

Drury Quarry - Sutton Block Extension

E8:9 Net Gain Delivery Plan: Wetland Planting

for: Stevenson Aggregates Limited



DOCUMENT CONTROL AND REVISION RECORD

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Prepared 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 8 of a series of 9 ecology documents (E8:9).

Table 1. Documents prepared as part of this project. The current 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 fresh-water 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 Bats 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.

EXECUTIVE SUMMARY

Background

Stevensons Aggregate Limited (SAL) is proposing a new quarry pit and associated facilities ('the Project') at its Drury Quarry. The Project area is located in the northern sector of the quarry, referred to as the Sutton Block, which is predominately zoned 'Special Purpose Zone: Quarry' (SPQZ) under the Auckland Unitary Plan – Operative in Part (AUP), with smaller perimeter areas zoned Mixed Rural Zone. This Project site comprises some 88 ha of land which is predominantly grazing pasture, with streams, wetlands and fragments of indigenous and exotic vegetation.

Scope

The purpose of the report is to offset the loss of wetland habitat within the Sutton Block expansion area, as shown in the table below (adapted from Bioresearches, 2025). In total, 18,758 m² of wetland habitat will be lost over the course of the pit expansion. Approximately 4 ha of wetlands have been designed and proposed for planting at the Tuakau offset site, with an offset ratio of 2:1.

Wetland Loss	Value	Area (m ²)
Impact Area (Stage 1-5)	Low to Moderate	18,758
Wetland Offset - Tuakau		Area to be Planted (m ²)
Zone 1 (UPL BUFFER)		3,200
Zone 2 (FACW)		27,400
Zone 3 (OBL)		13,300
Total Wetland Planting (Zone 2+3):		40,700 (4.07 ha)

The restoration and enhancement of the degraded aquatic habitats within the Tuakau offset site will provide positive aquatic ecological benefit, habitat creation, and biodiversity gains.

All mitigation, offset planting areas, including all of those identified in this Plan, are required to be protected in perpetuity.

The purpose of this report is to set out the site-specific wetland planting plans, to achieve the quantum and type of planting required to provide the calculated offset for wetland loss within the Sutton Block project area.

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1 INTRODUCTION

1.1 Purpose and Background

Bioresearches has been engaged by Stevensons Aggregates Limited (SAL) to provide a Net Gain Delivery Plan: Wetland Planting (NGDP:PP). The intent of this plan is to provide for the offset for the loss of wetland habitat within the proposed Sutton Block expansion area of Drury Quarry, based on the Ecological Compensation Ratios presneted in the Residual Effects Analysis Report for Streams and Wetlands (E5:9 REAR-SW). Details of the offset for stream habitat loss in relation to Sutton Block are presented in a separate Net Gain Delivery Plan: Riparian Planting (NGDP:RP).

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 (Figure 1).

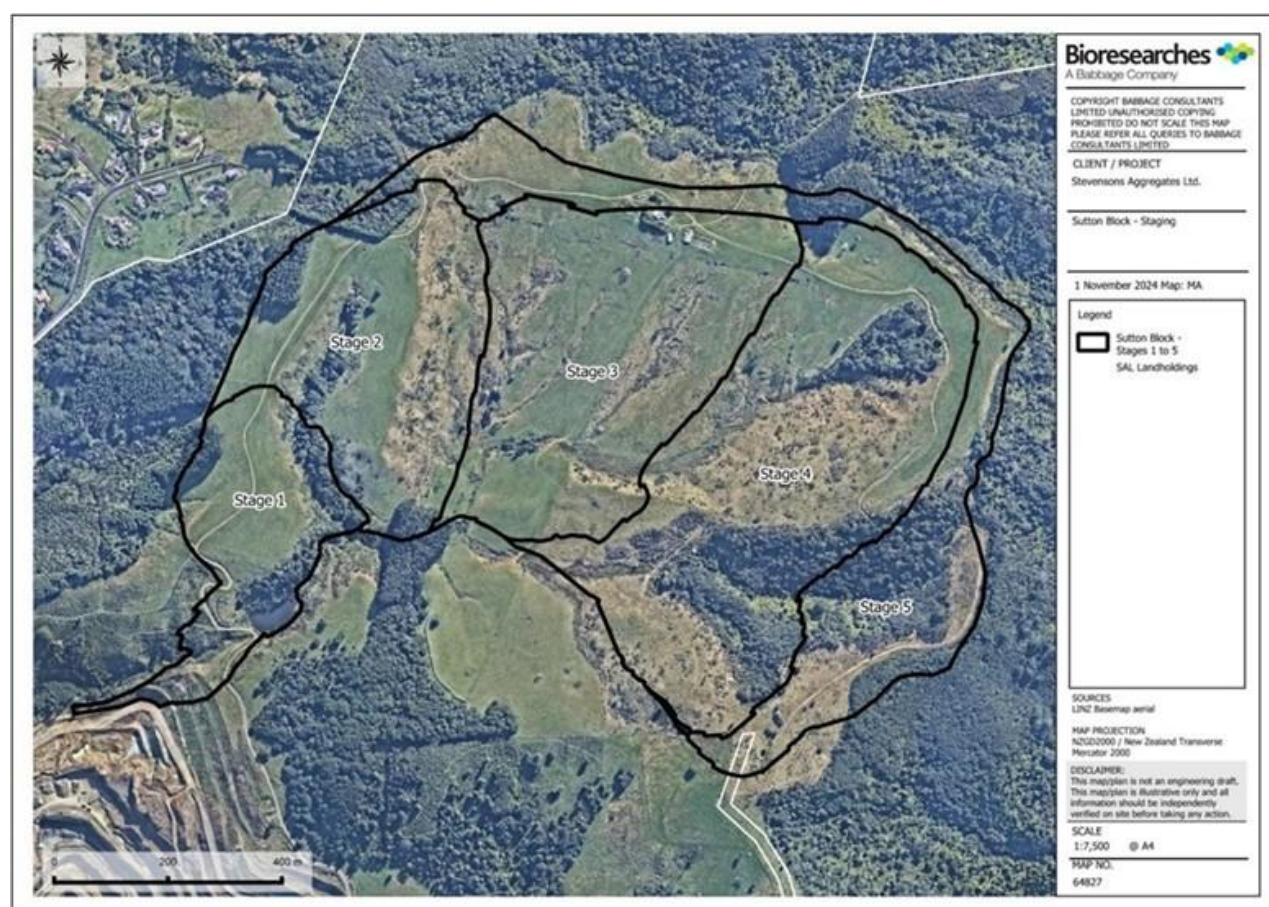


Figure 1: Map showing proposed Sutton Block pit and the vegetation clearance stages

The quarry expansion will be staged over approximately 50 years. In total, 18,758 m² of wetland habitat will be lost. This includes 11 wetlands, and a branch of a 12th wetland, all of which have a low to moderate ecological value (E2:9 EcIA, Bioresearches and JSEcology, 2025). The EcIA identifies that loss of aquatic habitat in the Sutton Block pit is a significant residual adverse effect under the AUP, and a Moderate to High level of effect under the EcIA guidelines (Roper-Lindsay et al., 2018), thus requiring offset compensation.

The location of aquatic offset activities for Sutton Block had to be considered off-site, as much of the remaining habitat within Drury Quarry property has been set aside for other restoration projects or does not meet the requirements for stream length and wetland size.

1.2 Offset Site: 86 Friedlander Road, Tuakau

The residual adverse effects associated with loss of stream and wetland habitats will be offset and compensated at 86 Friedlander Road, Tuakau (Tuakau Site). This site is 16km south of Drury Quarry and is located adjacent to the ecologically significant Waikato River (Figure 2).

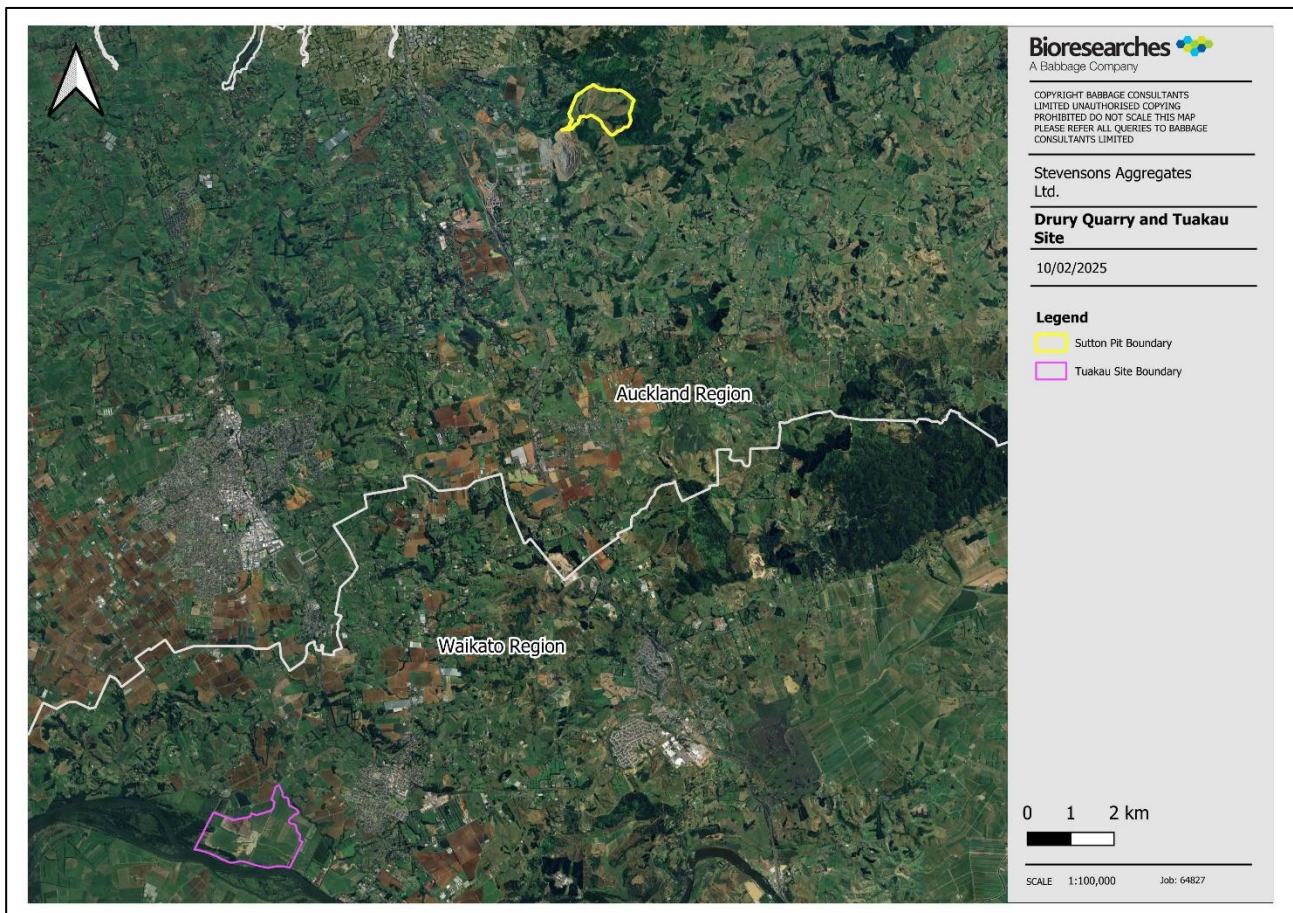


Figure 2: Sutton Block (pink polygon) and the Tuakau Offset Site (yellow polygon)

The background, justification and calculations for the quantum of offset required at the Tuakau Site for the loss of the stream habitats are provided in the Residual Effects Analysis Report – Stream and Wetland Loss (REAR-SW; Bioresearches, 2025).

The purpose of this plan is to ensure that the wetland restoration and planting at the Tuakau offset site is designed and undertaken in an appropriate manner to facilitate the on-going survival of the wetland and plants, and to achieve the long-term enhancement of the wetland values as set out in the REAR-SW (Bioresearches, 2025).

This plan has been prepared within several frameworks, specifically:

- 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
- Department of Conservation planting guide for the Meremere Basin
- The Residual Effects Riparian Planting Plan, also forming part of the Tuakau offset/compensation for loss of aquatic habitats for the Drury Quarry Sutton Block.

It is recommended that planting areas are covenanted to protect the revegetated areas in perpetuity.

The planting and wetland design section of this plan addresses:

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

The wetland design details provided include:

- a) location and flow paths;
- b) supporting design drawings including profiles;
- c) details of any construction methods;
- d) Details of ecological enhancements, including meander; low flow channel; pools;
- e) Monitoring and maintenance requirements.

1.2.1 Offset Site Description

The current use of the Tuakau site is farming and sand mining, with extensive areas of wetted pasture (70 ha). An unnamed tributary flows along the western boundary of the site, while the Tutaenui Stream flows along the eastern property boundary (Figure 3). The banks of both of these streams are proposed to be planted with riparian vegetation (detailed separately in the Net Gain Delivery Plan: Riparian Planting (E9:9 NGDP:RP, Bioresearches 2025).

Adjoining the western stream is a large expanse of covenanted kahikatea forest (3.59 ha), with a large section of low-lying pasture between the kahikatea forest and the Waikato River. This area of wetted pasture has been identified for the wetland offset.

Directly east of the site a second 4.97ha stand of kahikatea is present and west of the site is an extensive wetland known as the 'Piggott Wetland', which underwent extensive restoration by Fish and Game in 2017 (Waikato Catchment Ecological Enhancement Trust, 2022). The enhancement of this area would have significant ecological benefits, including protecting and enhancing the area for the native long-tailed bats (Threatened, Nationally Critical; O'Donnell et al., 2018) that are observed moving between the trees.

The area in which the offset wetland is located is generally flat, low-lying land adjacent to the Waikato River which forms part of the river floodplain. It contains of a mosaic of shallow hollows (approximately 0.5 m lower than the surrounding area) which at the time of the site visit contained standing water up to 0.4 m in depth; but would possibly be dry in summer months (Photo 1 to Photo 4).

Vegetation varies between these areas of higher and lower topography; the higher areas generally consist of creeping bent (*Agrostis stolonifera*), kikuyu (*Cenchrus clandestinus*), creeping buttercup (*Ranunculus*

repens) and sparse dock (*Rumex obtusifolius*); whilst in the hollows, vegetation is dominated by spearwort (*Ranunculus flammula*), water pepper (*Persicaria hydropiper*), creeping bent, creeping buttercup, mercer grass (*Paspalum distichum*) and starwort (*Callitriche stagnalis*), with areas of periphyton and bare ground also present.

Rushes, including soft rush, jointed rush and wīwī (*Juncus effusus*, *J. articulatus* and *J. edgariae*, respectively) are present throughout the area, with densities greatest in or adjacent to the hollows, and scattered black alder (*Alnus glutinosa*) are also present. A patch of reed sweetgrass (*Glyceria maxima*) is present in one location to the north-west of the wetland, in an area of deeper water.



Photo 1. An example of a deeper hollow within the proposed wetland restoration area



Photo 2. The proposed wetland restoration area



Photo 3. The proposed wetland restoration area



Photo 4. A shallower hollow within the proposed wetland restoration area

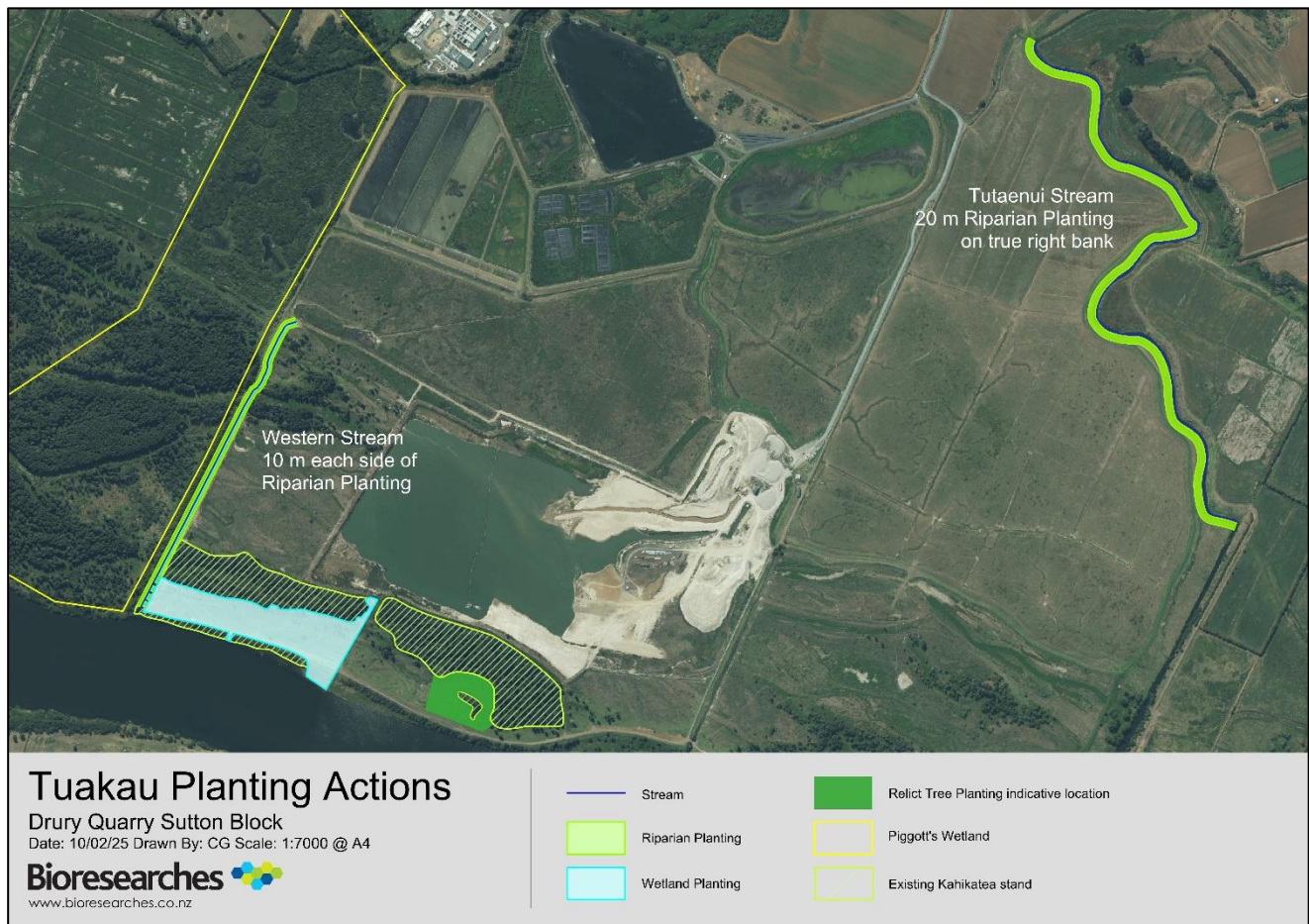


Figure 3: Map showing offset actions for Tuakau: Unnamed Western stream; adjoining Wetland Off-set Planting; and Tutaenui Stream (east).

Although the proposed restoration wetland is currently dominated by exotic pasture species with low botanical value, and is heavily impacted by stock grazing, it has good hydrological connectivity to the river. It is also at least seasonally, if not permanently wet, and has excellent potential for further restoration of the natural hydrological regime and vegetation composition. With slight modifications to the levels of the land adjacent to the stream running along the western end of the site, wetland creation would be easily achieved.

Three inlets between the Western Stream and the wetland offset site will be created, by lowering the bund to allow water flow into the wetland. The offset site will be earth worked, where necessary, to create areas of varying depths, and planted with a range of wetland vegetation in varying zones, providing for:

1. Obligate (OBL) wetland plants – wet most of the time, with connectivity to the stream, and inundation frequent.
2. Facultative wetland (FACW) vegetation – damp most of the time, inundation common in high rainfall events, usual storm events. Some areas would be associated with the stream (marshes), and some would be separate forming in shallow depressions (swamps).
3. Facultative vegetation (FAC) wetland – damp periodically, inundation from the stream only occasionally in a year or two, and then usually only short term. Flood zone rather than usually storm

flow zone. Plus, additional zones associated with lower points in the landform, and providing a transition zone between Zone 2 vegetation and terrestrial vegetation.

Creation of such habitats is expected to recreate a naturally representative ecosystem which would far more closely reflect what would have been present on site prior to removal of the original indigenous vegetation of the area, than the habitats which are currently present.

1.2.1.1 Historic wetland vegetation type

As described in Bioresearches (2025), the lower-lying portions of the site, prior to anthropogenic vegetation clearance, would have been vegetated with kahikatea, pukatea forest (WF8, a swamp forest type). These forests are generally dominated by kahikatea (*Dacrycarpus dacrydioides*), with pukatea (*Laurelia novae-zelandiae*), swamp maire (*Syzygium maire*), rimu (*Dacrydium cupressinum*), tawa (*Beilschmiedia tawa*), kiekie (*Frycinentia banksii*) and supplejack (*Ripogonum scandens*) also present (Singers & Rogers, 2014). Fens were likely present in the wetter areas with lower nutrient inputs, which would have been vegetated with mānuka (*Leptospermum scoparium*) associations (Boffa Miskell, 2022); grading into wetland carr type habitats including tī kōuka (*Cordyline australis*), toe toe (*Austroderia fulvida*) and flax (*Phormium tenax*) particularly in wetter areas or near open water (Ravine, 1992).

Other benefits of restoring this area to an indigenous wetland habitat, is to restore connectivity to the large area of kahikatea landward of the proposed site, connectivity to the large areas of restored kahikatea wetland to the west of the site and the connectivity to the Waikato River (Figure 4). Restoration of this area, along with the riparian planting along the Western Stream will connect these isolated habitats into one large, contiguous habitat.



Figure 4. Wetland restoration design for 86 Friedlander Road, Tuakau. Note existing stands of kahikatea swamp forest.

2 PLANTING AND ENHANCEMENT IMPLEMENTATION PLAN

2.1 Staged Planting and Maintenance

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:

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

Stage 1 – Pre-Planting

- Perimeter fence construction – fence all areas to be planted that stock would have access to, 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

- Replace unsuccessful plantings.
- Maintain plants with weed control.
- Additional planting of enrichment species at years 2-3.

2.2 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.

2.2.1 Perimeter Fence Construction

Fencing should be installed, where applicable, surrounding the outer boundary of the wetland and riparian planting areas. This is to protect from stock, and is to be of a stock-proof standard – timber post and wire design.

Fencing should surround both banks of the Western Stream, and the western bank only of the Tutaenui Stream.

Where practical, fencing should:

- Consist of a minimum 5 horizontal wires, preferably 7;

- Be built with timber round or half round posts, spaced at 3 to 5 m apart;
- Potentially with battens running vertically on the wires;

Fencing should be inspected annually and maintained to a stock-proof standard should damage be observed.

2.2.2 Weed Removal and Management

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 thus will require different methods of removal. 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.

Native vegetation should be retained where possible. 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, due to the planting occurring within typically wet environments. Spray should be completely avoided within 3 m of the wetted edge of streams, and within visibly wet planting areas. Blanket chemical weed control over the ground would also result in the loss of regenerating natives.

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; Waikato Regional Council, 2012):

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. Occurring in dry areas: Spray with glyphosate during extended dry periods and with a minimum 3 m distance from watercourses/wet ground – to be applied for initial removal and during ongoing control activities post-planting completion.
 - b. Where kikuyu occurs along stream bank edges, or wet ground, chemical spray control is not appropriate. Planting may occur into kikuyu grass and low-growing pasture weeds, provided the grass is initially cleared by hand/mowed around the plant base, and plants

continue to be released from kikuyu regrowth. Plant guards (section 2.3.5 of this report), and biodegradable weed mats surrounding each new plant, are recommended to reduce the need for spraying as new planting establishes.



Figure 5. Biodegradable plant protection tools: Left- plant guard, Right- square weed mat (Egmont Coir Tuffguard mat, available from: <https://www.egmontcommercial.co.nz/product/coir-tree-mats-plant-mat/>)

3. Large woody weeds that cannot be removed entirely or dug out (below 4m in height):
 - 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.
 - a. 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.
5. Aquatic macrophytes – to be removed by hand, with no chemical control used within 3 m of the stream edges.

Table 2: List of common pest plant species and their suggested removal methods should removing entirely not be possible

Botanic Name	Common Name	Weed Control Method
<i>Alnus glutinosa</i>	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
<i>Crataegus monogyna</i>	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.
<i>Berberis glaucocarpa</i>	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

<i>Pinus radiata</i>	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
<i>Zantedeschia aethiopica</i>	Arum lily	Cut across base of stems and immediately paste the stump with metsulfuron gel
<i>Populus alba</i>	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
<i>Salix</i> 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 <i>Note: all willows can regrow from stems, trunk and branch fragments. Any removed limbs or twiggy debris should be disposed of offsite to prevent re-establishment.</i>
<i>Ulex europaeus</i>	gorse	Cut across trunk and immediately paste the stump with metsulfuron or glyphosate gel
<i>Pennisetum clandestinum</i>	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, and plants continue to be released from kikuyu regrowth.
<i>Hedychium gardnerianum</i>	ginger	Cut across base of stems and immediately paste the stump with metsulfuron gel
<i>Cortaderia</i> spp.	pampas	Spray with glyphosate during extended dry periods and with a minimum 3 m distance from watercourses Cut foliage back to base and immediately paste the stump with 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 glyphosate (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.

2.2.3 Pest Animal Management

Pest animal control should be implemented at the **pre-planting** stage, to increase the success of new planting. Full details regarding pest control can be found in Section 4 of this report.

2.3 Stage 2 – Planting and Schedules

This section outlines a description of the planting zones, staging, and a plant list. The plants have been chosen based on information on indigenous Auckland vegetation (Singers *et al.*, 2017), Auckland Council (2023) riparian planting guides, Department of Conservation guidelines on planting within the Meremere Ecological District (DOC, 2024), as well as with respect to the vegetation at the offset site.

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.

2.3.1 Planting Zones and Description

Zones have generally been divided based on their tolerance of saturation, and using the wetland plant indicator rating (Clarkson *et al.*, 2021). The following abbreviations have been used:

- OBL – Obligate Wetland plant.
- FACW – Facultative Wetland plant. Usually occurs in wetlands, occasionally occurs upland.
- FAC – Facultative plant. Commonly occurs in wetlands and uplands.
- FACU – Facultative Upland plant. Rarely in wetlands and occurs almost always in uplands.

Zone 1: Facultative/Upland Wetland

This zone is the highest, with intermittent saturation and very occasional flooding. Inundation from the stream only reaches this zone occasionally, and usually only for a short term. The Facultative/Upland wetland planting provides a buffer between the lower wetland zones and the adjacent terrestrial environment.

The FAC/UPL planting is divided into two planting types, including:

- a. Swamp Forest (with focus on FAC /FACU plants as opposed to FACW/OBL)
- b. Cabbage tree wetland carr habitat

Zone 2: Facultative Wetland (FACW) Zone

This zone contains temporary standing water, and is saturated/damp most of the time. Inundation is common in high rainfall and storm events. Some areas would be associated with the stream (marshes), and some would be separate forming in shallow depressions (swamps).

This zone is also divided into two planting types, including:

- a. Swamp Forest
- b. Flaxland habitat

The swamp forest is reminiscent of a kahikatea swamp, while the flaxland is in reference to WL18 flaxland habitat as described in Singers *et al.* (2017).

Zone 3: Obligate (OBL) Wetland Zone

This zone is wet most, if not all, of the time; via soil saturation and, at times, standing water. This zone has connectivity to the Western stream via three inlets, and the Waikato River by two inlets. As a result, the planting area is frequently inundated, and affected by the tidal change in water height of the Waikato River. There are areas of open water where pooling will occur.

2.3.2 Planting Lists – Pioneer and Enrichment Staging

The planting will occur in two stages–

1. Planting of plants within the stream edge zone; and pioneer species within the upper riparian zone
2. An enrichment planting of future canopy/late successional species within the FAC/UPL Zone 1. The enrichment planting can occur from 3 years after the initial planting.

Pioneer planting (Stage 1) includes fast-growing plant species that provide natural protection for later successional canopy vegetation, that may otherwise have difficulty thriving in exposed environments. Pioneer plants establish quickly and create a canopy cover that will reduce exposure and shade out weeds.

Enrichment planting (Stage 2) of climax/canopy trees can be undertaken at 3 years following pioneer planting. Canopy/climax trees are late successional species and are usually slower growing and longer living. It may be necessary to first release or remove some of the pioneer plants to create space for enrichment species.

Note that the areas indicated are approximate, and will be subject to the finalised areas as calculated based on on-site delineations of levels.

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. The location of the planting and total area coverage can be found in Figure 4, with cross sections of the wetland illustrated in Figure 6 and Figure 7.



Figure 6: Map showing locations of cross-sections illustrated in the following figure

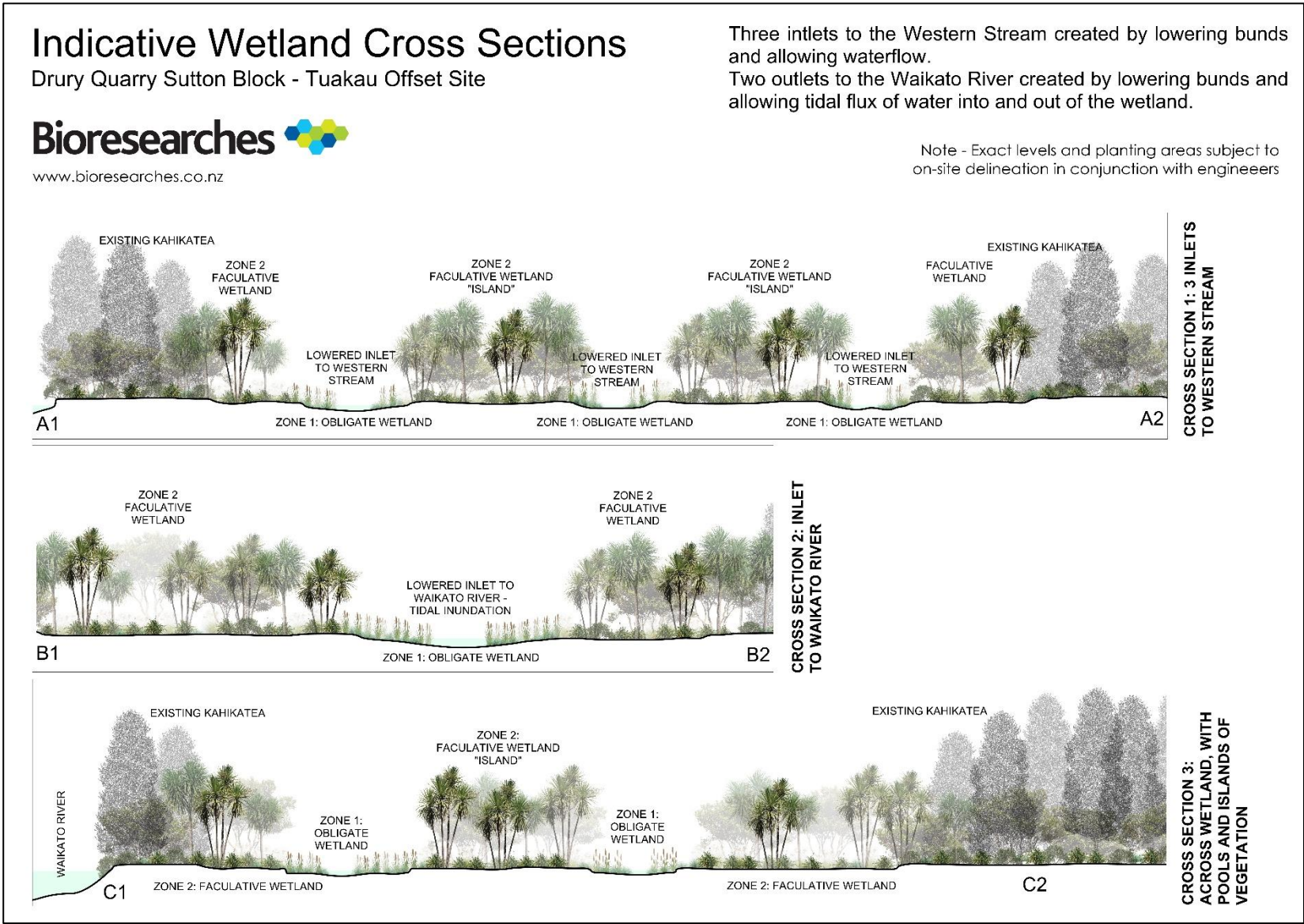


Figure 7: Cross-sections across wetland planting areas

Table 3: Plant list for Zone 1: Upland Wetland Zone - Swamp Forest

Zone	Botanical Name, Grade	Common Name	Wetland Plant Rating	Spacing (m)	Composition (%)	# Plants	# Plants + 10%
Zone 1: Swamp Forest 1,600 m ²	Pioneer Species (Year 1)						
	<i>Dacrycarpus dacrydioides (1-2L)</i>	Kahikatea, White pine	FAC	5	20	64	70
	<i>Plagianthus regius subsp. regius (1L)</i>	Manatu, Lowland ribbonwood	FACU	1.4	20	229	252
	<i>Leptospermum scoparium (1L)</i>	Mānuka	FAC	1.4	15	172	189
	<i>Melicytus ramiflorus subsp. ramiflorus (1L)</i>	Māhoe	FACU	1.4	15	172	189
	<i>Coprosma rotundifolia (1L)</i>	Round-leaved coprosma	FAC	1.4	15	172	189
	<i>Sophora chathamica (1-2L)</i>	Coastal kōwhai	Not Rated	5	15	172	189
				Total:	100	979	1077
	Enrichment Species (Year 2)						
	<i>Myrsine divaricata (1-2L)</i>	Weeping mapou	FAC	1.4	15	172	189
	<i>Pennantia corymbosa (1-2L)</i>	Kaikōmako	Not Rated	5	15	48	53
	<i>Laurelia novae-zelandiae (1-2L)</i>	Pukatea	FAC	5	15	48	53
	<i>Streblus heterophyllus (1-2L)</i>	Tūrepo, small-leaved milk tree	Not Rated	3	15	48	53
	<i>Carpodetus serratus (1L)</i>	Putaputawētā	FACU	1.4	15	172	189
				Total:	75	487	536

Table 4: Plant list for Zone 1: Upland Wetland - Cabbage Tree Carr habitat

Zone	Botanical Name, Grade	Common Name	Wetland Plant Rating	Spacing (m)	Composition (%)	# Plants	# Plants + 10%
Zone 1: Cabbage Tree Carr 1,600 m ²	Pioneer Species (Year 1)						
	<i>Cordyline australis</i> (1L)	Cabbage tree, Ti kōuka	FAC	1.4	20	229	252
	<i>Phormium tenax</i> (1L)	Harakeke, New Zealand flax	FACW	1.4	20	229	252
	<i>Coprosma propinqua</i> (1L)	Mingimingi	FAC	1.4	15	172	189
	<i>Leptospermum scoparium</i> (1L)	Mānuka	FAC	1.4	15	172	189
	<i>Juncus edgariae</i> (1L)	Wīwī	FACW	1.4	15	172	189
	<i>Gahnia lacera</i> (1L)	Cutty grass, gahnia	Not Rated	1.4	15	172	189
				Total:	100	1,144	1,258
	Enrichment Species (Year 2)						
	<i>Freycinetia banksia</i> (1L)	Kiekie	FACU	1.4	25	286	315
	<i>Melicytus micranthus</i> (1L)	Swamp mahoe	FAC	1.4	25	286	315
				Total:	50	572	629

Table 5: Plant list for Zone 2: Facultative Wetland Zone - Swamp Forest

Zone	Botanical Name, Grade	Common Name	Wetland Plant Rating	Spacing (m)	Composition (%)	# Plants	# Plants + 10%
Zone 2: Swamp Forest 13,700 m ²	Pioneer Species (Year 1)						
	<i>Dacrycarpus dacrydioides</i> (1-2L)	Kahikatea, White pine	FAC	5	15	678	746
	<i>Austroderia fulvida</i> (0.5L)	Toetoe	FAC	1.4	15	1469	1616
	<i>Dianella haemata</i> (0.5L)	Swamp turutu	FACW	1.4	10	980	1078
	<i>Carex virgata</i> (0.5L)	Swamp sedge	FACW	1.4	20	1959	2155
	<i>Coprosma tenuicaulis</i> (1L)	Swamp coprosma	FACW	5	20	1959	2155
	<i>Coprosma propinqua</i> (1L)	Mingimingi	FAC	1.4	20	1959	2155
				Total:	100	9,004	9905
	Enrichment Species (Year 2)						
	<i>Elatostema rugosum</i> (0.5L)	Parataniwha	Not Rated	1.4	15	1469	1616
	<i>Machaerina tenax</i> (0.5L)	Baumea	FACW	1.4	20	1959	2155
	<i>Syzygium maire</i> (1-2L)	Swamp maire, maire tawake	OBL	5	5	137	151
	<i>Laurelia novae-zelandiae</i> (1-2L)	Pukatea	FAC	5	15	411	452
	<i>Melicope simplex</i> (1L)	Potataniwha	Not Rated	1.4	20	1959	2155
				Total:	75	5,936	6529

Table 6: Plant list for Zone 2: Facultative Wetland Zone - Flaxland

Zone	Botanical Name, Grade	Common Name	Wetland Plant Rating	Spacing (m)	Composition (%)	# Plants	# Plants + 10%
Zone 2: Flaxland 13,700 m ²	<i>Phormium tenax</i> (1L)	Harakeke, New Zealand flax	FACW	1.4	25	2449	2694
	<i>Cordyline australis</i> (1L)	Cabbage tree, Ti kōuka	FAC	1.4	20	1959	2155
	<i>Cyperus ustulatus</i> (0.5L)	Giant umbrella sedge, Upoko-tangata	FACW	1.4	15	1469	1616
	<i>Astelia grandis</i> (0.5L)	Swamp astelia	OBL	1.4	25	2449	2694
	<i>Dianella haemata</i> (0.5L)	Swamp turutu	FACW	1.4	15	1469	1616
	<i>Carex geminata</i> (0.5L)	Cutty grass, Rautahi	FACW	Total:	100	9,796	10,775

Table 7: Plant list for Zone 3: Obligate Wetland Zone

Zone	Botanical Name, Grade	Common Name	Wetland Plant Rating	Spacing (m)	Composition (%)	# Plants	# Plants + 10%
Obligate Wetland 13,300 m ² (approximate)	<i>Schoenoplectus tabernaemontani</i> (0.5L)	Kuta, Lake clubrush	OBL	1	20	2,660	2926
	<i>Eleocharis sphacelata</i> (0.5L)	Kuta, Tall spike sedge	OBL	1	20	2,660	2926
	<i>Machaerina articulata</i> (0.5L)	Jointed twig rush	OBL	1	25	3,325	3658
	<i>Carex secta</i> (0.5L)	Pūrei	OBL	1	25	3,325	3658
	<i>Typha orientalis</i> (0.5L)	Raupō	OBL	1	10	1,330	1463
				Total:	100	13,300	14,630

2.3.3 Planting Procedure

The planting season runs from April through to August for Zone 1, but may be undertaken later in the planting season, up until and inclusive of October, for the wetland Zones 2 and 3.

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 mulch mat and plant guard (Section 2.3.5) around each plant

2.3.4 Plant Sourcing

All new plants should be eco-sourced from within the Meremere 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).

2.3.5 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. See Figure 8 below for an example of bio-degradable plant guards.



Figure 8: Left: Example of biodegradable plant guards; Right: Installation using timber or bamboo stakes

3 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, or until 80% canopy cover is achieved. Over this period, plants that fail to establish should be replaced. Maintenance must continue until 80% canopy closure targets are met.

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).

An annual report should be provided to the Client and project ecologist to ensure that planting targets are reached, detailing:

- Weed control including species targeted;
- General health of new plantings;
- Survival rates of new plants;
- Replacement planting undertaken/required; and
- Progress towards planting target of 80% canopy closure.

3.1 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

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 wetted edge of stream/wet ground), 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 **80% canopy closure**.

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

Table 8: 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												
	Fencing pest control												
	Plant maintenance												
Year two	Plant maintenance												
Year three	Plant maintenance												
Year 4/5													

3.1.1 Summer Activities

Summer (late November - late March) activities should include weeding, and watering plants if necessary during periods of drought.

3.1.2 Autumn and Winter Activities

Autumn and winter activities should include continued weeding (spraying may become inappropriate due to rain and wind), and the replacement of any dead plants. Plant replacement should be of the same species. Should a particular species continue to fail, 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).

3.1.3 Spring Activities

In spring, continued weeding is required.

4 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; 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 plan 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. Pest control is being undertaken within both the wetland and riparian planting zones, and should be undertaken in conjunction with the NGDP:RP (Bioresearches, 2025).

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

A map showing pest control can be found in Figure 9.

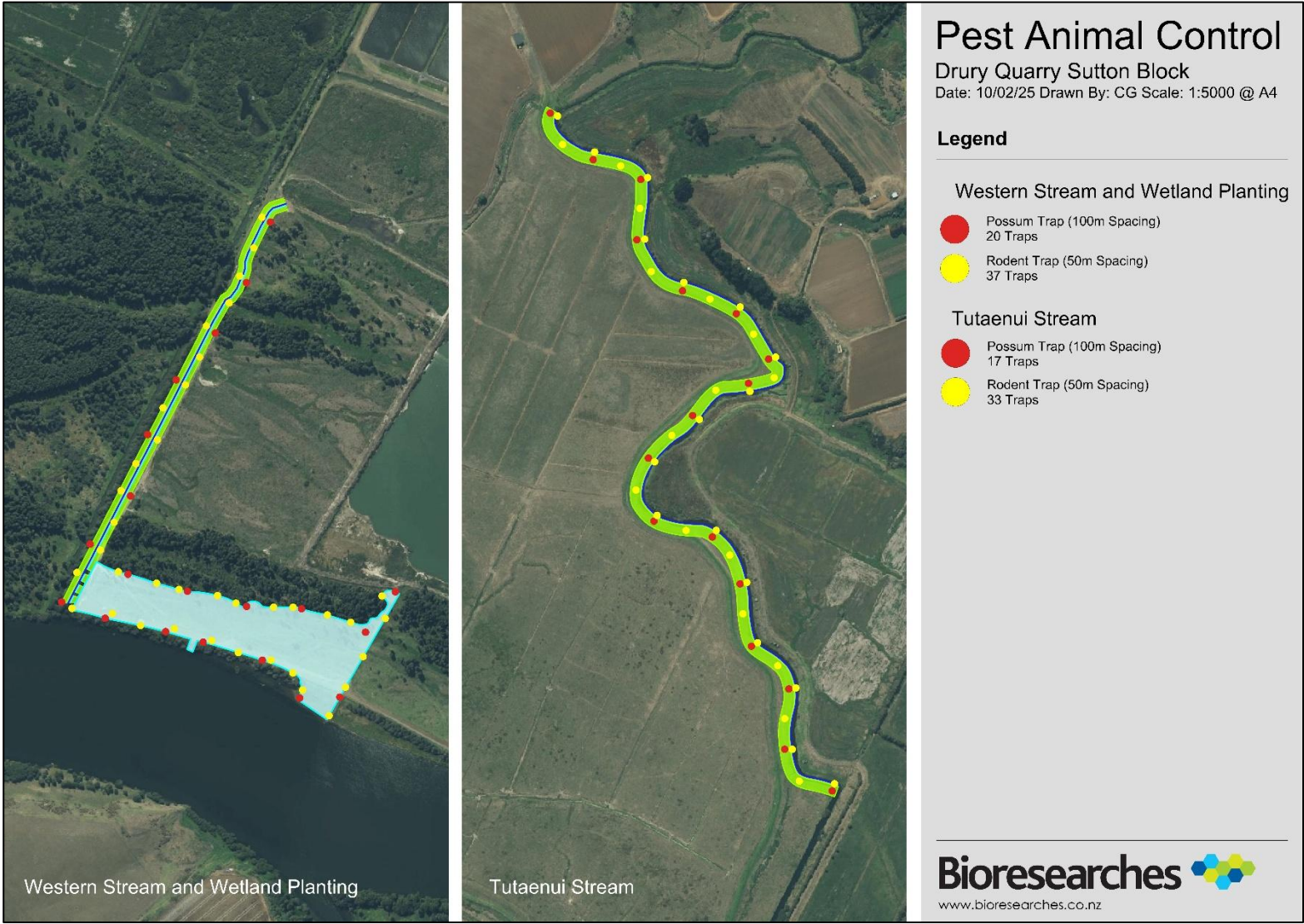


Figure 9: Map showing location of pest control within the Western Stream and wetland planting

4.1 Rodent Control Methods

Rodents will be controlled using **bait delivery or self-resetting instant kill** trapping methods. Rodent stations should be installed at approximately **50 m** spacing through the restoration planting area. Specific details for the bait or trap stations are provided below.

- Rodent Bait Stations

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).



Figure 10: Examples of rodent bait stations: a) Tamper-proof Protecta Sidekick, ideal for high-traffic areas; b) Philproof bait station, offering good weatherproofing for bait

- Rodent Self-Resetting Kill Traps

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.

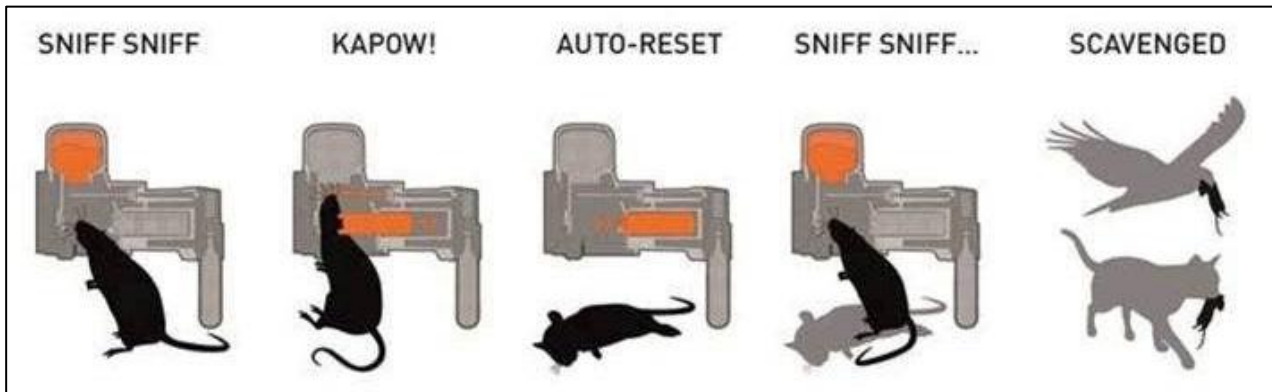


Figure 11: Operation process diagram of Goodnature A24 rodent and mustelid trap.

4.2 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.



Figure 12: a.) Possum Bait Safe station b.) Philproof bait station

- 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 bait 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.



Figure 13: a) Side view of a Trapinator possum trap with setting instructions; b) Trapinator possum trap mounted on tree

4.3 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.

4.4 Timing of Pulsed Control

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

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.

Table 9: 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 re-fill		Bait refill		Bait refill	
	Instant Kill Traps	Check, clear, rebait		Check, clear, rebait		Check, clear, rebait		Check, clear, rebait	

4.5 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)

4.6 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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APPLICABILITY AND LIMITATIONS

Restrictions of Intended Purpose

This report has been prepared solely for the benefit of Stevenson Aggregates Limited as our client with respect to the brief. The reliance by other parties on the information or opinions contained in the report shall, without our prior review and agreement in writing, be at such party's sole risk.

Legal Interpretation

Opinions and judgements expressed herein are based on our understanding and interpretation of current regulatory standards and should not be construed as legal opinions. Where opinions or judgements are to be relied on, they should be independently verified with appropriate legal advice.

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