest control	
Compensation score	5.82238	3.99525	1.82713	
Net gain outcome	43.6%			

Table 20: BCM inputs/outputs explanation table for SNA 166 and Western Fragment.

Model inputs	Explanation
Biodiversity type	Regenerating Broadleaved Forest (SNA 166 and adjacent Western Fragment)
Technical expert inputs(s)	Chris Wedding, Dylan van Winkel
Benchmark	A benchmark of 5 equates to high value regenerating vegetation with future canopy species such as podocarps and other long-lived broadleaved tree species present beneath a pioneer species-dominant canopy
How many habitat types OR sites are impacted	3 Rewarewa, Treefern, Western Fragment
Number of proposed	2 Revegetation (with pest control), Enhancement via pine management and pest control

Model inputs	Explanation
compensation measures	
Net Gain target	10%
Impact model inputs and descriptions	
Habitat/site impacted	**Rewarewa forest**
Impact contingency risk (uncertainty)	2: Moderate risk/moderate value (calculated impact score is multiplied by 1.05 (+5%)) Rewarewa forest assessed as 'Moderate' ecological value under EcIAG (Roper Lindsay et al. 2018).
Areal extent of impact (ha)	3.6 ha
Value score prior to impact	2.5 Relatively simple structure, low diversity, however threshold lowered for this value as many regenerating systems in landscape strongly modified (Roper-Lindsay et al. 2018)
Value score after impact	0.001 There will be a permanent and complete loss of habitat within the footprint (noting that the formula cannot work with 0).
Habitat/site impacted	**Treefern**
Impact contingency risk (uncertainty)	1: Low risk/low value (calculated impact score is multiplied by 1.0 (0%)) Very simple structure, low diversity (Roper-Lindsay et al. 2018)
Areal extent of impact (ha)	4.6 ha
Value score prior to impact	1.5 Simple structure, low diversity
Value score after impact	0.001 There will be a permanent and complete loss of habitat within the footprint (noting that the formula cannot work with 0).
Habitat/site impacted	**Western fragment**
Impact contingency risk (uncertainty)	1: Low risk/low value (calculated impact score is multiplied by 1.0 (0%))
Areal extent of impact (ha)	1.2 ha

Model inputs	Explanation
Value score prior to impact	2 Despite low value, naturally occurring area with some large, sprawling pohutukawa. Threshold lowered for this value as many regenerating systems in landscape strongly modified (Roper-Lindsay et al. 2018)
Value score after impact	0.001 There will be a permanent and complete loss of habitat within the footprint (noting that the formula cannot work with 0)
Compensation model inputs	
Compensation type 1	**Native revegetation**
Discount rate	+3 % (the default discount score as per Maseyk et al. (2015); Baber et al. (2021a). The discount rate addresses the temporal time lag between the impact occurring and the biodiversity gains being generated by the conservation action(s).
Finite end-point	20 years
Compensation contingency (confidence)	2 High confidence: restoration well establish method and moderate value plantings undertaken through surrounding landscape
Areal extent (ha) of compensation type	17.5 ha
Value score prior to compensation measure (relative to benchmark)	0.001 No existing habitat in planting areas
Value score after compensation measure (relative to benchmark)	2.5
Compensation model inputs	
Compensation type 1	**Enhance SNA via pine removal, pest control**
Discount rate	+3 % (the default discount score as per Maseyk et al. (2015); Baber et al. (2021a). The discount rate addresses the temporal time lag between the impact occurring and the biodiversity gains being generated by the conservation action(s).
Finite end-point	20 years

Model inputs	Explanation
Compensation contingency (confidence)	2 High confidence: method supports natural regeneration with some added diversity (pines suppress) through planting where pines controlled
Areal extent (ha) of compensation type	20 ha
Value score prior to compensation measure (relative to benchmark)	2 Some large areas of low value where pine dominance is strong.
Value score after compensation measure (relative to benchmark)	3

PART D: PLANTING PLAN

5. PLANTING PLAN

5.1 OVERVIEW

This planting plan covers four areas identified within the Residual Effects Assessment required to be enhanced, offset and/ or buffer planted on site (Figure 9~~Figure 9~~~~Figure 8~~ ~~8~~) to mitigate residual effects to flora and fauna, including:

- Terrestrial offset planting;
- Moko skink planting;
- Enhancement locations; and
- Buffer planting.

All replacement planting will be for the purpose of ecological restoration or conservation planting (cf. amenity planting) and only incorporate indigenous plant species found in the WF11 ecosystem type (Singers & Rogers, 2014).

WF11 - Kauri, podocarp, broadleaved forest has a Regional IUCN threat status of "Endangered" (Singers et al. 2017) and is characterised by vegetation that occurs in warm and sub-humid to humid areas with rainfall 1000–2500 mm per annum. It is found predominantly on ridge-crests and hillslopes with acidic leached soils (e.g. usually where kauri occurs) or more fertile (granular) soils such as in gullies (e.g. where broadleaved species occur). The vegetation is comprised of podocarp trees such as rimu, tōtara, thin-barked tōtara, miro and tānekaha. Kahikatea is more common in gullies and on alluvial terraces. Broadleaved tree species are often dominant in gullies, and include taraire, tawa, tōwai, kohekohe (coastal to lowland), pūriri, northern rātā, pukatea (damp lowland areas) and rewarewa. Associated understorey shrubs include karamu, kānuka, mānuka, mingimingi, heketara, five-finger, māpou and māmāngi.

Replacement plants should represent healthy specimens and be ecosourced from the Coromandel Ecological Region (Colville, Tairua, Thames and Waihi Ecological Districts - Waihi ED may be depauperate of numbers and diversity). Ecosourcing maintains local adaptations and natural genetic relationships of plants within local populations. Ecosourced plants are considered to be more likely to tolerate local environmental conditions and to survive following planting.

Section 5.3 lists the recommended plant species, plant numbers, spacing and minimum plant sizes for each of the planting areas. The species list may be adapted if an alternative species or size of plant would achieve monitoring targets, or if there are biosecurity risks associated with a species on the list. The project ecologist will be consulted prior to any changes being made.

- Plants should be a minimum size 1L or PB2. Plants of a smaller size may be used if they can be expected to meet monitoring targets in the required timeframes. The project ecologist will be consulted prior to plants smaller than 1L or PB2 being used.
- Plants must be sourced from a New Zealand Plant Producers Incorporated (NZPPI)-accredited nursery, or a local nursery with appropriate biosecurity measures in place .

Commented [MD5]: Updated to reflect planting plan.

Figure ~~9~~98: Site-wide offset locations of terrestrial offset planting and enhancement actions

5.2 PLANTING METHOD

A multi-staged approach will be adopted to achieve successful restoration of a more diverse range of flora consistent with ecosystem WF11 (Singers & Rogers, 2014).

5.2.1 Multi-staged Planting

Stage 1 - Spring/summer: prior to the winter restoration planting, site preparation will involve removal of any major weeds.

Stage 2 – Autumn/winter: Weed removal will be undertaken and pioneer species planted.

Stage 3 – Autumn/winter; after three years: Once the pioneer plantings have reached a sufficient size to shelter enrichment species (approximately 3 years with fast growing pioneer species), under-planting of canopy and enrichment species will commence. Releasing or removal of pioneer plantings may be required to make room for the new plantings.

5.2.2 Site Preparation

The site should be prepared for planting by removing weeds, including areas of pine, which will need to be mechanically removed, felled and left to rot, or poisoned and left in situ to make way for infill plants.

Planting will be undertaken over autumn and winter, so that the root systems have sufficient time to establish before the drier summer months (Table 21).

Table 21: Weed control and planting timeframes.

	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Initial weeding												
Planting												

5.2.3 Pioneer Planting Schedule

Pioneer planting provides for fast growing trees and shrubs that provide natural protection for later successional canopy vegetation that may otherwise have difficulty thriving in exposed environments. Pioneer plants establish quickly and create a canopy cover that will reduce exposure and shade out weeds.

This plan provides for 18 species of trees and shrubs that will provide year-round foraging, roosting and nesting habitat for nectarivore, frugivore and insectivore birds. Note some of

these species are also large and / or long-lived and will also form part of the canopy of a future forest (e.g. tōtara, rewarewa).

5.2.4 Future Canopy and Enrichment Planting Schedule

Five years after pioneer planting, future canopy and other enrichment species will be planted. Canopy/climax trees are late successional species, are typically larger, longer lived and slower growing. Therefore, the canopy diversity is expected to comprise all pioneer species for at least 30-40 years.

The planting locations (Figure 98) are generally low lying or gently sloping, and so the future canopy species are suited to this topography.

Nineteen enrichment species (mostly future canopy trees) are provided in Table 24~~Table 24~~~~Table 24~~. It may be necessary to first release or remove some pioneer species to create space for enrichment trees.

5.2.5 SNA 166 Enhancement Schedule

SNA 166 will be enhanced with a schedule of 14 species that will be planted into gaps where pine trees are removed (spacing minimum 5 m). Species recorded from SNA 166 plots have been excluded from the list so as to provide increased diversity at both understorey and future canopy tiers.

5.2.6 Buffer Planting Schedule

The Project edge at the abutment of TSF3 and SNA166~~.~~ is expected to be subject to new or increased edge effects, including weed incursion, light, wind exposure and desiccation effects. These edge effects would be minimised through establishing a minimum 10 m wide buffer of plantings of fast-growing native shrub species. Buffer planting provides protection for habitat edges by shading out weedy species, providing shelter from excessive light and wind and reducing the threat of desiccation. In order for the planting to provide an adequate buffer to minimise adverse effects, it will be no less than 10 m (approximately 11 plants deep at 1 m spacing), infill planted into newly created edge where there is existing open space on the forest floor would be appropriate to reduce edge effects on surrounding regenerating vegetation. All planting will only incorporate indigenous plant species found in the *WF11* ecosystem type (Singers & Rogers, 2014).

WF11 - Kauri, podocarp, broadleaved forest has a Regional International Union for Conservation of Nature (IUCN) threat status of "*Endangered*" (Singers et al. 2017) and is characterised by vegetation that occurs in warm and sub-humid to humid areas with rainfall 1000–2500 mm per annum. It is found predominantly on ridge-crests and hillslopes with acidic leached soils (e.g. usually where kauri occurs) or more fertile (granular) soils such as

in gullies (e.g. where broadleaved species occur). The vegetation is comprised of podocarp trees such as rimu, tōtara, thin-barked tōtara, miro and tānekaha. Kahikatea is more common in gullies and on alluvial terraces. Broadleaved tree species are often dominant in gullies, and include taraire, tawa, tōwai, kohekohe (coastal to lowland), pūriri, northern rātā, pukatea (damp lowland areas) and rewarewa. Associated understorey shrubs include karamu, kānuka, mānuka, mingimingi, heketara, five-finger, māpou and māmāngi.

Table 26~~Table 26~~~~Table 26~~ lists the recommended plant species, plant numbers, spacing and minimum plant sizes for the buffer planting area along the southern boundary of the southern fragment of SNA 166, with the new interface with TSF1A and TSF3.

5.2.7 Moko Skink Habitat Enhancement Planting Schedule

A selection of low growing shrubs and vineland will be planted to enhance and expand an area of known habitat for Nationally 'At Risk' moko skinks (*Oligosoma moco*). In addition, habitat shall be enhanced through the relocations of rocky substrate from the 'Western pōhutukawa fragment', which is scheduled to be removed as part of the TSF3 works. This will provide additional environmental complexity which, along with planting, will provide enhanced habitat. Moko skinks are an open grassland, vineland habitat specialist (typically occurring near coastal edges), and the provision of targeted enhancement will improve the biodiversity outcomes for the overall management, mitigation and offset package (offset trade-up, DOC 2014). Within the Waihi area, moko skink are a unique biodiversity component, given that their presence is rare on the mainland (excluding islands) and those at Waihi represent one of the farthest inland records for the species. The proposed enhancement habitat planting (1.7 ha) will aim to extend their current habitat, and provide or improve connectivity between currently disconnected components of their distribution around the WNP area.

The moko skink enhancement area is 4.04 ha and includes:

- 1.7 ha new planting
- 2.34 ha of enhancing existing habitat (pine tree management)
- Relocation of rocky substrate from the 'Western pōhutukawa fragment' into the new planting area

5.2.8 Planting Procedure

- Planting will be undertaken from May through to August inclusive.
- All plants will be set out on site according to the plant schedules.
- Planting holes should be at least 1.5 – 2 times larger than the plant root ball.

- Remove the plant carefully from the bag. If the plant is root bound, gently untangle roots and position in hole.
- Gently press soil around roots to bury in.
- Slow release fertiliser tabs are recommended to assist initial establishment of plants.
- If required, ~~A~~apply localised mulch and/or biodegradable weed mat squares to the base of the plant to reduce the risk of weeds overtaking the plant and to increase moisture retention in the soil. Note, blanket mulch or large areas of weed mat MUST NOT be used within lizard habitat areas.

5.2.9 Planting Strategy

To achieve a natural forest structure over time, indigenous species that align with those found in the local ecosystem have been selected and applied to the planting schedules with appropriate ratios and spacing.

This Plan follows the spacing recommendations from Waikato Regional Council, with spacing of 1.5 m between pioneer plants / small trees to achieve rapid canopy closure, and 5 m spacing between enrichment and future canopy species.

Species compositions should be set out by an experienced practitioner to ensure:

- Podocarps are generally planted on higher slopes.
- Broadleaved enrichment species are generally planted on lower or flatter topography in suitable habitat.
- Species susceptible to wind and frost damage are planted in suitable habitats with less exposure.

5.2.10 Planting Timeframes

Planting timeframes are provided in Table 22 below to ensure that plantings associated with offset and SNA edge buffer are prioritised following removal of SNA vegetation, and that replacement plantings are undertaken in such order so that the duration of the loss of planted areas is consistent with a 'temporary' effect (i.e. plantings are less than 25 years old at replacement, Roper-Lyndsay et al. 2018).

Table 22: Timeframes for restoration planting to deliver mitigation, replacement and offset planting activities.

Affected Area	Area to plant (ha)	Planting type	Timing
Lizard / moko skink habitat Enhancement	2.34	Pine tree management (remove or top, poison & delimb)	Prior to any vegetation removal at GOP, NRS, TSF3.
Lizard / moko skink habitat planting	1.7	Offset planting	Lizard habitat planting to be undertaken in first planting season following SNA vegetation removal at TSF3
Copper skink compensation at GOP	11.2	Habitat compensation planting	Prior to any vegetation removal at GOP
TSF3: SNA Offset planting	16.2	Offset	Pioneer planting complete by end of first planting season following SNA vegetation removal at TSF3
TSF3: SNA Enhancement (pine management & planting)	20	(Pine tree management (remove or top, poison & delimb) and replacement plant	Enrichment planting complete by end of first planting season following vegetation removal at Western Fragment, TSF3
TSF3: Buffer (SNA 166)	1	Buffer (5 m wide)	Planting complete by end of first planting season following SNA vegetation removal at TSF3
TSF3: Replacement	0.6	Replacement	As removed: pioneer planting complete over planting season following removal
NRS: Replacement	9.1	Replacement	As removed: pioneer planting complete over planting season following removal
GOP: Replacement	6.5	Replacement	As removed: pioneer planting complete over planting season following removal

5.3 PLANT SCHEDULES

Table 23: Pioneer planting schedule for 18 revegetation and replacement species. Flowering and fruiting times are indicated on the right (Yellow = flowers; orange = fruits and flowers; pink = fruits).

Species	Common Name	Spacing (m)	Abundance (%)	Size	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Alectryon excelsus	Tītoki	5	5	PB2												
Aristotelia serrata	Makomako	1.5	5	PB2												
Brachyglottis repanda	Rangiora	1.5	5	PB2												
Coprosma robusta	Karamū	1.5	5	PB2												
Dacrycarpus dacrydioides	Kahikatea	5	7	PB2												
Entelea arborescens	Whau	1.5	5	PB2												
Hoheria populnea	Houhere	1.5	5	PB2												
Knightia excelsa	Rewarewa	1.5	5	PB2												
Kunzea robusta	Kānuka	1.5	12	PB2												
Leptospermum scoparium	Mānuka	1.5	7	PB2												
Melicytus ramiflorus	Māhoe	1.5	5	PB2												
Myrsine australis	Māpou	1.5	4	PB2												
Pennantia corymbosa	Kaikōmako	1.5	5	PB2												
Plagianthus regius	Mānātu	1.5	5	PB2												
Podocarpus totara	Tōtara	5	4	PB2												
Pseudopanax arboreus	Whauwhaupaku	1.5	5	PB2												
Sophora fulvida	Kōwhai	1.5	7	PB2												
Veronica stricta	Koromiko / hebe	1.5	4	PB2												

Table 24: Enrichment planting schedule for offset restoration. List of 19 species. Flowering and fruiting times are indicated on the right (Yellow = flowers; orange = fruits and flowers; pink = fruits).

Species	Common Name	Spacing (m)	Abundance (%)	Size	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Beilschmiedia tarairi	Taraire	5	5	PB2												
Carpodetus serratus	Putaputawētā	1.5	8	PB2												
Coprosma arborea	Māmāngi	1.5	4	PB2												
Coprosma rhamnoides	Twiggy coprosma	1.5	3	PB2												
Corynocarpus laevigatus	Karaka	5	5	PB2												
Dacrydium cupressinum	Rimu	5	5	PB2												
Didymocheton spectabilis	Kohekohe	5	8	PB2												
Geniostoma ligustrifolium	Hangehange	1.5	3	PB2												
Hedycarya arborea	Porokaiwhiri	5	5	PB2												
Ixerba brexioides	Tāwari	2	5	PB2												
Laurelia novae-zelandiae	Pukatea	5	6	PB2												
Metrosideros robusta	Northern rātā	5	5	PB2												
Phyllocladus trichomanoides	Tānekaha	5	5	PB2												
Piper excelsum	Kawakawa	1.5	7	PB2												
Prumnopitys ferruginea	Miro	5	5	PB2												
Rhopalostylis sapida	Nīkau	2	8	PB2												
Schefflera digitata	Patē	3	5	PB2												
Vitex lucens	Pūriri	5	10	PB2												
Pterophylla sylvicola	Tōwai	3	8	PB2												

Table 25: Planting schedule for SNA enrichment species. Flowering and fruiting times are indicated on the right (Yellow = flowers; orange = fruits and flowers; pink = fruits).

Species	Common Name	Spacing (m)	Abundance (%)	Size	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Agathis australis	Kauri	5	20	PB5												
Alectryon excelsus	Titoki	5	7	PB5												
Beilschmiedia tawa	Tawa	5	8	PB5												
Corynocarpus laevigatus	Karaka	5	5	PB5												
Dacrydium cupressinum	Rimu	5	8	PB5												
Didymocheton spectabilis	Kohekohe	5	7	PB5												
Hedycarya arborea	Porokaiwhiri	1.5	8	PB5												
Kunzea robusta	Kānuka	1.5	2	PB5												
Metrosideros robusta	Northern rātā	5	5	PB5												
Pectinopytis ferruginea	Miro	5	5	PB5												
Phyllocladus trichomanoides	Tanekaha	1.5	10	PB5												
Podocarpus totara	Tōtara	5	5	PB5												
Prumnopitys taxifolia	Matai	5	5	PB5												
Vitex lucens	Pūriri	5	5	PB5												

Note: Understorey planting in the enhancement area may be able to be reduced depending on the abundance of native planting remaining once pines and other weed species have been cleared/managed/felled. Should significant native vegetation remain, the project ecologist should be consulted prior to making any changes to the planting schedule. Canopy planting should occur as scheduled.

Table 26: Planting schedule for buffered area around edge of TSF3. Flowering and fruiting times are indicated on the right (Yellow = flowers; orange = fruits and flowers; pink = fruits).

Species	Common Name	Spacing (m)	Abundance (%)	Size	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Piper excelsum	Kawakawa	1.5	20	PB2												
Corokia cotoneaster	Korokio	1.5	10	PB2												
Coprosma autumnalis	Kanono	1.5	10	PB2												
Leptospermum scopariam	Mānuka	1.5	20	PB2												
Leucopogon fasciculatus	Mingimingi	1.5	15	PB2												
Phormium cookianum hookeri	Whararikī	1.5	15	PB2												
Veronica stricta	Hebe	1.5	10	PB2												

Table 27: Planting schedule for lizard enhancement and offset areas. Flowering and fruiting times are indicated on the right (Yellow = flowers; orange = fruits and flowers; pink = fruits).

Species	Common Name	Spacing (m)	Abundance (%)	Size	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Phormium tenax	Harakeke	1.4	10	PB2												
Muehlenbeckia complexa	Pōhuehue	1.4	50	PB2												
Austroderia toetoe	Toetoe	1.4	10	PB2												
Leucopogon fasciculatus	Tall Mingimingi	1.4	10	PB2												
Metrosideros excelsa	Pōhutukawa	20	5	PB25												
Cordyline australis	Ti kōuka	1.4	10	PB2												
Coprosma propinqua	Mingimingi	2	5	PB2												

5.4 PLANT MAINTENANCE

Plants will be maintained annually from pioneer planting for at least five years following completion of enrichment planting.

If the survival rate has not met a minimum of 90% of the original density and species, with an 80% canopy closure by the fifth year, then maintenance shall continue until these conditions have been met.

Plant maintenance will include regular releasing of plants from weeds and replacement of plants that do not survive.

Ongoing maintenance is important to ensure plant survivorship, and native plant dominance and density. Plants will need to be released from weeds, and any that have died need to be replaced.

The ideal maintenance frequency decreases over time, over a five-year period (Table 28).

Table 28: Maintenance schedule for all plantings

Year	1	2	3	4	5
Number of maintenance visits	4	2	1	1	1

5.5 KEY PERFORMANCE INDICATORS

For the Planting Plan, the key performance indicators comprise:

- From the commencement of pioneer planting to the completion of enrichment planting, and for at least five years following, monitoring and maintenance will occur in accordance with the schedule provided in Table 28 to ensure a minimum survival rate of 90% of the original density and species of plantings, with an 80% canopy closure by the fifth year;
- If the monitoring and maintenance demonstrates that the survival rate is less than 90% of the original density and species of plantings, and / or with less than 80% canopy closure by the fifth year, maintenance will continue until such time that these requirements are met;
- Restoration planting is to occur in accordance with the timeframes provided in Table 22, and in accordance with the Plant Schedules provided as Table 23 (Pioneer Planting),

Commented [MD6]: Linked in to more clearly identify how it will be determined if management measures are functioning as they are intended to.

Table 24 (Enrichment Planting), Table 25 (SNA Enrichment Species), Table 26 (Buffered Area around TSF3), Table 27 (Lizard Enhancement and Offset Areas).

PART E: PLANT PATHOGEN AND WEED MANAGEMENT PLAN

6. MANAGEMENT OF PLANT PATHOGENS AND WEEDS

6.1 KAURI DIEBACK PROTOCOLS

6.1.1 Overview

Kauri Dieback is a soil-borne disease caused by the fungus-like organism *Phytophthora agathidicida* (**"PA"**) which has led to the rapid spread and dieback of kauri trees throughout their range. There is no known cure for this disease and kauri trees have subsequently been classified as 'Threatened- Nationally Vulnerable' (de Lange et al. 2018).

- PA can be spread by movement of contaminated soil, plant (roots, trunk, bark) materials and associated by-products such as sawdust.
- Contaminated material may be as small as a pinhead.
- The complete host range for PA is not known and it is possible that other plant species may host the pathogen.

Infection of a kauri tree with PA causes damage to the vascular tissues and prevents the tree from accessing the water and nutrients that it requires. Infected trees may display the following symptoms of stress:

- Bleeding gum and lesions on trunk
- Leaf yellowing and loss
- Branch loss (as opposed to naturally loss of lower bracnches)
- Canopy thinning

6.2 PURPOSE OF KAURI PROTOCOLS

The purpose of this Plan is to prevent and minimise any Project-mediated transmission of PA. It provides measures to prevent transmission of PA during the life of the Project.

PA is an unwanted organism under the Biosecurity Act 1993. In accordance with section 52 of that act, no person shall knowingly communicate, cause to be communicated, release, cause to be released, or otherwise spread the organism.

6.2.1 Kauri presence within the Waihi North Project

Kauri trees occur occasionally throughout the WNP area, where they mainly form components of selected planting mixtures. Some relict trees occur in the surrounding landscape and a small stand occurs on a northern projection of the southern fragment of SNA 166. There is one naturally occurring kauri tree within the proposed footprint of TSF3 and no kauri trees within the WNP area are known to exhibit any PA symptoms.

Overall, the risk of presence of PA within the WNP area is low, and the risk of spread beyond it is low. However, precautionary testing should be undertaken. If testing confirms PA presence, the area will be designated a PA Management Area and kauri hygiene protocols will be followed.

6.2.2 Identification of PA Infection

PA is currently not known within the WNP area. However, the following precautionary actions will be undertaken at TSF3 and all planted areas that support kauri trees:

At native plantings that support kauri trees:

Prior to any works occurring, a minimum of four soil samples (1-1.5kg) shall be collected from the base of the kauri tree, at 100 cm distance from around the base of the tree.

- At GOP: Choose 1 tree (if present)
- At NRS: Choose three trees.
- At TSF3: Choose one tree.

Plant and Food Research, Landcare Research and Scion are all able to undertake analysis of soil samples.

Soil Sample Collection method (4 samples per tree):

Remove leaves and other plant material that has not broken down from a small area of ground. Using a trowel or planting spade (cleaned between site samples) take a volume of soil (about 1-2 cups) from each of four points around the base of the selected tree, approximately 10 – 100 cm from the base and another four further out towards the drip line of the crown. Penetrate to about 100 mm deep. Put all 8 soil samples into one zip lock bag. The total amount should be 1-1.5 kg. Clearly label the bag with location / plot number / sample number. A duplicate second label, written on waterproof paper is to be inserted into the bag (in case ink runs off bag in transit).

Important: ALWAYS Clean trowel before sampling another tree: ensure all soild is removed and spray with 2% SteriGENE solution.

Bags of soil will be placed into a chilly bin and all soil samples stored in a refrigerator until dispatch to the assigned laboratory.

If samples return positive results, the measures outlined in the following sections will be implemented to manage the symptoms and prevent spread.

6.2.3 Kauri Hygiene Protocols for contaminated Zones (PA Management Areas)

The ~~following~~ protocols set out in Sections 6.2.4 – 6.2.7 must be complied with during all vegetation removal and earthworks within PA-contaminated areas **where PA is detected from testing** (PA Management Areas, being contaminated vegetation and associated surface soils at GOP, NRS or TSF3).

6.2.4 Planning Considerations

The PA Management Area shall be clearly demarcated on the ground by the Project Manager with the Project arborist or ecologist. Demarcation shall provide signage alerting all visitors and workers that the area is a PA Management area.

Signage instructing all visitors and workers entering the Management Area to sanitise footwear and equipment that has or may come into contact with soil or vegetation should be visible at all times.

A kauri dieback phytosanitary kit, consisting of a solution of 2% SteriGENE in clean water, a scrub brush and a kauri dieback hygiene procedure information sheet shall be held at the Management Area, periodically maintained and clearly visible to all personnel who enter the site. This kit must be used anytime persons enter and exit the Management area.

A metal parking area shall be provided at the Management Area to prevent vehicles tracking on soil.

Vehicle wash-down zones (wheels, truck/trailer) shall be provided at all access ways into the Management Area.

Vehicle wash-down zones shall be provided and positioned on a concrete or gravel area with good drainage to a sediment retention pond. After mud, soil, and vegetation has been removed by brush and/or rod, the vehicle should be sterilised with a 2% SteriGENE solution.

The vehicle should be as clean as possible before the SteriGENE is applied to allow thorough decontamination.

After the vehicle is cleaned, allow to dry for 1 – 10 minutes, and wash and sterilise tools (brushes and rods) used for vehicle cleaning.

For smaller vehicles, it is sufficient to dry brush off all visible mud, and then take the vehicle through a commercial car wash.

Always undertake a final visual inspection of the vehicles and machinery to ensure there is no remaining soil, mud, or plant material before the vehicle is moved.

6.2.5 Vehicles and Heavy Equipment

All vehicles (where possible) and heavy machinery should remain on-site for the duration of all vegetation removal, and earthworks to 2 m deep beneath surface vegetation at the site.

All light vehicles shall remain on metal tracks (not track on to farmland). Operators are responsible for ensuring machinery and vehicles are free of mud and soil on tyres, mud flaps, body, and underbody when entering an area containing kauri and when moving from one area of kauri to another. Interior mats can also be a point of transfer and should be cleaned regularly.

6.2.6 Footwear and Equipment

Upon entering and exiting the Management Area, each person must scrub the soles of their footwear with a dry brush to loosen and remove soil, and then spray with a 2% solution of SteriGENE. In addition, footwear should be re-brushed and sprayed when moving between areas of kauri, within the site.

All equipment that may come into contact with plant material or soil must be sanitised upon entry to and exit from the site using the brush and SteriGENE spray method. Equipment should be allowed to dry for at least 2 minutes, but preferably until completely dry, before transportation.

To assist with this, all on-site vehicles in the Management Area must hold a personal phytosanitary kit, including a 500 ml spray bottle of 2% SteriGENE solution and a scrubbing brush in a sealed plastic bag. At all site entries / sign in points, a scrubbing bush, 4 L jerry can of 2% SteriGENE solution and a 1 L spray bottle of the SteriGENE solution shall be kept and maintained in a suitable container.

6.2.7 Disposal of Contaminated Organic Material

Where PA is identified from soil tests, felled kauri trees and soil within 3 x canopy drip line must be disposed of at a facility approved by the National Kauri Dieback Programme. Currently, the closest facility approved for receiving PA-infected organic material is the Tirohia landfill in Paeroa, operated by Waste Management (6332 State Highway 26).

There may also be opportunities for contaminated soil material to also be disposed of within the tailings facility prior to the last tailings deposition. This will ensure that any such soil will become buried under subsequent tailings.

Soil for disposal shall be dampened with water and covered prior to transportation at all times.

Soil or organic material from this location must not be transported beyond the PA Management Area unless it is taken to an approved KDP landfill for disposal (see the guidelines for Landfill disposal guidelines below).

All soil and vegetation lifted from the Management Area must be loaded into a tip-truck / tip-trailer fitted with a sealed liner that is robust enough to contain the material without leaking during loading and transporting.

Waste Management should be provided with at least 24 hours' notice to accept site waste, which can be done by calling 0800 113 340. Vehicles used for transporting organic matter need to be securely covered as to prevent the release of potentially infected material en route. The vehicle should be thoroughly sanitised as per the methods outlined above.

6.3 MYRTLE RUST PROTOCOLS

6.3.1 Overview

Myrtle rust is a serious fungal disease of plants in the myrtle (Myrtaceae) family and is caused by the fungus Austropuccinia psidii. It affects several native plants including ramarama, pōhutukawa, rātā, kānuka and mānuka, as well as several exotic species. Myrtle rust is known to be present throughout most of the North Island (including Waihi), and across the top and on the west coast of the South Island (Beresford et al., 2019). In May 2018, the Ministry for Primary Industry's (MPI) response was closed, and the focus moved to science to find ways to manage the disease in the longer term.

Myrtle rust can be identified by the following symptoms (myrtlerust.org.nz):

- Bright yellow powdery eruptions appearing on the leaf
- Brown/grey rust pustules on older lesions
- Grey 'fuzzy spore growth on underside of leaf
- Some leaves may become buckled or twisted and will die off.

Figure ~~10109~~: **Myrtle rust on ramarama (left), rata (right). Images courtesy of myrtlerust.org.nz**

6.3.2 Purpose of Myrtle protocols

Myrtle Rust is now widespread and is wind-borne. Therefore, its transmission into the WNP area cannot be prevented (if it is not already present). However, Project-mediated transmission can be minimised through recommendations provided in this Plan.

Currently, if Myrtle Rust is found, the MPI website recommends:

> Don't touch it.

> Take a clear in-focus photograph.

> Submit the photograph to iNaturalist.

The following recommendations will ensure the appropriate management of myrtle rust risk within the WNP area.

6.3.3 Myrtle rust risk management during Plant Maintenance and Offset Monitoring

If personnel believe they have seen the symptoms of myrtle rust, refer MPI recommendations above and notify the relevant plant nursery (if the infected plants are less than 5 years old).

If personnel wish to remove infected myrtle plant material:

- Bury infected material onsite (at 50 cm depth), or
- Take the Myrtle rust infected material to a landfill or transfer station provided that is it securely enclosed in a sealed bag and disposed of as general waster (**not green waste**).

6.3.4 Myrtle rust risk management during revegetation planting

Prior to replanting, a signed Myrtle Rust Nursery Management Declaration certifying that the plant supplier has implemented the New Zealand Plant Producers Incorporated Myrtle Rust Nursery Management Protocol should be provided to the client and Regional Authority.

6.4 DIDYMO PROTOCOLS

Commented [MD7]: Linked in at request of DOC

6.4.1 Overview

Didymo (Didymosphenia geminata), also known as "rock snot", is an invasive freshwater algae found in New Zealand, primarily in the South Island.

Didymosphenia has large sarcophagus-shaped cells that are mounted on long mucilaginous stalks. Masses of this alga (commonly referred to as "didymo") primarily consisting of the stalks, can smother streambeds, and pile up along stream and river margins. Dried-up wads of this alga look like paper pulp dumped on the stream/river banks as shown in **Error! Reference source not found.**~~Figure 11~~ and **Error! Reference source not found.**~~Figure 12~~.

Figure 11: Didymo on stream rocks. Image courtesy of Landcare Research.

Figure 12: Didymo on rocks in stream bed. Image courtesy of Landcare Research.

6.4.2 Purpose of Didymo Protocols

Didymo is not yet detected in the North Island of New Zealand, therefore following the "Check – Clean -Dry" method outlined by MPI is of high importance (further details on cleaning methods is available on the MPI website) in preventing the spread through north island water ways.

6.4.3 Didymo Risk Management During Surface Activities

All gear and equipment being used in or near waterways should be washed using the "Check - Clean - Dry" method outlined by MPI. If personnel believe they have seen didymo, refer to the MPI recommendations at the website link above. Sightings should be reported to MPI or the local regional council.

~~6.4~~6.5 WEED MANAGEMENT

The control of weed plants will be implemented throughout all revegetation and enhancement areas to promote native forest regeneration.

Weed control will be maintained for a minimum of 5 years during which any competitive weeds will be removed.

~~Weed control to be carried out by a registered weed control contractor.~~

Guidance on the control of priority weeds is provided in Table 29; and an adaptive management approach may be required for additional weed species encountered.

Table 29: Weed plants within the WNP area and recommended control methods. Information adapted from weedbusters.co.nz. Photographs retrieved from NZPCN.org.nz and remain the property of their photographers. For more information regarding weed control methods, see weedbusters.org.nz

Species	Common name	Weed control method	Photograph
Asparagus scandens	Climbing asparagus	Spray lightly spring-early summer, avoid runoff, total coverage not required (200ml glyphosate/10L. Do not add penetrant when spraying against tree trunks). Spray autumn- winter only in frost-free areas on healthy growth, (increase rate to 300ml glyphosate/ 10L).	
Cortaderia selloana	pampas	Remove plants by hand as they appear or sizeable plants by bulldozer/ excavator. Compost or leave on site to rot down. Burn or bury any flower heads. Weed wipe (year-round): glyphosate (200ml/L + penetrant).	
Hedychium gardnerianum	wild ginger	Cut above pink collar at base and paint with glyphosate (250ml/L). Repeat annually or if plants re-sprout. Hand-pulling is suitable for small plants, but the debris should not be composted.	

Species	Common name	Weed control method	Photograph
Ligustrum sinense	Chinese privet	Cut and stump swap with glyphosate (250ml/L)	
Ulex europaeus	gorse	Spray (spring-summer): triclopyr 600 EC (20ml/10L) or triclopyr 300 EC (40ml/10L). Spray (autumn-winter): metsulfuron-methyl 600g/kg (5g/10L+ penetrant - knapsack) or (20g/100L + penetrant - spraygun) or a product containing 100g picloram+300g triclopyr/L (250ml/100L spraygun).	
Lonicera japonica	Japanese honeysuckle	Vial method for ground infestations. Pull up all stems possible and dispose. Treat and move vials monthly until plant eradicated. Treat remainder by placing cut vine ends in vials 5-10 m apart containing 1 g metsulfuron/ 20 ml. 5 g metsulfuron/ L or 200 ml Tordon Brush Killer/ L or Vigilant Gel. Glyphosate (10 ml/ L) or metsulfuron-methyl 600 g/ kg (5 g/ 10L + penetrant) or clopyralid (50 ml/10 L) or Tordon Brush Killer (60 ml/10 L).	
Pinus radiata	Radiata pine	Removal of pines from within the SNA De-limb and top to no more than 5 m. Remove branches and leave standing poles to break down naturally. Trunk drilling and poisoning (refer methods contained within Marlborough District Council Factsheet 174 “Poisoning wilding radiata pine”) Felled and/or poisoned trees to be left in situ to decompose naturally. Trunks may be drilled or cut to facilitate decomposition.	

6.6 KEY PERFORMANCE INDICATORS

Any sightings or confirmed infections of plant pathogens, weeds, or invasive species will be reported and managed in accordance with best practice standards and requirements. Further details of any measures and methods implemented in relation to the management of plant pathogens and weeds can be provided on request.

Commented [MD8]: Specific performance indicators are not identified in relation to infection matters. As such, they will be managed in accordance with best practice standards and requirements.

PART F: PEST ANIMAL MANAGEMENT PLAN

7. PEST ANIMAL MANAGEMENT

7.1 OVERVIEW

Mammalian pests such as rats, hedgehogs, mustelids, cats and possums are a significant threat to species habitats and native ecosystems. Rodents, mustelids (stoats, ferrets, and weasels), cats and possums' prey upon eggs and young fledglings of native birds and will prey upon native lizards of any life stage. Rodents increase browsing impact by eating seeds on the forest floor, inhibiting the next generation of plants from replacing those lost. Possums are prolific browsers and will selectively browse young saplings or new shoots, preventing the restoration of forests and ultimately threatening the ecosystem integrity.

7.2 METHODS

Pest animal control methods will follow current industry best practice. Pest management will be implemented throughout all mitigation areas until mine closure. Pest control will be implemented by a suitably qualified pest control contractor or suitably qualified OGNZL staff member.

The pest management programme will need to be reviewed annually by the Project ecologist to ensure pest management is achieving targets as expected.

Pest management recommendations ~~are provided in~~

and timings are provided in Table 30. Where necessary, the recommended management actions can be altered and implemented to improve pest management outcomes following approval from the project ecologist. Figure 13Figure 13Figure 10 and Figure 14Figure 14Figure 11 provide indicative locations of pest mammal control devices on-site.

7.3 RECORD KEEPING

Accurate recording of results from the pest control programmes is important for providing information on the status of predator populations on the properties over time. Annual reports, summarising the results of the pest control, should be prepared and made available to the Project ecologist for review. The pest control operator will be responsible for collecting data on trap catches / kill counters, the location of trapping/ bait devices, and preparation of summary reports.

Appendix 4A provides a standard template for bait take and trap catch records. At a minimum, the following set of information should be collected:

- Location of the traps
- Number of kills
- Number of traps nights
- Lure/bait (e.g. apple) used

Baiting records:

Placement of bait stations:

- Bait type
- Timing of placement
- Quantity used during each re-baiting
- Quantity of bait take each check (i.e. percentage bait-take)

7.4 TRACKING TUNNEL MONITORING

Tracking tunnels are an effective tool for detecting rodents, hedgehogs and mustelids, including at low densities. They are relatively inexpensive and may also detect trap-shy individuals, that may not otherwise be recorded from residual trap catch monitoring.

Tracking tunnels will be spaced through all pest control areas at 100 m intervals.

Newly inked cards will be set inside tunnels over a three day / night period at the end of each trapping / baiting pulse.

7.5 HEALTH AND SAFETY

When using toxin-based baits, always follow the manufacturers' instructions, and ensure the baits are stored in a dry safe area locked away from pets and children. If bait is consumed by a person, call the poison hotline (0800 764 766) immediately. If a pet consumes brodifacoum, take them to a vet immediately to receive Vitamin K1, an effective antidote to the anticoagulant.

DOCs standard operating procedures[1] should be followed when servicing the trap and bait network to reduce the risk of injury or harm to personnel.

Warning signs[2] must be installed at the locations of bait stations for the specific toxin, prior to the bait application.

7.6 KEY PERFORMANCE INDICATORS

Pest animal management will be implemented in accordance with best practice standards and requirements and reviewed annually by the Project ecologist to ensure pest management is achieving anticipated targets. Further details of any measures and methods implemented can be provided on request.

Commented [MD9]: Specific performance indicators are not identified in relation to pest animal management. As such, they will be managed in accordance with best practice standards and requirements.

[1] https://www.doc.govt.nz/globalassets/documents/conservation/threats-and-impacts/pest-control/sops/operational-planning/operational-planning-sop.pdf

[2] https://www.doc.govt.nz/about-us/our-policies-and-plans/our-procedures-and-sops/managing-animal-pests/warning-sign-templates/

Table 30:Pest management and monitoring regime for Waihi North Project (Waihi Area).

			Month and week																																														
			Jan				Feb				Mar				Apr				May				Jun				Jul				Aug				Sep				Oct				Nov				Dec			
Tool	Target species	Action	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Bait stations (Double tap)	Rodents Possums	Fill / refresh all baits																																														
		Remove all baits																																														
Humane kill traps (DOC 200 / Rewild-F-bomb / Timms / AT220)	Possums Hedghogs mustelids feral cats	Daily checks (Deactivate at end of each week)																																														
Tracking tunnels	Possums Hedghogs mustelids	Place fresh card and collect after three days																																														

Table 31: Pest management summary for the WNP

Target Pests	Management Action	Frequency / density
Rodents and possums	Bait stations baited with Double Tap Pellets (may rotate with other toxin to assist effectiveness)	Bait pulse four times per year (Jan-Feb, Apr, Aug-Sep, Nov). Stations placed no more than 50m apart.
Possums **Hedgehogs** **Mustelids (weasel / stoat/ferret)** **Feral cats**	Humane kill traps	Pulse four times per year (Jan-Feb, Apr, Aug-Sep, Nov). Set all traps on day 1 week 1 of pulse, check daily over week 1 then deactivate. Set all traps on day 1 week 3 of pulse, check daily over week 3 then deactivate. For two-month pulses (Jan-Feb, Aug-Sep): repeat weeks 1 and 3 of that month. Deactivate trap at end of week. Traps placed no more than 100 m apart (i.e. one trap per hectare) and placed along linear landscape features (e.g. inside bush edges, along watercourses).
Feral Cats	Humane kill traps or live capture recommended by DOC[3], baited with fresh meat (e.g. rabbit)	Traps spacing should be 100-200m apart. Live capture traps need to be inspected within 12 hours of sunrise. Live capture traps allow domestic cats to be returned to the owner, feral cats to be humanely killed. Replace meat fortnightly from Oct – Apr, and monthly from May – Sep for the kill traps.
Monitoring	Tracking tunnels	Tunnels set at 100m spacing Activated with cards at end of each month of pulse. Cards collected after three days / nights

[3] https://www.doc.govt.nz/nature/pests-and-threats/predator-free-2050/community-trapping/trapping-and-toxins/animal-welfare-and-trapping/

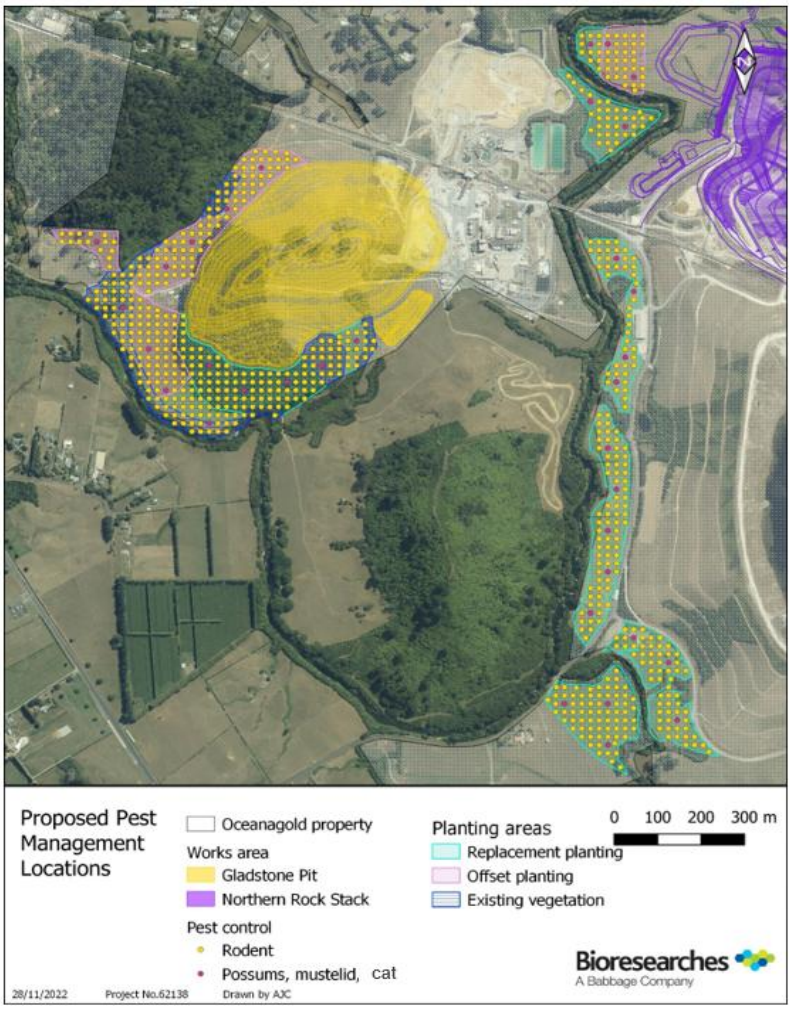

Figure ~~13131410~~: Indicative pest control locations for replacement and offset plantings

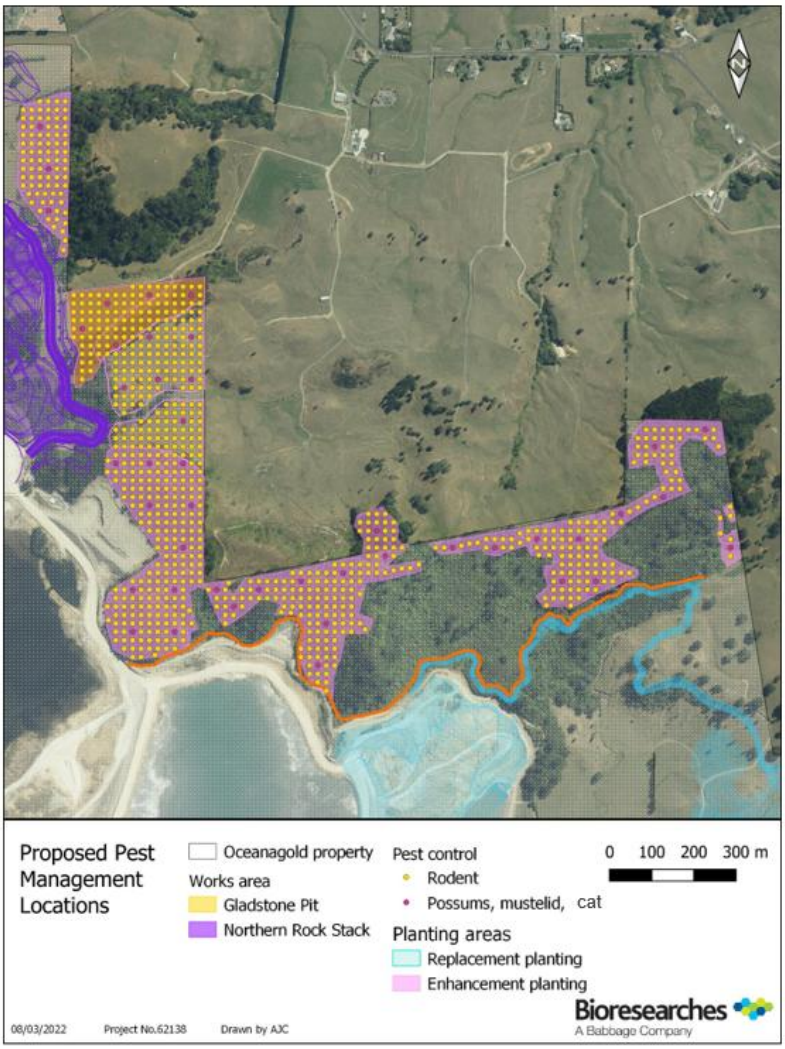

Figure ~~1414~~1511: Indicative pest control locations for offset planting

PART G: LIZARD MANAGEMENT PLAN

8. LIZARD MANAGEMENT PLAN

8.1 CONTEXT

Herpetofauna (reptiles and amphibians) comprise a significant component of New Zealand's terrestrial fauna, and the majority of the herpetofauna (~124 taxa) are represented by lizards (Hitchmough et al. 2021). All indigenous lizards are legally protected under the Wildlife Act 1953, and its subsequent amendments, and vegetation and landscape features that provide significant habitat for indigenous lizards are protected by the Resource Management Act ("**RMA**") 1991.

8.2 OBJECTIVES OF THE LIZARD MANAGEMENT PLAN

The objectives of this Lizard Management Plan ("**LMP**") are to minimise potential adverse effects on native lizards within the proposed footprints (GOP, NRS, TSF3) by way of capturing and relocating any indigenous lizards prior to and during vegetation removal, and providing habitat enhancement and pest control, where appropriate. Further, this LMP aims to achieve the following:

> The population of each species of native lizard present on the site at which vegetation clearance is to occur shall be maintained or enhanced, either on the same site of at an appropriate alternative site; and

> The habitat(s) that lizards are transferred to (either on site or at an alternative site) will support viable populations for all species present.

These objectives will be achieved by:

(a) Using current best practice to capture native lizards from vegetation in the footprint prior to and during vegetation clearance and relocate any captured individuals to safe and suitable habitats (avoid and minimise mortality of wildlife protected by the Wildlife Act);

(b) Applying recognised surveying and monitoring protocols that are to be followed, using the Department of Conservation's (DOC) Natural Heritage Management System's Herpetofauna Inventory & Monitoring Toolbox and / or using new advances in tools and techniques not yet incorporated into the toolbox;

(c) Meeting requirements of the Wildlife Act (WA 1953) and RMA

This LMP addresses the following:

> A summary of the affected habitat and species covered by the plan;

> Capture and relocation procedures;

> A summary of the proposed release (and enhancement) sites; and

> Post works management and monitoring (where required).

This LMP must be actioned under a valid Department of Conservation Wildlife Act Authority ('permit').

8.3 SUMMARY OF THE AFFECTED AREA AND EXISTING LIZARD POPULATIONS

8.3.1 Desktop Assessment

A review of the DOC Amphibian and Reptile Distribution Scheme (ARDS) database (*accessed December 2024*) for historic records of herpetofauna in the Waihi Ecological District revealed that five species of indigenous lizards have been reported within 10 km of the WNP area. These include copper skink (*Oligosoma aeneum*), shore skink (*Oligosoma smithi*), moko skin (*Oligosoma moco),* forest gecko (*Mokopirirakau granulatus*) and elegant gecko (*Naultinus elegans*). The closest records to the WNP area were represented by two copper skinks (occurring ≤ 650 m north of Martha Pit) and two elegant geckos (occurring ≤ 3 km away) although, it should be noted that the elegant gecko records represent individuals sighted in the mid-1960s.

Shore skinks are restricted to coastal environments (e.g. beaches and sand dune systems) and are not considered to be present within the WNP area.

8.3.2 Previous Survey Effort

The lizard fauna of the WNP area was identified through several independent surveys carried out between the months of December and May, during 2011-2012, 2017- 2020 and 2022. The surveys resulted in the detection of two indigenous lizard species, copper skink (*Oligosoma aeneum*) and moko skink (*Oligosoma moco*) (Bioresearches, 2025a~~, **Error! Reference source not found.**~~).

Copper skinks were recorded from the proposed GOP, (and were recorded in the surrounding landscape at Union Hill, and Favona wetland).

Moko skinks were recorded in dense vegetation at the northern extent of the southern SNA 166 fragment and in boulder jumbles among pasture and rank grass on the northern side of a pine stand, west of the NRS.

8.3.3 Species Covered by Plan

Lizard species managed under this plan (Table 32~~Table 32~~~~Table 32~~) have been identified from desktop analyses, habitat suitability and their ecological range (van Winkel et al, 2018). Rough grasses, native plantings, pine and rocky outcrops and stony areas within the WNP have been identified as either potential or confirmed habitats for protected skinks (copper

skink and moko skink). While survey coverage and effort has been extensive, the presence of other species (including geckos), or occurrence of species at other locations within the WNP footprint, remains possible.

Table 32: Lizard species covered under the WNP Lizard Management Plan: Threat status and potential habitats within the WNP.

Common name	Species name	Threat status	Potential habitat
Copper skink	*Oligosoma aeneum*	At Risk- declining	Rough grass, ground cover, native plantings, pine, rock outcrops
Ornate skink	*Oligosoma ornatum*	At Risk- declining	Rough grass, ground cover, native plantings, pine, rock outcrops
Moko skink	*Oligosoma moco*	At Risk- Relict	Rough grass, ground cover, native plantings, pine, rock outcrops
Forest gecko	*Mokopirirakau granulatus*	At Risk- declining	Naturally occurring native vegetation (foliage and ground cover), pine, rock outcrops
Green gecko	*Naultinus elegans*	At Risk- declining	Naturally occurring native vegetation (foliage)
Pacific gecko	*Dactylocnemis pacificus*	Not Threatened	Scrubland, mature forests, rocky islets, and rock outcrops

Figure 15151612: Moko skink (left); copper skink (right)

Figure 161~~613~~: Lizard survey locations and identified indigenous lizards recorded during the surveys (2012 & 2017, 2018, 2020, 2022

8.3.4 Summary of Potential Adverse Effects on Resident Lizards

Areas that support indigenous lizards will be directly affected by the activities proposed as part of the WNP. Activities such as vegetation removal, blasting, and significant earthworks could result in a range of direct and indirect adverse effects on the local lizard populations. Potential effects include, but are not limited to:

- Direct mortality or injury during vegetation clearance;
- Habitat loss, fragmentation, and isolation through the removal of vegetation and associated refuge structures (e.g. rocks);
- Displacement of lizards that could result in reductions in individual fitness or heightened risk of predation by exotic mammalian predators; and
- Construction related disturbances (e.g. noise, vibrations, or dust effects).

Notwithstanding these effects, the technical assessments supporting the resource consent application demonstrated a Low level of effect on indigenous lizards due to the low magnitude of known habitat removal (at GOP only). The moko skink, while found to be present in habitats contiguous with the NRS and TSF3 footprints, are avoided.

8.3.5 Managing Potential Adverse Effects on Indigenous Lizards

The complete avoidance of potential effects on indigenous lizards and their habitats cannot be achieved due to the current extent of the project design. Therefore, managing the effects will be achieved through mitigation that will involve the implementation of a salvage-relocation operation and release site habitat enhancement and in accordance with a Wildlife Act Authority. In addition, habitat augmentation will be provided for to contribute additional resources for resident indigenous lizards with the objective of maintaining indigenous lizard populations within the wider WNP area.

Notwithstanding the detection of only terrestrial skinks within the WNP area, the salvage methods described in this LMP are best practice and designed to detect and capture both terrestrial and arboreal lizards (e.g. skinks and geckos). That is, the methods are applicable across the range of lizard taxa that may potentially be encountered within the WNP footprint.

8.3.6 Securing Biodiversity Gains

Habitat creation / planting (1.7 ha) and enhancement actions (2.34 ha) for native lizards within the WNP are designed to maximise opportunities to protect and enhance existing moko skink values in perpetuity. Moko skink are a nationally 'At Risk' species that is often sympatric (share same habitats) with copper skinks. However, unlike copper skinks, moko

skinks are now extinct through most of their natural range on the New Zealand mainland, now persisting in potentially fewer than five populations along the north-east of the North Island, excluding offshore islands. Therefore, the localised presence of this species in the surrounding Waihi North landscape offers a significant opportunity to preserve and enhance this biodiversity value. Habitat enhancement measures for this species, and copper skinks, are addressed in a separate Residual Effects Offset Plan.

In addition to gains expected for moko skinks, a minimum 11.2 ha of habitat compensation planting will be undertaken at GOP, where it would be contiguous with existing habitats that will be retained and protected within OGNZL landholdings.

8.4 LIZARD SALVAGE AND RELOCATION

8.4.1 Site Demarcation

Prior to the commencement of the lizard salvage, the extent of the works footprint(s) should be clearly demarcated by contractors (e.g. pegged out, dazzled, taped) to ensure the Project herpetologist understands the full extent of the affected area.

Lizard capture is required at the following sites:

- GOP- all vegetation removal (plantings, pine, rock outcrop.)
- NRS- all vegetation removal (plantings).
- TSF3- all vegetation removal (SNA166, Western Fragment, Eastern Fragment, Southern Planted Fragment).

8.4.2 Lizard Capture

A DOC-authorised herpetologist, and assistant ecologist(s), will carry out a search and salvage operation ~~in~~ from October to April inclusive, during two Phases, including:

Phase 1: A pre-vegetation clearance systematic search and live trapping programme; and

Phase 2: A machine-assisted destructive search (focused areas).

The specific salvage methods for each of the Phases are detailed below.

8.5 PHASE 1: PRE-VEGETATION CLEARANCE LIVE TRAPPING PROGRAMME AND SYSTEMATIC SEARCHES

The following sections provide detail of trap types that will be used prior to vegetation removal at GOP, NRS and TSF3. Refer Table 2 for trapping and search effort per location. Traps will consist of:

> Artificial Retreats (ARs, Figure ~~14~~17), refer Lettink (2012)

> Pitfall Trap (Figure ~~14~~17), refer Hare et al. (2012a)

> Funnel Trap (Figure ~~15~~18), refer Hare et al. (2012b)

Live trapping:

> 60 - 200 baited (banana) traps (funnel or pitfall) and / or Artificial Retreats (ARs) shall be installed through ground cover scrub.

1. All traps shall be embedded in and furnished with vegetation to protect any captured lizards from heat and exposure during confinement.
2. Pitfall traps and ARs shall be installed at least one month prior to a minimum 4-day trapping period.
3. When not in use, all pitfall traps shall be sealed closed (so that no lizards can be captured) or furnished to the upper rim so that lizards may escape.

> All traps shall be checked no more than 24 hourly while active.

1. All native lizards shall be released at the designated release site immediately upon capture.

During trap checks, the Project herpetologist shall hand search all vegetation, logs and debris to capture lizards and to identify important areas that should be targeted for machine searching.

Figure ~~17171814~~: Artificial retreat (L); Pitfall trap with AR cover (R)

Figure 181815: Funnel trap (L); gecko in funnel trap (R)

Active Searches:

Both diurnal (day) and nocturnal (night) searches will be undertaken by a DOC-authorised herpetologist, assisted by other ecologists where required. Refer Table 33 for search effort per location.

1. During the day, searchers will walk the extent of the project footprint systematically lifting debris (e.g. logs, rocks, and organic and inorganic material), searching through vegetation foliage, thickets and rock piles by hand or with the assistance of tools (e.g. rakes), searching the crowns and skirts of tree ferns, and searching beneath flaking tree bark or within tree cavities to reveal lizards.

2. At night, spotlight searching using headtorches and binoculars will be used to target arboreal geckos occupying the trunks, branches, and foliage of trees. In instances where the foliage of tall trees cannot be effectively searched using this technique (e.g. canopy is too high or foliage too dense), the herpetologist will mark (e.g. dazzle paint) the trunk(s) and these trees(s) will be re-inspected during Phase 2 of the salvage operation.

8.6 PHASE 2. VEGETATION CLEARANCE AND MACHINE-ASSISTED SEARCHES

Phase 2 of the lizard salvage operation acts as a contingency, recognising that not every lizard may be detected and captured during the Phase 1 activities.

- Destructive searches will involve searching through potential habitat during vegetation removal, and with the assistance of an excavator fitted with a toothed bucket or rake (Figure 1619).
- Searches would cover all potential habitat within the site and continue until the supervising ecologist is satisfied that the potential habitats are sufficiently removed or degraded that lizards or katipo spiders are unlikely to be present.

- Only taller trees that have been marked for re-inspection during the nocturnal searches, will be felled using a chainsaw under the supervision of the Project herpetologist. Once the tree has been felled, the foliage, bark, and any holes or crevices in the branches/trunks will be inspected for lizards to the satisfaction of the herpetologist.
- At no stage should areas identified by the herpetologist as potential lizard habitat be mulched in situ by lowering a mulch-head directly onto standing vegetation. Mulching standing vegetation is highly destructive and eliminates all opportunities for the herpetologist to recover individuals or for the lizards to vacate the vegetation of their own accord before the vegetation is destroyed.
- Coordination and communication between the herpetologist and vegetation clearance contractors (both managers and labourers) is crucial to ensure injury to lizards, and the herpetologist, is avoided.

Figure 19192016: Machine-assisted searches. Herpetologist supervising the scraping of terrestrial vegetation

8.6.1 Lizard Handling and Temporary Containment

Indigenous lizards will be captured and handled by a DOC-authorised herpetologist only.

All lizards will be placed in a temporary containment box(es), which will be filled with vegetation matter and leaf litter and misted with water. Lizards will only be held temporarily for the period of the active searches or trap inspections (i.e. < 2 hr), after which the lizards will be released at the approved relocation site.

It is not anticipated that any lizard taxa with threat classifications higher than 'At Risk' will be encountered on-site. However, if this were to occur, the individual(s) will be captured and

held temporarily in a containment box while the Department of Conservation (Waikato Office) is notified, and further advice and instruction is given to the herpetologist.

8.6.2 Inadvertent Lizard Injury or Death

The following steps will be implemented if any injured or dead lizards are found during salvage:

- The Project herpetologist will notify DOC at the earliest opportunity within 24 hours after an injured or dead lizard is found;
- Any lizard death of 'Threatened', 'At Risk' species shall be sent to Massey University Wildlife Post-mortem Service for necropsy:
- The body will to be chilled if it can be delivered within 24 hours, frozen if longer than 24 hours to deliver;
- Appropriate measures shall be undertaken to minimise further lizard deaths;
- Injured lizards found during salvage will be taken to a suitably qualified vet as soon as possible for assessment and treatment. Injured lizards will be kept in an appropriate portable enclosure (i.e. a clean, well-ventilated plastic container) under the direction of the Project herpetologist to ensure the animal is handled appropriately until the lizard(s) can be assessed and treated;
- Lizards assessed by the vet or alternative specialist as uninjured, or otherwise in suitable condition for release, will be transported to the relocation site in the portable enclosure and released; and
- Euthanasia of an injured lizard shall only be undertaken under direction from DOC.

8.6.3 Lizard Salvage Timeframe

The duration of the pre-clearance live trapping and searches will continue for a period of 5 days of suitable weather (i.e. temperatures above 15°C, precipitation-free). However, the following contingency plan has been proposed to ensure that all efforts is made to salvage every lizard. If:

(a) No lizards have been caught over the 5-day search/ trapping period or the herpetologist has determined that the habitat is no longer suitable to support lizards, the salvage operation will cease, OR

(b) Lizards are still being caught on day 5, searching and trapping will continue until no lizards are captured within a 24-hour period thereafter employing the same search effort.

Phase 2 will then follow Phase 1 and will continue until all habitat for lizards has been removed to the satisfaction of the Project herpetologist.

8.6.4 Summary of salvage operation and minimum effort

Trapping effort would consist of a minimum 4-day period within a working week (traps activated on Monday- closed Friday). Artificial Retreats, where used, will be checked a minimum five times (Monday to Friday) Table 32 provides a minimum site-specific search and trap effort.

Table 33: Minimum search / salvage effort to be applied per area

Site	Effect	Salvage method(s)	Minimum effort
Gladstone Open Pit	Loss of 1.4 ha of planted and remnant (rocky hilltop) vegetation and habitat, and 5.1 ha of pine plantation	Active searches (diurnal & nocturnal)	10 hours (plantation logs)
		Live trapping / Artificial refuges	60 traps
		Machine-assisted searches	Until herpetologist has determined that the habitat is no longer suitable to support lizards
Northern Rock Stack	Loss of 8.1 ha of planted native vegetation and approximately 1 ha of pine-dominant vegetation	Active searches (diurnal & nocturnal)	None- little to no searchable material (plantings in grassland)
		Live trapping / Artificial refuges	180 traps
		Machine-assisted searches	Until herpetologist has determined that the habitat is no longer suitable to support lizards
TSF3	Loss of 8.3 ha of SNA vegetation, 1.5 ha of non-SNA naturally occurring vegetation and 0.3 ha planted vegetation	Active searches (diurnal & nocturnal)	20 hours
		Live trapping / Artificial refuges	200 traps
		Machine-assisted searches	Until herpetologist has determined that the habitat is no longer suitable to support lizards

8.6.5 Lizard Relocation

8.6.5.1 Relocation Site Criteria

The re-establishment, persistence and long-term protection of the displaced lizards relies on the appropriate selection of a suitable relocation site. A relocation site should offer equal or ideally better prospects for survival and long-term persistence of lizards when directly compared to the original capture site.

A suitable relocation site is one that provides all the necessary attributes required by lizards for survival and reproduction (e.g. shelter, food resources, reproductive access to mates, etc). It is necessary to understand the existing lizard community structure at a relocation site before introducing new individuals into the environment (this is particularly important where high numbers of lizards [i.e. > 20] are expected to be released). The following set of criteria have been applied to assist in determining a suitable relocation site.

1. Habitat size and complexity – ensure the relocation habitat is representative (equal quality) or of better quality, than the original capture site(s).
2. Vicinity to original population – limit the distance that lizards are relocated from their original capture site(s). Distances < 500 m will meet this criterion.
3. Security of estate – ensure legal protection of habitats at the relocation site (all offset locations are required to be protected (covenant, stock fence) in perpetuity).
4. Resident species composition and density – confirm the presence of indigenous lizards and limit the potential adverse effects of intra- and inter-species competition at the relocation site.

8.6.5.2 Selected Relocation Site

This Plan will increase (1.7 ha lizard habitat planting) habitat availability and enhance (2.34 ha pine canopy removal, provision of additional refuges) identified habitats (Figure 20~~Figure 20~~~~Figure 17~~ and Figure 21~~Figure 21~~~~Figure 18~~) that would be contiguous with SNA 166, following offset planting (17.5 ha) that will be undertaken in accordance with this Plan. The identified habitats currently support At Risk moko skinks, a species now rare on the New Zealand mainland, and which is typically sympatric (naturally occurs in the same areas) with copper skinks. Table 34~~Table 34~~~~Table 34~~ reviews the suitability of this location against release site assessment criteria.

Table 34: Assessment criteria as applied to the proposed SNA 166 lizard relocation site

Criterion	SNA 166	Meets criterion
1. Habitat size & complexity Ensure the relocation habitat is representative or of better quality than the original capture site(s)	> The total current area available to receive salvaged lizards is 1.3 ha, comprising naturally regenerating native scrub beneath a pine block. This block of vegetation supports moko skink at low density, and is inclusive of 4.04 ha of restoration and enhancement as per Figure ~~9~~8. The entire area will receive long-term pest predator control and revegetation will provide connectivity with SNA 166, where another moko skink record occurs. > Enhancement of SNA (i.e. planting, provision of supplementary refuges, fencing, weed management, and pest control) will significantly increase the quantity and quality of habitat for lizards.	Yes, where habitat enhancement is implemented.
2. Vicinity to original population Limit the distance that lizards are relocated from their original capture site(s) (i.e. preferably < 500 m)	> Considering the area extent over which the WNP covers, some salvaged lizards may be relocated more than 500 m (up to 5 km) from their original capture site. However, all lizards will remain within the wider WNP area, preserving the local diversity of lizards. > This plan provides a single dedicated area to create, protect and enhance habitat for a significant lizard community in perpetuity, and with connectivity to SNA 166. This approach will have greater overall benefits to indigenous lizard values than several smaller areas of management.	No
3. Security of estate Ensure protection and maintenance of habitats at relocation sites over the long-term, preferably in perpetuity.	> SNA 166 is a scheduled protected area under the Hauraki District Plan. > Mitigation measures, including revegetation and enhancement, will be protected in perpetuity, including protection of pest mammal control and fencing from livestock.	Yes, where habitat enhancement is implemented and maintained long-term.
4. Resident species composition & density Reduce as far as practicable the potential adverse effects of intra- and inter-specific competition at the relocation site.	> SNA 166 is known to support one species of indigenous lizard (moko skink). It is likely that at least one other species (copper skink) also occurs given the presence of suitable habitat for this species and its occurrence in the wider landscape. > Survey effort to date suggests that moko skink is localised and occurs at relatively low abundance within SNA 166. It is unclear why this might be though it could be inferred that pest mammal pressure are influencing the conspicuousness and/ or abundance of this species and currently, moko skink probably exist either below natural carrying capacity or at carrying capacity relative to the habitat quality within the SNA. > With habitat enhancement measures, the quantity and quality of existing lizard habitat within SNA 166 could be improved, leading to an increase in overall lizard carrying capacity to a level that will allow salvaged-relocated lizards to persist and thrive.	Yes, where habitat enhancement is provided.

Figure 20202117: Moko skink habitat, within boulder deposits and low scrub under pine canopy- east of the NRS area

Figure 21212218: Plan of the proposed lizard relocation area within the wider landscape surrounding the WNP

8.7 LIZARD RELEASE STRATEGY

All lizards will be hard-released (i.e. no soft-release pens) into appropriately enhanced habitat at the approved relocation site. It is expected that habitat enhancement will assist in achieving high survival and persistence of relocated lizards at the release site.

All relocated lizards will be recorded and basic demographic (sex, morphometric) measurements, and where possible, identification (ventral or dorsal identification photographs) information will be recorded.

8.8 LIZARD HABITAT ENHANCEMENT AND AUGMENTATION

8.8.1 Overview

A combination of lizard habitat enhancement (enhancing existing habitat) and habitat augmentation (recreating habitat) will be required to ensure that highest probability of survival of relocated lizards and maintain indigenous lizard populations within the wider WNP area over the long-term.

In its current state, the habitat at the proposed relocation site is considered suitable for a variety of indigenous lizards. However, the relocation of additional individuals into an already occupied environment raises concerns about potential intra- and inter-specific interactions such as direct competition (e.g. aggressive interactions, competitive exclusion) and resource availability/ competition (e.g. refuges, food supply, access to new territories). To mitigate these potential risks, management provisions will be required to enhance the relocation site, and its surrounds, to ensure that important resources are adequately provided for and the overall carrying capacity of the site is raised.

To enhance this area sufficiently to receive salvaged lizards, it is recommended that the following actions are implemented:

1) Site protection (e.g. stock-proof fencing);
2) Removal of pine trees;
3) Provision of supplementary refuge structures;
4) Implementation of mammalian pest control; and
5) Native revegetation planting.

Each of these elements are briefly discussed below.

8.8.2 Lizard Habitat Protection (Stock-proof Fencing)

Long-term security of the lizard release site is important to ensure relocated lizards successfully establish and persist into the future. To ensure that lizard habitat remains as undisturbed as possible, permanent stock-proof fencing will be provided around the full extent of the relocation site (SNA 166). Fences will exclude both livestock access and encroachment of other agricultural practices into lizard sensitive areas and ensure that the

enhancement plantings establish without disturbance or interferences (e.g. wandering livestock).

Fencing must be erected prior to the release of any lizards to avoid habitat disturbance.

8.8.3 Pine Tree Management

Pine trees currently form a canopy over regenerating native vegetation at the proposed lizard relocation site. These pines will be removed, or topped to no more than 5 m tall, poisoned and delimbed. The remaining pole will be left to break down naturally within the site. The removal of the top and limbs will stimulate growth in existing indigenous vegetation while providing habitat for fauna as both standing poles or log fall.

Pine tree management shall be undertaken prior to lizard habitat planting and the release of any lizards to avoid habitat disturbance after lizard release.

8.8.4 Supplementary Lizard Refuges

The provision of permanent refuge structures, including but not limited to log piles (including from some topped pine trees), natural debris (e.g. decaying vegetation), and rocks collected during the vegetation clearance activities will be required to supplement the natural refuges already present at the lizard relocation site.

Refuge structures will be relocated as directed or by the Project herpetologist(s) into the lizard enhancement areas prior to lizard salvage operation. Salvaged lizards will then be released beneath these refuge structures to provide immediate shelter.

8.8.5 Mammalian Pest Control

Mammalian pest control will target rodents, hedgehogs, mustelids, possums, and feral cats within the lizard relocation and enhancement area. The pest control operation will be established prior to (no less than 3 months before) any lizard release and be maintained (e.g. rebaiting of bait stations and re-setting of traps) until mine closure.

The pest control provider/operator should submit annual progress reports to WRC, DOC, HDC and the Project herpetologist for review. The data contained within the progress reports will assist analyses alongside the post-release lizard monitoring results to determine whether the level pest suppression is achieving the desired benefits for lizards.

The site-wide pest animal control programme is detailed in the separate Residual Effects Offset Plan.

8.8.6 Native Vegetation Planting

Creation of new lizard habitat and the enhancement of existing habitat will occur through an extensive revegetation planting programme. A specific planting schedule for provision of ground cover habitat is provided in the separate Residual Effects Offset Plan.

This 'lizard-friendly' native vegetation (e.g. densely growing and fruit producing plants) will provide cover and food resources for lizards. The plantings will be undertaken over 1.7 ha of currently grazed pasture and be contiguous with existing pine canopy habitat (2.34) and future offset planting that will be contiguous with SNA 166.

8.9 POST-RELEASE MONITORING

8.9.1 Overview

Lizard monitoring will be undertaken within the lizard enhancement and the lizard habitat planting area. The purpose of the monitoring is to determine the following success parameters:

1. Population increase (rough scale): Lizard encounters (copper skink, moko skink) increase over time (including recaptures);
2. Evidence of breeding: That captured animals include evidence of breeding (gravid females, juveniles); and
3. Habitat expansion: that lizard (copper skink, moko skink) habitat occupation extends into lizard habitat plantings;
4. Population expansion into planted habitats: That there is evidence of breeding within planted habitats.

Lizard monitoring will also assist monitoring of the performance of other actions, including pest control and plant maintenance.

8.9.2 Method and Frequency of monitoring

Lizard monitoring will be undertaken annually for the first five years following implementation of the Lizard Management Plan, and then five-yearly until mine closure. Lizard monitoring will be conducted regardless of the number of lizards released.

Monitoring will:

> Use standard survey techniques (DOC Biodiversity inventory and monitoring toolbox – Herpetofauna): artificial refuges (Lettink & Cree, 2007; Lettink, et al., 2011; Lettink, 2012), live traps (Hare, 2012a, b), and active searches (Hare 2012c),

> Trap location and trap types will be consistent each monitor following the initial five years, except where new potential habitats are investigated.

The results of each monitoring session and any emerging recommendations will be reported to WRC and DOC. In addition, all records of lizards will be submitted to the Department of Conservation for inclusion in their herpetofauna database.

8.10 KEY PERFORMANCE INDICATORS

Lizard management will be implemented in accordance with best practice standards and requirements and reviewed annually by the Project herpetologist to ensure lizard management is achieving anticipated targets.

Monitoring of population increase, evidence of breeding, habitat expansion, and population expansion into planted habitats will be undertaken annually for the first five years following implementation of the Lizard Management Plan, and then five-yearly until mine closure.

Annual progress reports of lizard management will be provided to WRC, HDC, and DOC detailing the level to which pest suppression is achieving the desired benefits for lizards.

Further details of any measures and methods implemented can be provided on request.

Commented [MD10]: Linked in to more clearly identify how it will be determined if management measures are functioning as they are intended to.

PART H: AVIFAUNA MANAGEMENT PLAN

9. AVIFAUNA MANAGEMENT PLAN

9.1 OVERVIEW

This Avifauna Management Plan outlines the methods that will be used to avoid, remedy, or mitigate any potential adverse effects on avifauna (birds) occurring within or temporarily utilising the WNP area.

Native forest birds are legally protected by the Wildlife Act 1953 and significant habitats[4] for indigenous fauna are protected under the Resource Management Act 1991. No direct habitat loss for birds of conservation concern (i.e. those listed as 'Threatened' or 'At Risk' by the New Zealand Threat Classification System; Robertson *et al.,* 2017) is expected within the WNP area. Though, it is anticipated that New Zealand dotterel, New Zealand pipit, New Zealand dabchick and other species associated with habitats at the existing tailings facility could benefit from activities associated with WNP (Waihi area).

9.2 SUMMARY OF AVIFAUNA VALUES AND EFFECTS

The WNP will require the removal of approximately 25.7 ha of vegetation, including native, exotic and plantations. These areas provide roosting, nesting and foraging habitat for local avifauna communities and the potential adverse effects of the proposed works on avifauna may include:

- Loss of habitat and associated resources from the local landscape;
- Noise-, dust-, or light-associated disturbance to nesting behaviour and nesting success or to sensitive birds; and
- Injury or mortality of eggs, chicks, and brooding females during the breeding season, as a result of vegetation clearance.

Notwithstanding these potential effects, the largely exotic assemblage of bird species within the WNP area has led to the magnitude of effects of the vegetation loss being considered Low. Acknowledging that native birds are protected under the Wildlife Act 1953, protocols to avoid or manage adverse effects are proposed.

[4] Significant habitats for avifauna include those that provide breeding and food resources and/ or important roosting sites.

9.3 PROTOCOLS FOR AVOIDING OR MANAGING EFFECTS ON AVIFAUNA

9.3.1 Overview

The potential effects on avifauna can be avoided or minimised through the following management measures:

- Constraints on vegetation clearance or with pre-clearance nest survey
- Constraints on noise-, dust-, or light-associated disturbances
- Procedures to manage accidental injury or mortality to native avifauna.

9.3.2 Vegetation Clearance and Pre-clearance Nest Survey

Vegetation clearance should be avoided during the peak bird breeding season (September to December inclusive) as far as practicable, to prevent harm or injury to eggs, chicks, and brooding females. While adult birds could be expected to fly away during vegetation clearance activities, brooding females could be at risk of injury if they remain on the nest until the vegetation begins to fall.

Where removal of such vegetation during the peak bird breeding season is unavoidable, a native bird nesting survey may be completed prior to clearance to avoid injury or loss of eggs, chicks, or active nests. The following protocols are recommended:

- Nest surveys will be undertaken by a qualified ecologist.
- Nest surveys will include inspections for tree cavities (including pine), tree nests and ground nesting species such as New Zealand dotterel, New Zealand pipit and harrier.
- Arborists may be required to assist with nest surveys where trees are too tall or the foliage too dense to accurately determine the presence/ absence of active nests.
- Where no active native bird nest(s) are found, the vegetation may be felled within three days of the nest survey. If clearance within this timeframe is not possible, the nesting survey should be repeated to verify the absence of active nests prior to clearance.
- Where an active native bird nest(s) is located, an exclusion perimeter (ca. 10 metres diameter) will be demarcated around the tree or nest, and works shall not breach this cordon until all nestlings have fledged. Vegetation may be removed once the ecologist has confirmed that nesting is complete.

9.3.3 Constraints on Noise, Dust or Light-associated Disturbances

Avifauna may be disturbed by loud or persistent construction related noise, increased dust and/ or bright and persistent lighting during construction. These disturbances could result in birds vacating the area temporarily but will be most harmful during the breeding season if

important nesting habitat is degraded (e.g. dust falling on nests), breeding call activity is affected, or nest failure is induced.

To manage these effects the following protocols will be implemented:

- Limit construction noise to commence at least one hour after sunrise and cease at least one hour before sunset.
- Limit or avoid the use of lighting during the night, or where lighting is deemed necessary, avoid directing light spill onto nearby vegetation or direct light downwards using lighting hoods.
- Ensure dust management protocols are in place and are adhered to throughout the life of the WNP.

9.3.4 Accidental Injury or Mortality to Native Avifauna

In the event of injuring a native bird during vegetation clearance or construction, the following procedures will be implemented:

- Injured native birds will be placed in an appropriate carrying box/ bag (e.g. one that is cool, dark, and material-lined) and immediately transported to a DOC-approved veterinarian for assessment and treatment;
- If the species is 'At Risk or 'Threatened', the local DOC office will be contacted within two hours of the event or, if after hours, DOC will be informed through the DOC hotline (0800 362 468).
- All injuries or mortalities will be accurately recorded and reported to DOC.

9.4 KEY PERFORMANCE INDICATORS

Avifauna management will be implemented in accordance with best practice standards and requirements, with all injuries or mortalities to be accurately recorded and reported to DOC.

Further details of any measures and methods implemented can be provided on request.

Commented [MD11]: Specific performance indicators are not identified in relation to avifauna management. As such, they will be managed in accordance with best practice standards and requirements.

PART I: BAT MANAGEMENT PLAN

10. BAT MANAGEMENT PLAN

10.1 OVERVIEW

All native bats are protected under the Wildlife Act 1953 (s3) and areas of significant indigenous vegetation and significant habitats of indigenous fauna (including native bats) are matters of national importance under the Resource Management Act 1991 (s6(c)). The habitats within and surrounding the WNP area could potentially support long-tailed bats (*Chalinolobus tuberculatus*), a 'Nationally Critical' species that is threatened by habitat loss, fragmentation, and introduced predators (O'Donnell et al., 2018).

The purpose of this Bat Management Plan (BMP) is to identify how the WNP will address potential adverse effects on native bats within the WNP area, especially in areas where vegetation removal (including exotic pine trees) is proposed (e.g. GOP, NRS and TSF3). Specifically, the BMP sets out procedures for how the potential adverse effects will be avoided or remedied or mitigated.

10.2 SUMMARY OF BAT VALUES AND POTENTIAL EFFECTS

Bat surveys (2011-2024) at Gladstone Open Pit recorded long-tailed bats at low levels, at the eastern edge of the block, at the edge of the pine plantation. As the pine trees on site have some capacity to support roosting habitat for native bats, removal of these pine trees could lead to the death or injury of native bats. The 'Protocols for minimising the risk of felling bat roosts' (the 'Bat Roost Protocols', or BRP) should therefore be followed to minimise this risk.

10.3 LONG-TAILED BAT ECOLOGY

Long-tailed bats are found throughout the North Island and are classified as a 'Nationally Critical' threatened species under the New Zealand Threat Classification System (O'Donnell et al, 2023). LTBs typically use forest edges and riparian areas for foraging and commuting (O'Donnell, 2000). They are highly mobile and have extensive home ranges that have been recorded to stretch 19km and cover over 50km2, with individuals capable of moving tens of kilometres in one night (O'Donnell, 2001a).

Roosts are often in tree cavities, epiphytes, or under loose bark (Borkin and Parsons 2009; Griffiths 1996) and change frequently, often on a nightly basis (O'Donnell, 2000). However, roost fidelity can be high on a year-to-year basis (Sedgeley & O'Donnell, 1999).

Roosts require habitat features that are mostly supported by larger trees and are carefully selected for thermal properties that are still not well understood (Sedgeley 2001; DOC, 2021b) and thus challenging to artificially replicate. Roost trees, particularly those that are used for communal roosting, are therefore considered a valuable and limited resource for LTBs.

A summary of the New Zealand bat reproductive cycle is included below (Figure 2219), to provide context to the requirements and procedures outlined in this document.

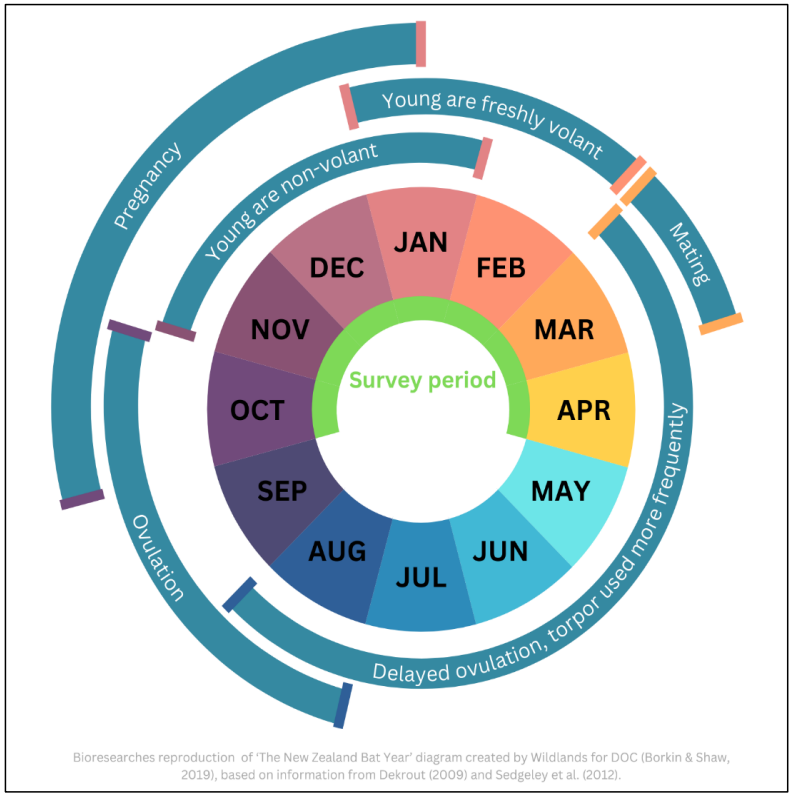

Figure 222223: Visual representation of the key stages of the reproductive cycle of bats (long-tailed & short-tailed bats) in Aotearoa New Zealand

10.4 PURPOSE OF PLAN

10.4.1 Overview

The purpose of this Bat Management Plan is to set out procedures to avoid impacts on native long-tailed bats ('Threatened–Nationally Critical) that may be adversely affected by potential roost tree felling within the WNP area.

1. This Plan adopts the requirements of current standard protocol as in accordance with the DOC advice including: DOC (2024) Protocols for minimising the risk of felling bat

roosts (Bat Roost Protocols (BRP)) Version 4, 2024 approved by the New Zealand DOCs Bat Recovery Group

2. DOC (2021) Artificial bat roost advisory note – DOC-6734995. New Zealand Bat Recovery Group Advice Note- The Use of Artificial Bat Roosts.

Vegetation removal for the Project requires the removal trees that support potential bat roost characteristics. Such trees are > 15 cm diameter at breast height (dbh), and support features including cracks, knot holes, flaking bark epiphytes.

10.4.2 Plan Implementation and Competencies

DOC requires that only personnel who are certified to be competent at high-risk activities for bats, such as 'Roost felling', may undertake them. This is particularly relevant whereby a Wildlife Act Authority would be required prior to any felling of a bat roost tree. Such a Wildlife Authority requires the understanding of what to do when bats are found during tree felling as per Appendix 6 of 'Initial veterinary care for New Zealand Bats'.

Therefore, prior to vegetation removal, this plan requires that:

- All trees that are >=15 cm dbh (diameter at breast height) shall be demarcated spray / marker paint and numbered on a map.
- For all identified trees, the DOC Tree Removal Protocol shall be adhered to.
- A bat survey (October 1 – April 30) is to be undertaken within the area of vegetation clearance, prior to tree felling. This will involve ABMs / acoustic bat monitors to be placed throughout the affected area (targeting trees with bat roost characteristics) one week prior to proposed clearance.
- The data must be analysed for bat activity on the morning immediately prior to proposed tree felling.
- Tree felling must be stopped if bat activity is detected at any time within two consecutive valid survey nights preceding tree felling.
- Where identified bat roosts require felling, those trees shall be replaced with a minimum six artificial bat roost boxes (see below).

10.5 DEPARTMENT OF CONSERVATION BAT TREE REMOVAL PROTOCOLS

10.5.1 Overview

This section details procedures to be followed to give effect to the DOC protocols for removing trees that have the potential to support bat roosts. The intention of the tree removal protocol is, in the first instance, to avoid felling bat roost trees, secondarily to move roost trees, and only if unavoidable, fell roost trees (but only once vacated by bats).

10.5.2 Certified Bat Ecologist

DOC requires that only certified personnel (certified bat ecologist) may undertake high-risk activities, such as identifying bat roosts within a tree where bats have been recorded, and that tree requires removal. Bat ecologists must be approved to the relevant competency level (CL) for the activity they are undertaking:

Table 35: Certification requirements for high-risk activities

Activity	Certification required
Identifying roost characteristics	Any individual confident with identifying high-risk features, with support of a bat ecologist approved at CL 3.3 where further investigation is required
Physical checking of potential roost features	CL 3.3, or a certified arborist under the direction of a bat ecologist approved at C.L 3.3
Assessing bat activity around potential roost trees with ABMs	CL 3.1
Assessing use of tree by roost watches	CL 3.2, or under direct supervision of such during counts requiring multiple watchers
Overseeing tree felling	**Any individual capable of physically inspecting trees for signs of bats once felled, and who is familiar with 'Initial Veterinary Care for New Zealand Bats' (Borkin and Shaw, 2019/2023)**

Note: *Certification and experience required for each activity in the Tree Removal Protocols, as per DOC BRP, v2 (2021)*

A Wildlife Act Authority would be required prior to any felling of a bat roost tree. Such a Wildlife Authority requires the understanding of what to do if bats are found during the tree felling as per Appendix 6 of 'Initial Veterinary Care for New Zealand Bats' (Borkin and Shaw, 2023)

10.5.3 Overview of Bat Roost Protocol

Aspects of potential bat ~~roots~~ roost tree management are required to be undertaken by an ecologist or arborist who is certified as competent for specific skill sets by DOC. Figure 23 (DOC, 2024) details the decision-making process required for implementing bat roost protocol.

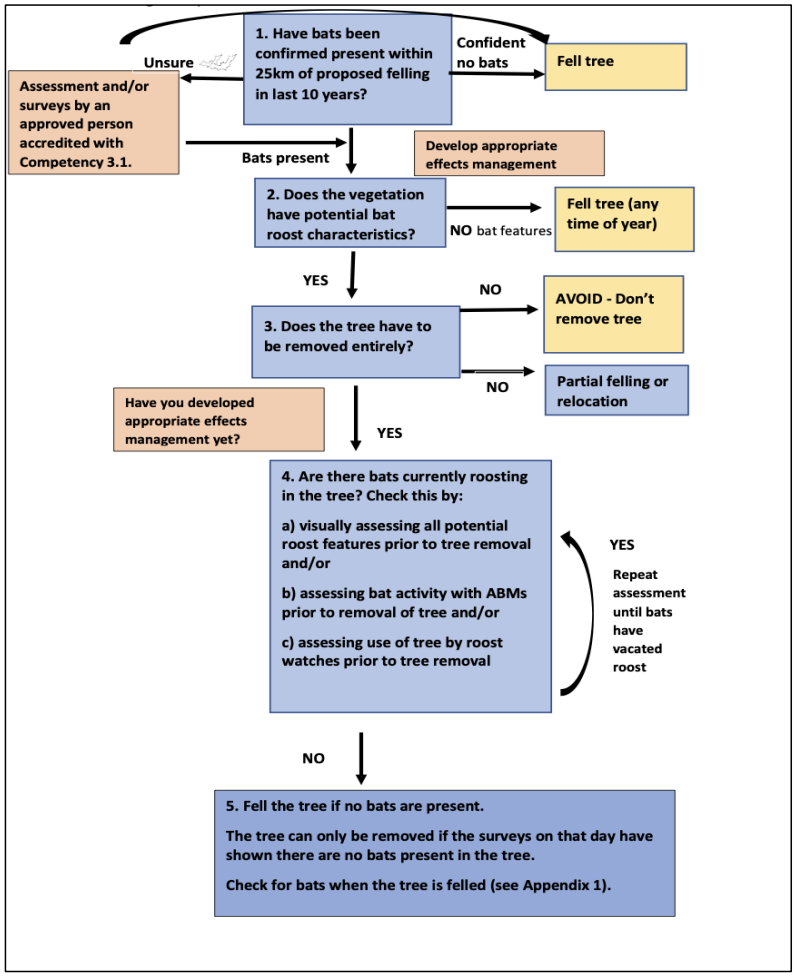

Figure ~~23232420~~: Decision tree for Bat Roost Protocol (based on DOC BRP, Version 4, October 2024).

10.5.4 Identifying Roost Characteristics

Where bats are recorded, vegetation supporting bat roost characteristics will be identified by the Certified Bat Ecologist, to inform sufficient coverage for pre-felling surveys required immediately prior to removal. High Risk Trees will be qualified as any trees that are ≥15 cm DBH (diameter at breast height) and support any of the following bat roost characteristics:

1. Hollows
2. Cavities
3. Knot holes
4. Cracks
5. Flaking, peeling, or decorticating bark
6. Epiphytes
7. Broken or dead branches/ trunk
8. Shelter, cavities, or hollows formed by multiple trunks/ double leaders
9. Dense tree-fern skirts

Where the vegetation does not support bat roost characteristics as above, the vegetation may be removed (any time of year) without bat roost protocols.

10.5.5 Bat Activity Assessment (High Risk Trees)

Where bats are detected at the site and affected vegetation supports bat roost characteristics (High Risk Trees), those trees will be assessed (between 1 October and 30 April) to determine any current activity by a certified bat ecologist, to ensure no bats are occupying potential roosts at the time of removal. This assessment must be undertaken immediately prior to tree removal by way of at least one of the following methods:

1. Tree climbing for visual inspection of potential roosts, if possible
2. Pre-felling surveys: minimum two consecutive valid survey nights immediately prior to removal
3. Roost watches: minimum two consecutive valid nights of roost entry/ exit watches immediately prior to removal

Where bats are confirmed present, the tree must not be felled. This process must be repeated on subsequent days until the bat ecologist confirms absence.

Confirmation of roost activity will trigger Section 10.5.9 - Procedure and Section 10.6 - Artificial Roost Provision.

10.5.6 Tree Climbing and Inspection

Roost features may be able to be accessed by an experienced tree climber or certified bat ecologist (approved at CL 3.3). A non-certified arborist must provide information along with photographs or video footage to the bat ecologist to inform the decision on whether the tree may be felled.

- An endoscopic camera should be available for this step and every possible corner of each potential roosting feature inspected, ie., cavity/crack etc. Cracks, holes, and splits may lead to cavities or may be superficial. A cavity may be wet indicating no/low potential as a bat roost.
- Search of tree features should be accompanied by use of a hand-held bat detector. If bats are present and not in torpor, then detection of presence listening at 25 kHz (for social calls) and 40 kHz (for echolocation calls) may help to determine if long-tailed bats are present.
- The presence of guano or urine staining should be noted.

Care must be taken while climbing trees to avoid disturbing, removing or destroying tree features with bat roost potential such as sections of loose bark or cavities in dead wood. Using mobile elevated platforms can be a good option. Bats are less likely to be active over colder periods, so climbing to check whether bats are present in potential roost features must take place between October 1st to April 30th when the temperature is 10°C or greater at official sunset on the night previous to inspection.

10.5.7 Pre-felling Surveys

Bat activity is to be recorded using ABMs. Location of ABMs must provide sufficient coverage to be able to determine if bat roosts are present in one or more of the trees. A minimum two consecutive valid survey nights immediately prior to felling will be undertaken by the certified bat ecologist (approved at CL 3.1). At least two nights are required as it is possible for bats to enter or leave a roost without echolocating, or to not leave the roost for a night.

Prior to the commencement of surveys, ABMs must be checked for correct operation at a site where bat activity is known to be regular, or by using the DOC – Bat Recorder Tester (Tussock Innovation Ltd) phone app made for this and available from Google Play Store. Faulty or suspect ABMs must not be deployed, and ABMs must be redeployed if faults occur.

10.5.8 Roost Watches

This must only be undertaken in combination with pre-felling surveys and can be carried out by a certified bat ecologist approved at CL 3.2. Where multiple personnel are required to cover a potential roost tree, at least one must have the appropriate certification and be

present for the entire duration of the watch. Watches must confirm no bat activity for two consecutive nights immediately prior to felling. The following weather conditions define a valid night for roost watches:

- Be undertaken between October 1- April 30 (inclusive)
- Temperature greater than 10oC all night between official sunset and sunrise.
- Precipitation < 2.5 mm for each two-hour period between official sunset and sunrise, and < 5 mm in the first 4 hours after official sunset.
- Roost watches should include the deployment of ABMs and analysis of data for the night of the roost watch.

10.5.9 Emergence watches

Each tree must be watched initially from sunset until it becomes too dark to see by sufficient people to observe all potential exit points.

This must be supported by the use of handheld detectors. The aim of emergence watches is to identify potential roost locations within the vegetation. Infra-red and thermal imaging cameras may be useful in this process.

10.5.10 Roost re-entry watches

The time when bats return to roosts can vary based on temperature and time of year.

- Observers must then return the next morning and watch the tree to determine whether bats return to the vegetation.
- Roost re-entry watch timing should be based on patterns of activity recorded onsite with acoustic recorders. Watches should begin two hours prior to when the last passes were recorded on the ABMs on previous nights and finish one hour after official sunrise time. Where this information is not available and at minimum, watches shall begin two hours prior to official sunrise until one hour after sunrise. Infra-red and/or thermal imaging cameras may be useful as a supplementary tool in this process.

If bats are sighted, or sign detected, or a roost (active/inactive) is confirmed, the approved bat ecologist, as soon as possible, shall:

- Call the tree felling supervisor to inform them which affected tree(s) cannot be felled due to detection of bat sign.
- Send an email to the site manager, and a bat ecologist representing the council and DOC detailing the results of the survey and outlining the measures for protection or relocating the roost tree.

- A record (including photos) of any vegetation containing bat roosts shall be kept detailing the date; size, location and species of tree or other vegetation; roost type, e.g., cavity, peeling bark, broken branch; detail outlining how presence of bats was confirmed; the number of bats present; and species present, if known.

10.5.11 Bats Detected

Vegetation removal must take place on the day of tree inspection, or the day roost watches or two consecutive nights of ABM data have confirmed that there are no bats present. If practical, trees are to be inspected for signs of bats once felled and before removing from site. People inspecting trees should be familiar with the Bat Care Advice document and able to check/inspect tree for signs of bats once felled.

If during the felling of a tree bats are detected, felling of that tree must stop immediately if safe to do so, and DOC and an approved bat ecologist at Competency Level 2.1 must be consulted.

If bats do not fly away or are potentially injured/found on the ground, felling can only re-start once permission has been obtained from DOC after consultation with an approved bat ecologist at Competency Level 2.1.

If bats are detected once the tree has **been felled**, all further work must stop, and DOC and an approved bat ecologist at Competency Level 2.1 must be contacted. The felled tree must be thoroughly inspected by the approved bat ecologist for further bats.

If any bats are found on the ground or in the tree once felled, place the bat in a cloth bag in a dark, quiet place at ambient (or slightly warmer) temperature and take to a veterinarian for assessment as soon as possible. A maximum of two bats should be kept in one bag. After delivering the bat to the vet, contact an approved bat ecologist at Competency Level 2.1 in consultation with the vet and DOC (0800 DOC HOT, 0800 362 468).

Bats must be kept for three days under observation and must be kept out of torpor for this time. Vets must euthanise bats whose injuries are causing suffering and are not likely to heal sufficiently to allow rehabilitation and return to the wild. The approved bat ecologist at Competency Level 2.1 and vet must consult with DOC to consider appropriate rehabilitation options where suffering is minimal and chances of return to the wild are high.

10.6 ARTIFICIAL ROOST PROVISION

Vegetation clearance has potential to remove communal roost trees which are a limited resource to long-tailed bats. Therefore, any loss of such habitat is a very high-level effect on the basis of the species threat status and the probable low availability of large suitable trees in the surrounding landscape.

Therefore, in accordance with the DOCs advisory note for the use of Artificial Roost Box (ARB), a minimum of six ARBs for each identified roost removed, will be installed in habitat suitable for bat roosting, as directed by the bat ecologist.

The total number of ARBs to be installed will be a minimum of six per identified roost tree lost.

ARBs will be installed within a nearby area of protected vegetation where bats have been detected (by survey, records or other knowledge).

All ARBs will (as per DOC advisory note on artificial bat roost provision):

- Be deployed at a minimum height of four metres from the ground
- attached securely to an appropriate tree, with no clutter within 2 m of the roost opening
- Be 'predator proofed' with 'tree bands' to prevent access by rats, cats and possums. Bands will be wrapped around the trunk above and below each roost box
- Be of multiple designs, of variable orientation and exposure to light
- Be installed near to the lost roost tree to facilitate discovery, where practicable and where location won't be subject to excessive disturbance (e.g. from artificial lighting, noise, vibration, or human curiosity)

10.6.1 ARB Monitoring

Where any ARBs are installed, they will be checked annually and maintained for a minimum of 10 years. At each inspection, any cobwebs, bird nesting material or invertebrates will be removed. Each ARB will be inspected for signs of bat roosting, such as guano. Anti-predator tree bands will be checked at 6-monthly intervals for a minimum of five years and maintained to ensure they remain securely attached to the tree. Close inspection and maintenance should occur between May-September (inclusive) to avoid sensitive months for juveniles and breeding females (Figure ~~21~~24). If bats are determined to be present in the ARB then maintenance must be postponed for a short time until the ARB is vacant (e.g. to the following day). While information on the effectiveness of ARB designs and optimal installation for long-tailed bats in New Zealand is limited, Hamilton City now has well over 100 ARBs installed throughout urban parks, with a study tracking use of 74 'Kent' style ARBs for 12 months (2021-2022) observing 32% of them used at some point by LTBs (Robinson et al., 2024). It should be noted that initial screening excluded ARBs that appeared unlikely to be used, however AECOM (2022) reported 41% of 80 ARBs installed in association with the Southern Links Project were being used within two years. This was likely facilitated by the Hamilton LTB population having ever-increasing exposure to ARBs beginning over a decade

ago. Uptake in other regions or effects on individual fitness and population have not been well studied

Various roost box designs have been used in New Zealand. Models utilised by long-tailed bats include:

> Various timber 'Kent' bat box designs and similar bespoke inspired designs (e.g. Waikato Regional Council)

> Schwegler 'woodcrete' designs (models 2F, 2FN, 1FF and 1FD; DOC, South Canterbury)

Long-tailed bats have been recorded roosting in the bespoke WRC 'Kent' design (Hamilton) and all four of the Schwegler designs (South Canterbury).

Figure ~~242421~~: Examples of artificial bat roost designs; Left: timber 'Kent' design (source: Treelands); Centre: Schwegler 2FN design and Right: Common Noctule bats inside 2FN bat roost (Source: Schwegler)

10.7 KEY PERFORMANCE INDICATORS

Bat management will be implemented in accordance with best practice standards and requirements. This is to include the installation of a minimum of six ARBs per identified roost tree lost. The ARBs are to be checked and maintained for a minimum of 10 years. Anti-predator tree bands are to be checked and maintained at 6 monthly intervals for a minimum of five years.

Further details of any measures and methods implemented can be provided on request.

Commented [MD12]: Specific performance indicators are not identified in relation to bat management. As such, they will be managed in accordance with best practice standards and requirements.

~~10.7~~10.8 CONCLUSION

Upon completion of works, all findings resulting from the implementation of the Bat Management Plan will be recorded (processed csv files and GPS locations) and sent to batdatabase@doc.govt.nz on a standard spreadsheet available by emailing this address.

~~10.8~~10.9 REFERENCES

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PART J: AQUATIC FAUNA SALVAGE AND RELOCATION PLAN

11. AQUATIC FAUNA SALVAGE AND RELOCATION PLAN

11.1 INTRODUCTION

11.1.1 Background

The Waihi North Project (WNP; the Project) has identified opportunities to expand the Waihi operation. To support these expansion operations a new tailings storage facility (TSF3), and a new rock stack (the Northern Rock Stack, NRS) are required. All of these facilities are proposed to be located over existing watercourses.

This Plan details the processes for native aquatic fauna (fish, kōura and mussel) salvages that are required in several watercourses within the WNP operation site. Successful translocations reduce the potential impacts on native fauna and will allow streamworks to commence.

The freshwater fish onsite are protected by the Freshwater Fisheries Regulations 1983, which prohibits intentionally killing of destroying indigenous fish.

11.1.2 Location

After conducting freshwater values assessments throughout the Project site, it is necessary to carry out fish and kōura salvage in the following stream reaches within the Waihi Area components of the WNP.

(a) TB1 and associated tributaries and wetlands at Northern Rock Stack

(b) Ruahorehore Stream and associated tributaries at Tailings Storage Facility (TSF3)

(c) Farm Detention Pond at TSF3 (fish salvage only).

The locations are shown in the following two figures:

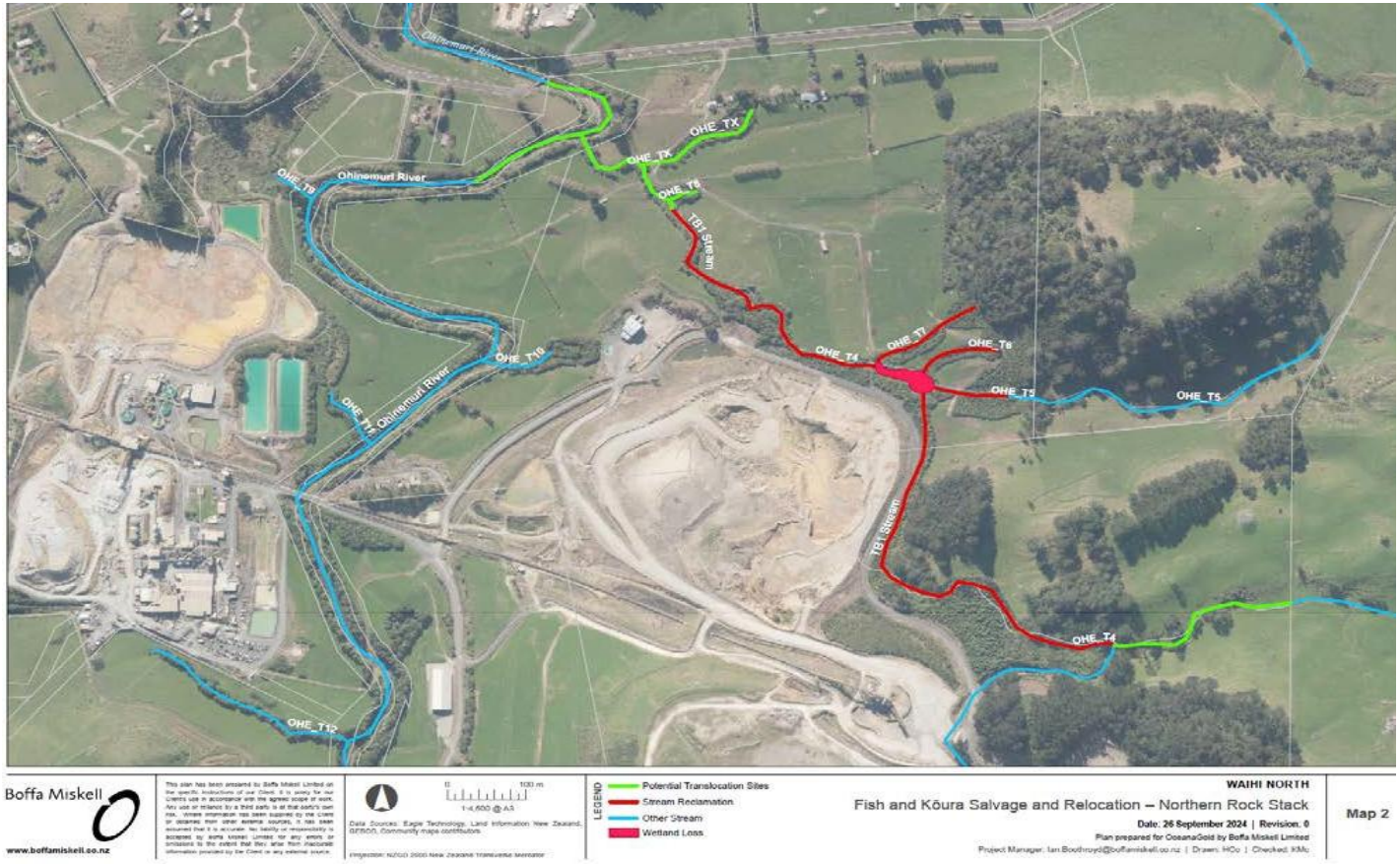

Figure ~~252522~~: Location of stream reclamation / aquatic fauna salvage (shown in red) and relocation sites (shown in green) at NRS

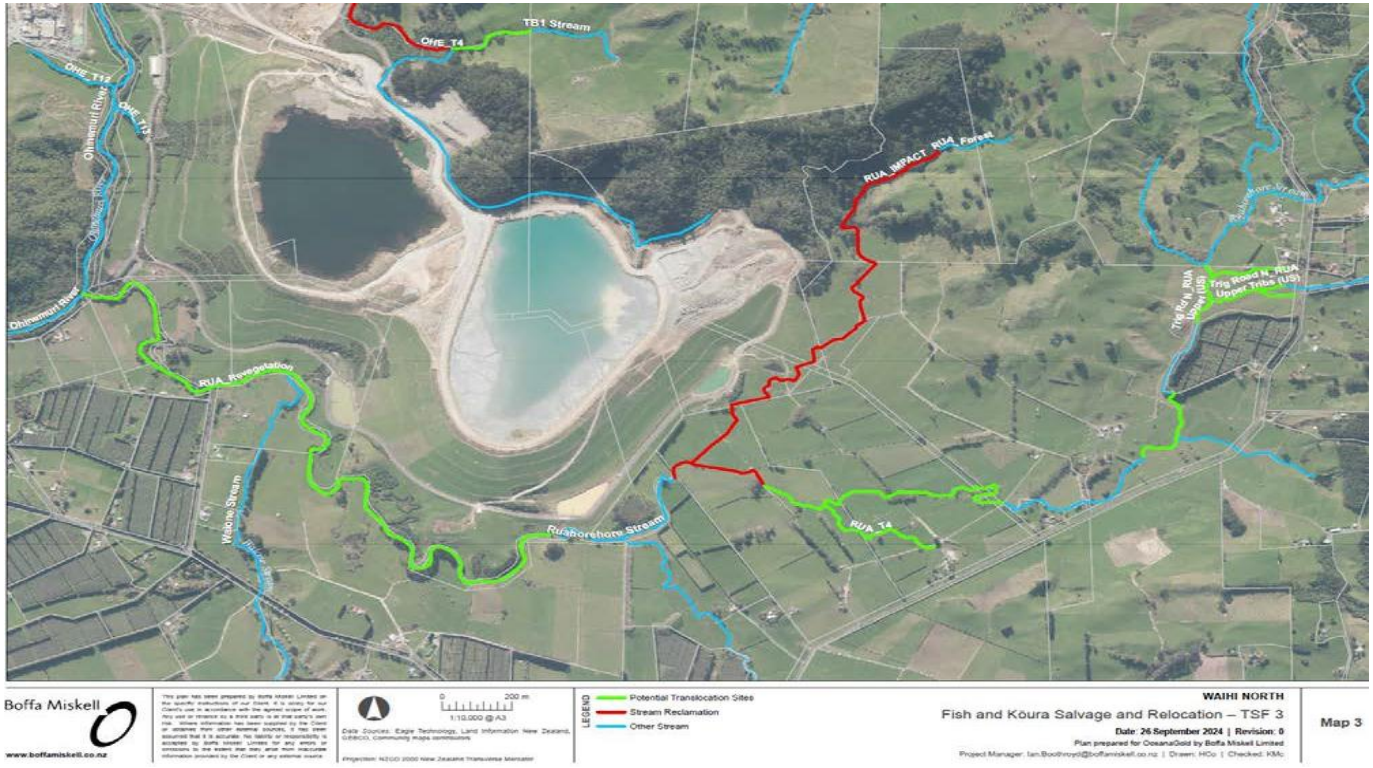

Figure 262623: Location of stream reclamation / aquatic fauna salvage (shown in red) and relocation sites (shown in green) at TSF3.

11.2 FISH COMMUNITIES

11.2.1 Overview

Assessments of fish communities were undertaken across all watercourses proposed to be reclaimed for the WNP to ascertain what species were present and their approximate density. Surveys were undertaken using a backpack mounted Electric Fishing Machine (NIWA kainga EFM300) operated by suitably qualified freshwater ecologists. A summary of the fish communities at each location are provided in the following section.

No specific surveys for kōura or mussel have been undertaken. Kōura were occasionally collected whilst electric fishing but no mussels were observed during associated surveys.

The threat status of the fish observed are show in Table 36 below.

Table 36: Threat status of species observed in waterways across the WNP Project (2017 – 2020). Threat status from Dunn et al (2017). Note* - Kōura threat status from Grainger et al. (2018).

Common Name	Species	Threat Status
Longfin eel	*Anguilla dieffenbachii*	At – Risk - Declining
Shortfin eel	*Anguilla australis*	Not Threatened
Common Bully	*Gobiomorphus cotidianus*	Not Threatened
Rainbow trout	*Oncorhynchus mykiss*	Introduced and naturalised
Kōura	*Paranephrops planifrons*	Not Threatened*

11.2.2 TB1

Two sites were surveyed along TB1 to evaluate fish communities. The populations of the two locations were similar, with only shortfin eel being identified. Some 150 m downstream of site TB1_upper was a large natural waterfall that would have posed a significant natural fish barrier to swimming fish species.

11.2.3 Ruahorehore Stream – TSF3

Fish communities within the Ruahorehore Stream and its tributaries were surveyed across five sites. Common bully, shortfin eel, rainbow trout, and longfin eel all observed, along with

kōura. The Ruahorehore Stream and its tributaries contains a variety of different habitats and this is reflected in the difference in fish communities observed.

Fish populations present at site RUA_revegetated contained an abundance of common bully (n= 90). Shortfin eel and kōura were al so present. Site RUA_lower had an abundance of shortfin eel with at least 30 individuals present: predominantly living within the macrophyte. Freshwater crayfish, a common bully and a rainbow trout were also recorded. Site RUA_upper was home to a large longfin eel over 1.1 m in length. In addition, three shortfin eels and five freshwater crayfish were present. A waterfall located between site RUA_upper and site RUA_forest represents a significant barrier to fish passage of swimming species. At site RUA_forest, kōura were very abundant with over 60 individuals recorded. A longfin eel and a shortfin eel were also recorded. Fish populations at site RUA_Trig Road were poor with only shortfin eel recorded.

11.2.4 Farm Detention Pond

Only shortfin eel were observed during fish surveys of the pond, with 7 individuals caught. An additional large eel (> 100 cm) was observed during fishing but was unable to be caught for formal identification.

11.3 PRE-STREAMWORKS

The proposed WNP requires the reclamation of some 4.1 km of stream within the Project area. This reclamation will be staged as the Project progresses. It is anticipated that this staging will be undertaken across many years. The specific staging of the streamworks has not yet be undertaken and consequently the specific sites and timing of reclamation are not known.

As the project progresses and stream reclamation is required, then a pre-streamworks site visit must be undertaken by the Project Freshwater Ecologist and members of the Project Team to discuss and confirm the proposed reclamation. This site visit should discuss and confirm, but not be limited to, the following:

- The upper and lower extent of the stream reclamation.
- The proposed timing of the reclamation and adverse weather options.
- The proposed method of streamworks.
- The proposed method of fish salvage, which should be consistent with this plan, and its implementation.
- The potential requirement for undertaking the fish salvage in stages if long reaches of stream are proposed to be reclaimed.

- The use of any diversion channels, both temporary or permanent.
- The proposed areas of relocation and any access arrangements.
- If the proposed reclamation stream contains soft sediment that may be suitable mussel habitat.
- A source of bracken fern *Pteridium esculentum* should also be confirmed.
- Monitoring methods.

The Project Freshwater Ecologist must also undertake a site visit to the proposed relocation sites, to ensure they are suitable. GPS locations must be recorded and a general habitat assessment undertaken.

The pre-streamworks site visit and associated Project Team meeting will inform the Relocation Event Fish Salvage Plan.

11.3.1 Mussel Surveys

Mussel surveys should be undertaken at sites where suitable mussel habitat has been identified during the Site Visit.

The mussel survey should follow Protocol 2 in Catlin et al. (2018). Protocol 2 is the recommended monitoring method in most situations and provides a good estimate of the species density and size structure. This level of detail will help to ascertain the size of the population and the extent of relocation site(s) and transportation methods that may be required.

In brief, this Protocol involves the following:

- Visual / hand searches of the stream bed by 2-4 people.
- The use of underwater viewers.
- Collection of habitat data.
- An initial 30-minute survey for Presence/absence.
- If mussels present, a more thorough survey using visual and hand search methods.
- Recording of individual mussel data such as species, length, width and depth.

Dependent on the length of stream reclamation, multiple surveys may need to be undertaken. The mussel survey will be used to inform the Relocation Event Fish Plan and if mussel salvage is required.

11.3.2 Relocation Event Fish Salvage and Relocation Plan

Prior to each reclamation / relocation event a Relocation Event Fish Salvage and Relocation Plan should be prepared. The WNP requires reclamation of stream reaches with different fauna communities and habitat features. Not all methods proposed within this Plan may be applicable at the time of salvage and relocation. The exact timing and staging of streamworks is currently unknown and stream habitats may change over time.

The Relocation Event Fish Salvage and Relocation Plan will detail fish, kōura and mussel salvage and relocation methods for the individual relocation events. This Plan shall detail as a minimum the following:

- Proposed location(s), including GPS locations, and length of stream to be reclaimed.
- Proposed streamworks and the use of any diversions, temporary or permanent.
- Staging of any salvage.
- Site preparation methods.
- Presence of mussels and if there is a requirement of a mussel survey.
- Kōura, mussel and fish salvage methods.
- Dewatering method.
- Details of relocation site(s), including general habitat, suitability for expected species, GPS locations and access.
- Storage and transport methods.
- Details of personnel implementing the plan and their associated experience and any permits required to undertake the work.
- Reporting requirements, including recording of the species and abundance of all fauna relocated or euthanised.

Relocation events within a Relocation Event Fish Salvage and Relocation Plan may include different stream reaches if the fish salvage and relocation operation is undertaken concurrently or consecutively. However, the bulleted above must be detailed within the Plan for each individual streamworks reach.

Relocation Event Fish Salvage and Relocation Plans must be consistent with this Aquatic Fauna Salvage and Relocation Plan.

Each Relocation Event Fish Salvage and Relocation Plan must be approved by Waikato Regional Council prior to implementation.

11.4 FISH, KŌURA AND MUSSEL SALVAGE METHODOLOGY

11.4.1 Overview

Prior to starting any instream works, or construction activities that may affect watercourses aquatic fauna salvage must be undertaken. To successfully salvage as many fish, kōura and mussels from watercourses as practicable a combination of whakaweku, visual searches, netting, electric fishing, and channel dewatering are likely to be required. The best combination of methods for each stream reach will be determined prior to streamworks by the lead freshwater ecologist dependent on the habitat present at the time of salvage. However, each fish salvage operation should plan to include the following:

- Site preparation (including exclusion nets);
- Tau Kōura / Kōura Salvage (whakaweku);
- Visual searches for mussels;
- Set-nets for fish (fyke and Gees minnow);
- Electric fishing for fish; and
- Stream dewatering.

The detail of each stage is further outlined below.

The project freshwater ecologist must be given as much notice of upcoming streamworks as possible. The successful implementation of this Plan is weather dependent and resource heavy and requires as much lead in time as possible. The execution of the Plan should be as close as practicable to the proposed streamworks, preferably finishing within 48 hours of streamworks, to limit the possibly of fish species re-entering the watercourse. The Plan should not be implemented during a time of high, or predicted high rainfall and weather forecasts, and stream water levels should be monitored regularly.

The methods described below are considered approved and appropriate practice for fish, kōura and mussel salvage respectively. The final method will be determined following a site visit. The plan must be implemented by a suitably qualified freshwater ecologist(s) who has the experience and associated permits and approvals required to safely undertake the work.

11.4.2 Salvage Timing

The successful implementation of the Plan is dependent on weather and the staging of the Project associated streamworks. Generally, water levels within streams are lower during summer months and there is a reduced frequency of high rainfall events. This makes it easier to navigate streams and reduces the chance of damage to the exclusion nets. Any streams

that are intermittent may also be dry during summer months, reducing the potential effects on fish.

The Project Freshwater Ecologist shall consult with the Project Team to plan the staging and sequence for work.

11.4.3 Site Preparation

Prior to the start of fishing the reach must be isolated upstream and downstream to prevent the movement of fish species into or out of the reach. This can be created through the installation of fish exclusion nets, or by bunding the upstream and downstream extents using earth or large metal plates. The final method will depend on the stream and the water depth at the time of implementing the Plan.

11.4.3.1 Fish Exclusion Nets

Fish exclusion nets can be installed by a suitably qualified and experienced ecologist prior to fishing. A fish exclusion net must be installed at the upstream and downstream extent of the proposed streamworks. The fish exclusion net prevents the movement of fish, while still allowing the flow of water. When installing a fish exclusion net, it's construction should include:

- Waratahs at 0.5m intervals to withstand potential high flows.
- Permeable mesh with aperture size less than 5 mm.
- Extra deep footing (400 mm below bed and 400 mm above water surface) that is secured to the streambed using rocks.
- Footings at each end extended 400 mm into bank and pinned.

The nets should be inspected daily to ensure they have not failed or been damaged. If high rainfall is forecast while the nets are in place, the nets must be inspected prior to and following the rainfall event. If water has overtopped the nets, or they have been damaged, a decision will need to be made by the Project Freshwater Ecologist about whether the salvage operation will need to start-again. This will be dependent on the stage at which the salvage operation is at and the extent of the fish exclusion breach.

11.4.3.2 Bunding

If the stream is too deep or otherwise unsuitable for fish exclusion nets, then earth bund/metal plates may be used. The bund or metal plates must be of sufficient size to prevent any water breaching over, or around.

Dependent on the duration of fishing, water may need to be pumped past the area of fishing, or it may need to be pumped into and out of the exclusion area to keep cool, oxygenated

water flowing within the channel. The pump must be fitted with a fish exclusion rose, or covered in shade cloth with an aperture of no more than 5 mm. This will be decided between the Project Freshwater Ecologist and the Project Team and will depend on the stream habitat, season, weather and associated streamworks.

Water levels of the bund should be inspected daily to ensure water has not breached the bund. If water has overtopped the bund, or have been damaged, a decision will need to be made by the Project Freshwater Ecologist about whether the salvage operation will need to start again.

This will be dependent on the stage at which the salvage operation is at and the extent of the breach.

11.4.4 Tau Kōura / Kōura Salvage

The Tau Kōura (traditional Māori kōura harvest method) of using whakaweku has been adapted and undertaken in conjunction with modern practises to capture kōura. Tau kōura works by placing whakaweku (bundles of bracken fern *Pteridium esculentum*) on the stream bed that kōura then colonise. A variation of this will be utilised where individual fern bundles are used.

Tau Kōura varied methods are:

- Individual whakaweku are to be constructed using bracken fern fronds that have been cut off near the ground and bound together using cable ties (See Appendix 11A) for full method).
- Individual whakaweku are to be anchored to the streambed or streambank, in line with water flow. It should be set in water 0.2 m or deeper (Kusabs et al., 2018), and can include pools, runs, or be placed along the stream edge.
- The whakaweku should be left in place for a minimum of two weeks prior to sampling, ideally up to four weeks.
- When retrieving the whakaweku a large stop net is to be placed downstream of, then used to wrap and lift the whakaweku to the streambank to prevent the loss of any kōura.
- The kōura should then be placed in a large fish bin with an aquarium air pump. Some of the whakaweku fronds should be placed in the fish bin to provide cover.

Where possible kōura should be transported via vehicles in fish bins or lidded buckets, at low speed to the translocation site. Kōura should be placed into pools or areas of slow flow at the translocation site(s). Preference should be given to areas with abundant habitat cover (large wood, undercut banks, cobbles, boulders) to provide shelter to the newly introduced individuals.

Where possible, exclusion nets should be installed prior to the placement of whakaweku and stay in place for 2-4 weeks prior to sampling. The whakaweku should be inspected following any periods of high rainfall, to ensure they are still in place. Sampling should only occur once exclusion nets or bunds are in place.

The other fishing methods should commence once the whakaweku have been sampled. Whakaweku are to be re-deployed during netting methods and checked daily (after their initial 2-4 week soak). However, they should be removed from the stream prior to electrofishing.

Whakaweku also can catch smaller fish such as elver (juvenile *Anguilla spp.*), juvenile *Galaxias* species and bullies. These should also be harvested from the whakaweku and relocated with any kōura.

These methods may need to be adapted to the streams depending on factors such as debris, macrophyte cover, water depth, etc. This will be confirmed by the Project Freshwater Ecologist.

11.4.5 Freshwater Mussel Salvage

Freshwater mussels (Kākahi, or Kāeo), are common and widespread throughout New Zealand with two species present within the Waikato Region: *Echyridella menziesii and Echyridella aucklandica*. Kākahi are free-living and semi-burrow themselves into substrates but can also move around using their muscular foot (Catlin et al, 2018.). No mussel specific surveys have been undertaken within the watercourses of the WNP. However, they may be present and accordingly salvage actions must be undertaken.

Freshwater mussel salvage should be undertaken prior any kōura or fish salvage, either netting or electric fishing (mussel salvage could be undertaken at the same time as the installation of whakaweku). The mussels must be given time to settle into their translocation habitat prior to the translocation of any kōura or fish species.

Mussels are found buried into sandy/silty substates and are typically found along banks, in undercut areas, amongst macrophytes, within shaded areas and next to logs (Catlin et al.2018). The following methods should be used for salvage and are based upon those outlined in Catlin et al (2018).

- An underwater viewer should be used to view the stream bed.
- The entire streambed, where practicable, should be systematically visually searched, identifying mussels that are emerging from the streambed.
- If a mussel is found visually, remove if from the substrate and then undertake a tactile hand search of the surrounding area to 8 cm deep, to detect any buried mussels.

> The base and stalks of macrophytes should be inspected for any juvenile species.

> The entire length of stream to be reclaimed should be searched for mussels.

Mussel health should be recorded including species, any shell thickening or erosion, length. The presence of any dead shells (both sides must be present) should also be recorded.

To transport captured mussels McEwan (2022) recommends they are submerged in water, with consideration given to physical movement within the transportation vessel. It is also recommended that mussels be planted into the substrate at the relocation site, by gently pushing the umbo (shell origin) end into the sand/silt, orientated upwards, to half cover the mussel as outlined in Catlin et al. (Appendix 6) (further details in Appendix 11B). Planting the mussel into the substrate may reduce their risk of predation (McEwan, 2022).

11.4.6 Fish Salvage

11.4.6.1 Netting: Fyke and G-Minnows

Netting is to use a combination of baited fyke nets and G-Minnow traps. The total number of nets/traps will be dependent on the site and will be determined at the time of deployment.

Netting should follow the following method:

> Nets should be set at regular intervals within the exclusion channel. All nets should be baited and set with an 'air gap' and left overnight.

> Channels with high macrophyte growth may require the creation of 'capture pits'. These pits are large pits made in the channel using a digger. They create clear areas in the channel within which fyke nets can be set. They also provide refugia for fish during the final dewatering process allowing efficient capture.

> Nets should be checked the following morning. Any fish captured are to be identified and transferred to a large fish bin prior to relocation.

> If large numbers of fish are captured, then fish may need to be released prior to the checking of all nets to minimise time spent within the fish bins.

If fish are captured then the nets are to be inspected for any damage, rebaited and redeployed for consecutive nights, until the total catch is less than 20% of the first nights catch, up to a maximum of four nights. It is recommended that fish salvage commences on a Monday to enable four consecutive nights of salvage more easily, if required. If very high numbers of fish are still being captured after the fourth consecutive night, a decision will be made by the Project Freshwater Ecologist if further netting is required.

If no fish are captured within the nets, then the nets do not need to be re-deployed, and the netting component of the Plan is considered complete.

11.4.6.2 Electric Fishing

Following the completion of netting, or if netting is not suitable, then electrofishing should be undertaken. Electrofishing should only be undertaken by a suitably qualified freshwater ecologist who has necessary permits and approvals and the experience to use an electric fishing machine.

Electrofishing should be carried out as follows:

- All suitable areas within the exclusion channel should be electrofished using a NIWA Kainga EFM300 backpack fishing machine or similar.
- Three electrofishing passes are to be undertaken. If large numbers of fish are still being caught on the third pass then electrofishing shall continue until a capture rate of <20% off the first pass is achieved.
- If necessary, fish should be placed into a recovery bucket prior to being placed in larger fish bins, to allow the effects of the electrofishing machine to wear off.
- If large numbers of fish are captured, then fish may need to be released in between passes to minimise time spent within the fish bins.

All captured fish species shall be held in large fish bins filled with cool, oxygenated water. Large eel species should be separated from smaller fish species. Elvers and fish species may be held together. Further details of storage and transport is provided in Section 3.9.

During fish salvage operations it is possible that additional kōura may be captured. If this occurs, then kōura should be held separately from other fish species.

11.4.6.3 Dewatering

Following the completion of netting and/or electrofishing then the channel can be dewatered. The following methods should be followed:

- Dewatering should occur as soon as practical following completion of fishing, to minimise the risk of fish exclusion barriers failing.
- The upstream source of water must be stopped. Depending on the type of streamworks to be undertaken, this may be through the blocking and diversion of the upstream reach to a new channel, or through pumping the water over and / or around the streamworks reach.
- If not already in place, an earth bund or a metal plate may be used to stop water entering the earthworks reach at the upstream and downstream ends. These must be placed within the fish exclusion nets. Similarly, if the water is to be pumped, the pump head must be within the fish exclusion nets to prevent any fish entering the pump.

- Once the source of water has been stopped then the reach will be allowed to sufficiently drain either naturally or through use of a pump. The specialist ecologist may require capture pits to be dug if they were not created earlier.

A suitably qualified and experienced freshwater ecologist must supervise the dewatering. A hand net should be used to capture any fish that are observed. If suitable, a single electrofishing pass may be undertaken within the channel or capture pits.

11.4.7 Storage and Transport

11.4.7.1 Mussels

During the salvage mussels shall be placed in fish bins or buckets of stream water, with an aquarium air pump, located in the shade. While contained the temperature and quality of the water must be monitored, with the water to be changed regularly. Mussels must be translocated to their new location on the day of salvage.

It is anticipated that mussels will be transported to their relocation site either through walking (generally through paddocks) or by driving (along roads or farm races). To transport the mussels, they should be placed in buckets of stream water, with an aquarium air pump. Where the transport to the relocation site may be over uneven ground, then stream vegetation may be placed in the buckets to reduce the occurrence of mussel shells abrading each other.

11.4.7.2 Kōura

Captured kōura are to be held in a large fish bin prior to relocation, but not in the same bin as fish. The fish bin will have an aquarium air pump, some vegetation and will be located in a shaded spot. While contained, kōura will be monitored for signs of stress, with water to be changed regularly.

It is anticipated that kōura will be transported to their relocation site either through walking (generally through paddocks) or by driving (along roads or farm races). To transport the kōura, they should be placed in buckets of stream water, with an aquarium air pump.

11.4.7.3 Fish

Any fish captured will be held in a large fish bin prior to relocation. The fish bin will have an aquarium air pump, some vegetation, and will be placed in a shaded spot. Whilst contained, fish will be monitored for signs of stress, with water to be changed regularly. Smaller fish species (e.g. Galaxiidae or Gobiidae species) are to be kept separate from eels. Kōura should be kept on their own. Large eels will be separated and kept within mesh bags within fish bins.

It is anticipated that fish will be transported to their relocation site either through walking (generally through paddocks) or by driving (along roads or farm races). It is not anticipated that the fish will need to be transported through dense bush or for long distances. Therefore fish will be transported in fish bins, or buckets. When transporting the bins or buckets to the relocation site the lids must be securely fastened. Where practicable, bins should be transported at low speeds to minimise the movement of water within the fish bins.

Fish must not be held overnight in fish bins.

11.4.8 Relocation Sites

Prior to the implementation of this Plan suitable relocation sites must be identified. Relocation sites should be as close as possible to the fish salvage site, ideally upstream or downstream. The relocation sites must contain suitable, stable habitats for the relocation species. A number of salvage sites might be needed to be identified if high number of fish species are anticipated. The location of relocation site should be recorded, and any access requirements should be arranged prior to implementing this Plan (see Figures ~~22~~ 25 and ~~23~~26).

- TB1 and tributaries and wetlands
  - Upper TB1 Stream
  - Upper reaches of TB1 tributaries
  - Lower TB1 Stream
  - Ohinemuri River
- Ruahorehore Stream and tributaries
  - Lower Ruahorehore Stream
  - Upper Ruahorehore Stream
  - Tributaries to Ruahorehore Stream

If no/not enough suitable habitat is available within the same catchment, then additional catchments must be as close as possible.

All potential relocation sites must be inspected prior to starting the salvage to ensure suitable is present.

Detail of the relocation site must be recorded including location, photos and a general habitat assessment.

11.4.9 Data capture

The species, size and general health of all species (including kōura and mussels) caught must be recorded. This includes native and non-native or pest species, alive or dead. Their relocation site must also be recorded.

The final methods undertaken for each implementation of the Plan must be recorded and provided within a summary report.

11.4.10 Biosecurity

Any pest fish species captured shall be humanely euthanised using AQUI-S solution and disposed of to landfill.

Two species of exotic freshwater clams (Corbicula) have been found in the Waikato Region and it is imperative to stop their spread. The two species, Corbicula fluminea and Corbicula australis have been given the legal status of an Unwanted Organism under the Biosecurity Act. Specific Controlled Area Notice's (CAN) are in force and have specific rules to follow for equipment that has been used within the area.

Any equipment used within the CAN area must follow the Check-Clean-Dry[5] requirements to ensure that the clam is not transferred. Of particular relevance to this Plan is the treatment of the absorbent material on fyke and hand nets. If these have been used in any CAN area, then they must be frozen overnight, or submerged in hot water (refer to Ministry of Primary Industries).

It is recommended that no nets or associated equipment that has been in a CAN area is used.

11.5 PERMITS AND APPROVAL

The Plan is to be implemented by a suitably qualified and experienced freshwater ecologist. Electrofishing should only be undertaken by an experienced operator who have their Electric Fishing Certification, as issued by the National Institute of Water and Atmospheric Research (or equivalent) and be familiar with using a NIWA Kainga300 Electrofishing machine. The following permits and approvals are required to undertake this work:[6]

> Department of Conservation Authority to operate and Electric Fishing Machine

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[5] https://www.mpi.govt.nz/outdoor-activities/boating-and-water-activities-preventing-the-spread-of-pests-weeds-and- diseases/check-clean-dry/

[6] The permits and approvals were required at the time of writing and may change prior to implementation of the plan.

- Fish & Game New Zealand Authority to take sports fish within the Auckland/Waikato Region.
- Fisheries New Zealand Special Permit / MPI Special Permit

All conditions specified within the above permits and approvals must be adhered to. Notably notification and reporting requirements must be undertaken within the specified timeframes therein.

11.6 REPORTING

Following the implementation of this Aquatic Fauna Salvage and Relocation Plan, a Summary Report will be prepared. For all species the following will be recorded:

- Date, time, location, and method of capture.
- Species, size and health.
- Location and basic habitat of release site.
- Details of species released at each site.

The results of any aquatic fauna captured will be uploaded into NIWA's Freshwater Fish Database. Results will also be provided to the Ministry of Primary Industries, Fish and Game and the Department of Conservation as a requirement of the required Permits.

Due to the large nature of the Project, it is likely that the Plan will be undertaken in stages across the WNP footprint. A summary report should be prepared for each area completed. The final report should incorporate results from all salvage operations undertaken.

11.7 MONITORING

Following the completion of any relocation events that result in the relocation of kōura or mussels, then ongoing monitoring of their population should be undertaken to assess the effectiveness of the relocation. Monitoring should be undertaken annually in autumn at each relocation site.

11.7.1 Mussel

Relocation mussel populations should be monitored at least one-, three- and five-years following relocation, allowing for monitoring surveys to be undertaken in autumn. Populations should be monitored using Protocol 2 detailed in Catlin et al. (2018) over a 50 m reach.

Detailed monitoring methods should be described in the Relocation Event Fish Salvage and Relocation Plan.

11.7.2 Kōura

Koura populations should be monitored at least one-, three- and five-years following relocation, allowing for monitoring surveys to be undertaken in autumn. Populations should be monitored over a 50 m reach. Monitoring should be undertaken using Tau Kōura and utilising whakaweku. Monitoring should include the abundance and size (orbit-carapace length) of individuals and note if any eggs were present.

Monitoring events should also undertake a general habitat assessment of the monitoring reach.

Detailed monitoring methods should be described in the Relocation Event Fish Salvage and Relocation Plan.

11.8 KEY PERFORMANCE INDICATORS

Commented [MD13]: Linked in to more clearly identify how it will be determined if management measures are functioning as they are intended to.

As detailed above, following the salvage and relocation of aquatic fauna (and the implementation of the Aquatic Fauna Salvage and Relocation Plan), a summary report(s) is to be prepared outlining the:

- Date, time, location, and method of capture.
- Species, size and health.
- Location and basic habitat of release site.
- Details of species released at each site.

The summary report is to be uploaded to NIWA's Freshwater Fish Database, and provided to the Ministry of Primary Industries, Fish and Game and the Department of Conservation.

Following the relocation of any kōura or mussels, the relocated population will be monitored to assess the effectiveness of the relocation. Such monitoring will occur 1 year, 3 years, and 5 years following relocation, with monitoring surveys to be undertaken in autumn.

In the instance that monitoring determines the effectiveness of relocation is not sufficient, the Project Freshwater Ecologist will review and amend the measures of the Aquatic Fauna Salvage and Relocation Plan as necessary.

~~11.8~~11.9 REFERENCES

Catlin, A., Collier, K., Pingram, M. and Hamer, M. 2018. Regional guidelines for ecological assessment of freshwater environments – standardised protocol for adult freshwater mussel monitoring in wadeable streams. Waikato Regional Council Technical Report 2016/23.

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Kusabs, I.A., Hicks, B.J., Quinn, J.M., Perry, W.L., Whaanga, H. 2018. Evaluation of a traditional Māori harvesting method for sampling kōura (freshwater crayfish, Paranephrops planifrons)and toi toi (bully, Gobiomorphus spp.) populations in two New Zealand streams. New Zealand Journal of Marine and Freshwater Research. Volume 52 (4), 603-625.

~~11.9~~11.10 APPENDIX 11A: TAU KŌURA METHODS

The below methods are taken from NIWA (2024).

Tau Kōura is a traditional method used for harvesting Kōura and has commonly been used in the Te Arawa and Taupō lakes, where kōura are abundant. A variation of tau kōura which makes use of individual fern bundles is also used to harvest kōura and small fish (e.g. elvers and whitebait) in streams, rivers and the shallow shoreline areas of lakes, ponds and wetlands. These fern bundles bundles are known as whakaweku in the Te Arawa and Taupō districts, and as koere and taruke in other areas (NIWA, 20242).

~~11.9.1~~11.10.1 Whakaweku construction

Collect bracken fern (*Pteridium esculentum*) fronds by cutting them off near ground level. This leaves the rhizome intact so that the fern regrows quickly.

Construct bundles of about 10-12 fronds by binding their stems together. Using strong plastic cable ties, adjust the fronds so that they form an open bunch, and cut the ends off the fern bundles to make a “handle”

Figure 2727~~2824~~: Constructing a whakaweku (fern bundle) for catching kōura: (a) collecting bracken fern, (b) binding 10-12 bracken fern fronds together using cable ties, and (c) a finished whakaweku ready for use.

~~11.9.2~~11.10.2 Where to put your whakaweku

The individual whakaweku should be anchored on the streambed and positioned in line with stream flow. You can use a rope tied to the whakaweku to anchor the whakaweku to the bank or waratah. The whakaweku (once water-logged) is usually kept in position by its own weight in areas of low current velocity. In faster flows, or in deeper water, you may need to add weight (e.g., rocks) to the whakaweku or attach it to a waratah to anchor it in the desired location.

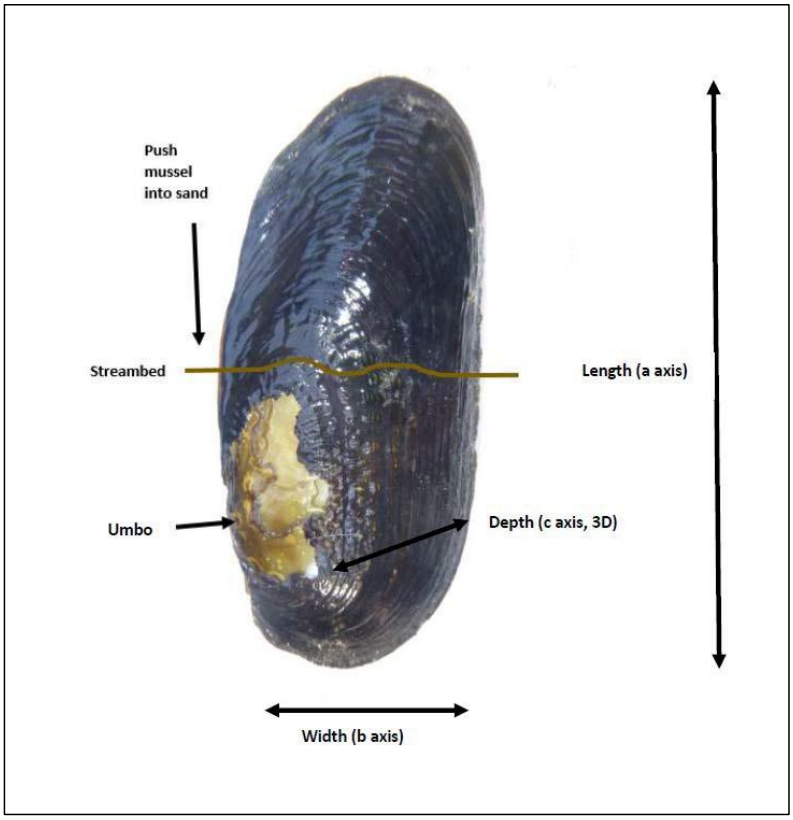
You can set whakaweku anywhere in a stream where the water depth is greater than about 50 cm, including in deep pools, beneath undercut banks or mid-stream. The whakaweku work even if they are not fully submerged in water.

Figure ~~28282925~~: Whakaweku set in a small stream

~~11.10~~11.11 APPENDIX 11B: MUSSEL TRANSLOCATION

The below information is taken from Catlin et al. (2018).

All mussels have an umbo, or shell origin - it is usually obvious as the shell will be eroded around it. Return mussels into the substrate by gently *pushing* the umbo end down into the sand/silt to half cover the mussel. It is important to put the correct end downward, because their siphons (used for filter-feeding) are located inside the top of the shell if positioned like the photo), and need to be oriented upward to filter-feed the water column. Mussels in streams need to be embedded so that they can maintain their position in suitable habitat and not become "washed out" when flows increase.



Echyridella menziesii	*Echyridella aucklandica*
Curved outline (usually) to top of shell (i.e., the dorsal edge) – often the shell outline is quite round.	Dorsal and ventral shell margins are parallel. Mussels often appear quite tubular (i.e., long and thin, rather than round).
	Some large mussels can be "bent", with a concave ventral margin (see top picture).
Growth lines curved up to 80mm	Growth lines up to 80mm are more or less parallel to dorsal and ventral margins
Weak nodules / ridges can be present	Nodules / ridges often obvious on upper (dorsal) part of shell
Maximum length is usually 80 mm, less commonly found 90-100 mm in length,	Generally grows to a larger size than *E. menziesii* and often >90 mm long.
Can be either brown or greenish in colour – colour does not distinguish the species	
Shells of both species can have no erosion or severe erosion and deformation	

PART K: STREAM DIVERSION AND DEVELOPMENT PLAN

Commented [MD14]: This was previously referenced in the ELMP, but not contained within it. It has been linked into the ELMP for consistency in approach.

12. STREAM DIVERSION AND DEVELOPMENT PLAN

12.1 OVERVIEW

The new tailings storage facility (TSF3), and two new rock stacks (the Northern Rock Stack, NRS and Willows Rock Stack) are proposed over existing watercourses within the footprint of the WNP.

To offset a portion of this unavoidable impact, two ecological functional stream diversions are required totaling 2,765 m which will contribute to loss of stream habitat on the unnamed 'TB1' stream within the NRS due to the NRS Diversion, and the Ruahorehore Stream and tributaries within the TSF3 due to the TSF3 Diversion. The Stream Diversion and Development Plan (SDDP) sets out the principals of the stream diversions and development and only applies to stream diversion channels not clean water diversion channels.

The NRS Diversion will be 965 m and will discharge through a short section of an unnamed tributary and then into the Ohinemuri River. The TSF3 Diversion will be 1,800 m and will channel flows into the Ruahorehore Stream and into the Ohinemuri River.

12.2 EXISTING ECOLOGICAL VALUES

12.2.1 TB1 Stream / NRS Diversion

TB1 Stream is an existing formed diversion that was created from an earlier expansion of mining operations. The TB1 stream is located to the north of the Processing Plant and drains directly into the Ohinemuri River (Figure 29). There are several small tributaries to the east that flow in the TB1 stream that will also be reclaimed either in their entirety or within their lower reaches. The upstream source of water for TB1 will be unchanged for the NRS diversion, flowing from tributaries to the south-east and south.

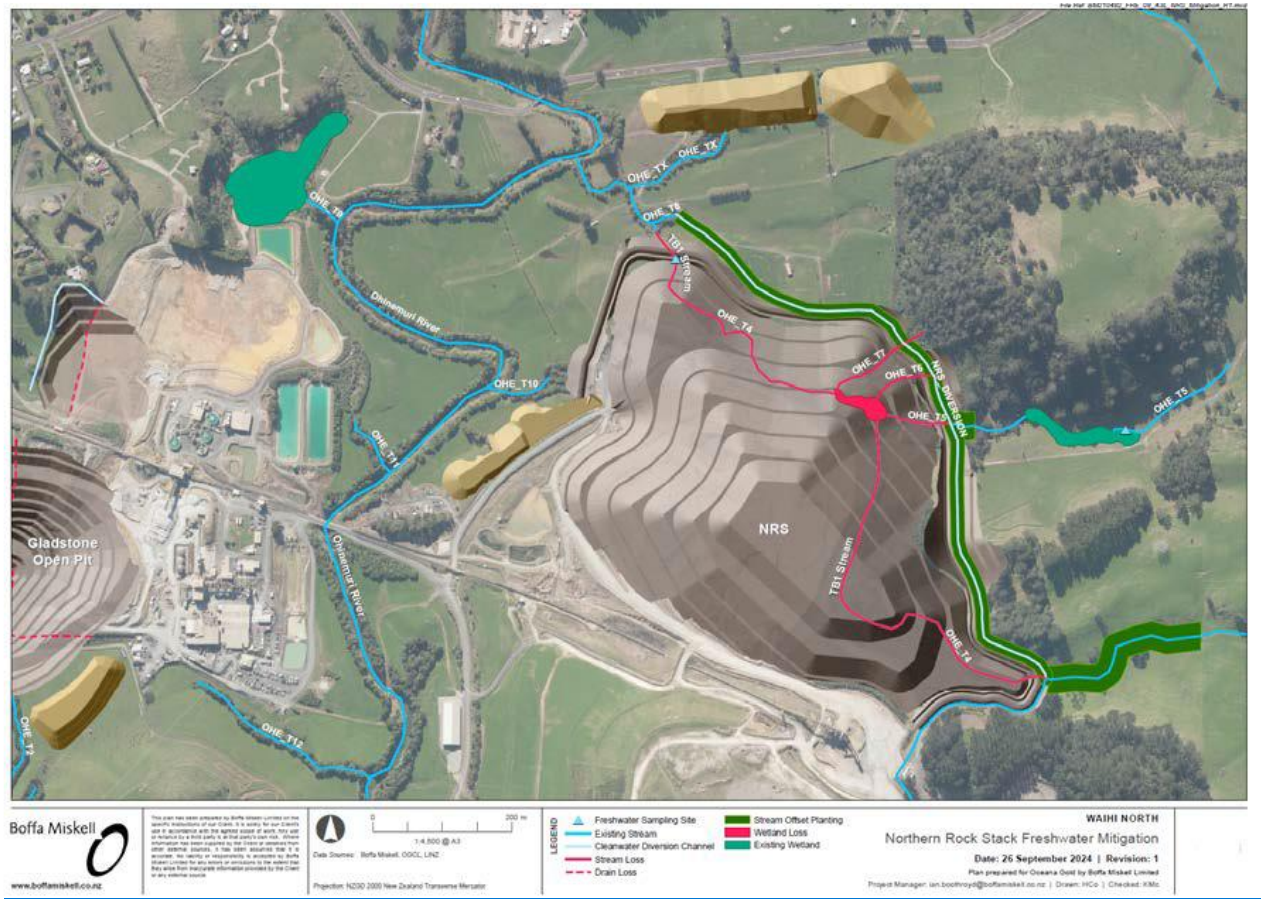


Figure 29: Map of the existing TB1 Stream and proposed NRS Diversion.

TB1 Stream has a reasonably wide (1.7 – 3.4 m) channel with a silt / sand substrate with the occasional small gravel present. Water flow was slow, with large and deep pools (up to 1.26 m deep) present along the reach and some areas of anoxic sediment. Riparian vegetation had been planted to approximately 10 m either side and fenced off from the surrounding grazed pasture. Native species such as flax, lemonwood, cabbage tree and mapou have been planted, amongst others. Giant umbrella sedge is abundant along the stream edge on both banks, with it extending out to several meters towards the downstream end of the reach. Small areas of active erosion were present with bank slumping more apparent at the downstream end of the reach. Macrophytes were rare along the survey reach, with small areas of *Nitella sp*. observed. Towards the lower reaches the stream channel shallowed and concentrated patches of watercress and water purslane (*Ludwigia palustris*) were present.

Macroinvertebrate communities were dominated by taxa pollution tolerant. However, a number of pollution sensitive EPT taxa were observed. The MCI-sb was indicative of 'fair' biotic function, with probable moderate pollution.

Fish taxa was poor, with only shortfin eel recorded (*Anguilla australis*).

TB1 Stream had an SEV score of 0.501, which is indicative of 'moderate' ecological functionality.

A wetland feature occurs within the TB1 stream corridor. This wetland has been formed from a former silt pond that was developed as part of the construction of the TSF2. This is not a 'natural inland wetland'[7] because it is a deliberately constructed wetland as part of a re-routed watercourse and arising from a former created silt pond. It will not be recreated as part of the NRS Diversion.

12.2.2 TSF3 Diversion / Ruahorehore Stream

The Ruahorehore Stream, associated tributaries and drainage canals are located to the east of the existing tailing storage facilities, south of the Processing Plant. The proposed TSF3 footprint will result in the loss of a section of the Ruahorehore Stream and associated tributaries, and a number of connected drainage canals (Figure 30). The headwaters of the Ruahorehore Tributary are located within a forested area and neighbouring grazing areas to the north. The flow from these headwaters will be maintained through the TSF3 diversion channel. A small area of the main stem of the Ruahorehore will be realigned at the downstream extent of the TSF3 diversion channel.

[7] NPS-FM Subpart 3, 3.21 Definitions relating to wetlands and rivers: natural inland wetland (b) a deliberately constructed wetland.

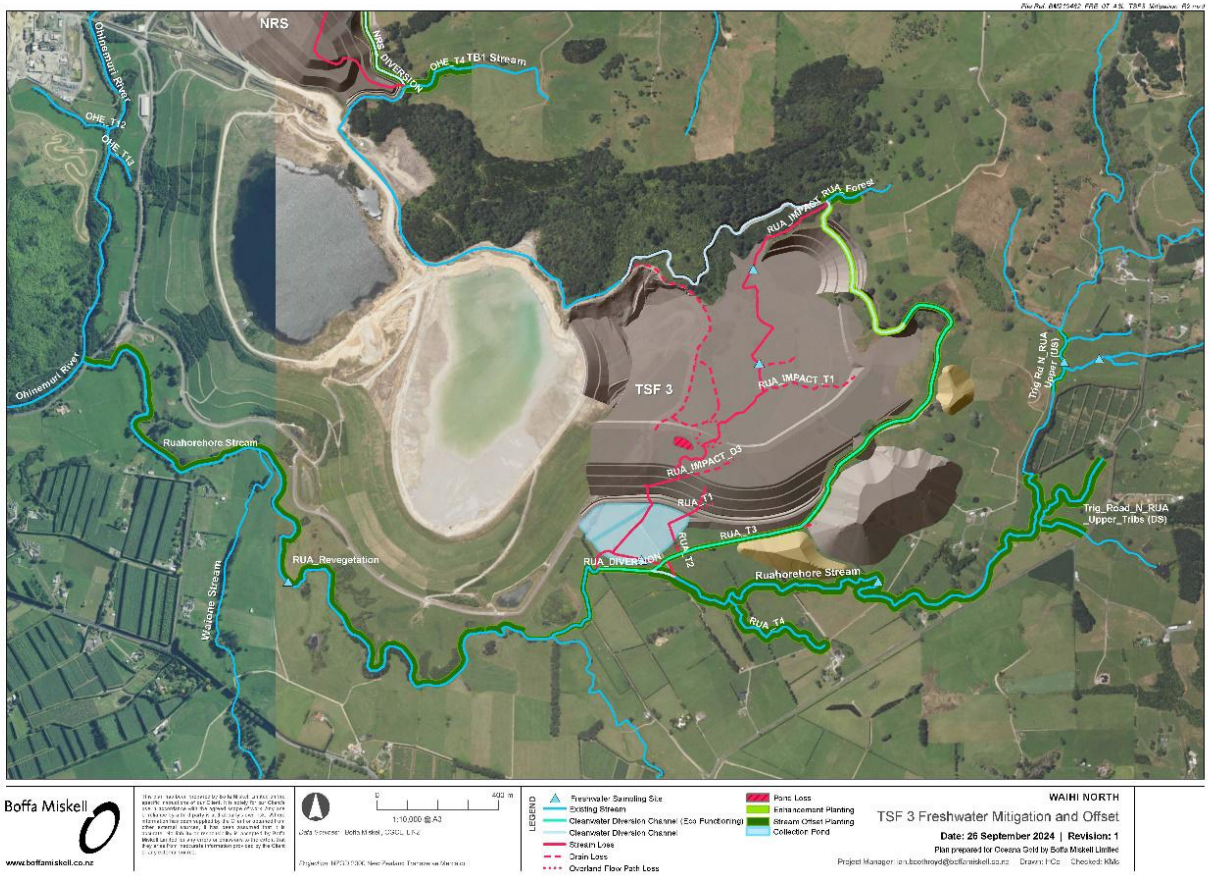


Figure 303031: Map of the existing Ruahorehore Stream and Tributaries, and proposed TSF3 Diversion.

The watercourses within the TSF3 footprint are generally characterised by an incised channel of varying width (0.17 - 3.3 m) and depth (0.2 - >1 m), and substrate comprised largely of silt / sand with occasional small gravels and bedrock present. Riparian vegetation is largely absent, with the occasional weedy shrub or hedging present. Bank slumping is evident along much of the stream length, with areas of pugging from stock also present. Macrophytes were often abundant, particularly along the stream edges including the emerged species willow weed and mercer grass (*Paspalum distichum*) and the submerged species *Elodea canadensis* and *Nitella sp*.

Macroinvertebrate communities were dominated by pollution tolerant species such as *Oxyethira* and the snail *Potamopyrgus antipodarum*. MCI-sb scores had a range of 74.1 – 110, with high scores seen at the upstream survey site.

Fish communities were comprised mainly of shortfin eel, with kōura, a common bully and a rainbow trout (*Oncorhynchus mykiss*) also recorded.

SEV-scores had a range of 0.435-0.532, which is indicative of 'moderate' ecological functionality.

12.3 DIVERSION DESIGN OBJECTIVES

The proposed stream diversions, NRS and TSF3, are to be ecologically functioning diversions that replicate the habitat and ecological functioning of a stream. These two diversions have been included within stream offset calculations and have minimum ecological functionality (via a predicted SEV score) to achieve.

The design of the stream diversions must be fit for purpose and ensure that stream ecological functions are maintained or improved on from the stream to be lost. The new diversion channels must provide appropriate aquatic habitat for fish, macroinvertebrates and plants, while conveying water. The below are a guideline for the design and construction of the diversion. Final detail design has not been undertaken but is to be consistent with the principals of this Plan.

12.3.1 Stream Channel

12.3.1.1 Channel Meander

The two diversion channels should mimic and improve upon, as much as practicable, the natural meanders of the section of stream being reclaimed.[8] The addition of boulders, submerged logs, etc. will be used to aid meander development and increase flow heterogeneity.

[8] Stream TB1 and Rurahorehore Stream; the diversion mimicking the stream in the catchment it is within.

12.3.1.2 Habitat Diversity and Channel Complexity

Hydrologic heterogeneity and instream habitat complexity can be improved upon through the creation of natural features such as runs, riffles and small and large pools. These features can be created utilising natural substrates such as rocks, logs and large boulders (See Figure 29 below). Both of the diversion channels are within catchments with a high loading of fine sediment, and these may become smothered with time. However, their presence increases stream heterogeneity and stability.

The extent of created habitat should be at a minimum consistent with the habitat present in the stream to be reclaimed and similar to neighbouring natural tributaries, with the final substrate present mimicking that naturally occurring in similar sized tributaries in the wider catchment.

A visual survey of the existing stream should be undertaken prior to the design of the diversion channel by the Project Freshwater Ecologist and the relevant designer/engineer to ascertain the correct ratios for channel complexity and bed material.[9] The channel complexity and availability will 'naturalise' over time as the new diversion channel becomes established.

The channel design must create a low-flow, or baseflow, channel, a bank full channel and a floodplain area (Figure 29). A low flow channel aims to maintain flowing water as much as practicable during dry conditions. This provides a refuge for fish and for fish movement, at least to extend a period of habitat availability should dry conditions persist.

12.3.1.3 Stream depth, wetted width and velocity

Stream depth and wetted width affect the total area of habitat that can be utilised by aquatic biota, and the volume of water conveyed during normal flows. Stream width and depth should mimic that of the channel to be reclaimed. A survey of the existing stream should be undertaken prior to the design of the diversion channel by the Project Hydrologist to ascertain the stream depths, widths, velocities and capacity. The final design should mimic, where possible, these with some localised variation for the creation of large and small pools and meanders.

[9] This includes the ratios of riffe/run/pool/chute, and silt/sand/gravels/cobbles/boulders.

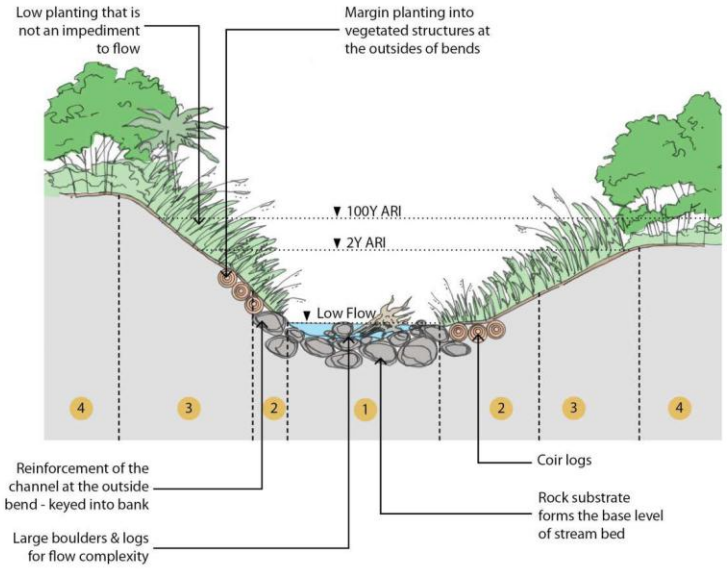


Figure 313132: *Example of a channel design, illustrating a low flow channel and the use of rocky substrates and woody debris.*

Water velocities can affect macroinvertebrates, fish and macrophyte establishment as individual species have different flow preferences. The diversion channel should initially seek to replicate base flow velocities present in the existing channels. The use of channel features such as cascades can be created to help maintain desired flow rates. These features must maintain the relevant fish passage.

12.3.2 Riparian Vegetation

Riparian vegetation is integral to the ecological success of the stream channel diversions. The stream profile must allow the planting of riparian vegetation close to and extending over the water surface to create ample stream edge habitat. This will provide shading to the water surface, detritus in the form of fallen leaves and potential habitat for fish and macroinvertebrate species.

All stream diversions are to be planted with a minimum of 10 m of riparian planting either side of the stream channel, with 20 m where surrounding land use allows. Exceptions to this

occur where mine operation infrastructure or land ownership issues arise. Riparian planting for diversion channels is detailed in the Stream Enhancement and Riparian Planting Plan.[10]

12.3.3 Assumed SEV Scores

The management of freshwater effects for the site is conceived as a wholly integrated 'package' that encompasses all aspects of mitigation. As part of this package the Stream Ecological Valuation (SEV) and associated Environmental Compensation Ratio (ECR) assessments were used to inform the mitigation package. Therefore stream diversions have an 'assumed'[11] SEV score that informs the overall quantum of stream mitigation (both diversion and riparian restoration) that is required. The SEV score incorporates a set of attributes that, overall, need to be met in order to achieve the predicted SEV score, and consequently the overall mitigation quantum. Further details of the SEV are given in Appendix 12A.

Each site has an assumed SEV score, that should be met by 7 years post-livening. Other key attributes for the mitigation are the assumed wetted widths and proposed lengths of the diversions.

12.3.3.1 NRS Diversion

The assumed SEV score the NRS diversion is 0.673. Some other key scores used within the SEV ECR and overall quantum calculations, that must be met by the design include:

- Average wetted width of 1.5 m.
- Total diversion channel length of 965 m.
- Riparian planting to a minimum average of 10m width both sides.
- Shade from riparian planting to average of 71-90%.

The NRS diversion channel will have the same water source as it does currently and will continue to discharge into the lower reaches of TB1 Stream and out into the Ohinemuri River.

Existing tributaries to the east of the NRS diversion channel will discharge into the diversion channel. However, many will be significantly shorter in length.

[10] Boffa Miskell, 2024. In preparation.

[11] SEVm-P score. As outlined in Storey et al (2011).

12.3.3.2 TSF3 Diversion

The assumed SEV score of the TSF3 diversion is 0.673. Some other key scores used within the SEV ECR and overall quantum calculations, that must be met by the design include:

- Average wetted width of 1.8 m.
- Total ecologically functional diversion channel length of 1,800 m.
- Riparian planting to a minimum average of 10m width both sides
- Shade from riparian planting to average of 71-90%.

The TSF3 diversion channel will have the same water source as it does currently, originating from a neighbouring paddock and flowing through an area of regenerating native bush, maintain connection between the lower Ruahorehore Stream and the forested headwaters of its tributary.

The diversion channel is not anticipated to be 'ecologically functional' in the upper reaches but will still enable fish passage for Anguilliforms and some climbers up into the upper reaches of the Ruahorehore Tributary.

12.4 CONSTRUCTION METHODOLOGY

12.4.1 Construction Principles

The final construction method will be subject to the final design of the diversion channels. Below are some general principles for construction.

- The stream diversion channel should be constructed offline and prior to any instream works within the channel to be reclaimed.
- Once the construction of the diversion channel is complete, it should be inspected by the Project Freshwater Ecologist to ensure ecological principals have been integrated.
- Prior to livening of the channel, a fish salvage shall be undertaken within the existing channel to be reclaimed. The details of the salvage are detailed in the Freshwater Fauna Salvage and Relocation Plan. Implementation will reduce any incidental mortality of native fish species

12.5 FISH PASSAGE

12.5.1 Objectives

The National Policy Statement for Freshwater Management (MfE, 2024; NPS-FM) sets out fish passage objectives, in particular specifying that *"The passage of fish is maintained, or is*

improved, by instream structures, except where it is desirable to prevent the passage of some fish species in order to protect desired fish species, their life stages, or their habitats."

The stream diversion channels that are created must enable fish passage for native climbing and swimming species, where appropriate (Table 37). Fish communities were surveyed and were generally depauperate across all sites, with the below species identified:

- TB1 diversion: at a minimum it should enable passage of Anguilliforms along its length, with passage for climbers and swimmers within the lower reaches.
- TSF3 diversion: at a minimum the lower, ecologically functional, reaches need to enable the passage of swimming fish. The upper, steeper, reaches of the diversion should enable the passage of climbers and Anguilliforms.

Table 37: Swimming ability classification of some New Zealand Freshwater fish species (Boubée et al.,1999).

Swimming ability classification	Species
Anguilliforms: These fish are able to worm their way through interstices in stones or vegetation either in or out of water. They can respire atmospheric oxygen if their skin remains damp.	Shortfinned and longfinned eels, and to some extent juvenile kokopu and koaro. Torrentfish may also fit into this category, but they need to remain submerged at all times.
Climbers: These species climb the wetted margins of waterfalls, rapids and spillways. They adhere to the substrate using the surface tension and can have roughened "sucker like" pectoral and pelvic fins or even a sucking mouth (lamprey). The freshwater shrimp, a diadromous native crustacean, is an excellent climber.	Lamprey, elvers, juvenile kokopu, koaro and shrimp. To a limited extent juvenile common and redfinned bullies.
Jumpers: Able to leap using the waves at waterfalls and rapids. As water velocity increases it becomes energy saving for these fish to jump over the obstacle.	Trout, salmon, and possibly (on a scale of 20–50 mm) smelt and inanga.
Swimmers: Fish that usually swim around obstacles. They rely on areas of low velocity to rest and reduce lactic acid build-up with intermittent "burst" type anaerobic activity to get past high velocity areas.	Inanga, smelt, and grey mullet.

12.5.2 Trout Fishery

The Ohinemuri River is classified as a significant trout fishery and there are important trout spawning tributary streams (including the Mataura Stream) as well as streams providing habitat for juvenile trout populations (including the Ruahorehore Stream). A juvenile rainbow trout was captured.

As stipulated above, the design of the TSF3 diversion must allow the passage of trout within the lower reaches. Trout are a swimming species and have no ability to climb, unlike many native species. The upper reaches of the Ruahorehore Stream naturally impeded the passage upstream of trout and the diversion channel should replicate this, with the passage of trout into the upper reaches considered undesirable.

12.6 ECOLOGICAL COLONISATION

The diversion channel is a new stream channel and as such, upon livening will be devoid of any aquatic life. Both the NRS and the TSF3 diversions have source populations of macroinvertebrate and fish species both upstream (within the forested reaches) and downstream. Colonisation of the diversion channels may occur at different rates, and it make take several weeks for aquatic communities to establish. Studies on recolonisation of New Zealand streams following flood events generally show that it takes some 4-8 weeks for macroinvertebrate communities to establish. The fauna and flora that establish in the diversion channels are expected to be similar to these source populations.

The exception being that juvenile trout have previously been captured in the lower reaches of the Ruahorehore, but these are not expected to populate the upper reaches of the TSF3 Diversion.

12.7 MONITORING

12.7.1 Pre-Livening Monitoring

Prior to the livening of the diversion channel an inspection should be undertaken by the Project Freshwater Ecologist and the relevant designer/engineer. The inspection must ensure that the stream and channel design meet the ecological objectives of this Plan.

12.7.2 Post-Livening Monitoring

Immediately following the livening of the diversion channel an inspection should be undertaken by the Project Freshwater Ecologist and the relevant designer/engineer. The inspection must ensure that the stream and channel design meet the ecological objectives of this Plan. In particular, fish passage along the length of the channel should be inspected. Any issues identified must be brought to the attention of the stream design and construction team, and a remedy found.

The diversion channels should undergo routine monitoring in the first year following construction to ensure stability of the channel.

12.7.3 Riparian Vegetation Monitoring

Riparian vegetation monitoring is to be undertaken to ensure the health and success of the riparian planting. The success of the planting directly impacts the success of the stream diversion. The details of the riparian planting monitoring are outlined in the Stream Enhancement and Riparian Planting Plan.

12.7.4 Stream Ecological Valuation Monitoring

Following completion of the stream diversion and associated riparian planting, the channel is to be monitored for ecological functionality to ensure it is meeting it's offset mitigation objectives. A Stream Ecological Valuation (SEV) survey must be undertaken at each of the diversion channels. The SEV is to be carried out in approximately the middle of the diversion, with the same location surveyed each monitoring round.

The SEV surveys should be undertaken at the diversion sites at 1, 3 and 5 years following the completion of riparian planting. SEV scores should be no less than 80% of the predicted SEV Score by year 5 (SEVm-P). Monitoring shall continue until the target SEV score has been achieved, or until a maximum of 5 years. Regular monitoring prior to the 7-year target will allow any major issues to be identified and remedied earlier If the SEV score has not been achieved by 5 years, then a Stream Enhancement and Riparian Remedial Plan shall be prepared outlining ways in which to achieve the predicted score. This should be submitted to Council for approval.

- NRS Diversion Target SEV: 0.673
- TSF3 Diversion Target SEV: 0.673

The monitoring should be undertaken by a suitably qualified and experienced freshwater ecologist who is experienced at undertaking SEV surveys.

12.8 REPORTING

The consent holder must submit a report to the Consent Authority annually by 30 June each year, detailing the following:

- The extent and location, if any, of stream diversion channel construction in the previous 12 months.
  - This should include the final construction drawings of the diversion channel.
- The extent and location, if any, of stream reclamation in the previous 12 months.
  - This should include the outcomes of any Freshwater Fauna Salvage undertaken.
- The results of the post-livening monitoring SEV surveys.

> This should include any management actions that may have been identified following the surveys.

12.9 KEY PERFORMANCE INDICATORS

The key performance indicators relating to stream diversion and development are set out in Section 12.7 of this Ecology and Landscape Management Plan comprising a mixture of visual surveys, inspections, and monitoring methods.

12.10 REFERENCES

Boubée, J., Jowett, I., Nichols, S., and Williams, E (1999). Fish Passage at Culverts: A review, with possible solutions for New Zealand indigenous species. NIWA, Department of Conservation.

12.11 APPENDIX 12A: SEV METHOD

12.11.1 Stream Ecological Valuation

The SEV is recommended by Auckland Council for providing an ecological valuation of streams and is increasingly being used outside of Auckland. The SEV uses a set of fourteen qualitative and quantitative variables to assess the integrity of stream ecological functions (Table 38).

Field work consists of a comprehensive assessment of the in-stream and riparian environment. This includes a fish survey, aquatic macroinvertebrate sampling and cross-sections of the stream to measure width, depth and substrate, as well as using qualitative parameters for reach-scale attributes

Table 38: Summary of the 14 ecological functions used to calculate the SEV score.

Hydraulic functions:	Biogeochemical functions:
Processes associated with water storage, movement and transport. • Natural flow regime • Floodplain effectiveness • Connectivity for species migrations • Natural connectivity to groundwater	Relates to the processing of minerals, particulates and water chemistry. • Water temperature control • Dissolved oxygen levels maintained • Organic matter input • In-stream particle retention • Decontamination of pollutants
Habitat provision:	**Biotic functions:**
The types, amount and quality of habitats that the stream reach provides for flora and fauna. • Fish spawning habitat • Habitat for aquatic fauna	The occurrences of diverse populations of native plants and animals that would normally be associated with the stream reach. • Fish fauna intact • Invertebrate fauna intact • Riparian vegetation intact

This data is analysed using a series of formulae in order to produce an SEV score of between 0-1, where a 0 is a stream with no ecological value and 1 is a pristine stream with maximum ecological value. Interpretation of SEV scores is given in Table 39 below.

Table 39: Interpretation of SEV scores (Adopted from Golder Associates, 2009).

Score	Category
0 - 0.40	Poor
0.41 – 0.60	Moderate
0.61 – 0.80	Good
0.81+	Excellent

12.11.2 Ecological Compensation Ratio

To calculate the amount of enhancement required to mitigate the impacts of streamworks An environmental compensation ratio (ECR) was calculated.

The environmental compensation ratio utilises the SEV score to calculate a ratio for the minimum area to be restored as mitigation for unavoidable stream loss. The ECR has the underlying principal of 'not net loss' and is based upon 'no net loss of area-weight stream function'. A minimum ratio of compensation of 1:1 is required.

The formula for calculating the ECR is as below:

- ECR = [(SEVi-P – SEVi-I)/(SEVm-P – SEVm-C)] x 1.5
- SEVi-C & SEVi-P are the current and potential SEV values respectively for the site to be impacted.
- SEVm-C & SEVm-P are the current and potential SEV values respectively for the site where environmental compensation is to be applied.
- SEVi-I is the predicted SEV value of the stream to be impacted, after impact.
- 1.5 is a multiplier.

The ECR calculation requires the prediction of a 'potential' and 'impact' SEV scores. The potential scores for impact sites assume that best practise enhancement works have been undertaken. The prediction of the impact scores assume that the proposed streamworks have been undertaken. The generally accepted SEV score for culverts is 0.2. The predicted potential and impact scores do not include biotic functions (invertebrate fauna intact and fish fauna intact) as they are too difficult to predict.

The ECR considers that environmental compensation ratios greater than 1 are valid because of:

- The ecological risk factors associated with the cumulative loss of streams and the steady change in areal distribution of high-quality stream reaches;
- The long time-lag before full benefits of environment compensation (i.e. from riparian planting) accrue to the mitigated sites; and

The overall difference between the expected and actual success of stream restoration methods.

PART L: STREAM ENHANCEMENT RIPARIAN PLANTING PLAN

Commented [MD15]: This was previously referenced in the ELMP, but not contained within it. It has been linked into the ELMP for consistency in approach.

13. STREAM ENHANCEMENT RIPARIAN PLANTING PLAN

13.1 OVERVIEW

The new tailings storage facility (TSF3), and two new rock stacks (the Northern Rock Stack, NRS and Willows Rock Stack) are proposed over existing watercourses within the footprint of the WNP. To mitigate the impacts on, and loss of watercourses, stream restoration by riparian planting is proposed along some 10,285 m of stream.

This purpose of this Plan is to out the principals for riparian planting.

13.2 QUANTUM REQUIRED

The impact on some watercourses within the footprint of works is unavoidable. Across the footprints of works, there is an overall expected loss of some 4,122 m of low to high value stream loss as well as some 9 m_2 of warm spring. This is to be offset with the creation of 10,285 m of stream diversion channels[1] and stream restoration. With the exception of the warm spring, the offset has been informed by an Ecological Compensation Ratio (ECR) and the outcome equates to an approximate 3:1 offset ratio (gain:loss).

The total quantum of stream enhancement and riparian planting includes a 'whole of project' assessment. Where possible, riparian planting has been proposed as close to the stream loss as possible, but this has not always been feasible. The loss of the warm spring within the Wharekirauponga Stream catchment and the headwater stream within the GOP, are not able to be mitigated within their respective catchments. Therefore, stream and enhancement and riparian planting are presented as a project total, not broken down into individual areas of stream loss. Further details of the stream loss are presented in the Freshwater Ecological Assessment (Boffa Miskell, 2025).

The areas of stream enhancement and riparian planting are shown in Figure 30, Figure 31 and Figure 32 below.

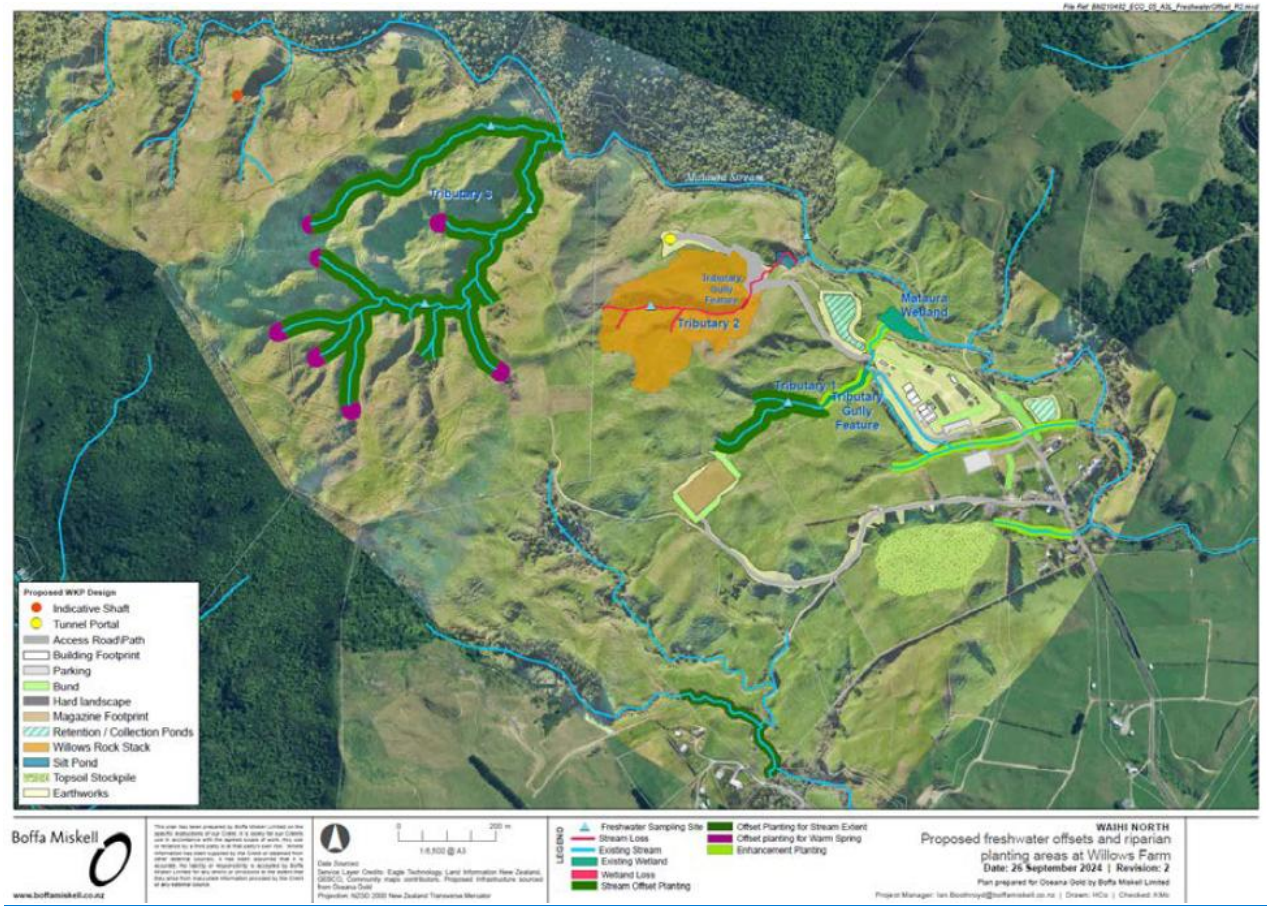


Figure ~~323233~~:- Map of 'Willows Farm' showing areas of Riparian Planting (Offset Planting).

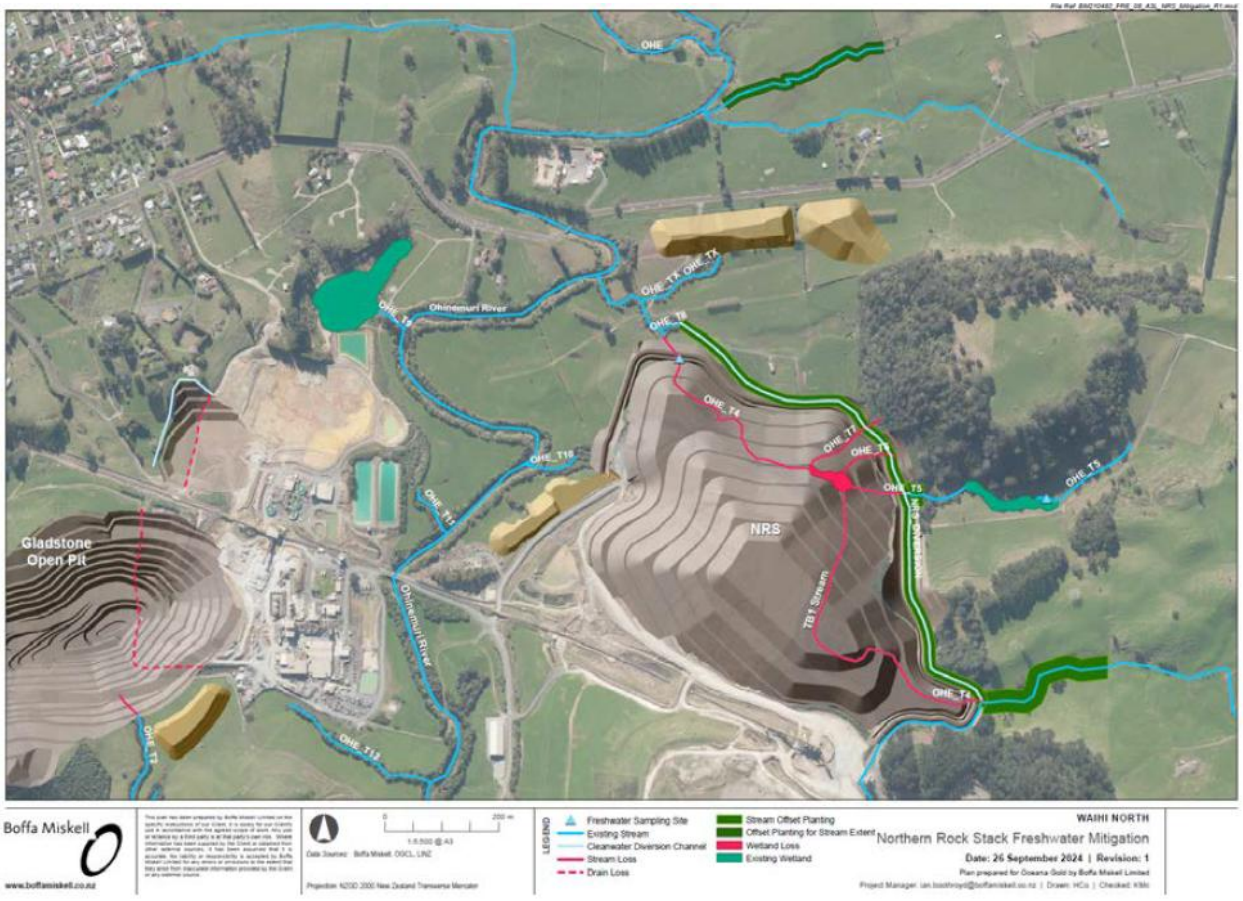


Figure ~~333~~334:- Map of the Northern Rock Stock area, showing areas of Riparian Planting (Offset Planting).

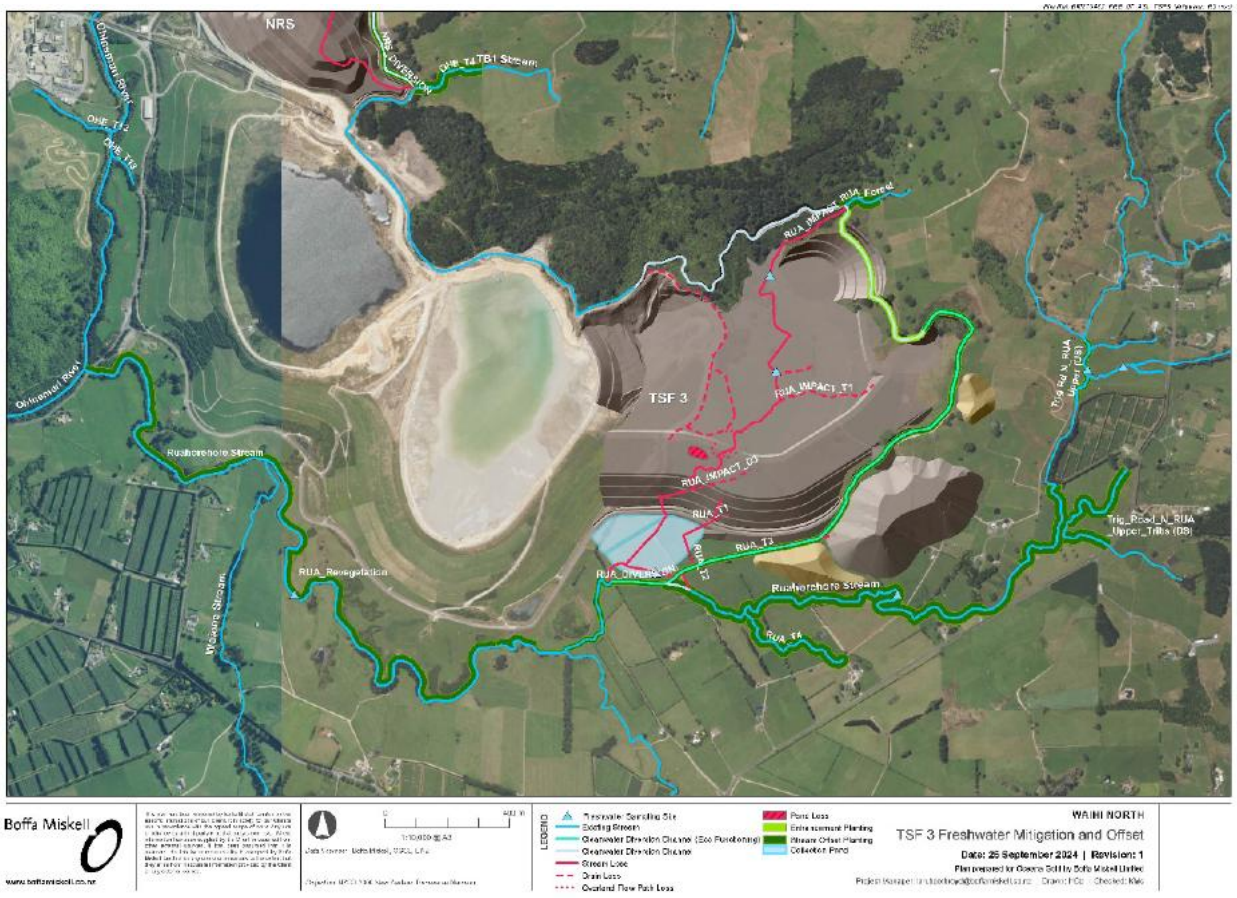


Figure 343435:- Map of the Tailings Storage Facility 3 area, showing areas of Riparian Planting (Offset and Enhancement)

13.3 TIMING

13.3.1 Project Timing

The WNP is a large project that will be undertaken in stages across many years. Similarly riparian planting will be undertaken within planting seasons across many years. Where practicable existing stream channels undergoing enhancement planting can be planted as soon as the wider project is consented, as there is no streamworks or earthworks required. Owing to the large amount of riparian planting required across the project, it is not practical to undertake it all prior to any stream reclamation.

The specific timing around the NRS and TSF3 diversion construction is unknown at this stage. Ideally the diversion channels will be created, and operational, prior to the reclamation of any stream channel. However, this may not be feasible.

13.3.2 Seasonal Timings

All planting should be undertaken during the planting season of April to September, inclusive. Planting should commence no later than one month following the completion of weed control. This will minimise the risk of weed re-infestations competing with native planting.

The planting of diversion channels is subject to the project staging and earthworks schedule and is further described in the Stream Diversion and Development Plan (Boffa Miskell 2025).

13.4 RIPARIAN PLANTING OBJECTIVES

The enhancement of streams through the use of riparian planting has a myriad of benefits for the ecological health of the stream (Figure 33), including:

- Improved water quality through the filtration of overland flow.
- Increased shade leading to reduced water temperatures and increased oxygen levels.
- Improved bank erosion control through stabilisation from plant roots.
- Improved woody debris and plant detritus within the stream channel for instream fauna.
- Increased instream habitat complexity through overhanging vegetation and inputs of woody debris.

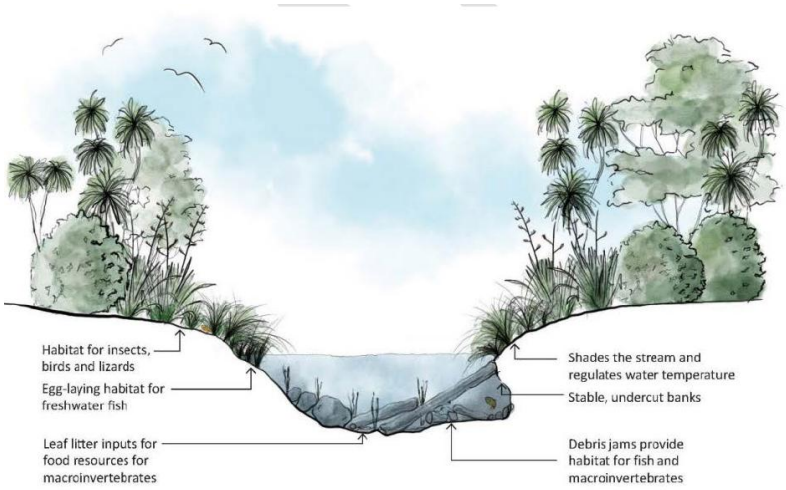


Figure ~~353536~~: Example of benefits of riparian planting to stream ecology (Boffa Miskell, 2021).

13.4.1 Planting Plans

A detailed Planting Plan, including a planting schedule and specification, must be prepared and must be consistent with this SERPP. The planting plan should include the all the areas identified in Figure 30, Figure 31 and Figure 32. The planting plans must be specific to each stream reach and its unique hydrological features and ecological function objectives.

The planting plan shall prioritise the use of pioneer species to allow successful competition with potential weed species while providing shade to streams. Detailed planting plans should consider species that provide suitable food sources for bird species and habitat for lizards and bird species.

A 10 metre riparian width, from the edge of the stream channel, is considered to be the minimum width to ensure self-maintenance of the riparian margin from invasive plant species. This 10m is to be the minimum width across riparian margins, with most margins to be planted to an average of 20 m with (See Figure 30-32).

All plants used should be eco-sourced from the Waihi ED, or an adjoining ED, to ensure they are well suited to the conditions. All plant specimens from the Myrtaceae family must be free of myrtle rust.

The riparian planting must be designed to achieve 70-90% shading of the stream channel, 7 years after the completion of planting of the stream reach. Therefore, the Planting Plan must include appropriate overhanging stream-edge and canopy species.

13.4.2 Site Preparation

The planting plan and associated specification will detail all required site preparations. Some general preparation steps are outlined below that the aforementioned must be consistent with.

13.4.2.1 Soil Conditions

The contractor should assess the ground and soil conditions prior to any planting, and where they consider that the existing topsoil is deficient, they shall tell the Project representative and ascertain if any remedial action is required.

13.4.2.2 Clearing

Areas to be planted shall be cleared of any weed species and inorganic debris. Native species are to be retained where possible.

13.4.2.3 Herbicide

All areas are to be planted with established weeds shall be sprayed with a minimum of 2 applications of approved herbicide, commencing at least 6 weeks prior to planting. Each application shall be at least one week apart. The last application should be applied at least two weeks prior to clearing the ground.

If weeds are well-established then existing weed growth may require manual trimming/removal prior to the herbicide application. Vegetation over 0.2m should be removed or mown/mulched prior to herbicide application.

13.4.2.4 Manual Removal

The cutting of large trees may be required, particularly if willow species are present. All stumps within 5m of streams shall remain in the ground, with the bole of the tree to be cut down to just above the ground level.

13.4.3 Planting

Prior to any planting, the contractor shall set out the plants according to the planting schedule. The Project Landscape Architect should then confirm the set out of the plants, prior to planting. As much notice as possible should be given of any upcoming inspections.

13.4.4 Fencing

All stream enhancement and riparian planting that is located within rural areas shall be fenced to prevent livestock access. It is preferable to install a higher quality fence as it is likely to have fewer maintenance issues.

13.5 ON-GOING MAINTENANCE

13.5.1 Weed Control

Pest plants and weeds should be controlled regularly for the year following planting. All planted areas shall be kept weed free to the extent that perennial weed species are eradicated, and annual weed species are well controlled. Additional weed control may be required in spring.

Spraying should be undertaken using an approved herbicide and should be spot sprayed using a protective spray nozzle/cone to avoid overspray. The maintenance schedule for weed control may differ for each area and will be confirmed in the Planting Specification.

13.5.2 Plant Health

For the year following planting, maintenance of plant health is to be undertaken and may include watering, insect and disease control, pruning, mulching and other accepted horticultural operations to ensure normal and healthy plant establishment and growth. The maintenance schedule may differ for each area and will be confirmed in the Planting Specification.

In addition to routine maintenance, monitoring should be undertaken following significant storm events or during periods of prolonged high or low rainfall.

13.5.3 Planting Success

The monitoring and maintenance of success of planted species is key to ensuring success of the riparian planting. All plants shall be monitored and maintained in accordance with the provisions in Section 4.6 of this ELMP.

Maintenance will include the replacement of any dead or dying planted plants and weed control if required. At the end of the five-year monitoring period a plant survival rate of 90% must be achieved. If this has not occurred, then further replacement planting, and weed control must be undertaken until the 90% survival rate is achieved.

13.6 PEST ANIMAL CONTROL

Pest animal control should be implemented following the completion of planting to ensure the success of the planting. Where there is a risk of the plants being pulled out, by species such as pukekos, then wire staples should be installed around the root balls of plants.

A Pest Management Plan is in preparation that will describe methods for the management of pest animal species within riparian margins.

13.7 MONITORING OF PLANTING SUCCESS

Monitoring of the successful establishment of the riparian planting for the Freshwater Ecology Offset Monitoring should be undertaken following the five-year maintenance and monitoring plan by a suitably qualified freshwater ecologist.

Riparian planting should achieve at least 70% canopy cover or 70% stream surface shading. An exception to this is any planting on the Ohinemuri River, as the large width of the river prevents this being achieved. Planting alongside the Ohinemuri River should achieve the 90% plant survival rate with obvious overhanging vegetation and visible stream surface shading. If the planting does not achieve the 70% canopy cover, then a Stream Enhancement and Riparian Remedial Plan shall be prepared outlining methods to in which to achieve the 70% canopy cover.

In addition to the ongoing monitoring of planting success a suitably qualified freshwater ecologist should undertake a Stream Ecological Valuation (Storey et al, 2011) at the following key locations:

- Ruahorehore Stream: Just below stream diversion (location of SEV RUA_Lower).
- Ruahorehore Stream Tributary: (location of SEV RUA_Trig)
- Willows Stream Tributary 3: South Arm (location of SEV Willows 3: South Arm downstream)

The SEV surveys should be undertaken at the mitigation sites at Years 3 and 5 following the completion of riparian planting. SEV scores should be no less than 80% of the predicted SEV Score (SEVm-P). Monitoring shall continue until the SEV score has been achieved, or until a maximum of 5 years. If the SEV score has not been achieved by Year 5, then a Stream Enhancement and Riparian Remedial Plan shall be prepared outlining ways in which to achieve the predicted score.

13.8 QUALIFICATIONS

Only certified applicators shall be responsible for the application of herbicides.

13.9 REPORTING

Yearly reporting should be submitted annually following the planting season and by 30 June detailing the following:

- The location and extent of stream restoration and/or riparian planting undertaken in the preceding planting season.
- The number, mix, size and spacings of planting carried out at each location.
- Records of any dead/dying plants encountered.
- Details of any replacement planting undertaken.
- Any recommendations of additional planting, enhancement or management actions that should be undertaken to ensure successful planting.

13.10 KEY PERFORMANCE INDICATORS

The key performance indicators relating to stream enhancement riparian planting are set out in Sections 13.7 and 13.9 of this Ecology and Landscape Management Plan comprising a mixture of monitoring, valuation, adaptive management, and reporting measures.

13.11 REFERENCES

Boffa Miskell 2025. Waihi North Project: Freshwater Ecological Assessment. Report prepared for Oceana Gold (NZ) Limited.

Storey, R.G., Neale, M.W., Rowe, D.K., Collier, K.J., Hatton, C., Joy, M.K., Maxted, J.R., Moore, S., Parkyn, S.M., Phillips, N. and Quinn, J.M. 2011. Stream Ecological Valuations (SEV): a method for assessing the ecological functions of Auckland Streams. Auckland Council technical report 2011/09.

PART M: LANDSCAPE AND VISUAL MITIGATION PLAN

Commented [MD16]: Linked in at request of Hauraki District Council.

14. LANDSCAPE AND VISUAL MITIGATION PLAN

14.1 OVERVIEW

The objective of the Landscape and Visual Mitigation Plan is to deliver an integrated management approach that works in tandem with ecological measures to ensure the landscape and visual impacts of the Waihi North Project (WNP) are comprehensively addressed. This approach guides how change is introduced, managed during operations, and carried through to closure, ensuring that adverse effects on the WNP area and its surrounds are avoided where possible, and otherwise remedied or mitigated. While the plan's purpose is to guide the management of visible change in the landscape, it does so by considering the interconnected physical, perceptual, and associative attributes of the landscape—ensuring outcomes that protect and enhance ecological values, natural character, and overall landscape integrity.

14.2 SUMMARY OF LANDSCAPE AND VISUAL VALUES AND EFFECTS

The landscape surrounding Waihi is primarily influenced by working and established mining operations with some rural lifestyle use typically set against the broader natural backdrop of the Coromandel Ranges. While the area accommodates significant mining activity, including the Martha Mine and associated infrastructure, the enclosing landforms and vegetation which will remain, help limit visual exposure and maintain a sense of coherence within the local landscape.

The Coromandel Ranges are identified as an outstanding natural landscape at both district and regional levels and provide a dramatic and memorable backdrop with their steep, forested volcanic landforms. Nearby rivers and their margins further contribute to the area's natural character, albeit currently more typically modified in the context of ongoing rural land use and some more substantial riparian planting adjoining the established Process Plant. Landscape values in this setting are therefore defined by the juxtaposition of industrial and natural elements, where visual containment, legibility of landform, and broader amenity values form important considerations.

The proposed development will result in incremental but contained modifications to rural and mining landscape characteristics, as well as beneficial effects to natural character. While components will alter local landform patterns and require vegetation clearance, they are largely confined within the existing operational footprint or areas already influenced by mining. Visual containment is supported by surrounding landforms such as Union and Winner Hills, and proposed mitigation includes native revegetation, riparian planting, and recontouring to support rural land use and broader biodiversity benefits which endure post-closure. Overall, adverse landscape effects will remain localised during construction and

operation and are expected to remain well managed and visually integrated over time through ongoing rehabilitation and containment.

14.3 METHODS FOR AVOIDING OR MANAGING EFFECTS

The Landscape, Natural Character and Visual Effects Assessment ("Assessment", Boffa Miskell, 2025) has been prepared concurrently with the project and has therefore influenced the anticipated project outcomes. Methods for avoiding or managing effects have been developed in two ways:

- Measures that intrinsically comprise part of the development design through an iterative process;
- Specific additional mitigation measures designed to reduce adverse effects of the final development proposals including areas of buffer planting included on *Figure 21b*: Proposed Mitigation – GOP, NRS and TSF3, reproduced as Figure 26 below.

In accordance with the above, areas of planting as indicated in *Figure 21b* of the Graphic Supplement supporting the Assessment accords with Figure 2: Proposed Integrated Mitigation Planting Stage. Through proposed integrated mitigation, planting will commence concurrently with proposed mining activity and supports closure.

The specific landscape mitigation methods which have been development for each component of the project seek to avoid or manage adverse effects during operation. The components and specific methods development to manage landscape effects are shown within a comprehensive Landscape Mitigation Plan which includes the following areas of planting which occurs during operation encompassing the following proposed planting areas (reproduced as Figure 26):

Riparian Planting

> Within OGNZL owned land = 22.9 ha.

> Owned by others = 12.9 ha.

Native Terrestrial Planting

> Within OGNZL owned land = 35.9 ha.

> Owned by others = 3.1 ha.

> Planted buffer = 5.6 ha.

> SNA Enhancement = 27.1 ha.

Wetland Planting

> Within OGNZL owned land = 1.3 ha.

For each component of the WNP within the Waihi area the following methods have been identified to manage the potential for adverse landscape and visual effects.

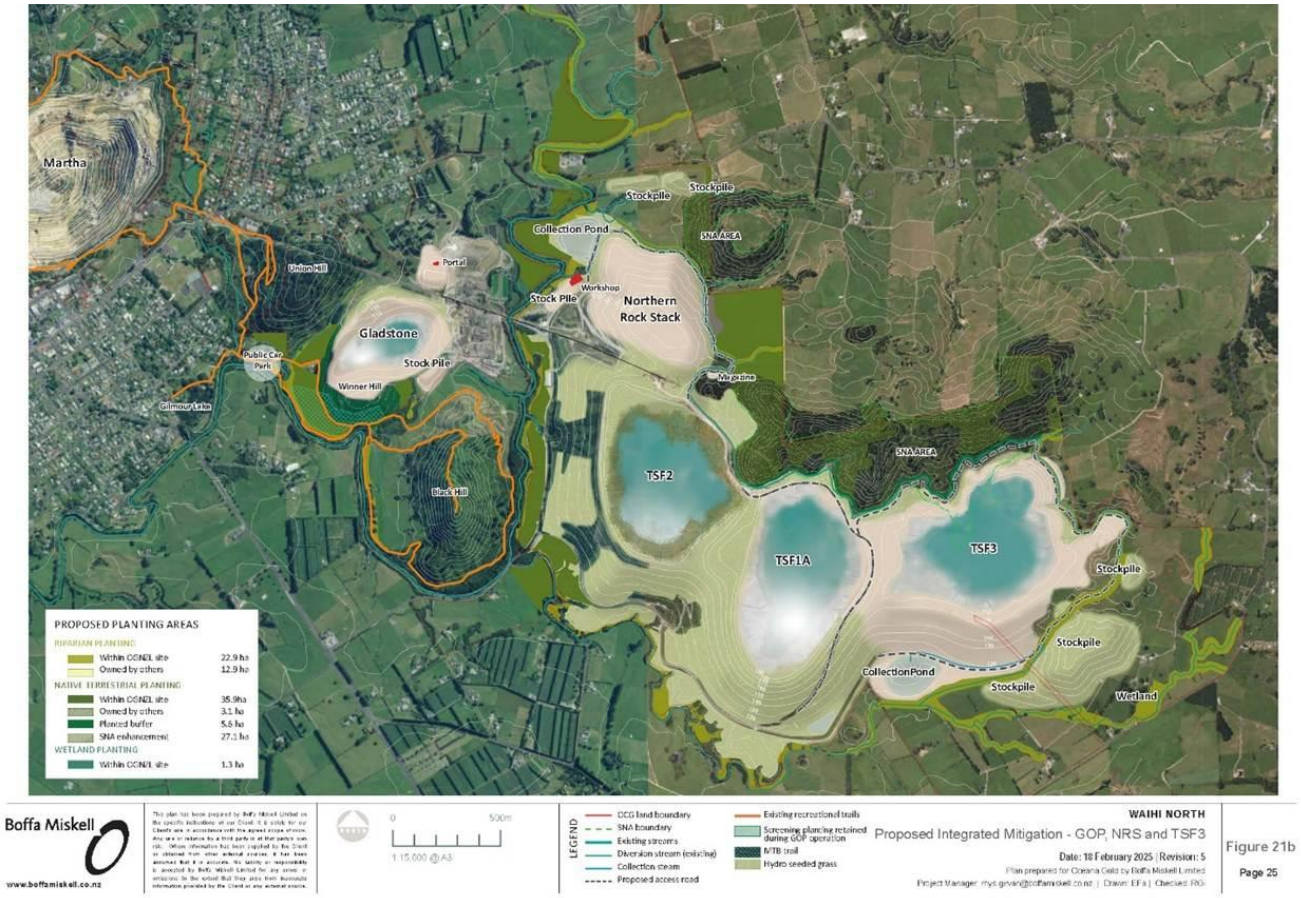


Figure 26: Landscape Mitigation Plan

GOP

The potential for adverse landscape effects associated with the GOP and the subsequent accommodation of tailings within the resulting open pit occur within a mining and productive landscape context including its association with established mining activity and plantation pine which remains enclosed through a combination of intervening landforms and vegetation. In addition, the mining activity will generally occur from east to west to ensure any activity associated with the removal of landform typically remains concealed from wider views to the south-east of Waihi.

To further mitigate the potential visual effects associated with the GOP during mining operation, established pine trees on Winner Hill outside the footprint of the mine will be retained whilst Gladstone Pit is in operation, referred to as Replacement Planting Zone 3 as set out in Section 3: Integrated Landscape and Ecological Response Plan above. Following mining and during implementation of the tailing's storage facility, existing pine trees will be progressively removed and re-established with native vegetation in accordance with native terrestrial planting on OGNZL land.

The final landform surrounding the pit will be re-established in pasture and native shrubs therefore offering further opportunities to assimilate the modified landform within a working rural landscape to further reduce the level of any longer-term adverse effects.

NRS

The proposed NRS will remain contained within the Martha Mineral Zone and resemble part of the larger sequence of rounded landforms to the east of Waihi along the foothills of the Coromandel Ranges. Impacts of mining activity have already been established in this context and will continue to influence the character of this landscape in a manner which remains relatively well contained. During operation, the following additional measures are proposed to provide project benefits and remedy or mitigate natural character, landscape and visual effects:

- Establishment of Screen Planting fast-growing native planting along the periphery and margins of Golden Valley Road (see Table 2: Planting Referred to in Condition 195 of the Hauraki District Council Conditions);
- Maintaining temporary stockpiles in pasture to reduce views of the ongoing raw worked appearance of the NRS;
- Reinstatement of riparian and terrestrial vegetation along the margins of diverted streams and reinforcing existing vegetation along the Ohinemuri River; and
- Removing and rehabilitating areas accommodating temporary stockpiles and round off the final contour of the NRS and reinstate with pasture at project closure.

Process Plant

Containing all processing and water treatment activity within the existing footprint and structures ensures there is very limited potential landscape, natural character and visual effects associated with this aspect of the project. Where possible, all new and replacement infrastructure installed onsite should be coloured the same as the existing infrastructure and therefore remain visually recessive in this established and contained industrial context.

TSF3

The proposed TSF3 extends east of and adjoins the existing tailings storage facilities along the toe of a more elevated backdrop to the north and east. During operation, the following measures are proposed to mitigate natural character, landscape and visual effects:

- Ensure stockpiles are hydroseeded with pasture to resemble adjoining rural areas during operation
- Replace vegetation proposed to be removed in SNA T13UP166 and along existing watercourses to offset vegetation loss and improve connectivity along Ruahorehore Stream (see Table 2: Planting Referred to in Condition 195 of the Hauraki District Council Conditions).
- Re-establish the final embankment and stockpile in pasture and facilitate reestablishment with native wetland plants within stored tailings areas at completion.

Closure Plan

In accordance with Conditions C65, C66 and C67 of Waihi North Project - Schedule 1: Proposed Conditions Common to the Hauraki District Council and Waikato Regional Council Resource Consents, the Consent Holder must rehabilitate all areas within Areas 5, 6 and 7 that have been subject to mining activities authorised as part of this consent by:

> *i. Restoration, riparian and wetland edge planting, and provision of recreational trails, in general accordance with Figure B – Proposed Closure – GOP, NRS and TSF3 annexed as **Attachment 2** to these conditions.*

The closure plan directed via this condition is reproduced in Figure 27 below.

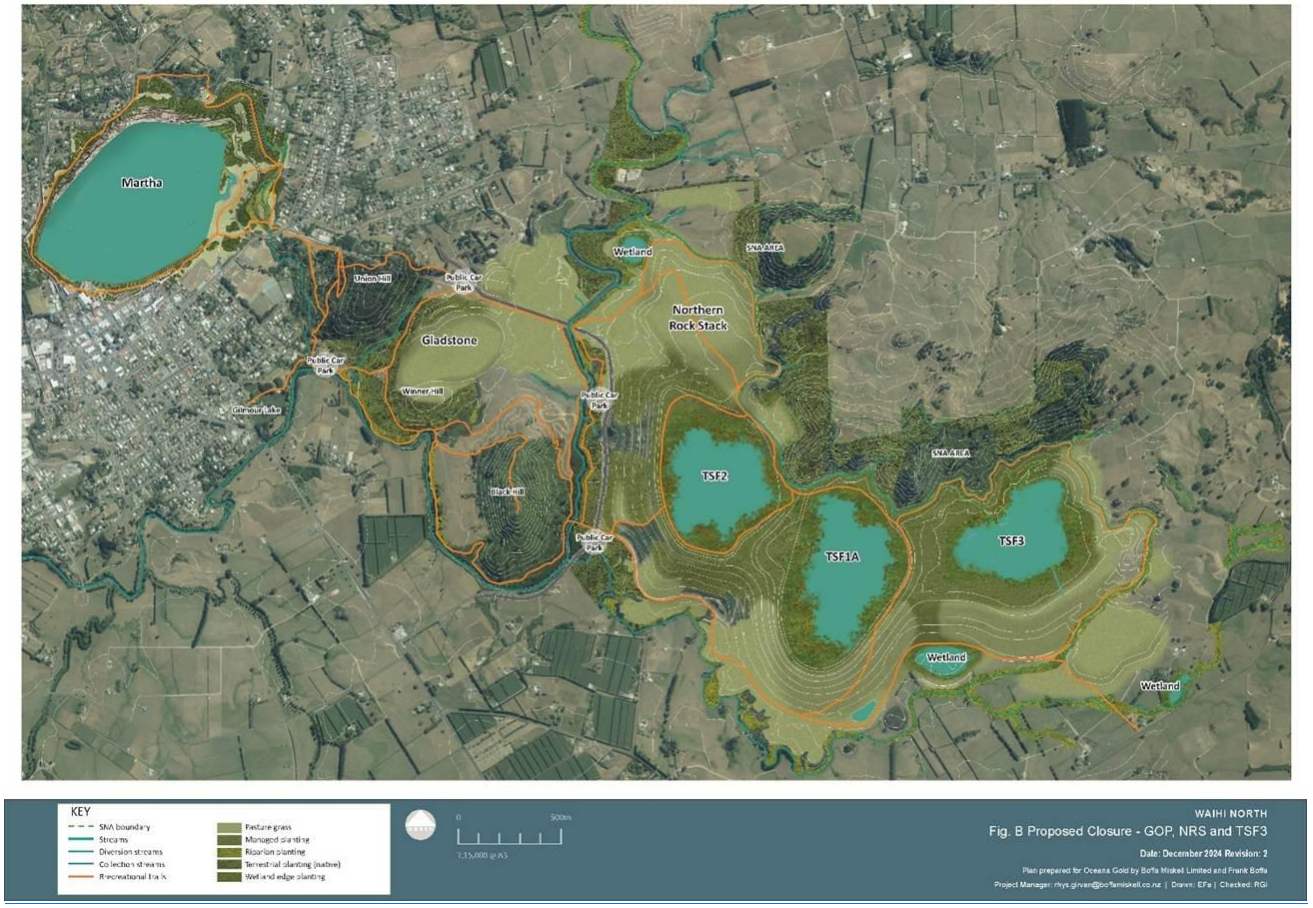


Figure 27: Landscape Closure Plan

14.4 SUITABILITY OF MITIGATION MEASURES

The proposed landscape and visual mitigation measures are well suited to the existing and evolving character of the Waihi area, where established mining activity is already a defining feature of the landscape. The measures respond to both the physical and perceptual context of each component of the project, using a combination of landform recontouring, native revegetation, wetland enhancement, and targeted buffer planting to integrate new development with the surrounding environment.

Proposed mitigation measures build on the iterative design of the project and are consistent with best practice landscape management. Visual effects are further reduced through containment by landforms, retention of screening vegetation during active phases, and the timing of planting to align with operational sequencing. The approach set out in the Ecology and Landscape Management Plan also ensures that visible change is actively managed throughout the life of the project and contributes to longer-term rehabilitation and landscape coherence at closure.

14.5 MONITORING AND REPORTING

As an integrated landscape and ecological response, areas of planting included in *Figure 21b* of the Assessment (reproduced as Figure 26 above) provides the total aggregated areas for each planting type. This overfall quantum of planting aligns with planting included in Figure 2: Proposed Integrated Mitigation Planting Plan and Table 2: Planting included in Section 3 for the purpose of integrated monitoring and reporting.