L & K Tylee

Ecological Management Plan
Horahora Subdivision

Bluewattle Ecology
ecological assessment + restoration

TABLE OF CONTENTS

1 Introduction 4
1.1 Background & Scope 4
1.2 Purpose and objectives 6
1.3 Site description 6
2 Bat Management Plan requirements 8
2.1 Summary of findings from previous surveyS – bats and potential roost trees 8
2.2 bat mitigation overview 8
2.3 Definition of a bat ecologist 9
2.4 Prefelling potential roost tree surveys 10
2.4.1 Potential Bat Roost Trees 10
2.4.2 Bioacoustic survey method 11
2.5 Vegetation Removal Protocols during construction 12
2.5.1 Summary of application of tree felling protocols 12
2.5.2 Quality Assurance Check List for Vegetation Removal in Relation to Bats 12
2.5.3 Protection of active roosts and Accidental discovery of a bat 13
2.5.4 Reporting 13
2.6 Minimising Disturbance from Construction Activities 14
2.6.1 Site induction and toolbox meetings 14
2.6.2 Specific construction bat habitat protection standards 15
3 Minimising Harm to native birds and lizards 15
3.1 Lizards 15
3.2 Native birds (avifauna) 16
4 Ecological Restoration and Management Plan Requirements 17
4.1 Habitat creation and enhancement planting 17
4.2 Animal Pest Control 20
4.2.1 Rat and possum control 20
4.2.2 Chemical control 20
4.2.3 Manual control 21
4.2.4 Mustelid control 21
4.2.5 Feral cats 21
4.3 Pest Plants 22
4.4 Planting requirements 25
4.4.1 Restoration planting and species selection 25
4.4.2 Planting Techniques 28
4.4.3 Planting Maintenance 29
Appendix I Tree Felling Protocols 30
Appendix II – Potential bat roost trees Inventory 41
Appendix III Examples of Natural and Artificial Bat Roosts 45

Prepared by: Gerry Kessels & Brenda Bartels

Reviewed by: Rebecca Steenstra (Cogswell)

Version: Final2 020726

PWF Ref: LKT.00680

Contents page photo: Long-tailed bat in flight – with permission from the Department of Conservation

1 INTRODUCTION

1.1 BACKGROUND & SCOPE

L & K Tylee have applied for resource consents to develop a rural-residential subdivision of their c. 45.61 ha riverside property at 597 Horahora Road, Arapuni (Figure 1). The site is a long strip of land, with a flat to gently rolling contour and situated on an elevated terrace along the banks of the Waikato Awa. The eastern extent of the property is bordered by Horahora Road. Bluewattle Ecology was commissioned by L & K Tylee to complete an assessment of ecological effects report to accompany the proposed 73 lot subdivision of their riverside property (Figure 1). Refer to the document "*L & K Tylee - Assessment of Ecological Effects*" [1] (the 'AEE').

This document, being the Ecological Management Plan (EMP), provides the management requirements to mitigate any effects from the subdivision and as recommended by the AEE.

All potential adverse ecological effects can be adequately addressed by applying a number of specific avoidance, remediation, mitigation and compensation measures summarised as follows:

a) Any vegetation removal of mature trees within the construction areas should take place outside of the peak bird breeding season (August to December inclusive) and the period when bats are in torpor (1 May to 1 October). If tree removal cannot be achieved outside of the bird nesting dates, then those areas should be assessed by an appropriately qualified ecologist for nesting birds immediately prior to vegetation removal (this can be undertaken at the same time as the bat pre-felling checks).

b) All housing will be set back from the edge of the Waikato Awa and the associated vegetation to buffer the adverse effects of the development on bats. Creation of 'bat buffer zones' adjacent to key bat habitats with a 20 m width, with an additional 5 m setback to buildings, will be applied to protect foraging and commuting habitats.

c) Any tall vegetation clearance will be minor and will be limited to trees near the road to achieve sight distances or construct access/rights of way. The tree loss will be mitigated by the restoration planting that will be undertaken in the onsite wetland (c.0.75 ha) and the stream link bat corridor (1.05 ha). An additional gully area of 1.437 ha, linking the edge of the Waikato Awa riparian zone and the stream link bat corridor will also be restored. Waikato Awa Details of this restoration and management are contained in section 4.4.

d) The existing vegetation within Lots 15, 63, 16, 17, 18, 19, Lot 20 and 21, will be protected by way of consent notice or covenant. To protect restored habitat in the additional gully area a consent notice will be required for Lots 58, 48 and 29.

e) Pest plant and animal control will be undertaken across the subdivision.

f) Minimising the effects of artificial lights along the edge of the Waikato Awa through low light design with a 0.3 lux and where possible, 2700 Kelvin limit through a consent condition, will prevent light spillover effects from the development.

[1] Bartels, B & Kessels, G. Assessment of Ecological Effects for a subdivision at 597 Horahora Road. For L&K Tylee, Kessels & Associates Ltd (trading as Bluewattle Ecology) – dated 13 August 2026.

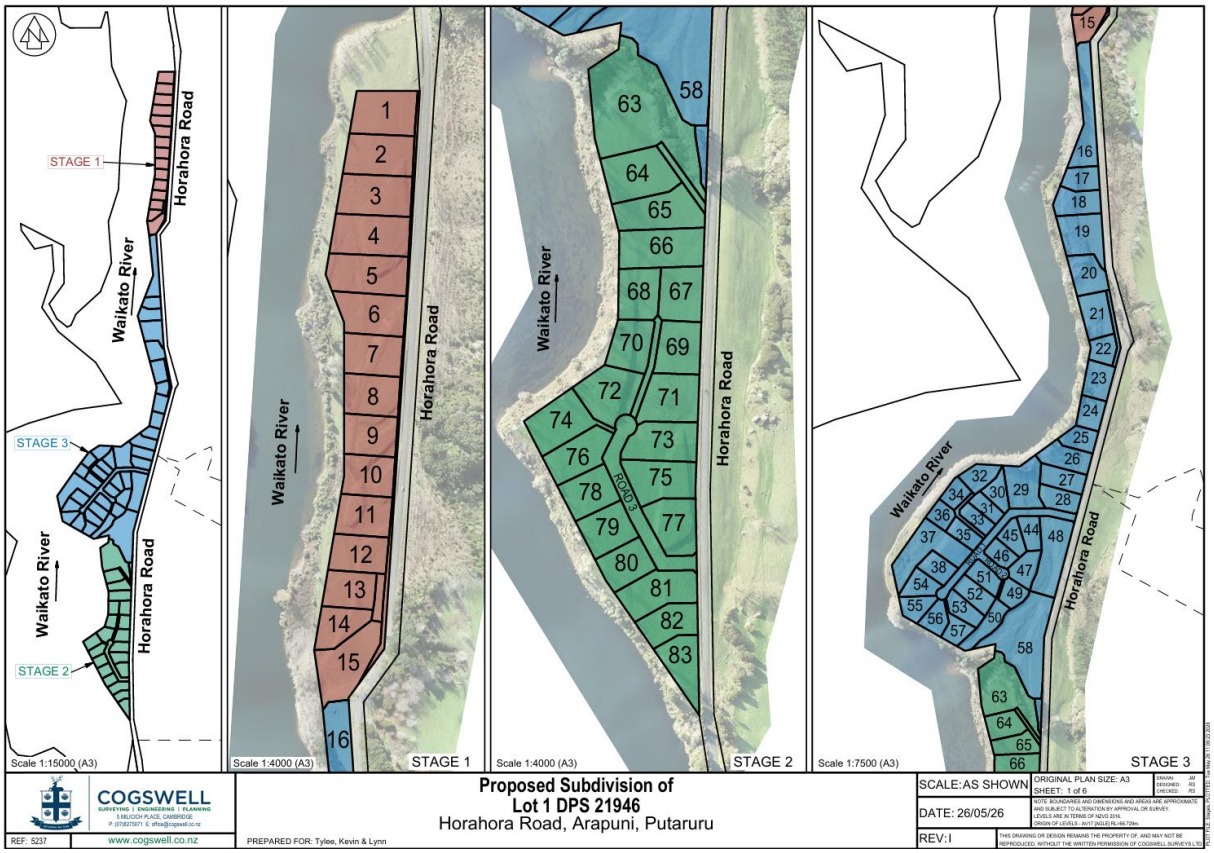


Figure 1: Proposed Subdivision Concept Plan for 597 Horahora Road (supplied by Cogswell Surveys).

1.2 PURPOSE AND OBJECTIVES

The EMP is divided into two parts, the first part includes the details required for a Bat Management Plan (BMP – section 2) and the second part details Ecological Restoration and Management Requirements (ERMR – section 3). Both parts cover the construction, operational, restoration and management activities associated with the Horahora housing development.

Figure 1 defines the area where this EMP shall be applied. The objective of the EMP is to:

I. Apply potential roost tree protocols if potential bat roost trees are found within the earthworks area to minimise the risk of injury or mortality of native birds, bats and lizards (sections 2 and 3);

II. Detail planting specifications and maintenance to enhance long tailed bat, stream and wetland habitat within the site, including maintenance specifications necessary to ensure successful establishment of enhancement plantings (section 4.4); and

III. Identify priority pest plant and pest animal species and measures to control these species sections 4.2 and 4.3).

In addition, restoration planting of the stream link bat corridor, the wetland mosaic and the gully linking the stream link bat corridor gully and the Waikato Awa shall be undertaken with a combined area of c. 3.067 ha (see Figure 2 and section 4.4).

The development will be completed in three Stages (Stages 1-3) as shown in Figure 2. Restoration of the stream link bat corridor and the wetland mosaic shall occur when Stage 1 is developed, to ensure that the new bat foraging and commuting vegetation in the protected areas, is established well ahead of the development affecting bat habitat in High Value habitats and restoration areas in Stages 2 and 3.

1.3 SITE DESCRIPTION

The site is situated on the banks of the Waikato Awa, on an alluvial terrace, and is bordered to the east by Horahora Road. Outside of the property boundary, the landform drops steeply to the edge of the Waikato Awa. An unnamed tributary stream flows beneath Horahora Road, through the site and discharges directly to the awa. This stream was clear and swift flowing, with substrates dominated by sand and gravel.

Vegetation onsite is predominantly short, grazed grasses and herbs, comprising mostly of rye grass, though other exotic grasses and herbs, particularly yarrow, are present. The land is undulating and generally slopes down toward the Waikato Awa. Clusters of mature exotic trees and shrubs are present along the river edge (mostly outside the property boundary), and these areas were dominated by poplar with some pines. The understorey in these areas is comprised mainly of exotic weedy species, rank grass, and the occasional indigenous species. These patches of exotic trees may provide habitat for several indigenous birds, as well as long-tailed bats and lizards, such as copper skink.

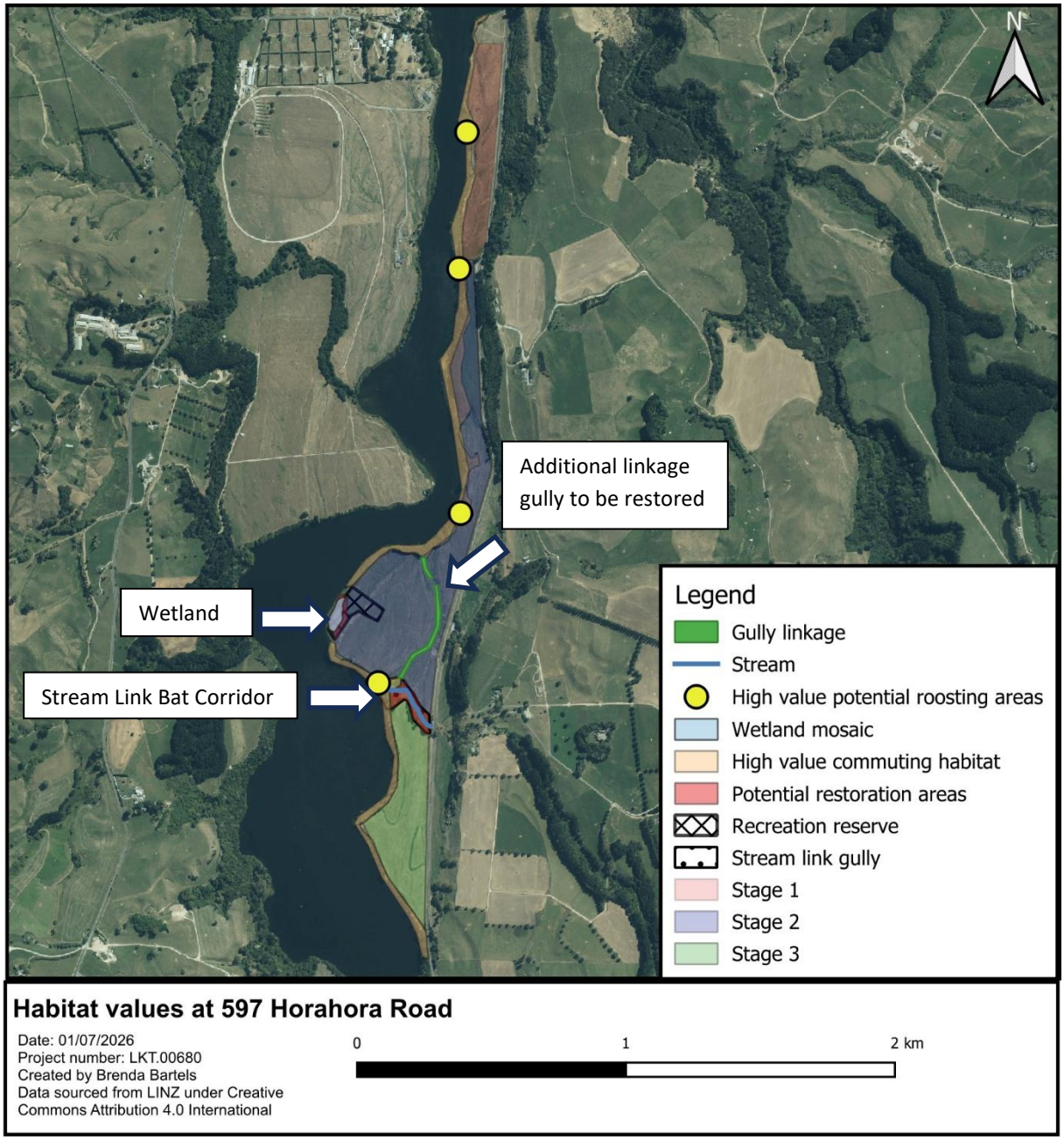


Figure 2: Habitat Values at 597 Horahora Road, which shows the three areas requiring management as part of this EMP, as well as the Stages of development.

2 BAT MANAGEMENT PLAN REQUIREMENTS

2.1 SUMMARY OF FINDINGS FROM PREVIOUS SURVEYS – BATS AND POTENTIAL ROOST TREES

Pekapeka-tou-roa surveys were undertaken in spring 2022 across the proposed site, using four fixed automated bioacoustic bat detectors. The survey highlighted a moderate to high presence of bats across the proposed site, within the vegetated margins of the Waikato Awa, and in mature exotic trees throughout the site.

A total of 4684 bat passes were recorded over 18 nights of surveying, averaging 65 bat passes per ABM per night at three locations. The survey results suggest that the Horahora housing development site is an important area for long tail bats for commuting, roosting and foraging. The areas bats use as habitat are:

1. Waikato River margin habitat adjacent to 597 Horahora Road (predominantly outside of the boundary of the site): Primarily used for commuting and foraging habitat and contains several high and moderate value roost trees. See yellow circles in Figure 8.
2. Stream link bat corridor which is primarily used as foraging and corridor habitat.
3. Potential restoration areas which are primarily used as foraging habitat.
4. Pasture area: bats likely to be flying over the pasture while commuting between habitats and opportunistic foraging. All other areas within the scheme boundaries

A preliminary bat roost survey was undertaken in March 2022, which shows potential bat roost trees within and adjacent to the development site. Seven of those were within the property boundary. Three of those seven trees require a detailed survey to be completed, in accordance with best practice prior to any tree clearance. Refer to section 3.1.1 of the Ecological Assessment for further information.

2.2 BAT MITIGATION OVERVIEW

The approach to bat management on site includes avoiding adverse effects on commuting, foraging and roosting habitat for long-tailed bats. The specific requirements to be implemented in order to minimise adverse effects of the subdivision on bats, throughout the EMP are:

- Implementation of the Department of Conservation's (DOC) tree felling protocols for felling potential bat roost trees.
- Establishment of bat boxes on remaining trees if occupied roosts are found in any of the felled trees.
- Establishment of the high value bat habitat along the property boundary with the Awa, which includes exotic poplar forest with exotic understorey and areas of exotic shrubland. Refer to the green hatched area on the scheme plan. The proposed Bat buffer zone is located adjacent to high value bat habitats (Figure 2), and is a minimum width of 20 m, with an additional 5 m setback to buildings, to protect foraging and commuting habitat for bats. This area currently comprises pasture. Refer to the 25 m bat habitat setback shown on the subdivision scheme plans. This includes 20 m buffer plus the 5 m setback to buildings. The buffer area does not need to be vegetated/planted, provided the below lighting standards are met (refer to section 3 below).

- Requirement for an artificial light spill from housing lights, outdoor lights and streetlights to be at or below 0.3 lux at the outer edge of the 20m bat buffer zone (refer to Figure 1 and Figure 2).
- Protection of the consent notice areas as shown on the scheme plan – refer to areas on Lots 15 to 21 and 63.
- Early planting of new bat foraging and commuting vegetation in the protected areas (Lots 15 to 21 and 63), ahead of development phases
- Design and implement long-term animal pest control within the subdivision and along the river margin; and
- In addition, and outside of the requirements of this EMP, legal measures over each new title will be required which bans the keeping of domestic cats entirely.
- A site induction for all employees and contractors is required to inform them of the specific bat behaviour constraints and habitat use and requirements of the site.

Restoration planting of the stream link bat corridor, the wetland mosaic (within Lot 37 on scheme plan) and the additional gully linking existing habitat shall be undertaken with a combined area of c. 3.067 ha (see Figure 2).

The development will be completed in three Stages (Stages 1-3) as shown in Figure 2. Restoration of the stream link bat corridor and the wetland mosaic shall occur when Stage 1 is developed, to ensure that the new bat foraging and commuting vegetation in the protected areas, is established well ahead of the development affecting bat habitat in High Value habitats and restoration areas in Stages 2 and 3.

2.3 DEFINITION OF A BAT ECOLOGIST

A suitably qualified and experienced bat ecologist (defined as a person who has met the required ethical standards to be registered as a competent, authorised bat worker by the New Zealand Bat Recovery Group for the work which they are undertaking), has prepared this EMP and will be required to provide guidance and ensure compliance with this BMP during the construction and operational; phases of the development.

Only bat ecologists certified by the Department of Conservation as 'authorised competent bat workers' are able to implement the monitoring, roost tree inspection protocols and handling requirements of this EMP – hereafter referred to as the project 'bat ecologist'. A set of competencies has been developed by the NZ Bat Recovery Group to ensure that anyone working with bats is competent to do so.

The competencies referred to in this document which a bat ecologist must have are:

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 NewZealandBats': https://cdn.ymaws.com/www.nzva.org.nz/resource/resmgr/docs/other_resources/Initial_Vet_Care_NZ_Bats. pdf)

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).

2.4 PREFELLING POTENTIAL ROOST TREE SURVEYS

The sections below outline the requirements for potential roost tree surveys, which shall be undertaken before earthworks commence in accordance with best practice in terms of timing, but only if potential roost trees are to be felled during construction of the subdivision.

2.4.1 POTENTIAL BAT ROOST TREES

2.4.1.1 IDENTIFICATION PROTOCOLS FOR ROOST TREES

All trees on site planned to be removed or limbed as part of the construction of the subdivision (exotic or native) with a diameter at breast height (DBH)[2] greater than 15 cm were assessed to confirm if they are either high, moderate or low risk potential bat roost trees before any vegetation clearance occurs within the earthworks and vegetation clearance areas.

2.4.1.2 HIGH-RISK TREES

Trees deemed to pose a high risk as potential bat roosts are those with a DBH greater than 15 cm and exhibiting one or more of the following features:

- Cracks, crevices, cavities, or fractured limbs of sufficient size to accommodate roosting bat(s).
- Sections of loose flaking bark large enough to provide roosting space for bats.
- A hollow trunk, stem, or branches.
- Deadwood within the canopy or stem that is of suitable size to support roost cavities or hollows.
- Presence of bat droppings, grease marks, or urine staining around cavities or ground.

2.4.1.3 MODERATE-RISK TREES

Trees deemed to pose a moderate risk as potential bat roosts are those with a DBH greater than 15 cm and exhibiting one or more of the following features:

- Single trees or small 2-3 clusters of trees that are isolated within an exposed environment surrounded by pasture, lawn or paved surfaces.

[2] Diameter at breast height, or DBH, is a standard method of expressing the diameter of the trunk or bole of a standing tree. DBH is one of the most common dendrometric measurements. DBH is measured at approximately 1.3 m above ground measures form the base of the tree trunk in question.

- Trees that exhibit some, but few and smaller cracks, crevices, cavities, or fractured limbs of sufficient size to accommodate up to 2 roosting bat(s).
- Sections of loose flaking bark large enough to provide roosting space for up to 2 bats.

2.4.1.4 LOW-RISK TREES

All trees with a DBH less than 15 cm, as well as trees with a DBH greater than 15 cm lacking the characteristic features of a high-risk bat roost, are categorised as low-risk trees. These trees can be felled at any time without the need for further assessment or monitoring. However, it is important to note that regardless of trunk diameter, any vegetation demonstrating evidence of roosting bats (e.g., roost features, droppings, grease marks, urine staining) can be treated as a potential roost tree and can be classified accordingly by the bat ecologist on a case-by-case basis.

2.4.2 BIOACOUSTIC SURVEY METHOD

The following outlines the survey methodology to be used for a pre-felling bioacoustic survey before felling of potential roost trees occurs:

- At least one bioacoustic Automated Bat Monitor (ABMs – for example DOC model 'AR4' or other widely accepted bioacoustic bat detection device) shall be deployed at each potential bat roost tree, or when in clustered stands of potential bat roost trees, within 50 m of each tree, for no less than two valid survey nights[3] immediately before felling is scheduled.
- All detectors shall be calibrated to have the same time and date settings (NZST) and pre-set to start monitoring one hour before sunset until one hour after sunrise.
- The distance between detectors of distinct monitoring locations shall be no less than 50 m apart to increase the chance of independent bat monitoring.
- The recorders shall be suspended at least 2 m above the ground to reduce superfluous detections caused by terrestrial insects (usually cicada species).
- The locations of the ABMs shall be tagged and mapped.

A valid survey night is one when weather conditions allow bats to be most likely to be detected: avoiding heavy rain (>10mm/h), and windy (>5.6m/s) or cold (<8°C, ideally >10°C) nights.

[3] See standards to achieve a valid survey night in section 4(b) of the prefelling protocols – Appendix 1

2.5 VEGETATION REMOVAL PROTOCOLS DURING CONSTRUCTION

Before any vegetation clearance occurs within the earthworks and vegetation clearance areas all trees (exotic or native) with a diameter at breath height greater than 15 cm assessed as a high or moderate risk potential bat roost trees will be required to follow the tree felling protocols. The protocols to be followed for investigating removal or limbing of potential bat roost trees are prescribed by the latest version of the New Zealand Department of Conservation's Bat Recovery Group Protocols for minimising the risk of felling bat roosts (Bat Roost Protocols -Version 4: October 2024 is attached as Appendix I).

2.5.1 SUMMARY OF APPLICATION OF TREE FELLING PROTOCOLS

I. ***If High or Moderate Risk potential trees are proposed to be removed, this shall be undertaken in accordance with the protocols outlined in Appendix I.***

II. ***High or Moderate Risk potential bat roost trees can only be felled using these protocols between the 1st of October to the 30th of April in any one calendar year.***

III. ***These protocols shall not be required if only Low Risk potential roost trees are found on site. Low Risk trees can be felled at any time with no further input form a bat ecologist.***

IV. ***The pre-felling vegetation assessments, utilising either acoustic and/or visual methods (refer to tree felling protocols in Appendix I for specific details), must be carried out exclusively by a bat ecologist who holds appropriate certification from DOC and possesses demonstrated competence in the chosen method.***

V. ***No trees or vegetation identified as potential roosts can be felled or cleared without obtaining explicit prior approval from the bat ecologist.***

2.5.2 QUALITY ASSURANCE CHECK LIST FOR VEGETATION REMOVAL IN RELATION TO BATS

Quality Assurance and Seasonal Restrictions Check List as summarised in Figure 3):

a) The felling of potential roost trees can only be undertaken between the 1st of October to the 30th of April in any one calendar year.

b) The tree removal protocols will apply to all trees, tree ferns and other vegetation ≥15 cm DBH, that meet the criteria for a potential bat roost defined as a tree which provides features that are able to be used for bat roosting proposed to be removed anywhere on the development site – exotic or native (see section 2.5.1).

c) No trees or associated vegetation identified as potential roosts can be felled or cleared without the approval of the bat ecologist.

d) Prior to the commencement of pre-felling surveys, all ABMs shall be tested to ensure they are not faulty. This can be achieved using DOC Bat recorder tester v0.1 application or at a site where bat activity is known to be high. Faulty or suspect ABMs are not to be deployed;

e) Roost habitat assessments can be undertaken at any time of year; and

f) Once the results of the visual surveys and ABM data have been reviewed by the bat ecologist the following communication procedures shall be implemented:

i. If no bats are sighted or detected, the affected tree(s) and/or vegetation to be removed under direct supervision of the bat ecologist in accordance with relevant protocols set out in Appendix I of this EMP.

ii. If bats are sighted or detected within and/or emerging or entering a tree, the bat ecologist shall call the vegetation clearance supervisor to inform them that the affected tree(s) cannot be cleared. The bat ecologist will advise on the requirements for the next steps in accordance with the relevant protocols set out in Appendix I.

2.5.3 PROTECTION OF ACTIVE ROOSTS AND ACCIDENTAL DISCOVERY OF A BAT

If during the implementation of the EMP or an accidental discovery of a roost active/occupied roost is confirmed, the following actions shall be undertaken:

a) The immediate area shall be cordoned off with safety fencing and signage erected in a 25 m radius around the roost, alerting any person approaching the area that a bat roost is present and to stay clear.

a) The existence of the roost will be publicised to all works staff and work instructions for the immediate area will be updated to reflect the presence of the roost and the measures to minimise disturbance.

b) No work will take place within 25 m of the occupied roost from one hour before dusk to one hour after dawn until a specific site roost disturbance minimisation plan is devised by the bat ecologist.

c) The bat ecologist shall keep a written record (including photos) of any vegetation containing bat roosts 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; then number of bats present; and

d) Re-consider again whether the tree must be felled and design and implement appropriate additional mitigation measures required to offset or compensate for the loss of the occupied roost tree if it is required to be removed.

Where the tree requires felling and before the tree can be felled, evidence that bats have vacated the roost shall be confirmed by (as a minimum):

a) ABM surveys must continue until no bat activity is recorded for at least two consecutive valid survey nights; and

b) Visual inspections (including thermal imagery) and roost watch methodologies described in Appendix 1 shall be carried out to confirm the non-occupancy of the roost.

Appendix 1 of the BMP outlines the notification and harm minimisation processes which must be adhered to in the event of a disabled, injured or dead bat found during any vegetation clearance occurring on site, irrespective of whether the clearance is in accordance the BMP or not.

2.5.4 REPORTING

The results of the bat roost protocol implementation will be reported in a completion/compliance report in the form of a letter or memorandum, submitted within 15 working days following the completion of vegetation clearance. The report will include details of the potential bat roost trees monitored including the size, location and type of potential roost trees or vegetation as well as weather

data during bat roost protocol implementation. The results of all pre- and post-clearance survey effort shall be submitted to DOC for inclusion to the national bat distribution database.

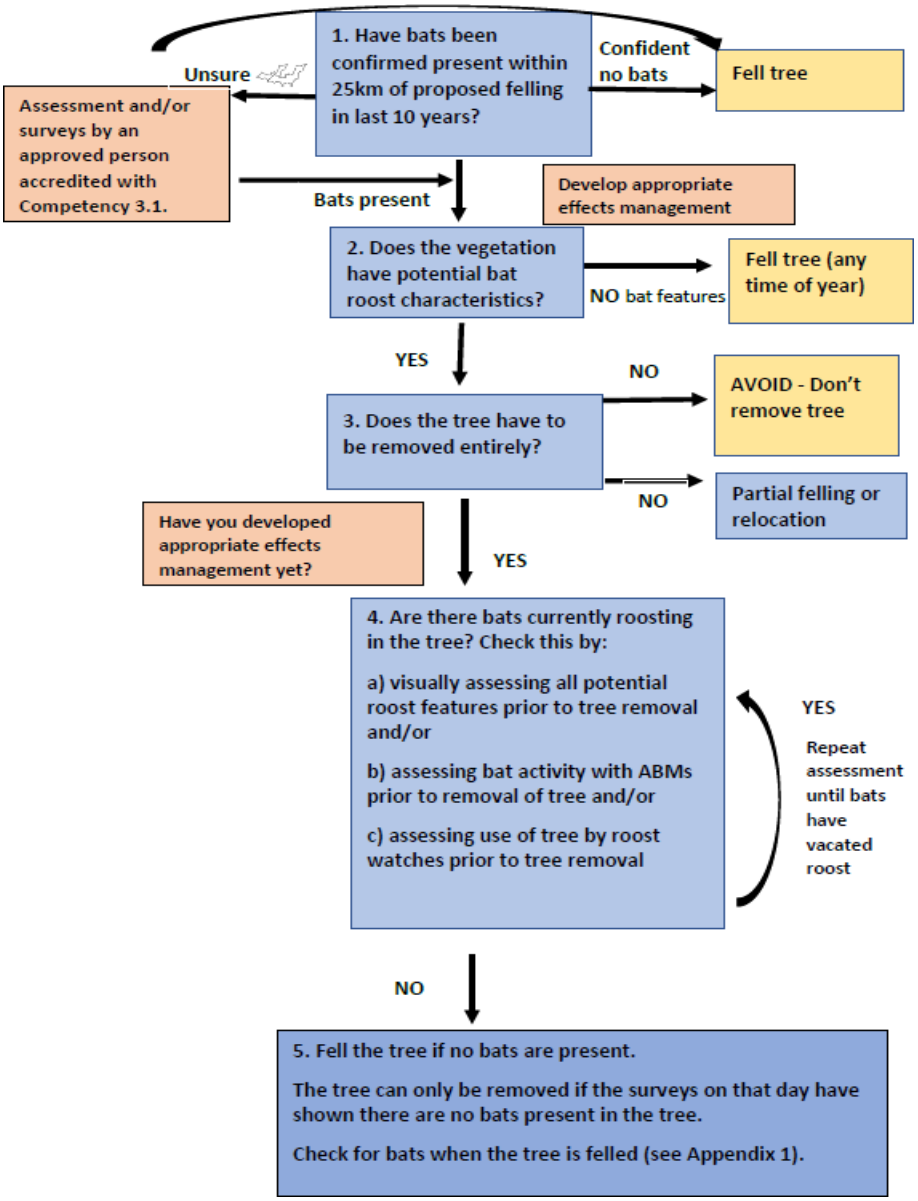


Figure 3. Steps for tree removal when applying the potential bat roost tree protocols

2.6 MINIMISING DISTURBANCE FROM CONSTRUCTION ACTIVITIES

2.6.1 SITE INDUCTION AND TOOLBOX MEETINGS

A site induction for all employees and contractors is required to inform them of the specific bat behaviour constraints and habitat use and requirements of the site. This should be completed prior to works commencing on the site and a record of inductions kept. This induction can either be stand-alone or integrated into the typical health and safety induction process. This induction should include, at a minimum:

- Vegetation removal and accidental bat discovery protocols.
- Procedures for the accidental discovery of long-tailed bats inside work areas.
- The importance of compliance with the protocols and the reporting processes for observed breaches of required potential bat roost tree removal protocols.

- Contact details for the bat ecologist, environmental compliance staff, and emergency numbers for any identified issues observed onsite.

2.6.2 SPECIFIC CONSTRUCTION BAT HABITAT PROTECTION STANDARDS

2.6.2.1 SPECIFIC ENABLING AND CONSTRUCTION WORK RESTRICTIONS

a) Enabling Works and Construction Works shall be actively managed to avoid or otherwise remedy or mitigate any off-site nuisance effects caused by dust, debris, silt laden runoff, light or vibration adjacent to the Waikato Awa.

b) Security lighting associated with Construction Works shall not be located within 40 m of the Waikato Awa and shall be located to avoid spill of light exceeding 0.1 lux above the natural ambient illuminance between Civil Dusk and Civil Dawn measured in a vertical plane within 3 m of the boundary within this 40 m boundary.

2.6.2.2 TIMING

Should an occupied bat roost site be discovered on site, there will be a need to schedule construction activities to avoid sensitive periods for bat activity, such as breeding seasons when the pups are non-volant (November-December) or during torpor periods (March-October), and/or create a 25 m works exclusion buffer zone.

3 MINIMISING HARM TO NATIVE BIRDS AND LIZARDS

3.1 LIZARDS

Native lizards are absolutely protected under the Wildlife Act 1953.

Previous surveys across the site did not discover copper skinks. Due to the land use, active grazing management and expected presence of a healthy predator population, copper skinks are unlikely to be discovered easily.

Therefore, no specific lizard survey, salvage or translocation protocols are considered necessary.

However, the following accidental discovery protocols shall apply should lizards be discovered during construction.

Should any lizards be detected incidentally within cleared vegetation an exclusion area (10 m radius) with clear signage will be established around the area an ecologist contacted to further search the area. Any further vegetation clearance works will cease within the exclusion area until the area has been cleared for vegetation removal by a qualified ecologist.

All injured lizards, if found, shall be transported by a qualified ecologist to the nearest suitable veterinarian experienced in indigenous wildlife rehabilitation. Contact details of a DOC approved vet are to be confirmed before the start of any vegetation removal works. If no DOC approved vet is available, the lizard is to be taken immediately to Hamilton Zoo for examination: Hamilton Zoo, 183 Brymer Road, Hamilton 3289; phone 07 838 6720.

Vets must euthanise lizards whose injuries are causing suffering and are not likely to heal sufficiently to allow rehabilitation and return to the wild.

3.2 NATIVE BIRDS (AVIFAUNA)

Vegetation clearance between October to April conflicts with the need to minimise the risk of harming native birds. All vegetation clearance should follow the protocols outlined below to minimize harm to nesting native birds during this time.

All adult avifauna are expected to disperse from the area during vegetation clearance activities, and therefore are unlikely to be harmed. However, during breeding season, there is a potential that vegetation clearance may have a direct impact on nests, eggs, and chicks. To avoid potential impacts on any active nesting native avifauna from the development, all areas to be impacted by proposed vegetation clearance will be searched for nesting birds by a suitably qualified ecologist.

Following the demarcation of vegetation to be cleared the following survey steps should be employed to survey for nesting native birds:

- Visually survey (with the use of binoculars where appropriate) the location of clearance directly for the presence of nests including any areas of vegetation be retained but within 10m of the boundary of vegetation clearance.
  - Observe location for adult birds showing either site fidelity or returning to specific locations within vegetation.
  - Listen for adult birds or fledglings in vegetation.

Once this survey is complete the ecologist onsite should communicate with the construction team onsite and confirm either:

- no nests have been found and vegetation clearance should proceed immediately under ecologist supervision. If nesting birds are discovered during clearance the protocols outlined in Section 3.3 should be followed; or
- a nest has been observed and the protocols outlined below should be followed.

An exclusion zone of 10 m radius will be established around any active native bird nesting sites with clear signage established to alert all personnel in the vicinity of nesting sites. Vegetation clearance and any other construction related activities will cease within the exclusion area. Works can commence once nesting is complete (i.e. chicks are fledged and have left the nest permanently) or nests are naturally abandoned. Nesting completion will be determined by periodic survey by the site ecologist. This should be, if possible, from a distance.

If a nest of an At-Risk or Threatened species is discovered the ecologist onsite must consider whether 10 m exclusion radius is likely to be sufficient to avoid nest abandonment and should have the ability to decide upon an appropriate exclusion zone where 10 m is not sufficient.

During the nesting period no personnel or machinery may enter the 10 m exclusion zone. In the event where this exclusion zone covers a required access route for other work areas the ecologist should determine the risk of the allowance of personnel and/or machinery in the exclusion zone and determine necessary controls for movement in the exclusion zone if appropriate. These controls may include but not be limited to limitations on the time of day activity may occur, number of movements, and/or types of equipment able to transit the zone.

Injured native birds, if encountered during construction works should be immediately taken to a vet approved by DOC. Contact details of a DOC approved vet are to be confirmed before the start of any bird nesting surveys and vegetation removal works. If no DOC approved vet is available, the birds are to be taken immediately to Hamilton Zoo for examination: Hamilton Zoo 183 Brymer Road, Hamilton 3289; phone 07 838 6720.

Injured birds are to be transported in a clean, cool, dark, ventilated, material-lined bag/box. The transportation environment should be quite (avoid loud noises, conservations etc). If more than one injured bird is encountered at the same time, the birds shall be transported in separate boxes. All holding containers should be closed to stop birds escaping, and of appropriate size to prevent the bird from moving too much (e.g. flapping wings) and potentially injuring itself further. Implementing these measures should minimise stress, overheating and additional injury of the birds . Vets must euthanise birds whose injuries are causing suffering and are not likely to heal sufficiently to allow rehabilitation and return to the wild.

Any injured or dead native bird encountered (or euthanised by the vet) should be reported to DOC on 0800 DOC HOT (0800 362 468).

4 ECOLOGICAL RESTORATION AND MANAGEMENT PLAN REQUIREMENTS

4.1 HABITAT CREATION AND ENHANCEMENT PLANTING

Several natural features on the property that are proposed for restoration and management, to manage and offset the potential adverse effects of the proposed subdivision. These areas include the creation of 'bat buffer zones' adjacent to key bat habitats, at least 20 m in width, with a 5 m setback to buildings, to be implemented to protect foraging and commuting habitats. In addition to this the proposal includes consent notice areas. Figures 4, 5, 6, 7 and 8 below shows the location of these consent notice areas and the extent of the 20m wide bat buffer and 5 m building set back (25 m total illustrated). The restoration planting of the stream link bat corridor, the wetland mosaic and the additional linkage gully have a combined area of c. 3.067 ha.

This ERMP outlines the objectives and implementation methods required to restore and manage the overall ecological condition of the natural features, to achieve this, the following key management measures are required:

I. Areas 'AH', 'BA-BH', 'D', 'E', 'F', 'G', 'H', 'AI', 'O' to be protected with a consent notice.

II. *Planting within the site to enhance long tailed bat, stream and wetland habitat within the site.*

III. Maintenance shall continue until plantings have reached sufficient maturity to be largely self-sustaining and have reached 80% canopy closure for all ecosystem types. The survival rate shall ensure a minimum 90% of the original density and species.

IV. *Identify pest plant and animal species to be controlled and maintenance specifications necessary to ensure successful establishment of enhancement plantings.*

A successful restoration project requires a sequence of actions to be carried out. The site needs to be prepared properly, and the plants need to be put into the ground at a time of year when they are able to get maximum root growth before the weather becomes hotter and drier and the soils start to dry out. The planted site needs to be managed over subsequent years to enable the planted native species to overcome early competition from environmental weeds. Good weed management in the first few

years of a planting project, combined with a planting designed to rapidly establish a closed canopy, is an essential ingredient for a successful project.

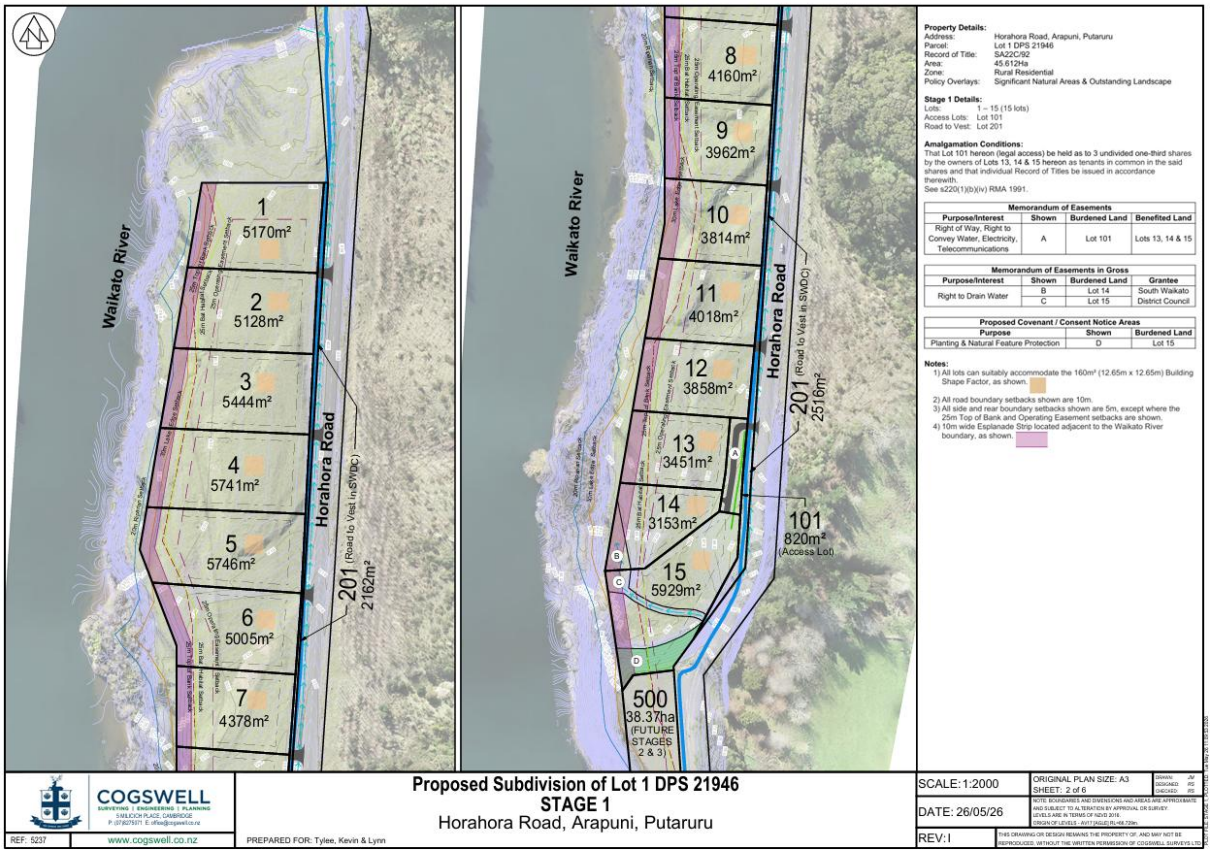


Figure 4. Stage 1 Scheme Plan

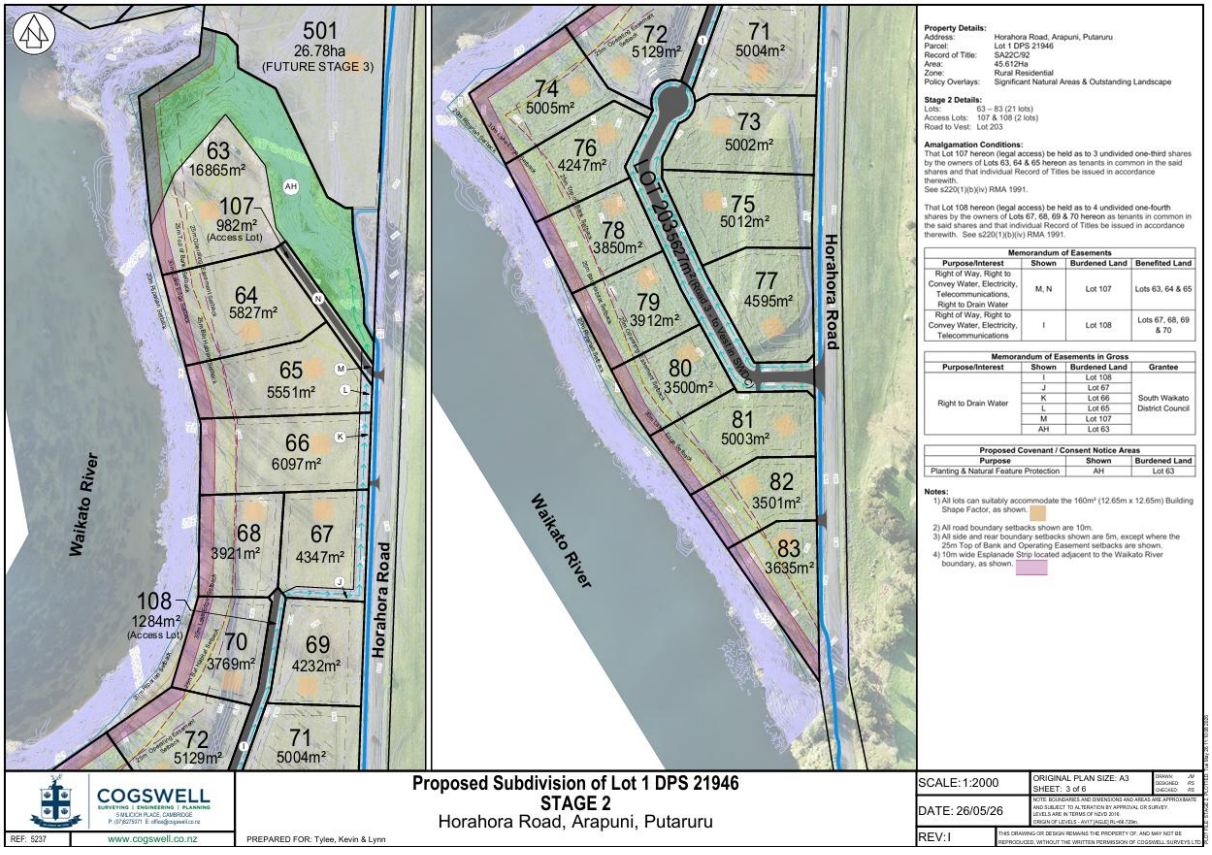


Figure 5. Stage 2 Scheme Plan.

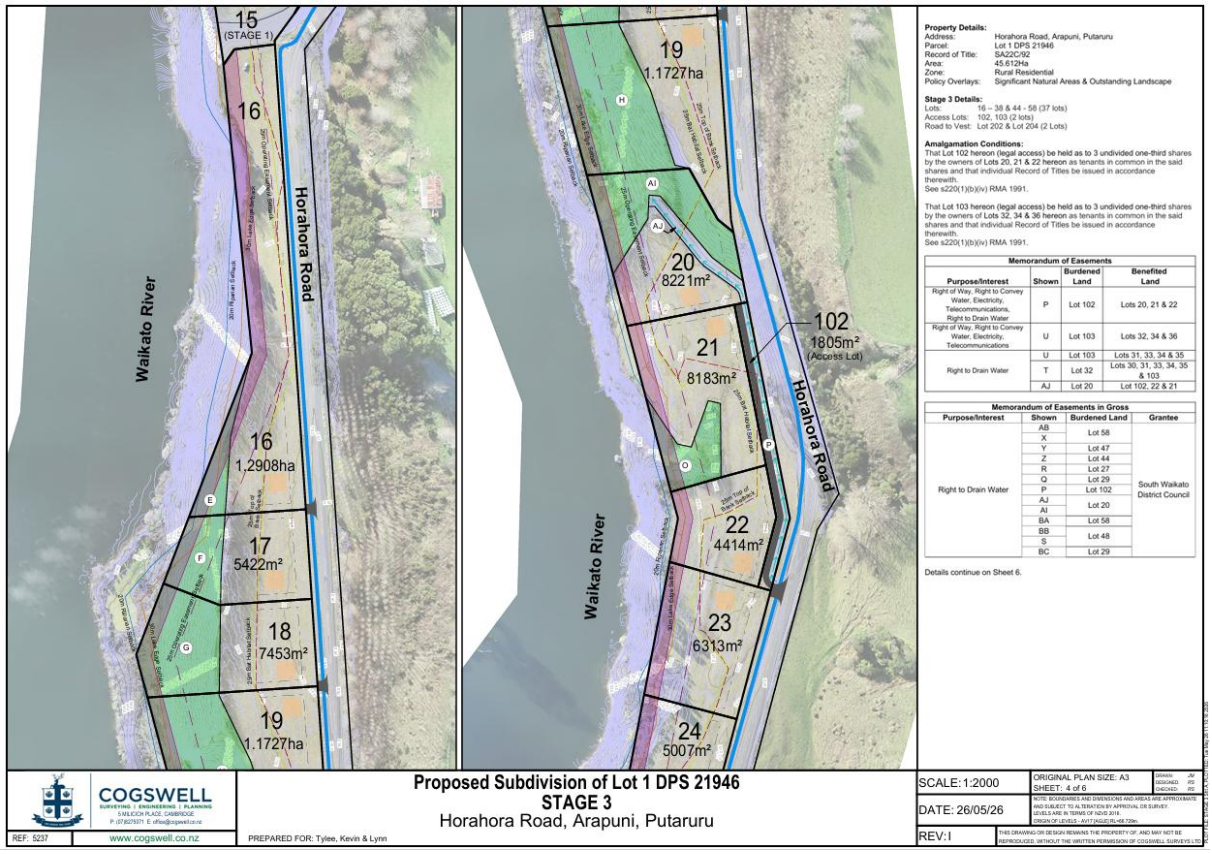


Figure 6. Stage 3 Scheme Plan.

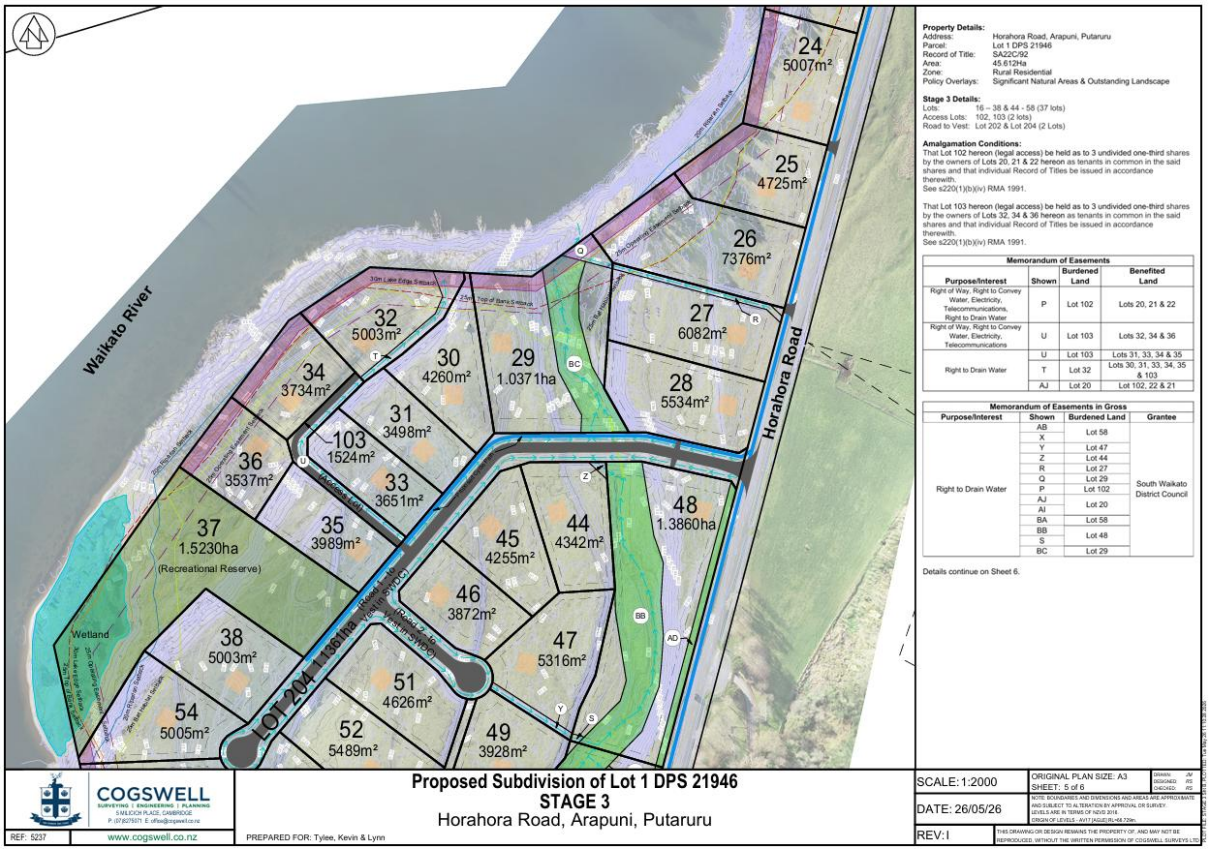


Figure 7. Stage 3 Scheme Plan continued.

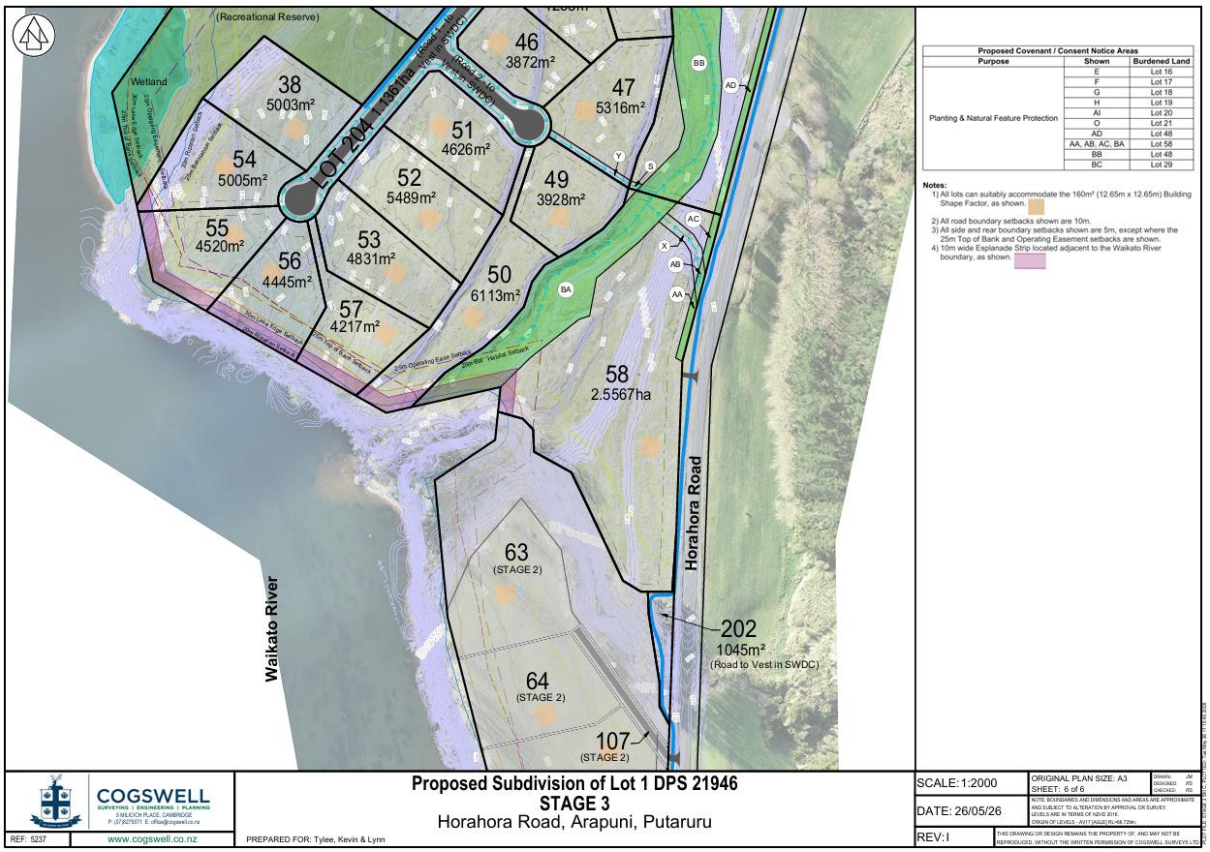


Figure 8. Stage 3 Scheme Plan additional.

4.2 ANIMAL PEST CONTROL

The aim of pest animal control is to reduce the numbers of both predatory and browsing animal pests. Reducing numbers of browsing pests within the vicinity of the site will prevent browse of palatable newly planted species during early establishment, increase survival, and reduce the threat of successional disruption and the introduction of pest plants and pathogens. Control of predatory pests will improve the survival of long tailed bats potentially using the Awa and its margins for roosting.

All pest animal control activities will be undertaken by suitably experienced and qualified professionals. Animal pests will be managed via a combination of kill trapping and poison in contained 'bait stations'.

4.2.1 RAT AND POSSUM CONTROL

An animal pest control plan shall be implemented to keep rats and possums at low levels. This may comprise chemical (e.g. bait stations) and/or manual control (e.g. traps and shooting) as detailed below. Note that these requirements cover all restoration areas.

4.2.2 CHEMICAL CONTROL

Rats and possums can be controlled with bait stations containing pindone, brodifacoum (Pestoff®) or cholecalciferol. The Philproof® bait station is suitable for possums and rats. Place bait stations around natural area margins and through the centre of the larger areas to ensure they are spaced 50 m apart. Fill stations with suitable/safe toxin once and refill four weeks later. This is called 'pulse feeding' – because these baits are slow-acting, possums will consume more than is necessary if stations are refilled more often. Baiting can be done throughout the year, but possums are hungrier in winter.

Four pulses per year are recommended (Aug, Nov, Jan and April). These can be deployed on the inside of posts along the fence line.

'Pulsing' bait fill in stations will maximise bait take and lower pest animal densities enough for birds and other fauna to thrive. This means filling them 3-4 times over a 4-6 week period (depending on bait take). Pulsing before and after winter, when other food sources in the environment are low, is key to restricting opportunities for pests to breed. Take extra care using poisons if you have pet or working dogs free-ranging on the property.

4.2.3 MANUAL CONTROL

Kill traps can be used to control pest mammals but require more regular checking and re-setting than bait stations. Single set traps will need to be checked and rebaited weekly at first (especially for rats) until the catch rate comes down significantly. Following this initial blitz, trapping intervals can be extended to fortnightly during the spring and summer months and at least monthly for the rest of the year. An increase in catch rates indicates the need for more frequent trapping.

Rat traps shall be placed at a density of two per hectare, spaced at 50 m intervals. Possum traps shall be placed at a density of one per hectare, spaced at 100 m intervals. Bait for manual traps should be species-specific and replaced regularly. Rat traps can be baited with peanut butter while possum traps are most effective when baited with a mix of cinnamon, icing sugar and flour. Goodnature® (A12s and A24s) or NZ Auto Traps (AT220s) self-resetting traps can be used to minimise the effort required. The AT220's work very well however their initial set-up cost is higher than bait stations and other types of kill trap.

4.2.4 MUSTELID CONTROL

The best time to trap mustelids is during late spring and summer. Mustelids often follow pre-existing tracks or natural linear features with low vegetation, such as stock tracks, or along stream banks. Mustelids will investigate any tunnels and burrows encountered while hunting, and trap tunnels or covers should be used to cover the set traps. This will also prevent the capture of non-target birds and animals.

The DOC 150® and DOC 200® series traps are well proven in trapping small mustelids and rats. The larger DOC 250® is also able to trap larger ferrets. A self-setting alternative for trapping small mustelids (stoats and weasels) is the Goodnature A24® rat and stoat trap. Allow a minimum of one mustelid trap per hectare (Table 1). Setting appropriately spaced bait lines that run through the area of indigenous vegetation is another alternative setup. Bait traps with fresh fish, poultry, rabbit or an egg for mustelids. Never wash traps after they have caught a mustelid, as the scent left by the captured animal will attract others, acting as a natural lure. Check and re-bait traps fortnightly during summer and monthly during winter.

4.2.5 FERAL CATS

Cats are cautious by nature and not easily trapped. Where feral cats appear to be frequenting these areas live capture box traps may be used to capture feral cats these need to be checked daily for legal purposes. Any captured cats should be humanly euthanised as soon as possible. Baits such as fresh fish, poultry, rabbit, or simply cat food may be used to lure feral cats into the live capture trap. Live capture traps are legally required to be checked no more than 12 hours after sunrise each day.

4.3 PEST PLANTS

Pest plants can outcompete, smother, and inhibit the growth of native species, typically by competing for space and resources. Table 2 presents information on priorities for control of plant pests. The Waikato Regional Pest Management Plan (WRPMP) 2022 - 2032[4] outlines the regional council's priorities and strategies in managing invasive, exotic plant species. Those plant species listed in the WRPMP have been classified based on their actual or potential adverse impacts on the environment.

The priority for pest plant control is to remove those species that have the potential to alter or disturb natural processes in established native vegetation or prevent establishment of native vegetation. Priorities for weed control have been provided in Table 1. Control methodologies described in Table 1 and are based on general best practice for minimal ecological impact. The control method depends on the species and the extent of infestation, with spraying limited to the control of dense and large infestations only. Chemical and manual weed control should be carried out in accordance with NZS8409:2004 Management of Agrichemicals as stated in Section 19 Rule 19.4.2.4(c) of the Waipa District Plan. For further information on control methodologies see weedbusters.org.nz. Control practices shall aim to reduce weed species to low levels. Weed control is far more effective during summer months and should be carried out when no significant rainfall is predicted for the following days. Once pest plant control is started it is important that regular checks are made (every 3-6 months) to monitor the effectiveness of the control and to look for new invasions.

4.3.1.1 HERBICIDE USE

When working with herbicides always follow manufacturer's instructions regarding mixing and application and ensure that any additives are compatible with the herbicide used. Note that only herbicides certified for use over water should be used near stream or wetland habitat. Note that residual herbicides containing metsulfuron-methyl, picloram or aminopyralid (i.e. Tordon Brushkiller XT) should be avoided close to desirable plant species. Care will need to be taken to protect new plantings or naturally regenerating plants from herbicides.

[4] Waikato Regional Council 2022: Waikato Regional Pest Management Plan 2022-2032, Hamilton, 203 p.

Table 1: Pest plant species and priorities and methods for control. Cell colour shows the priority for control: red is high, orange is medium and yellow is low.

Common name	Botanical name	RPMS Designation	Location & notes	Control method
Privet	*Ligustrum lucidium L.sinense*	Site-led (Wetlands) – Chinese privet only	Scattered in stream link bat corridor gully and along the Waikato Awa edge.	Small seedlings and saplings can be hand pulled. For larger specimens cut and paint stump or drill and poison with metsulfuron-methyl 600g/kg (1g/L) or 25% 360g/L glyphosate solution.
Blackberry	*Rubus fruticosus agg.*	Site-led – Wetland Prevent spread and minimise impacts on high biodiversity sites	Blackberry was observed in most areas, with small fragments also observed within pasture.	Small patches (year round): Either dig out root crowns and rhizomes, or cut stems and apply glyphosate (400 ml/L) to stumps. Dispose of plant material appropriately. Large patches (summer - autumn): Spray with metsulfuron-methyl (7.5 g/15 L) or triclopyr (60 ml/15 L). Be aware that spraying is only effective before leaves become brittle. Spray at least six months before planting to allow adequate time for the residual herbicide to break down.
Bindweed	*Convolvulus*	Not listed in WRPMP	Observed in poplar forest .	Physical removal: Hand pull, dig out roots (all year round). Dispose of plant material at a landfill or refuse transfer station. Cut and paste: Cut the stem/trunk as close to the ground as possible and cover the entire stump with herbicide as soon as possible after cutting. Apply metsulfuron gel (10g/L strength). Foliar spray - Apply metsulfuron herbicide at a rate of 0.5g/L using a hand held sprayer/knapsack. Use the recommended adjuvant shown on the label.
Pampas	*Cortaderia sp.*	Sustained control – Production and Environmental pest	Few plants in the stream link bat corridor gully.	Hand pull or dig out the plant to ensure all of the plant crown is removed. Foliar spray early spring to mid-summer when plants are actively growing (and before the plants produce flowers in autumn). Apply Glyphosate (360 g/L active ingredient) herbicide at 10ml/L plus organosilicone penetrant 2ml/L to cover entire plant. Note: Glyphosate overspray will kill other (desirable) plants.
Himalayan honeysuckle	*Leycesteria formosa*	Not listed in WRPMP	Scattered in stream link bat corridor gully and along the Waikato Awa edge.	Small plants can be hand pulled and disposed of at a refuse centre, burned or deeply buried. Larger plants climbing up on desired species shall be cut and the stumps painted immediately after cutting with metsulfuron-methyl 600g/kg (5 g /L) or a product containing 100g picloram+300g triclopyr/L (200ml/L) (e.g. Tordon Brushkiller XT®) or picloram gel. Leave cut vines in trees to die. Regrowth can be sprayed with metsulfuron-methyl 600g/kg (2g/10L + penetrant).

Common name	Botanical name	RPMS Designation	Location & notes	Control method
Barberry	*Berberis glaucocarpa*	Not listed in WRPMP	Scattered along the Waikato Awa.	Spray spring-autumn with glyphosate (10ml/L). Cut or frill and saturate immediately with glyphosate (200ml/L) or metsulfuron-methyl 600g/kg (5g/L + penetrant)
Buddleia	*Buddleja davidii*	Not listed in WRPMP	Scattered in stream link bat corridor gully and along the Waikato Awa edge.	Handpull seedlings and small plants. Cut and paste - Cut the stem/trunk as close to the ground as possible and cover the entire stump with herbicide as soon as possible after cutting. Apply glyphosate gel (120g/L strength). Foliar spray - Apply herbicide using a handheld sprayer/knapsack to plants <1m tall or gun and hose for larger infestations. Use the label recommended adjuvant. Apply glyphosate (360 g/L active ingredient) herbicide at 20ml/L plus organosilicone penetrant (2ml/L) to cover entire plant.
Cherry tree	*Prunus sp.*	Not listed in WRPMP	Scattered along the Waikato Awa.	Handpull seedlings and small plants. Cut or frill and saturate immediately with glyphosate (200ml/L) or metsulfuron-methyl 600g/kg (5g/L + penetrant)
Inkweed	*Phytolacca octandra*	Not listed in WRPMP	Scattered in stream link bat corridor gully and along the Waikato Awa edge.	Pull small plants or cut stems at ground level and paint the stumps with metsulfuron-methyl 600g/kg (1g/L)
Gorse	*Ulex europaeus*	Progressive Containment (occupier control): controlled within 20 m of a boundary	Occasional plant. The occasional gorse does not usually hinder restoration efforts.	Handpull seedlings and small plants. Spray spring-autumn with glyphosate (10ml/L). Cut or frill and saturate immediately with glyphosate (200ml/L) or metsulfuron-methyl 600g/kg (5g/L + penetrant)
Broom	*Cytisus scoparius*	Sustained control – Production and Environmental pest	Scattered in stream link bat corridor gully and along the Waikato Awa edge.	Handpull seedlings and small plants. Cut and paste - Apply picloram gel (43g/l strength) or metsulfuron gel (10g/L strength) to the entire cut stem. Do not use near desirable plants or overwater or wetlands. Foliar spray (Late Spring to late Autumn) - Apply herbicide using a knapsack to small areas and plants <1m tall, or gun and hose for larger infestations. Use the adjuvant recommended on the label. Apply glyphosate (360 g/L active ingredient) herbicide at 20ml/L plus organosilicone penetrant (2ml/L) to cover entire plant. Note: Glyphosate overspray will kill other (desirable) plants.

4.4 PLANTING REQUIREMENTS

All planting requirements are within the following Consent Notice Areas:

- Area 'AH' within Lot 63 (Stream Link Bat Corridor);
- Additional gully planting linkage between the Waikato Awa and the Stream Link Bat Corridor areas BA-BH within Lots 58, 48 and 29; and
- Wetland Area in the Recreational Reserve - Lot 37.

The detailed plant species list for each of the two restoration areas is provided in Table 3 (overleaf). Species type and numbers can be exchanged but only with prior written approval of a suitably qualified and experienced ecologist).

Canopy forming species can be planted initially or once the early successional plantings have achieved canopy closure, supplementary planting of the restoration areas should be undertaken to establish canopy species common to this area (but which are often lacking due to selective logging). These species should be planted in lightwells and sheltered gaps within restoration plantings.

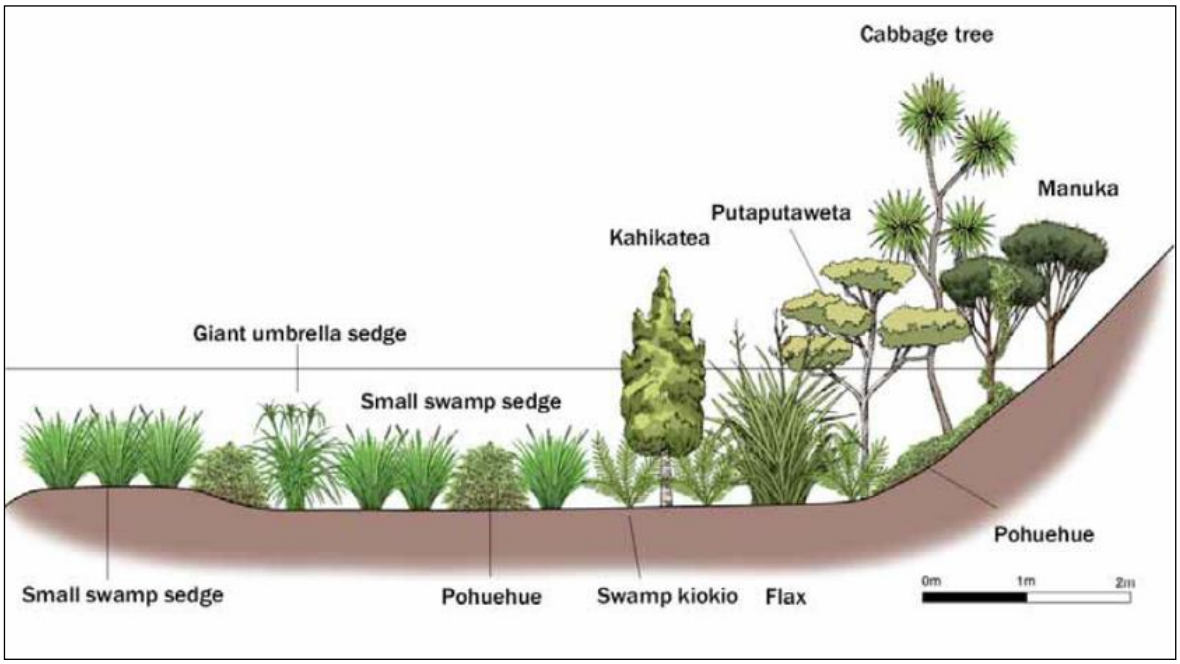


Figure 9: Generalised riparian planting cross-section.

4.4.1 RESTORATION PLANTING AND SPECIES SELECTION

Table 3 shows the two restoration areas and approximate plants required for restoration. Table 4 shows the species to be planted and appropriate densities and plant container specifications.

The Stream Link Bat Corridor (Area AH in Lot 63) is dominated by exotic vegetation, with large areas of rank exotic grassland. Large poplar trees are present at the top of the gully and several of these trees are considered high value potential bat roost trees. These trees will remain. Other weed species listed in section 4.3 will need to be controlled before planting can begin. The area for revegetation is 1.05 ha.

The Wetland Area in the Recreational Reserve (Lot 37) measures c.0.71 ha and includes areas of undulating terrain, with many small depressions, where hydrophytic vegetation is present. It is estimated that approximately 15% of this area supports wetland hydrology, the remainder of the

vegetation to be planted here should be suited to being inundated on occasion as this area likely floods during high river levels.

The additional gully to be vegetated will link the Waikato Awa riparian zone and the Stream Link Bat Corridor. This area is located in lots 58, 48 and 29 within areas BA-BH. This area is a well-drained shallow gully which is part of the river terrace formation, and a range of damp-dry species will be planted here.

Table 2: Plant numbers and densities required for replanting in each of the restoration areas.

Vegetation Area	Planting zones	Total planting area (m^2)	Average plant spacing (m)	Approximate number of plants required
Stream Link Bat Corridor	Predominantly dry with some damp	10,500	1.5	5,348
Wetland mosaic	Predominantly damp/dry with c. 20% wetland	7,100	0.75 – 1.5	2,170 (wetland) 3,182 (Damp/dry)
Additional gully to be vegetated	Predominantly dry, some damp in the base of the gully	14,370	1.5	7319
Total		31,970		18,019

Table 3: Species to be planted in the restoration areas (species type and numbers can be exchanged but only with prior written approval of a suitably qualified and experienced ecologist).

Botanical Name	Common name	Stream Gully Link (consent notice area)				Wetland Mosaic (consent notice Lot 37)				Additional gully (consent notice BA-BH)		Total	Plant grade (pot size)
		Dry hillslopes		Damp stream edge		Damp/dry		Wetland		Damp/dry			
		% of mix	No. required	% of mix	No. required	% of mix	No. required	% of mix	No. required	% of mix	No. required		
Alectryon excelsus	titoki	3%	136							2%	146	283	1L, PB2
Aristotelia serrata	wineberry	5%	227	8%	64	10%	318			10%	732	1342	1L, PB2
Carex geminata	rautahi			15%	120			35%	760			880	Root trainer
Carex secta	purei			15%	120			35%	760			880	Root trainer
Coprosma robusta	karamu	10%	455			10%	318			10%	732	1505	1L, PB2
Cordyline australis	cabbage tree			20%	160	10%	318	9%	195	10%	732	1405	1L, PB2
Dacrycarpus dacrydioides	kahikatea			2%	16	2%	64	1%	22			101	1L
Dacrydium cupressinum	rimu	1%	45									45	1.5L, PB3
Dodonaea viscosa	Akeake	8%	364							2%	146	510	1L, PB2
Knightia excelsa	rewarewa	3%	136									136	1L, PB2
Kunzea robusta	kanuka	25%	1137									1137	1L, PB2
Hoheria populnea	Lacebark	5%	227			5%	159			5%	366	752	1L, PB2
Leptospermum scoparium	manuka			10%	80	30%	955			22%	1610	2645	1L, PB2
Melicytus ramiflorus	mahoe	12%	546			10%	318			10%	732	1596	1L, PB2
Myrsine australis	mapou	12%	546			10%	318			10%	732	1596	1L, PB2
Phormium tenax	harakeke			30%	240	10%	318	20%	434	10%	732	1724	Root trainer
Pittosporum eugenioides	lemonwood	5%	227									227	1L, PB2
Podocarpus totara	totara	5%	227							1%	73	301	1.5L, PB3
Sophora microphylla	Small-leaved kowhai	3%	136			3%	95			4%	293	525	1L, PB2
Veronica stricta	koromiko	3%	136							4%	293	429	1L, PB2
Total		**100%**	**4,548**	**100%**	**800**	**100%**	**3,182**	**100%**	**2,170**	**100%**	**7,319**	**10,700**	

4.4.2 PLANTING TECHNIQUES

Site preparation for planting will be completed as part of the pest plant strategy. Non-invasive grasses/groundcovers are not recommended for control and should be left uncontrolled where possible with the intention of providing a living mulch effect whereby native plants are somewhat protected from drought, frost and wind damage.

Planting should ideally be done in autumn when there is sufficient soil moisture and soil temperatures are still high enough to promote root growth. Planting can be done right through winter until around September.

Plants should be bought from a reputable grower, should be from a local seed source (ideally Atiamuri Ecological Districts), and should be healthy and robust.

Plant quality is to be checked upon delivery by the nursery / supplier. The foliage and roots of the supplied plants must be in good health. Plant quality will be tested by the contractor with visual inspections, and by lifting no less than 10 supplied plants by the stem to confirm whether the planter bag / root trainer of each plant is supported (i.e. the plant doesn't pull out of bag). Plants considered by the contractor to be of poor quality will be rejected and will need to be replaced by the nursery.

Plants grown from natural populations in neighbouring districts are preferred to non-eco-sourced plants. If planting any myrtle species, such as kānuka and rātā (*Metrosideros* spp.), nursery stock shall be checked for signs of myrtle rust prior to planting. Identifying features of myrtle rust can be found on the Department of Conservation website[5].

It is recommended that experienced professional ecological restoration contractors undertake this planting work in order to define the quantity of plants needed and be afforded the opportunity to make appropriate changes to species selection, site preparation and timing based on-site specific conditions, when deemed necessary.

In the open restoration areas, plants are to be planted at a density of one plant every 0.75 to 1.5 m (approximately 5,000/ha) in groups of three or more. Large canopy forming trees (planted in the initial restoration phase) should be spaced approximately 3-4 m apart. Smaller trees and shrubs can be scattered throughout. Supplementary canopy enhancement species, planted after the early successional species have gained canopy closure, should be spaced approximately 10-15 m apart (approximately 115/ha to 50/ha). Spot-spraying with a glyphosate herbicide should be carried out to control weed and grass growth 28 to 14 days prior to planting. Spots should be approximately 0.3 x 0.3 m in area and spaced according to the required planting density (e.g. 1.5 m centre to centre).

If specified plants are not available it is preferable to increase the proportion of another plant in the list rather than substitute another species which may not be suitable for the site.

In areas where soil has been compacted as the result of previous land uses, the soil can be loosened to a depth of 0.5 m using a crowbar or trenching spade. After planting, the soil level against the stem should be the same as before planting. Staking is recommended so that plants are more easily located.

The plant is to be secured in the ground by filling the space surrounding the roots with soil and lightly compressing it. Soil compression will fill any voids that might be present around the roots avoiding damage caused by water accumulation. Initial watering after planting is required.

[5] https://www.doc.govt.nz/nature/pests-and-threats/diseases/myrtle-rust/, accessed 16/10/2019

Optimal plant stock will be used in the planting which has the following attributes:

- Healthy, vigorous, and free from obvious signs of disease and pests;
- Planter bag or pot size RRTT, PB3 - PB5;
- Of at least average size for the specified pot/planter bag size;
- Well-developed root system with high amount of new root growth; and
- Not root bound.

4.4.3 PLANTING MAINTENANCE

Planted areas should be regularly maintained to keep them weed-free and plants should be released at least three times in the first year after planting and one or two times in the subsequent four years. This involves clearing competing vegetation from around each plant, which gives them the best chance of survival and maximises growth rates. Releasing can be done with a non-residual herbicide such as glyphosate, with a brush-cutter, or manually.

It is normal to expect a mortality rate of at least 10%. Additional plants should be planted in the spaces where other plants died.

The habitat creation and enhancement plantings outlined above are to be maintained and monitored annually for five years, and measured against the following performance criteria:

· Trees reach an average height of four metres.

· An average of 75% canopy closure is attained.

· A 90% survival rate of plants is achieved.

Establishment monitoring will be undertaken no more than two weeks after planting completion to ensure nothing is adversely affecting early plant performance. Ongoing, longer-term monitoring will be undertaken annually during the growing season. Should any dead or dying plants be recorded appropriate replacement planting will be undertaken during the following planting season. If the above performance criteria are not met within five years of establishment, appropriate management measures (e.g., treatment of competing exotic vegetation, replacement or infill planting etc) will be implemented. Monitoring will continue annually until the newly planted areas achieve the performance criteria set out above.

Monitoring of planting performance will be undertaken by suitably qualified and experienced ecological restoration contractors, capable of measuring tree height, canopy closure, assessing plant survival, calculating the average of these measures across the planting easements, and performing infill plantings where required.

APPENDIX I TREE FELLING PROTOCOLS

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.

1

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 needed.

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.

[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).

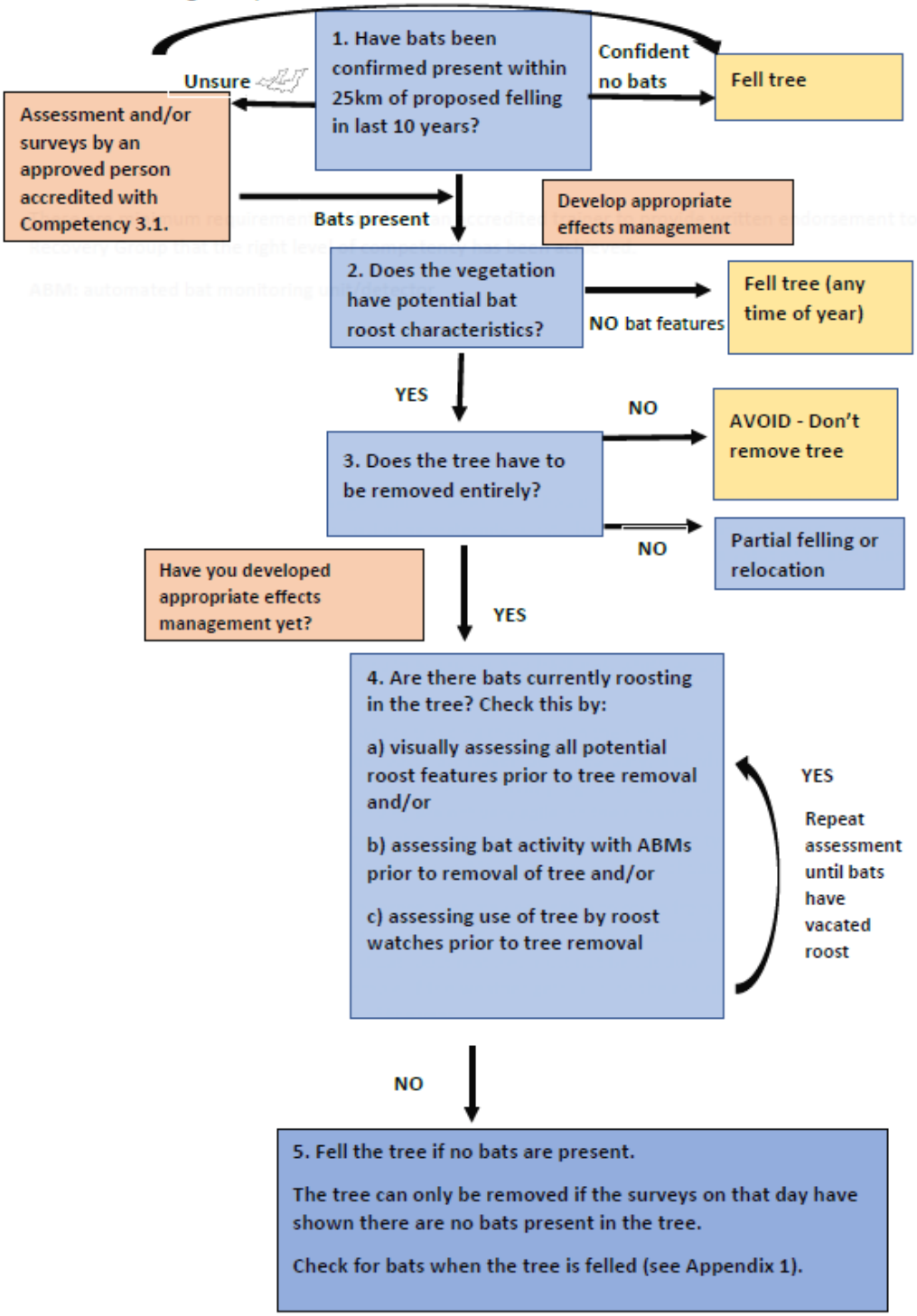
[3] A group of bat specialists that advise on bat issues and assess bat competencies
[4] Available at www.doc.govt.nz/bat-worker-resources

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 100km².

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. If no bats are observed entering or exiting for two consecutive 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

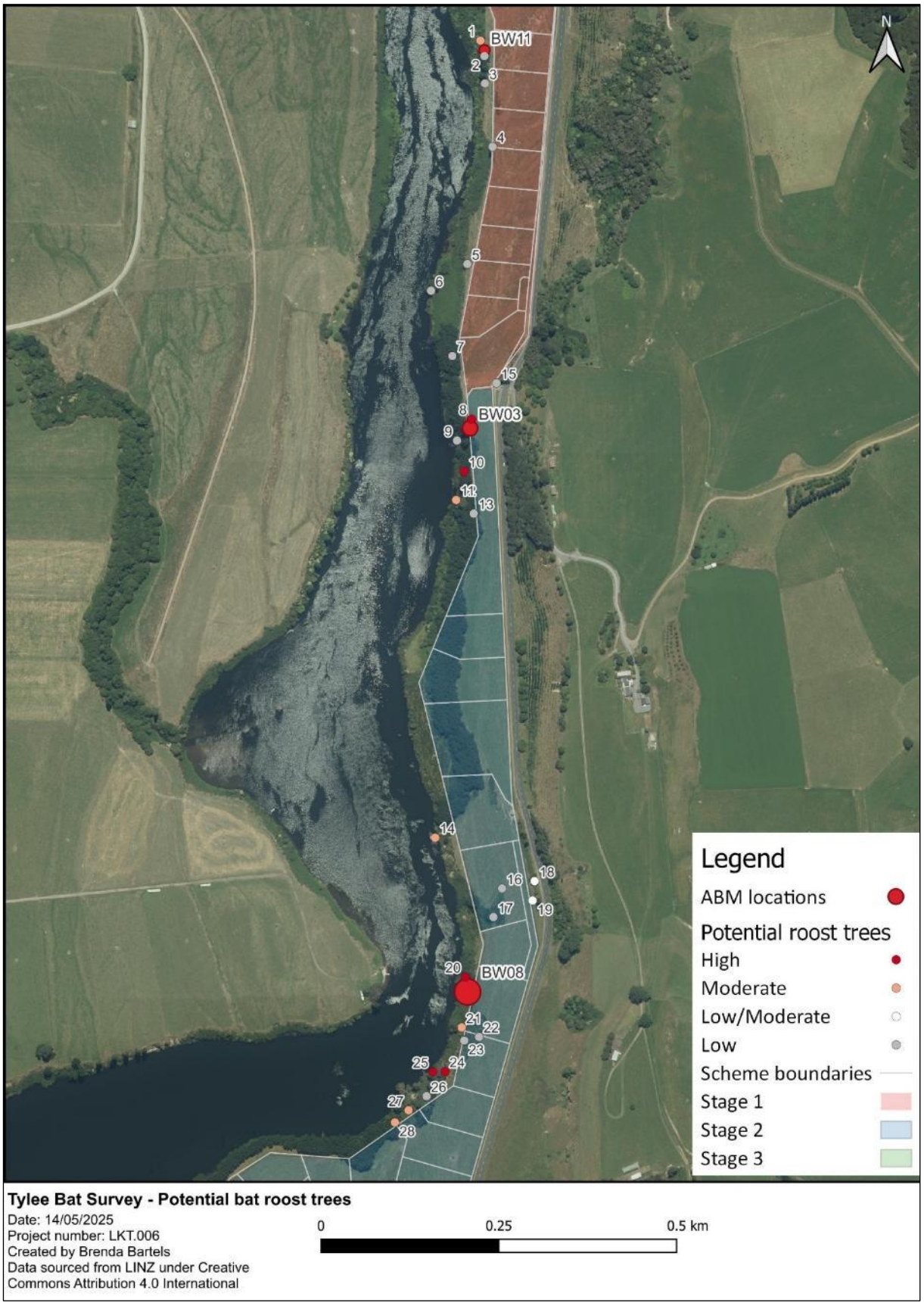
Bats must be kept for three days under observation and must be kept out of torpor for this time. Additional detail is found at the links provided in this footnote[17]. Vets must euthanise bats whose injuries are causing suffering and are not likely to heal sufficiently to allow rehabilitation and return 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.

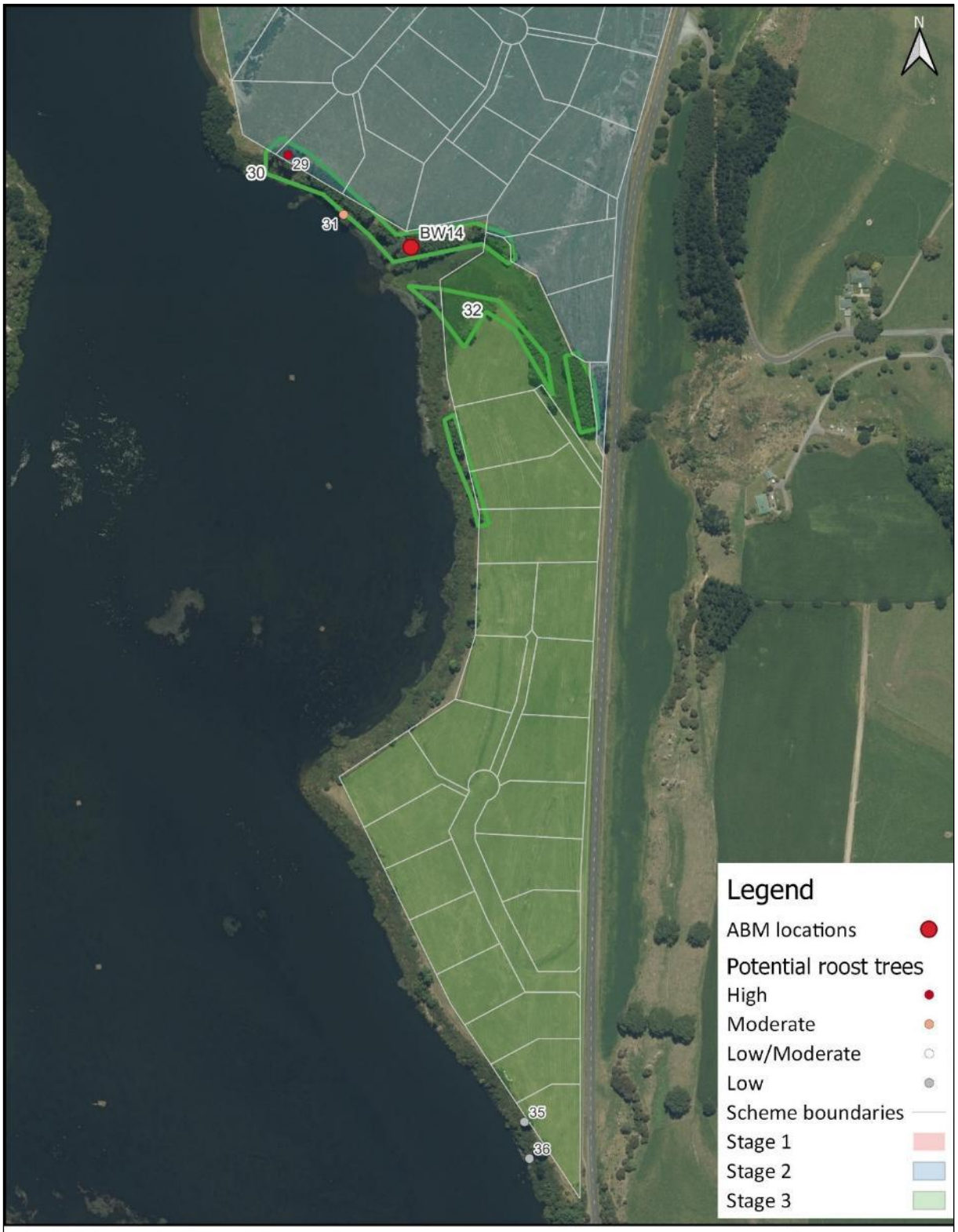
Euthanised bats or any dead bats (or bat parts) found must be handed to DOC and is a legal requirement under the Wildlife Act. If the bat is held for longer than 12 hours, store it in a food grade safe glass jar in the freezer to preserve the bat's smell for the potential use of training conservation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

Summary of potential bat roost tree assessment at Hopuhopu.





ID	Tree Species	DBH (cm)	Description	Potential Bat Roost suitability	Pre-felling survey required
1	Pine	70	Pine with DHB of 70cm next to dead, fallen down pine	Moderate	N/A
2	Poplar	30-60	Cluster of 5 Poplars with a DBH between 30 and 60cm	Low	No
3	Pine	60	Standalone pine	Low	No
4	Poplar	50	Standalone poplar	Low	No
5	Poplar	20-60	Standalone poplar, multi trunks	Low	No
6	?	80-110	Multi trunk	Low	No
7	Poplar	15-40	x 20 poplars, 80% of poplars in this area have a DHB >15cm	Low	No
8	Pine	70	Standalone pine with broken branches	High	No
9	Pine	40	Standalone pine near water	Low	No
10	Pine	80	Standalone pine with broken branches	High	N/A
11	Pine	70		Moderate	N/A
12	Pine	70		Moderate	N/A
13	Poplar	15-50	5% of poplars in this area have a DHB >40cm	Low	No
14	Pine	50		Moderate	N/A
15	Poplar	60-80	x 2 near road	Low	No
16	Pine	30-60	x2 corner open paddock	Low	No
17	Poplar	60		Low	No
18	Australian blackwood	70	x 3 with one fallen down	Low/Moderate (road)	N/A
19	*Populus nigra 'Italica'*	15-80	Cluster of 2 multi trunk poplars, possible cavities but near road	Low/Moderate	N/A
20	Pine	90	Standalone pine with broken branches near water	High	N/A
21	Pine	60	x3 pines near water	Moderate	N/A
22	Pine	40-60	x2	Low	No
23	Pine	60	Pine surrounded by shrubs	Low	No
24	Pine	80	x2 pines (14/15) close together with broken branches, near the water	High	No
25	Pine	50	x2 pines (14/15) close together with broken branches, near the water	High	N/A
26	Pine	70	Standalone pine	Low	No

ID	Tree Species	DBH (cm)	Description	Potential Bat Roost suitability	Pre-felling survey required
27	Pine	80	Standalone pine next to dead tree with peeling bark	Moderate	N/A
28	Pine	70	Near the water surrounded by poplars	Moderate	N/A
29	Pine	80	Dead Pine	High	Yes
30	Poplar	80-120	x30 Poplars in this area with every single one being	Low/Moderate	N/A
31	Pine	40-70	x3 pines with 10m apart, all M	Moderate	N/A
32	Poplar	30-40	x10 plus dead pop in favourable gully location	Low/Moderate	Yes
33	Poplar	80-120	x10 poplars with 40m apart	Low/Moderate	Yes
34	Poplar	60-80	x10 poplars with 10m apart	Low	No
35	Poplar	60	Standalone poplar with young poplar shrubs	Low	No
36	Pine	>60	Standalone pine at the end of the property (no pic)	Low	No

APPENDIX III EXAMPLES OF NATURAL AND ARTIFICIAL BAT ROOSTS

TREES FOR HABITATS

the living tree company

Habitat creation in trees for the New Zealand environment.

Hollows occur naturally in the old grove forests, mature exotics and native trees around New Zealand, and provide an opportunity to encourage biodiversity in our environments.

Natural hollows are a direct result of physiological stress to the tree, when the heartwood is exposed to the environment. This can be caused by environmental factors, fungi, bacteria, insects, natural canopy reduction and age.

Pruning for Biodiversity

Hollows for habitat creation can also be encouraged by human intervention. Pruning for biodiversity is commonly done in Europe, America and Australia and is called habitat pruning, eco-pruning or fracture pruning.

These types of pruning involve simulating natural break-outs in the tree to leave natural-looking stumps and branch tear-outs.

The Oak below has been left in Auckland Domain and is a great example of how declining trees can be an asset in speeding up the senescence in a tree and encouraging decaying wood to harbour a bigger biodiversity.

Auckland Domain, Oak.

Natural hollow in a Kauri

FACTORS TO CONSIDER WHEN CREATING HABITATS:

- **Various entrance hole and cavity sizes which will determine the different types of wildlife that might use them**
- **Protection from predators and pests**
- **Light minimisation for nocturnal wildlife**
- **Drainage**
- **Association with food crops**
- **Introduction of guano to encourage roosting sites**
- **Use of a vegetable oil as lubrication for your chainsaw bar**
- **Protection against prevailing wind and weather**

TREES FOR HABITATS

the living tree company

Habitat Creation in Trunk Wood

By chainsawing into the heartwood, habitats can be customised for numerous wildlife species. Here is an example of habitats we created for the long-tailed bat in standing trunks. (This requires good chainsaw knowledge as many of the cuts use the tip of the bar and can promote dangerous kickback.)

LONG-TAILED BAT HABITAT:

1. Cut into the trunk horizontally with two cuts at the desired height. Bore cut the face plate out.

2. Bore into the wood and make the chosen number of chambers. Cut the chambers into a fork-shaped pattern with the horizontal cut meeting the entrance hole (as shown in the picture). The entrance needs to be on a slope so it works as drainage. The size of the sloping entrance should be 17–21mm for long-tailed bats. Make sure the chambers are smaller than the face plate so that the hollow will be sealed.

3. Drill into the face plate and then screw the face plate back on to the wood.

Pest Proofing

Pest proofing the tree is important. On the trunk of the tree, below where the habitat is to be created, it is a good idea to mound around the tree's circumference a metal, aluminium or plastic sheath that predators cannot climb above. We tend to use polycarbonate joined with aluminium as it does not visually degrade the integrity of the tree as much. Make sure to prune neighbouring trees well clear of the host tree as possums can easily jump from one tree to another. For living trees, the pest guard needs to be revisited and checked to allow the expansion of the trunk.


Pest Guard

PEST GUARD EXAMPLE

1. Measure the tree and cut out the polycarbonate (60mm wide) with a 20mm overlap for joining with the aluminium bracket.

2. Drill into the aluminium and make three holes. Match up the middle hole with the plastic and drill into the plastic.

3. Tape the plastic tight to the tree and insert the aluminium bracket underneath the plastic.

4. Pop rivet the middle hole through the aluminium bracket and plastic.

5. Pull the plastic together and match up the top and bottom drill holes in the plastic and the aluminium bracket. A piece of wood could come handy to make sure there is no drilling into the tree.

6. If the tree has a natural taper, the guard can be moved downwards to get it as tight as possible.

Human-made constructions

Human-made constructions are also an alternative. Here is a bat house made for long-tailed bats; there are endless ways to make them and numerous materials that might be used. These constructions could harbour any type of wildlife depending on construction type.

TREES FOR HABITATS

the living tree company

Relocation of Habitats

Relocation of habitats is sometimes required. For example, relocation would be needed in tree failures or trees that are condemned for removal. The tree wood containing the habitat can be safely lowered to the ground by rigging and can be re-erected onto living trees. With the help of familiar pheromones, the wildlife could have a better chance of finding their way to the new roosting site. This has been shown to be successful for bats in the UK and we are now making trials in New Zealand and are excitedly awaiting results.

Many trees are being removed to ground level in urban environments due to factors such as:

- Changes in RMA
- Urban development
- Diseases and pests, such as Kauri Dieback, Dutch Elm and Cypress canker
- Declining and dying trees for public and structural safety
- Landscaping trends and poor knowledge.

By using some of the techniques discussed in this text, we could enhance biodiversity by leaving trunks as new habitats and still ensure safety for the public.

"We should always remember that the description 'dead wood' implies a static state, without consideration for the process of decay and the diversity of lifeforms involved." *(Andrew Cowan)*.

the living tree company
ENVIRONMENTAL, CLIMBING AND TREE CARE SERVICES

REFERENCES

Bat Conservation Trust. (n.d.) Retrieved from http://www.bats.org.uk/
Cowan, Andrew. (n.d.) Decaying wood recycling within arboreal ecosystems. EssentialARB, Issue 8, Spring 2003.
Fay, Neville. (April 2003.) Natural Fracture Pruning Techniques. Retrieved from http://www.treeworks.co.uk/downloads/8%20-%20Coronet%20cuts%20&%20retrenchment%20pruning%2017%20April%202003.pdf
Gibbons, Phillip & Lindenmayer, David. (2002). Tree Hollows and Wildlife Conservation in Australia. Vic, Australia: CSIRO Publishing. ISBN 0-643-06705-1.
VTIO Victorian Tree Industry Organisation Habitat Creation Paper-13/09/2010. Retrieved October 15, 2014 from http://vtio.org.au/downloads/

With thanks to:
Gerard Kelly, ProjectEcho | Gerry Kessels, Kessels Ecology
Hannah Mueller, Waikato University | Josh Guilbert, Auckland University
Scott Forest, Contract climber.

Revegetation

For revegetation we could also apply some of these techniques to use in existing exotic trees. We might also use fast-growing exotic trees that could be transformed into desirable nesting spots to harbour many species essential to our ecosystem before the native trees reach their maturity.
As one tree species might be a problematic weed in Auckland but considered a specimen tree in the Waikato, it pays to talk to local Arborists, council, DOC or environmental organisations.

Some Factors to consider are:

- Will these trees become a weed infestation?
- What would you like to attract—invertebrates, birds or bats?
- Could the temporary exotic tree be easily be killed off after a desired period of time?
- Heavy fruiting and flowering could work as a food crop for birds but also pests.
- Will they naturally be good species to create hollows?
- What has been used in other projects around your area?

ABOUT THE LIVING TREE COMPANY

The Living Tree Company is an Auckland-based environmental arborist company with a passion for maintaining and improving New Zealand's unique natural environment. We are currently taking part in various trials for habitat creation and other ecological and arboreal projects. We believe the more work we do together the bigger and stronger the impact we can have. Please contact us with any enquiries or to share information.

This is an introduction to habitat creation in trees for the New Zealand environment. The text is prepared from an arboricultural standpoint and is to be used as an introductory discussion for ecologists.

CONTACT:
Fredrik Hjelm | 027 726 7382
info@thelivingtreecompany.co.nz
www.thelivingtreecompany.co.nz