# Ararimu Road, Papakura, Auckland

## Ecological Mitigation and Offset Management Plan

Report prepared for

**SB Civil Ltd**

Prepared by

**RMA Ecology Ltd**

Report number and date

**2307**

**April 2025**

**BETTER ECOLOGICAL OUTCOMES**

**Prepared for:**

SB Civil Limited

c/ Williamson Water and Land Advisory

10/ 1 Putaki Drive

Auckland

| | |
|---|---|
| **Prepared by:** | Emily Roper<br>Senior Ecologist |
| **Reviewed and Authorised by:** | Graham Ussher<br>Principal Ecologist |

**Project No.** 2307

**Version date:** April 2025

**Version status:** Draft v.2

**Citation:**

RMA Ecology Ltd. April 2025. *Ararimu Road, Papakura, Auckland: Ecological Mitigation and Offset Management Plan.* Report prepared for SB Civil Ltd, Auckland. 45 pages.

***Revisions***

| *Revision* | *Date* | *Description* |
|---|---|---|
| *v.2* | *April 2025* | *Additional buffer planting at northern end of site; amendment to ESC plans and location of SRPs.* |

# Contents

# 1.0 Introduction

## 1.1 Background

SB Civil Ltd has [been granted resource consent] (the 'Consent') under the Resource Management Act 1991 for the construction and operation of a managed fill facility at a property on Ararimu Road, Papakura, Auckland, legal description Lot 2 DP 77813 and part of Lot DP 166299, Lot 8 DP 369781 (the 'site') (**Figure 1**).

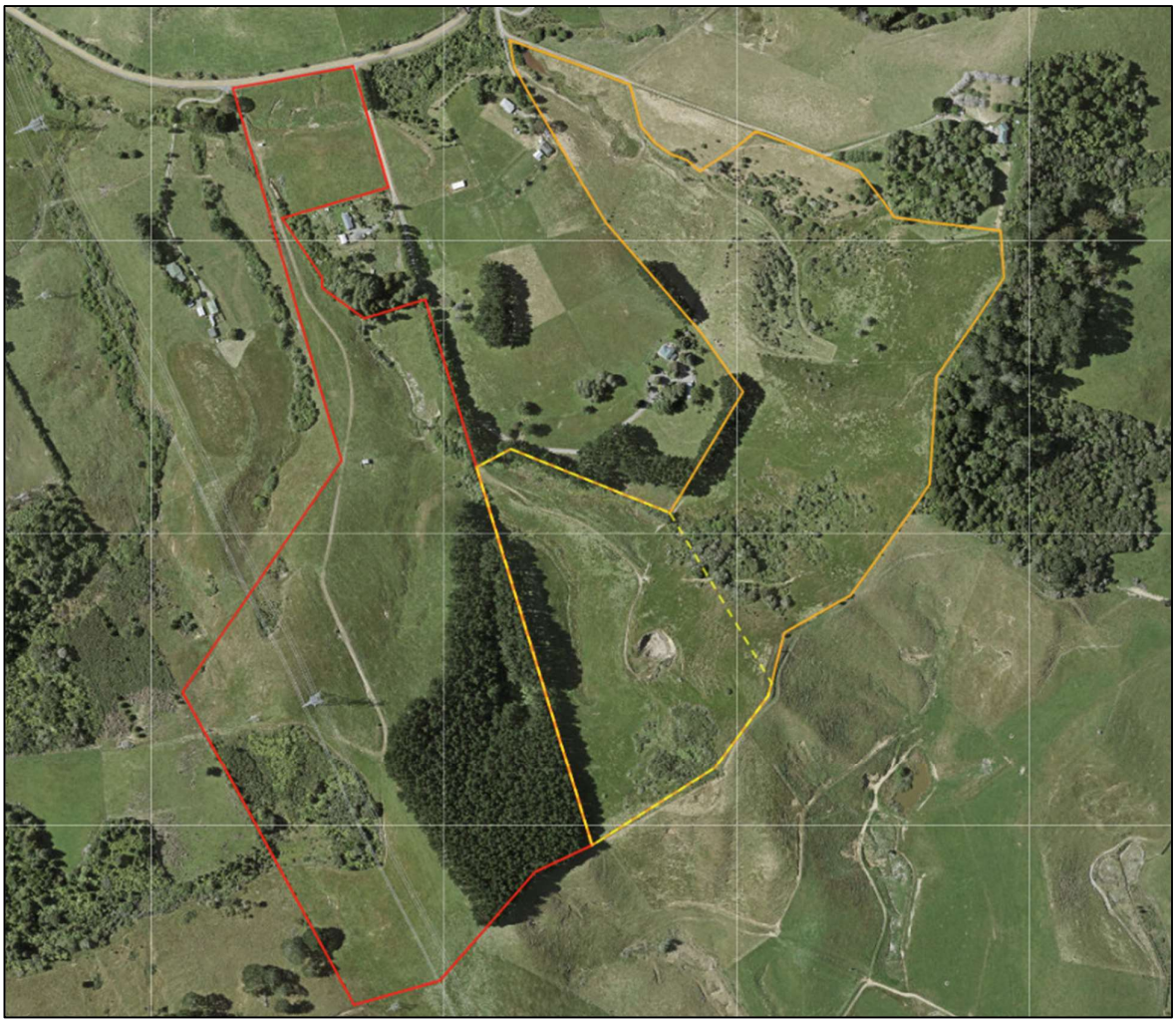

**Figure 1.** The site, including Lot 2 DP 77813, Ararimu Road, Auckland (red line), and the adjacent property, Lot 1 DP 166299, Lot 8 DP 369781 (yellow dashed line). The remainder of the adjacent property is marked with an orange line and is not part of the site.

The proposed managed fill facility will result in the permanent loss of 2,108 $m^2$ of natural inland wetland, (Wetland W7) and 35 m of intermittent stream (Stream I1) (**Figure 2**).

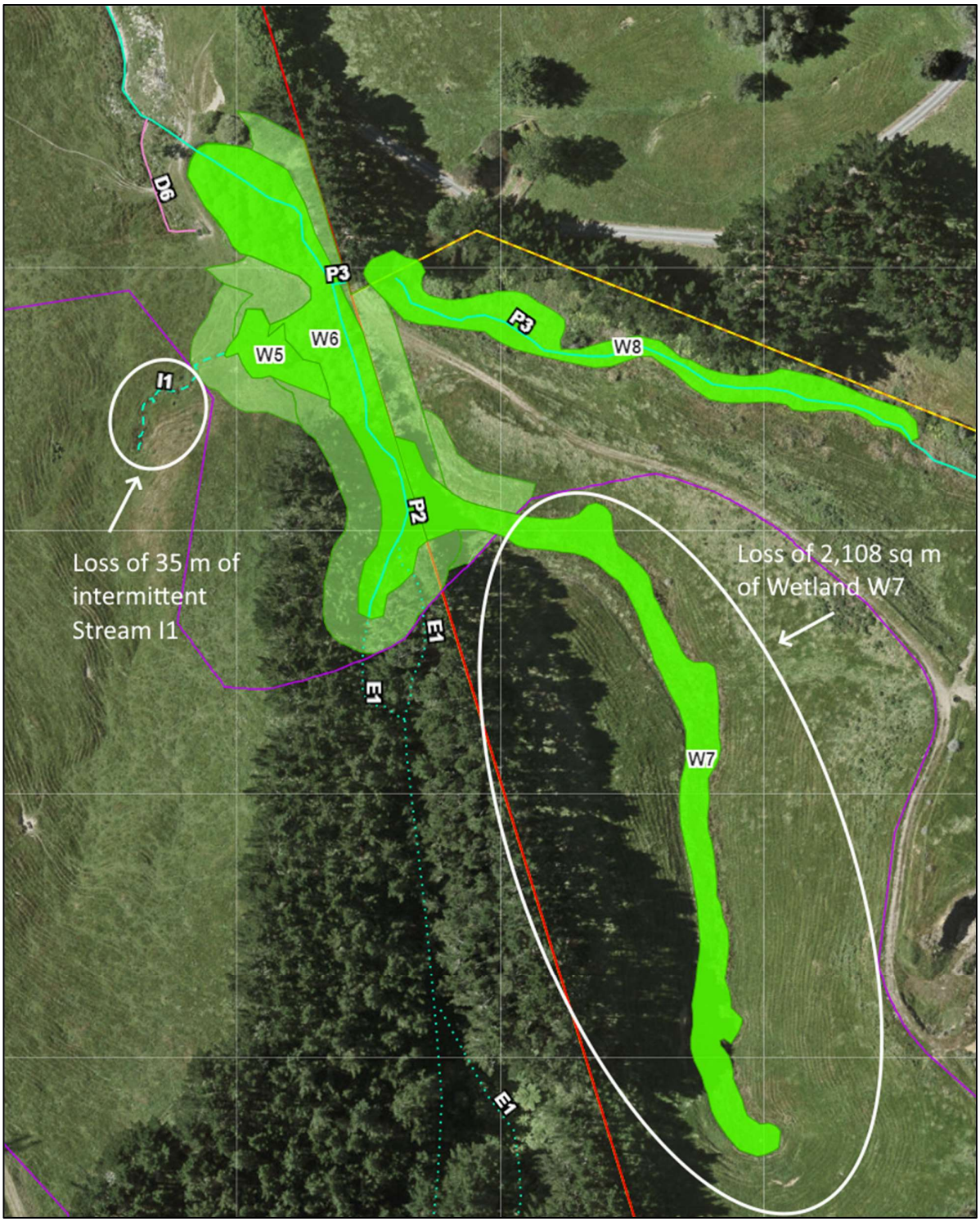


**Figure 2:** The proposed fill (footprint of fill marked with a purple line) will result in the loss of 2,108 m² of Wetland W7 and 35 m of Stream I1. Wetlands are shown in green, with a 10 m buffer marked in light green. Watercourses are shown with turquoise lines (solid lines for permanent streams, dashed lines for intermittent streams, and dotted lines for overland flowpaths).

In order to manage unavoidable adverse effects on streams and wetlands, a mitigation and offset package has been developed by SB Civil Ltd.

The resource conditions relating to this Plan are shown below:

Consent Conditions TBC:

-

-

-

The mitigation and offset package is described in this Ecological Mitigation and Offset Management Plan (EMOMP). This plan provides the basis from which to plan operational needs to fulfil the effects management package.

The ecological features that are included within this EMOMP as enhancements are:

- For the permanent loss of Wetland W7 (2,108 $m^2$), the following **offsets** are proposed:
    - Restoration of 2,682 $m^2$ of natural inland wetland (Historic Wetland HW3) through minor excavation to ensure appropriate hydrology is restored, fencing from stock, weed control, and planting with native species, including planting a 10 m buffer around the wetland (**Figure 3**); and
    - Restoration of 453 $m^2$ of natural inland wetland (Historic Wetland HW1) through minor excavation to ensure appropriate hydrology is restored, fencing from stock, weed control, and planting with native species, including planting a 10 m buffer around the wetland (**Figure 4**).
    - Additional buffer planting to make up the shortfall in area for the parts of the 10 m buffer that cannot be planted as they cover the proposed access track or are on neighbouring land (**Figure 4**).
- For the permanent loss of 35 m of Stream I1, the following **offsets** are proposed (**Figure 4**):
    - Planting 35 m of Stream P1 with native plants to a width of 20 m on each bank to replace the loss of Stream I1 **value**; and
    - Restoration of 471.5 $m^2$ of natural inland wetland (Historic Wetland HW1) as a 'trade-up' for the loss of Stream I1 **extent**, through minor excavation and blocking of existing drains to ensure appropriate hydrology is restored, fencing from stock, weed control, and planting with native species, including planting a 10 m buffer around the wetland.
    - Additional buffer planting to make up the shortfall in area for the parts of the 10 m and 20 m buffers that cannot be planted as they cover the proposed access track or are on neighbouring.

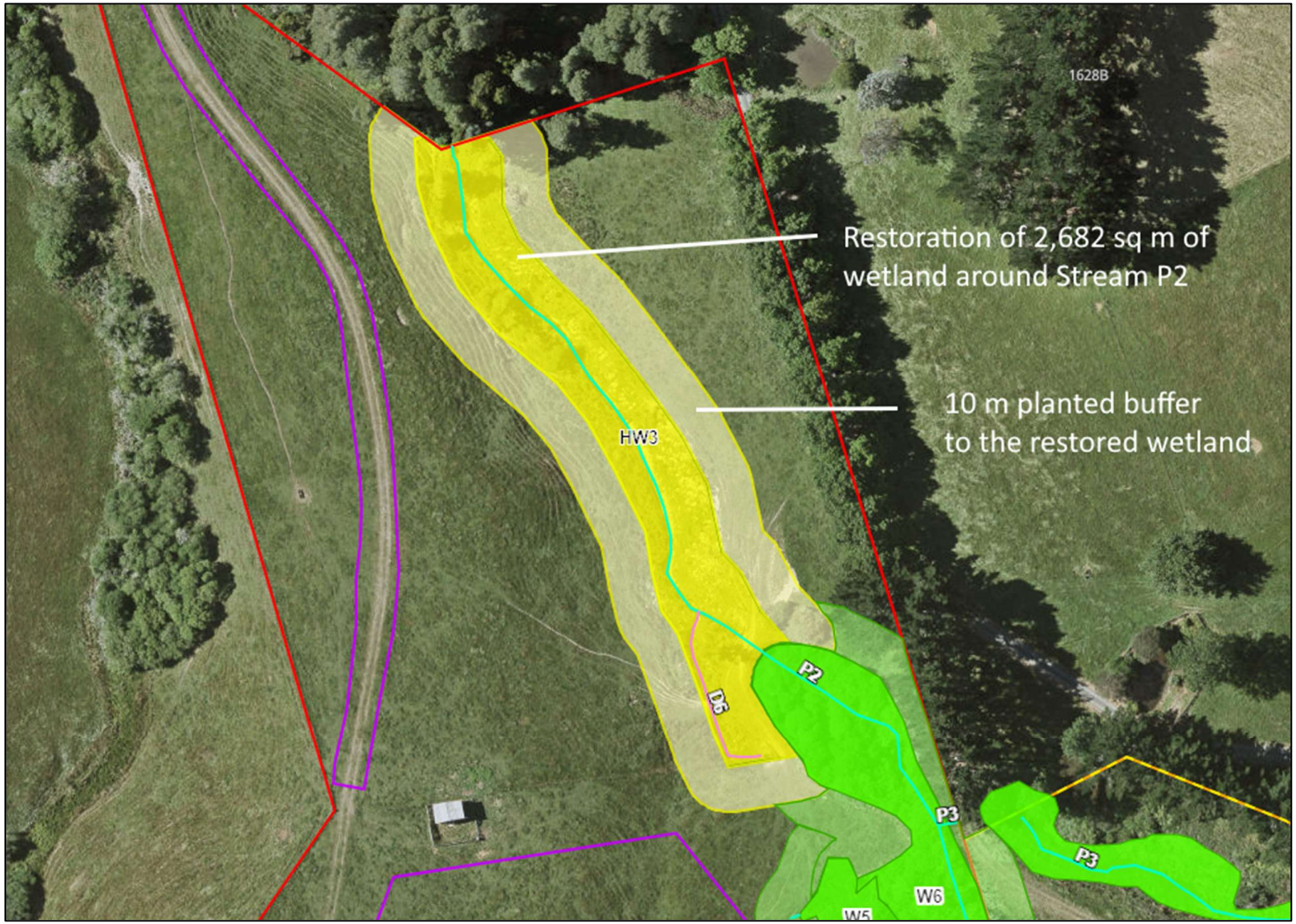


**Figure 3:** Restoration of 2,682 $m^2$ of historic wetland around Stream P2 by excavating to restore ground levels and therefore suitable hydrology for wetland species, and planting, including of a 10 m buffer around the wetland.

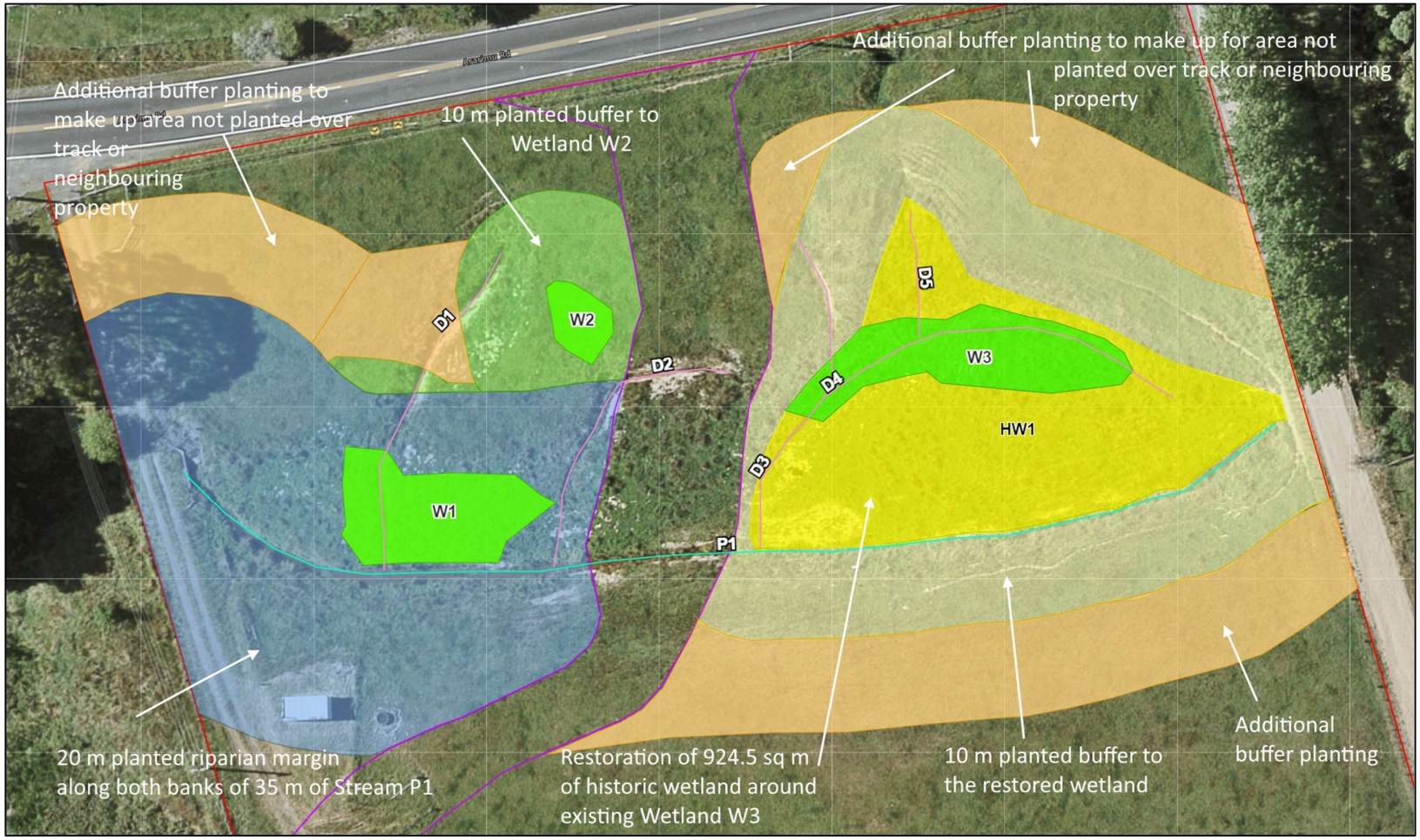


**Figure 4:** Restoration and enhancement of wetlands and streams at the northern end of the site:

- 924.4 $m^2$ of historic wetland around existing Wetland W3 (excavation to restore ground levels and suitable hydrology for wetland species, and planting, including of a 10 m buffer around the wetland);
- 20 m planted riparian margin along both banks of 35 m of Stream P1;
- 10 m planted buffer around Wetland W2; and
- Additional buffer planting to make up the area not planted over the access track and neighbouring property. The purple line marks the proposed access track.

# 2.0 Site description

## 2.1 Ecological context

The site is located within a typical Auckland rural environment. Although the original natural ecology has been heavily modified or removed through past farming activities, the site still supports freshwater ecosystems which are of ecological value.

The site is situated within the Hunua Ecological District, which is characterised has having supported a diversity of podocarp/ broadleaf/ kauri forest in pre-human times on lowland and coastal hills (Lindsay *et al*. 2009). The potential ecosystem extent, as assessed by Auckland Council, is 'WF12 – Kauri, podocarp, broadleaved, beech forest'[1]. The lowland areas of the district are now highly modified with original ecosystems cleared or drained and converted to farmland. Historic aerial photographs from Retrolens[2] indicate that the site has been cleared for farming since at least 1944.

There are no scheduled Significant Ecological Areas (SEA), as identified by the Auckland Unitary Plan (AUP), present on the site. Adjacent and other nearby properties support areas of native gully and/ or streamside forest that are identified as SEAs in the AUP. No other areas of protection, such as covenants, are present on the site.

The site supports a network of streams that arise in three gullies that run approximately south to north. The headwater streams flow to the south and lead into an un-named tributary of the Wairoa River, which flows east to west across the northern end of the site. Natural inland wetlands have formed in two of the main gullies, and around the streams at the northern end of the site. See **Figure 5** showing the location of the streams and wetlands on the site.

**Stream P1**

Stream P1 flows east to west through pasture that has been grazed in the recent past (**Plate 1**). The channel is likely to have been modified through straightening and deepening. The dominant substrate making up the stream banks and channel bottom is clay. There is a small amount of small- to medium-sized gravel within the channel.

Habitat for native fish is limited to sections of undercut banks and small areas of in-channel or overhanging bank-side vegetation. The New Zealand Freshwater Fish Database records a number of native fish species within the wider Wairoa River catchment. As Stream P1 only supports limited habitat for native fish, it is unlikely that many of these species are present. Shortfin eel (*Anguilla australis* – Not Threatened) is the most likely species to be found as it can tolerate higher water temperatures and lower dissolved oxygen content than most other native fish species. The NIWA River Map has predicted records for fish in all streams, and shortfin eel is the one species predicted to be present in this stream.[3]

[1] Singers *et al.* 2017. *Indigenous terrestrial and wetland ecosystems of Auckland*. Auckland Council.

[2] www.retrolens.co.nz

[3] https://shiny.niwa.co.nz/nzrivermaps/

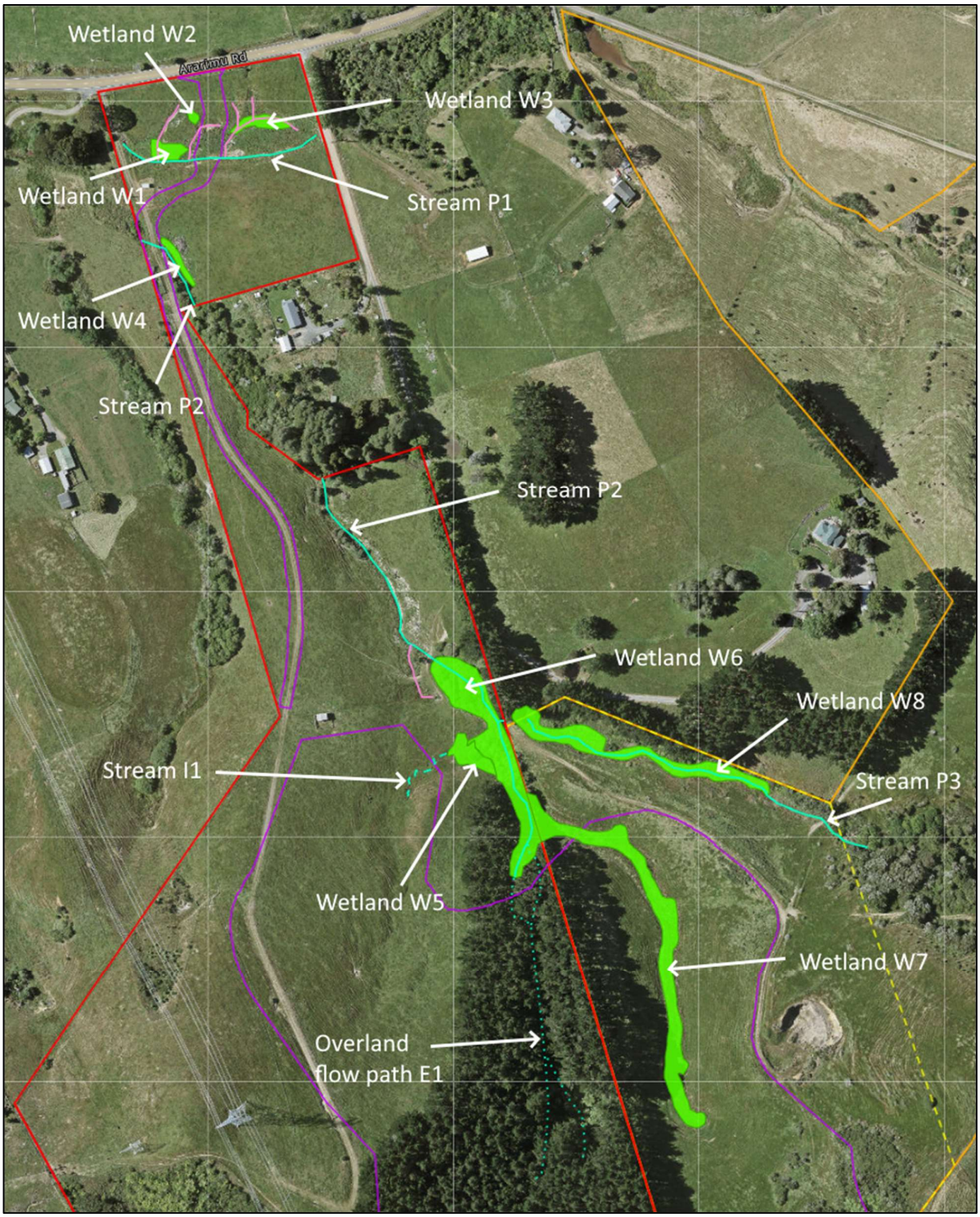


**Figure 5:** Location of wetlands (green polygons) and streams (solid and dashed turquoise lines) at the northern end of the site. Drains are marked with pink lines.

**Stream P2**

Stream P2 begins at the northern end of the central gully and flows north through the site before crossing the site boundary into the neighbouring property to the east of the site (302.6 m in length). Upstream of Stream P2 the channel becomes braided, indistinct and ephemeral (overland flow path E1). There is a narrow band of terrestrial vegetation remaining following clearance of the pine trees, which includes tree fern and exotic shrub species such as Chinese privet (*Ligustrum sinense*). Beyond this band of vegetation, the stream flows through an area of wetland (Wetland W6) where willow (*Salix* sp.) dominates the canopy, and mostly native wetland species, including sedges, rushes and ferns, form the understorey (**Plate 2**).

The central section of P2 flows through pasture that has been grazed in the recent past (**Plate 3**). Woody riparian vegetation along this section is limited to scattered willow along the true left bank at the downstream end. There is a short section (55.8 m long) of Stream P2 that re-enters the site towards the northern end before crossing into the neighbouring property to the west – this section flows through pasture that has been grazed until recently.

The dominant substrate making up the stream banks and channel bottom is clay. The sections of the stream that flow beneath the pine and willow canopies also contain root and leaf mats and woody debris. These sections provide a greater range of habitat for native fish and aquatic invertebrates than the sections passing through pasture. It is likely however, that due to the lack of suitable habitat in the downstream reaches, shortfin eel is the only native fish species that may be present in Stream P2.

**Stream P3**

Permanent Stream P3 flows east to west though a shallow gully at the edge of the site boundary, and is 283.3 m in length. It flows off the site into the neighbouring property before re-entering the site 4 m upstream of its confluence with Stream P2. The stream flows though Wetland W8. Its banks are vegetated with grazed pasture grass. A line of pine trees grows along the upper true right bank, and mark the boundary between the site and the neighbouring property.

The dominant substrate making up the stream banks and channel bottom is clay. Fish habitat is limited to in-channel vegetation. Shortfin eel is the only native fish species that is likely to be present in Stream P3.

**Stream I1**

Stream I1 is an intermittent, short 47.7 m section of stream that drains the western gully, leading into wetland (Wetlands W5 and W6) and on into Stream P2. It is a narrow (average width 0.2 m), deeply incised natural channel that flows through pasture until it reaches the wetland (**Plate 4**). There is no woody riparian vegetation along this short stream, although long grasses on the margins provide some shade for the stream bed. Its bed and banks are formed of clay and it supports only very limited habitat for aquatic invertebrates. Fish habitat is very restricted as undercut banks, debris, leaf packs, and roots are absent – the stream is effectively only a chute channelling water.

**Plate 1:** Stream P1 – flows east to west across the northern end of the site.

**Plate 2:** Stream P2 – northern section flowing through Wetland W6 beneath a canopy of mature willow and ground cover of sedges, rushes, and ferns.

**Plate 3:** Stream P2 – central section flowing through pasture with scattered willow shrubs along the true left bank at the downstream end.

**Plate 4:** Stream I1 – a short section of incised stream that flows through pasture and drains the western gully.

**Wetlands W1, W2, and W3**

These wetlands are located at the northern end of the site, alongside Stream P1. They are part of a wider area of historic wetland that has been drained; a network of ditches currently still drains this area (**Plate 5**). They all support a very similar suite of wet-adapted plant species, including *Juncus effusus, Agrostis stolonifera, Holcus lanatus, Glyceria declinata*, and *Lycopus europeaus*. The assemblage of plant species at all three wetlands meets the Dominance Test (Clarkson, 2013[4]), meaning that these wetlands meet the criteria for a natural inland wetland under the National Policy Statement for Freshwater Management (NPS-FM).

The wetlands are in poor ecological condition as they support only exotic plant species, have been, and continue to be drained, and until recently, have been grazed by stock.

**Wetland W4**

Wetland W4 is a linear patch of wetland located along the northern section of Stream P2 (**Plate 6**). Wetland W4 exhibits an assemblage of plant species that meet the Clarkson 2013 Rapid Test and therefore qualifies the area as a natural inland wetland under the NPS-FM. Obligate wetland species *Glyceria maxima*, and facultative wetland species *Juncus effusus*, *Juncus articulatus*, *Juncus sarophorus* and *Persicaria hydropiper* are the dominant species.

The ecological condition of the wetland is moderate as it supports a mix of exotic and native species and has not been trampled and grazed to the extent that Wetlands W1, W2 and W3 have been.

**Wetlands W5 and W6**

These two wetlands are adjacent to each other and are part of the same wetland system, but have been described as separate wetlands as they support a different suite of plant species.

Wetland W5 is a small area of wetland at the downstream end of Stream I1, that supports an assemblage of plant species that meet the Rapid Test, and therefore qualify the area as a natural inland wetland under the NPS-FM. Obligate wetland species blue sweetgrass, and facultative wetland species *Juncus effusus*, *Ranuculus flammula*, and *Paspalum distichum* are the dominant species. The ecological condition of the wetland is poor as it supports only exotic species and has been subject to trampling and grazing by stock in the recent past.

Wetland W6 is located at the eastern boundary of the site along Stream P2. It extends into the neighbouring property, merging with Wetland P7. Wetland P7 has different characteristics and is therefore described as a separate wetland (see below).

Wetland W6 supports an assemblage of plants that meet the Rapid Test and therefore qualify the area as a natural inland wetland under the NPS-FM. Much of W6 has a canopy and/ or sub-canopy of *Salix* sp., a facultative wetland species, and a ground layer of obligate wetland species including *Carex secta* and *Eleocharis acuta*, and facultative wetland species including *Parablechnum minus* (**Plate 7**). The ecological condition of the wetland is moderate as it has been fenced from grazing stock and supports a mix of native and exotic species.

[4] Clarkson, B (2013) *A vegetation tool for wetland delineation in New Zealand*. Landcare Research.

**Wetland W7**

Wetland W7 is a linear wetland situated in the bottom of a gully on the leased land on the neighbouring property, to the east of the central gully. It supports an assemblage of plants that meet the Rapid Test and therefore qualify the area as a natural inland wetland under the NPS-FM. Dominant species include obligate wetland species *Glyceria declinata* and *Typha orientalis*, and facultative wetland species *Juncus effusus*, *Juncus sarophorus*, and *Ranunculus flammula* (**Plates 8 and 9**).

The ecological condition of the wetland is poor as it is trampled and grazed by stock, and supports mostly exotic species of rush and grass. There have been recent influxes of sediment into the wetland, which are likely to be the result of trampling of surrounding slopes by livestock, exacerbated by the multiple storm events in the Auckland region in 2023. Increased erosion of the upstream historic quarry during storm events may also have contributed towards sediment inputs.

**Wetland W8**

Wetland W8 is a linear wetland alongside permanent Stream P3 on the neighbouring property. It supports an assemblage of plants that meet the Rapid Test and therefore qualify the area as a natural inland wetland. Dominant species include facultative wetland species *Juncus effusus*, *Juncus articulata*, *Juncus pallidus*, *Cyperus ustulatus* and *Ranunculus flammula*, with clumps of the obligate wetland species *Carex secta*.

The ecological condition of the wetland is moderate as it supports a mix of native and exotic species, but it is also subject to trampling and grazing by stock where access is possible. The wetland is not fenced but is protected to some degree from stock by the steep side of the gully.

**Plate 5:** View west over Wetland W3 in the foreground, and Wetlands W2 and W1 in the background. The uneven nature of the ground reflects historic ditch works and grazing activity.

**Plate 6:** Wetland W4 alongside Stream P2 supporting obligate wetland species reed sweetgrass and a range of facultative wetland species including *Juncus effusus* and *Persicaria hydropiper*.

**Plate 7:** Wetland W6 supports a canopy and sub-canopy of willow species, and ground cover of *Carex secta* and *Parablechnum minus*.

**Plate 8:** Wetland W7 – *Typha orientalis*, *Juncus effusus* and *Juncus sarophorus* at the downstream end. This wetland is accessible to stock and shows signs of damage though trampling and grazing, as well from sediment input.

**Plate 9:** Wetland W7 – the upper and middle reaches support a mix of *Juncus* rushes, *Glyceria declinata* and *Ranunculus flammula*.

**Terrestrial ecology**

The majority of the site comprises grazed pasture grasses, that have been grazed up until recently (and we understand will continue to be grazed over spring and summer as part of ongoing livestock use of the site).

The central gully supported a stand of planted pine trees up until clearance under an authorised felling permit in March-April 2024. This area is now clear of vegetation, apart from a line of pine trees along the western edge of the gully that has been retained to create a visual screen for neighbouring properties. Once the remaining pine slash has been cleared from the gully slopes, the area will be seeded with pasture species to maintain slope stability and control erosion.

There is an area of regenerating native bush and wetland at the south western edge of the site, that lies in the head of another gully that runs downstream into the neighbouring property to the west. This area was not formally surveyed during the site visit as it lies outside of the area proposed for the managed fill operations.

No 'At Risk' or 'Threatened' terrestrial plant species are expected to be present on the site.

The lack of native woody vegetation on the site, apart from the patch of regenerating native bush at the south western edge of the site, means that there is limited habitat for native terrestrial fauna. A number of common native bird species have been observed using the site. There is no suitable habitat for native lizards within the footprint of the proposed development. There is no habitat within the development footprint that is suitable for roosting bats.

No 'At Risk' or 'Threatened' fauna species are expected to be present within any of the terrestrial vegetation on the site.

## 2.2 Development impacts and effects management

This section provides a concise summary of the un-avoided effects, mitigation, and offsetting that forms the overall effects management package.

### 2.2.1 Un-avoided effects

- Permanent loss of extent and values with the infilling of Wetland W7 (2,108 $m^2$); and
- Permanent loss of extent and values with the infilling of Stream I1 (35 m).

### 2.2.2 Mitigation

- Mitigation will be provided for the **potential impacts on native freshwater fish** by the salvage and relocation of fish prior to works in the stream and wetland areas if these areas are considered by a freshwater ecologist to support habitat for freshwater fish (to be determined immediately prior to the earthworks). The salvage works will be fully described within a separate Native Freshwater Fish Relocation Plan, to be provided as a Condition of Consent.

### 2.2.3 Offsetting

- The **permanent loss of extent and values of 2,108 m$^2$ of Wetland W7** will be offset through:
    - Restoration of 2,682 m$^2$ of natural inland wetland (Historic Wetland HW3) through minor excavation to ensure appropriate hydrology is restored, fencing from stock, weed control, and planting with native species (**Figure 3**), including planting a 10 m buffer around the wetland; and
    - Restoration of 453 m$^2$ of natural inland wetland (Historic Wetland HW1) through minor excavation to ensure appropriate hydrology is restored, fencing from stock, weed control, and planting with native species, including planting a 10 m buffer around the wetland (**Figure 4**).
- The **permanent loss of 35 m of Stream I1** will be offset through:
    - Planting 35 m of Stream P1 with native plants to a width of 20 m on each bank to replace the loss of Stream I1 **value**; and
    - Restoration of 471.5 m$^2$ of natural inland wetland (Historic Wetland HW1) as a 'trade-up' for the loss of Stream I1 **extent**, through minor excavation and blocking of existing drains to ensure appropriate hydrology is restored, fencing from stock, weed control, and planting with native species, including planting a 10 m buffer around the wetland (**Figure 4**).

## 2.3 Expected ecological outcomes from ecological enhancement

The next sections of this management plan describe the actions that will be carried out to achieve wetland restoration (creation and enhancement) and stream restoration (reinstatement and enhancement) at the site.

For each of those enhancement actions there are tangible ecological targets that are required to be met. These are listed below and form the basis for monitoring and reporting on progress towards achieving the intended enhancements.

### 2.3.1 Wetland re-creation and enhancement at Historic Wetlands HW1 and HW3

The required characteristics of the wetland restoration areas are:

1. A minimum area of 3,602.5 m$^2$ of historic wetland to be re-created:
    i. Re-creation of 2,683 m$^2$ of wetland at Historic Wetland HW3 and 453 m$^2$ of wetland at Historic Wetland HW1 to offset the loss of Wetland W7; and
    ii. Re-creation of 471.5 m$^2$ of wetland at Historic Wetland HW1 to offset the loss of extent of Stream I1.
2. A 10 m buffer around the re-created wetlands to be planted with native species, noting that a small area (ca. 180 m²) of the buffer around Wetland HW3 will be planted following the removal of the Sediment Retention Pond at the completion of the fill (**Figure 6**).
3. Additional widths of buffer planting within the site to make up the shortfall over areas that cannot be planted as they fall within the access track or on neighbouring property (**Figure 4**).

4. Hydrological monitoring information that demonstrates that the wetland creation areas have similar hydrological profiles as the hydrological profiles of existing Wetlands W1-W3, which are adjacent to HW1, and are in a similar location to HW3.
5. All planted areas (wetlands and buffer areas) must achieve 90 % canopy cover on average, or greater, within 5 years of planting being completed.
6. The re-created wetland and buffer areas are to be fenced from livestock.
7. After 5 years following the completion of wetland restoration works, Wetlands HW1 and HW3 (including their 10 m planted buffers) will achieve the following WEV wetland condition scores, or show a trajectory that provides confidence that these WEV scores will be achieved within 10 years following the completion of the wetland restoration works.
    i. Wetland HW1 WEV 0.758
    ii. Wetland HW3 WEV 0.750


**Figure 6:** One area of wetland buffer to be planted following removal of the Sediment Retention Pond at the end of the fill operation (from Figure 2c of the landscaping plan – Simon Cocker Landscape Architecture).

### 2.3.2 Stream enhancement at Stream P1

The required characteristics of the riparian planting at Stream P1 as offset for the loss of value at Stream I1:

1. An average planted riparian width of 20 m wide on both banks along 35 m of Stream P1.
2. Additional widths of buffer planting within the site to make up the shortfall in buffer planting over areas that cannot be planted i.e. over the access track and on neighbouring property (**Figure 4**).
3. The planted buffer areas are to be fenced from livestock.

4. Planted native vegetation cover of 90 % on average or greater, to be achieved within 5 years of planting being completed.

### 2.3.3 Additional wetland buffer planting

Native planting will also be undertaken to 10 m from wetland edges (**Figures 7 and 8**), to buffer the wetlands from the proposed managed fill activities, and to enhance the overall biodiversity of the wetlands:

1. 10 m planted buffer to Wetlands W2, W4, W5, and W6;
2. 10 m planted buffer to the remaining 284.4 m² of Wetland W7;
3. The planted buffer areas and wetlands are to be fenced from livestock.
4. Wetland W8 will be planted around the northern edge as part of the landscape planting plans. There will be no ecological enhancement planting required at Wetland W8; however, the wetland and the landscape planting are to be fenced from livestock.
5. Planted native vegetation must achieve 90 % cover on average within 5 years of planting being completed.

Further native planting will also be undertaken as mitigation for visual effects, which will provide additional buffering of wetlands, as well as enhancing the biodiversity of the site as a whole. The location of the landscape planting and full details of these planting areas and schedules are provided in the Landscape Management Plan[5].

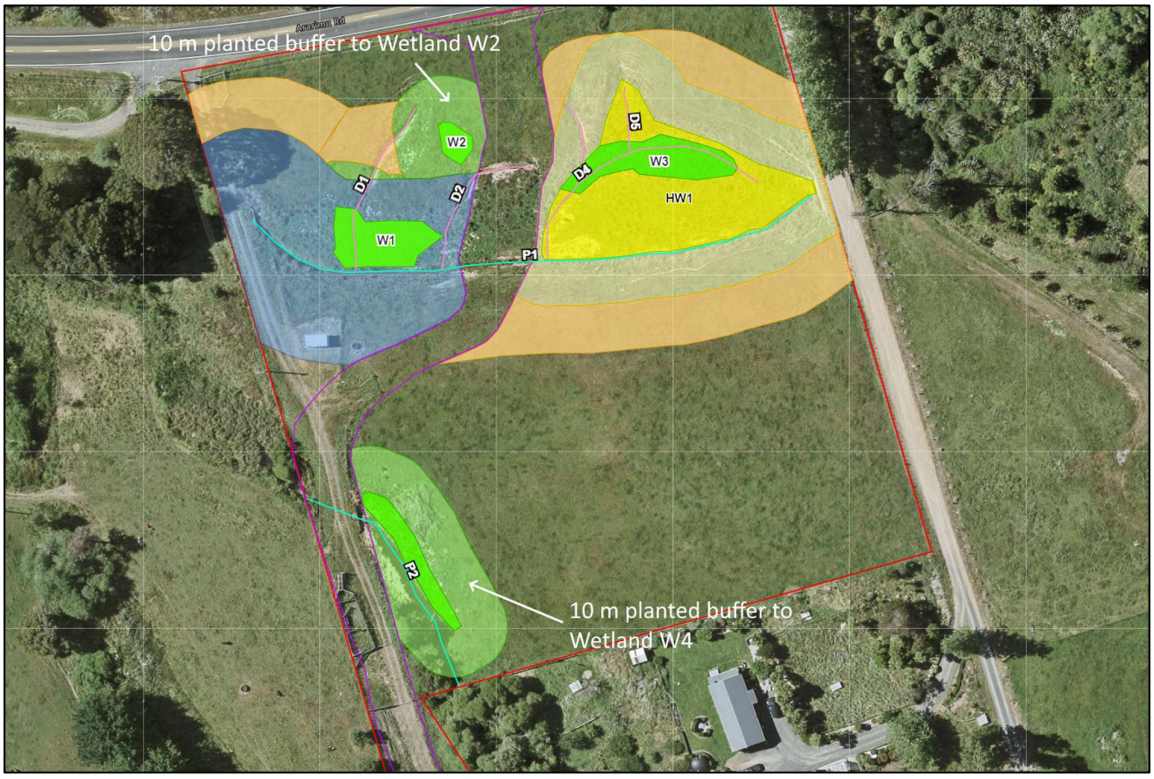


**Figure 7:** Planted 10 m buffers to Wetlands W2 and W4.

[5] *Ararimu Road: Landscape Management Plan*, Simon Cocker Landscape Architect, September 2024.

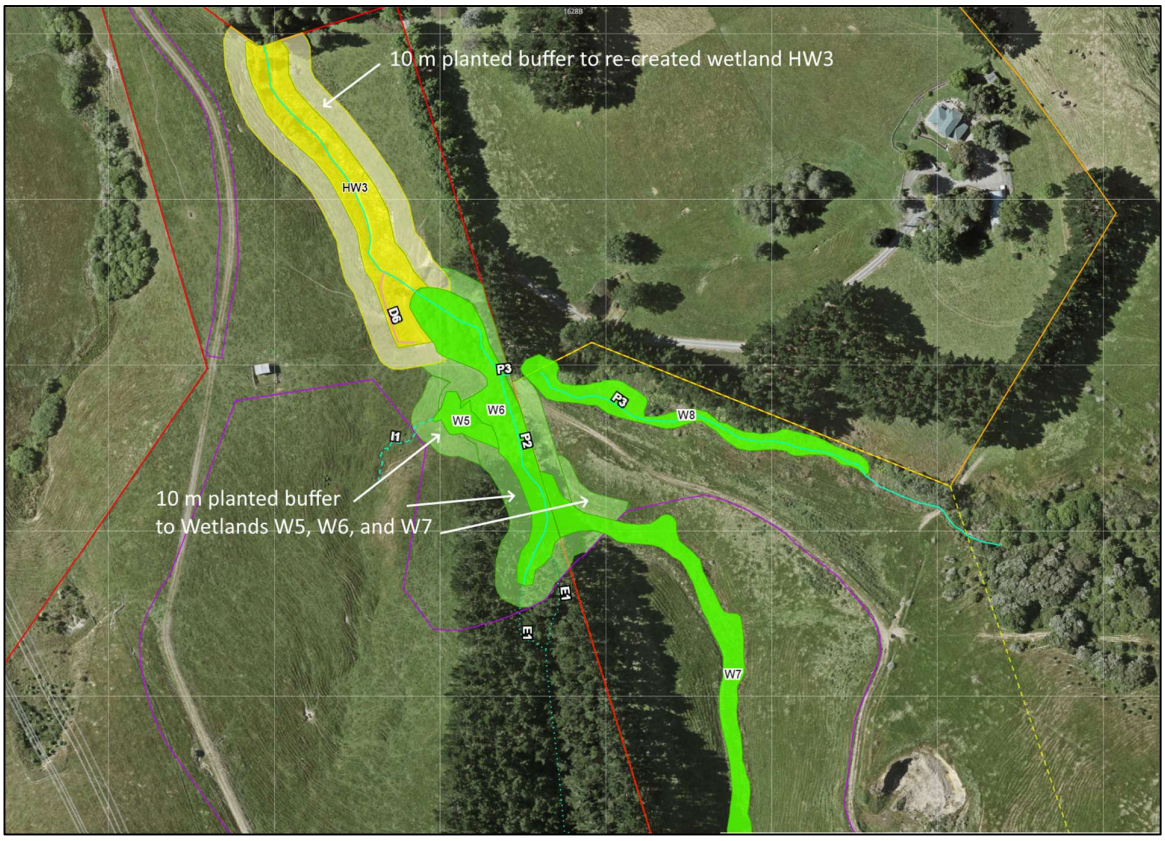


**Figure 8:** Planted 10 m buffers to Wetlands W5, W6, and W7.

# 3.0 Restoration of historic wetland

Wetland restoration will be carried out in the areas of historic wetland around the current Wetland W3 and the central reach of Stream P2. Historical aerial photographs indicate that these areas have supported wetland vegetation in the past.

Both of these areas have undergone earthworks in the past (likely over multiple occasions) to improve drainage. Small drainage ditches have been dug in the northern part of the site around Wetland W3, and Stream P2 has been dredged to increase flood capacity. Dredged material has been deposited around both the wetland and the stream, effectively filling in the surrounding wetland areas and lowering the water table.

In order to restore these areas as wetland, the hydrology will be restored by removing the dredged material and filling in the drainage channels. Any vegetation remaining after completion of the earthworks will be retained rather than attempting to spray out existing wetland species, which could cause unwanted erosion and soil stabilisation issues. Where invasive weeds are present in a planting area, these will be controlled, otherwise existing exotic plants will be retained and native species planted amongst the exotics, with the anticipation that planted native species will establish and gradually outcompete exotic plants.

The existing wetland areas support a mix of mostly exotic grasses, rushes, and smaller plants. The historic ecosystem type predicted for this location is WF12 (kauri, podocarp, broadleaved, beech forest). The

planting plans below have been informed by TP148, Te Haumanu Taiao (version 2023), Auckland Council Wetland Facts 02: planting guide, and Auckland Council Riparian Facts: planting guide.

The schedule of works and planting list for each wetland follow in **Tables 1 – 4**.

| Table 1: Historic Wetland HW1 schedule of works | |
|---|---|
| **Actions** | - Earthworks to remove dredged material, restoring ground levels to the same as surrounding wetlands (W1, W2, and W3), and to fill existing drainage channels.<br>- Erect fence to exclude stock (if present) to minimum 10 m from margin of restored wetland prior to planting.<br>- Planting to be complete by end of winter in the year following earthworks.<br>- Ongoing weed control, infill planting, monitoring and reporting until closure (5 years from start of planting). |
| **Site planting area** | **960 $m^2$ of wetland and 1510 $m^2$ of buffer (10 m from wetland margin + additional areas that account for buffer that falls within the access track or neighbouring property) – see Figure 4** |
| **Revegetation objective** | Wetland rushes and sedges in the wetland with wetland shrubs at the margins.<br>Lowland mixed broadleaved/ podocarp forest within wetland buffer. |
| **Existing vegetation** | Pasture grass. |
| **Site Preparation** | Remove/ kill weeds from planting areas and control rabbits and possums to low levels prior to planting. Knock-down control of pukeko as required.<br>Fence to exclude stock (if present) from minimum 10 m wide margin, and connect to existing fence lines. |
| **Planting** | Use plant guards (if needed). Planting at 0.5 m and 1 m centres (2 m centres for canopy trees). |
| **Monitoring** | Assess planted area on completion of planting. Annual monitoring of plant health and weed control, with additional monitoring of canopy closure in Years 3 and 5 following completion of the planting programme. |
| **Maintenance** (up to five years) | Weed control 2 times/ year for Years 1-5, in spring and summer.<br>Infill planting as required to ensure canopy closure.<br>Undertake pest animal control as needed. |

| Table 2: Historic Wetland HW1 planting schedule | | | | | | |
|---|---|---|---|---|---|---|
| **Wetland (960 m$^2$)** | | | | | | |
| **Botanical Name** | **Common Name** | **Plant size at time of planting** | **Planting unit** | **Planting centers (m)** | **Percentage mix (%)** | **Numbers required** |
| *Austroderia fulvida* | Toetoe | RT | Moist edges | 1 | 15 | 165 |
| *Phormium tenax* | Harakeke | RT | Moist edges/ boggy areas | 1 | 16 | 176 |
| *Carex virgata* | Purei | RT | Moist edges/ boggy areas | 0.5 | 12 | 528 |
| *Carex secta* | Purei | RT | Boggy areas | 0.5 | 12 | 528 |
| *Cordyline australis* | Ti Kouka | RT | Moist edges/ boggy areas | 1 | 10 | 110 |
| *Veronica stricta* var. *stricta* | Koromiko | RT | Moist edges | 1 | 5 | 55 |
| *Leptospermum scoparium* | Manuka | RT or Pb3 | Moist edges | 1 | 10 | 362 |
| *Sophora microphylla* | Kowhai | RT or Pb3 | Moist edges | 1 | 5 | 55 |
| *Juncus edgariae* | Rush | RT | Boggy areas | 0.5 | 10 | 440 |
| *Cyperus ustulatus* | Umbrella sedge | RT | Boggy areas | 0.5 | 5 | 220 |
| | | | | **TOTAL** | **100** | **2,639** |
| *Year 2/ Year 3 enrichment planting* | | | | | | |
| *Dacrycarpus dacrydioides* | Kahikatea | Pb3 | Moist edges | 2 | 5 | 14 |
| **Buffer (1510 m$^2$)** | | | | | | |
| **Botanical Name** | **Common Name** | **Plant size at time of planting** | **Planting unit** | **Planting centers (m)** | **Percentage mix (%)** | **Numbers required** |
| *Phormium tenax* | Harakeke | RT | Wet or dry | 1 | 10 | 173 |
| *Coprosma robusta* | Karamu | RT | Wet or dry | 1 | 15 | 260 |
| *Leptospermum scoparium* | Manuka | RT or Pb3 | Wet or dry | 1 | 15 | 260 |
| *Veronica stricta* var. *stricta* | Koromiko | RT | Moist edges | 1 | 10 | 173 |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Kunzea ericoides* | Kanuka | RT or Pb3 | Dry | 1 | 15 | 260 |
| *Myrsine australis* | Mapou | RT or Pb3 | Dry | 1 | 10 | 173 |
| *Cordyline australis* | Ti kouka | RT | Wet or dry | 1 | 10 | 173 |
| *Aristotelia serrata* | Makomako | RT or Pb3 | Moist edges | 1 | 5 | 87 |
| *Year 2/ Year 3 enrichment planting* | | | | | | |
| *Dacrydium cupressinum* | Rimu | Pb3 | Buffer | 2 | 1 | 4 |
| *Knightia excelsa* | Rewarewa | Pb3 | Buffer | 2 | 1 | 4 |
| *Pseudopanax arborea* | Fivefinger | RT or PB3 | Moist edges | 1 | 4 | 69 |
| *Carpodetus serratus* | Putaputaweta | RT or Pb3 | Moist edges | 1 | 4 | 69 |
| | | | | **TOTAL** | **100** | **1,705** |

| Table 3: Historic Wetland HW3 schedule of works | |
|---|---|
| **Actions** | - Earthworks to remove dredged material, restoring ground levels to the same as the flooded margins of the existing stream.<br>- Erect fence to exclude stock (if present) to minimum 10 m from margin of restored wetland prior to planting.<br>- Planting to be complete by end of winter in the year following earthworks.<br>- Ongoing weed control, infill planting, monitoring and reporting until closure (5 years from start of planting). |
| **Site planting area** | **2,683 $m^2$ of wetland and 3,332 $m^2$ of buffer (10 m from wetland margin + additional areas that account for buffer that falls within the access track or neighbouring property) – see Figure 3** |
| **Revegetation objective** | Wetland rushes and sedges in the wetland with wetland shrubs at the margins.<br>Lowland mixed broadleaved/ podocarp forest within wetland buffer. |
| **Existing vegetation** | Pasture grass. |
| **Site Preparation** | Remove/ kill weeds from planting areas and control rabbits and possums to low levels prior to planting. Knock-down control of pukeko as required.<br>Fence to exclude stock (if present) from minimum 10 m wide margin, and connect to existing fence lines. |
| **Planting** | Use plant guards (if needed). Planting at 0.5 m and 1 m centres (2 m centres for canopy trees). |
| **Monitoring** | Assess planted area on completion of planting. Annual monitoring of plant health and weed control, with additional monitoring of canopy closure in Years 3 and 5 following completion of the planting programme. |
| **Maintenance** (up to five years) | Weed control 2 times/ year for Years 1-5, in spring and summer.<br>Infill planting as required to ensure canopy closure.<br>Undertake pest animal control as needed. |

| Table 4: Historic Wetland HW3 planting schedule | | | | | | |
|---|---|---|---|---|---|---|
| **Wetland (2,683 m²)** | | | | | | |
| **Botanical Name** | **Common Name** | **Plant size at time of planting** | **Planting unit** | **Planting centers (m)** | **Percentage mix (%)** | **Numbers required** |
| *Austroderia fulvida* | Toetoe | RT | Moist edges | 1 | 15 | 461 |
| *Phormium tenax* | Harakeke | RT | Moist edges/ boggy areas | 1 | 16 | 492 |
| *Carex virgata* | Purei | RT | Moist edges/ boggy areas | 0.5 | 12 | 1476 |
| *Carex secta* | Purei | RT | Boggy areas | 0.5 | 12 | 1476 |
| *Cordyline australis* | Ti Kouka | RT | Moist edges/ boggy areas | 1 | 10 | 307 |
| *Veronica stricta* var. *stricta* | Koromiko | RT | Moist edges | 1 | 5 | 154 |
| *Leptospermum scoparium* | Manuka | RT or Pb3 | Moist edges | 1 | 10 | 307 |
| *Sophora microphylla* | Kowhai | RT or Pb3 | Moist edges | 1 | 5 | 154 |
| *Juncus edgariae* | Rush | RT | Boggy areas | 0.5 | 10 | 1230 |
| *Cyperus ustulatus* | Umbrella sedge | RT | Boggy areas | 0.5 | 5 | 615 |
| | | | | **TOTAL** | **100** | **6,672** |
| *Year 2/ Year 3 enrichment planting* | | | | | | |
| *Dacrycarpus dacrydioides* | Kahikatea | Pb3 | Moist edges | 2 | 5 | 38 |
| **Buffer (3,332 m²)** | | | | | | |
| **Botanical Name** | **Common Name** | **Plant size at time of planting** | **Planting unit** | **Planting centers (m)** | **Percentage mix (%)** | **Numbers required** |
| *Phormium tenax* | Harakeke | RT | Wet or dry | 1 | 10 | 382 |
| *Coprosma robusta* | Karamu | RT | Wet or dry | 1 | 15 | 573 |
| *Leptospermum scoparium* | Manuka | RT or Pb3 | Wet or dry | 1 | 15 | 573 |
| *Veronica stricta* var. *stricta* | Koromiko | RT | Moist edges | 1 | 10 | 382 |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Kunzea ericoides* | Kanuka | RT or Pb3 | Dry | 1 | 15 | 573 |
| *Myrsine australis* | Mapou | RT or Pb3 | Dry | 1 | 10 | 382 |
| *Cordyline australis* | Ti kouka | RT | Wet or dry | 1 | 10 | 382 |
| *Aristotelia serrata* | Makomako | RT or Pb3 | Moist edges | 1 | 5 | 191 |
| *Year 2/ Year 3 enrichment planting* | | | | | | |
| *Dacrydium cupressinum* | Rimu | Pb3 | Buffer | 2 | 1 | 10 |
| *Dacrycarpus dacrydioides* | Kahikatea | Pb3 | Buffer | 2 | 1 | 10 |
| *Pseudopanax arborea* | Fivefinger | RT or PB3 | Moist edges | 1 | 4 | 153 |
| *Carpodetus serratus* | Putaputaweta | RT or Pb3 | Moist edges | 1 | 4 | 153 |
| | | | | **TOTAL** | **100** | **3,764** |

# 4.0 Stream enhancement at Stream P1

Enhancement planting of 20 m on both banks along 35 m of Stream P1 will be undertaken to offset the loss of value at Stream I1, along with the additional width of buffer planting required to take into account the areas that cannot be planted over the access track and on the neighbouring properties.

The existing vegetation along the banks of Stream P1 comprises exotic pasture species. The schedule of works and planting list follow in **Tables 5 and 6**:

**Table 5: Stream P1 schedule of works**

| | |
|---|---|
| **Site planting area** | **1,400 $m^2$ of riparian buffer (35 m x 20 m on each bank – including additional areas that account for buffer that falls within the access track or neighbouring property) – see Figure 4.** |
| **Revegetation objective** | Riparian margin – lowland mixed broadleaved/ podocarp forest. |
| **Existing vegetation** | Pasture grass. |
| **Site Preparation** | Remove/ kill weeds from planting areas and control rabbits and possums to low levels prior to planting. Knock-down control of pukeko as required.<br>Fence to exclude stock (if present) from minimum 20 m wide margin, and connect to existing fence lines. |
| **Planting** | Use plant guards (if needed). Planting at 0.5 m and 1 m centres (2 m centres for canopy trees). |
| **Monitoring** | Assess planted area on completion of planting. Annual monitoring of plant health and weed control, with additional monitoring of canopy closure in Years 3 and 5 following completion of the planting programme. |
| **Maintenance** (up to five years) | Weed control 2 times/ year for Years 1-5, in spring and summer.<br>Infill planting as required to ensure canopy closure.<br>Undertake pest animal control as needed. |

| Table 6: Stream P1 planting schedule | | | | | | |
|---|---|---|---|---|---|---|
| **Riparian buffer (35 m x 20 m on both banks = 1,400 $m^2$)** | | | | | | |
| **Botanical Name** | **Common Name** | **Plant size at time of planting** | **Planting unit** | **Planting centers (m)** | **Percentage mix (%)** | **Numbers required** |
| *Carex virgata* | Purei | RT | Stream edge | 0.5 | 15 | 963 |
| *Carex geminata* | Rautahi | RT | Stream edge | 0.5 | 15 | 963 |
| *Austroderia fulvida* | Toetoe | RT | Stream edge or on bank | 1 | 15 | 241 |
| *Coprosma robusta* | Karamu | RT | Stream bank | 1 | 15 | 241 |
| *Phormium tenax* | Harakeke | RT | Stream bank | 1 | 10 | 160 |
| *Cordyline australis* | Ti Kouka | RT | Stream bank | 1 | 10 | 160 |
| *Veronica stricta* var. *stricta* | Koromiko | RT | Stream bank | 1 | 5 | 80 |
| *Sophora microphylla* | Kowhai | RT or Pb3 | Stream bank | 1 | 5 | 80 |
| *Year 2/ Year 3 enrichment planting* | | | | | | |
| *Dacrydium cupressinum* | Rimu | Pb3 | Stream bank | 2 | 5 | 20 |
| *Dacrycarpus dacrydioides* | Kahikatea | Pb3 | Stream bank | 2 | 5 | 20 |
| | | | | **TOTAL** | **100** | **2,928** |

# 5.0 Additional wetland buffer planting

Native planting will also be carried out around all remaining areas of wetland that will not otherwise be restored/ enhanced as part of the mitigation and offset package. A 10 m buffer will be planted around Wetlands W2, W4, W5, W6, and the remaining area of Wetland W7.

The schedule of works and planting list for Wetlands W2, W4, W5, W6, and W7 follow om **Tables 7 and 8**:

| **Table 7: Wetlands W2, W4, W5, and W6 schedule of works** | |
|---|---|
| **Site planting area** | **W2: 336 $m^2$ + W4: 832 $m^2$ + W5: 500 $m^2$ + W6: 2,411 $m^2$ + W7: 406 $m^2$ = 4,485 $m^2$ total of buffer planting (10 m from wetland margin)**<br>Areas that overlap with adjacent wetland buffers or areas identified for mitigation or offset planting have been excluded from the above totals. |
| **Revegetation objective** | Lowland mixed broadleaved/ podocarp forest within wetland buffer. |
| **Existing vegetation** | Pasture grass. |
| **Site Preparation** | Remove/ kill weeds from planting areas and control rabbits and possums to low levels prior to planting. Knock-down control of pukeko as required.<br>Fence to exclude stock (if present) from minimum 10 m wide margin, and connect to existing fence lines. |
| **Planting** | Use plant guards (if needed). Planting at 0.5 m and 1 m centres (2 m centres for canopy trees). |
| **Monitoring** | Assess planted area on completion of planting. Annual monitoring of plant health and weed control, with additional monitoring of canopy closure in Years 3 and 5 following completion of the planting programme. |
| **Maintenance** (up to five years) | Weed control 2 times/ year for Years 1-5, in spring and summer.<br>Infill planting as required to ensure canopy closure.<br>Undertake pest animal control as needed. |

| Table 8: Wetlands W2, W4, W5, W6, and W7 planting schedule | | | | | | |
|---|---|---|---|---|---|---|
| **Buffer (W2: 336 $m^2$ + W4: 832 $m^2$ + W5: 500 $m^2$ + W6: 2,411 $m^2$ + W7: 406 $m^2$ = 4,485 $m^2$ total)** | | | | | | |
| **Botanical Name** | **Common Name** | **Plant size at time of planting** | **Planting unit** | **Planting centers (m)** | **Percentage mix (%)** | **Numbers required** |
| *Phormium tenax* | Harakeke | RT | Wet or dry | 1 | 10 | 514 |
| *Coprosma robusta* | Karamu | RT | Wet or dry | 1 | 15 | 771 |
| *Leptospermum scoparium* | Manuka | RT or Pb3 | Wet or dry | 1 | 15 | 771 |
| *Veronica stricta* var. *stricta* | Koromiko | RT | Moist edges | 1 | 10 | 514 |
| *Kunzea ericoides* | Kanuka | RT or Pb3 | Dry | 1 | 15 | 771 |
| *Myrsine australis* | Mapou | RT or Pb3 | Dry | 1 | 10 | 514 |
| *Cordyline australis* | Ti kouka | RT | Wet or dry | 1 | 10 | 514 |
| *Aristotelia serrata* | Makomako | RT or Pb3 | Moist edges | 1 | 5 | 257 |
| *Year 2/ Year 3 enrichment planting* | | | | | | |
| *Dacrydium cupressinum* | Rimu | Pb3 | Buffer | 2 | 2 | 26 |
| *Dacrycarpus dacrydioides* | Kahikatea | Pb3 | Buffer | 2 | 2 | 26 |
| *Pseudopanax arborea* | Fivefinger | RT or PB3 | Moist edges | 1 | 3 | 154 |
| *Carpodetus serratus* | Putaputaweta | RT or Pb3 | Moist edges | 1 | 3 | 154 |
| | | | | **TOTAL** | **100** | **4,986** |

# 6.0 Planting process

The planting areas on the site are discrete riparian and wetland areas. Good practice principles for this planting follows preferred methodologies and standards advocated by Auckland Council (e.g. Council's TP 148 guidelines, Appendix 16 to the Unitary Plan, and Te Haumanu Taiao (2023 version)). Planting will follow 'WF12' planting schedules for the terrestrial buffer planting areas and the Auckland Council Wetland and Riparian Planting Guides. The key features of the planting strategy include:

- Creating a self-sustaining native plant community;
- Increasing the diversity of native species; and
- Providing greater function/ services for streams and wetlands.

## 6.1 Site preparation

### 6.1.1 Top soil

Where earthworks are required to restore ground levels for wetland restoration and to re-create stream channel, a minimum of 300 mm of clean topsoil (e.g. screened of fines) will be placed in the planting area following earthworks and not more than 6 weeks prior to planting.

### 6.1.2 Weed control

Existing vegetation will be removed in areas requiring earthworks. Further weed control will only be required if earthworks and topsoiling occur long enough before planting such that weeds are able to invade, germinate and grow to the point where they will immediately compete with planted natives. To avoid the need for further weed control, topsoil should be spread in the planting area not more than 6 weeks prior to planting. If this timing is not met, then blanket coverage herbicide application or spot-spraying (at least 600 mm diameter) at anticipated plant locations will be required.

## 6.2 Planting

Ecological principles that underpin this plan are:

- Use of indigenous species that are representative of natural local plant communities and which provide appropriate community structure;
- Source seed and plants locally where possible (eco-sourcing[6]) in order to select strains that are best suited to local environmental conditions and to maintain the integrity of local genetic stocks; and
- Plant species which give long-term benefits for stream health.

[6] Following the guidance provided in the 2005 edition of Ecosourcing: Code of practice and ethics. Published by the Waitakere City Council, Auckland.

### 6.2.1 Timing

In terms of overall planting, the following timeline is laid out below.

Stock will be removed from wetland and riparian areas at Year 1, which will lead to immediate benefits for sediment, water quality and soils.

- Year 1
    - Construct wetlands at Historic Wetlands HW1 and HW3.
    - Prepare planting areas at Wetlands HW1 and HW3 (fencing, stock exclusion, weed control).
    - Prepare planting areas at Stream P1, and Wetlands W2, W4, W5, W6, and W7 (fencing, stock exclusion, weed control).
    - Fence Wetland W8 and adjacent area to be planted for landscaping.
    - Procure plants for on-site planting (8-10+ months to grow for supply).

- Year 2
    - Plant Wetlands HW1 and HW3 including 10 m buffers.
    - Plant Stream P1 buffer.
    - Plant all buffer areas to Wetlands W2, W4, W5, and W6.

- Year 3
    - Maintain, monitor, infill plant, enrichment plant if canopy growth sufficient, report on planting.

- Year 4
    - Maintain, monitor, infill plant, enrichment plant, report on planting.

- Year 5
    - Maintain, monitor, infill plant/ enrichment plant if required, report on planting.
    - If targets have not been met, undertake an assessment to determine if further monitoring/ maintenance is required.

- Year 6 onwards, if required
    - Maintain, monitor, report on planting until targets in management plan are met.

All planting will be carried out between the months of April to September. All plant material will be hardened off to cope with the climatic conditions of the site.

### 6.2.2 Methodology

Plantings will be set out in general accordance with the planting plans attached to this Plan. The various plant species shall be distributed within the mix at specified centres. Generally, no more than two plant specimens of the same species shall be located together in a single cluster. Unless shown otherwise, trees within these mixes shall be distributed randomly and in small clusters, as they would occur naturally, in accordance with the average spacing specified. Groundcover plants (grasses etc.) will be clustered at a maximum of three plants together. Groundcover species will be placed towards the edges of the planting areas, and large species towards the centres, to provide a tiered vegetation perspective from the surrounding view-points.

The planting holes for individual plants shall be well cultivated and large enough to contain the plant roots without distortion. Cultivated planting holes shall be at least twice the diameter of the plant rootball and 1.5 times the depth of the rootball. All holes for plants shall be hand dug with the sides and the bottom of the hole well loosened to remove glazing and to allow root penetration.

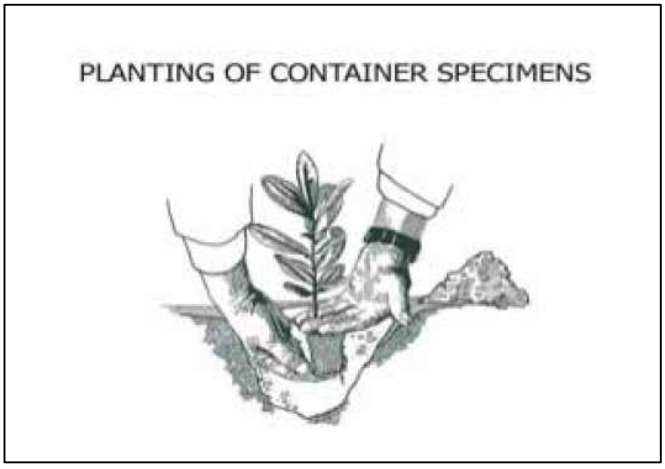


Illustration showing cultivated planting hole and depth of plant.

Prior to planting all plant root balls shall be thoroughly soaked. Backfill material will consist of the material from the planting hole well cultivated prior to backfilling. If roots are formed in a tight mass, they will be gently freed prior to planting. All care will be taken to keep the rootball of the plant intact during placement. Root bound plants will be discarded and replaced with suitable replacements.

The base of the planting hole will be filled and firmed with backfilling material to a level where the top of the plant rootball is level with surrounding ground. On sloping sites this level will relate to the bottom edge of the hole. Backfill in a maximum of 150 mm layers firming material evenly without compaction. When the backfilling is complete the plant will be gently firmed in.

A bamboo stake shall be positioned next to each plant to aid relocation during maintenance visits. Plant guards to be used if pest animal grazing is likely to be a problem for the healthy establishment of the plants.

### 6.2.3 Mulch

Mulch shall be placed across the planting area to a depth of 75 mm-100 mm as soon as possible following planting.

## 6.3 Maintenance

Ongoing maintenance will be required to ensure plants establish, and reach a sufficient maturity to be self-sustaining. The frequency of maintenance will be determined by the planting contractor as necessary to achieve the required **90 % plant survival rate** (Condition xx).

Plant maintenance shall include the following:

- Weeding of all planted areas. Weed control by hand and/ or chemical as required;
- Watering of all trees and shrubs at the frequency and amount required to sustain good healthy development;

- Control of insects and diseases by treatment with an appropriate chemical or other control as approved by the consent holder's representative;
- Removal of any diseased or damaged plant or part thereof;
- Replenish mulch to maintain a minimum 75 mm-100 mm compacted cover where appropriate; and
- Replace plants to ensure the required coverage is maintained.

### 6.3.1 Pest plants

Pest plants are at low density at the site. They may be completely cleared during earthworks. However, pest plants in surrounding areas will quickly invade the planting area following the completion of earthwork activity. The key objectives of weed control in the plantings are to:

- Control the competition of weeds within the planting areas;
- Control and contain outbreaks of infestations of invasive environmental weed species; and
- Ensure minimal damage to native plants during weed control operations.

Ongoing control of weed species from the site will require two key methods of control to be undertaken on a regular basis. The aim should be to maintain zero population density of pest plants (i.e. no matures). This will likely require at least biannual visits.

1. Large infestations of sprawling weeds will be treated by direct-application of herbicide. This is the preferred control method for large infestation of such species as it minimises soil disturbance and presents a low risk of spray drift or damage to non-target vegetation. All weed control requiring the use of herbicide will be undertaken by a qualified and experienced contractor.
2. Manual weed eradication will be used in most areas where it is not possible to use spray or use herbicide control. This will be applied for creeping weeds, invasive vines, and weeds within the native forest areas.

The use of agrichemicals will only be undertaken providing the following conditions are met:

- Identified weed species that require agrichemical control should be treated at the rates outlined in Auckland Council pest control guidance document;
- All agri-chemical usage including the transport, storage, application, levels of training and supervision, disposal and management shall be in accordance with NZS 8409:2004;
- Agrichemical application shall not be undertaken at any time if it may cause off-target contamination of adjacent properties and other non-target areas;
- Every effort shall be taken to ensure non-target species are not contaminated. Direct application methods shall be used where possible. Vegetable based spray dye should be added to all spray solutions;
- Spraying should not be undertaken when wind velocities exceed 8 knots at point of release;
- The applicator shall have due regard for the conditions of use of chemicals around waterways;
- No non-permitted use of agrichemical in or near the stream shall occur;

- Agrichemical should be applied in periods of active growth and not when the plant is in a stress situation such as during a drought period;
- Depending on the herbicide used, the time to kill the weed may vary considerably. Smaller plants may die within weeks others may take months. In all cases it is most likely that follow up spray within the same growing season will be required;
- Personnel applying herbicide should have completed an approved agrichemical course and all operations should comply with the Agrichemical Users Code of Practice (NZ Agrichemical Education Trust); and
- Spray diaries will be completed and retained as a record of weed infestation and control.

Weed infestation material will be packed into suitable transport containment and disposed of at an approved Auckland Council disposal site, unless it is viable to leave weed material on site such it is unlikely to re-sprout, spread or in any way hinder plantings.

Good weed hygiene will be adopted when working on site. Clothing, boots, and equipment will be free of any weed material and seeds before leaving the site. This will prevent the spread of the weed species off the site.

### 6.3.2 Pest animals

The purpose of the control is to facilitate the success of planting areas.

Advice will be sought from a qualified pest animal control contactor regarding the need for animal control at this site – given its urban setting.

Animal pests will be controlled to a low level. The duration of control will be determined by bait take/ capture results, as required. It is expected that control (if any) will need to be undertaken in a pulsed manner, four times per year annually, for a minimum of three consecutive years.

Due to the surrounding land use context, the key animal pest that threaten the planting area are likely to be possums and rabbits. Other larger browsing animals such as feral pigs, stock, deer, and goats are not present.

All animal pest control will be undertaken by an experienced pest management contractor, to be engaged by the consent holder. The types of baits, trap maintenance (e.g. bait replenishment) and specific locations should be determined onsite by the pest management contractor – if the risk is low (as determined by the pest management contractor) a reduced programme of control may suffice.

A combination of poison control and trapping is recommended for controlling possums and rabbits (e.g. Goodnature A24 or Timms Traps). Each trapping period should be conducted over a period of three weeks each year, and checked regularly (every 3-5 days).

Monitoring sheets will be completed and retained as a record of animal pest control.

### 6.3.3 Infill planting

Infill planting will be undertaken 1 year and 3 years following planting, if required, in order to achieve an average of 90 % or more native plant canopy cover by five years following completion of planting. Enrichment planting will be undertaken 2 or 3 years following initial planting.

# 7.0 Permanent protection

[Consent condition xx] outlines the process for legal protection of the site. This process is to be undertaken within two years of the completion of the five-year maintenance plan (that is, between five- and seven-years following planting).

Insert condition of consent:

# 8.0 Monitoring programme

## 8.1 Ecological monitoring

Monitoring will be undertaken to report on progress towards meeting the targets outlined below, to identify potential management issues, and to enable corrective actions to be made. The targets of the wetland and stream mitigation and offset programme are:

### 8.1.1 Wetland re-creation and enhancement at Historic Wetlands HW1 and HW3

The required characteristics of the re-created wetlands are:

1. All areas of wetland to be fully fenced from livestock;
2. Minimum area of 2,683 $m^2$ of re-created wetland at Wetland HW3;
3. Minimum area of 924.5 $m^2$ re-created wetland at Wetland HW1;
4. Similar hydrological profile as the hydrological profiles of existing Wetlands W1, W3, and W6;
5. A native planted buffer of 10 m around both re-created wetlands;
6. Additional buffer planting to account for the areas that cannot be planted on the access track and neighbouring property (**Figure 4**);
7. At least 90 % canopy cover, on average, within 5 years of planting being completed; and
8. WEV condition scores of 0.758 (HW1) and 0.750 (HW3) after 5 years following completion of the restoration works, or showing a trajectory that provides confidence that these WEV scores will be achieved within 10 years following the completion of the restoration works.

### 8.1.2 Stream enhancement at Stream P1

The required characteristics of the enhanced stream are:

1. All planted areas to be fully fenced from livestock;
2. An average planted riparian width of 20 m wide on both banks along 35 m of Stream P1;

3. Additional buffer areas planted to account for those areas that fall within the access track or on neighbouring property (**Figure 4**); and
4. At least 90 % canopy cover, on average, within 5 years of planting being completed.

#### 8.1.3 Additional wetland buffer planting

The required characteristics of the buffer planting are:

1. All planted areas to be fully fenced from livestock;
2. 10 m native planted buffer around Wetlands W2, W4, W5, W6, and W7;
3. At least 90 % canopy cover, on average, within 5 years of planting being completed.

#### 8.1.4 Additional fencing

Wetland W8 will not be planted for ecological enhancement, mitigation, or offset purposes. The northern bank of the wetland up to the site boundary will be planted for landscaping purposes. The wetland and landscape planting are to be fully fenced from livestock.

The following subsections describe the monitoring methods required to assess the above measures.

### 8.2 Planting for wetlands, wetland buffers, and stream margins

Revegetation success monitoring will be undertaken within all planted areas.

The below monitoring schedule accounts for the need to assess the physical extent of planted areas, compliance with the agreed plant species list, and then the condition of planted areas on a regular basis, whilst allowing for management (such as weed control and infill planting) to be identified and resolved.

For clarity, monitoring will be undertaken:

- **At the completion of planting (Year 0)** to assess areas planted and correct species.
- **6 months after planting** to assess survival, weeds and other issues, and replanting needs.
- **1 year after planting** to assess survival, weeds and other issues, and replanting needs.
- **3 years after planting** to assess survival, weeds and other issues, and replanting needs.
- **5 years after planting** to assess survival, weeds and other issues, and replanting needs.
- **Any additional monitoring that is deemed to be required beyond 5 years after planting** will be determined following the 5-year monitoring assessment.

### 8.3 Wetland Ecological Value (WEV) monitoring

Wetland Ecological Valuation (WEV) monitoring will be conducted on Wetlands HW1 and HW3.

The version of the WEV accounting model dated 2018 will be used.

For clarity, WEV monitoring will be undertaken:

- **1 year after planting**
- **3 years after planting**
- **5 years after planting**

## 8.4 Wetland hydrological monitoring

While vegetation within wetland areas (monitored as above) provides the principal means of assessing whether a wetland has established or is maintained, surface hydrology is an important aspect to monitor to ensure that:

(i) The newly created wetland areas support similar hydrology to the adjoining established wetlands, and

(ii) The consented managed fill works do not affect hydrology of these wet areas in an unexpected manner.

One shallow groundwater piezometer will be installed at each restored wetland and reference wetland:

- HW1 and reference wetlands W1 and W3;
- HW3 and reference wetland W6; and
- W7 (remaining area) and reference wetland W8.

The groundwater in the piezometers will be continuously monitored (at a 15-minute interval) using pressure transducers with attached dataloggers. The dataloggers will be downloaded every 3-6 months for analysis, and the data barometrically corrected using atmospheric pressure data from a nearby weather monitoring station.

Monitoring will be undertaken continuously for 5 years from the completion of the restoration works (with data downloaded every 3-6 months; at each data download, the transducers will be re-set as needed). Reporting will annual.

The following variables will be assessed from the dipwell data.

- Shallow groundwater levels.

See **Figures 9 and 10** for indicative location of shallow groundwater piezometers.

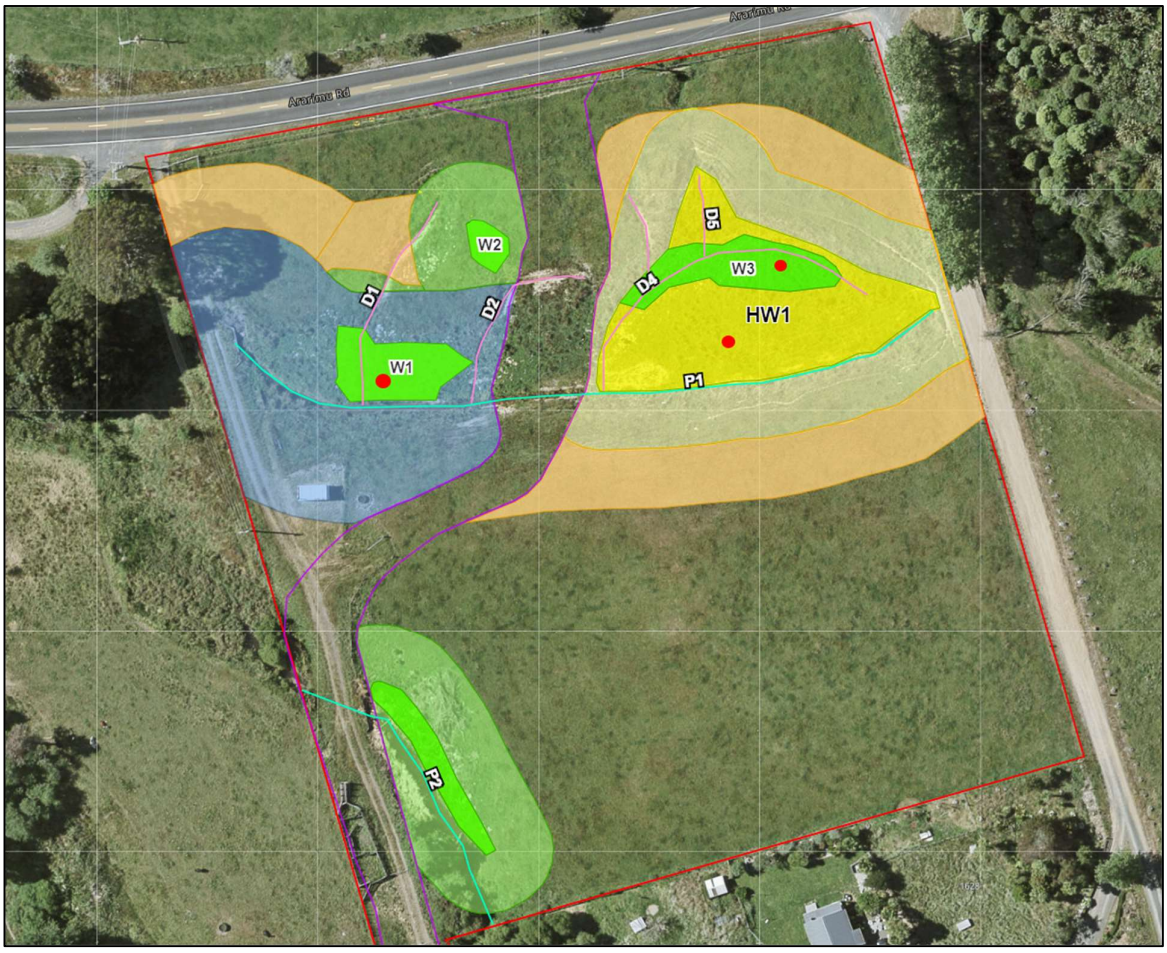


**Figure 9:** Indicative locations of shallow groundwater piezometers (red dots) – northern end of site.

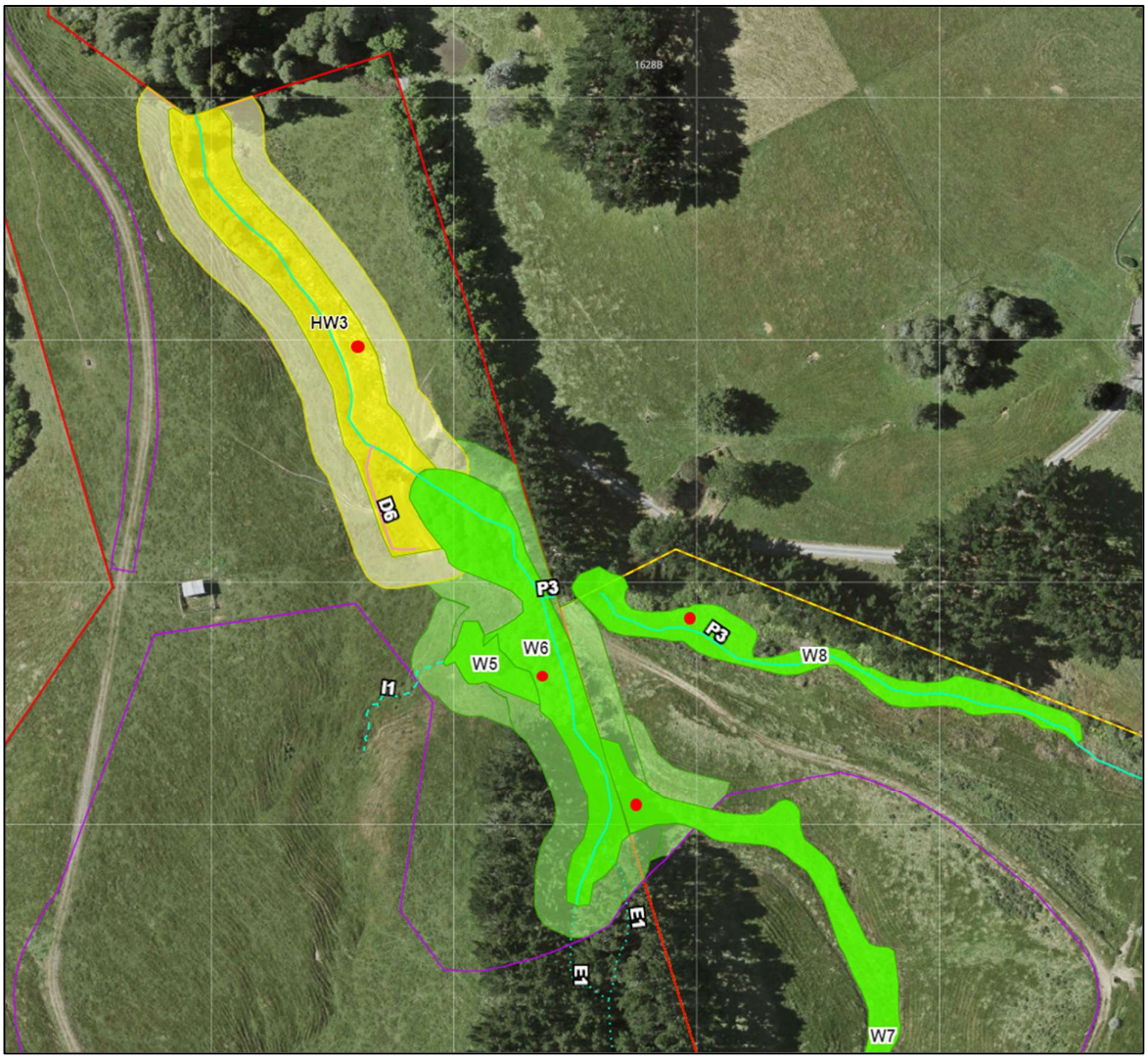


**Figure 10:** Indicative locations of shallow groundwater piezometers (red dots) – centre of site.

## 8.5 Overall ecological monitoring reporting

A monitoring report shall be submitted to Auckland Council for approval in accordance with the monitoring schedule and in total for a minimum period of five years.

**Each monitoring report** will include:

- The date of the inspection;
- The person carrying out the inspection and their qualifications;
- For plant survival:
    - The percentage survival of plant species, estimated by walking a 100 m transect (or maximum length of the planted area) and noting the number and type of dead plants (using bamboo stakes and/or presence of dead plants as an indicator of original planting). Transects will be located at:

    - Wetland HW1 – 1 x transect
    - Wetland HW3 – 2 x transects
    - Stream P1 riparian margin – 1 x transect
    - Buffer planting at Wetlands W2, W4, W5, W6, and W7 – 1 x transect each
- For canopy cover:
    - The percentage cover of native canopy will be assessed over a series of 2 m radius circles within each planting area.
    - Location of assessment points to be set on GIS prior to the first monitoring visit, and re-visited at each monitoring round.
- The condition of native plantings, including their coverage in respect to gaps (which will be mapped to show location, and to estimate gap sized for which re-planting is required), and overall health;
- Recommendations for replacement of dead plants and implementation of these recommendations (remediation work). Any recommended remediation work will include a start date for replanting.
- A map showing the general locations of weeds found and controlled over the previous year;
- Observations of any damage to native trees and plants (whether caused by people, pest animals or natural events) that may increase the susceptibility of the planted areas to weed invasion;
- Pest animal control applied in that year together with an estimate of the number of pest animals removed or the effectiveness of control techniques at reducing pest densities; and
- Corrective actions undertaken to reduce threats to planted areas and levels of pest animals, as appropriate.
- For hydrological monitoring
    - An annual report comparing shallow groundwater levels between existing (W1, W3, and W6) and new (HW1 and HW3), and existing (W8) and reinstated (W7).

## 8.6 Ecological monitoring timeline

**Table 9** below summarises the timing for the monitoring programme requirements.

**Table 9.** Summary of monitoring and reporting actions. Shaded cells indicate times where monitoring or actions are required.

| Monitoring component | Year following completion of mitigation or offset works or planting | | | | | |
|---|---|---|---|---|---|---|
| | **Year 0** | **Year 1** | **Year 2** | **Year 3** | **Year 4** | **Year 5** |
| Post-planting inspection to confirm plants and areas | Time 0 & 6 months | | | | | |
| Plant survival, canopy cover, gaps, weeds –<br>• Wetlands HW1 and HW3 (including 10 m buffers)<br>• 10 m buffers to Wetlands W2, W4, W5, W6, and W7<br>• 20 m riparian margin to Stream P1<br>• 10 m riparian margin to Stream I1 | | | | | | |
| Hydrology monitoring – Wetlands HW1 and HW3 | | | | | | |
| WEV monitoring at HW1 and HW3 | | | | | | |
| Infill planting – if required | | | | | | |
| Compliance report | | | | | | |

## 8.7 Remediation works

If remediation work is recommended to wetland restoration areas, the consent holder will:

- Undertake the remediation work within six months from when it was recognised as being necessary; and
- Provide Council with a report confirming the remediation work has been undertaken. This report will be submitted to Council within 6 months after the remediation work has been undertaken.

g:\shared drives\rma ecology main drive\rma ecology ltd\active projects\2307 ararimu managed fill ak\working\ecological mitigation and offsetting mp\2307.ararimurd.ecolmitigationoffsetplan.3april2025.draftv2.docx