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Proposed Sutton Block, Drury Quarry

E3:9 Ecological Management Plan

for: Stevenson Aggregates Limited

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DOCUMENT GUIDE

As part of the Sutton Block pit expansion, a full suite of ecology assessments, reports and plans have been developed (Table 1). A summary of each document, including its objectives and key findings are provided in this section. This table is provided at the start of each ecology document with the relevant document highlighted to improve navigation. This document is 3 of a series of 9 ecology documents (E3:9).

Table 1. Documents prepared as part of this project. This document is highlighted.

Document name (abbreviated name)	Aspects covered
E1:9 Ecology Documents Guide and Summary	Summary of the whole project and guidance for navigating documents.
Ecological Impact and Management	
E2:9 Ecological Impact Assessment (EcIA)	Assessment of ecological values and impacts of the proposed Sutton Block on terrestrial and freshwater ecosystems, including regenerating and mature forest fragments, water courses and wetlands. Fauna values include common native invertebrates and birds, At Risk pipit, copper skinks, longfin eel and (potentially) threatened long-tailed bats. Recommendations are provided for avoiding, managing, offsetting and compensating for significant residual adverse effects.
E3:9 Ecological Management Plan (EMP)	Management of ecological impacts in accordance with the effects management hierarchy, prior to and during and following construction. Specific impacts and values addressed in this Plan include: a) Management of Vegetation Removal b) Avifauna Management Plan c) Long-Tailed Bat Management Plan d) Native Lizard Management Plan e) Edge Effects Management Plan f) Native Freshwater Fauna Management Plan g) Sutton Block Riparian Planting Plan
Residual Effects Analysis Reports (REAR)	
E4:9 REAR: Terrestrial Ecology (REAR-TE)	Residual effects on terrestrial ecosystems and fauna
E5:9 REAR: Stream and Wetland Loss (REAR-SW)	Residual effects on freshwater ecosystems
Net Gain Delivery Plans (NGDP)	
E6:9 NGDP: Planting Plan (NGDP:PP)	Terrestrial offset planting
E7:9 NGDP: Pest and Weed Control (NGDP:PWC)	Terrestrial offset pest and weed control
E8:9 NGDP: Wetland Planting (NGDP:WP)	Freshwater offset planting of wetlands.
E9:9 NGDP: Riparian Planting (NGDP:RP)	Freshwater offset planting of streams.

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LIST OF ACRONYMS AND ABBREVIATIONS

Abbreviation/Acronym	Explanation
5MBC	Five-minute bird counts
ABM	Automatic bat monitor
AEE	Assessment of Environmental Effects
AMP	Avifauna Management Plan
ARB	Artificial Roost Box
ARDS	Amphibian and Reptile Distribution Scheme
AR	Artificial Retreat
AUP	Auckland Unitary Plan
AUP OP	Auckland Unitary Plan Operative in Part
BMP	Bat Management Plan
CCR	Carved Cavity Roost
EcIA	Ecological Impact Assessment
ED	Ecological District
EG	Exotic Grassland
EEMP	Edge Effects Management Plan
EMP	Ecological Management Plan
EXP	Planted Exotic Forest
EXS	Exotic Scrubland
FFDB	NIWA's New Zealand Freshwater Fish Database
VS2	Kānuka scrub/forest
Ha	Hectares
LMP	Lizard Management Plan
MCI	Macroinvertebrate Community Index
MFE	Ministry for the Environment's
MF4	Kahikatea forest
NES-F	National Environmental Standards for Freshwater
NFFMP	Native Freshwater Fauna Management Plan
NPS-FM	National Policy Statement for Freshwater Management
NPS-IB	National Policy Statement – Indigenous Biodiversity
NVS	National Vegetation Survey
NZPCN	New Zealand Plant Conservation Network Database
RF	Rock forest
SAL	Stevensons Aggregates Limited
SEA	Significant Ecological Area
SEV	Stream Ecological Valuation
Spp	Species
SPQZ	Special Purpose Quarry Zone
SQMCI	Semi-Quantitative Macroinvertebrate Community Index
VES	Visual Encounter Surveys
VS2	Kānuka scrub/forest
VS5	Broadleaved species scrub/forest
WF7	Pūriri Forest
WF9	Taraire, tawa, podocarp forest
WF13	Tawa, kohekohe, rewarewa, hīnau, podocarp forest
ZOI	Zone of Influence

1 INTRODUCTION

This Ecological Management Plan (EMP) has been prepared for the Drury Quarry – Sutton Block (Sutton Block) project on behalf of Stevenson Aggregates Limited (SAL). The Sutton Block project involves the staged development and operation of a quarry over approximately 108 ha. The Sutton Block is designed to be a separate quarry pit located to the north of the existing Drury Quarry pit, within SAL's landholdings in Drury, Auckland.

The EMP encompasses a suite of management plans that sets out how actual and potential adverse ecological effects associated with the Sutton Block project will be addressed.

1.1 Purpose and objectives of the EMP

This EMP encompasses a suite of management plans which will come into effect in the event of Stevenson's Ltd obtaining resource consents for the development and operation of the Sutton Block. The purpose of this plan is to avoid and minimise the potential effects on native biodiversity during development of the Sutton Block.

Under the new legislative framework (National Policy Statement for Individual Biodiversity, 2023) effects are required to be managed under the effects management hierarchy:

> **effects management hierarchy** means an approach to managing the adverse effects of an activity on indigenous biodiversity that requires that:
>
> (a) adverse effects are avoided where practicable; then
>
> (b) where adverse effects cannot be avoided, they are minimised where practicable; then
>
> (c) where adverse effects cannot be minimised, they are remedied where practicable; then
>
> (d) where more than minor residual adverse effects cannot be avoided, minimised, or remedied, biodiversity offsetting is provided where possible; then
>
> (e) where biodiversity offsetting of more than minor residual adverse effects is not possible, biodiversity compensation is provided; then
>
> (f) if biodiversity compensation is not appropriate, the activity itself is avoided.

This EMP has been prepared to identify how the project will address and manage adverse effects on the ecological values of the land within the Drury Quarry – Sutton Block footprint and its surrounds. The EMP focusses on terrestrial flora and fauna, however also includes some measures to address freshwater effects. Specifically, management measures relating to freshwater fauna are included. The EMP sets out procedures for how SAL will minimise and manage adverse effects on ecological values within the proposed Sutton Block, including:

- Avifauna
- Lizards;
- Bats;
- Edge effects; and
- Native freshwater fauna.

1.2 Responsibilities and competencies

1.2.1 Key personnel (SQEP)

This EMP, and each section, is required to be prepared and implemented by a SQEP (Suitably Qualified and Experienced Person(s)), in close coordination with SAL. As at 2024, the following ecological leads are identified as responsible for the implementation of the EMP:

Table 2. Identification of SQEP as required by the draft resource consent conditions

EMP Section	Biodiversity Value	SQEP responsible
4	Avifauna	Michael Anderson
7	Bats	Chris Wedding
4	Lizards	Chris Wedding
4	Edge effects	Jennifer Shanks
8	Native Freshwater Fauna	Laura Drummond
9	Riparian Planting	Treffery Barnett

1.2.2 Staff induction procedures

Prior to the commencement of any staged vegetation removal, all SQEP (Table 2) and any personnel working or assisting with ecological management in accordance with this Plan, shall hold a prestart meeting to discuss the location and extent of any works required, the required ecological management actions in accordance with actions identified in this Plan, any lead in times required to complete pre- vegetation clearance management actions.
Where the final stage 5 extent is reached following any vegetation removal works, requirements for implementation of edge-effects management (Section 4 of this EMP) shall be implemented, including physical demarcation and fencing, to ensure works and associated activities do not breach these works areas, including silt and sediment spill.

1.3 EMP structure

1.3.1 Linked documents

This document has been prepared to direct actions to minimise ecological effects within and adjacent to Drury Quarry – Sutton Block, however, should be read in conjunction with those documents listed in Table 1.

1.4 Draft resource consent conditions

Draft resource conditions are provided in the Ecological Impact Assessment (Document 2).

2 ECOLOGICAL VALUES AND EFFECTS SUMMARY

2.1 Site overview

2.1.1 Terrestrial ecology values

In total, 16.78 ha of indigenous vegetation and fauna habitat would be removed to accommodate the new pit and associated infrastructure. Three different ecosystem types would be affected: Taraire, tawa podocarp forest (7.33 ha), Kānuka scrub/forest (8.8 ha) and Rock Forest (0.65 ha). The botanical values of the site are moderate to high. Areas of Rock Forest have high values and areas of Taraire, tawa podocarp Forest and Kānuka Forest have moderate values.

No Nationally Threatened plants were recorded within the Project. No threatened fauna were recorded, however At-Risk copper skink (*Oligosoma aeneum*), At-Risk New Zealand pipit (*Anthus novaeseelandiae*), and At-Risk longfin eel (*Anguilla dieffenbachii*) were recorded.

A Very High level of effect is expected for Rock Forest, moderate levels for Taraire, tawa podocarp Forest and low for Kānuka Forest. A low level of effect is expected for Terrestrial fauna. Within the SPQZ, loss of terrestrial ecological values cannot be avoided, however, recommendations are provided, in accordance with the Effects Management Hierarchy (NPSIB), to manage, offset and compensate for adverse effects of the activity.

2.1.2 Freshwater ecology values

Aquatic habitats on the site comprised streams and wetlands. In total 3,341 m of stream length and 1.88 ha of wetland areas would be removed over the approximately 50-year life of the pit. As the loss of these habitats is variously assessed at a moderate or high level of effect, which cannot be avoided or minimised, offset and compensation is recommended to manage the adverse effects of the new quarry pit.

2.2 Ecological mitigation framework

2.2.1 General approach and guiding principles

The National Policy Statement for Indigenous Biodiversity (New Zealand Government, 2023) 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(aiii))). 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:

1. How each step of the effect's management hierarchy will be applied.
2. If biodiversity offsetting or biodiversity compensation is applied, how the proposal has complied with principles 1 to 6 in Appendix 3 and 4 and has had regard to the remaining principles in Appendix 3 and 4, as appropriate.

2.2.2 Measures to avoid or minimise potential effects

Measures to avoid or minimise potential effects are described in full within the Ecological Impact Assessment (Bioresearches and JS Ecology, 2024).

2.2.2.1 Adverse effects that are avoided, where practicable

The proposed Sutton Block Pit has been specifically designed to avoid Karearea Pā, a significant ecological feature (Rock Forest) additionally of very high cultural value. Cultural engagement resulted in design amendments that provided for a greater setback from this feature than earlier designs. As a result of iwi consultation, the Sutton Pit extent has been moved further away from Karearea Pā, providing a larger buffer (approximately 13.2 ha) for the site on the north-eastern and western sides and avoiding 610 m of stream loss and 5,241 m^2 of wetland loss. This updated design has resulted in a reduction in pit depth.

2.2.2.2 Adverse effects that are minimised, where practicable

Species-specific adverse effects (mortality) must be minimised through specific methodology, as addressed in management plans such as capture-relocation, propagation, translocation, habitat enhancement and pre-vegetation removal surveys to avoid nesting birds and roosting bats. Therefore, management methods are provided within this EMP to avoid and minimise these adverse effects on fauna and flora species.

2.2.2.3 Adverse effects that are remediated, where practicable

No adverse effects are proposed to be remediated, as all vegetation and habitat values that are proposed to be removed, would be within the proposed pit.

2.2.3 Measures to offset or compensate for residual ecological effects

2.2.3.1 Residual adverse effects that are offset

We propose to offset the residual adverse effects on the following biodiversity types because they meet the principles for biodiversity offsetting as set out in Appendix 3 of the NPSIB.

- Very high-level effect resulting from the loss of High value Rock Forest
- Moderate-level effect resulting from the loss of moderate value regenerating kānuka forest.
- Moderate- level effect resulting from the permanent loss of Moderate value Taraire, tawa, podocarp forest.
- Very low-level effect resulting from the permanent loss of Low value Relict trees.

Offsetting is not strictly required for the loss of relict trees within pasture, as the overall effect is less than moderate. However, mature native trees have ecological value as sources of seed for regeneration in nearby forest habitats and as potential sources of food and nest/roost sites for mobile native fauna such as birds. Although their overall value to the Sutton site is assessed as **Low** and the level of effect due to their loss as **Very low**, replacement planting to offset their loss

is considered appropriate. This will ensure the resources they provide are replaced and exceeded in the long term and their genetic provenance is maintained.

2.2.3.2 Residual adverse effects that are compensated

Compensation is not proposed, however it is noted that the Ecological Compensation Ratio method is used, based on SEV values to offset loss of stream and wetlands.

2.3 EMP Staging and Timeframes

2.3.1 Activities prior to vegetation removal

A summary of the timing for management actions, in accordance with this EMP, are summarised in Table 3

Table 3. General timing for management actions required by the EMP.

EMP Section	Management Action	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
VRMP	Vegetation removal												
AMP	Pre-felling Nest Surveys												
EEMP	Bunding/Fencing established at new edge												
FMP	Fish Removal and Relocation												
LMP	Lizard Salvage												
BMP	Bat Surveys												

The following activities are to be completed before any vegetation removal can take place as part of the Stage 3 Works:

Vegetation Removal Management Plan

- Accurate survey of the clearance area and clear visual demarcation of the edges.
- Fauna management as set out in the AMP, LMP and the BMP.
- Native fish management as set out in the NFMP.
- Identification by the project ecologist of forest natural resources to be salvaged as set out in this section.
- Notification of local iwi that vegetation clearance is scheduled to be undertaken and opportunity provided for a representative to identify forest resources they may wish to have salvaged for their own purposes including native logs, vegetation and soils.

Avifauna Management Plan

- Nest surveys to be undertaken from September 1 to February (inclusive) prior to vegetation clearance.
- If active nests of native birds are located, a 10 m buffer around the nest is required until the nest fails or the chicks naturally leave the natal area.
- If a Karearea nest is found, an increased buffer of 200m is required.

Lizard Management Plan

- Local iwi representatives are to be notified and provided opportunities for involvement in all aspects of capture, relocation, and associated monitoring.
- Lizard salvage will take place between October and April (inclusive) prior to vegetation removal.
- Nocturnal searching for lizards in standing vegetation will occur prior to felling.
- Creation of at least one ~1x1 m ecostack in lizard release area.

Bat Management Plan

- Local iwi representatives are to be notified and provided opportunities for involvement in bat survey and monitoring.
- Bat surveys will need to be conducted between October 1 and April 30 prior to vegetation clearance.
- At least 10 valid survey nights are required to be completed prior to vegetation removal. If no bats are detected vegetation removal can continue without further surveying.
- If bats are detected, high risk trees that support bat roost characteristics will be assessed to determine any current activity immediately prior to vegetation removal. If an active roost is confirmed, a 30 m no-works buffer is to be established and the roost tree must not be removed/ altered until advice has been obtained in writing from DOC, and the project bat ecologist is satisfied that the tree is no longer occupied.
- Where roost trees are identified, Artificial Roosts (boxes/ chainsaw hollows) will be deployed in suitable habitat nearby along with anti-predator tree bands on any trees where ARBs are installed.

Native Freshwater Fauna Management Plan

- Local iwi representatives are to be notified and provided opportunities for involvement in all aspects of capture and relocation of freshwater fauna.
- Fish removal from impacted streams and relocation will take place no more than one week prior to instream works.

2.3.2 Activities during and immediately post vegetation clearance

Vegetation Removal Management Plan

- The salvage of forest resources will be undertaken where possible for use in restoration planting and enhancement areas where appropriate. Resources include young seedlings for growing in the nursery and use as planting stock and punga logs carrying young epiphytes for managing in the nursery.

Edge Effects Management Plan

- As vegetation is cleared at each stage, new edges will be created. Where this clearance occurs alongside indigenous vegetation (e.g. SEA), bunding or fencing will be established along these new edges as soon as possible following the removal of vegetation to mitigate any edge effects resulting from increased exposure and the active works being conducted.
- Buffer planting will take place along the newly created SEA edges the first winter following vegetation removal.

Lizard Management Plan

- Destructive searches for lizards will take place as vegetation is being cleared.
- All felled vegetation will be stacked aside and remain in situ for at last one month to allow for further searches of canopy vegetation.
- Creation of further ecostacks within the lizard release area in advance of lizard release as required.

2.3.3 Monitoring and maintenance

This is a summary of the monitoring and maintenance elements of this EMP.

Edge Effects Management Plan

- The edge of the SEA and all edge planting will need to be maintained to remain weed-free until full canopy closure occurs. The edge environment and all edge plantings should be checked for regrowth of pest plants at three monthly intervals for the first year after planting and at 6 monthly intervals for Years 2 - 4. Year 5 onwards will require weed checks on an annual basis until the edge planting is fully established and the forest is no longer vulnerable to weed invasion.
- Fencing must be maintained for 10 years or until quarrying has finished in that area. Maintenance checks must be undertaken 6-monthly or as soon as any breaches are noticed, and any repairs made as soon as practically possible.

Lizard Management Plan

- Success monitoring would be undertaken at release site locations, targeting ecostacks, where lizards are relocated.
- Monitoring would consist of stations of four artificial retreats and / or pitfall traps.
- Where Artificial Retreats are used, they would be installed at least four weeks prior to survey period. Pitfall traps may be left in situ between survey years, however, will be neutralised with either an impenetrable cover, or filled to ensure any lizards can climb out.
- Survey period would provide for four trap inspections during fine, non-consecutive days over November-December or March-April, when lizards are most active. Artificial Retreat survey / monitoring would be undertaken in accordance with Lettink (2012).

Bat Management Plan

- If ARBs are deployed following bat roost detection, they will require annual follow-on monitoring and maintenance for a minimum of five years. Inspection and maintenance should be conducted on ARBs between March and September (inclusive).
- Anti-predator tree bands installed on trees with ARBs will be checked and maintained on a six-monthly basis for a minimum of five years.

3 MANAGEMENT OF VEGETATION REMOVAL

Vegetation removal from the Sutton Block area is proposed to be carried out in 5 stages over 50 years to align with the overall quarry plan and development of the rock extraction area (Figure 1).

3.1 Pre-Clearance

Prior to vegetation removal in each staged area, the following needs to be undertaken:

1. Accurate survey of the clearance area and clear visual demarcation of the edges.
2. Fauna management as set out in the AMP, LMP, and the BMP.
3. Native fish management as set out in the NFMP.
4. Identification by the project ecologist of forest natural resources to be salvaged as set out in this section.
5. Notification of local iwi that vegetation clearance is scheduled to be undertaken and opportunity provided for a representative to identify forest resources they may wish to have salvaged for their own purposes including native logs, vegetation and soils.

Sufficient time needs to be allowed for these tasks to be undertaken at appropriate times of the year to ensure their success. Discussion should take place between the ecologists and the quarry manager as to what methods are to be used to clear the vegetation and how damage to native vegetation or fauna outside the clearance footprint can be minimised. Agreement needs to be reached with the quarry manager as to which forest resources can feasibly be salvaged during vegetation clearance and where resources will be placed or stored.

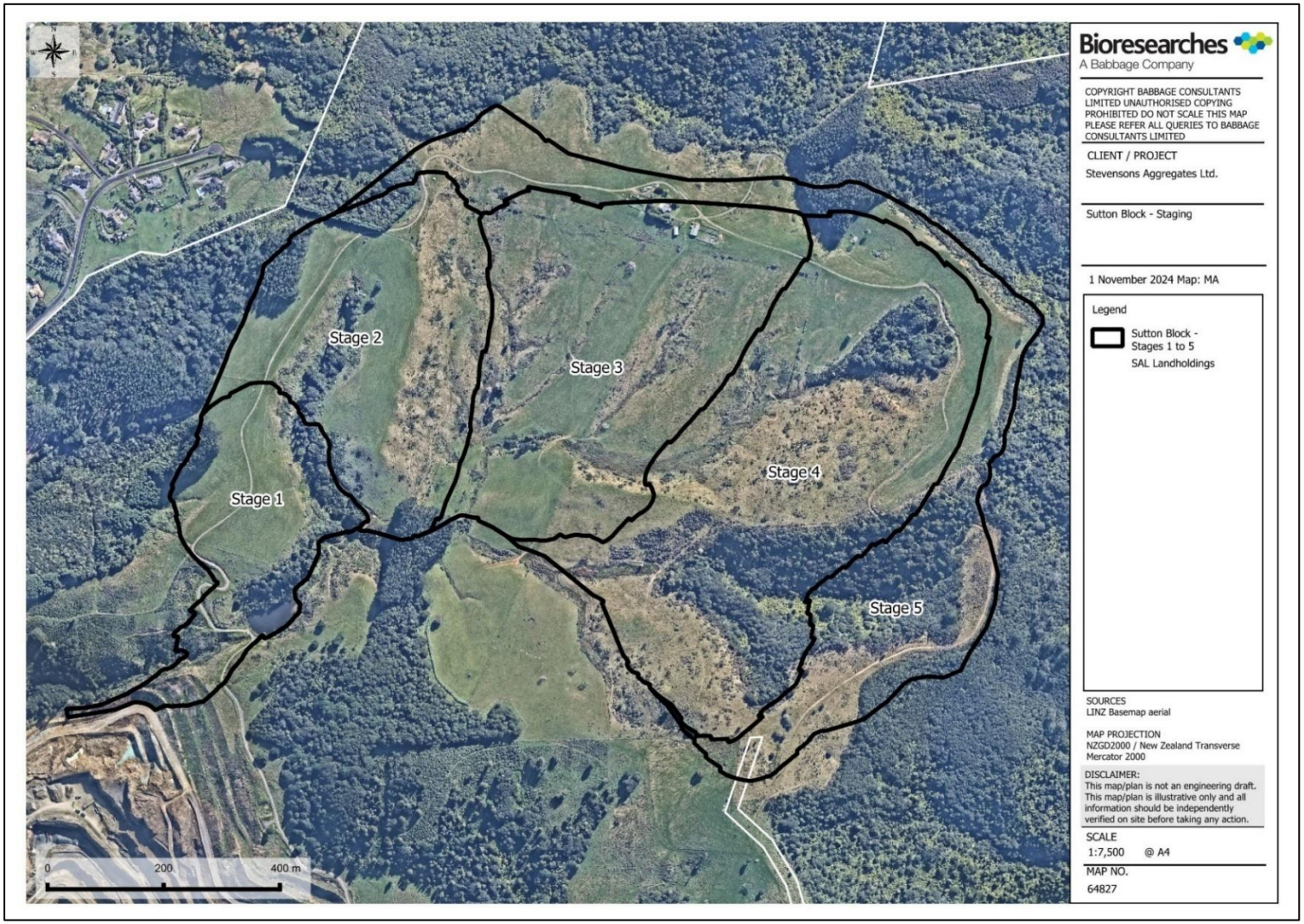


Figure 1 Indicative staging of proposed Sutton Pit, Drury Quarry.

3.2 Pre-start meeting and staff induction.

Immediately prior to vegetation clearance, a pre-start meeting is to be held to explain to quarry staff and contractors the ecological requirements associated with the vegetation clearance. Attendees should include:

- Quarry manager
- Quarry environmental manager
- Machine operators
- Subcontractor representatives
- Project ecologists
- Mana whenua representatives.

The Quarry managers should explain the methods to be used to clear the vegetation, and any practical or technical precautions to be taken to minimise damage to native vegetation or fauna outside the clearance footprint. It will be explained which forest resources or taonga are to be salvaged and how this is to be achieved.

The project ecologist and local iwi representatives provide will any additional information to quarry staff and subcontractors as necessary to ensure salvaged material is appropriately managed to retain its ecological viability.

3.3 Post clearance: edge effects management

As set out in the EEMP, edge effects within the remaining parts of the SEAs will be managed through either (a) the planting of at least a 10m wide buffer of native vegetation or (b) the erecting of a permanent fence where there is insufficient space for a vegetated buffer. A permanent 1.5 m high fence and super silt geotechnical fabric will be positioned at the dripline of the forest edge, allowing space between the tree trunks and the fence.

Edge effects management, including fencing and planting is to be initiated as soon as practicable following the completion of vegetation clearance each year.

3.4 Salvage of forest resources within the Sutton Block

Areas of mature forest will be removed from the Sutton Block rock extraction area. The salvage of forest resources will be undertaken where possible for use in restoration planting and enhancement areas where appropriate. Resources suitable for salvage include:

- Young seedlings of native canopy and understorey species for growing in the nursery and use as planting stock.
- Large rocks for recreating Rock Forest revegetation.
- Punga logs carrying young epiphytes for managing in the nursery and introduction to planting areas as conditions become suitable for them.

The use of these resources in biodiversity offset and compensation planting provides the opportunity to account for several biodiversity attributes that are not specifically captured by the modelling. These include:

- Genetic provenance of Drury flora species and genetic diversity (whakapapa).
- Epiphytes.
- Nonvascular flora such as mosses, liverworts, and lichens.

The use of these forest resources in planting areas (where appropriate) provides an opportunity to establish a presence for these biodiversity components that may otherwise take a very long time to establish naturally. Although the ultimate success of these efforts has not been quantified to date, it is expected that there will be at least modest success introducing these components if carefully managed by knowledgeable practitioners. Salvage of forest resources should be overseen by the project ecologist. Iwi may also wish to salvage logs and other resources as per their Cultural Impact Assessment.

3.5 Utilisation of forest resources salvaged from the Sutton Block footprint.

The salvage of young seedlings of canopy and understorey species will be undertaken from the parts of the Sutton Block footprint that will be cleared first. This work will be done by knowledgeable staff from Drury Quarry's plant supplier who will identify and uplift suitable seedlings in the appropriate seasons. The practice should continue as successive areas are scheduled for clearance. Once they are of suitable size, these plants can be most effectively utilised at revegetation sites within Drury Quarry.

Punga logs carrying young epiphytes should be salvaged prior to, or at the time of vegetation clearance. They can be stored in a shade house with a misting system or automatic watering to keep them moist, until such time as a pioneer canopy develops at the biodiversity offset and compensation planting sites. They can then be placed under the developing canopy with the intention that they will encourage the establishment of epiphyte species within the restoration planting. A suitably qualified botanist and Drury Quarry's planting contractors should oversee this work.

3.6 Natural colonisation

Many fern species will naturally self-introduce as favourable habitats become available for them. Expected colonisers include tree ferns (*Alsophila dealbata, Sphaeropteris medullaris, Dicksonia squarrosa*), epiphytic ferns (*Asplenium flaccidum, A oblongifolium, A. polyodon, Icarus filiformis, etc.*), ground ferns (*A. bulbiferum*), and numerous others.

Use of salvaged punga logs in restoration planting areas, where possible, will help epiphytic species and non-vascular flora species to naturally establish.

4 EDGE EFFECTS MANAGEMENT PLAN

4.1 Edge effects created by the Sutton Pit Project

When part of a tract of forest vegetation is cleared, a new edge is created between the remaining forest and the surrounding matrix of open habitat. Interior forest habitats, previously with shaded, cool conditions, are exposed to elevated levels of light, temperature, and wind. Humidity levels are decreased, and some interior forest species may not survive these drier, windier edge conditions. Regeneration of some forest species is also supressed by edge effects. Weed invasion may occur in vacant habitat along the forest edge where native vegetation has been removed. Edge effects have been found to alter forest environmental conditions up to 50 m into the forest from the newly created edge in northern North Island forests (Young & Mitchell 1994). With the removal of forest vegetation from the Sutton Pit Project area, a new edge will be created for the remaining tract of forest within SEA_T_5323 at two locations (Figure 2).

4.2 Management of edge effects

4.2.1 Buffer planting

The usual approach to managing edge effects is to plant a 10 – 20m buffer of native pioneer vegetation next to the new forest edge. The vegetation quickly grows up, providing wind protection and shading to the edge habitats, thereby mitigating edge effects. Where this is not possible, engineering solutions may be needed.

4.2.2 Fencing

The Sutton Pit Project may not have 10 m of plantable buffer between the quarry workings and the forest edge in all cases. Therefore, fencing of the edge of the forest is proposed for these areas. A permanent 1.5 m high fence and super silt geotechnical fabric will help to block out wind, sunlight and dust from the adjacent forest. The fence should be positioned at the dripline of the forest edge, allowing space between the tree trunks and the fence.

The proposed fencing will also physically protect the SEA from any effects of the quarrying activity by ensuring there is no access for personnel, no encroachment by machinery and no storage of any materials within the remaining SEA.

Any gaps in the forest edge canopy or other vacant habitat within the fence should be planted with pioneer species where possible to deter weeds from establishing in the disturbed edges.

4.3 Locations where edge effects will be managed.

4.3.1 Western pit edge

Some areas of exotic trees will be cleared from within the pit footprint on the western edge of the pit. To ensure visual screening for Macwhinney Drive residents and areas west of the pit, a 10 m wide strip of fast-growing exotic trees (eucalypts and acacia species) will be planted along the western edge of the pit above Macwhinney Drive. To the west of the exotic trees a 5 m strip of

native species will be planted. This visual screening strip will also buffer an existing area of podocarp broadleaved forest and proposed areas of biodiversity offset and compensation planting above Macwhinney Reserve (Figure 2).

4.3.2 Northwestern pit edge and bund

On the northwestern side of the pit a small area of podocarp broadleaved forest and regenerating native vegetation will require buffering from quarrying activities. Contiguous with this is the western end of the bund which will be adjacent to SEA_T_5323 (Figure 2). These areas could be fenced off as described in Section 4.2.2 or receive buffer planting if there is sufficient plantable space.

4.3.3 Southeastern pit edge

Some 6 ha of native vegetation will be removed from SEA-T_5323 in the southeastern pit footprint leaving a new forest edge. This edge may require a combination of fencing and buffer planting to seal the new forest edge (Figure 2) as parts of it are very steep with mature podocarp broadleaved forest.

4.4 Timing

Planting should occur in the winter planting season immediately following vegetation removal. If possible, edge effects management should be implemented prior to impacts.

Visual screening planting will be established along the western edge of the pit following removal of the pine plantation on the land adjacent to Macwhinney Reserve. This will occur in in the first 2 years of the Sutton Pit Project (please refer to the Boffa Miskell Visual effects report).

Planting/fencing will occur along the northwestern edge of the pit and bund between Years 5 and 10 as the pit is expanded and the bund is established.

On the southeastern edge of the pit, vegetation loss is not expected to occur until after Year 20. Any fencing that is required will need to be erected along the remaining SEA edge at the time the new forest edge is created as shown in Figure 2. The fencing will permanently separate the SEA from the quarried area. Once the vegetation has been removed the fence should be constructed without delay and the geotechnical fabric attached.

The edge effects management proposed in this report ties in with the proposed planting to address visual effects of the Sutton Pit and with the proposed offset and compensation planting plans (JS Ecology, 2023). The edges of all areas of existing SEA_T_5323 and SEA_T_5349 outside the Sutton Pit project area will be fully buffered and protected.

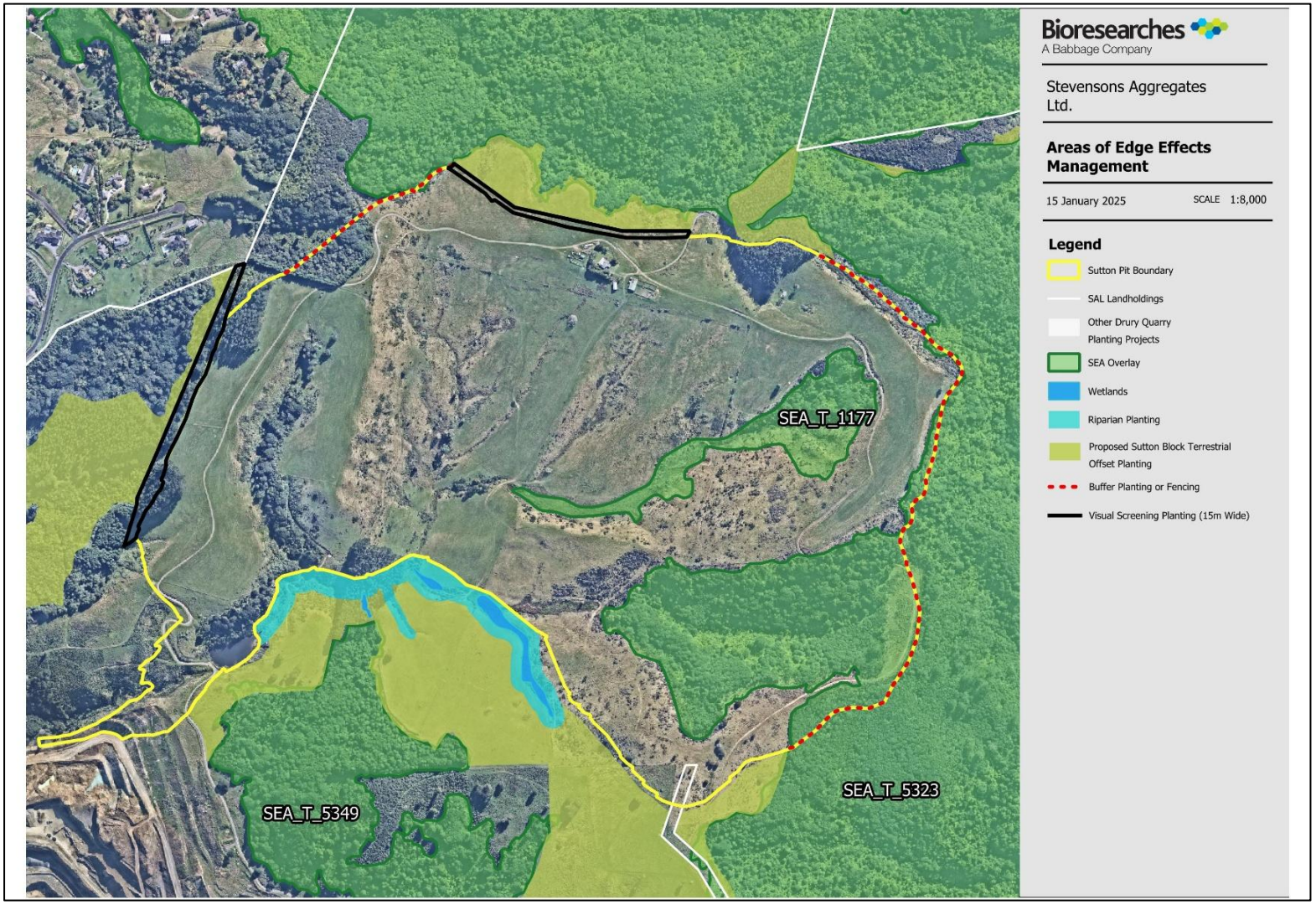


Figure 2. Areas of the Sutton Pit edge where edge effects will require management (Pink thick dashed lines) and visual planting of the western pit edge.

4.5 Planting

4.5.1 Location of Planting

Areas to be planted comprise a 10 – 20 m wide vegetated buffer on the edge of the remaining forest edges where there is sufficient plantable area to allow this. Buffer planting of these forest edges needs to be a densely planted strip of pioneer native vegetation at least 10 m wide. Any weedy patches or gaps left in the canopy due to the removal of adjacent trees should also be planted. Edge planting areas should be mapped prior to planting and the number of plants required be calculated. Weed removal should be undertaken as necessary prior to planting to ensure the planting area is weed-free.

4.5.2 Planting schedule

Planting will comprise a simple palette of pioneer species appropriate to the broadleaved podocarp forest and kānuka forest found within the SEA, as set out in Table 4. Other native species from the surrounding forest will also gradually colonise these areas. Note that plant numbers are per 10 m wide by 100 m long strip of planting (1000 m^2).

Table 4. Planting schedule for buffer planting/ 100m of 10m wide buffer planting.

Common name	Botanical name	Grade	Spacing/m	% of mix (Up to)	# of plants/100m
Kānuka*	*Kunzea robusta*	0.5L	1.4	30	153
Kāramuramu & Karamū	*Coprosma robusta/ Coprosma lucida*	0.5L	1.4	10	51
Koromiko	*Hebe stricta* var. *stricta*	0.5L	1.4	10	51
Māhoe	*Melicytus ramiflorus*	0.5L	1.4	20	102
Mānuka*	*Leptospermum scoparium*	0.5L	1.4	20	102
Mapou	*Myrsine australis*	0.5L	1.4	10	51
Totals				**100**	**510**

4.5.3 Timing of planting

Planting should be undertaken between May and September to coincide with the cooler, wetter months of the year.

4.5.4 Planting Maintenance

Planted areas will need to be maintained weed-free until full canopy closure occurs. The plantings should be checked for regrowth of pest plants at three monthly intervals for the two years after planting and at 6 monthly intervals for Years 3 - 5. Year 6 onwards will require weed checks on an annual basis until full native cover is fully established and the forest is no longer vulnerable to weed invasion. Maintenance of these areas should be included in the broader planting maintenance and reporting programme for the Drury Quarry site.

4.5.5 Fence Maintenance

Fencing must be maintained in good repair for the life of the quarry. Super silt geotechnical fabric must be maintained and kept securely attached to the fence for a minimum period of 10 years or until quarrying has finished in that area. Maintenance checks must be undertaken 6-monthly or as soon as any breaches are noticed, and any repairs made as soon as practically possible.

5 LIZARD MANAGEMENT PLAN

5.1 Introduction

This Lizard Management Plan (LMP) has been prepared for Stevenson Aggregates Limited to minimise potential effects on native lizards (skinks and geckos) prior to and during removal of their identified and potential habitats at the proposed Sutton Pit, Drury Quarry (Figure 3). The Project supports a total of 13.22 ha of non-pasture vegetation cover, comprised of a mixture of native (9.73 ha) and exotic (3.49 ha) vegetation that may support indigenous lizards within and around the edges of their extents. Figure 3 has mapped an additional conservative buffer to previously mapped habitats as a precaution given that habitat stability is unpredictable over the 50-year life of the quarry.

The ecological effects assessment (E2:9 EcIA) identified that the habitat suitability for lizards is considered moderate (high-value copper skinks are known to be present, but low apparent diversity and heavily degraded habitats due to extensive grazing). Habitats within the Sutton Block pit are highly fragmented but are surrounded by an extensive area of Significant vegetation comprised of kānuka, broadleaved and podocarp forest. All of this forest which falls within SAL landholdings (108.35 ha) will be protected by a covenant and enhanced through pest management, buffer planting, and contiguous offset revegetation (63 ha) as part of the overall ecological package.

The purpose of this Lizard Management Plan (LMP) is to detail the management measures required to avoid and minimise adverse effects on native lizards associated with vegetation/ habitat clearance within the Project footprint. Actions required to manage adverse effects on individuals within the quarry expansion zone are: capture and relocation, release site protection/ enhancement, and post-translocation monitoring (if triggered).

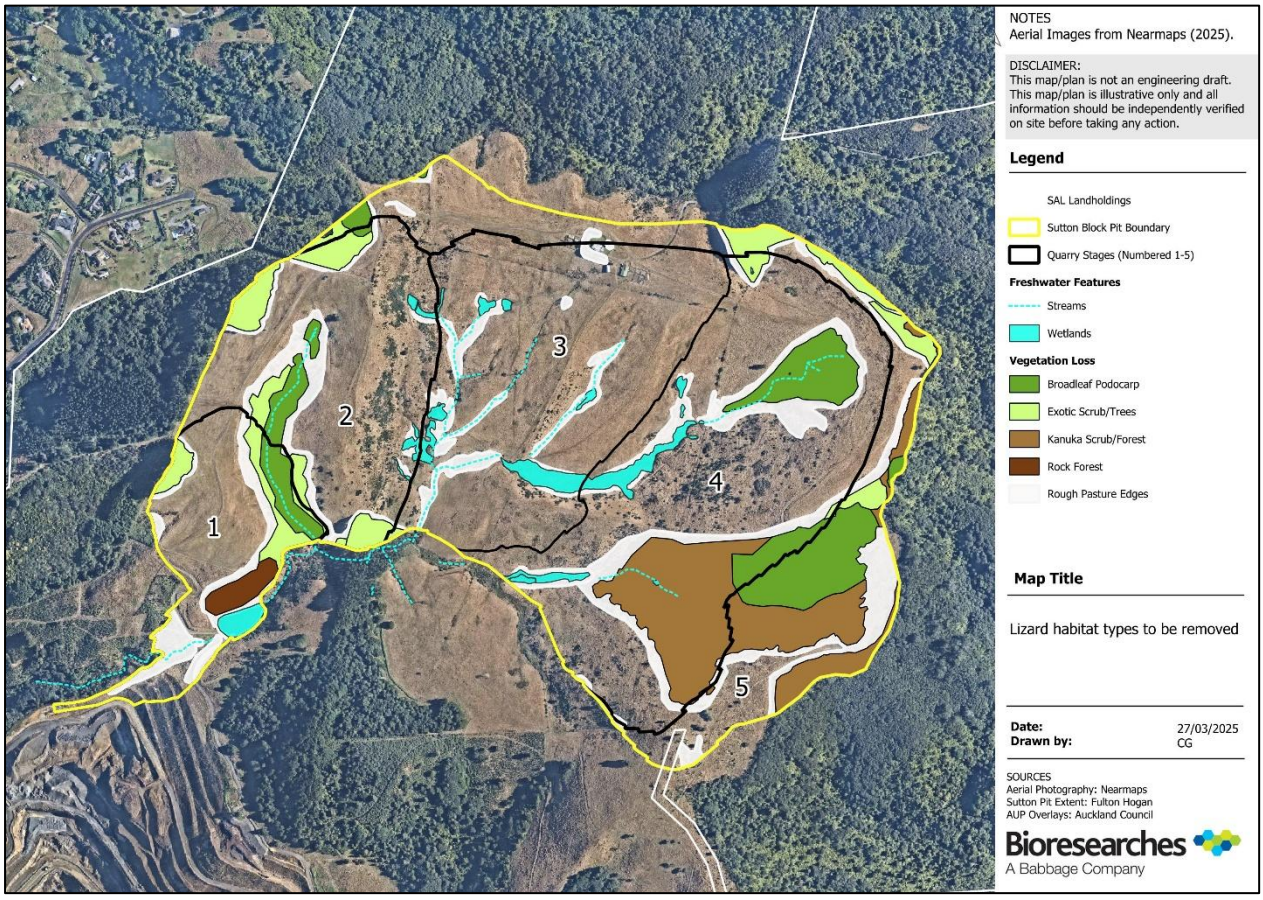


Figure 3: The vegetation marked for removal at Drury Quarry – Sutton Block.

5.1.1 Objectives

The objectives of the LMP are to set out measures to minimise potential adverse effects on native lizards within the construction footprint by way of capturing and relocating any indigenous lizards prior to and during vegetation removal, and providing habitat enhancement and pest control. 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 (impact site) shall be maintained or enhanced, at an appropriate alternative site; and
- The habitat(s) that lizards are transferred to (release site) will support viable populations for all species present pre-clearance.

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 relocating any captured individuals to safe and suitable habitats;
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 Resource Management Act (1991).

This LMP addresses the following:

- A summary of the affected habitat and species covered by the plan;
- Capture and relocation procedures;
- Details of the recommended release site;
- Post works management and monitoring (where required).

5.1.2 Statutory Context

Native reptiles are legally protected under the Wildlife Act 1953 (and subsequent amendments), and vegetation and other features that provide habitat for these species are recognised by the Resource Management Act 1991.

Lizards comprise a significant component of New Zealand's terrestrial fauna and 124 taxa are currently recognised (Hitchmough *et al.* 2021). Of these, 96% are classified as 'Threatened', 'At Risk' or 'Data Deficient' under the New Zealand Threat Classification System (Townsend *et al.* 2008; Hitchmough *et al*. 2021).

Statutory obligations require management of populations of protected species where they or their habitats are threatened by land use changes. This LMP has been prepared or reviewed by a Department of Conservation ("DOC")[1] -authorised herpetologist (Table 8) and a checklist of the important components of this Plan is provided in Table 6

Table 5. Details of Project Herpetologist.

Credentials and Contact Details of Project Herpetologist	
Project Ecologist / Herpetologist	Chris Wedding
Credentials	M.Sc.; 18 years herpetological experience
Wildlife Authority	Subject to FTAA Wildlife Approval
Email	[redacted]
Contact Number	[redacted]

Table 6. Lizard Management Plan Checklist

Project start-up	Required of:	Completed
Lizard Management Plan Approval	Auckland Council	
Approved Lizard Released Sites	Stevenson Aggregates/ mana whenua	
Demarcation of works footprint	Surveyor/ vegetation clearance contractor	
Pre-works management (minimum 7 days prior to staged vegetation clearance)		
Pre-works lizard capture and site preparation	Herpetologist / Ecologist	
Works lizard management		

[1] The project specific WAA is currently being processed by DOC and has not been issued.

Machine assisted habitat searches	Herpetologist, clearance contractor	
Post Works		
Completion report (per stage) to client, Auckland council. ARDs Records to Auckland Council, DOC	Herpetologist	

5.1.3 Tangata whenua as kaitiaki

This Plan recognises the role of tangata whenua as kaitiaki of rerenga rauropi (indigenous biodiversity) and integrates tikanga Māori into its approach to management and monitoring.
SAL maintains partnerships with iwi and will provide for participation in implementation of this Lizard Management Plan. Opportunities will be provided, including knowledge sharing, for all aspects of capture, holding, release, and monitoring of native lizards.

5.1.4 Lizard species covered by plan

Five species have been identified within 5 km of the project site (Table 7), including copper skink (*Oligosoma aeneum),* ornate skink (*Oligosoma ornatum*); forest gecko (*Mokopirirakau granulatus*), and elegant gecko (*Naultinus elegans*). A sixth species, the striped skink, has very few records in the Auckland Region, but recent eDNA analyses detected this species in the Hunua Ranges. It is associated with older growth forest where they have been found in dense epiphytic vegetation, under loose bark and fallen logs. This species therefore also has potential to be present.

Table 7. Threat status and habitat preferences of lizard species potentially present on site. Threat status as per Hitchmough et al. (2021)

Common name	Species name	Threat status	Ground cover	Trees and shrubs	Epiphytes	Recorded from Drury
Copper skink	*Oligosoma aeneum*	At Risk- declining	✓			✓
Ornate skink	*Oligosoma ornatum*	At Risk- declining	✓			
Striped skink	*Oligosoma striatum*	At Risk- declining	✓	✓	✓	
Forest gecko	*Mokopirirakau granulatus*	At Risk- declining	✓	✓	✓	
Elegant gecko	*Naultinus elegans*	At Risk- declining		✓		
Pacific gecko	*Dactylocnemis pacificus*	Not Threatened*	✓	✓	✓	

Note: * Pacific gecko has a Regional Threat status of 'At Risk- declining'.

5.2 Lizard salvage and relocation protocols

The lizard management would be implemented as two Phases, including pre-works systematic searches and trapping, and works-assisted destructive searches. Further, release site monitoring would be implemented where triggered by sufficient numbers of lizards relocated under this plan. Activities undertaken during these phases are detailed below. A summary of the LMP activities have been provided as a checklist in Table 9.

This Plan requires pre-clearance trapping and destructive habitat searches prior to and during vegetation removal. All relocated native lizards will be released into habitats that are enhanced to the satisfaction of the Project herpetologist. To increase carrying capacity of the release site, shelter / refuge provision will be provided with all lizards relocated.

5.2.1 Timing of the salvage and relocation

Indicative staging of the proposed Pit is shown in Figure 2, whereby operations are anticipated at years 3, 15, 30 and 50 of the quarry life. Timing of lizard management would therefore be repeated per stage, requiring preclearance trapping, followed by destructive searches during vegetation removal.

This Plan may only be enacted between October 1 and April 30, and during fine, settled weather, when native lizards in the Auckland Region are most active.

5.2.2 Phase 1: pre-clearance salvage of native lizards

Prior to the commencement of any vegetation clearance or earthworks, a herpetologist(s) will undertake trapping and active searches for lizards in all identified habitats within the indicative stage, or other demarcated area of vegetation that requires removal (Figure 3 and Figure 1). These searches will be carried out over two to four weeks preceding the scheduled vegetation clearance date(s) and will target all native reptile species using the described methods; the use of artificial retreats (Figure 4), systematically searching potential habitats and night searches (spot lighting).
Phase 1 efforts would include:

a. Systematic habitat searching;
b. A minimum 2 weeks of ground trapping (including installation /repeated 24h inspections) using banana baited Gee's Minnow funnel traps; and,
c. Nocturnal spotlight searching.

All captured lizards would be processed (measured, weighed, and photographed, where appropriate) and relocated to the identified relocation site (refer Section 5.3).

5.2.2.1 Environmental conditions

Lizard capture would only be undertaken during favourable weather conditions, specifically: when temperatures are above 10 °C , it is precipitation-free or with light precipitation (i.e. light drizzle), and ideally with wind speed < 15 km/hr to ensure lizard detection probability is maximised.

5.2.2.2 Trapping

- A minimum of 100 traps per ha (approx. 1 per 100 m^2) would be set through all potential lizard habitats within each indicative stage.

- A minimum 10 days intensive trapping period would be undertaken per indicative stage or other demarcated area of vegetation that requires removal.
- All traps shall be embedded in, and furnished with vegetation to protect any captured lizards from heat and exposure during confinement.
- Pitfall traps and ARs shall be installed at least three weeks prior to the minimum 10-day trapping period.
- 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.
- If a lizard is captured within the last three days of the trapping period, trapping must continue beyond the ten-day period until three trap days are achieved without lizard capture.
- All native lizards shall be released at the designated release site immediately upon capture (refer Section 5.3).
- During trap checks, the Project Herpetologist (or a suitably experienced ecologist nominated by 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 4: Artificial retreat (L); Pitfall trap with AR cover (R).

5.2.2.3 Systematic searches

Systematic searches would be undertaken through all potential and searchable habitats between traps. during trap checks and vegetation removal, with coordination and in cooperation with the vegetation clearance contractor. Systematic searches shall:

- Involve searching through all potential habitats including logs, rocks, fallen epiphytes and other ground cover;
- Searching would degrade surrounding habitats such that they:
    - Increase detection within traps,
    - Decrease likelihood of lizards remaining within habitats.

Any lizards captured would be released to the approved relocation site (detailed in Section 5.3; see Figure 7) as determined by the Project ecologist.

5.2.2.4 Nocturnal spotlight searches

- Nocturnal spotlight searches will be undertaken along all affected vegetation edges within each stage.
- A minimum three nights of spotlight searches would be undertaken per area of vegetation prior to any vegetation clearance.
- If a gecko is sighted and cannot be captured (e.g. due to height), then the affected tree shall be marked / taped and the Project herpetologist shall undertake a targeted search of that tree during vegetation tree felling (Phase 2 works management).
- If a gecko is sighted within affected vegetation within the three nights of night searching, then a further night search will be undertaken, and repeated until a night search does not identify any new geckos (excluding which are identified within marked vegetation (above) within the affected vegetation.
- All native lizards shall be released at the designated release site(s) immediately upon capture.

5.2.3 Phase 2: works management

Phase 2 may be commenced once the Project Herpetologist is satisfied that all lizard habitat has been effectively trapped and systematically searched, and night-searched, such that no further lizards are likely to be captured using the methods as determined by Phase 1 trapping and searches.

Phase 2 will involve the recovery of lizards by a herpetologist(s) during vegetation removal activities. The Project Herpetologist is required to be on site during vegetation removal.

5.2.3.1 Searches of felled tree vegetation

Felled vegetation will not be mulched in situ (i.e lowering a mulch-head directly onto standing vegetation), unless approved by the project herpetologist. In some instances, approval to mulch discrete areas of poor-quality vegetation (e.g., areas of young gorse or blackberry and other similar areas not considered to support native lizards) may be given by the project herpetologist.

All standing native vegetation (e.g., established trees/ shrubs > 40 mm diameter at breast height) will be felled using hand saws (e.g. chainsaws) and trees > 5 m tall sectioned (deconstructed). The project herpetologist will supervise the felling of trees/ shrubs and search the foliage and branches/ trunks at their discretion to recover lizards.

- Note that this material may be required to be recycled for use at restoration locations (refer Section 3).

Phase 2 nocturnal spotlight searches

Nocturnal searching would be undertaken by experienced herpetologists, using powerful headlamps and aided by binoculars. Searches would target:

- Standing vegetation, prior to felling.

- Stacked vegetation, where it would be stockpiled on a flat surface.
- Felled vegetation will be stacked and remain in situ for no less than two weeks, so that canopy foliage and other habitats (e.g. epiphytes) of trees can be accessed during searches (e.g. Figure 5).

Figure 5. 'At Risk' elegant gecko on kānuka, approximately 1 week after felling (refer red circle and inset image).

5.2.3.2 Machine-assisted destructive searches

Machine-assisted destructive searches require the vegetation removal contractor to work with the Project herpetologist to search through vegetation as it is removed. This involves scraping back of surface vegetation (Figure 6), as well as lifting heavy objects (e.g., large logs) so that lizards hiding beneath can be captured. An excavator with a toothed bucket or root-rake attachment will be required.

- Some vegetation (tree foliage, epiphytes) may need to be stockpiled for future searching (e.g. night search canopy foliage (refer Section 5.2.2.3).
- Recoverable leaf litter substrate, woody debris and potential shelter structures (e.g., logs, rocks) will be collected and transferred to the lizard relocation site(s) by the herpetologist.
- Note that this material may be required to be recycled for use at restoration locations (refer Section 3).

Figure 6. Machine-assisted lizard searches. Herpetologist supervising the scraping of terrestrial vegetation.

5.2.3.3 Lizard capture

Native lizards will be captured and handled by a DOC-authorised herpetologist, or by a suitably qualified and experienced person working under their supervision. All native lizards captured prior to and during vegetation clearance operations will be placed immediately into containment boxes and held temporarily for release. Captured lizards will be measured, sexed, weighed and photographed, and released at the designated release site the same day where possible. The retention of lizards in captivity for periods longer than one day should be avoided as far as practicable.

5.2.3.4 Incidental discovery

In the very unlikely event that a native lizard is found in the footprint that is not covered by this Plan, the species will be retained in temporary captive management and the Department of Conservation will be notified. Note that incidental discoveries would be notable because they are likely to include species outside their known range, and/or are threatened species and not expected to occur within the Project area, therefore are not covered in this plan.

5.3 Release site

Direct transfer of salvaged lizards from the impact site to a receiving site is preferred wherever possible, and the selection of an appropriate lizard relocation site is crucial to ensuring the best possible outcome for lizard salvage-relocation programmes.

The Department of Conservation's key principles for lizard salvage and transfer guidelines require consideration of the following components when selecting a receiving site(s):

1. The site must be ecologically appropriate and have long-term security;
2. The habitat at the site must be suitable for the salvaged species;

3. The site must provide protection from predators; and
4. The site must be protected from future human disturbance.

5.3.1 Release site description

In consideration of the above principles, the proposed Sutton Pit ecological package provides for a 108.35 ha area (Figure 7) to the immediate east and north of the proposed pit where lizards may be released. This area supports low copper skink abundance, as determined from surveys supporting the EcIA, however the vegetation has the potential to support other skink and gecko species as identified in Table 7. The habitat values of this area, including capacity to support lizards, are expected to improve as part of the offset and compensation package (Bioresearches & JS Ecology, 2024).

This is a significant tract of recovering and regenerating indigenous forest, largely comprised of a mosaic of regenerating kānuka forest (VS2) and taraire, tawa and podocarp forest (WF9). It contains very similar vegetation to that within the project area. These areas are largely already fenced to exclude stock, but currently receive no other biodiversity management. There are also some fragments (5.35 ha) of unfenced rock forest to the southeast of the SAL landholdings.

These areas are proposed to be legally protected by way of covenant, and enhanced from Stage 1 through:

- Control of pest predators including possums, rats, and mustelids,
- Control of ungulate browsers including deer, goats, and pigs,
- Pest plant control; and,
- Fencing of the rock forest remnant patches.

Planting to buffer and connect these areas is additionally proposed. These enhancements are further detailed in the Net Gain Delivery Plan: Pest and Weed Control (document E7:9; JS Ecology Ltd, 2025).

A 20 m buffer edge of enhanced forest is identified in Figure 7 that is expected to receive relocated lizards. Specific receptor locations along this buffer edge have not been identified in maps. This is because the proposal covers five stages over 50 years, and while the habitat suitability across this area is predicted to substantially improve with pest management (e.g., vegetation ground cover, leaf litter depth and dead wood are modelled as fauna habitat indicators, using a BOAM and reported in document E4.6 Residual Effects Analysis Report), these decisions are better informed at the time of relocation and based on:

1. Proximity to the affected stage;
2. Where other lizards have been released following management; and
3. Where microhabitats are determined to be most suitable for the species at the time of management.

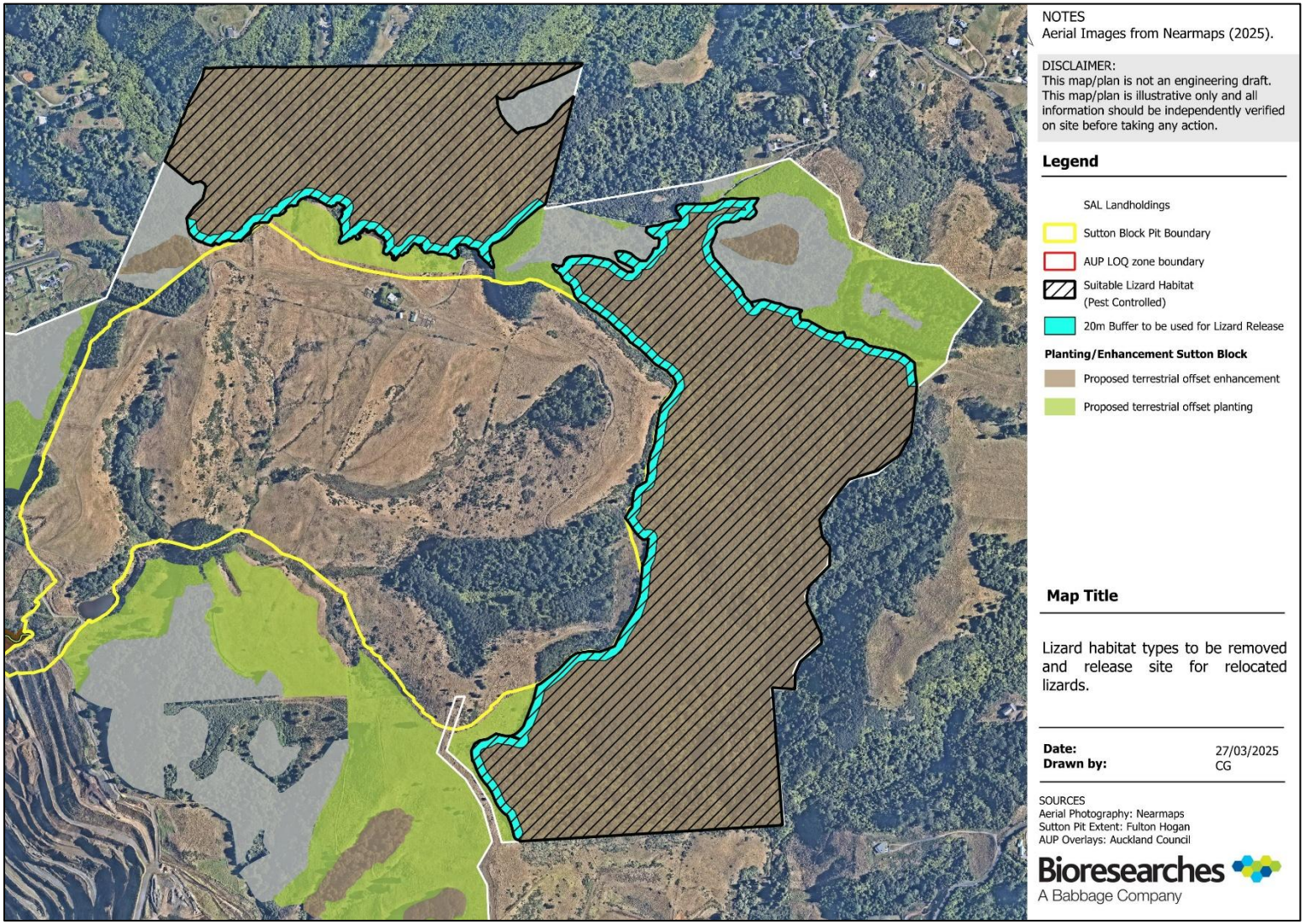


Figure 7. Map showing proposed terrestrial enhancement areas and the proposed release site.

5.3.2 Release site enhancement

This Plan acknowledges that the proposed release site may already support the full suite of lizard species covered under this Plan. Displaced lizards have a lower likelihood of survival where the carrying capacity of adjacent habitats is stressed through increased competition for fewer resources. Further, displaced animals have a higher probability of risk of predation, and a rapid increase in lizard numbers in a given area is likely to result in a corresponding increase in predators. These effects are expected to be reduced at the release site, which will be within an area of targeted pest control as part of a wider ecological package, however provision of additional natural retreats with relocated lizards will be important to maximise successful establishment of transferred lizards.

5.3.2.1 Ecostacks

For the first lizard released and every five lizards thereafter, at least one supplementary refuge (an ecostack or brush pile, Figure 8), comprising of a c. 1m x 1m pile of small, stacked logs and brush or rocks shall be created within the lizard release area. The material used to create these piles will be sourced from the vegetation to be cleared.

To ensure that captured and relocated lizards immediately have habitat available, at least one refuge must be created prior to any lizard management activities commencing, in a location within the release site. If five lizards are caught and released, at least one additional refuge will be installed before any additional lizards are transferred.

Following completion of lizard salvage for each stage, a further five ecostacks will be provided at the relocation site as advance habitat provision for lizard salvage at future stages.

Figure 8. Example of ecostack / stacked brush pile as a supplementary refuge for relocated lizards.

5.3.2.2 Mouse control

Control of mice would be triggered by higher lizard values (refer Table 8) and will be achieved by way of 20 m spacing for self-resetting traps that target mice (e.g. Goodnature A24), or lockable bait stations (containing Double Tap (diphacinone and cholecalciferol or other suitable toxin) within the lizard release and buffer area (Figure 7). Mouse control will provide a significant increase in pest station density within this area, to respond to smaller home ranges of mice, compared to rats. The frequency of baiting and trapping would be pulsed, as detailed in Table 6 of Document 7 (NGDP PPWC), which addresses pest control maintenance for the forest area mapped in Figure 7.

Table 8. Triggers for management and post-release monitoring provisions.

	Trigger	Required Action	Duration of management
A	1-5 native lizards per stage	Provision of 1 ecostack, and an additional 5 ecostacks at completion of each stage (in support of future stages)	Prior to relocation
B	≥ 10 native lizards per stage	Provision of 1 ecostack per 5 lizards, and an additional 5 ecostacks at completion of each stage (in support of future stages)	At relocation
C	≥ 20 native lizards per stage	Provision of 1 ecostack per 5 lizards Implement Success Monitoring, and an additional 5 ecostacks at completion of each stage (in support of future stages)	Monitoring annually for 5 years following release
D	≥ 30 native lizards per stage Or ≥ 40 native lizards over whole Project Or ≥ any pacific geckos	Provision of 1 ecostack per 5 lizards Implement Success Monitoring, and an additional 5 ecostacks at completion of each stage (in support of future stages) Provision of mouse control within lizard release area (20 m spacing for traps or bait stations)	Monitoring annually for 5 years following release per stage

5.4 Monitoring and reporting

5.4.1 Monitoring

Success monitoring would be undertaken at release site locations, targeting ecostacks, where lizards are relocated. The purpose of the monitoring is to determine success by measuring / identifying:

1. Occupancy by lizards of ecostacks, as provided for habitat replacement.
2. Identifying any relocated lizards, where photograph ID is used.
3. Recording any trends in numbers and species encountered within the pest managed area.
4. Presence of gravid females or juveniles.

Monitoring would consist of stations of four artificial retreats and / or pitfall traps. Each monitoring station will be set at a minimum of four locations (based on trigger c, Table 8), targeting locations of ecostacks.

Where Artificial Retreats are used, they would be installed at least four weeks prior to the survey period. Pitfall traps may be left in situ between survey years, however, will be neutralised with either an impenetrable cover, or filled to ensure any lizards can climb out.

The survey period would provide for four trap inspections during fine, non-consecutive days over November-December or March-April, when lizards are most active. Artificial Retreat survey/ monitoring would be undertaken in accordance with Lettink (2012).

5.4.2 Reporting

A works-completion report would be prepared by the Project herpetologist within 1 month of completion of all vegetation removal, per indicative stage. The report would detail:

1. The number of lizards and species captured and transferred;
2. The number and location of any ecostacks created;
3. Whether monitoring is triggered from the relocation; and,
4. All information as required of an ARDS report (Amphibian Reptile Distribution Scheme, Department of Conservation).

The works completion report would be submitted to Auckland Council Ecological Advice Team, Natural Environment Design, Environmental Services.

6 AVIFAUNA MANAGEMENT PLAN

6.1 Introduction

This Avifauna Management Plan (AMP) has been prepared for Stevenson Aggregates Limited to minimise potential effects on native birds prior to and during removal of their potential habitats as part of an expansion of the Drury Quarry pit into the Sutton Block.

An EcIA identified a suite of common, At Risk and Threatened indigenous bird species that may nest in trees (foliage, cavities) and on the ground within the Project. The removal of their habitats would therefore be expected to result in injury and / or mortality if such species are nesting at the time of removal.

6.1.1 Plan purpose

The objectives of the AMP are to avoid (mortality) and minimise (disturbance) potential adverse effects on native avifauna associated with the construction of the proposed Sutton Pit at Drury Quarry. This would be achieved by identifying any active nests of native birds prior to works (habitat removal), so that nesting can be completed and chicks can naturally fledge.

Almost all native birds are legally protected under the Wildlife Act 1953 (and subsequent amendments), and vegetation and other features that provide habitat for these species are recognised by the Resource Management Act 1991. Thus, statutory obligations require that management of native birds where they or their habitats are threatened by land disturbance or development.

The New Zealand Threat Classification System lists 491 avian taxa (Robertson et al., 2021), of which 241 are classed as non-vagrant and native species. Of these, 74% are listed as either threatened, 'At Risk' or 'Data Deficient' under the New Zealand Threat Classification System (Townsend et al. 2008). All native birds are afforded protection with the exception of two species: Spur-winged plovers (*Vanellus miles*) and black-backed gulls (*Larus dominicanus*).

Table 9. Purpose, specific objectives, performance measures and monitoring relevant to the AMP.

Criteria	Explanation
Purpose	This Avifauna Management Plan (AMP) has been prepared for Stevenson Aggregates Limited to minimise potential effects on native birds prior to and during removal of their potential habitats as part of an expansion of the Drury Quarry pit into the Sutton Block (Figure 1). The purpose of this Avifauna Management Plan (AMP) is to detail the management measures required to minimise adverse effects on native birds associated with vegetation/ habitat clearance.
Specific Objectives	The objectives of the AMP are to avoid (mortality) and minimise (disturbance) potential adverse effects on native avifauna associated with the construction of the proposed Sutton Pit at Drury Quarry. This would be achieved by identifying any active nests of native birds prior to works (habitat removal), so that nesting can be completed and chicks can naturally fledge.
Performance Outcomes	This AMP includes provisions for forest and wetland bird breeding protection and effects minimisation including:

	(a) Seasonal constraints on felling and/or noise disturbance in habitats that are likely to have high bird values to avoid or minimise harm to eggs and chicks; (b) Proposed controls for maintaining a 30 m setback of construction works from the margin of wetlands during peak breeding season (September – December); and (c) A process for ensuring no nesting birds are present within vegetation to be cleared if works are required during peak breeding season (September – December). (d) Bird nest survey and checks prior to any wetland clearance from January to March inclusive.
Monitoring	Compliance monitoring and biodiversity outcome monitoring to better understand the response of birds to the proposed residual effects management package. This includes verification of predicted likely Net Gain outcomes and adaptive management response.
Reporting	A pre-clearance compliance monitoring report will be provided to Auckland Council, no later than 30 working days prior to commencement of construction activities for each year in which construction is undertaken. Incident based reporting will be provided to Auckland Council within five working days of an unforeseen event occurring.

6.1.2 Statutory context

Almost all native birds are legally protected under the Wildlife Act 1953 (and subsequent amendments), and vegetation and other features that provide habitat for these species are recognised by the Resource Management Act 1991. Thus, statutory obligations require that management of native birds where they or their habitats are threatened by land disturbance or development.

The New Zealand Threat Classification System lists 491 avian taxa (Robertson et al., 2021), of which 241 are classed as non-vagrant and native species. Of these, 74% are listed as either threatened, 'At Risk' or 'Data Deficient' under the New Zealand Threat Classification System (Townsend *et al.* 2008). All native birds are afforded protection with the exception of two species: Spur-winged plovers (*Vanellus miles*) and black-backed gulls (*Larus dominicanus*).

6.1.3 Draft consent condition scope

This AMP has been developed in accordance with the Sutton Block consent condition 3. The requirements of these consent conditions are addressed through the implementation, monitoring and reporting procedures set out in the AMP and the following interlinking plans. The term 'vegetation clearance' in this AMP refers to all vegetation clearance proposed to enable construction of the Sutton Block.

6.1.4 Responsibilities and competencies

Table 10 sets out the roles and responsibilities in relation to the AMP. SAL Manager holds the overall accountability for the implementation of and compliance with this plan.

The project Ornithologist will implement this AMP and various phases of bird-related work on the Sutton Block Project. The project ornithologist will liaise when appropriate with arborists, vegetation clearance teams and site engineers.

Table 10. Details of Project Ornithologist.

Credentials and Contact Details of Project Herpetologist	
Project Ornithologist	Michael Anderson
Credentials	PhD; 21 years of ornithological experience
Email	Michael.Anderson@bioresearches.co.nz
Contact Number	0210677453

6.2 Summary of avifauna values and effects

6.2.1 Avifauna Species present, and potentially present within the proposed Sutton Pit

A full desktop survey and site investigations were carried out as part of the EcIA (Bioresearches, 2024). A summary of the species detected and likely present are found in Table 11. More details are provided in Section 6.2.2 for Threatened and At-Risk species that are potentially present.

Table 11. Birds recorded as present or potentially present within the Site from the AEE (Bioresearches, 2024).

Common name	Scientific name	National threat classification (Robertson *et al.*, 2021)	Desktop study	Incidental observa-tions	Five-minute bird counts
Australasian Bittern, Matuku-hūrepo	*Botaurus poiciloptilus*	Threatened – Nationally Critical	✓		
Australasian harrier, kāhu	*Circus approximans*	Not Threatened	✓	✓	
Banded rail, moho pererū	*Gallirallus philippensis*	At Risk - Declining	✓		
Black shag, kawau tuawhenua	*Phalacrocorax carbo*	Threatened - Nationally Vulnerable	✓		
Grey duck, pārera	*Anas superciliosa*	Threatened - Nationally Vulnerable	✓		
Grey teal, tētē moroiti	*Anas gracilis*	Not Threatened	✓		
Grey warbler, riroriro	*Gerygone igata*	Not Threatened	✓	✓	✓
Karearea	*Falco novaeseelandiae*	Threatened - Nationally Increasing			
Kererū, New Zealand pigeon,	*Hemiphaga novaeseelandiae*	Not Threatened	✓	✓	✓
Morepork, ruru	*Ninox novaeseelandiae*	Not Threatened	✓	✓	
Little black shag, kawau tūī	*Phalacrocorax sulcirostris*	At Risk - Naturally Uncommon	✓		
Little shag, kawau paka	*Microcarbo melanoleucos*	At Risk - Relict	✓		
New Zealand dabchick, weweia	*Poliocephalus rufopectus*	Threatened - Nationally Increasing	✓		
New Zealand kingfisher, kōtare	*Todiramphus sanctus*	Not Threatened	✓	✓	✓
New Zealand pipit, pīhoihoi	*Anthus novaeseelandiae*	At Risk - Declining	✓	✓	
North Island fantail, pīwakawaka	*Rhipidura fuliginosa*	Not Threatened	✓	✓	✓

North Island kākā	*Nestor meridionalis*	At Risk - Recovering	✓		
North Island kōkako	*Callaeas wilsoni*	Threatened - Nationally Increasing	✓		
Paradise shelduck	*Tadorna variegata*	Not threatened		✓	✓
Pied shag, kāruhiruhi	*Phalacrocorax varius*	At Risk - Recovering	✓		
Pūkeko	*Porphyrio melanotus*	Not Threatened	✓	✓	✓
Shining cuckoo, pīpīwharauroa	*Chrysococcyx lucidus*	Not threatened		✓	
Silvereye, tauhou	*Zosterops lateralis*	Not Threatened	✓	✓	✓
Spotless crake, pūweto	*Zapornia tabuensis*	At Risk - Declining	✓		
Spur-winged plover	*Vanellus miles*	Not Threatened	✓	✓	✓
Tūī	*Prosthemadera novaeseelandiae*	Not Threatened	✓	✓	✓
Welcome swallow, warou	*Hirundo neoxena*	Not Threatened	✓	✓	✓
White-faced heron	*Egretta novaehollandiae*	Not Threatened	✓		

6.2.2 Threatened and At Risk species

The Assessment of Ecological Effects (Bioresearches, 2024) determined that of the 12 Threatened or At-Risk bird species recorded near the site during the desktop study, many are not expected to be present because the site is lacking in their specific habitat requirements. Based on the outcomes of the AEE, only three of these species were either recorded on site or are considered to have potential to utilise the existing habitats on site. Further information about these species are provided below.

6.2.2.1 Pipit (Anthus novaeseelandiae novaeseelandiae; At Risk – Declining)

Pipit is the only Threatened or At Risk (TAR) species that was confirmed to be present on site. Only one observation of a pipit was recorded, with one bird seen foraging within pastoral areas.

Pipits are considered likely to have benefitted from forest clearance for pasture, however, have subsequently declined with land-use intensification (Beauchamp, 2013). It is known that pipits are present at lower frequencies in areas of heavily grazed pasture (such as is present within the site) than in areas of rough pasture (Beauchamp, 2013), and consequently, much of the site would be considered to be of relatively low value for pipit, although they are known to utilise wetlands. Pipits require tussocks or long grass for breeding, and therefore, because of the heavily grazed nature of the site, are considered unlikely to breed within the site.

6.2.2.2 North Island Kākā (*Nestor meridionalis septentrionalis*; At Risk – Recovering)

The North Island kākā is a highly mobile species (NPSIB, 2023) and is sighted throughout the Auckland Region. Kākā are rare to uncommon in mainland forests, however they are known to periodically leave the offshore islands they inhabit (e.g., Great and Little Barrier Islands, but also some mainland 'sanctuaries', including Hunua Ranges) and disperse across mainland Auckland for foraging, primarily in winter months (Moorhouse, 2013).

The nearest recorded North Island kākā sighting is ~4 km to the Northwest of the Site[2]. They are recorded with the Hunua Ranges much more frequently, which is ~14 km to the east. Therefore, there is some potential for North Island kākā to visit the Site intermittently to forage, but they are highly unlikely to be breeding at the Site.

[2] https://ebird.org/species/nezkak1

6.2.2.3 Karearea / New Zealand falcon (*Falco novaeseelandiae*; At Risk – Recovering)

Karearea are not known to be permanent residents within the Auckland Region (they are also considered absent north of Auckland), however, they are occasionally sighted in the region (Seaton, 2013).

The nearest recorded karearea sighting is ~4 km to the North of the Site on Hunua Road[3]. but sightings throughout the Auckland region are uncommon and sporadic. Therefore, there is a very low potential for karearea to visit the Site intermittently to forage, but highly unlikely to be breeding at the Site.

6.2.3 Breeding season of native species recorded on Site.

Fourteen native species have been recorded on site. All of these, except for pipit, are non-threatened native species. As such, direct harm to these species, their nests, eggs, and nestlings, still need to be avoided. Table 12 (below) outlines the breeding season timelines for these species, indicating that the spring/summer months are the main breeding months for most species. On site vegetation clearance should therefore be avoided during key parts of their breeding season, from August to March (inclusive). However, note this coincides with lizard and potential bat management requirements and therefore may not be possible to implement.

[3] https://ebird.org/species/nezfal1

Table 12 Breeding seasons of birds recorded within the Site from the EcIA (Bioresearches, 2024). Indicative breeding months are from New Zealand Birds online (nzbirdsonline.org.nz) and includes both egg-laying and nestling dates.

Common name	Breeding Season											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Australasian harrier, kāhu	■	■	■	■					■	■	■	■
Grey warbler, riroriro	■	■						■	■	■	■	■
Kererū, New Zealand pigeon,	■	■	■	■	■	■	■	■	■	■	■	■
Morepork, ruru	■	■	■	■	■				■	■	■	■
New Zealand kingfisher, kōtare	■									■	■	■
New Zealand pipit, pīhoihoi	■	■						■	■	■	■	■
North Island fantail, pīwakawaka	■	■	■					■	■	■	■	■
Paradise shelduck	■	■						■	■	■	■	■
Pūkeko	■	■	■	■	■	■	■	■	■	■	■	■
Shining cuckoo, pīpīwharauroa	■	■	■							■	■	■
Silvereye, tauhou	■	■						■	■	■	■	■
Spur-winged plover				■	■	■	■	■	■	■	■	
Tūī	■	■							■	■	■	■
Welcome swallow, warou	■	■	■					■	■	■	■	■

6.2.4 Effects on avifauna

All ecosystems within the Sutton Block project (i.e. pit) area at Drury Quarry will be directly affected and there is potential for some ongoing effects to native avifauna residing within the vicinity of the project.

Potential immediate effects on avifauna during the construction phase include:

- Destruction of nests and/or mortality of nest contents (eggs/chicks).
- Removal of habitat used for foraging or nesting
- The creation of habitat edge effects;
- Sediment runoff to wetlands and watercourses affecting wetland bird habitat;
- Construction noise, light and dust disturbance.

Potential ongoing effects resulting from the operation and maintenance of Drury Quarry and the Sutton Block include:

- Effect of vehicle noise and disturbance on birds.
    - Resident birds in surrounding habitat most significantly affected during the breeding season, when noise may impact communication between conspecifics, potentially reducing breeding success.
- Mortality or injury with vehicles or construction equipment.
    - Reduced potential due to low speed vehicle movement within quarry areas.
- Increase in exotic bird populations due to increased habitat modification.
- Degradation of wetland quality on pit margin and downstream riparian habitat, impacting on wetland bird species.

Table 13. Total avian habitat areas impacted, as well as specific total areas for threatened and at risk species. Areas for Karearea and Kākā include both native and exotic forest types.

Forest type	Ecological value	Adverse ecological effects on habitats and species addressed in the AMP
Habitat types associated with native avifauna		
Rock Forest	High	**Area:** 0.65 ha
Taraire, Tawa, Podocarp Forest	Moderate	**Area:** 7.33 ha
Kānuka Forest	Moderate	**Area:** 8.8 ha
Relict trees amongst pasture	Low	**Area:** <0.1 ha
Exotic Forest	Negligible	**Area:** 2.47 ha
Exotic Grassland	Low	**Area:** 83.5 ha
Wetlands	Low-Moderate	**Area:** 1.88 ha
Threatened and At-Risk species		
New Zealand pipit, pīhoihoi	High	83.5 ha of potential habitat loss and indirect effects
New Zealand Falcon, Karearea*	High	22.04 ha of potential habitat loss and indirect effects
North Island kākā*	High	22.04 ha of potential habitat loss and indirect effects

*Species not recorded on site but identified in the AEE as being recorded in the wider landscape and having potential habitat present.

6.3 Management of Effects

6.3.1 Vegetation Clearance

All vegetation clearance must occur outside the main native bird nesting season (September to February inclusive) to minimise any risk of disturbance that vegetation removal would have on nesting birds. If this unavoidable, a nesting survey will be required prior to any felling.

Note that by restricting vegetation clearance to outside the main native bird breeding season the risk of disturbing nesting forest birds is significantly reduced (but not entirely eliminated), therefore vegetation should still be checked for obvious signs of nesting activity prior to clearance works being undertaken.

Vegetation clearance should not commence until approval has been received from the project ecologist/ ornithologist. If active nests are located, habitat clearance should be delayed until after chicks have both fledged from the nest and are sufficiently independent to leave the natal territory with or without the parents. The nestlings of many forest bird species will fledge from the nest but will remain poor flyers and dependent on parents to feed them for an extended period of time. This period varies by species and may require on-site evaluation by a suitably qualified and experienced ecologist/ ornithologist.

6.3.2 Nest Surveys

If vegetation clearance is unavoidable during the main native bird nesting season, an approved and experienced ecologist or ornithologist must visually inspect all trees and shrubs proposed for removal within 24 hours of felling to identify any active nests. This includes checking cavities and hollows for nesting birds (e.g., morepork, kingfisher, etc).

During clearance of wetlands, the same restrictions around the time of breeding season shall apply. Although no wetland bird species were detected on site, their presence cannot be ruled out. Should clearance be required during the nesting season, it is recommended that a wetland bird survey be carried out beforehand. If any wetland birds are detected, nest surveys will be required prior to any wetland clearance.

6.3.3 Nest Management

Should any nesting be observed, a 10-metre buffer of vegetation shall be required to remain around the nest site until an approved and experienced ecologist or ornithologist has confirmed that the nest has naturally failed or the chicks have hatched and naturally left the natal site. Following inspection and confirmation of absence of nesting birds, the consent holder must submit a completion report to the council for approval within 30 working days.

6.3.3.1 Karearea/New Zealand falcon nests

Karearea / New Zealand falcon are considered very unlikely to breed at the site. However, additional information is provided here about their nest management, as it differs from many other native species and existing protocols have been developed.

Karearea / New Zealand falcon nest on the ground and are found both in native and exotic plantation forest. Recognising nests can be difficult, as nests are simple scrapes on the ground and eggs can be cryptic[4]. Incubation is 25-35 days and chicks begin to fly at 32-45 days.

Should a Karearea / New Zealand falcon nest be located on site, an increased buffer zone is required. Negative impacts to falcon breeding can occur when mechanical operations such as vegetation clearance or earthworks occur near an active falcon nest. This is especially the case during the time that falcons are incubating eggs or brooding young that are less than two weeks old.

To avoid impacting falcon breeding success it is recommended that all mechanical operations are excluded from within 200 m (line of sight) of a falcon nest for the whole time that the eggs and chicks are in the nest (approx. 75 days) (see Figure 9).

The following guidelines are adapted from advice for forestry operations regarding New Zealand Falcon/Karearea nests[5].

1. Between August & March be vigilant for breeding falcons.
2. All newly discovered nests and falcon sightings are to be reported to the project ecologist/ornithologist for advice on how to proceed.
3. Physically mark the nest location (e.g. with flagging tape) so operators know the area to avoid.
4. If the nest cannot be located then setbacks should be measured from the location of any dive-bombing behaviour.
5. Delay working in the area of the nest until the end of the operation in that area.
6. Where possible all mechanical operations should avoid the area within 200 m of the nest (line of sight) until all the chicks have fledged the nest.
7. Where a 200 m buffer is unworkable, operations can be reduced to 100 m.
8. Operations may continue (up to 15 m from a falcon nest) but only once chicks are >2 weeks old[6].
9. Where possible setbacks around vegetation clearance should not be reduced below 200 m.
10. Where operational constraints make a 200 m buffer unworkable, vegetation clearance and earthworks can be reduced to 100 m at the discretion of the project ecologist/ornithologist.

[4] https://rarespecies.nzfoa.org.nz/site/assets/files/1088/how_to_identify_a_new_zealand_falcon.pdf
[5] https://www.wingspan.co.nz/PDF/Forestry-Management-Protocols-final.pdf
[6] A two-week-old chick is downy grey rather than white.

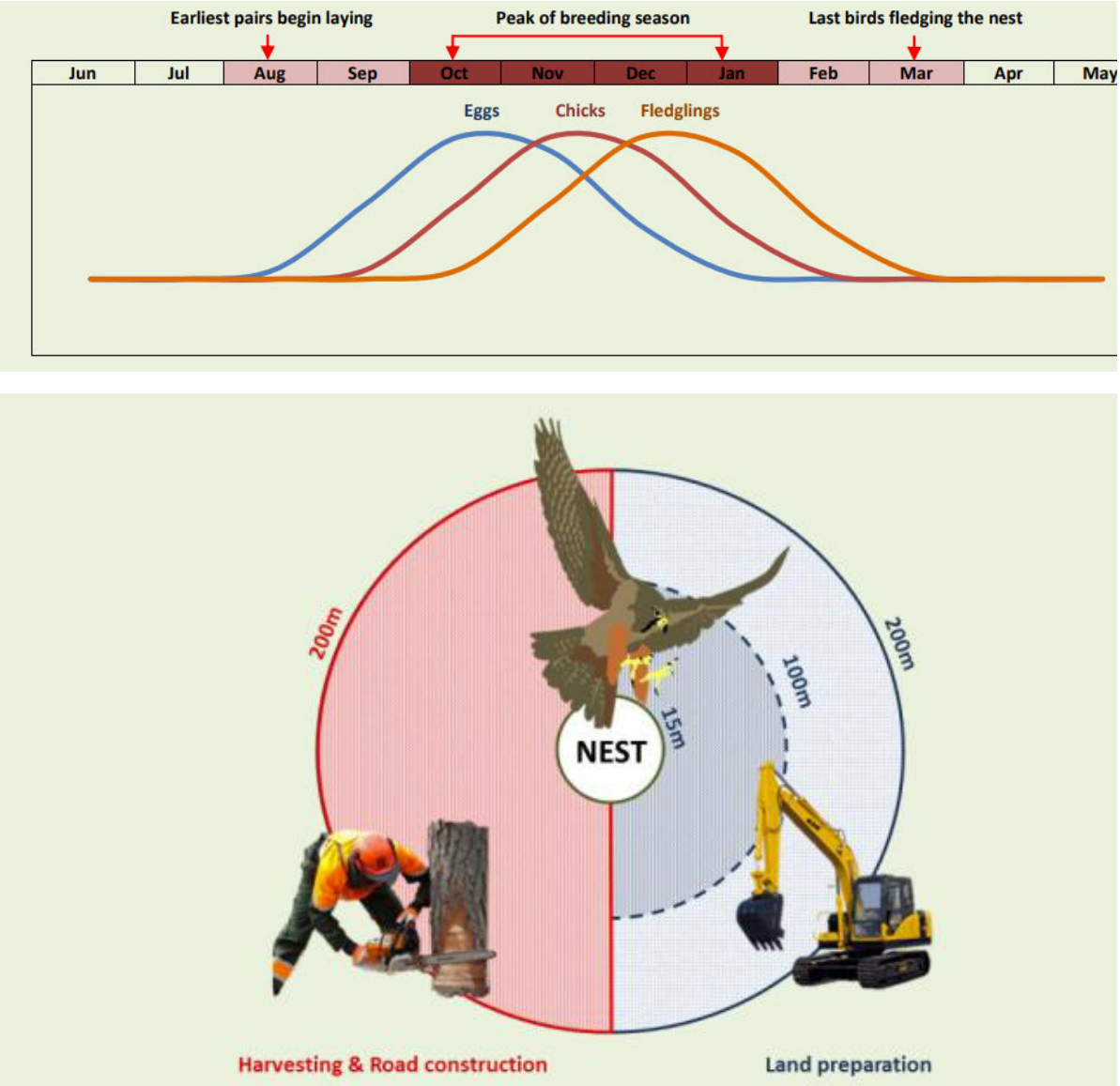


Figure 9. The New Zealand Falcon/ Karearea breeding season (top), with details about occurrence of egg laying, chicks and fledglings. The recommended setbacks of harvesting, road construction (200m) and land preparation operations (variable dependant on nest stage) from active falcon nests (bottom)[7].

6.3.4 Accidental harm to birds during vegetation clearance

In the event of finding a dead or injured native bird during construction of the Sutton Block, the following procedures will be implemented:

- Injured native birds will be taken immediately to a vet approved by DOC for assessment;
- Birds will be placed in a cool, dark, material-lined box/bag by or under the direction of a Project ecologist to ensure the bird is handled appropriately; and

[7] https://www.wingspan.co.nz/PDF/Forestry-Management-Protocols-final.pdf

- The local DOC office or DOC hotline (if after hours) will be contacted no longer than two hours after the injured or dead bird is found. The DOC hotline is 0800 DOCHOTLINE (0800 362 468).
- The name of the contact information for approved contact in the event of native bird injury or mortality shall be advised by DOC.
- DOC and veterinary advice shall be sought in conjunction with a suitably trained Project ecologist when considering the rehabilitation requirements of any injured native birds (for example, legislative requirements will need to be considered).
- Once the vet has made an assessment, the project ornithologist will, taking into account the advice from the vet, determine any rehabilitation action required and the longer-term future for the bird/s. If the bird is dead or euthanised by the vet, it must be taken to the local DOC office as soon as practicable.

6.4 Monitoring and reporting

6.4.1 Reporting

Following inspection and confirmation of absence of nesting birds the project ornithologist/ecologist will report to the consent holder. The consent holder will then submit a completion report to the council for approval within 30 working days. The report should detail the number of active nests located and their management until nest failure or fledging and dispersal of chicks from the natal territory. The report would also detail whether any follow up pest control or monitoring is required and the timing for this. The works completion report would be submitted to Auckland Council Ecological Advice Team, Natural Environment Design, Environmental Services.

7 BAT MANAGEMENT PLAN

7.1 Introduction

This Bat Management Plan (BMP) has been prepared for Stevenson Aggregates Ltd to avoid and minimise potential effects on native bats as a result of tree removal as part of the proposed expansion of Drury Quarry into Sutton Block (the Site). The project area is zoned 'Special Purpose Zone: Quarry' (SPQZ) under the Auckland Unitary Plan – Operative in Part (AUP). This document is focused on the small areas of indigenous vegetation marked for removal.

7.1.1 Plan purpose

The purpose of this Bat Management Plan (BMP) is to set out procedures to avoid, remedy or mitigate impacts on native long-tailed bats (*Chalinolobus tuberculatus*) ('Threatened - Nationally Critical') that may be adversely affected by tree removal as part of the Sutton Block, including:

1. Minimise the risk of killing bats during tree removal within the Project area, adopting current best practice standards as set by the Department of Conservation's (DOC) bat roost protocols for minimising the risk of felling occupied bat roosts (BRP, version 4, 2024);
2. Provide alternative, suitable artificial roost habitat for bats, where an active or inactive roost is identified during implementation of bat roost protocols; and
3. Where artificial roost provision is triggered, provide for multiple artificial roost designs, placement and monitoring to support robust research into artificial roost use by bats.

All native bats are protected under the Wildlife Act 1953 (Wildlife Act) (s 3). The protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna (including native bats) is a matter of national importance in the Resource Management Act 1991 (s 6(e)).

Table 14: Purpose, specific objectives, performance measures and monitoring relevant to the BMP.

BMP Component	Explanation
Purpose	*This BMP outlines how bat management during the project meets the requirements of condition 5 of the Resource Consent Conditions*
Specific Objectives	*The objective of the BMP is to achieve the standards set out in Condition 5 , and to avoid, remedy, minimise or mitigate the potential adverse effects of the project on long-tail bats from the removal of any vegetation and/or trees that are potential bat roost habitat.*
Performance Outcomes	*In particular, the BMP shall include:* *(a) A vegetation removal protocol prepared by a qualified bat ecologist that sets out the monitoring procedures to be implemented for the removal of any vegetation and/or trees that are identified as potential bat roosts. This can be achieved through acoustic surveys, direct observation of trees prior to their removal, and by managing the time (month) of removal;* *(b) Details of ongoing monitoring and reporting of bat activity where occupied bat roosts are discovered;*

	(c) Management actions to minimise disturbance to bats from temporary or permanent lighting associated with the activities; *(d) Proposal for minimising disturbance from construction activities near any discovery of active roosts until the bat ecologist confirms they are vacant; and* *(e) Methods for the replacement of any actual and potential bat roosts that are removed as part of the proposal.* *The vegetation removal protocol set out in the BMP shall be implemented for the removal of any vegetation and/or trees that are identified as potential bat roosts by a suitably qualified ecologist.*
Monitoring	*TBC*
Reporting	*Incident based reporting during vegetation clearance will be followed according to Protocols B and C for managing effects on bats.* *A compliance monitoring report will be submitted annually to AC following completion of each season of vegetation clearance (by June 30th each year).*

7.1.2 Draft consent condition scope

This BMP has been developed in accordance with the Sutton Block consent condition 5.
The requirements of these consent conditions are addressed through the implementation, monitoring and reporting procedures set out in the BMP and the following interlinking plans. The term 'vegetation clearance' in this BMP refers to all vegetation clearance proposed to enable construction of the Sutton Block.

7.1.3 Responsibilities and competencies

Table 2 sets out the roles and responsibilities in relation to the BMP. SAL Manager holds the overall accountability for the implementation of and compliance with this plan.

The project bat ecologist (chiropterologist) will implement this BMP and various phases of bat-related work on the Sutton Block Project. The bat ecologist(s) will be accredited with the relevant DOC skill competency for bat workers relating to the type of bat work outlined in Section 7.4. The project bat ecologist will liaise when appropriate with arborists, vegetation clearance teams, and site engineers.

7.2 Long-tailed bats

Long-tailed bats (LTBs) are found throughout the North Island and are classified as a 'Nationally Critical' threatened species by DOC (O'Donnell et al, 2023). Long-tailed bats typically use forest edges and riparian areas for foraging and commuting (O'Donnell, 2000). They have extensive home ranges (up to 5629 ha) and can fly tens of kilometres per night (O'Donnell, 2001). 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).

7.2.1 Bat records near the Project area

Previous surveys have not recorded bats within the Sutton Pit area, however a single potential pass was detected to the south of the existing pit in 2020, from more than 300 valid survey nights

of Drury Quarry including within and around the Sutton Block. Beyond Drury Quarry, long-tailed bat records are sparse, however while stronghold populations occur to the east in the Hunua Ranges, bats a few records occur 7-8 km to the west, and at Ponga Road, 1 km north (Figure 10).

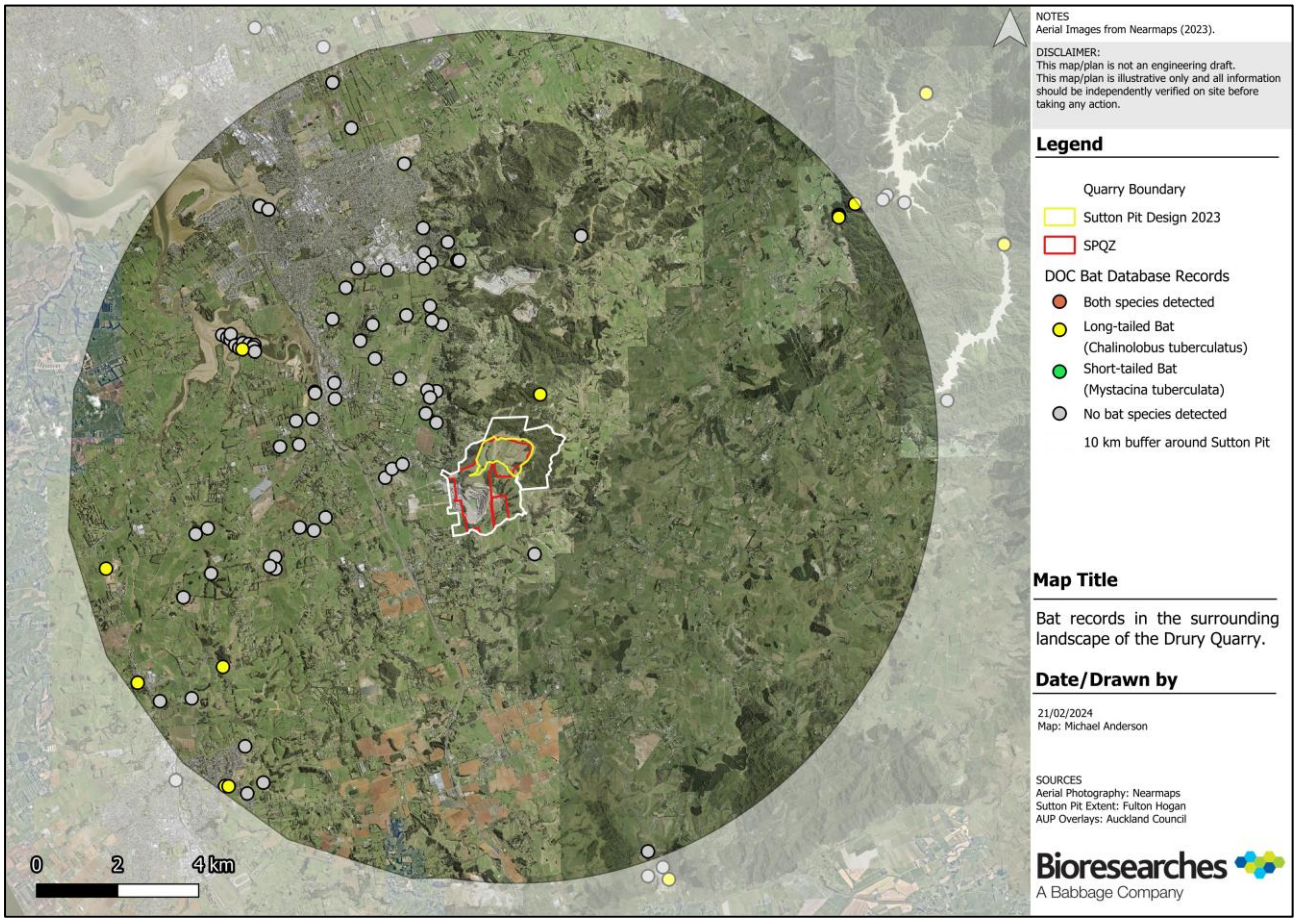


Figure 10. Bat survey information within a 10 kilometre radius surrounding Drury Quarry (DOC bat database accessed February 2024).

7.3 Site Description and potential habitat

The area of affected vegetation is approximately 22.03 ha of mixed native (16.78 ha) and exotic (5.25 ha) vegetation, much of which are associated with fragments of old growth trees (See Figure 3).

7.3.1 Terrestrial Vegetation within the Sutton Block Pit

Four small areas of indigenous terrestrial vegetation occur within the Sutton Block pit; which consist Broadleaved Podocarp Forest ("BLP") and Kānuka scrub/forest ("VS2"). Rock forest ('RF', Figure 11), occurring on volcanic boulder field as a specialized variant of BLP with a suite of species being particular to the habitat. Exotic terrestrial habitats within the Sutton Block pit include small patches of planted exotic forest (EXP) on the western side of the SPQZ, mainly on the edges. In addition, there are areas of exotic scrubland (EXS) and exotic grassland (EG) within the Sutton Block pit.

Figure 11. Rock Forest fragment at Sutton Pit, Drury Quarry.

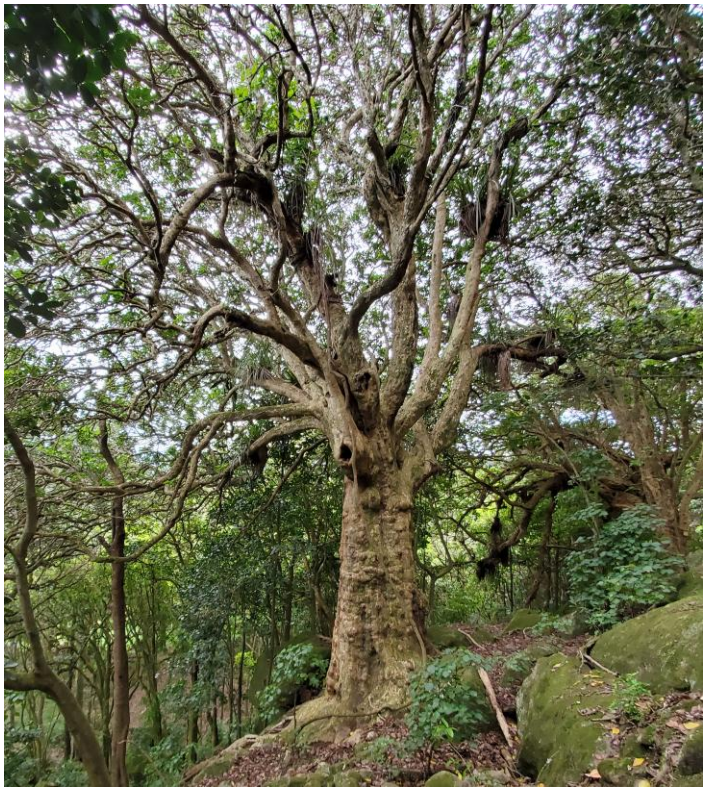


Figure 12 Mature pūriri tree within proposed Sutton Pit with visible bat roost characteristics

Large trees (>15 cm DBH) with potential roost habitat were observed within all four forest types within the proposed Sutton Pit, and these support potential roost features including cracks, knot holes, cavities, and epiphytes (see Figure 12).

7.4 Tree removal protocols

This section details procedures to be followed to give effect to the DOC protocols (Department of Conservation, 2024) for removing trees that have the potential to support bat roosts. Where new versions of the Bat Roost Protocols are released, the most current version will take precedence over the one outlined here (Version 4).

7.4.1 Accredited bat ecologist

DOC requires that only certified personnel may undertake some activities pertaining to bat management. When implementing this Plan, bat ecologists must be approved and accredited to the relevant Competency (C) for the activity they are undertaking:

Table 15. Accreditation requirements for bat activities pertaining to tree felling

Activity	Certification required	Timing of activity
Presence/ absence survey to determine if bats are using the Project Area	Must be designed by approved person accredited with **C 3.1** to determine presence around trees due to be felled/ habitat available at site.	Oct – April inclusive, and when weather criteria are met.
Identifying roost characteristics	Initial criteria (tree is ≥15 cm DBH) can be measured by any ecologist. Identification of Potential Roost Features requires accreditation at **C 3.3.**	Any time of year, but within 6 months of final tree felling.
Physical checking of potential roost features	**C 3.3**, or a certified arborist under the direction of a bat ecologist approved at C 3.3.	Oct – April inclusive, and when sunset temperature previous night is minimum 8° C.
Assessing bat activity around potential roost trees with ABMs	**C 3.1**	Oct – April inclusive, for two consecutive valid nights immediately prior to planned felling.
Assessing use of tree by roost watches	**C 3.2**, or under direct supervision of such during counts requiring multiple watchers.	Oct – April inclusive, for two consecutive valid nights (dusk AND dawn watches required for both) immediately prior to planned felling.
Overseeing tree felling	An approved person accredited with the relevant competency (**C 3.1, 3.2, or 3.3**) used to determine bat absence, and who is: • Familiar with 'Initial Veterinary Care for New Zealand Bats' (Borkin, 2019) • Physically able to check felled trees for bat sign Able to consult with DOC and someone accredited to **C 2.1** if a bat is observed.	Oct – April inclusive, and when pre-felling requirements have been met.

Note: Certification and experience required for each activity in the Tree Removal Protocols, as per DOC BRP (Department of Conservation, 2024)

7.4.2 Planning, staging and pre-felling survey requirements

Prior to undertaking any vegetation removal, the extent of vegetation will be mapped out and agreed with the project ecologist, to provide for current survey information. Surveys must be designed by an approved person accredited with **C 3.1**.

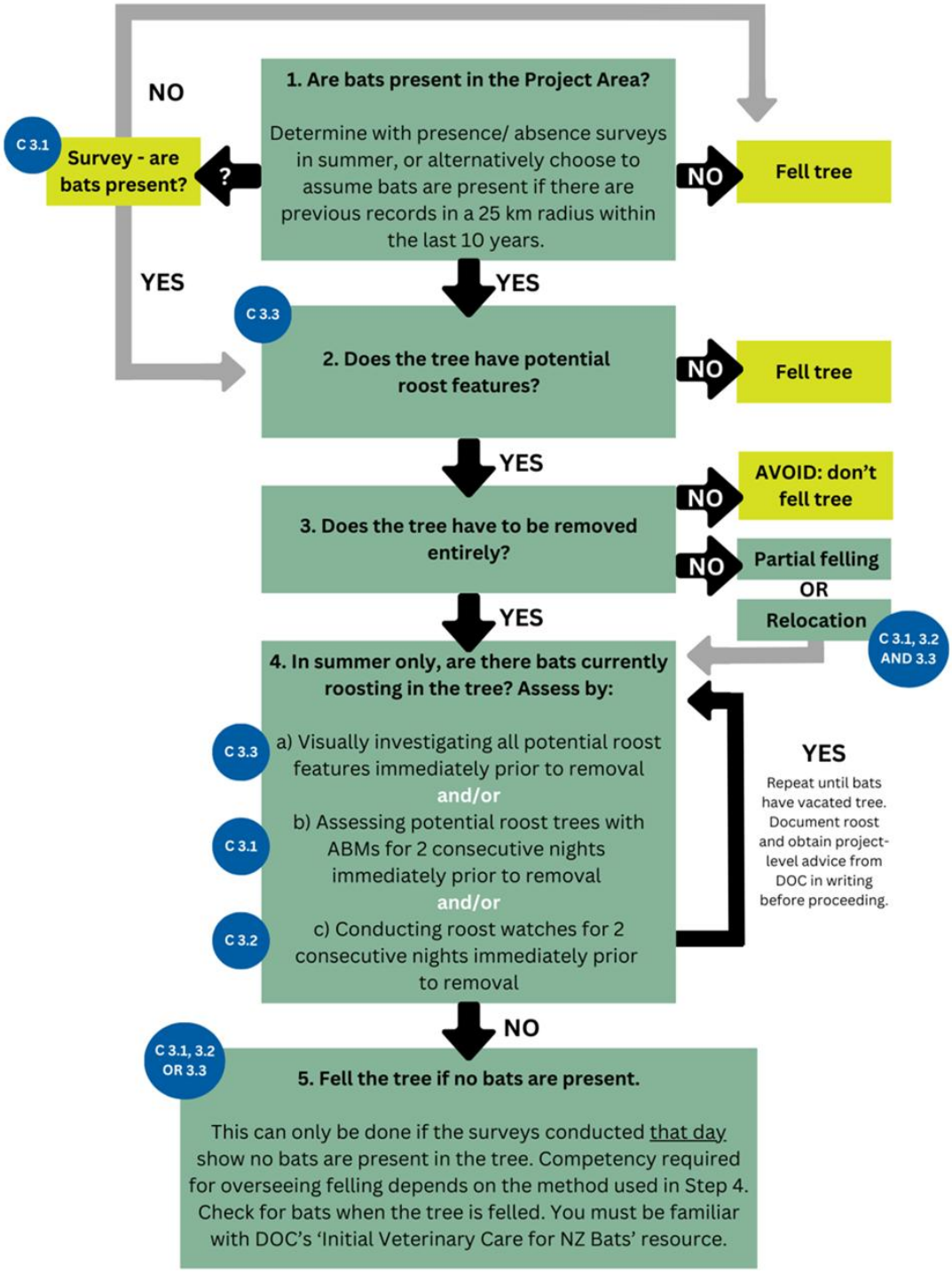
When surveys occur, each extent will be surveyed for a minimum of ten **valid** survey nights. Where bats are not detected, the vegetation may be removed without further survey work provided the Project Bat Ecologist is satisfied the survey information is current (at a minimum, within the same season). While bats have not been recorded to date within the Sutton Block, this may change over the life of the consent, especially with adjacent habitat enhancement. Where any bats are detected during surveys of the Site, Bat Roost Protocols must be followed for any vegetation removal (Section **Error! Reference source not found.**).

Survey data will be shared with DOC at the end of the summer survey season so it may be added to the national database, following any relevant report submission.
All surveys will only consider valid survey nights, although data from all nights will be processed and any passes recorded on invalid nights will still be considered as evidence of bat presence. A valid survey night must:

1. Begin one hour before official sunset and end one hour after official sunrise.
2. Have a temperature 8° C or greater for the first four hours after official sunset.
3. Have no to very little precipitation within the first 4 hours after official sunset, although a light mist or occasional drizzle may be acceptable as assessed by an ecologist accredited with **C 3.1**.
4. No wind, or light wind within the first four hours after official sunset.

7.4.3 Overview Bat roost Protocol

Figure 13 details the decision-making process required for implementing Bat Roost Protocols. Where bats are not detected in a survey as outlined above, the vegetation may be removed without further survey work provided that the accredited bat ecologist (**C 3.1**) is satisfied the survey information is current. Where bats are detected, further assessment of Potential Roost Features of affected trees will be undertaken.



Bioresearches reproduction of 'Tree removal in bat areas flow chart' and associated text from 'Bat roost protocol V4' (Bat Recovery Group, DOC, 2024)

C = Accredited at given Competency number. Note that an activity without a stated Competency may have other requirements

Figure 13. Decision tree for Bat roost protocol (based on DOC BRP, Version 4, October 2024).

7.4.4 Roost characteristics

Where bats are recorded or assumed to be present, vegetation supporting Potential Roost Features (PRFs) will be identified and catalogued by the project bat ecologist to inform which trees the bat roost protocols apply to.

High-risk trees will be qualified as any trees that are ≥15 cm DBH (diameter at breast height) and support PRFs. PRFs include:

- Hollows
- Cavities
- Knot holes
- Cracks
- Flaking, peeling, or decorticating bark
- Epiphytes
- Broken or dead branches/ trunk
- Shelter, cavities, or hollows formed by multiple trunks/ double leaders
- Tree ferns that have dense skirts of dead fronds
- Artificial Roost Boxes

Trees ≥15 cm DBH that cannot be comprehensively assessed for PRFs, for example due to obscured sightlines or limited access, will be precautionarily classified as High-risk also.
Qualifying trees based on size may be conducted by any ecologist capable of measuring DBH, but an approved bat ecologist accredited with **C 3.3** must conduct any identification of PRFs.
Where the vegetation does not support any potential roost features as above, the vegetation may be removed (any time of year) without bat roost protocols.

Assessment of trees for PRFs is valid for six months, unless significant storm/ high wind events occur which could create new roost features, as determined by the accredited ecologist.
If potential roost features are identified in an area where bats are known, suspected, or assumed to be present, those trees must be assessed to confirm that no bats are currently roosting in them prior to felling, as outlined in Section 7.4.5.

7.4.5 Bat activity assessment (high risk trees)

Where bats are confirmed or likely present in the Project Area, 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 an accredited 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; and/or
2. Pre-felling surveys: minimum two consecutive valid survey nights immediately prior to removal; and/or
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 an active or inactive roost will trigger Section 7.4.6 Procedure, and Section 7.4.7 Artificial Roost Provision if the roost cannot be retained.

7.4.5.1 Climbing and inspecting potential roost features

Roost features may be able to be accessed by an experienced tree climber or accredited bat ecologist **(C 3.3)**. A non-certified arborist must provide information along with photographs or video footage to the accredited 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, e.g., 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 LTBs are present.

7.4.5.2 Pre-felling roost ABM surveys

A minimum of two consecutive valid survey nights immediately prior to felling will be undertaken by the accredited bat ecologist **(C 3.1)**. At least two consecutive 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. If any passes are detected, regardless how many or the time of night, the tree(s) covered by the ABM in question must not be felled that day unless bat absence can be confirmed with another method (e.g., climbing to visually inspect potential roost features).
Prior to the commencement of surveys, ABMs must be checked for correct operation. This may be done 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.

7.4.5.3 Roost watches

This must only be undertaken in combination with pre-felling roost ABM surveys (Section 7.4.5.2) and be carried out by a bat ecologist accredited with **C 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 valid nights immediately prior to felling. The following weather conditions define a valid night for roost watches (DOC, 2024):

1. Be undertaken between October 1- April 30 (inclusive)
2. Maintain air temperature >8°C for the entirety of the night
3. Ideally no to very little precipitation within the first 4 hours after official sunset, although a light mist or occasional drizzle may be acceptable as assessed by an ecologist accredited with **C 3.1.**
4. Include ABM deployment and data analysis for the same night
5. No wind, or light wind within the first four hours after official sunset, as determined by an ecologist accredited with **C 3.1**.

Emergence watches

Each tree must be watched from at least ½ hour prior to sunset until it becomes too dark to see by sufficient people to observe all potential exit points. This must be supported using handheld detectors and use some form of night vision aid (e.g., thermal scope, infra-red camera) which can detect bats once it becomes too dark to see. The aim of emergence watches is to identify potential roost locations within the vegetation.

Roost re-entry watches

The time when bats return to roosts can vary based on temperature and time of year. Observers must return the next morning following an evening emergence watch and observe 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 ABMs, e.g., as a guide, 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 will be useful as a tool in this process.

7.4.6 Procedure if bat roost presence is confirmed

Avoidance of felling bat roost trees should be the first step in any project. If bats are sighted, or sign detected, or a roost (active or inactive) is confirmed, the approved bat ecologist, as soon as possible, shall:

- Reassess the necessity of felling the specific tree with the arborist and project manager. For example:
    - Can the works area be modified to avoid the roost tree?
    - Can the tree be topped / pruned etc. such that any component of the tree that supports roost habitat can be retained?
    - Can the tree or the roost feature be relocated? Note this requires an accredited bat ecologist with all three Level 3 Competencies (**C 3.1, C 3.2, and C.3.3**)
- If the tree and its roost features cannot be avoided, then:

    - Call the tree felling supervisor to inform them which affected tree(s) cannot be felled due to detection of bat sign;
    - Clearly mark and cordon off the tree and a 30 m radius to prevent further disturbance; and
    - Notify the site manager, the relevant Auckland Council contact, and the local DOC office detailing the results of the survey and outlining the measures for protecting or managing 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.
- If an active or inactive roost is confirmed, advice must be obtained at a project level in writing from DOC before felling or otherwise conducting works that will impact the roost tree.

7.4.7 Artificial Roost provision

Roost trees, especially those used for communal roosting, are a valuable resource for LTBs. Therefore, any loss of such habitat is a very high-level effect on the basis of the species threat status and the potential low availability of suitable roosts in the surrounding landscape. Restoration planting will not replace high-value roosts in the short to medium term (Sedgeley & O'Donnell, 1999) therefore is unsuitable to remediate loss.

Therefore, this Plan requires provision of carved cavity roosts (CCRs) and/ or artificial bat roost boxes (ARBs), in accordance with DOC's advisory note for the use of ARBs. Where an active or inactive roost is confirmed during Bat Activity Assessment of the High-Risk Trees in this Plan and is unable to be managed in a way to maintain the roost features (e.g. by topping, tree relocation, or relocation of just the trunk/ branch section supporting the roost), CCRs or ARBs will be installed in habitat suitable for bat roosting, as directed by the accredited bat ecologist.

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

Artificial roosts will be installed within a nearby area of protected vegetation, where bats have been detected (by survey, records, or other knowledge). Such opportunities would exist within the 108 ha area of vegetation surrounding the Sutton Block which is to be protected and enhanced.

All artificial roosts will (as per advice note on the use of ARBs (Department of Conservation, 2023)):

- Be deployed at a minimum height of four metres from the ground;
- Be attached securely/ carved into an appropriate tree, with no clutter within 2m of the roost opening;

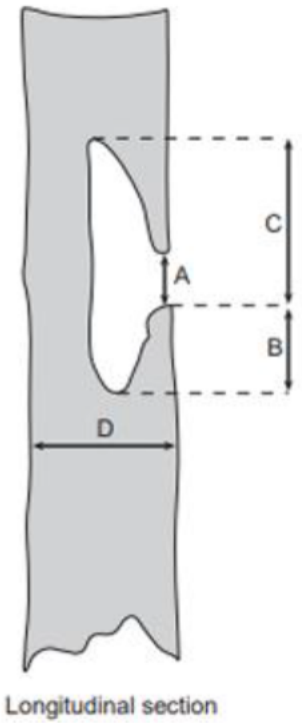
- Be 'predator proofed' where practicable with metal tree bands to prevent access by rats, cats, and possums. Bands will be wrapped around the trunk above and below each artificial roost, provided that non-contiguous vegetation can be maintained between this area and surrounding trees;
- Be of multiple designs (in the case of ARBs), of variable orientation and exposure to light; and
- 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).

7.4.7.1 Carved Cavity Roosts

Creating CCRs (also known as tree veteranisation or chainsaw hollows) involves carving suitable cavities into living or dead wood for bats to roost in. This is a very new technique in New Zealand. While it is likely that CCRs offer more thermal stability than ARBs, their attractiveness to bats, ideal dimensions, and long-term efficacy has not been tested. It is therefore proposed that where CCRs are utilised, they do not comprise more than 50% of artificial roosts provided.

CCR trials in Australia found that all vertical cavities carved into live trees had sealed over with wound-wood within 2 years (Department of Conservation, 2023; S. R. Griffiths et al., 2018). Where CCRs are installed in live trees, chainsaw scoring of the tree surface around the entrance is recommended to slow cavity closure and provide a rough landing surface for bats (S. R. Griffiths et al., 2018).

A technique involving less maintenance is to carve the cavities into standing dead trees, or into trunk sections (e.g., logs from felled trees) which can then be attached to other standing trees. Note that CCRs in logs may not be as thermally stable as those carved directly into standing trees (S. R. Griffiths et al., 2018). CCRs are to incorporate average LTB roost dimensions from Sedgeley & O'Donnell (1999) (Figure 14) and any current information available from trials underway.



Cavity characteristics: letter notation following Figure 1	Mean
Distance to nearest vegetation	7 m
Entrance Height from ground	15 m
Entrance area (height x width): A	100 cm^2 e.g. 10x10 cm. Minimum 5 cm wide.
Internal cavity depth: B	14 cm
Internal cavity height: C	43 cm
Diameter at cavity height (DCH): D	66 cm
Inside cross section: F	405 cm^2
Wall thickness: G	24 cm
Volume	26731 cm^3

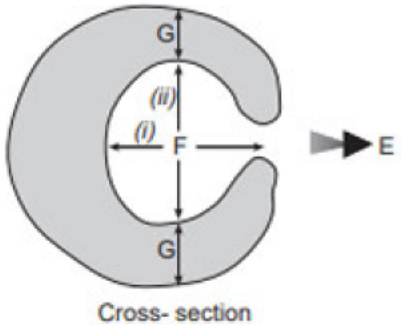


Figure 14. Average long-tailed bat roost dimensions from Sedgeley & O'Donnell (1999).

7.4.7.2 Artificial Roost Boxes

While information on the effectiveness of ARB designs and optimal installation position 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, and potentially limited alternative roost options.

In Canterbury, 96 Schwegler ARBs were installed and monitored across 12 years, with sign of LTBs only detected in 10% of boxes (O'Donnell, 2024). As the boxes were concentrated into 24 locations and were checked infrequently (1-5 years), actual rates of use by roosting bats may be underestimated.
Effects of ARB use on individual fitness and population have not been studied in Aotearoa.

Various roost box designs have been deployed in New Zealand. Models utilised by LTBs include:

- Various timber 'Kent' bat box designs and similar bespoke inspired designs (e.g., Waikato Regional Council).
- Schwegler 'woodcrete' designs (including models 2F, 2FN, 1FF and 1FD).

Figure 15. Examples of artificial bat roost designs; a) Timber 'Kent' design (source: Treelands); b) Schwegler 2FN design (source: Schwegler); and c) Various Schwegler ARBs, flat 1FF model in front (source: A. Hart).

7.4.8 Monitoring and reporting requirements

A compliance monitoring report will be submitted annually to AC following completion of each season of vegetation clearance (by June 30th each year). This will detail any acoustic surveys, habitat assessments, and tree felling protocols undertaken.

Where any CCRs or ARBs are installed, they will be checked annually for a minimum of five years. At each inspection, any cobwebs, bird nesting material, or invertebrates will be removed.

Each artificial roost will be inspected for signs of bat roosting, such as guano. CCRs in live trees will have the bark and cambium cut back if it is encroaching on the cavity, after confirming bats are not currently present within. 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. If bats are determined to be present in the artificial roost, then maintenance must be postponed for a short time until the roost is vacant (e.g., to the following day).

Note that other protected indigenous fauna may utilise artificial bat roosts (O'Donnell, 2024). If a native bird is nesting in an artificial roost, maintenance must be delayed until after the chicks have fledged and left the nest or the nest has failed, after which the nesting material may be removed. Native lizards may not be handled or removed from artificial roosts.

An annual report detailing maintenance undertaken, artificial roost and predator band condition, and sign of occupation by indigenous fauna (including bats, birds, lizards, and notable

invertebrates such as wētā) is to be sent to Auckland Council for a minimum of five years. If any artificial roost use is confirmed (at any time), details are to be provided to DOC to support ongoing research and technique refinement.

8 NATIVE FRESHWATER FAUNA MANAGEMENT PLAN

8.1 Introduction

Bioresearches were engaged by Stevenson Aggregates to prepare a Native Freshwater Fauna Management Plan (NFFMP) for works in streams and wetlands proposed at Drury Quarry. The streamworks proposed will include the extensive reclamation of stream and wetland habitat over 50 years for the creation of a new quarry pit, known as the Sutton Block pit (Figure 16).

A formal fish survey has been conducted, and records from the New Zealand Freshwater Fish Database have been investigated. Freshwater fish captured within the freshwater habitats included shortfin eel (*Anguilla australis*), longfin eel (*Anguilla dieffenbachii*), and the freshwater crayfish or kōura (*Paranephrops planifrons*).
Database records show banded kōkopu (*Galaxias fasciatus*), kākahi (*Echyridella menziesi*) and shortfin eel have been previously recorded within the Sutton Block extent.

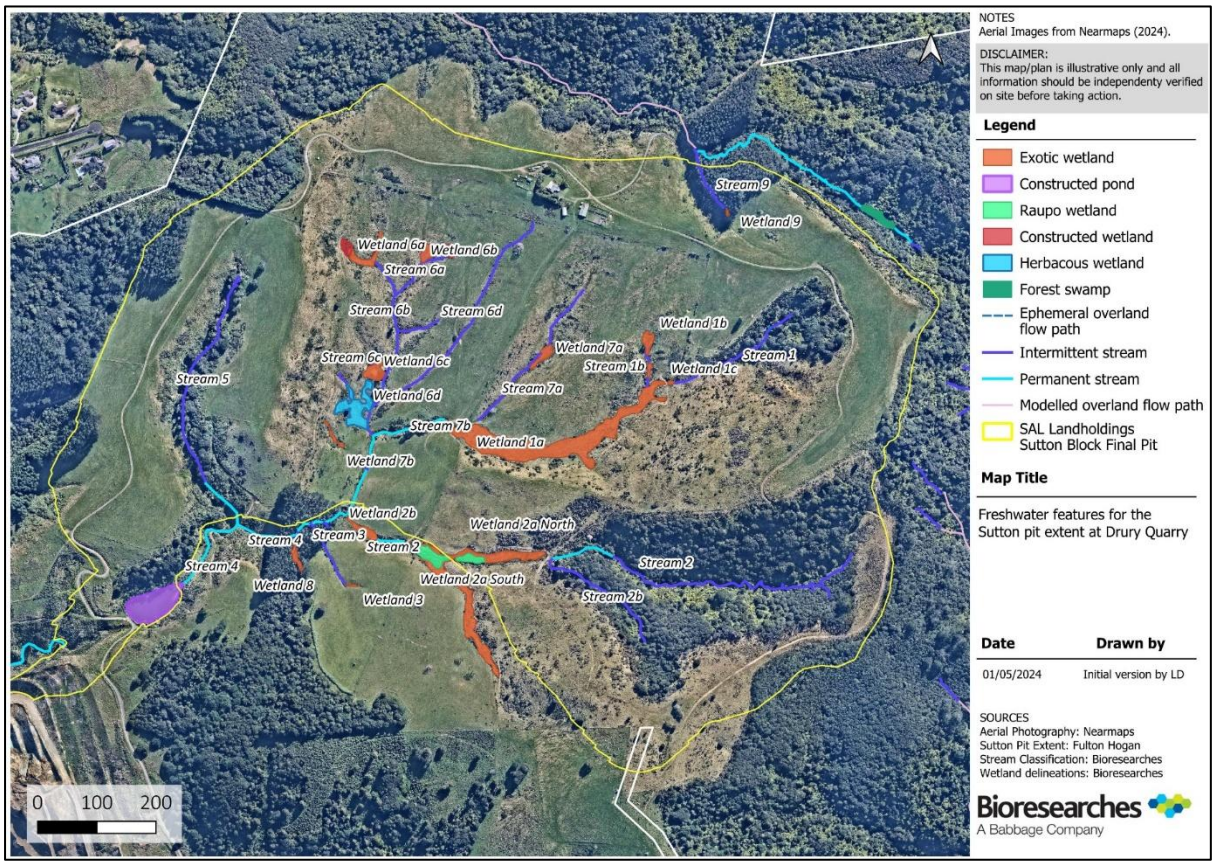


Figure 16. Map of the freshwater habitats (wetlands and stream) present within the Sutton Block. Features located within the yellow polygon are subject to the NFFMP.

This document provides the Native Freshwater Fauna Management Plan (NFFMP) with the methodology for the native freshwater fauna (fish, koura, kākahi) recovery and relocation, in accordance the proposed conditions of consent.
The objective of the NFFMP is to avoid, remedy or minimise the potential adverse effects of the Project on native fish, kōura and kākahi.

8.1.1 Draft consent condition scope

The proposed condition recommends the NFFMP must be:

a) Be prepared by SQEP(s).

b) Include as a minimum:

i) Take into account the outcomes of consultation with the Ngai Tai ki Tamaki Trust.

ii) Methodologies to capture fish within the impact streams.

iii) Methods to recover kākahi and koura.

iv) Fishing effort.

v) Details of the relocation site.

vi) Storage and transport measures including the best practice for prevention of predation and death during capture.

vii) Euthanasia methods for diseased or pest species.

8.2 Methodology

8.2.1 Commencement of Recovery Plan

Fish and aquatic fauna removal and relocation will be undertaken within one week of commencement of any instream or wetland works. The fauna recovery may be carried out in stages, depending upon the infringement of earthworks into recognised aquatic habitat.

8.2.2 Exclusion screens

Prior to capturing aquatic fauna, a barrier (bunds or exclusion screens) to fish movement shall be placed at the upstream and downstream areas of the potential aquatic habitats in which earthworks would be infringed upon to prevent fish from recolonising the impacted areas.

Exclusion screens will be constructed from steel waratahs and shade cloth. The shade cloth allows water to continue to flow downstream while preventing fish passage. The exclusion screen will extend 1 m past the wetted widths of the aquatic habitat and will be embedded into the dry ground or the banks.

Waratahs will be securely hammered into the ground and evenly spaced across the aquatic habitat to effectively support the shade cloth. Where extra support is considered necessary, wire will be threaded horizontally across through the waratahs to further support the shade cloth. Shade cloth will then be fastened to the waratahs and wire supports (where applicable) using zip ties. The shade cloth will extend above the water level to an approximate height of 0.5 m. Along the stream bed the shade cloth will either be embedded and pinned, or an apron of the shade cloth will be formed and pinned.


Photo 1 and 2. Photo examples of fish exclusion barriers

8.2.3 Fish and fauna capture methodology

The New Zealand Freshwater Fish Sampling Protocols (Joy et al. 2013) will be followed unless specified within this plan. Setting of Gee-minnow traps will also be in general accordance with A Revised Methodology to Survey and Monitor New Zealand Mudfish Species (Ling et al. 2013).

All Bioresearches freshwater ecologists have conducted multiple successful freshwater fish relocations and have electric fishing licences and have extensive experience in freshwater fish handling and ecology. At least one of them will be present on site during the relocation.

Native fish and kōura present shall be captured over a minimum of two days using a combination of netting/trapping and electric fishing.

Water levels permitting, baited Gee-minnow traps (GMT) and fyke nets will be placed at intervals over the stream works area and left in place overnight. Fine meshed fykes with a separator grill will be used. All nets and traps will be set with an airspace to provide trapped fish access to atmospheric oxygen and will be set in general accordance with the New Zealand Freshwater Fish Sampling Protocols (Joy et al. 2013), with a minimum of one fyke net and two GMT's per 25 m, ideally, this trap density will be increased. Small buoys are to be placed in the fyke nets if required (i.e. if the overnight oxygen levels in the water are likely to be low). The traps will be checked the following morning, prior to 9 am, with any captured fish and other aquatic fauna recovered.

A minimum of two electric fishing runs within the areas will be carried out over the trapping period. One electric fishing run will be undertaken prior to setting any traps or nets and another electric fishing run will be undertake post the last occasion of retrieving the traps or nets. Electric fishing shall be undertaken using an electric fishing machine (EFM 300). When used correctly, the EFM 300 temporarily stuns the fish, allowing them to be caught without damage.

Kākahi may be present within the soft substrates of the reclamation areas and shall be salvaged by hand searching soft sediments, within either wadeable or dewatered freshwater habitats. A benthic viewer may be used to assist the searches or within deeper waters. These hand searches

should target recognised kākahi habitats such as soft sediments under logs, undercut banks and the edges of large pools.

8.2.4 Performance standards

As a minimum performance for trapping if more than ten native fish (excluding juvenile shortfin eels) are caught during a single trapping effort within the staged area of the site then trapping will continue until numbers are depleted to the satisfaction of the project ecologist (using an 80% removal rate as a target, based on the Hayne's 1949[8] regression method). A single trapping effort is considered to be one night of trapping.

In relation to juvenile shortfin eels (<350mm), fishing will continue until a 50% removal rate is achieved (based on the Hayne's (1949) regression method).

Dewatering will commence provided that the electric fishing minimum performance standards have been met. Native fish, such as eels (*Anguilla* spp.), will burrow into silt substrates when they are disturbed or as water levels decrease. As a result of this, during the dewatering stage, a freshwater ecologist will be present to search through drained habitat, rocks/debris, remaining pools or thick sediment for any remaining fish. Once dewatering is completed an excavator will be used to carefully scrape out any thick layers of sediment. Any sediment removed from aquatic habitat will also be handed checked by the freshwater ecologist.

8.2.5 Fish and fauna handling and relocation

Fish handling will be in accordance with Section 3.9 of the New Zealand Freshwater Fish Sampling Protocols (Joy et al. 2013) and the Bioresearches MPI Special Permit 872.

All native fish captured will be relocated on the day of capture to suitable alternative habitat. Ideally fish are relocated to suitable, similar habitat types within the same catchment where suitable shaded permanent water is present. Stream information obtained from the Auckland Council GIS viewer and onsite assessments revealed suitable habitats (e.g. high shading and sufficient water levels) to be present immediately downstream of the reclamation area, within the permanent stream, Stream 4.

Following capture, fish will be transferred into lidded containers of an appropriate volume for the number of fish caught and kept cool. Whilst contained fish will be monitored and water will be changed every hour. If any individual captured fish shows signs of stress (loss of righting response, exuding excessive mucus, gulping air, and or mouth gaping) the water will be changed to provide more oxygen, or the fish will be moved to the relocation site immediately.

[8] Hayne, D.W. 1949: Two methods for estimating populations from trapping records. Journal of Mammalogy 30: 399–411.

Fish will be visually examined for general health (visual skin lesions or heavy fungal burdens) and if considered unhealthy by an appropriately qualified freshwater ecologist, they will be humanely euthanized in accordance with Section 29 of the MPI Special Permit (872).

Large eels (> 500 mm) will be contained individually to avoid injury to other smaller captured fish. Kōura, if present, will also be separated into their own containers.

Kākahi will be transported within separate lidded buckets with aeration bubblers, with kākahi crowded together at the bottom of the bucket. Kākahi will be placed in suitable stream habitats at the relocation site, side-lying, to allow kākahi to bury themselves.

Captured fish will be securely transported to the relocation site and gently transferred into the downstream reach within two hours of being captured. If large numbers of fish are captured, they will be distributed across multiple release points in the general area to avoid short term overstocking and predation risks.

8.2.6 Timing of works

The initial works required by the NFFMP will be undertaken no more than one week prior to any stream works commencing within the specified area. Ongoing maintenance of the temporary fish barriers will be undertaken until streamworks are complete within the area.

8.2.7 Biosecurity

All equipment will be thoroughly cleaned and dried prior to their use. Equipment includes but not limited to; electric fishing machine, waders, fyke nets, gee minnow traps and transfer buckets.

Any pest fish caught will be humanely euthanized and all euthanized pest fish will be disposed of in a bio secure manner to land, in accordance with MPI Special Permit 872.

8.2.8 Adaptive management

Due to the high level of intrinsic variability in any fish and aquatic fauna recovery and relocation, this plan may be slightly modified by an appropriately qualified freshwater ecologist to ensure fish and fauna are recovered in a safe and professional manner, as well as in accordance with the New Zealand Freshwater Fish Sampling Protocols (Joy et al 2013).

As the project progresses, appropriate changes to this Native Freshwater Fauna Management Plan should be undertaken, as seen fit by the project ecologist.

8.3 Culvert design for fish passage

Culverts have the potential to restrict fish passage to upstream habitats if installed or constructed poorly. Where practicable, culverts will be constructed to be 'fish-friendly' and in accordance with New Zealand fish passage guidelines[9].

8.4 Reporting and requirements

8.4.1 Reporting

Following each relocation, a short report will be prepared detailing the fish and fauna captured (species and number) during the recovery, as well as details on the relocation site. The Auckland Council shall be provided with a copy of the report within five days of completion of dewatering. Fish records will also be sent to NIWA to be included in the New Zealand Freshwater Fish Database.

8.4.2 Permits

Bioresearches hold an MPI Special Permit (872) that to allow persons or agencies to take aquatic life and relocate it to a suitable habitat where this is necessary or required to mitigate adverse effects of habitat modification on the aquatic life.

Since the capture and relocation sites are not within a conservation area and the fact that any fish captured will be relocated within the same catchment, no other permits are considered necessary

8.4.3 Reporting required under the National Environmental Standards for Freshwater

The Resource Management (National Environmental Standards for Freshwater) Regulations 2020 identifies monitoring and maintenance requirements for consented structures (section 69). Requirements under section 69 are presented below.

69 Condition of resource consent for activities: monitoring and maintenance

[9] National Institute of Water & Atmospheric Research Ltd. (NIWA) (204). New Zealand Fish Passage Guidelines Version 2.0. Prepared for the Ministry for the Environment June 2024. 427pp.

(1) This regulation applies to any activity that—

a. is the placement, use, alteration, extension, or reconstruction of any of the following structures in, on, over, or under the bed of any river or connected area:

i. a culvert:

ii. a weir:

iii. a flap gate (whether passive or non-passive):

iv. a dam:

v. a ford; and

b. is a class of activity that requires a resource consent, whether under this subpart or otherwise.

(2) A resource consent granted for the activity must impose conditions that—

a. require monitoring and maintenance of the structure that is sufficient to ensure that its provision for the passage of fish does not reduce over its lifetime; and

b. require a plan for that monitoring and maintenance that includes—

i. how the monitoring and maintenance will be done; and

ii. the steps to be taken to avoid any adverse effects on the passage of fish; and

iii. the steps to be taken to ensure that the structure's provision for the passage of fish does not reduce over its lifetime; and

iv. how often, as specified by the consent authority, the information must be provided under paragraph (c) (for the purposes of reassessing the structure's effect on the passage of fish); and

v. a process for providing that information; and

c. require an updated version of the information relating to the structure that was required for the original resource consent to be provided to the consent authority at the following times:

i. at the intervals required by the plan; and

ii. each time a significant natural hazard affects the structure.

Monitoring and maintenance of all structures installed for this project will meet the above conditions and will be outlined in further detail in the Stormwater System Operation and Maintenance Plan [to be developed].

9 SUTTON RIPARIAN PLANTING PLAN

9.1 Executive Summary

Bioresearches has been engaged by Stevensons Aggregates Limited (SAL) to provide a Sutton Riparian Planting Plan (SRPP).

The purpose of the riparian planting in the Sutton Block is to mitigate the loss of freshwater volume via expected catchment reductions The planting detailed in this Plan aims to minimise these effects through riparian planting of 'open' stream and wetland habitat within the same catchment (20 m on main stream and 10 m on tributaries), through provision of shade to reduce temperature and temperature fluctuations, and habitat enhancement via organic matter inputs.

This Plan details planting schedules and associated maintenance for watercourses and wetlands, including the northern tributary/main stem adjacent to the final pit, and its tributaries.

9.2 Introduction

9.2.1 Purpose and Background

SAL is proposing a new quarry pit and associated facilities ('the Project') to extend the life of its Drury (Auckland) Quarry operation. The new pit would be excavated within an area to the north-east of the existing pit, in an area known as the Sutton Block ('the Site'). The Sutton Block comprises approximately 88 hectares of predominantly grazing pasture, with fragments of indigenous and exotic vegetation, permanent and intermittent streams, and natural wetlands.

Bioresearches has been engaged by Stevensons Aggregates Limited (SAL) to provide a Sutton Riparian Planting Plan (SRPP). The purpose of the riparian planting in the Sutton Block is to mitigate the loss of freshwater volume via expected catchment reductions. The planting detailed in this Plan aims to minimise these effects through riparian planting of 'open' stream and wetland habitat within the same catchment (20 m on main stream and 10 m on tributaries), through provision of shade to reduce temperature and temperature fluctuations, and habitat enhancement via organic matter inputs.

This Plan details planting schedules and associated maintenance for watercourses and wetlands, including the northern tributary/main stem adjacent to the final pit and its tributaries (Figure 17, Bioresearches, 2024). The planting adjoins, and will be contiguous with, proposed offset planting for the Project (Figure 17).

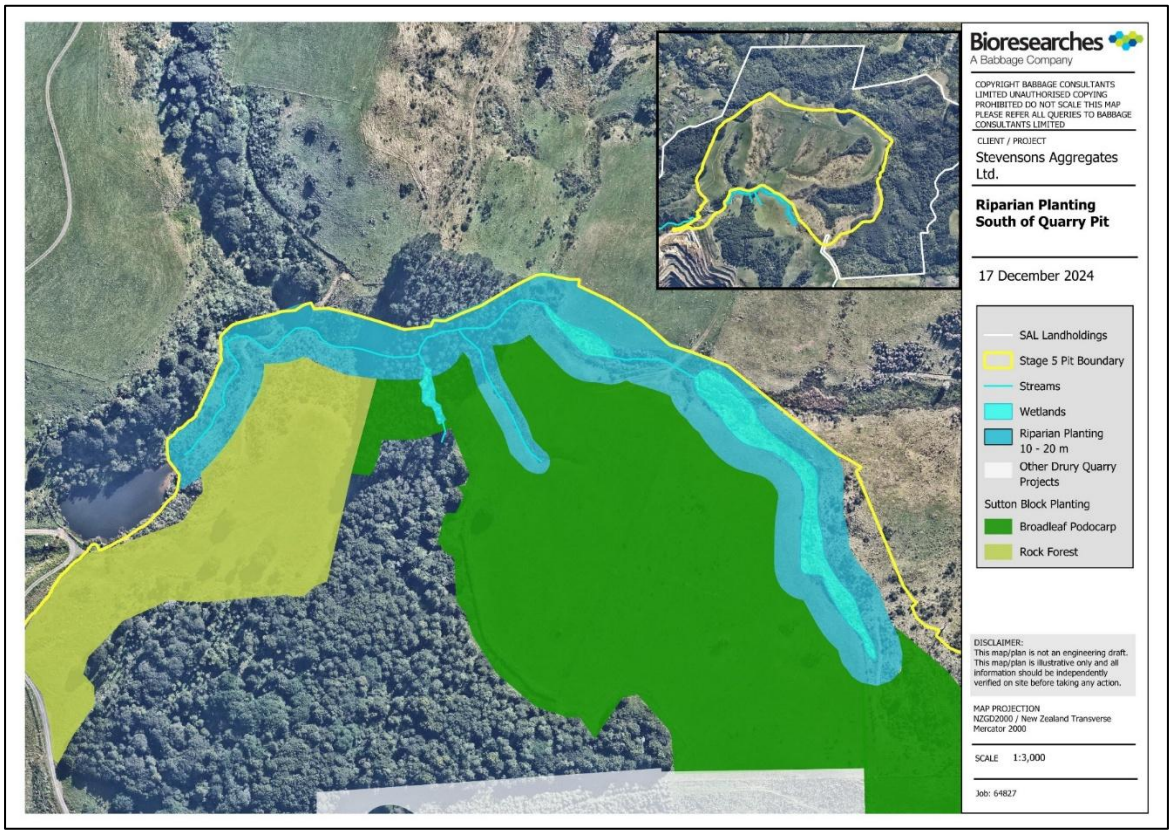


Figure 17: Locations of riparian planting south of the proposed Stage 5 pit

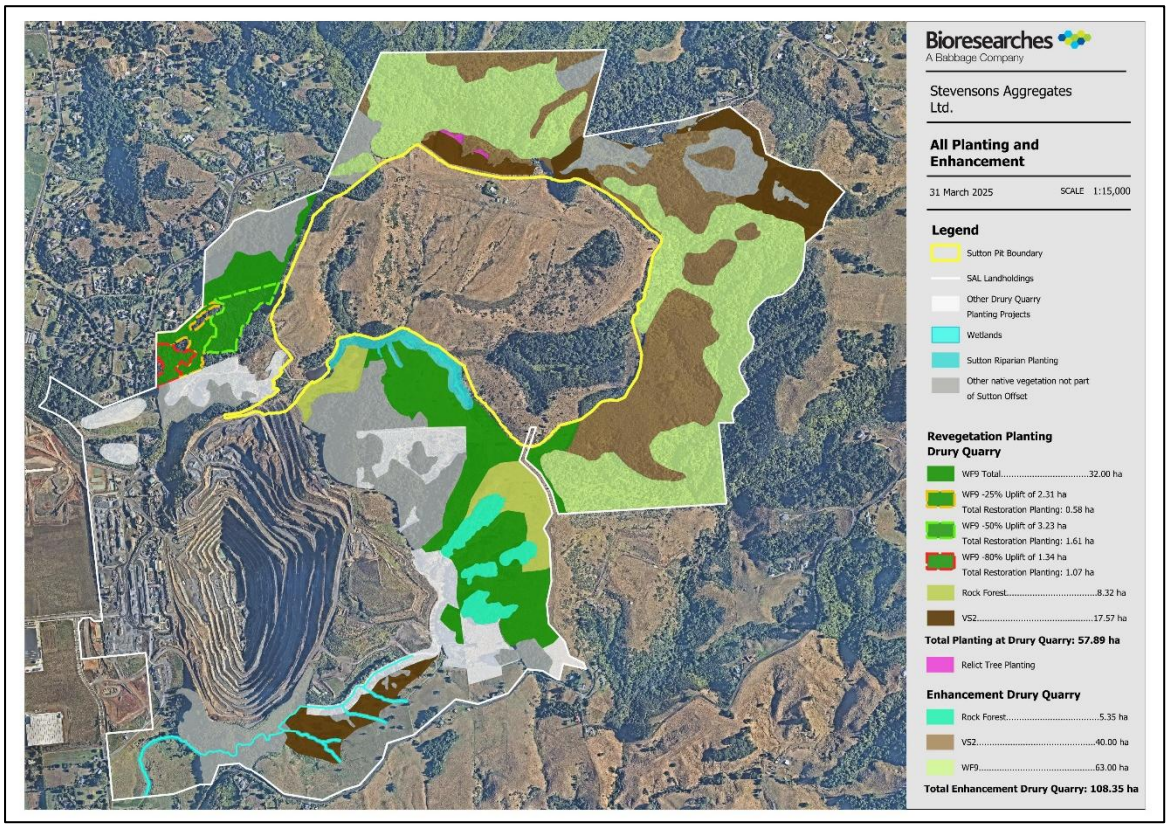


Figure 18: Map showing Drury Quarry Sutton Block offset and revegetation actions, including riparian planting

Ten metres (10 m) of riparian planting (minor tributaries) and 20 m (main tributaries) is to be planted surrounding remaining reaches and wetlands outside the Sutton Block extent. Riparian planting will provide temperature control, and improve provision of habitat (woody debris, leaf litter).

This plan is based on several frameworks, including:

- Appendix 16 of the Auckland Unitary Plan (AUP): Guideline for native vegetation plantings
- Te Haumanu Taiao (Auckland Council, 2023) guidelines on restoring natural environments in Auckland
- Auckland Council guidelines on riparian planting
- The Residual Effects Planting and Pest Management Plan prepared for Drury Quarry Sutton pit (JS Ecology, 2024).

Planting areas are to be covenanted to protect the revegetated areas in perpetuity.

9.2.2 Contents of this Plan

According to the Assessment of Ecological Effects (Bioresearches and JS Ecology, 2024), this plan must, as a minimum:

i) Consider the outcomes of consultation with relevant local Iwi;
ii) Include plans identifying the areas of proposed riparian planting;
iii) Describe plant species mixes; plant spacing, density and layout; plant size (at time of planting); and planting methods (including ground preparation, mulching and trials);
iv) Describe where the plants will be eco-sourced from (including species genetic source and propagation methodology);
v) Describe fencing (location, type and maintenance requirements), stock exclusion, or any other physical works necessary to protect planted areas from livestock;
vi) Describe the legal arrangements (land purchase, leasing or covenanting) to be entered into to ensure the planted areas are retained in perpetuity;
vii) Include a plant pest management programme that as a minimum targets species that threaten new or replacement plantings;
viii) Include an animal pest management programme;
ix) Describe the ongoing maintenance and management of planted areas, including a requirement that over a 5-year period (or until 80% canopy cover is achieved) plants that fail to establish are replaced.

This plan addresses:

1. Weed removal and management;
2. Planting methodology, sourcing and schedules;
3. Protection of plants required at the implementation stage;
4. Plant monitoring targets and maintenance; and
5. Plant disease and pest animal management.

9.3 Planting Site Description

The majority of the stream and wetland habitat, that will remain outside of the pit boundary, does not currently have riparian vegetation. Stream banks are mostly bare, or very sparsely sheltered by low-stature common natives and exotics. The wetlands are currently surrounded by pasture grass and weeds.

In general, the streams and wetlands are subject to a high degree of sun exposure and associated negative effects of increased temperature.

Photo 3: Example of wetland habitat on-site, which currently contains native raupō, exotic Persicaria maculosa, and edges of gorse

Photo 4: Example of stream habitat on-site, currently devoid of riparian vegetation

The Sutton Riparian Planting will provide the following ecological benefits:

- Replace pasture grass and/or weed species with higher value native shrubs and trees in the riparian zone;
- Reduce temperature fluctuation control and reduction of nuisance growth of aquatic vegetation through shading;
- Provide organic material (plants and invertebrates) into the stream, increasing shelter and food resources for instream fauna;
- Stabilisation of channel banks and channel shape; and
- Reduction of sediment inputs into the streams.

9.4 Mana Whenua Values

Drury Quarry have undertaken consultation with Mana Whenua iwi in relation to the proposed pit development and management of natural resources.

Ballard's Cone (Kārearea pā) is a site of high cultural value to Mana Whenua. This pā site comprises existing native vegetation, south of the areas proposed in this plan to be riparian planted. Between the pā and the riparian planting, terrestrial revegetation planting is proposed within the Residual Effects Planting and Pest Management Plan (JS Ecology, 2024).

Ngaati Te Ata and Ngāti Tamaoho iwi have indicated a wish to revegetate the area surrounding Kārearea pā. Restoration planting of rock forest, podocarp broadleaved forest and kānuka forest is planned in this area (JS Ecology, 2024). The salvage of native seeds, cuttings and seedlings from the impact site is proposed during vegetation removal. These will be reused within the replanting areas, preserving the whakapapa of the mature forest species being lost in the Sutton Pit footprint. There will also be opportunity for salvage of native logs for cultural use at the time vegetation is removed.

The enhancement of the remaining stream and wetland habitat north and adjoining to Kārearea pā and the terrestrial residual effects replanting will further enhance the mana and value of the site, by improving stream habitat and ecological function.

9.5 Planting and Enhancement Implementation Plan

A multi-staged approach is adopted by the following plan to ensure the survival and establishment of plantings and successful revegetation.
This section includes details of:

- Weed removal and management;
- Pest animal management;
- Planting installation; and
- Maintenance.

The following stages are adapted within this Plan:

Stage 1 – Pre-Planting

- Perimeter fence construction – fence all areas to be planted if stock are still present, to ensure segregation from stock
- Weed control - prior to the winter restoration planting, site preparation involves removal of any major weeds within the enhancement and revegetation sites.
- Animal Pest Control – Begin baiting, trapping and shooting programmes to reduce animal pest indices.

Stage 2 – Planting

- Prepare enhancement area and plant pioneer species according to the planting schedule.

Stage 3 – Ongoing Maintenance (five years)

- Replace unsuccessful plantings.
- Maintain plants with weed control.
- Once the pioneer plants have reached sufficient size to shelter enrichment species (approximately three years), under-planting of canopy and enrichment species can commence within the revegetation site. Releasing or removal of pioneer plantings may be required to make room for the new plantings. Enrichment planting should be undertaken in conjunction with the enrichment planting of the residual effects planting and pest management plan.

9.5.1 Stage 1 – Pre-Planting

Prior to planting, fence construction, and plant and animal pest control, should be undertaken. This increases the chance of planting success at the time of installation.

9.5.1.1 Perimeter Fence Construction

It is likely that fencing will not be required due to the lack of stock surrounding the planting areas once planting has been undertaken. Fencing has been proposed to surround the terrestrial revegetation (JS Ecology, 2024), which will also incorporate the riparian planting outlined in this plan.

9.5.1.2 Weed Removal and Management

Weed removal is required before planting, both along the riparian margins and within the stream channel. Weeds and pest plants can smother the existing indigenous flora and inhibit growth of any new plantings. Some weed species will need continued maintenance, as their seeds or rhizomes can persist in the ground. Weed removal success is improved when carried out in the warmer months (October to March) and should be completed prior to planting activities commencing.

Native and Exotic Species On-Site

Weed species are currently present on site. The weeds vary in size, and will require different methods of removal. Native vegetation should be retained where possible. A list of common weed species and their suggested removal methods can be found in the section below.

Weed control must be undertaken by or under guidance of a suitably qualified contractor/ecologist. Natives on-site should be marked with flagging tape or similar prior to weed control, to ensure they are not removed or damaged. Native seedlings should also be retained to allow the natural regeneration of the enhancement areas.

Weed Removal Methods

The weed removal methods described below detail methodologies recommended to foster natural regeneration and prevent the loss of native species.
It is recommended that weeds are removed entirely, by hand or using small machinery, wherever possible.

The use of herbicides should be avoided or minimised wherever it is practical to do so, and completely avoided within 3 m of the wetted edge of streams. Blanket chemical weed control over the ground would also result in the loss of regenerating natives. Given the large size of the revegetation area, it is acknowledged that some chemical weed control may be necessary.

This section provides guidelines and restrictions regarding the application of chemical control substances which are to be followed where chemical control is required.

The following are options for the removal of weeds of varying size and difficulty (Forest and Bird, 2024):

1. Rake, roll up, dig out or pull out entire plant (including root system) and dispose at a refuse/green waste station (woody weeds below 4 m in height).
2. Kikuyu and pasture weeds:
    a. Where kikuyu occurs along stream bank edges and riparian margins, chemical control is not recommended. Planting may occur into kikuyu grass and low-growing pasture weeds, provided the grass is initially cleared by hand/mowed at a low setting surrounding the new plant, and plants continue to be released from kikuyu regrowth. Plant guards and biodegradable weed mats surrounding each

new plant, are recommended to reduce the need for spraying as new planting establishes

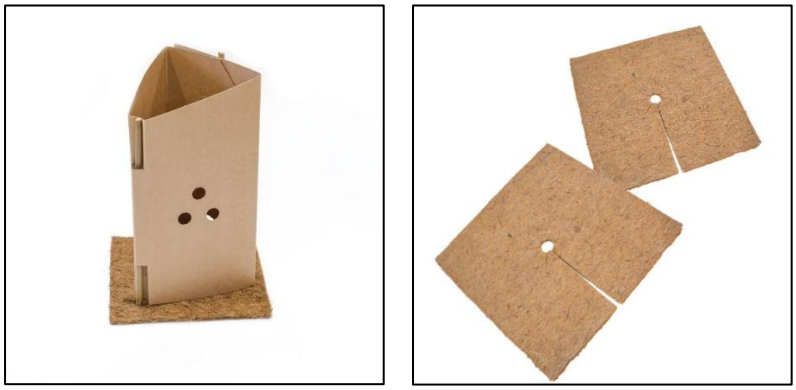


Figure 19. Biodegradable plant protection tools: Left- plant guard, Right- square weed mat (Egmont Coir Tuffguard mat)

3. Large woody weeds that cannot be removed entirely or dug out (below 4m in height):
   a. Drill and inject: Drill 18mm holes angled downwards in spiral up tree trunk. For 50mm stems, drill one hole. For 100mm stems, two holes. For larger stems, holes 150mm apart. Inject glyphosate (500 ml / L) into stem.
   b. Cut across trunk and immediately paste the stump with metsulfuron or glyphosate gel.
4. Large trees (above 4 m in height) to be removed by a qualified arborist.

Special note should be made of large pest tree species that may occur within or overhanging watercourses. Some species, such as poplar and willow, will regrow from stumps and therefore cutting the tree across the trunk is not an appropriate weed control method. However, removing the tree entirely may reduce bank stability. The logs and roots in the stream also provide good aquatic habitat. It is recommended that pest species such as this are controlled according to number 3 above: either cut and paste with gel, or drilled and injected, but leaving much of the base of the trunk in-ground. Note that for larger pest trees (>15 cm DBH) such as willows, standing control is recommended to eliminate any risk to cavity-dwelling indigenous fauna (e.g. cavity-nesting birds, bats) and/ or to help support habitat for these fauna in future.

Logs and woody debris should be left in-situ, as these provide habitat diversity both within and surrounding the stream. They may also foster populations of native skinks.

Photo 5: Examples of woody debris on-site that should be left in-situ

Table 16: List of common pest plant species and their suggested removal methods- should mechanical removal not be possible

Botanic Name	Common Name	Weed Control Method
Alnus glutinosa	Black alder	Slice through the lower part of the trunk of large shrubs/small trees (below 4 m in height) and inject glyphosate into stem, or paste the stump with metsulfuron gel (see number 3 in methods above). Remove entire tree via qualified arborist
Crataegus monogyna	hawthorn	Slice through the lower part of the trunk of large shrubs/small trees (below 4 m in height) and inject glyphosate into stem, or paste the stump with metsulfuron gel.
Berberis glaucocarpa	barberry	Cut across trunk and immediately paste the stump with metsulfuron gel Spray with glyphosate during extended dry periods and with a minimum 3 m distance from watercourses
Pinus radiata	Monterey pine	Slice through the lower part of the trunk of large shrubs/small trees (below 4 m in height) and inject glyphosate into stem, or paste the stump with metsulfuron gel (see number 3 in methods above). Remove entire tree via qualified arborist
Zantedeschia aethiopica	Arum lily	Cut across trunk and immediately paste the stump with metsulfuron gel
Populus alba	poplar	Slice through the lower part of the trunk of large shrubs/small trees (below 4 m in height) and inject glyphosate into stem, or paste the stump with metsulfuron gel (see number 3 in methods above). Remove entire tree via qualified arborist
***Salix* spp.**	willow	Slice through the lower part of the trunk of large shrubs/small trees (below 4 m in height) and inject glyphosate into stem, or paste the stump with metsulfuron gel (see number 3 in methods above). Remove entire tree via qualified arborist
Ulex europaeus	gorse	Cut across trunk and immediately paste the stump with metsulfuron or glyphosate gel
Pennisetum clandestinum	kikuyu	Spray with glyphosate during extended dry periods and with a minimum 3 m distance from watercourses Where kikuyu occurs along stream bank edges, blanket chemical control may not be appropriate. Planting may occur into kikuyu grass and low-growing pasture weeds, provided the grass is initially cleared

		by hand/mowed surrounding the plant, and plants continue to be released from kikuyu regrowth.
Hedychium gardnerianum	ginger	Cut across trunk and immediately paste the stump with metsulfuron gel
Cortaderia spp.	pampas	Spray with glyphosate during extended dry periods and with a minimum 3 m distance from watercourses Cut across trunk and immediately paste the stump with glyphosate gel
Solanum mauritianum	woolly nightshade	Cut and paste stump with double strength glyphosate gel

Herbicides should only be applied following a minimum of three (3) days without rainfall, and when rainfall is not forecast within 24 hours. This prevents run-off into watercourses, and the herbicide rapidly draining into groundwater. In addition, the following general guidelines apply when using herbicide control methods:

- Identify plants that will need to be retained prior to commencing weed removal activities;
- Keep a minimum of 1 m away from any native plants when applying glyphosphate (and 3 m away when using herbicides with residual activity such as Metsulfuron); and
- Refrain from spraying directly next to watercourses – remain a minimum of 3 m distance from the wetted edge at all times.

It is recommended the use of the following chemical control substances is **avoided** due to their ability to accumulate in the environment:

- 2,4-D ester, MCPA and/or MCPB (often contained in herbicides marketed as 'broadleaf killers', e.g. 'Pasture-Kleen', 'Ken-ester Relay' or 'Pasture Guard');
- Picloram and/or triclopyr (often contained in herbicides marketed as 'brushkillers', e.g., 'Eliminate Brushkiller' or 'Tordon Brushkiller');
- Clopyralid (e.g. 'Void');
- Asulam (e.g., 'Asulan');
- Fluroxypyr (e.g., 'Tandus XL' or 'Starane'); and
- Saflufencil (e.g., 'Sharpen').

Always follow the manufacturer's instructions carefully and use the recommended safety precautions to protect the user and water health. A wetting agent, such as Boost™, should be used to better adhere the spray adhere to the plant, allowing an increased efficacy of kill. Avoid spraying herbicide on windy days, when the droplets are likely to drift beyond the target area. The user should be suitably qualified in applying chemicals, such as in possession of a GROWSAFE certificate.

Maintaining up-to-date records of agrichemical usage is a legal requirement for the management of agrichemicals as set under the Hazardous Substances and New Organisms (HSNO) Act and specified in the New Zealand Standard for Management of Agrichemicals (NZS 8409:2021). Risks associated with the use of agrichemicals are required to be managed as indicated on the label and other product information so that adverse environmental effects are avoided.
A diary should be kept of all weed control, planting, and pest control work carried out.

9.6 Stage 2 – Planting and Schedules

This section outlines a description of the planting zones, and a plant list including pioneer and enrichment species. The plants have been chosen based on information on indigenous Auckland vegetation (Singers *et al.,* 2017), Auckland Council (2023) riparian planting guides, as well as with respect to the surrounding restoration planting that has been discussed in JS Ecology Residual Effects Planting and Pest Management Plan (2025).

Additional weed control may be required prior to planting. Chemical weed control prior to planting should be undertaken not less than three weeks prior to planting.

9.6.1 Planting Zones and Descriptions

The riparian planting adjoins other proposed revegetation planting and existing forest areas, which have been outlined in JS Ecology (2024). This planting has been divided into different ecosystem categories according to Singers et *al*. (2017). In order to provide a seamless restoration area, the different terrestrial revegetation ecosystems have been used to inform the riparian planting.

Surrounding stream habitat, riparian planting has been divided into a 3m stream edge zone, and then an additional 7-17 m of riparian planting. The riparian planting varies in width, being 20 m each side of main tributaries and wetlands, and 10 m each side of smaller tributaries. The wetlands do not contain a 3m stream edge planting zone but a continuous riparian planting area. Overall, the planting reflects a variety of flowering and fruiting times across all four seasons, to ensure an ecologically diverse and supportive community of native flora and fauna resources.

Podocarp Broadleaved Riparian Planting

The riparian planting adjoining the podocarp broadleaved forest contains WF9 species that have been incorporated into the gully sections of the residual effects terrestrial planting (JS Ecology, 2025). Key species include kahikatea and pukatea.
This planting comprises 20 m either side of a main stream channel, and 10 m either side of minor tributaries.

Rock Forest Riparian Planting

The riparian planting adjoining the rock forest revegetation primarily surrounds large raupō wetlands, with the main tributary flowing in between. Key canopy species include pūriri and taraire.

9.6.2 Planting Lists – Pioneer and Enrichment Staging

The planting will occur in a single stage containing primarily pioneer species, with some enrichment species that can tolerate higher light conditions. It is expected that the seed source from the enrichment planting within the terrestrial section will also benefit the adjoining riparian planting.

The tables below provide species lists for the planting plans. The tables include total plant numbers, accounting for 10% die-off during the initial period following planting.

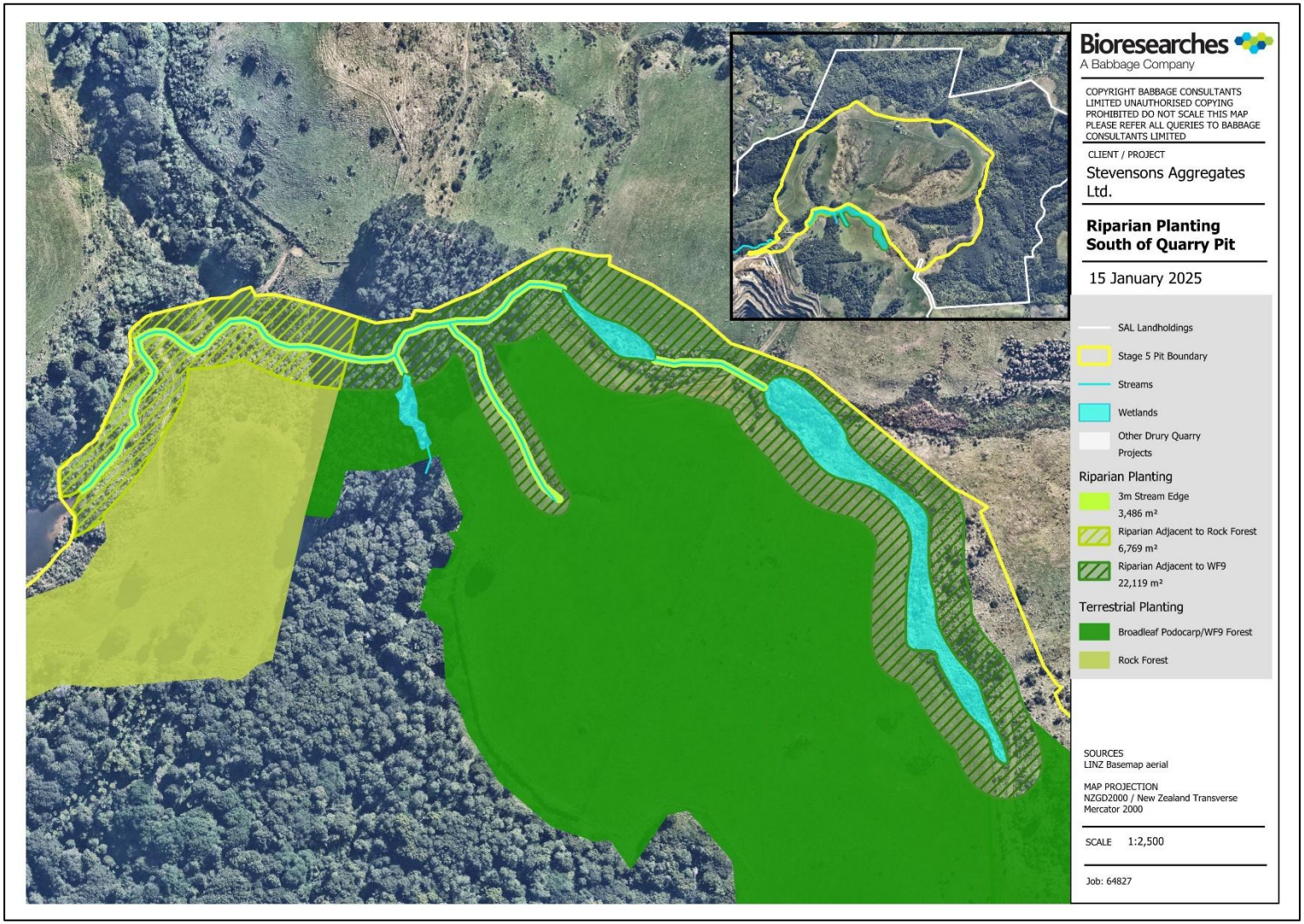


Figure 20: Location of riparian planting zones, including the stream edge, and rock forest and WF9 riparian planting

Table 17: Plant list for 3m stream edge - all planting zones

Stream Edge - All Planting Zones 3,486 m²						
Botanic Name	**Common Name**	**Grade**	**Spacing (m)**	**Composition (%)**	**No. Plants**	**No. Plants+10%**
Austroderia fulvida	toe toe	0.5L	1	5	174	192
Carex dissita	flat leaved sedge	0.5L	1	10	349	383
Carex geminata	rautahi	0.5L	1	15	523	575
Carex secta	pūrei	0.5L	1	10	349	383
Carex virgata	pūkio	0.5L	1	20	697	767
Carpodetus serratus	putaputawētā	0.5L	1	10	349	383
Cordyline australis	tī kōuka	0.5L	1	15	523	575
Cyperus ustulatus	giant umbrella sedge	0.5L	1	10	349	383
Dacrycarpus dacrydioides	kahikatea, white pine	1L	3	5	58	63
				100	**3369**	**3706**

Table 18: Plant list for upper riparian - Podocarp Broadleaved Forest

Podocarp Broadleaved Riparian Planting – 22,119 m²						
Botanic Name	**Common Name**	**Grade**	**Spacing (m)**	**Composition (%)**	**No. Plants**	**No. Plants+10%**
Aristotelia serrata	makomako	0.5L	1.4	3	474	522
Coprosma robusta	karamū	0.5L	1.4	10	1582	1740
Cordyline australis	tī kōuka	0.5L	1.4	10	1582	1740
Hedycarya arborea	porokaiwhiri	0.5L	1.4	2	316	348
Kunzea robusta	kānuka	0.5L	1.4	20	3163	3479
Leptospermum scoparium	kānuka	0.5L	1.4	10	1582	1740
Melicytus ramiflorus	māhoe	0.5L	1.4	5	791	870
Pittosporum tenuifolium	kōhūhū	0.5L	1.4	5	791	870
Pseudopanax arboreus	whauwhaupaku	0.5L	1.4	5	791	870
Pseudopanax crassifolius	horoeka	0.5L	1.4	10	1582	1740
Dacrycarpus dacrydioides	kahikatea	1L	3	5	365	401
Laurelia novaezelandiae	pukatea	0.5L	3	5	365	53
Podocarpus totara	tōtara	1L	3	5	365	401
Sophora microphylla	kōwhai	1L	3	5	365	401
				100	**14112**	**15523**

Table 19: Plant list for upper riparian – Rock Forest

Rock Forest Riparian Planting – 6,769 m²						
Botanic Name	**Common Name**	**Grade**	**Spacing (m)**	**Composition (%)**	**No. Plants**	**No. Plants+10 %**
Coprosma robusta	karamū	0.5L	1.4	7	339	373
Dodonaea viscosa	akeake	0.5L	1.4	5	242	266
Hebe stricta var. stricta	koromiko	0.5L	1.4	5	242	266
Phormium cookianum subsp. *hookeri*	whaririki	0.5L	1.4	5	242	266
Hoheria populnea	houhere	0.5L	1.4	6	290	319
Kunzea robusta	kānuka	0.5L	1.4	6	290	319
Leptospermum scoparium	mānuka	0.5L	1.4	6	290	319
Myrsine australis	māpou	0.5L	1.4	6	290	319
Melicytus ramiflorus	māhoe	0.5L	1.4	4	194	213
Corynocarpus laevigatus	kāraka	1L	3	5	113	124
Alectryon excelsus	tītoki	1L	3	5	113	124
Beilschmiedia tarairi	taraire	1L	3	6	135	149
Didymocheton spectabile	kohekohe	1L	3	5	113	124
Hedycarya arborea	porokaiwhiri	1L	3	5	113	124
Knightia excelsa	rewarewa	1L	3	5	113	124
Litsea calicaris	mangeao	1L	3	5	113	124
Podocarpus totara	tōtara	1L	3	5	112	123
Vitex lucens	pūriri	1L	3	9	203	223
				100	**3546**	**3901**

9.6.3 Planting Procedure

The planting season runs from April through to August.

During planting, the following procedures should be followed to ensure maximum survival of plants and optimal growth and health.

- Prior to planting, ensure all plants are thoroughly watered and have been allowed to drain out of direct sunlight.
- Set the plants out on site according to the recommended spacing. Aim to follow a randomised planting layout rather than straight lines, to achieve a "natural" rather than uniform look. Plant species should be mixed to avoid large single-species groupings.
- Dig a hole 1.5 – 2 times wider than the plants' root ball. Ensure the edges of the hole are roughened, especially in clay soil, to avoid a "pot effect" and the drowning of plants. Back-fill with a small amount of soil to cover the base.
- Carefully remove the plant from the bag. If the plant is root bound/has circling roots, untangle the roots carefully.

- Back-fill the hole with part new soil and part existing soil. Break up clumps of existing soil with a shovel as much as possible. As you fill, avoid stomping firmly on the soil, as this may over-compact the ground and restrict root growth. Some moderate tapping with the shovel or by hand once planted is adequate.
- Fill the planting hole until the top of the root ball sits just above the soil level; cover the root ball with soil. The final position should be in a slight mound to account for compaction of soil over time and prevent drowning.
- Install a mulch mat and plant guard around each plant

9.6.4 Plant Sourcing

All new plants should be eco-sourced from within the **Hunua Ecological District**. Eco-sourcing protects the genetic lineage of plants in the area, and ensures plants are adapted to their specific regional climatic conditions.

All plantings from the Myrtaceae family of species shall be sourced from a nursery that is a signatory to the Myrtle Rust Nursery Management Declaration V6, 11 October 2017, certifying that the plant producer has implemented the New Zealand Plant Producers Incorporated Myrtle Rust Nursery Management Protocol (Myrtle Rust Nursery Management Protocol – V6, 11 October 2017).

9.6.5 Physical Protection – Plant Guards

New seedlings are susceptible to grazing by pests such as possums and rabbits, and therefore adequate measures need to be taken to ensure plants are protected.

Rabbits and pūkeko can compromise restoration efforts by consuming the young foliage on new plantings. To protect vegetation during the first two-to-three years of establishment, it is recommended that environmentally-friendly plant guards are installed.

Figure 21: Left: Example of biodegradable plant guards; Right: Installation using timber or bamboo stakes

9.7 Maintenance Plan

The maintenance plan of this report details the required plant aftercare, including replacement plants and weed control. It includes activities which should be undertaken for a minimum of **5 years** following planting. Over this period, or until 80% canopy cover is achieved, plants that fail to establish should be replaced.

In the instance that planting targets are not being met (i.e., plants continue to fail despite replacement planting), a substitute species may be used subject to the approval of a consulting ecologist. Replacement plants should be at least of the same size (relative to surrounding plants).

9.7.1 General Activities

Maintenance should occur for a minimum period of 5 years.

Maintenance will include:

- Manually removing weed species should they re-establish, with focus on releasing new plants from encroaching weeds;
- Fertilising and watering new plants if considered essential; and
- Replacing any plants that do not survive within the following planting season (April to August inclusive).

Plant maintenance should occur bi-monthly for the first year (or for 12 months after planting/initial weed control).

Thereafter, the planting areas shall be maintained quarterly for at least 3 years after initial planting.

Chemical weed control may be used, but should be avoided within 1 m of planted or existing natives. The use of chemical weed control should follow the guidelines outlined in Section 2.2.2 of this plan. This includes the use of chemicals around waterways (no closer than 3 m of the wetted edge, and preferably no spray at all within the riparian zone), and when rain is likely (must follow three days without rainfall and not within 24 hours of expected rain).

Where weeds are re-establishing, it should be ensured that removal includes hand-releasing the stems of new or existing natives, particularly from kikuyu grass.

Targets of success include at least an **80% canopy closure** (Bioresearches, 2024).

A sample schedule of the plant maintenance and management activities required are presented in the table below.

Table 20: Sample Planting and Maintenance Activity Schedule for the riparian planting areas

Time	Activity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Year One	Initial weed control												
	Initial planting												
	Fence and pest control installation												
	Plant maintenance												
Year two	Plant maintenance												
Year three+	Plant maintenance												

9.8 Pest Animal Management

Rodents (rats, *Rattus* spp., mice, *Mus musculus*), possums (*Trichosurus vulpecula*) and mustelids (*Mustela* spp.) are major ecological pests that prey on native birds, their chicks and eggs, bats, lizards, and invertebrates, and compete with native wildlife for fruits and seeds. In addition, rabbits (*Oryctolagus cuniculus*) and the native pūkeko (*Porphyrio melanotus*) are known to hinder restoration efforts and impede on the natural regeneration of indigenous plant communities.

Pest animal management should be in accordance with the pest animal control guidelines for the Auckland Region (Auckland Council, 2023), as well as the nationally-relevant Predator Free NZ guidelines. Some general guidelines regarding rodent and mustelid/possum control have been detailed below.

All pest control would be undertaken by a registered and experienced pest control provider that holds a licence for controlled substances (pest control toxins).

Pest control should generally be undertaken in conjunction with the terrestrial pest control plan outlined in JS Ecology (2024), although guidelines are recommended below.

9.8.1 Rodent Control Methods

Rodents will be controlled using lockable bait delivery or self-resetting instant kill trapping methods. Rodent stations should be installed at approximately **50-100m spacing** depending on the type of trap utilised through the restoration planting area (PredatorFreeNZ, 2024). Specific placement locations should be decided upon on-site, considering both the accessibility for maintenance and for targeting of pests. Specific details for the bait or trap stations are provided below.

- Rodent Bait Stations (50m interval)

Stations would be stocked with Diphacinone, Cholecalciferol or Pindone baits, and interchanged periodically to maintain control. Where bait take remains high, the control operator may use an

alternative toxin, such as brodifacoum. Brodifacoum should be used sparingly, as it has a longer persistence in the environment and can bioaccumulate. Bait stations must shield bait from rain and interference from non-target species (livestock).

- Rodent Self-Resetting Kill Traps (100m interval)

Trap types would be humane and specific to rat control (e.g., Goodnature A24 rodent and stoat trap) and provide a counter to monitor trap triggers. Place traps along the inside of fence line away from stock, 20 cm above the ground. Traps should be checked twice per week for the first two weeks and then as needed over the following four weeks, depending on the number of times triggered and carcasses that require removal.

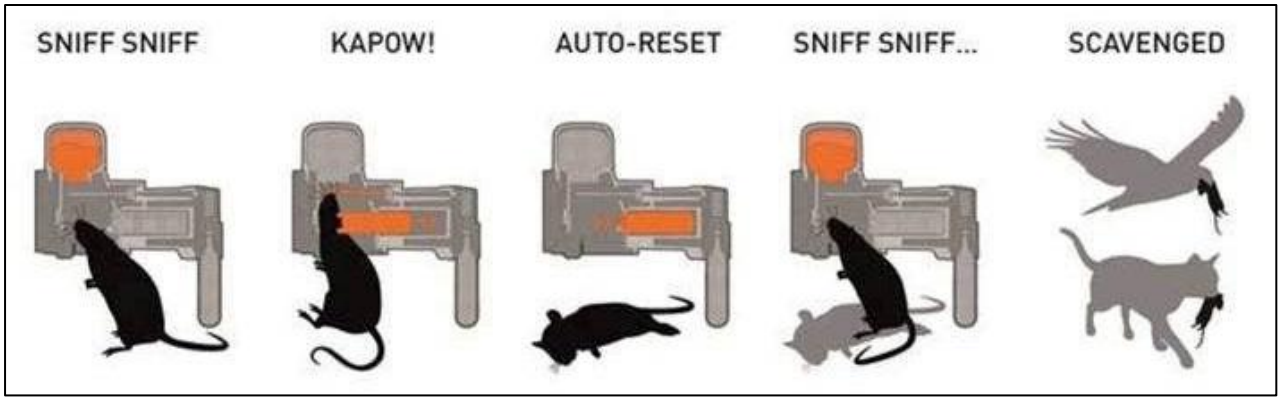


Figure 22: Operation process diagram of Goodnature A24 rodent and mustelid trap.

9.8.2 Possum Control Methods

Possums will be controlled using **bait delivery or instant kill** trapping methods. Possum stations should be installed at approximately **100 m** spacing through the restoration planting areas. The specific placement of possum control stations shall be decided upon on site, considering accessibility for maintenance and for targeting of pests.

- Possum and Mustelid Bait Stations

Bait delivery stations for possums include the Possum Bait Safe (Baitsafe.co.nz) or the Philproof Possum Bait Station. Stations would be stocked with Cholecalciferol, Pindone, or Potassium Cyanide (Controlled substance Licence required) baits and interchanged periodically to limit risk of bait shyness. Effective baiting may require pre-feeding. Where bait take remains high, the control operator may use an alternative toxin, such as brodifacoum. Brodifacoum should be used sparingly, as it has a longer persistence in the environment and can bioaccumulate.

- Possum Humane Instant Kill Traps

Trap types must be humane (passed NAWAC testing) and specific to possum control (e.g., Trapinator). Traps should be checked weekly and rebaited/ cleared as needed. Appropriate lure types for possums include peanut butter, fresh apple, or solid possum lures, ideally used in tandem with blaze around the trap to lure possums from a distance.
These traps are ideally mounted to a timber stake or existing tree.

9.8.3 Pest Control Monitoring and Triggers

Efficacy of pest control would be monitored via records of percentage bait take for bait stations and number of triggers and carcasses removed for instant kill traps.

- Bait replacement should be maintained weekly throughout a pulse period where bait take is more than 50% at any station. If bait take remains over 50% for more than three consecutive weeks, bait toxin type should be changed.
- Traps should be checked twice per week for the first two weeks and then weekly if traps are triggered more than 50% of their reset life. If more than 50% remains, traps may be checked less than weekly as determined by the pest control provider.

9.8.4 Timing of Pulsed Control

The pest management programme would be pulsed four times per year. Each pulse would consist of a 4-week period.

Table 21: Pulsed control program for pest animal management

Time	Activity	Jan	Feb-Mar	Apr	May-Jun	Jul	Aug-Sep	Oct	Nov-Dec
Four times per year	Pulse period								
	Bait stations	Bait refill		Bait refill		Bait refill		Bait refill	
	Instant Kill Traps	Check, clear, rebait		Check, clear, rebait		Check, clear, rebait		Check, clear, rebait	

During each pulse period, bait stations would be maintained with fresh cereal baits or paste, and checked weekly until bait take ceases. For instant kill varieties, traps requiring manual clearing would be checked weekly during this 4-week period to ensure proper functioning and clearance of any carcasses. Self-resetting traps that don't require frequent rebaiting (e.g. A24) may be checked less frequently, as determined by the pest control provider.

9.8.5 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 Council compliance for review. The pest control operator would be responsible for collecting data on trap catches, maintaining the pest control devices, and preparation of summary reports.

At a minimum, the following set of information should be collected:

- Location of the traps;
- Number of kills;
- Number of traps nights; and
- Lure/bait (i.e., 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)

9.8.6 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.

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