

TERRESTRIAL MANAGEMENT PLAN

NZ Transport Agency Waka Kotahi

Mill Road Stage 1

SEPTEMBER 2026

NZ TRANSPORT AGENCY
WAKA KOTAHI

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QUALITY REVIEW AND APPROVAL RECORD

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1 INTRODUCTION

1.1 Project overview

The Mill Road Stage 1 Project will provide a strategic transport corridor between Manukau and Takaanini in South Auckland. The Project includes widening and realignment of sections of Redoubt Road and Mill Road, new road formation, bridge structures over Puhinui Gully and Cheesman's Bush, stormwater infrastructure, earthworks, vegetation clearance, construction access, and associated landscape and ecological restoration works.

This Terrestrial Management Plan (TMP) forms part of the ecological management framework for the Project. It has been prepared to support implementation of the terrestrial ecology management requirements for the Project and to provide a practical framework for managing the effects of construction, restoration, monitoring, and reporting.

1.2 Objective and scope

The objective of the TMP is to, as far as practicable, manage adverse effects on terrestrial ecological values associated with construction of the Project.

The TMP addresses:

- vegetation and habitat clearance within Significant Ecological Areas and other in-scope terrestrial vegetation and integration of this process with fauna salvage or management requirements;
- management of Significant Trees[1] and retained vegetation, in conjunction with the Old Growth Tree Management Plan (OGTMP – Appendix A);
- management of threatened and at-risk flora, including king fern, carmine rātā, and white rātā;
- avifauna nesting controls and clearance protocols;
- bat survey and vegetation clearance protocols;
- lizard and terrestrial invertebrate habitat protection, and habitat feature salvage;
- restoration planting, lizard habitat creation, pest plant and pest animal control, and enrichment planting;
- biodiversity outcome monitoring and reporting.

The TMP structure is as follows:

Section 2 Vegetation Clearance Protocols (VCP): Sets out the required vegetation clearance controls before, during, and after clearance. This includes confirmation of clearance limits, ecological hold points, threatened and at-risk flora management, fauna survey and salvage interfaces, and the salvage and reuse of habitat features.

Section 3: Avifauna Management Plan (AMP): Details measures to avoid or minimise effects on indigenous birds, particularly nesting birds.

Section 4: Bat Management Plan (BMP): Details precautionary measures to avoid or minimise effects on long-tailed bats.

Section 5: Habitat Restoration and Enhancement Plan (HREP): Details the restoration, enhancement, and maintenance measures required to manage residual terrestrial ecological effects. This includes restoration planting, lizard habitat planting and enhancement, deployment of salvaged habitat features, pest plant control, pest animal control, retained forest enhancement, performance standards, defects and remedial actions, implementation programming, and HREP reporting over the 10-year management period.

Section 6: Biodiversity Monitoring: Details the biodiversity outcome monitoring programme required to verify whether the restoration, enhancement, and retained forest management measures are achieving the intended ecological outcomes. It sets out monitoring areas, monitoring design, ongoing monitoring, and requirements for contingency responses where performance standards are not being met.

[1] Trees categorised as:
Mature: Generally DBH of up to 50-80 cm;
Large: Generally DBH of up to 80-130 cm; or
Old-growth: At full expected DBH or more >130cm DBH

Section 7: Integrated TMP Annual Reporting: Provides for a consolidated annual report on terrestrial management outcomes.

1.3 Terrestrial ecological values and effects requiring management

The terrestrial ecological values and residual effects requiring management are concentrated in Cheesman's Bush, Puhinui Gully, Everglade Park / Kingsclere Place Reserve, 134 Mill Road WF9 forest, and associated areas of planted, mixed, exotic scrub, treeland, and grassland vegetation that provide indigenous fauna habitat. The highest residual effects relate to impacts on WF9 taraire, tawa, podocarp forest, VS5 broadleaved scrub / forest, Significant Trees, threatened and at-risk flora, and confirmed or potential native lizard habitat.

A summary of the values and features relevant to this TMP is provided in Table 1-1.

Table 1-1: Ecological values with the proposed alignment

Ecological value or feature	Habitat type or species	Ecological value	Impact or relevance to management
Indigenous forest and scrub, including Significant Ecological Areas	WF9 taraire, tawa, podocarp forest at Cheesman's Bush (SEA_T_9102), Puhinui Gully (SEA_T_4570), Everglade Park / Kingsclere Place Reserve (SEA_T_538a), and 134134134 Mill Road outside the mapped SEA overlay; and VS5 broadleaved species scrub / forest at Puhinui Gully.	High to very high	The Project affects approximately 0.3135 ha of WF9 impact at Cheesman's Bush, 0.11 ha of WF9 impact and 0.5151 ha of VS5 across the Project area, including vegetation within Cheesman's Bush and impact at Watercare Bush / Puhinui Gully and WF9 forest at 134 Mill Road outside the SEA overlay. Localised works also affect WF9 vegetation at the edge of, and 0.03 ha of impact at Everglade Park. Management requirements include; clearance minimisation and controls, avoidance of unnecessary disturbance, edge and retained-vegetation protection of retained vegetation and forest edges, Significant Tree interface management, habitat feature salvage, restoration and enrichment planting, pest plant and pest animal control, and biodiversity outcome monitoring.
Significant Trees	Mature, large, or old-growth native trees within WF9 and VS5	Very high	Managed through the OGTMP and arboricultural supervision, with minimisation of removal and protection of retained trees.
Threatened and at-risk plants	King fern, carmine rātā, white rātā	High	Requires targeted pre-clearance survey, marking, avoidance where practicable, salvage or translocation where feasible, and post-relocation monitoring.
Birds	Koekoeā / long-tailed cuckoo, New Zealand pipit, kārearea / bush falcon, New Zealand kākā, kererū, tūī, and other indigenous birds	Low to very high	Seasonal clearance management, pre-clearance surveys, setbacks, and monitoring of active nests until fledging or nest failure.

Ecological value or feature	Habitat type or species	Ecological value	Impact or relevance to management
Bats	Long-tailed bat	Very high	Requires pre-works survey to determine whether tree fell protocols are required. If bats are detected and tree fell protocols are required then roost feature assessment, and protocols to avoid and minimise the potential for harm to bats during tree felling.
Lizards	Copper skink, ornate skink, forest gecko, Pacific gecko, elegant gecko	High	Managed through the Lizard Management Plan (Appendix A), with interface requirements for salvage, clearance supervision, habitat feature relocation, lizard habitat planting, pest control, and monitoring.
Invertebrates	Rhytid snail, cave wētā, peripatus / velvet worm	Moderate to high	Requires manual searching where suitable habitat is affected and salvage of habitat features such as coarse woody debris, leaf litter, bark, root plates, and forest duff.

1.4 Roles and responsibilities

The Project Environmental Manager is responsible for overall implementation of, and compliance with, this TMP. Roles and responsibilities relevant to this TMP are summarised in Table 1-2.

Table 1-2: Roles and Responsibilities relevant to this TMP.

Role	Responsibility
Environmental Manager	• Overall responsibility for implementation of, and compliance with, the TMP. • Coordinate the Project start-up meeting with the Project Ecologist, Site Manager, and relevant contractors before works commence. • Coordinate invitations for Mana Whenua to participate in and support any relocation where required, enabling the appropriate exercise of kaitiakitanga and consideration of cultural concerns. • Maintain project-level communication with the Project Ecologist, Site Manager, and contractors regarding the works programme and any changes that may affect TMP implementation. • Ensure the TMP requirements are incorporated into project inductions, environmental procedures, and compliance reporting.
Site Manager	• Understand the TMP requirements relevant to the construction activities under their control. • Implement the TMP on site by programming works around required surveys, salvage, ecological hold points, exclusion areas, and supervision requirements. • Provide the Project Ecologist and relevant contractors with sufficient notice of upcoming works and changes to the site programme. • Brief new site personnel on the TMP requirements relevant to their work and ensure contractor compliance with ecological instructions. • Immediately report ecological incidents, unexpected discoveries, or non-compliance to the Environmental Manager and Project Ecologist, and implement any required stop-work or corrective actions.
Project Ecologist/s*	• Ensuring appropriate SQEP Supporting Ecologists are resourced and available to support/implement tasks. • Overall responsibility for TMP implementation in support of the Project.

Role	Responsibility
Project Arborist	• Provide arboricultural oversight of works affecting Significant Trees in accordance with the OGTMP (Appendix A). • Oversee Significant Tree removal, pruning and topping, and works in close proximity to retained Significant Trees. • Provide specialist direction and support to the Works Arborist, including confirming tree protection measures, exclusion zones, pruning parameters, and any unanticipated requirement for tree removal. • Prepare or approve arboricultural completion and maintenance reporting required by the OGTMP.
Technical Lead Ecologist(s) / Specialist Ecologists	• Oversee and facilitate implementation, compliance monitoring, and reporting for the VCP, BMP, AMP, and LMP as relevant to their specialities.
Supporting Ecologist(s)*	• Must meet the requirements of a SQEP (dependent on tasks undertaken). • Assisting Project Ecologist or Technical Lead Ecologist(s) with implementing this TMP as required.
Contractor(s)	• Understand and implement TMP requirements

2 VEGETATION CLEARANCE PROTOCOLS

2.1 Purpose and overview

The Vegetation Clearance Protocols (VCP) set out the required actions for avoiding or minimising adverse ecological effects on terrestrial habitats and associated vegetation/trees during construction of the Project.

While the VCP covers all habitat impact management measures (including for invertebrates), management measures for individual native trees and native fauna are detailed in the following plans:

- Old Growth Tree Management Plan (OGTMP) (Appendix A)
- Avifauna Management Plan (AMP) (Section 3)
- Bat Management Plan (BMP) (Section 4)
- Lizard Management Plan (LMP) (Appendix B)

Table 2-1 below summarises the habitat management measures (before, during and after vegetation clearance) within habitats, along with the associated roles and management plans.

Table 2-1: Summary of vegetation clearance management measures, roles and responsibilities, and relevant management plans.

Timing	Required action	Primary responsibility
Before clearance	Confirm clearance extent, physically delineate clearance and no-access areas[2], identify ecological hold points, and brief contractors on ecological constraints and requirements.	Environmental Manager, Site Manager, Project Ecologist
Before clearance	Complete threatened and at-risk plant surveys in affected WF9 and VS5 vegetation, including king fern and potential rātā locations. Mark plants to be avoided or salvaged.	Technical Lead Ecologist - botany
Before clearance	Complete avifauna, bat, lizard, and invertebrate pre-clearance requirements in accordance with the relevant management plans and requirements.	Specialist ecologists

[2] Areas of specific sensitivity where there is no clearance proposed but access by personnel shall be avoided for access or staging. For example, root zones of retained Significant Trees.

Timing	Required action	Primary responsibility
Before clearance	Confirm locations for stockpiling or placement of salvaged coarse woody debris, root plates, logs, leaf litter, and forest-floor habitat material.	Project Ecologist, Restoration Contractor, Site Manager
During clearance	Undertake staged clearance under ecological and, where required, arboricultural supervision where works affect SEA vegetation, Significant Trees, or confirmed/potential lizard habitat.	Site Manager, Project Ecologist, Project Arborist
During clearance	Retain and relocate felled native stems, large limbs, root plates, coarse woody debris, and leaf litter where practicable, except where material is made available to mana whenua for cultural use.	Contractor under ecological supervision
After clearance	Check felled material and stockpiles for lizards and notable invertebrates before mulching, relocation, or reuse.	Specialist ecologist/s
After clearance	Confirm final clearance extents, retained habitat features, stockpile locations, and any incidents or non-compliances.	Project Ecologist

2.2 Before vegetation clearance

The following protocols shall be implemented prior to the vegetation clearance commencing.

2.2.1 Works planning

The following protocols are detailed in approximately a stepwise process, however, many of these requirements can be carried out concurrently. Many protocol requirements also span across the prior, during, and after vegetation clearance process. There are also lead-in time requirements to ensure the timing of activities such as fauna salvage can occur within appropriate seasonal time periods. Therefore, each tranche of work should be preceded by establishing a works plan to determine the interaction and staging of each required step for vegetation clearance.

Plans for locations for stockpiling and/or placement of vegetation and habitat features shall be determined during this stage to ensure that these locations do not interfere with construction or restoration works.

The requirements of the OGTMP (Appendix A) and LMP (Appendix B) must also be considered in this planning.

2.2.2 Physical delineation

The required disturbance footprint shall be physically delineated before vegetation clearance or earthworks commence. Delineation may include high-visibility barrier fencing, temporary construction fencing, flagging, signage, spray marks, or other controls suitable for identifying clearance areas to contractors and Project Ecologists. Delineation, with clear signage and labelling, may also be used to identify retained vegetation, no-go areas, Significant Trees and root protection zones, ecological exclusion areas, active bird nest setbacks, bat roost constraints, lizard salvage areas, and restoration or release habitat areas.

No vegetation clearance shall occur outside the delineated disturbance footprint unless the proposed change has been reviewed by the Project Ecologist and confirmed as being within the identified ecological effects envelope and the scope of the relevant approved consent. Any breach of ecological exclusion fencing, accidental vegetation damage, or encroachment into habitat outside of the consented impact footprint shall be reported immediately to the Site Manager, Environmental Manager, and Project Ecologist. Auckland Council shall be notified of any such incident within 48 hours of the breach occurring.

2.2.3 Fauna surveys and salvaging

Before habitat clearance, the Project Ecologist shall confirm which fauna management requirements apply to each clearance area.

This confirmation shall consider habitat type, species records, vegetation structure, season, clearance method, and proximity to retained habitat. Avifauna, bat, lizard, and invertebrate hold points shall be closed before clearance starts. Where multiple fauna requirements apply, the Project Ecologist shall coordinate sequencing so that one survey or salvage activity does not undermine another, for example by ensuring bird nesting setbacks are not disturbed by lizard salvage or habitat feature relocation.

Procedures to avoid or minimise impacts to avifauna, bats, and lizards prior to habitat clearance are detailed in the AMP (Section 3), BMP (Section 4) and the LMP (Appendix A). These management requirements contain multiple requirements that must be completed prior to vegetation clearance.

2.2.4 Threatened plant surveys and salvage

Targeted surveys shall be undertaken before vegetation clearance in affected SEA and WF9/VS5 areas to identify king fern, carmine rātā, white rātā, and any other threatened or at-risk flora. Where practicable, plants shall be avoided and protected in situ and identified by exclusion fencing or flagging.

Where avoidance is not practicable translocation of individual plants (including seedlings) will be undertaken by the Technical Lead Ecologist (botanist). Mana Whenua representatives shall be invited to participate. Translocation should be timed to avoid periods of drought or extreme cold, and soil moisture conditions should be favourable (e.g. during winter or early spring). Excavation is preferably to be done manually to minimise root damage, with care taken to retain surrounding soil and root mass. However, if the specimen is not able to be managed by hand and there is practicable access to the location with machinery this can be utilised under the supervision of the botanist. Each plant should be immediately placed into a pre-prepared container or wrapped in damp hessian to prevent desiccation and moved and planted in a suitable location as soon as practicable.

2.2.5 Seed collection

Where practicable, seed collection shall be undertaken from suitable indigenous plants within or near affected SEAs and restoration areas for use in restoration planting. Seed collection shall be undertaken in consultation with Mana Whenua. Seed collection shall avoid unnecessary damage to parent plants or surrounding vegetation that is not going to be cleared as part of works. Seed collection shall target mature seed and shall generally occur between late spring and early autumn, depending on species-specific seed ripening. Records shall be kept of species, collection date, source location, collector, quantity, and intended nursery or propagation destination.

2.2.6 Invertebrate salvaging

There are no standard methods for salvaging invertebrates, but the invertebrate species expected to be present will be readily detected during manual searching for lizards and can be translocated to suitable nearby habitats during this process. Notable invertebrates for salvage targets are Rhytid snails, weta, and peripatus (invertebrates in the Family Peripatopsidae).

Release sites for invertebrates should be selected, on a case-by-case basis, to best match the type of habitat and climatic conditions of the collection site.

2.2.7 Habitat feature salvage and reuse

Coarse woody debris, felled logs, retained stems, root plates, leaf litter, forest duff, and other habitat features shall be salvaged (this can occur before, during and after vegetation clearance), where practicable, and reused in restoration, enhancement, and lizard release areas. Material shall be placed to create damp shaded refuges, small interstitial spaces, basking opportunities adjacent to cover, and long-term habitat for lizards, invertebrates, fungi, and soil biota.

Material shall not be placed where it could enter streams or obstruct stormwater or construction drainage systems.

2.3 During vegetation clearance protocols

Vegetation clearance and earthworks will commence only after all measures comprising the before vegetation clearance protocols have been implemented and have been confirmed by the Project Ecologist and Technical Lead Ecologist(s).

During vegetation clearance multiple protocols will continue to need to be followed:

- Physical delineation (Section 2.2.2) will continue to be required to be maintained and monitored.
- Fauna surveys and salvaging (Section 2.2.3) may be continued as part of the vegetation clearance process. For example, machinery assisted lizard salvage may be required (Appendix B), or nesting avifauna setbacks (Section 3) may need to be adhered to. Invertebrate salvage can also continue during any ecologist supervised clearance.
- Habitat feature salvage (Section 2.2.7) shall continue during salvage and suitable habitat elements shifted to restoration or retained habitat areas as appropriate.

2.4 Post-vegetation clearance protocols

Vegetation and debris stockpiles shall be managed following the requirements outlined in the LMP (Appendix B).

The relocation of material from stockpiles, and any mulching, will be managed to prevent the discharge of sediment and wood chips into streams, in accordance with the ESCP, and the LMP protocols for stockpile management (Appendix B).

2.5 Vegetation Clearance Protocol Reporting

An annual VCP monitoring report shall be prepared as part of an integrated TMP annual report by end of June for the period of 1 May – 30 April for each year of construction (ending with the lizard salvage season) and include:

- Overview maps illustrating:
  - The location of vegetation clearance undertaken during the year (and years prior);
  - Information on the species and number of threatened plants salvaged and relocated; and
  - Areas of stockpiled coarse wood, for deployment to rehabilitation or offset/compensation sites once ready.
- Recommendations for improvements to VCPs for the next season (where required).

3 AVIFAUNA MANAGEMENT PLAN

3.1 Plan purpose and scope

This AMP sets out the methods that will be used to avoid or minimise adverse ecological effects on indigenous avifauna species in terrestrial and wetland habitats affected by the Project. It applies to vegetation clearance, groundcover removal, and other habitat disturbance where indigenous birds may be nesting or dependent young may be present or close by.

The Project Ecologist shall determine whether the AMP applies to each vegetation clearance and earthworks area. This assessment shall be, based on the vegetation type, timing of clearance, likelihood of nesting, bird activity observed at the site, and proximity of clearance to retained suitable habitat. The Project Ecologist shall communicate this determination to the Environmental Manager and Site Manager to inform the planning and staging of works.

3.2 Pre-clearance nesting bird surveys

During the nesting bird season, from September to March inclusive, the following pre-clearance survey requirements apply:

- Native bird nest surveys shall be undertaken by a SQEP (Specialist or Supporting ecologist(s)) no more than three days before vegetation or habitat clearance.
- The survey shall cover the clearance area and adjacent vegetation that may be disturbed by the works.

- The purpose of the survey is to confirm whether active native bird nests, eggs, chicks, or dependent young are present.
- Where trees or vegetation cannot be adequately inspected from the ground because of height, dense canopy, or limited access, additional checks shall be undertaken. Additional checks may include binocular inspection and observation of bird behaviour, including repeated flights to the same location (indicating the presence of an unseen nest), site fidelity, or other activity indicating nesting.
- If no active native bird nests are identified, vegetation within the surveyed area may be cleared within three days of the survey.
- If an active native bird nest is identified within or adjacent to the clearance area, the following requirements shall apply:
    - the nest location shall be recorded by GPS;
    - an exclusion setback shall be established around the nest;
        - no vegetation clearance shall occur within 30 m of an active nest of a native bird classified as Not Threatened until chicks have fledged or the nest has failed and been abandoned;
        - no vegetation clearance shall occur within 50 m of an active nest of a native bird classified as Nationally or Regionally Threatened or At Risk until chicks have fledged or the nest has failed and been abandoned;
    - the exclusion setback shall be clearly marked or cordoned so that construction personnel do not enter or disturb the area; and
    - the Specialist or Supporting Ecologist(s) shall monitor the nest and confirm when vegetation clearance may recommence.

Setback distances may be amended where recommended by the Technical Lead Ecologist for avifauna, based on species, nest location, vegetation structure, site conditions, and likely disturbance risk. Any amended setback shall be recorded and included in annual reporting.

3.3 Avifauna reporting

An annual avifauna report shall be prepared as part of an integrated TMP annual report by end of June for the period from 1 May to 30 April each year of construction and include:

- maps showing the location of any active native bird nests identified during pre-clearance surveys or works;
- a summary of survey timing, survey effort, areas surveyed, nests detected, setbacks applied, monitoring undertaken, and fledging or nest failure outcomes; and
- any recommended changes to avifauna avoidance or minimisation measures for the next clearance season (if required).

4 BAT MANAGEMENT PLAN

Long-tailed bats were not detected during bioacoustic surveys for the Terrestrial EcIA and several previous surveys in the nearby area. The Terrestrial EcIA assesses residual effects on bats as negligible with suitable survey and vegetation removal protocols. However, mature trees within Cheesman's Bush, Puhinui Gully, and 134 Mill Road contain potential roost features and bat use cannot be completely ruled out.

Before any construction or enabling works that require removal of WF9, VS5, EF.1, TL.3, or other trees with potential roost features, the Specialist Ecologist (bats) shall design and implement a bioacoustic survey within 12 months of the proposed clearance. The survey shall be undertaken between 1 October and 30 April inclusive, when bats are more active, and include at least 14 suitable survey nights.

Survey effort should be determined by the Technical Lead Ecologist (bats) based on the extent of area to be cleared and types of habitat present or nearby, with particular focus on potential roost features. Surveys should target potential roost trees, linear features such as shelterbelts, waterways, and/or

wetlands. An indicative suitable survey effort for the entire Mill Road alignment would be 25 bioacoustic detectors spread across suitable habitat types within the entire designation.

Suitable conditions are defined for the purpose of this survey report as follows:

- Air temperature does not drop below 10°C from sunset until four hours after sunset;
- Rainfall of no more than 2.5 mm occurs in the first two hours after sunset;
- Mean overnight wind speed does not exceed 20 km/h;
- Overnight wind gusts do not exceed 60 km/h; and
- Nights where there is not a full moon or one night either side of a full moon.

If no bats are detected, vegetation clearance is extremely unlikely to encounter and disturb, injure, or kill a bat and therefore shall proceed without further requirement for monitoring for bats other than the incidental detection protocol defined in Section 4.1.

If bats are detected during this survey the Department of Conservation protocol for minimising the risk of felling occupied bat roosts (tree fell protocol) shall be followed (Appendix D). This protocol requires identification of potential roost trees and defines suitable mechanisms to ensure bats are not present with trees when they are felled. Due to the low levels of bat activity, it is likely that bioacoustic surveys prior to felling are the most efficient and effective mechanism to implement.

4.1 Incidental bat detection protocol

If a bat (including if it is injured or dead) is discovered during works, including if bat/s are sighted and escape/fly off, all works in the immediate area shall stop and the Project Ecologist and Specialist Ecologist (bats) shall be notified immediately. If they are not available, and an injured or dead bat has been captured, contact the DOC wildlife hotline: 0800 362 468 for further instruction. DOC shall be notified as soon as practicable and within 24 hours.

Bats (if able to be caught and whether they appear injured or not) shall be placed in cloth bag which is then placed in a clean, ventilated container under the direction of the Specialist Ecologist (bats) and taken to a suitably qualified veterinarian or bat care specialist as directed by DOC. Dead bats shall be chilled or frozen as directed, and submitted for necropsy if required by DOC. Euthanasia of an injured bat shall only occur under direction from DOC or an appropriately qualified veterinarian if the animal is suffering and unlikely to survive. Uninjured bats shall be released at dusk as close as practicable to the area of capture by the Specialist Ecologist (bats).

Incidental detection of bats shall be a trigger for any subsequent potential roost tree felling works to be conducted under the tree fell protocol (Appendix C).

4.2 Bat reporting

An annual bat management compliance monitoring report shall be prepared as part of an integrated TMP annual report by end of June for the period of 1 May – 30 April for each year of construction and include:

- Overview maps showing the location of survey devices.
- Results of the bat surveys.
- Summary information on the implementation of protocols for minimising the risk of felling occupied bat roosts, if they are required.
- Incidental detections and resulting actions and outcomes.
- Recommendations for improvements to effects avoidance and minimisation protocols for next season (where required).

5 HABITAT RESTORATION AND ENHANCEMENT PLAN

The Habitat Restoration and Enhancement Plan sets out the measures required after habitat clearance to restore, enhance, and protect terrestrial ecological values. It provides the primary framework for implementing the Project's residual effects management package. Restoration, enhancement, maintenance, pest plant control, pest animal control, contingency measures, and outcome monitoring shall be implemented for a 10-year management period which commences at the completion of Phase 1 planting (re. Section 5.4.1.1).

The HREP applies to all ecological management areas listed in Table 5-1. The table identifies the management area, the required management response, and the approximate area subject to that response. The requirements that follow apply differently depending on whether an area is a restoration planting area, lizard habitat area, retained forest enhancement area, riparian or wetland planting area, or lizard release site.

The areas of restoration and enhancement are mapped within Appendix D.

There are broadly three types of planting proposed across the areas defined in Table 5-1:

- ‘Restoration planting’ means new indigenous planting installed to restore or recreate terrestrial habitat in areas that are currently pasture, cleared ground, modified vegetation, or otherwise lacking the intended indigenous vegetation structure. Restoration planting is intended to establish a trajectory toward indigenous forest, shrubland, wetland, riparian, or lizard habitat outcomes, as relevant to the management area.
- ‘Enrichment planting’ means later-stage or targeted planting into restoration or retained forest enhancement areas once site conditions are suitable for longer-lived, shade-tolerant, canopy, subcanopy, or understorey species. Enrichment planting is used to increase species diversity, structural complexity, and the trajectory toward the target WF9 taraire, tawa, podocarp forest or other relevant indigenous habitat type.
- ‘Enhancement planting’ means planting and associated habitat management within retained indigenous or mixed vegetation to improve existing habitat condition, structure, buffering, connectivity, or resilience. Enhancement planting does not replace the retained vegetation; it supplements it where pest plant control, pest animal control, edge management, or targeted planting is required to improve ecological function.

Additional to the planting types above and in Table 5-1 ecological restoration is required to occur as part of the Freshwater Management Plan for stream realignments, wetland enhancement and creation, and riparian planting.

Table 5-1: Ecological management areas and response

Management area	Required management response	Approximate area
Ecological Restoration A	WF9 restoration planting, pest plant control, maintenance, and enrichment planting.	5.29 ha
Ecological Restoration B	WF9 restoration planting, pest plant control, maintenance, and enrichment planting.	5.07 ha
134 Mill Road WF9 restoration and planting	Restoration and enhancement of existing WF9-associated vegetation, including enrichment planting, pest plant control, and pest animal control.	1.05 ha
Ecological Restoration – Lizard Habitat Mix	WF9 trajectory restoration planting with specific lizard habitat features, including logs, root plates, refugia, dense groundcover, and basking-cover interfaces.	5.18 ha
Cheesman's Bush	Pest plant control, pest animal control, enrichment planting, and monitoring within retained SEA vegetation.	3.66 ha
Puhinui Gully	Pest plant control, pest animal control, enrichment planting, and monitoring within retained SEA vegetation.	3.26 ha
Total area under ecological restoration and enhancement		**23.51 ha**

5.1 Site Preparation

5.1.1 Overview

Site preparation inspections will be undertaken between December and February to determine the management actions required within the restoration and enhancement locations. Site inspections will confirm and record the following:

- Locations for felled-log deployment;
- Locations and requirements for fencing; and
- The types and location of pest plant species to inform the necessary controls.

The addition of topsoil is not considered necessary as plantings will be planted into pasture. Furthermore, mulching will not be used (despite reducing pest plant establishment) because mulching also suppresses the natural colonisation of native seedlings and reduces habitat suitability for ground-dwelling lizards and invertebrates.

5.1.2 Stock-proof fencing

Stock fencing will be installed to exclude livestock from all revegetation enhancement and ecological restoration areas. Fencing will be set back at least 1 metre from the planted areas to prevent browsing and encourage rank grass to grow, providing habitat for copper skink.

Fencing locations will be determined during site preparation inspections by the Restoration Contractor in conjunction with Project Ecologist and should target all areas where restoration planting is adjacent to areas where livestock are grazed.

5.1.3 Protected species constraints

5.1.3.1 Herpetofauna

There is the potential for copper skink to be present within the grassland and ground layer habitat throughout the entire site. If the restoration or enhancement requires vegetation clearance that may

disturb native lizard habitat and cause death or injury to lizards, the clearance shall follow the requirements of the LMP (Appendix B).

5.1.3.2 Avifauna

Where vegetation clearance/disturbance is undertaken during the bird nesting season and impacts avifauna nest habitat, the works shall adhere to the requirements of the AMP (Section 3).

5.2 Pest plant control

Pest plant control shall be implemented across restoration areas, enhancement areas, affected SEA edges, retained Cheesman's Bush and Puhinui Gully vegetation, 134 Mill Road WF9 vegetation within the designation, and lizard habitat areas.

Priority pest plants include invasive species that suppress indigenous regeneration or compromise restoration outcomes. Species identified and their control methods are outlined in Table 5-2 below.

Table 5-2: Pest plant species and control methods

Scientific name	Common name	Control recommendations (until native plantings dominate)
Cenchrus clandestinus	Kikuyu grass	Foliar spray before planting using glyphosate with penetrant. Maintain control during plant establishment. Avoid overspray onto native or desirable plants.
Leycesteria formosa	Himalayan honeysuckle	Pull or dig seedlings and small plants. Leave non-seeding material on site to rot down where appropriate. Dispose of seeding material in general waste. Cut stems close to ground level and treat the stump immediately with glyphosate or metsulfuron gel. Foliar spray small plants or larger infestations with glyphosate or metsulfuron plus penetrant, avoiding overspray onto non-target plants.
Ligustrum lucidum	Tree privet	Pull or dig seedlings and small plants. Cut stems close to ground level and treat the stump immediately with glyphosate or metsulfuron gel. Larger stems may be basal sprayed, drilled, or frilled using an appropriate triclopyr or metsulfuron herbicide.
Passiflora 'Tasconia' subgroup	Banana passionfruit	Pull roots where practicable. Cut off above-ground stems or tie/hang stems so they cannot layer. Dispose of fruiting or viable material securely. Where roots cannot be pulled, cut and paste stems with glyphosate, metsulfuron, or picloram gel. Foliar spray ground masses with glyphosate, triclopyr, or picloram/triclopyr plus penetrant, avoiding overspray onto non-target plants.
Rubus sp.	Blackberry	Dig out small patches only and dispose of root crowns and rhizomes in general waste. Cut and paste stems with glyphosate gel where appropriate. Foliar spray larger infestations in summer to autumn before leaves become brittle using glyphosate, metsulfuron, triclopyr, or picloram/triclopyr plus

Scientific name	Common name	Control recommendations (until native plantings dominate)
		penetrant at label rates. Treat regrowth once stems have sufficient leaf area for herbicide uptake.
Selaginella kraussiana	African clubmoss	Rake or hand pull small infestation areas, containing all fragments for disposal. Spray larger infestations using the herbicide and rate confirmed by the Project Ecologist or pest plant control contractor (Herbicide selection will be location and application specific).
Solanum mauritianum	Woolly nightshade	Hand pull or dig small plants, including roots. Cut larger plants close to ground level and immediately treat the stump with picloram gel. Wear appropriate PPE because leaf and stem hairs can irritate skin, eyes, nose, and throat.
Tradescantia fluminensis	Tradescantia	Rake and roll up small infestation areas, working from the edge toward the centre of the infestation. Contain all fragments during removal, disposal, and transport because dropped fragments readily spread infestation. Dispose in general waste. Foliar spray larger areas with triclopyr plus organosilicone penetrant, thoroughly wetting all parts of the plant. Undertake follow-up control within 2-3 months, with repeat treatments as required.
Ulex sp.	Gorse	Cut stems close to ground level and treat the stump immediately with glyphosate gel or picloram gel. Foliar spray small plants or larger infestations with glyphosate or metsulfuron plus penetrant where suitable, avoiding overspray onto non-target plants.

5.3 Pest animal control

Pest animal control as specified in this HREP shall be implemented within planting and retained vegetation areas within the designation at Cheesman's Bush, Puhinui Gully, and 134 Mill Road, as listed in Table 5-1 and mapped within Appendix D (referred to hereafter as "the control areas").

The pest animal control programme shall target rats, mice, mustelids, hedgehogs, and possums. Predator control is required because rats, mice, mustelids, hedgehogs, and possums can prey on native lizards, birds, eggs, nestlings, invertebrates, and other fauna. Browser control may be required where they pose a risk to the establishment and regeneration of planted areas (refer to Table 5-4) because rabbits, hares, possums, and stock incursions can reduce planting survival, suppress indigenous regeneration, and maintain open habitat conditions that favour reinvasion by pest plants.

Pest control specific to lizard release sites is detailed within the LMP (Appendix B)

5.3.1 Spatial extent and device layout

The Pest Control Contractor, and Project Ecologist shall confirm the final pest animal control layout before implementation.

The proposed network is a 50 m x 50 m grid across the control areas, supplemented by targeted devices along habitat edges, riparian margins, likely movement corridors, and monitoring hotspots. The Pest Control Contractor and Project Ecologist shall confirm final device locations before implementation. Device locations may be adjusted from the nominal grid where required by steep slopes, waterways, construction constraints, public access, safety, cultural constraints, non-target risk, landowner requirements, property

boundaries, toxin rules, animal welfare requirements, or statutory controls, provided effective coverage is maintained.

The installed pest control device layout shall be mapped and included within relevant reporting (refer to Section 5.7).

5.3.2 Control methods and target species

Table 5-3 sets out the pest animal control methods that shall be implemented for the target species. Where toxins are used, they shall be used only by appropriately trained personnel and in accordance with label requirements, landowner approvals, and all relevant statutory controls.

Table 5-3: Target pest animals, ecological risks, and required control methods

Target animal	Primary ecological risk	Required control method
Rodents	Predation of lizards, birds, eggs, nestlings, invertebrates, and seeds.	Install bait stations as a 50 m x 50 m control network. Pulse baiting shall be used for knockdown and maintenance control, with bait stations checked and topped up during each pulse.
Mustelids	Predation of lizards, birds, and other fauna.	Install DOC 200, DOC 250, or equivalent mustelid-capable kill trap at a density of 2 per hectare and preferentially along habitat edges, riparian margins, fence lines, and likely movement corridors. Traps shall be baited, checked, cleared, and reset on the servicing schedule confirmed for the stage, with increased servicing where mustelids are detected.
Hedgehogs	Predation of lizards, eggs, ground fauna, and invertebrates.	Kill traps installed for mustelid control will also control hedgehogs.
Possums	Browse of indigenous vegetation, predation risk to birds and eggs, and suppression of regeneration.	Install Timms traps, bait stations, or other possum control devices at a rate of 1 per hectare. Possum control shall be supported by wax tag, chew card, camera, bait take, or trap catch monitoring.
Rabbits and hares	Browse of restoration plantings and suppression of indigenous regeneration.	Browse monitoring, shooting, exclusion, baiting where lawful and appropriate, and intensified control where browse thresholds are exceeded.

5.3.3 Initial knockdown and maintenance control

During the knockdown phase, the 50 m x 50 m bait station and trap network shall be installed and operated to reduce rats, mice, mustelids, hedgehogs, possums, and other target pest animals before lizards are released (refer to the LMP Appendix B) and before newly planted areas are vulnerable to browse damage.

Rodent knockdown shall use bromadiolone bait in bait stations across the 50 m x 50 m network. Bait stations shall be checked and topped up twice weekly during the knockdown pulse for four to eight weeks, or until rodent tracking is less than 10% residual tracking index (RTI) for rats and less than 20% RTI for mice.

After the initial knockdown phase, the maintenance phase begins and bait stations will be inspected and re-baited quarterly for the remaining 10 year control period. Subsequent rodent maintenance pulses shall use diphacinone bait unless the Pest Control Contractor and Project Ecologist confirm that an alternative approved toxin is required to maintain effective control.

DOC 200, DOC 250, Timms traps, and other approved kill traps shall be checked and serviced on a schedule aligned with the knockdown pulse and subsequent maintenance pulses. During knockdown, traps shall be checked and cleared weekly.

5.3.4 Pest animal monitoring

5.3.4.1 Rodents and Mustelids

Tracking tunnels will be used to monitor changes in rodent and mustelid abundance during the control period. A network of tracking tunnels at 50 m x 50 m spacing will be installed throughout the control area and monitored after every second baiting pulse.

For all monitoring rounds all tracking tunnels should be baited using crunchy peanut butter during fine weather and left overnight. The following day tracking tunnels should be checked. If the cards are still clear they can be utilised for mustelid monitoring (see below).

Every second tracking tunnel (i.e., 100 m spacings) should be activated for mustelid control. To do this peanut butter should be removed (if no tracks are present) and replaced with fresh rabbit meat. Cards should then be left out for a further two fine nights before being retrieved. If tracks are on cards following rodent monitoring these should be replaced with new cards and baited.

5.3.4.2 Possums

Wax tags are an easy way of monitoring possums and may be used to support tracking tunnel monitoring methods to determine the efficacy of the pest control within the relocation site. Four wax tag lines should be randomly installed within the control areas. Monitoring lines should include 10 wax tags at 20 m intervals i.e., 200 m monitoring line. Once installed, wax tags should be left out for seven nights before being retrieved. Possum monitoring should be carried out in conjunction with tracking tunnel monitoring i.e., prior to and following each pulse. As the relocation site is small, the wax tag index is unlikely to give an accurate measure of abundance but should determine whether possums are within the site. If possums are detected following a pulse, additional traps may be installed during subsequent pulses.

5.3.4.3 Browsers

Browser monitoring shall be focused on the impacts on plantings detected during maintenance and inspections. The amount of browse on plants shall be noted for each inspection and browser control implemented when loss rates would inhibit canopy closure.

5.3.4.4 Other species

Tracking tunnel monitoring may detect the presence of additional species such as hedgehogs. Specific monitoring of these species is not proposed; however, their presence will be noted and additional DOC200 traps may be installed if presence appears high.

5.3.5 Performance targets and response triggers

The pest animal control programme shall be managed responsively against the performance targets and monitoring triggers in Table 5-4. Note: the triggers do not extend the 10-year management period. Where targets are not met, the response shall be to increase control intensity, increase servicing frequency, infill the control network in affected areas, or review methods so that control efficacy is improved within the existing management period.

Table 5-4: Pest animal monitoring triggers and required responses

Monitoring result or trigger	Required response
Rat tracking remains above 10% following control	Extend the current baiting pulse for a further two weeks, comprising two additional bait installs, then repeat tracking tunnel monitoring. Review bait take, bait availability, device condition, and device spacing. If rat tracking remains above 10% RTI, install additional bait stations or traps in the affected area and continue maintenance pulses until the next scheduled monitoring round confirms improvement and is trending towards or has met the 10% RTI performance criteria.
Mouse tracking remains above 20%	Extend the current baiting pulse for a further two weeks, comprising two additional bait installs, then repeat mouse tracking. Review bait type, bait

Monitoring result or trigger	Required response
	availability, bait take, and device density. If mouse tracking remains above 20% RTI, locally infill the 50 m x 50 m bait station network in the affected area and increase baiting intensity during the next pulse.
Mustelids detected	Increase DOC-series or equivalent trap checks and rebaiting to at least twice monthly within two weeks of detection. Review trap placement along likely movement corridors and relocate or add traps where required. Intensified servicing shall continue until the next monitoring round confirms reduced mustelid activity.
Hedgehogs detected frequently	Review trap placement within two weeks, install additional hedgehog-capable traps where detections are concentrated, and repeat monitoring after the next servicing cycle to confirm whether detections have reduced.
Possum detections continue after control pulse	Increase possum control effort within one month, review trap or bait station placement, undertake a follow-up control pulse, and repeat wax tag, chew card, camera, or equivalent monitoring after the pulse.
Browse damage affects more than 10-15% of monitored seedlings in a monitoring round	Within two weeks, identify the likely browser, inspect fencing and plant protection, intensify rabbit, hare, possum, or stock exclusion control, and repeat browse monitoring within six weeks to confirm whether new browse has reduced below the trigger level.
Severe browse recurs on the same species or in the same planting area	Review species palatability, plant guards, fencing, browser control method, and control frequency.
Protected or guarded plants perform markedly better than unprotected plants	Treat browse as a limiting factor and intensify browser control or plant protection.
Persistent pest animal activity despite control	The Project Ecologist, Project Herpetologist, and Pest Control Contractor shall review methods and monitoring results within one month. The review shall consider detection patterns, bait take, tracking results, trap catch, hotspots, device placement, device density, servicing frequency, toxin selection, and non-target constraints, and shall identify revised methods to increase control efficacy before the next scheduled monitoring round.

5.3.6 Reporting and records

The Pest Control Contractor shall maintain records of device locations, device type, installation date, servicing dates, bait type and quantity where relevant, bait take, trap catches, monitoring results, device faults, device replacements, and any non-target issues. Device locations shall be mapped and updated if devices are relocated. Pest control records shall be provided to the Project Ecologist for inclusion in annual HREP reporting (refer to Section 5.7).

5.4 Planting Specifications

Plant species shall be eco-sourced from ecologically appropriate wild populations within the Manukau, Hunua, or Tamaki Ecological District, preferably from seed or plant material collected near the Project area. Species selection shall be confirmed in consultation with Mana Whenua.

Terrestrial planting shall be undertaken between April and October, when soil moisture is typically higher. Plant stock shall:

- be healthy, vigorous, and free from obvious signs of disease and pests;
- be of at least average size for the specified pot/plastic bag size (i.e. PB 3-5);

- have a well-developed root system with a high amount of new root growth; and
- not be root bound.

Plant species shall be set out on site by the Restoration Contractor in consultation with the Project Ecologist. Species shall be placed in locations that match their ecological tolerances and the intended planting outcome. Placement shall consider:

- slope and landform;
- soil type, drainage, and compaction;
- exposure to wind and frost;
- aspect and likely soil moisture;
- light conditions, including full sun, edge, and shaded canopy conditions; and
- proximity to retained vegetation, lizard habitat features, and maintenance access.

Planting holes shall be spaced in accordance with the relevant planting plan. Each hole shall be large enough to accommodate the root ball without distortion and deep enough so the plant collar sits approximately 1 cm below the surrounding ground level.

Fertiliser tablets shall be placed in the planting hole where they are not already included in the nursery root ball. Soil at the base of the hole shall be loosened before planting. Backfill shall be firmed around the root ball to remove voids while avoiding compaction that could restrict drainage or root growth.

Plants should be marked with bamboo stakes to assist maintenance and monitoring. Mulch and other ground conditioning are not required for these planting areas.

5.4.1 Ecological restoration and enrichment planting

Ecological restoration planting shall increase indigenous vegetation diversity, structure, and long-term resilience in the management areas. Planting is intended to restore a trajectory toward WF9 taraire, tawa, podocarp forest or other relevant indigenous habitat types, support fauna habitat, and contribute to the Project's residual effects management package.

The restoration and enhancement planting mixes for each terrestrial habitat type have been developed using species that:

- are characteristic of the affected WF9 ecosystem type;
- would naturally occur in the local ecological context;
- have been recorded in surrounding SEA or non-SEA remnants;
- are appropriate for the Manukau Ecological District;
- provide food, shelter, or structural habitat for indigenous fauna affected by the Project; and
- reflect input from cultural advisers where provided.

5.4.1.1 Planting Timing

Planting shall be implemented in two phases.

Phase 1

Phase 1 planting shall be undertaken in all ecological restoration planting areas (Table 5-1). It shall use pioneer and early successional species suited to open conditions, higher light, lower soil moisture, and wind exposure. These species are intended to establish initial vegetation cover, improve soil condition, and create conditions suitable for later enrichment planting.

Phase 2

Phase 2 enrichment planting shall be undertaken once site conditions are suitable for later successional species. Enrichment planting is programmed for Year 7 in Ecological Restoration Area A and Year 5 in Ecological Restoration Area B. The timing shall be confirmed by the Restoration Contractor and Project Ecologist, based on canopy development, pest plant control, soil moisture, and the likely survival of enrichment species. Enrichment planting shall support long-term forest structure, and ecological function.

5.4.1.2 Planting Species

Phase 1 species have been selected for tolerance of open-site conditions and consistency with WF9 ecosystem characteristics. Enrichment species have been selected as later successional species historically associated with the target ecosystem type. Table 5-5 lists the Phase 1 restoration species, and Table 5-6 lists the Phase 2 enrichment species.

Ecological Restoration Area A comprises open pasture and cleared areas with limited existing canopy or seed sources. Enrichment planting in these areas shall be delayed until the planted canopy has developed sufficiently to support shade-tolerant species. Ecological Restoration Area B is adjacent to existing WF9 remnants, including Cheesman's Bush and Watercare Bush. Enrichment species may be planted from the outset where suitable canopy or edge conditions exist, or later as planted vegetation develops. Final timing and placement of enrichment planting shall be confirmed by the Restoration Contractor and Project Ecologist.

Table 5-5: Phase 1 restoration plant species list

Common name	Scientific name
Kāramu	*Coprosma robusta*
Tī kōuka	*Cordyline australis*
Kahikatea	*Dacrycarpus dacrydioides*
Houhere / Lacebark	*Hoheria sexstylosa*
Kānuka	*Kunzea robusta*
Mānuka	*Leptospermum scoparium*
Māhoe	*Melicytus ramiflorus*
Māpou	*Myrsine australis*
Harakeke	*Phormium tenax*
Kōhūhū	*Pittosporum tenuifolium*
Tōtara	*Podocarpus totara*
Koromiko	*Veronica stricta var. stricta*
Pūriri	*Vitex lucens*

Table 5-6: Phase 2 plant species list for enrichment (under established canopy)

Common name	Scientific name
Kauri	*Agathis australis*
Taraire	*Beilschmiedia tarairi*
Tawa	*Beilschmiedia tawa*
Hangehange	*Geniostoma ligustrifolium var. ligustrifolium*
Mamangi / tree coprosma	*Coprosma arborea*
Shiny karamu	*Coprosma lucida*
Twiggy coprosma	*Coprosma rhamnoides*
Karaka	*Corynocarpus laevigatus*
Kahikatea	*Dacrycarpus dacrydioides*
Rimu	*Dacrydium cupressinum*
Kohekohe	*Didymocheton spectabilis*
Porokaiwhiri / Pigeonwood	*Hedycarya arborea*
Houhere / Lacebark	*Hoheria sexstylosa*
Rewarewa	*Knightia excelsa*
Kawaka	*Libocedrus plumosa*
Māhoe	*Melicytus ramiflorus*
Tānekaha	*Phyllocladus trichomanoides*
Tōtara	*Podocarpus totara*
Miro	*Prumnopitys ferruginea*
Whauwhaupaku / Five-finger	*Pseudopanax arboreus*
Horoeka / Lancewood	*Pseudopanax crassifolius*
Pūriri	*Vitex lucens*

5.4.2 Lizard Habitat Planting

Planting of lizard habitat (approximately 3 ha) is interspersed between the ecological restoration planting, surrounding the proposed stormwater raingardens, and the wetland restoration area at [redacted] The remaining 2 ha of lizard habitat creation is located in an area at the [redacted] surrounding the stormwater pond and a raingarden (Appendix D). Table 5-7 details the species to be planted in areas designated for lizard habitat planting.

Table 5-7 Planting mix for lizard habitat planting areas

Common name	Scientific name
Throughout	
Tōtara	*Fuchsia procumbens*
Pōhuehue	*Muehlenbeckia axillaris*
Pōhuehue	*Muehlenbeckia complexa*
Kaihua	*Parsonsia heterophylla*
Whaririki	*Phormium cookianum*
Harakeke	*Phormium tenax*
Kawakawa	*Piper excelsum*
Koromiko	*Veronica macrocarpa var. macrocarpa*
Adjacent to WF9 (Forest Edge context)	
Forest sedge	*Carex lambertiana*
Aruhe	*Coprosma areolata*
Mingimingi	*Coprosma propinqua*
Mingimingi	*Coprosma rhamnoides*
Mahoe	*Melicytus ramiflorus*
Māpou	*Myrsine australis*
Wī	*Poa cita*
Houpara	*Pseudopanax lessonii*
Adjacent to road	
Toetoe	*Austroderia fulvida*
Speckled sedge	*Carex testacea*
Taupata	*Coprosma repens*
Tauhinu	*Ozothamnus leptophyllus*
Pinatoro	*Pimelea prostrata*
Koromiko	*Veronica stricta var. stricta*

5.4.3 Enhancement planting

Enhancement planting shall be undertaken within retained vegetation areas identified in Table 5-1, which includes 134 Mill Road WF9 vegetation, Cheesman's Bush, and Puhinui Gully. Enhancement planting shall be limited to canopy gaps, open edges, and other localised areas within established vegetation where planting can improve indigenous species diversity, structural complexity, regeneration, and habitat condition without unnecessary disturbance to retained vegetation. Canopy gaps and open edges are often caused by pest plant control where pest plants dominated an area, as such pest plant control within these areas shall be followed up with suitable enhancement planting.

Enhancement planting shall use species listed in Table 5-6, unless the Project Ecologist confirms that a species from Table 5-6 is unsuitable for a particular gap because of light, moisture, exposure, pest plant pressure, access, or other site-specific conditions. Species shall be placed to match their ecological tolerances, with shade-tolerant canopy, subcanopy, and understorey species prioritised in semi-shaded or sheltered gaps and more light-tolerant species used on open edges or larger canopy gaps.

Enhancement planting locations shall be confirmed on site by the Restoration Contractor and Project Ecologist after initial pest plant control and before planting. Planting shall avoid damage to existing indigenous vegetation, natural regeneration, large roots, salvaged habitat features, lizard refugia, and other retained habitat values. Planting density shall be determined by gap size and the existing vegetation structure, with plants clustered where required to accelerate canopy closure or improve habitat structure.

5.5 Post-planting Maintenance

5.5.1 Post-planting Maintenance

Post-planting maintenance shall be undertaken in all ecological restoration, enhancement, and lizard habitat planting areas for the 10-year management period. The purpose of maintenance is to achieve plant establishment, suppress pest plant competition, replace failed planting, and support canopy closure or the intended habitat structure.

During the first 12 months after planting, the Restoration Contractor shall complete a minimum of 12 maintenance visits. Maintenance shall be timed to respond to seasonal growth, with increased attention during spring and other high-growth periods. Before maintenance begins, the Restoration Contractor shall provide the Project Manager and Project Ecologist with the proposed maintenance schedule.

After the first year, the maintenance frequency may be reduced where plant losses are less than 10% and pest plant competition is controlled. Any reduction in maintenance frequency shall be approved by the Project Ecologist.

5.5.2 Replacement Planting

Dead or failed plants shall be replaced during the next suitable planting season using the same species, or another appropriate species from the relevant planting species list. Replacement planting is required to maintain planting density, avoid persistent canopy or groundcover gaps, and reduce opportunities for pest plant reinvasion.

5.5.3 Pest Plant Control

Pest plant control shall be undertaken to maintain planted areas free from pest plant competition and to support long-term indigenous vegetation establishment. Pest plant control shall follow the methods in Section 5.2.

For the first three years after planting, chemical and/or manual pest control shall be undertaken at least twice per year, once in spring and once in autumn. Additional release pest plant control shall be undertaken where pest plants are affecting plant survival or growth. From Year 4 onward, pest plant control shall be undertaken at least annually, or more frequently if required to meet performance targets.

5.5.4 Watering

Plants shall be watered in after planting where soil moisture is low or where autumn or winter conditions have been unusually dry. Any water required for establishment watering shall be supplied by the Restoration Contractor.

5.5.5 Programme

Restoration, enhancement, and lizard habitat planting shall be timed to suit seasonal planting windows and construction staging. The seasonal implementation and maintenance programme is summarised in Table 5-8.

Table 5-8 Seasonal staging for the implementation of enhancement and restoration activities.

Enhancement and restoration activities	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Phase One (Year one)												
Site preparation inspection	✓	✓										✓
Pest plant control (pre-planting)	✓	✓	✓									
Pest animal control (pre-planting)	✓	✓	✓									
Stock-proof fencing (pre-planting)	✓	✓	✓									
Felled log deployment (pre-planting)	✓	✓	✓	✓								
Terrestrial revegetation planting				✓	✓	✓	✓	✓	✓			
Phase 2 (Year seven (Area A) and year five (Area B)) – Enrichment planting												
Terrestrial enrichment planting				✓	✓	✓	✓	✓	✓			
Phase 3 – Ten year maintenance period												
Restoration site inspection (Year 2-10)	✓	✓										✓
Replacement planting (Year 1-10)				✓	✓	✓	✓	✓	✓			
Enhancement plantings (Year 1- 10 as required)				✓	✓	✓	✓	✓	✓			
Pest plant control	✓	✓	✓	✓	✓				✓	✓	✓	✓

5.6 Annual inspections

Annual inspection surveys shall be undertaken during planting and maintenance periods:

- Identify pest plants;
- Identify pest animal damage;
- Identify and map noticeable gaps in plantings;
- Estimate planting survival and densities of all terrestrial plants within revegetation sites; and
- Estimate canopy coverage.

The following Key Performance Indicators (KPIs) shall be assessed during HREP annual inspections to confirm that restoration, enhancement, and enrichment planting meet the Project's ecological objectives and consent requirements:

- Planting uses healthy, eco-sourced plant stock that is true to form and actively growing.
- Planting is 100% complete at practical completion for each relevant stage.
- Plant loss does not exceed 10% by the end of the defects, liability and maintenance period, with no obvious bare patches or concentrated failures.
- Planting achieves 90% canopy cover of the ground within 10 years.
- Pest plants and pest animals are controlled throughout the management period to support plant establishment and ensure they do not inhibit natural indigenous plant restoration.
- The Project Ecologist inspects planting at completion and maintenance close-out to confirm consistency with the Landscape Plans and this HREP.
- Mana Whenua representatives are offered the opportunity to inspect the planting.
- Compliance with restoration extent, species mix, timing, and maintenance.

5.7 HREP Reporting

An annual HREP report shall be prepared as part of an integrated TMP annual report by end of June for the period of 1 May – 30 April for each year of construction and include:

- the restoration and enhancement work completed during the reporting period;
- areas planted, including species and numbers planted;
- pest plant control completed;
- pest animal control completed;
- replacement planting undertaken;
- watering or drought response;
- stock fencing installed or maintained;
- a summary of habitat features deployed
- plant survival;
- current canopy closure and expected trajectory;
- browse damage rate;
- pest plant issues;
- pest control reporting aligned with the information in Section 5.3.6

6 BIODIVERSITY MONITORING

The following section details the monitoring required to assesses the ecological trajectory of the restoration and enhancement areas, and when contingencies are triggered where monitoring shows that outcomes are unlikely to be achieved within the 10-year period.

The monitoring follows a process of baseline assessment (Terrestrial EcIA and associated vegetation plot data), protocol and management plan implementation and maintenance records drafted annually (reference sections 2.5, 3.3, 4.2, and 5.7), and outcome monitoring at Years 3, 6, and 10.

6.1 Monitoring areas and timing

Monitoring shall be undertaken within a representative sample of ecological restoration planting areas and enhancement planting areas. Locations shall be selected using a random approach to ensure representative spatial cover and adequate replication across the sites. The density of monitoring stations shall achieve a one per two hectares of each type of restoration or enhancement area. For plots within retained vegetation the same plot locations utilised for the Terrestrial EcIA shall be used as they provide a suitable baseline.

The Project Ecologist shall ensure plot locations represent the principal planting types and the range of site conditions, including differences in planting age, slope, aspect, exposure, and proximity to retained indigenous vegetation.

Routine HREP inspections shall continue to assess plant losses, planting gaps, pest plant competition, browse damage, and maintenance requirements. Formal vegetation plot monitoring shall commence in Year 3 following planting of each relevant area and shall be repeated in years 3, 6, and 10.

Monitoring shall occur in March – April for each monitoring repeat.

6.2 Vegetation monitoring method

Permanent 10 m x 10 m vegetation plots shall be established by the Project Ecologist.

Each plot shall be marked at its centre and corners where practicable, assigned a unique identifier, and recorded by GPS. Fixed photographs shall be taken from the plot centre toward the northwest, northeast, southwest, and southeast, or from other recorded bearings where site conditions require an alternative arrangement. The same plot boundaries, photograph locations, and bearings shall be used for each monitoring round.

Each plot shall include four fixed 2 m x 2 m seedling/sapling subplots, located at or near the plot corners.

Any departure from this layout shall be recorded and repeated during subsequent monitoring. Plot and subplot locations may be moved only where they become unsafe, inaccessible, or no longer representative because of physical disturbance. The reason for relocation and the replacement location shall be recorded.

The following information shall be recorded within each 10 m x 10 m plot (Table 6-1 provides a summary of the attributes, methods, and KPIs/targets to contextualise the data capture):

- the species and number of live and dead planted stems, including enrichment plants; where complete stem counts are not practicable because stems can no longer be reliably distinguished, plant survival shall be estimated using a documented and repeatable sampling method;
- live stem density, expressed as stems per square metre, and the location and approximate area of conspicuous gaps or concentrated plant loss;
- all indigenous and introduced vascular plant species present, distinguishing planted individuals from natural recruitment where practicable;
- the identity and estimated percentage cover of pest plant species, including any species suppressing planted stems or indigenous recruitment;
- evidence of browse, plant disease, drought stress, waterlogging, physical damage, or other factors affecting establishment; and

- the retention and condition of enhancement planting, including survival of planted enrichment species.

Within each 2 m x 2 m seedling/sapling subplot, all woody seedlings up to 1.3 m tall shall be counted by species. Seedlings shall be recorded as indigenous or introduced, and as planted or naturally recruited where this can be determined. Results shall be reported as seedling/sapling density per square metre, species richness, and the proportion of the total seedling count comprising indigenous and introduced species. Pest plant seedlings shall also be identified and counted by species.

Plant diversity shall be reported as the number of indigenous and introduced vascular plant species recorded within each plot. Changes in species richness shall be interpreted alongside planting records, plant survival, seedling recruitment, pest plant control, and site conditions. The presence of an introduced species shall not, by itself, indicate failure; interpretation shall focus on whether introduced species are increasing in prevalence or inhibiting indigenous plant establishment or recruitment.

6.3 KPIs & Targets and contingencies

KPIs and targets are defined in Table 6-1 below.

Results from the biodiversity monitoring shall be assessed by the Project Ecologist to determine whether KPIs or targets (Table 6-1) are currently (for trends) or likely to be achieved within the 10 year restoration and enhancement period (for canopy closure).

If they are not, the Project Ecologist shall develop, with the Restoration Contractor, a contingency plan with measures to remediate the issues identified and ensure successful implementation of the proposed management within the 10-year management period.

Contingency actions will be dependent on issues identified and may include, but not be limited to:

- Infill planting to address canopy gaps, bare areas, low stem density, or areas where plant loss exceeds the performance target.
- Replacement planting using more appropriate species where the original species mix shows poor survival, poor growth, or poor suitability to site conditions.
- Increased maintenance frequency, including additional release weeding, plant checks, and targeted remedial works during high-growth periods.
- Intensify pest plant control, including additional control rounds, follow-up treatment, targeted control of problem areas, and treatment of seedling recruitment.
- Revise pest plant control methods where current methods are ineffective, including changes to herbicide, application method, timing, or contractor approach.
- Install additional plant protection where browse is limiting establishment, including guards, fencing repairs, exclusion fencing, or targeted browser control.
- Improve site conditions where plant performance is poor, including correcting planting depth, relieving compaction, improving drainage, watering during dry establishment periods, or addressing erosion.
- Review and revise planting layout or species placement where monitoring shows plants are poorly matched to light, moisture, exposure, edge effects, or canopy conditions.

In the event of issues being identified and a contingency plan being required, the Project Ecologist shall consider and determine whether a supplementary (additional to the defined monitoring in Years 3, 6, and 10) monitoring round to determine if contingency measures have been effective is required.

Table 6-1 Attributes, data collection methods and associated KPIs / Targets

Biodiversity attribute	Monitoring method	KPI / Target
Vegetation structure and condition	10 x 10 m vegetation photo points with photographs taken from the centre of the plot on a NW, NE, SW and SE bearing. The plot will be centred by corner stakes.	Positive trajectory demonstrated through rolling 3 year monitoring averages; Dominant species trend toward vegetation community representative of WF9 ecosystem.
Recruitment using seedling and sapling density	Count native sapling (<2.5 cm DBH, >130 cm height) and seedling (> 30 cm) by species within a single 2m x 2m subplots located in each corner of the 10m x 10m vegetation plot.	Increasing or stable seedling/sapling density relative to baseline over time (seed recruitment).
Herbaceous and groundcover composition	Percentage cover estimates of herbaceous vegetation, bare ground and leaf litter within four 2m x 2m subplots located in each corner of the 10m x 10m vegetation plot.	Positive trajectory in vegetation structure and condition.
Canopy closure	Measured visually.	≥90% canopy closure achieved by Year 10.
Threats or stressors	Observations of browse, disease, physical or environmental stressors, pest plant abundance.	Threats and stressors decline over time.

6.4 Biodiversity reporting

A Biodiversity monitoring report shall be prepared after each monitoring round by end of June and included as part of the integrated TMP annual report for that year.

The report will include:

- Monitoring results;
- Updated maps and representative photos;
- Assessment of results using a rolling monitoring average to verify a sustained positive trajectory in biodiversity outcomes;
- A contingency plan, if required, detailing how issues identified during monitoring are to be rectified and improved to ensure KPIs and targets are met and timing of next monitoring round if this requires modification; and
- Recommendations for improving the monitoring programme, next round, if required.

7 INTEGRATED TMP ANNUAL REPORTING

An integrated TMP annual report shall be prepared for each reporting period during construction and the 10-year management period. The report shall cover the period from 1 May to 30 April and shall be submitted to Auckland Council by the end of June. The report shall consolidate the reporting required by Sections 2.5, 3.3, 4.2, 5.7,and 6.4, together with relevant reporting required under the OGTMP.

The extent of reporting shall reflect the ecological management activities undertaken during the reporting period. Where a requirement did not apply, or no relevant activity was undertaken, this shall be stated. Information may be provided by reference to an appended specialist report, monitoring report, schedule, or map, provided the integrated TMP annual report clearly identifies where each requirement is addressed.

APPENDIX A OLD GROWTH TREE MANAGEMENT PLAN

*[Refer to **Appendix C6** of the Substantive Application]*

APPENDIX B LIZARD MANAGEMENT PLAN

*[Refer to **Appendix E1** of the Substantive Application]*

APPENDIX C DEPARTMENT OF CONSERVATION PROTOCOLS FOR MINIMISING THE RISK OF FELLING OCCUPIED BAT ROOSTS (TREE FELL PROTOCOL)

Protocols for minimising the risk of felling occupied bat roosts

(Bat Roost Protocols)

Version 4: October 2024 approved by the New Zealand Department of Conservation's Bat Recovery Group

The use of these protocols is only one step in the RMA effects management hierarchy i.e., avoid, remedy, mitigate. Avoidance of felling bat roost trees should be the first step in any project. Using this protocol only reduces the likelihood of killing or injuring bats present in roosts at the time of felling. It does not avoid, remedy or mitigate any other effects.

Purposes of this document:

1. To outline why protection of roosts is important for the persistence of New Zealand bats and why removal of known and potential roosts should be avoided.
2. Where tree removal cannot be avoided, to set out the minimum requirements and protocols for removing trees in areas where bats are present, to minimise the risk of killing bats.

This protocol does not eliminate the risk to bats of death or injury because bats or active bat roosts can be missed. The best way to eliminate risk of felling an active roost is to **avoid** felling any known or potential roosts.

Context

Bat roost protocols and the Wildlife Act 1953

Aotearoa New Zealand bats are absolutely protected species under the Wildlife Act 1953. It is an offence to catch alive or kill, hunt, possess, molest, or disturb bats under the Act. Any projects where tree or vegetation removal overlaps with the occurrence of bats, there is a risk of killing or injuring bats that may be present. Following the bat roost protocol reduces the likelihood of killing or injuring bats.

Bat roost protocols and the RMA

The occurrence of bats and bat habitat is a matter of 'significance' under Section 6(c) of the Resource Management Act (RMA). Bat roost protocols have become a standard part of bat management plans that may be required under RMA consents. Where developments require consents, and bats (a threatened species) are present, the developments should 'Avoid' impacting bats and bat habitat. Where this is not possible, the effects management hierarchy must be followed with attempts made to "remedy, mitigate, offset, and compensate" for impacts on bats and bat habitat.

Bat roost protocols are not considered an appropriate management measure to address bat roost habitat loss, as they only attempt to reduce the risk of bats being killed by tree felling. Therefore, implementing bat roost protocols where bats are present should be considered a last resort after following the RMA effects management hierarchy.

This protocol has therefore been framed following the RMA effects management hierarchy by first focusing on the avoidance of effects, helping to identify and avoid the removal of roost trees, and to minimise the risk to bats of death or injury if avoidance is not possible. This approach is usually informed by gathering data on bats in the local areas and seeking advice from someone who has been certified as competent by DOC to assess roost use by bats using bat detectors, identify potential roost features, and undertake emergence watches.

Identifying and protecting *both active and inactive (*i.e., trees used by bats at other times of year) roosts by avoiding their removal is an important step in supporting the survival and persistence of bats.

Effects management/compensation

If trees are felled and habitat lost, then compensation measures should be considered to address the adverse effects. What these measures should be is beyond the scope of this document. Provision of artificial roosts in the short-term and planting for the long-term are some of the methods commonly used in development projects, but their effectiveness is untested and understanding this is future research need**e**d.

The status of Aotearoa New Zealand bats

Aotearoa New Zealand's two extant bat species (pekapeka) are classified as threatened.

Long-tailed bats are classified as 'Nationally Critical' because the species is likely to have a 70% decline in numbers within three generations.

Lesser short-tailed bats have three subspecies. The northern subspecies is classified as 'Nationally Vulnerable' because there are 1000-5000 mature individuals and the predicted decline in numbers is 10-50% within three generations. The central subspecies is 'Declining' because there are 20 000-100 000 mature individuals, and the predicted decline is 10-50% within three generations. The southern subspecies is 'Recovering' because there are 1000-5000 individuals, and the predicted increase is >10% within three generations.

Threats to bats

This document deals specifically with roost protection; however, roost protection is only part of the wider issue of habitat loss. Habitat loss through land clearance, habitat degradation, fragmentation and disturbance and loss of roosts reduces roosting, foraging and socialising areas. Individual bats and colonies are also threatened by the local felling of individual trees.

Bats have large home ranges which can include unprotected peri-urban habitat. Protecting habitat and maintaining connectivity of vegetation are crucial for bats being able to persist and flourish in the environment.

Predation and competition by introduced predators: mustelids, rats, cats, and possums have all been implicated in the decline of bats[1].

Roosts are critical to the survival of bats

Roosts are where bats gather to shelter during the day and at night. They are used to socialise, mate, give birth, and raise young. Bats have very specific requirements when they are choosing roosts and are not just choosing any tree. The specialised features of roosts make them rare and almost irreplaceable in any landscape or habitat type except over very long-time frames. People sometimes falsely suggest that "bats can just move to another tree". This is not the case, particularly where trees suitable as roosts are limited[2].

Bats demonstrate high site fidelity to existing roosts and their specific roosting areas, and they move on a rotation among these. Because roost trees are likely to be rare, and bats choose which of their roosts to occupy to fulfil specialised requirements, felling roost trees even when bats are absent will have a significant negative effect. If the number of suitable roosts and their surrounding habitat is reduced in the landscape, bats are forced to use roosts that are less thermally efficient. This means they will use more energy to survive, resulting in reductions in survival and lower reproductive success. In this way, roost removal is likely to result in higher risk of local extinction.

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[1] O'Donnell CFJ; Christie JE; Hitchmough RA; Lloyd B; Parsons S 2010. The conservation status of New Zealand bats, 2009. New Zealand Journal of Zoology 37: 297– 311.

[2] Many references available, for example, Borkin KM; Parsons S. 2011. Sex-specific roost selection by bats in clear-fell harvested plantation forest: improved knowledge advises management. Acta Chiropterologica 13(2): 373-383; Borkin KM; O'Donnell CFJ; Parsons S. 2011. Bat colony size reduction coincides with clear-fell harvest operations and high rates of roost loss in plantation forest. Biodiversity and Conservation 30; Sedgeley JA; O'Donnell CFJ 1999b. Roost selection by the long-tailed bat, *Chalinolobus tuberculatus*, in temperate New Zealand rainforest and its implications for the conservation of bats in managed forests. Biological Conservation 88:261–276; Sedgeley JA; O'Donnell CFJ 2004. Roost use by long-tailed bats in South Canterbury: Testing predictions of roost site selection in a highly fragmented landscape. New Zealand Journal of Ecology 28:1-18.

Bats can roost in native or exotic vegetation – therefore it should not be presumed that exotic species such as pine trees will not support bats. Roosts, including maternity roosts, have been found in many exotic species including, but not limited to, pine, poplar, oak, and acacia species, black locust, willow, eucalyptus and Tasmanian blackwood.

Bats are at risk of being injured or killed when trees are felled

If a tree is felled with a bat in it, it is highly likely that the bat will be injured or killed, although this may not be apparent at the time because injuries, such as bruises and fractures, which would hinder bats' ability to fly well, may take time to be obvious.

The highest risk of injuring or killing bats or trapping them within their roosts is when they are heavily pregnant, when young are still dependent on the roost (late November – February) and when bats are more likely to be in torpor (a type of hibernation in May – September). Heavily pregnant bats are slower and less agile, and young bats cannot fly, and when they are new to flying are not very agile, so their chances to escape are reduced when roost trees are felled. Also, it is possible that if the larger female-dominated maternity roosts are cut down when females are raising their young to independence (October-March), a whole colony of bats could be destroyed at one time.

If trees are cut down when bats are in torpor, bats may be unable to rouse from torpor and to fly away in time to escape. Additionally, it is significantly harder, sometimes impossible, to detect bats roosting in trees during torpor. For these reasons, trees with potential bat roost features must not be cut down in winter. Bats also use torpor for short periods during summer, for example, if the weather gets cold, so the risk of killing or injuring bats that cannot escape falling trees exists at any time of the year.

Bat roost protocol

When and how to use the protocol

Whenever vegetation removal is proposed in areas where bats are potentially present and where their habitat may be impacted, follow the decision tree (Figure 1) below as a guide to what sort of action should be undertaken. The decision tree is designed firstly to avoid felling bat roost trees, secondarily aimed at moving roost trees, and only if unavoidable, felling roost trees (but only once vacated).

None of the methods of inspecting roosts described below eliminates the risk of failing to identify bats when they are present. Therefore, techniques such as filling in cavities with expandable foam are not supported as a tool. This is because there is a risk of trapping bats that have not been detected within cavities.

Definitions

Competencies: a set of competencies developed by the NZ Bat Recovery Group[3] to ensure that anyone working with bats is competent to do so. Contact bathandler@doc.govt.nz for a list of competencies and requirements to become an authorised competent bat worker.

Competencies referred to in this document:

2.1 Bagging, storage, handling, measuring, weighing, sexing, aging, temporary marking and releasing appropriately:
For long-tailed bats: 50 individuals
For short-tailed bats: 50 individuals

3. High risk activities – Roost felling (all of these competencies include the understanding of what to do when bats are found during tree felling as per Appendix 6 of 'Initial veterinary care for New Zealand Bats'[4])

- 3.1 Assessing roost tree use using Automatic Bat Monitors - Demonstrate correct timing, placement, and interpretation of data for 10+ times according to DOC's Tree Felling Protocols.
- 3.2 Undertake roost watches/emergence counts at 10+ occupied roosts where the entrance is visible.
- 3.3 In at least two different forest/habitat types, including the forest/habitat type where trees are going to be assessed: evaluate 10+ potential roost features in trees (e.g., cavities, peeling bark, epiphytes).

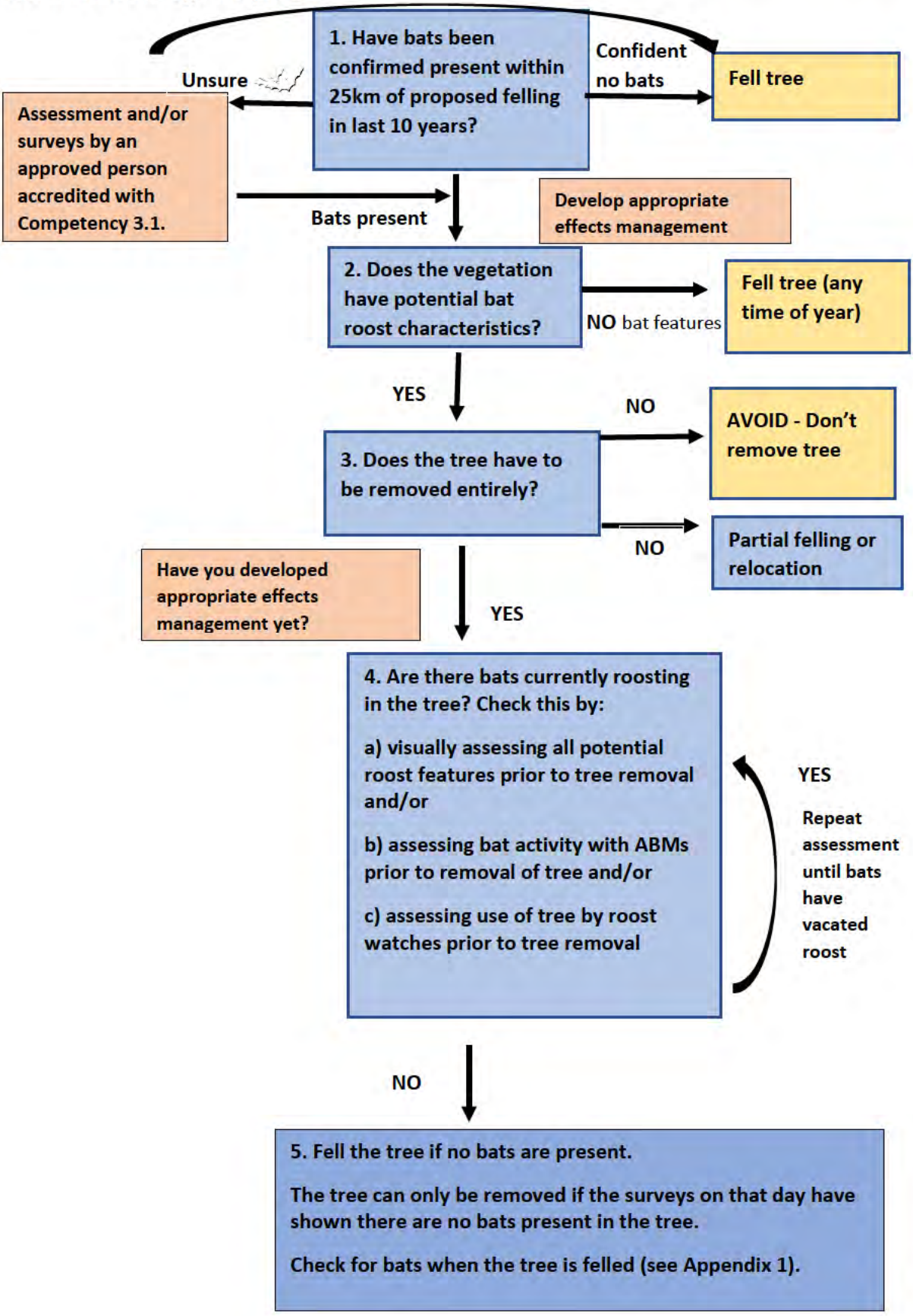
[3] A group of bat specialists that advise on bat issues and assess bat competencies
[4] Available at www.doc.govt.nz/bat-worker-resources

These are minimum requirements and rely on an accredited trainer to provide written endorsement to the Bat Recovery Group that the right level of competency has been achieved.

ABM: automated bat monitoring unit/detector

Figure 1. Tree removal in bat areas flow chart

Each numbered step relates to a step in the Decision Tool for Tree Removal. Follow each step fully in the text to work through the process.



Step by step decision tool for tree removal in bat areas (to be used in conjunction with Figure 1).

Step 1. Does the bat roost protocol apply to my project?	Response	Who can make this assessment?	When?
a) Is there known bat activity within a radius of 25 km of the vegetation to be removed (see [5] and [6] notes below)?	a) If Yes, proceed to b If No, consider whether survey work needs to be done.	Evidence can come from on-the-ground surveys and reports from the national DOC database if within the last 10 years, consultants, and/or other credible sources. Evidence should be interpreted by an experienced bat ecologist.	Any time
b) Are bats present in the Project Area i.e. where trees are planned to be felled?	b) If Yes, go to step c If unknown, undertake comprehensive survey if bats are likely to be present. If no bats are present after comprehensive survey, you do not need to follow protocol.	If surveys are required to support the assessment, then these will need to be designed by approved person accredited with Competency 3.1. to determine presence around trees due to be felled.	Acoustic surveys to determine presence should be undertaken when bats are most active and environmental conditions are suitable (October 1st to April 30th)[7]. Surveys undertaken at other times of year are considered less reliable for determining absence.
c) Is the tree known to provide a roost location for bats? (Previous knowledge).	c) If yes, go to step 3 If no (but bats are present in the project area), go to step 2.		

Notes for Step 1

1a) Bats are a highly mobile species. Long-tailed bats can have home ranges (the areas that they regularly use) as wide as 19km, and short-tailed bats about 24km. Three colonies of long-tailed bats in the Eglinton Valley collectively had a home range of 100km^2.

When assessing whether bats might be present at a site you have to consider any surveys that have been done in the wider area, how long ago the surveys were done and whether more surveys are required.

[5] The largest home range span for the long-tailed bat in the Eglinton Valley was 19 km (O'Donnell 2001. J. Zool., Lond. 253, 253-264).

[6] The largest home range span for the lesser short-tailed bat in the Eglinton Valley was 23.6 km (O'Donnell et al. 1999. New Zealand Journal of Ecology 23(1): 21-30).

[7] Borkin K.M. 2010. Ecology of New Zealand's Long-tailed bat (*Chalinolobus tuberculatus*) in exotic plantation forest. Unpublished PhD thesis, University of Auckland.

1b) If you are doing a new survey then you should design the survey to cover the project area. Examples of surveys are shown in the Bat Inventory and Monitoring Toolbox (https://www.doc.govt.nz/our-work/biodiversity-inventory-and-monitoring/bats/). See 'Bats: Counting away from bat roosts: bat detectors on line transects' and 'Counting away from bat roosts: automatic bat detectors'.

Send bat data (processed csv files and GPS locations) to batdatabase@doc.govt.nz on a standard spreadsheet available by emailing this address.

Step 2. Does the vegetation proposed to be removed have potential bat roost characteristics?	**Response**	**Who can make this assessment?**	**When?**
a) Is the tree ≥15 cm DBH (Diameter at Breast Height)[8]?	If yes, further assessment is required (2b). If no, the vegetation can be removed at any time. There may be roosts that have smaller DBH. If any vegetation is suspected to have a bat roost present, removal shall be halted immediately, and protocols reviewed.	Anyone who can measure a tree DBH.	Any time
b) On visual inspection, does the tree (dead or alive) have features that indicate roost potential (Potential Roost Features/PRFs)? These features include: • hollows • cavities • knot holes • cracks • flaking, peeling, and decorticating bark • epiphytes • broken or dead branches or trunk • cavities/hollows/shelter formed by double leaders • Artificial roost boxes	If yes go to step 3 If unsure i.e. cannot assess due to foliage or limited access, further assessment is required. This may include climbing inspection of the tree. If no potential roost features are present, the vegetation can be removed at any time[9], but if upon felling you find a bat follow section 5.	Approved person accredited with Competency 3.3.	Visual inspections can occur at any time of the year, but within 6 months of final felling dates. This accounts for any changes in trees that may occur over time. If there are **NO** potential roost features, felling can occur at any time of year.
Step 3. Does the tree have to be removed entirely?	**Response**	**Who can make this assessment?**	**When?**

[8] This diameter at breast height is based on dimensions of roosts used by south Hamilton long-tailed bats that were identified by Dekrout (2009, Unpublished PhD thesis, University of Auckland) - the smallest roosts were 15.5 cm DBH; but note that in South Canterbury Sedgeley and O'Donnell (2004, New Zealand Journal of Ecology 28(1): 1-18) found that 25% of long-tailed bat roosts were smaller than 18.8 cm DBH.
[9] All surveys to assess whether trees are potential roosts shall take place within 6 months of final felling dates. If felling does not take place within this time, then assessments must be repeated. This is intended to account for any changes in trees which may occur over time.

a) Is the only option to remove the tree entirely?	If yes, continue to step 4 If no, consider leaving the tree in place, cutting off specific limbs only or relocating the tree. If any felling, partial felling (where the part to be felled has potential bat roost features) or tree relocation takes place you **MUST** proceed to step 4. If a roost (active/inactive) is confirmed, then advice should be obtained at a project level in writing from DOC before proceeding.	Project leader (i.e. the accountable decision-maker for the project)	Any time

Notes for Step 3

Trees must only be relocated when bats are absent and when standard automated bat monitoring unit (ABM) weather conditions are met (see notes section 4b for appropriate weather conditions), and in consultation with an ecologist with all competencies of level 3: 'High risk activities – Roost felling'.

Advice in writing can be given on behalf of the Operations Manager of the DOC District you are working in. If you do not know the contact details for this office, you can phone 0800 ASK DOC (0800 275 362) or email info@doc.govt.nz . In emergencies, phone 0800 DOC HOT (0800 362 468).

Step 4. Are there bats currently roosting in the tree? (Follow a or b or c or a combination)	**Response**	**Who can make this assessment?**	**When**
a) Are potential features being used by roosting bats? A tree climber may be required to check all features (see notes for 4a below). If roost is occupied repeat 4a another day until roost is vacated.	If yes, **THE TREE MUST NOT BE FELLED UNTIL BATS HAVE VACATED IT**. If no, the tree can be removed on the day of the tree inspection following step 5. If bats continue to use the roost, then the tree must not be cut down until the bats leave the roost. At this point reconsider whether this tree must be felled.	An approved person accredited with Competency 3.3 or an experienced tree-climber (e.g., an arborist) working with an approved person accredited with Competency 3.3. If the latter, the tree climber must provide information along with photographs or video footage, to the	October 1st to April 30th when the temperature is 7°C or greater at official sunset in the South Island or 8°C or greater in the North Island.

	Advice must be obtained at a project level in writing from DOC prior to felling the tree. If you do not know the contact details for the office, you can phone 0800 ASK DOC (0800 275 362) or email info@doc.govt.nz.	approved person accredited with Competency 3.3 who assesses and decides whether the tree can be removed. If roosts are known or confirmed through this process, then this information must be communicated to the nominated DOC or Council bat ecologist for this project.	
b) Is bat activity recorded at any time during two consecutive, valid survey nights preceding tree felling[10]? At least two nights are required as it is possible for bats to enter or leave a roost without echolocating, or to not leave the roost for a night.	If yes (bats are detected), survey must continue until no bat activity is recorded for two consecutive nights (to indicate bats have left the area) prior to felling **OR** roost features of each tree must be visually assessed via climbing. If bat activity is consistent in the area and 2 nights with zero bat passes cannot be obtained, Go to 4c or 4a. If no bats are detected for two consecutive nights, the vegetation can be removed on the day immediately following the survey nights using the method in 5.	An approved person accredited with Competency 3.1	October 1st to April 30th and when conditions meet the requirements for standard ABM weather conditions (see 4b notes).
c) Are bats observed emerging or re-entering the tree? This involves watching roost features to identify bats returning to or exiting potential roost features. It should only be used in combination with previous ABM monitoring (4b) (see notes 4c	If yes (bats are seen at either watch), it is a confirmed roost.	An approved person accredited with Competency 3.2.	Between October 1st and April 30th only **AND** when weather parameters meet

[10] Le Roux et al (2013) found that in and around Hamilton "The longest consecutive monitoring period without bat detections at each site was three nights during winter." Le Roux et al 2013. New Zealand Journal of Zoology (2013): Spatial and temporal variation in long-tailed bat echolocation activity in a New Zealand city, New Zealand Journal of Zoology, DOI: 10.1080/03014223.2013.827125.

for method). At least two consecutive emergence and re-entry watches should occur at dusk and dawn immediately preceding the felling as it is possible for bats to enter or leave a roost without being detected, or to not leave the roost for a night. It is strongly recommended that a night vision aid is used for emergence watches to reduce the risk of missing bats if they leave after it becomes too dark to see.	Removal of a roost should not occur. <u>If no bats are observed entering or exiting for two consecutive</u> dusk and dawn watches, the vegetation can be removed on the day immediately following the final dawn watch using the method in 5.	If more than one person is required for a roost watch at a tree, a minimum of one approved person accredited with Competency 3.2 must be present on site for the duration of the roost watch to supervise.	the roost watch requirements.

Notes for Step 4.

4a) Tree climbing and inspection

Care must be taken while climbing trees to avoid disturbing, removing or destroying tree features with bat roost potential such as sections of loose bark or cavities in dead wood. Using mobile elevated platforms can be a good option. Bats are less likely to be active over colder periods, so climbing to check whether bats are present in potential roost features must take place between October 1st to April 30th when the temperature is 7 °C [11] (South Island) or 8°C (North Island) or greater at official sunset on the night before inspection.

A tree climber may be required to check all potential bat roost features.

- Can bats be seen? An endoscopic camera should be available for this step and every possible corner of each potential roosting feature inspected, i.e., cavity/crack etc. Cracks, holes, and splits may lead to cavities or may be superficial. A cavity may be wet indicating no/low potential as a bat roost. Ensure that the tree climber is provided guidance from the competent bat worker about bat identification and care required when probing endoscopes into potential roosting features which may disturb bats.
- Can bats be heard? Search of tree features should be accompanied by use of a hand-held bat detector. If bats are present and not in torpor, then detection of presence listening at 25 kHz (for social calls) and 40 kHz (for echolocation calls) may help to determine if long-tailed bats are present. Short-tailed bat social calls are often audible or detected at 25-27 kHz.
- Is guano present or urine staining? See Appendix 1.

4b) ABM survey work

ABMs are to be used to record bat calls. Location of ABMs must provide sufficient coverage to be able to determine if bat roosts are present in one or more of the trees. Department of Conservation-manufactured AR4 bat detectors are considered likely to detect long-tailed bats only over short distances i.e., up to 30-60 m distant from the

[11] O'Donnell CFJ 2000. Influence of season, habitat, temperature and invertebrate availability on nocturnal activity of the New Zealand long-tailed bat (*Chalinolobus tuberculatus*). New Zealand Journal of Ecology 207-221.

detector (S. Cockburn, Department of Conservation, pers. comm.). This is similar detection distances of other detector types. Ensure the survey design Note that rain and wind can affect detectability because the sounds can have the same frequencies as bat calls. These sounds are picked up by bat detectors, potentially obscuring bat calls.

'Valid' survey nights must have the following features:

- Begin one hour before official sunset and end one hour after official sunrise.
- Temperature 8°C or greater for the first four hours after official sunset time for the North Island and 7°C for the South Island[12].
- Ideally no to very little precipitation within the first 4 hours after official sunset, although a light mist or occasional drizzle may be acceptable as assessed by an ecologist accredited with Competency 3.1.
- No to light wind within the first four hours after official sunset.

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

4c) Roost watches

The following weather conditions define a valid night for roost watches:

- Temperature greater than 8°C all night between official sunset and sunrise for the North Island and 7 °C for the South Island.
- Ideally no to very little precipitation within the first 4 hours after official sunset, although a light mist or occasional drizzle may be acceptable as assessed by an ecologist accredited with Competency 3.1.

Roost watches should include the deployment of ABMs and analysis of data for the night of the roost watch.

Emergence watches

- Each tree must be watched from at least 1 hour prior to sunset in the South Island and from ½ hour prior to sunset in the North Island until it becomes too dark to see by sufficient people to observe all potential exit points. This must be supported using handheld detectors, and consider the use of night vision aids which can detect bats once it becomes too dark to see. The aim of emergence watches is to identify potential roost locations within the vegetation. Infra-red and thermal imaging cameras will be useful in this process.

Roost re-entry watches

[12] South Island temperatures are based upon O'Donnell (2000) as above. North Island temperatures are based on Borkin et al. 2023. Influence of weather on long-tailed bat detection in a North Island exotic forest. New Zealand Journal of Ecology, Vol. 47, No. 1.

The time when bats return to roosts can vary based on temperature and time of year.[13,14]

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

The methods above (Climbing and inspecting; ABM use and roost watches) can be implemented as in steps 4.

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

- Call the tree felling supervisor to inform them which affected tree(s) cannot be felled due to detection of bat sign.
- Send an email to the site manager, and the local DOC office if an active roost is found, detailing the results of the survey and outlining the measures for protection or relocating the roost tree. Advice must be obtained at a project level in writing from DOC prior to felling the tree. If you do not know the contact details for the office, you can phone 0800 ASK DOC (0800 275 362) or email info@doc.govt.nz.
- A record (including photos) of any vegetation containing bat roosts shall be kept detailing the date; size, location and species of tree or other vegetation; roost type, e.g., cavity, peeling bark, broken branch; detail outlining how presence of bats was confirmed; the number of bats present; and species present, if known.

Step 5. Fell the tree if no bats present	**Response**	**Who can make this assessment?**	**When**
NB: Vegetation removal must take place on the day of tree inspection or the day immediately following two consecutive emergence/re-entry surveys that confirm that there are no bats present.			
a) If you have undertaken a visual inspection of the vegetation (following step 4a, then the vegetation can be removed **ONLY ON THE DAY OF INSPECTION** and meets the valid weather conditions (defined in notes 4c) at official sunset the day prior to inspection. If you have undertaken ABM surveys or roost watches 4b or 4c the vegetation can be removed **ONLY ON THE DAY IMMEDIATELY**		An approved person accredited with the relevant competency (based on method used) who are familiar with the 'Bat First Aid and veterinary care' documents shown in footnote[15], and physically able to	When the inspection method chosen allows.

[13] Dekrout AS. 2009. Unpublished PhD thesis. University of Auckland, New Zealand Pp 168.
[14] Griffiths R. 2007. Activity patterns of long-tailed bats (Chalinolobus tuberculatus) in a rural landscape, South Canterbury, New Zealand. New Zealand Journal of Zoology, 34:3, 247-258, DOI: 10.1080/03014220709510083.

[15] Initial Veterinary Care for NZ Bats UPDATED 2023.pdf (doc.govt.nz) and Bat Care Advice for first responders 2023.pdf (doc.govt.nz) available at www.doc.govt.nz/bat-worker-resources

FOLLOWING SURVEY COMPLETION (i.e., if the survey ends in morning the tree can be felled the same day only). Trees must be inspected for signs of bats once felled and before removing from the site, if safe to do so. Follow Appendix 2 if bats are detected during vegetation removal.		check/inspect tree for signs of bats once felled.	

Appendix 1. Identification of guano.

Bat droppings ('guano') will superficially look like rodent droppings, being dark in colour and a similar size and shape to a large grain of rice. Bat droppings will easily crush under pressure (e.g., when squeezed between fingers) and will disintegrate into a dusty/crumbly substance in comparison to smearing (rodents). Where beetles form part of the bat's diet, crushed droppings can look shiny/glittery due to the presence of elytra. Larger colonies may leave piles of guano at the bottom of the roosting feature (Figure 1). Where individuals or small colonies are present, it is likely that only individual pieces of guano may be found, therefore careful inspection is needed.



Figure 1: Guano at the base of communal long-tailed bat roost. Photo: M. Choromanski

Appendix 2. If bats are detected during tree relocation or removal

NB: Vegetation removal must take place on the day of tree inspection, or the day roost watches have been completed or two consecutive nights of ABM data have confirmed that there are no bats present at that time. If practical, trees are to be inspected for signs of bats once felled and before removing from site. People inspecting trees should be familiar with the Bat Care Advice document shown in footnote[16] and able to check/inspect tree for signs of bats once felled.

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

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

If bats are detected once the tree has been felled**,** all further work must stop, and DOC and an approved person accredited with Competency 2.1 must be contacted. The felled tree must be thoroughly inspected by them for further bats**.**

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

[16] Initial Veterinary Care for NZ Bats UPDATED 2023.pdf (doc.govt.nz) and Bat Care Advice for first responders 2023.pdf (doc.govt.nz) available at www.doc.govt.nz/bat-worker-resources

Bats must be kept for three days under observation and must be kept out of torpor for this time. Additional detail is found at the links provided in this footnote[17]. Vets must euthanise bats whose injuries are causing suffering and are not likely to heal sufficiently to allow rehabilitation and return to the wild. The approved person accredited with Competency 2.1 and the vet must consult with DOC to consider appropriate rehabilitation options where suffering is minimal and chances of return to the wild are high.

Euthanised bats or any dead bats (or bat parts) found must be handed to DOC and is a legal requirement under the Wildlife Act. If the bat is held for longer than 12 hours, store it in a food grade safe glass jar in the freezer to preserve the bat's smell for the potential use of training conservation dogs.

[17] Initial Veterinary Care for NZ Bats UPDATED 2023.pdf (doc.govt.nz) and Bat Care Advice for first responders 2023.pdf (doc.govt.nz) available at www.doc.govt.nz/bat-worker-resources

APPENDIX D ECOLOGICAL MANAGEMENT AREA MAPPING

Adjacent map extent
Civil design extent
Existing designation
Proposed designation
Post-works waterway alignment
Artificial swale/drainage ditch
Artificial/Piped/Culvert
Ephemeral
Intermittent
Permanent

Significant Ecological Areas Overlay
Terrestrial



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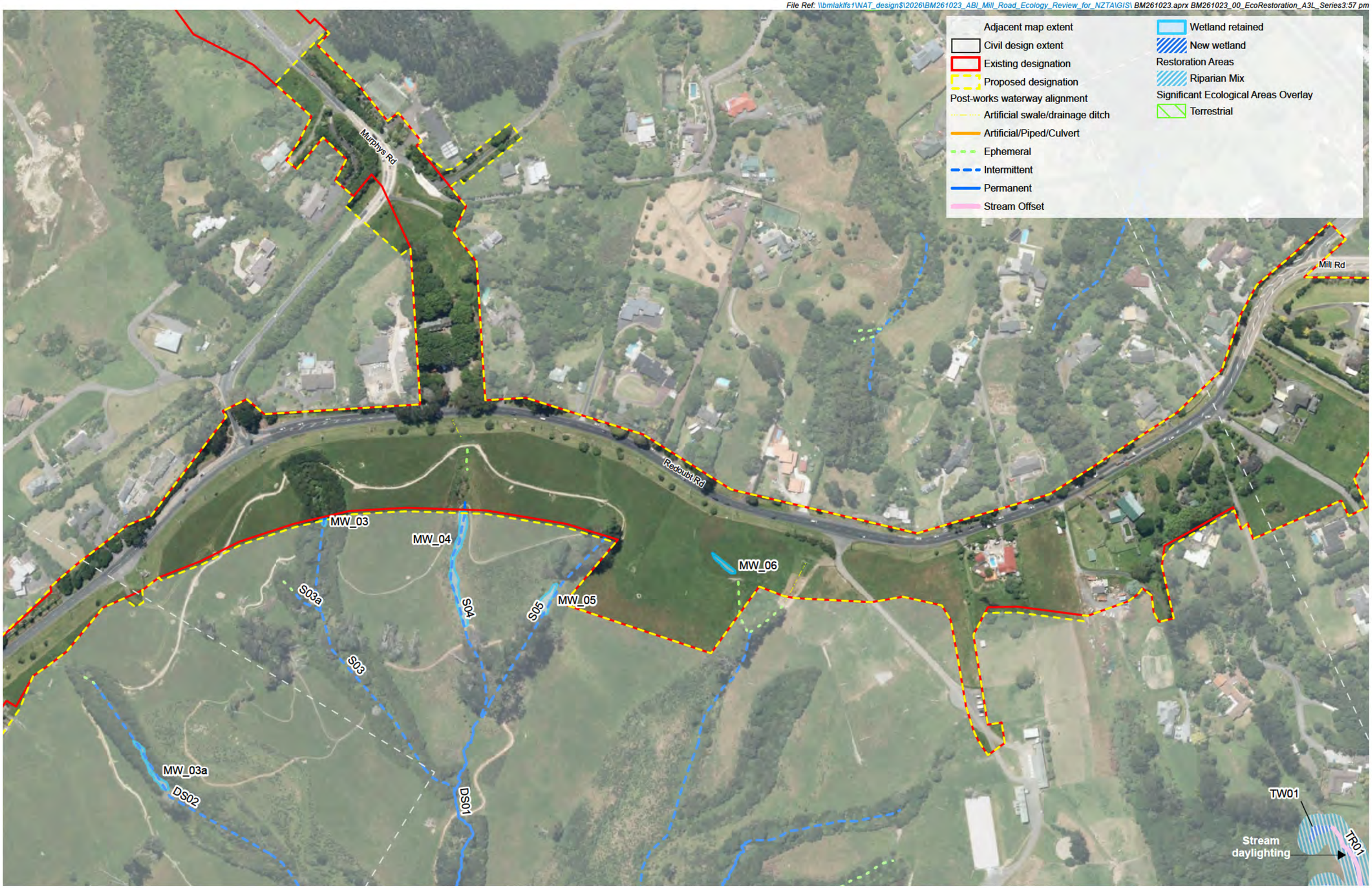
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Project Manager: s9(2)(a) | Drawn: LJa | Checked: ABI

Map 1



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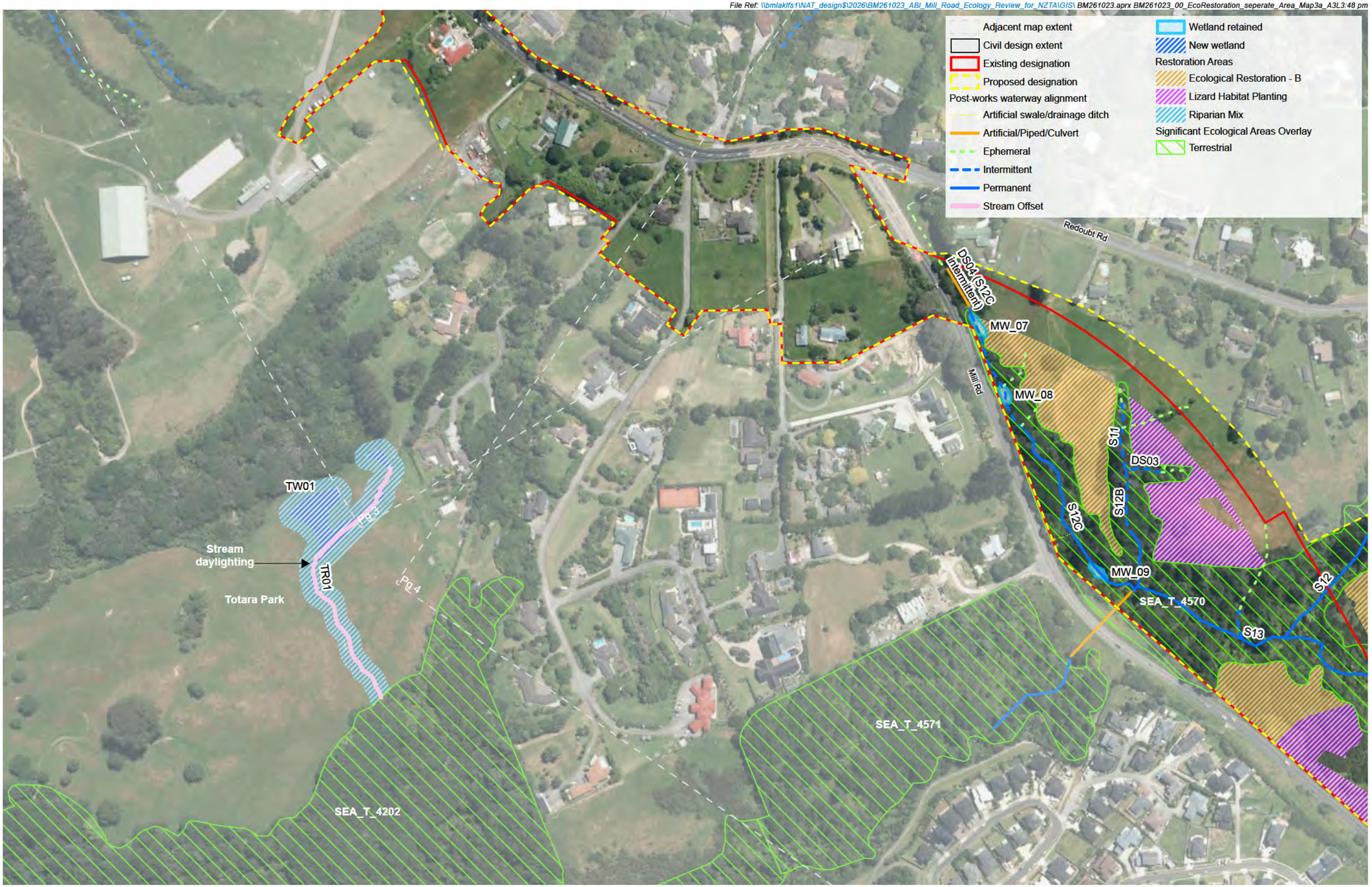
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Map 3



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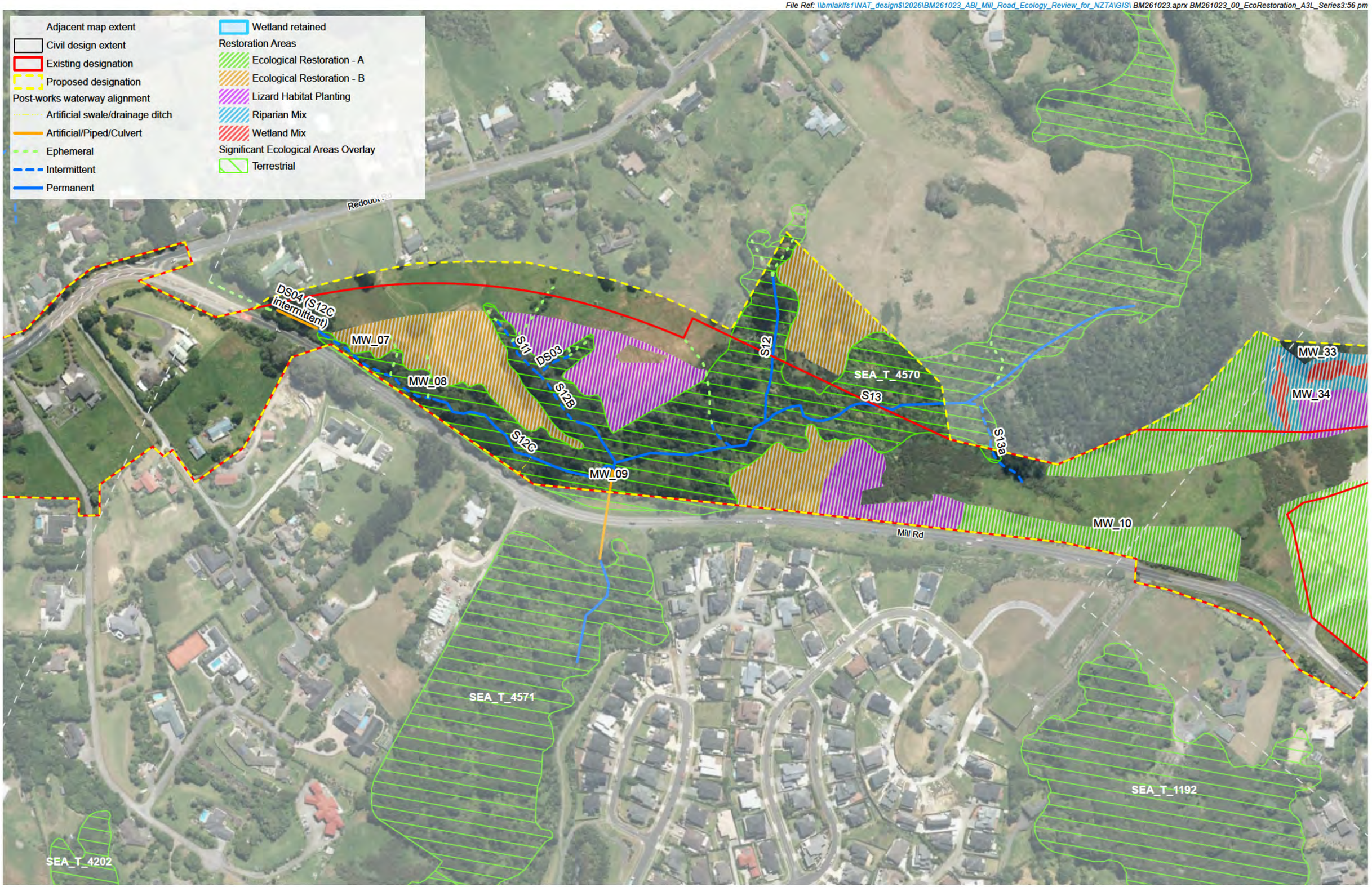
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Map 3a



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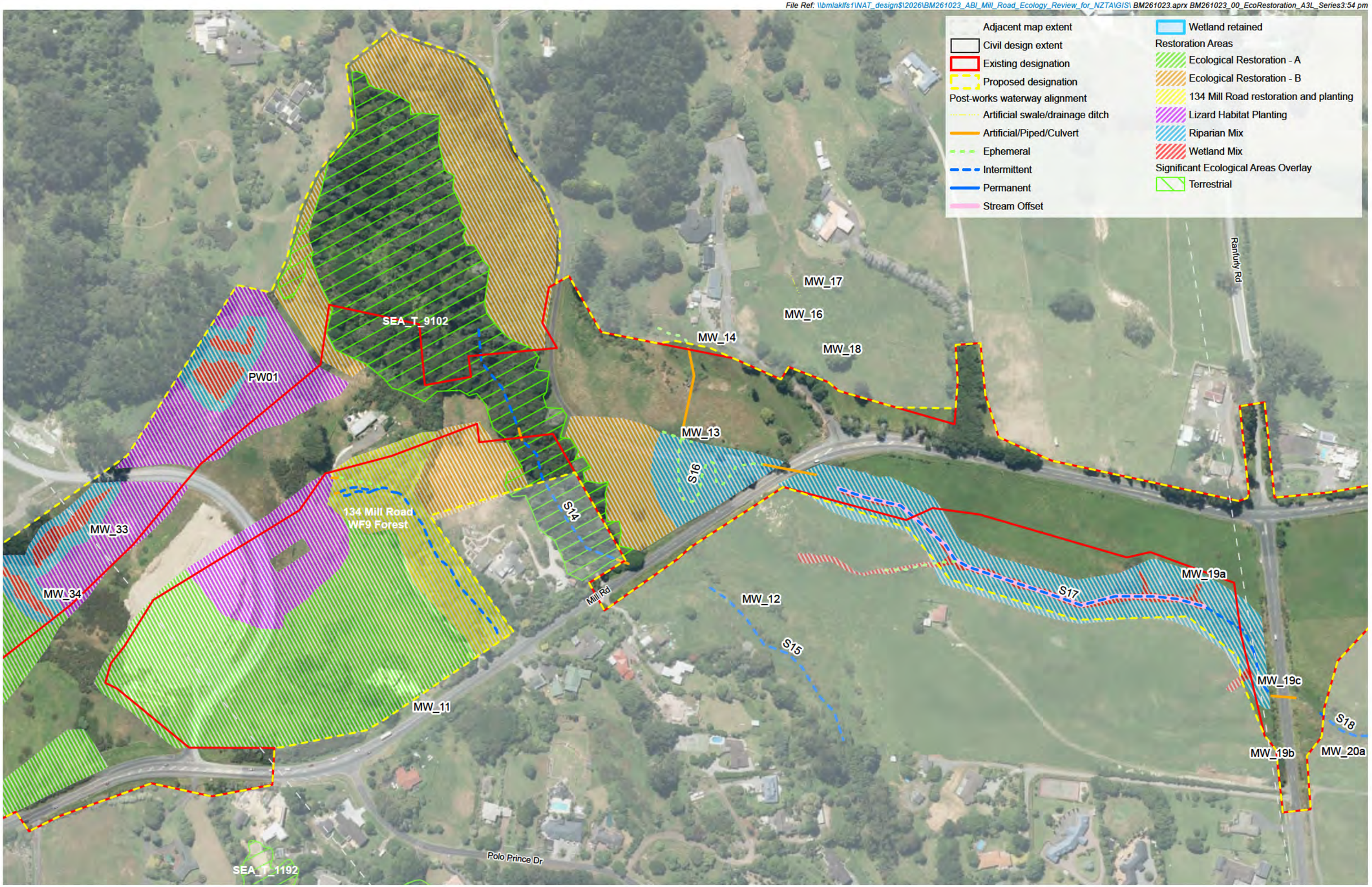
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Map 4

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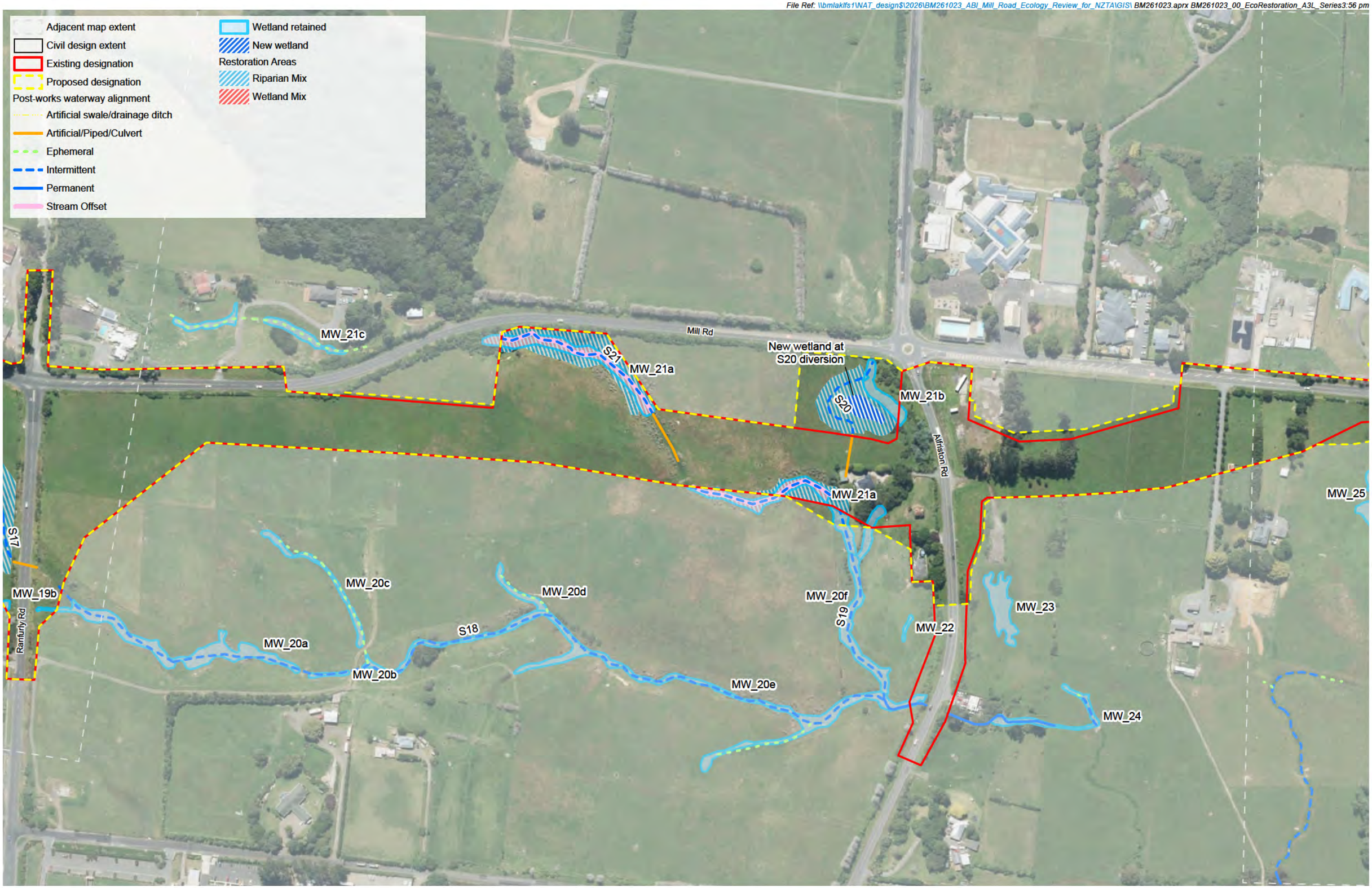
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Map 5



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Map 6



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Map 7