Boffa Miskell

Huia Replacement WTP

Ecological Management Plan for Geotechnical Investigations

Prepared for Watercare Services Limited

19 August 2024

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Executive Summary

The following Ecological Management Plan (EMP) has been prepared to manage potential adverse ecological effects of geotechnical investigations at Watercare's replacement Water Treatment Plant (WTP) in Huia.

The EMP describes actions necessary to minimise risks for native birds, bats, kauri snails, lizards and Hochstetter's frogs before, during and after vegetation clearance associated with geotechnical works at the Project Site. It also provides a basis for future fauna management plans which will be developed for the subsequent construction phase of the WTP.

The priority for the approach to geotechnical work at the Site is to minimise the extent of high-value vegetation and habitat clearance, which in turn will reduce impacts on native fauna. Where tree and/or ground clearance is required, the prescribed management protocols must be implemented.

Geotechnical investigations will be localised and discrete, with flexibility to select exact locations based on ecological values and as a result, impacts on native biodiversity are expected to be low.

Furthermore, the nature of the small clearance areas and their distribution across the Site make it highly likely that most fauna disturbed during surveys/works will quickly disperse into adjacent habitat and will therefore not be significantly displaced by these works.

The EMP contains:

- A description of the proposed geotechnical works to establish site access and drill sites and their potential ecological impacts.
- A description of habitats that will be affected, and the native fauna species that may be impacted by Project works.
- Fauna survey and salvage methods, including seasonal constraints for key species.
- Reporting requirements.

Management protocols involving capture and relocation of native species will require permission under a Wildlife Act Authority (DOC permit).

This plan has been informed by data from ecological field surveys and reports associated with the Project since 2016, supplemented with information from desktop assessments and local knowledge.

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Appendices

1.0 Introduction

1.1 Project Description

Watercare Services Limited (Watercare) operates water supply dams within the Waitākere Ranges, including the Upper and Lower Huia Dams and the Upper and Lower Nihotupu Dams. The Huia Water Treatment Plant (Huia WTP, named for the source of the water) is located in Waima and treats the water from these dams before it is distributed via the water transmission network. The existing Huia WTP is critical infrastructure providing 20% of Auckland's water to over 300,000 residents, and it is nearing the end of its functional life.

Watercare have been granted consent to construct a replacement water treatment plant (the Huia WTP) adjacent to the existing site in Waima. Geotechnical assessments are required prior to the detailed design of the replacement WTP and will result in localised vegetation clearance and earthworks to enable geotechnical equipment access to test sites. The consent conditions[1] for the replacement WTP require that an Ecological Management Plan (EMP) is developed to minimise potential effects of works on local flora and fauna during geotechnical investigations.

1.2 Purpose

The geotechnical investigations will require that patches of vegetation must be cleared for the 16 proposed boreholes, and to create safe access paths for both people and equipment to move between them.

The purpose of this EMP is to provide protocols that minimise the risks of injury and mortality to native fauna in relation vegetation clearance for boreholes. The EMP sets out vegetation and fauna management methods that must be followed throughout geotechnical investigations, including protocols to be undertaken prior to, and during vegetation clearance and borehole drilling.

This EMP provides protocols to minimise risks for native fauna and flora during geotechnical investigation work *only*. Consent conditions require that additional management plans must be developed for the next stages of the Project (i.e. wide-scale vegetation clearance and bulk earthworks)[2].

1.3 Related plans

This EMP is part of a larger package of environmental management protocols for the Project. This plan should be read in conjunction with the following management plans:

- Phytophthora Risk Management Plan (PRMP, BML 2024a)
- Lizard Pest Control Plan (BML 2024b)

[1] Consent reference BUN60339273, dated 24 February 2020.

[2] This EMP, as well as the associated PRMP and Operational Pest Control Plans are restricted to the small-scale vegetation and habitat clearance required to undertake geotechnical site investigations. These plans will be consistent with consent conditions 20 - 25 (EMP), 43 - 47 (geotechnical investigation specific PRMP), and 23 (b) (ii) (lizard release site requirements), where appropriate to the scale of works. These conditions are provided in Appendix 1 for reference.

- Huia WTP – Ground Investigation Method Statement and Phytophthora Risk Management Plan Review (Aurecon 2024)

1.4 Drilling Options

The methodology for ground investigations has yet to be established and will depend on availability of equipment and operational factors such as access to water and drilling depth. Aurecon has prepared a draft method statement that describes drilling methodology and space requirements for different equipment (Appendix 2). The method statement also follows the general requirements of the PRMP to reduce the potential risks of *Phytophthora* spread during borehole sampling. Following contractor engagement, confirmation of access, clearance requirements, recommended drilling rigs/plant and cleaning processes will be finalised.

This EMP covers the work scenario with the largest footprint (and associated risk to fauna). This comprises the use of a drill machine attached to a small tractor. Pathways approximately 3 m wide are required to allow machinery to be driven to drill sites. Minor earthworks may be required to level paths for safe transport of the tractor.

Existing accessways and small, informal tracks with minimal earthworks will be sufficient if a smaller drill can be used, which can be disassembled, carried to site on foot and then re-assembled.

The required investigations include shallow soil sampling, mapping and exploratory drilling methods to understand the ground and hydrogeological conditions of the site. Aurecon estimate that the drilling programme will take from two to three months to complete, including access track establishment and drilling works.

1.5 Roles and responsibilities

Fauna surveys and salvage must be completed and communicated as such before vegetation clearance can be undertaken.

Project Ecologists

It is the responsibility of the lead Project Ecologist to:

- Clearly communicate clearly with Project Arborists/Drill Site Managers about fauna survey progress and when fauna surveys for an area have been completed and if an area is approved for trimming/felling or ground clearance and fencing.
- Complete the checklist in Appendix 3 to record survey/salvage results and monitor progress. The checklist can be sent to Watercare as works progress and approval is given to clear vegetation in each area.

Project Arborist

It is the Project Arborist's responsibility to:

- Ensure that protocols for carrying out vegetation clearance (as described in Section 4.3 of this EMP and the PRMP) are adhered to during works.

- Ensure Tree Protection Zones (TPZ) and Kauri Containment Zones (KCZs) are clearly identified on the Site. Supervise works adjacent to a TPZ and manage a tree risk register[3].
- Document a root pruning, root protection (if roots must be covered for drill / walking access) and remediation methodology.

Site Manager

It is the Site Manager's responsibility to:

- Adhere to protocols for accidental discovery of wildlife on Site if an ecologist is not present (Section 4.6).

Project Engineer

It is the Project Engineer's responsibility to:

- Review and assist the contractor in designing and maintaining compliant drilling works control in accordance with the PRMP and consent conditions.
- Conduct periodic inspections of the installed control measures to ensure ongoing compliance.
- Provide instruction and oversight to ensure adequate hold points are stipulated and observed to achieve the Phytophthora risk management principles.

2.0 Ecological values and potential impacts

2.1 Background

The works footprint is 4.3 ha in total, 3.5 ha of which comprises indigenous forest and scrub – dominated vegetation. The footprint of the plant has been designed to avoid areas assessed as of highest ecological integrity, including mature kauri forest, kauri – podocarp forest and swamp forest ecosystem units (BML 2019). Vegetation to be removed is primarily kanuka dominated forest and scrub, with some areas of indigenous broadleaved scrub and a patch of rank grass and weedfield.

Geotechnical drilling will require tree trimming, clearing ground cover habitat and cutting/covering raised roots throughout these habitats for drill holes and accessways. In most cases it is possible to slightly adjust borehole locations and access pathways to avoid clearing high value vegetation.

Vegetation within the replacement WTP proposed footprint will be cleared for construction but only a small proportion of this vegetation will be impacted for the geotechnical investigation stage of works addressed by this EMP.

[3] A tree risk register must be developed prior to vegetation works and must identify individual trees subject to Tree Protection Zone (TPZ) protections and document ongoing monitoring of tree protection measures.

2.2 Fauna

Native lizards, frogs, kauri snails, birds and bats have been recorded in forest habitat in the wider Waima and Waitakere Ranges area. Full details of survey findings and the potential impacts of the Project are described in the Assessment of Ecological Effects (BML 2019) and summarised briefly below. Key habitats for native species are provided in Table 1.

2.2.1 Native lizards

Detection rates and diversity of native skinks and geckos within the Project Site were both very low, comprising one species of skink, copper skink (*Oligosoma aeneum*). All native lizards potentially present are classified as At Risk.

Native skink habitat includes leaf litter, grasslands, weedfield and forest. Geckos occupy seral scrubland and forest. Appropriate habitat is abundant within the Project Site and groundcover and tree clearance will need to account for lizards in all areas. Unmanaged clearance of these habitats may result in disturbance, injury or death of native lizards.

2.2.2 Hochstetter's frogs

Hochstetter's frogs were not recorded during three dedicated surveys in 2019, or incidentally during other site surveys. Hochstetter's frogs are classified as At Risk – Declining.

Hochstetter's frogs occupy damp forest habitats and are usually associated with small streams and tributaries with sufficient cover (i.e., cobbles, leaf litter, logs and overhangs). It is unlikely that Hochstetter's frogs are present within the Project Site, and drilling work will avoid watercourses.

2.2.3 Native birds

Seven native bird species were detected during surveys (fantail, grey warbler, kingfisher, kereru, shining cuckoo, silvereye, tūī). These species are representative of Waitakere Ranges bush habitats. No threatened or uncommon birds were detected within the Project Site. Wide-ranging species such as kaka are not resident in the Project Site but may use the area occasionally.

Birds are highly mobile and will generally move away from noise and activity, although eggs and chicks are extremely vulnerable to disturbance during the breeding season. Key habitats for native birds include woody standing trees, dead standing trees, and mānuka / kānuka scrub.

2.2.4 Bats

No bats were detected during surveys within the Project Site. Given the relative proximity of known bat roosts and the habitat connectivity between the site and the other records, we consider that long-tailed bats (*Chalinolobus tuberculatus,* Threatened – Nationally Critical) may use the area occasionally for foraging and possibly for solitary roosts but are unlikely to regularly roost in the Project Site. Wider area bat surveys carried out in 2020 have confirmed that the Project Site, and the immediate wider area, is unlikely to contain communal roost trees or core habitat for the long-tailed bat populations in the Waitakere Ranges. Throughout the

survey period bats were only detected at the three Western most locations, around the Lower Nihotupu Reservoir.

Prospective habitat for solitary bat roosts includes most trees >15 cm diameter, treefern and ti kouka crowns, and large dead standing trees with crevices.

2.2.5 Kauri snails

Kauri snail (*Paryphanta busbyi*) is a species of giant land snail endemic to Northland, with populations found in the Waitakere Ranges. It is one of New Zealand's largest species of land snail, classified as At Risk – Declining (Andrew et al, 2012). There have been no snails observed within the Project Site, while snails and snail shells have been found in forested sites in the vicinity, including along exhibition Drive and near Nihotupu Reservoir.

Given the availability of suitable habitat present within the site (moist interior forest with deep leaf litter), there is potential for kauri snails to be present within the Project Site.

Table 1: Habitat utilised by native species recorded or potentially present at the Site.

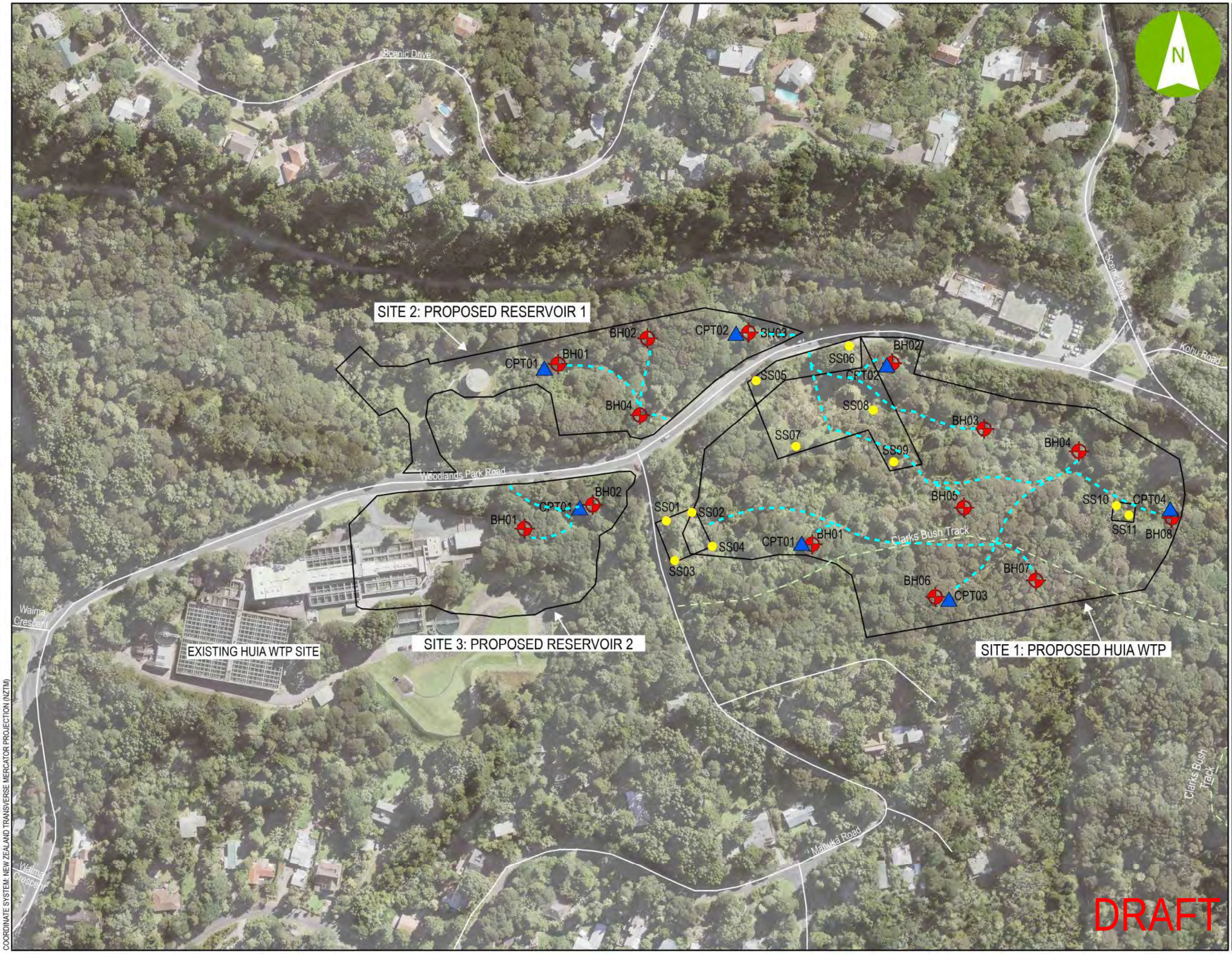
Habitat type	**Relevant fauna**
Ground cover (leaf litter, debris, logs, fallen foliage etc):	Copper skinks, ornate skinks, Hochstetter's frogs, kauri snails
Woody trees and large dead standing trees	Forest birds and long-tailed bats (nesting/roosting)
Mānuka/kānuka scrub and other trees with complex cover	Elegant geckos, forest geckos, forest birds

3.0 Management Approach

3.1 Activities

Geotechnical investigations require the establishment of boreholes and accessways between them. We understand that there is scope to 'microsite' boreholes to avoid high quality features, but that they must be located in close proximity to the indicative locations provided in Figure 1. Key principles for accessway establishment and drill site works are provided below.

Large parts of the site will remain intact during geotechnical investigations, and it is preferable for wildlife to be able to continue using the undisturbed areas of the Site. For this reason, a comprehensive salvage effort to translocate fauna is not a priority at this stage of the project. If wildlife is observed naturally dispersing into habitat that will be retained, it is not necessary to catch and translocate it unless the individual appears to be near works, or the proposed fencing cannot exclude it from dispersing into work areas or accessways.



COORDINATE SYSTEM: NEW ZEALAND TRANSVERSE MERCATOR PROJECTION (NZTM)

EXTENTS MAP

LEGEND

- PROPOSED SITE LAYOUT

PROPOSED GEOTECHNICAL INVESTIGATIONS

- MACHINE BOREHOLE (BH)
- CONE PENETRATION TEST (CPT)
- SURFACE SOIL SAMPLE (SS)
- PROPOSED ACCESS TRACKS (SUBJECT TO SITE WALKOVER AND CONFIRMATION WITH WSL AND DRILLING CONTRACTOR)

0 50 100 Metres

NOTES:
1) IMAGERY IS SOURCED FROM TOITU TE WHENUA (LINZ) AND REPRODUCED UNDER THE CREATIVE COMMONS ATTRIBUTION 4.0 NEW ZEALAND LICENSE.
2) GROUND INVESTIGATION LOCATIONS ARE APPROXIMATED ONLY AND MAY BE SUBJECT TO CHANGE FOLLOWING GPS SURVEYING.

DISCLAIMER

aurecon

CLIENT: Watercare

REV	DATE	REVISION DETAILS	APPROVED
A	22.03.24	PROPOSED GROUND INVESTIGATION PLAN	

SCALE: 1:2,000 | SIZE: A3
DRAWN: G. RAWSON
REVIEWED: C. CHU
VERIFIED:

PRELIMINARY
NOT FOR CONSTRUCTION
APPROVED
DATE 22.03.24

PROJECT: WATERCARE HUIA WATER TREATMENT PLANT REPLACEMENT
TITLE: PROPOSED GROUND INVESTIGATION PLAN SHEET 1 OF 1

DRAWING No.	PROJECT No.	AREA	TYPE	DISC	NUMBER	REV
	521290	059	SKT	GG	001	A

3.2 Site Access

A proposed ground investigation plan with indicative geotechnical sample locations and accessways is provided in Figure 1. Access tracks for drilling sites will be 2 m to 3 m wide. Access tracks will be stabilised with geotextile or hard fill prior to use. Final access track routes will be marked on the site following site walkovers to determine the least extent of vegetation clearance and earthworks. Key principles for track establishment are as follows:

- Fauna salvage protocols must be carried out prior to groundcover clearance / tree trimming and felling. Where suitable habitat is identified, the Project Ecologist may recommend installing polythene fences around accessways following fauna surveys/salvage to avoid lizards / snails / frogs migrating back into the works area before clearance.
- Minimise soil and vegetation disturbance. As far as possible, avoid mature canopy trees and limit vegetation clearance to the extent necessary for access tracks. Use established pathways where possible.
- Trees felled during this phase are to be cut at the base. No grubbing or tree stump removal. Cleared vegetation is to be placed adjacent to the track and left in-situ. All felling / trimming must be carried out by an Auckland Council approved arborist using best practice methods.
- Cut material from earthworks to level tracks is to be spread and compacted on the track surface and covered in geotextile material/ hard fill. No excavated soil from track construction activities is to be moved within the WTP site or taken off-site. Geotextile / hard fill material will remain in-situ after completion of geotechnical works.
- Track surfaces are to be covered in hard fill or geotextile material prior to use, to minimise direct contact with soil or organic matter during operations. All material imported to site must be either hardfill direct from a quarry (no recycled hardfill) or from a kauri-free catchment.
- Surface water from tracks shall be allowed to drain to ground.
- Careful on-the-ground selection of micro-sites for boreholes and access pathways.
- Tree Protection Zones (TPZs)[4] (Figure 2) will be clearly marked out (i.e. fenced with high vis barrier fencing) on the site to minimise accidental encroachment and damage to individual trees. Trees within the TPZ will not be felled or trimmed and the Arborist will supervise / monitor any works adjacent to a TPZ. There must be no equipment / machinery refuelling or storage of fuel or other substances detrimental to tree health within a TPZ.

[4] Tree Protection Zones identify significant, mature native trees that require specific protections.

Vegetation
- Large Native Trees
- Kanuka - Kahikatea Forest
- Kanuka - Kohekohe - Mahoe - Nikau Forest & Scrub
- Kanuka - Mamangi Forest
- Kanuka Forest
- Kauri - Podocarp Forest
- Kauri Forest
- Swamp Maire - Puketea - Kahikatea Swamp Forest
- Kanuka – Mahoe Forest & Scrub
- Mahoe Scrub
- Rough Grass & Weedfield
- Existing Infrastructure

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DRAFT

Data Sources: Eagle Technology, Land Information New Zealand, GEBCO, Community maps contributors

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

- Proposed Borehole Locations
- Existing Access Track
- Proposed Access Track
- Extent of Earthworks
- Site Boundary
- Tree Protection Zone
- Kauri Containment Zone

HUIA GEOTECHNICAL INVESTIGATIONS

Estimated Extent of Vegetation Clearance for Geotechnical Investigations

Date: 30 May 2024 | Revision: 0

Plan prepared for Watercare Services Limited by Boffa Miskell Limited

Project Manager: katherine.muchna@boffamiskell.co.nz | Drawn: LJa | Checked: ESu

3.3 Drill Site Activities

Works at drill sites will involve vegetation clearance to enable drill rig access and set-up, and extraction of a soil core. Drill rig sites are to be delineated with tape or temporary fencing to ensure all activities are contained within the managed area. Core extraction may involve the use of water as a lubricating agent to recover the core, but all water and soil is to be captured and contained.

Key principles for geotechnical sampling operations are as follows:

- Fauna salvage protocols must be carried out prior to groundcover clearance / tree trimming and felling. Where suitable habitat is identified, the Project Ecologist may recommend installing polythene fences around drill site following fauna surveys / salvage to avoid fauna migrating back into the works area before clearance.
- Minimise soil and vegetation disturbance. As far as possible, avoid mature canopy trees and large standing dead trees and limit vegetation clearance to the extent necessary to accommodate the drill rig. This may include trimming overhanging branches and leaving the rest of the tree intact.
- Trees felled during this phase are to be cut at the base. No grubbing or tree stump removal. Cleared vegetation is to be placed adjacent to the drill site and left in-situ. All felling / trimming must be carried out by an Auckland Council approved arborist using best practice methods.
- Tree Protection Zones (TPZs)[5] (Figure 2) will be clearly marked out (i.e. fenced with high vis barrier fencing) on the site to minimise accidental encroachment and damage to individual trees. Trees within the TPZ will not be felled or trimmed and the Arborist will supervise / monitor any works adjacent to a TPZ. There must be no equipment / machinery refuelling or storage of fuel or other substances detrimental to tree health within a TPZ.

4.0 Fauna Management Protocols for Work Activities

4.1 Salvaging cryptic fauna

Many of the native fauna species that may be present on Site are difficult to detect at low densities, which may have resulted in prior surveys having not detected some species that may be present within the Project Site. For this reason, we do not recommend further surveys as an effective approach for fauna salvage.

We therefore recommend that destructive searches and / or supervised clearance strategies are prioritised to maximise chances of detecting and salvaging vulnerable kauri snails, Hochstetter's frogs, and native lizards.

[5] Tree Protection Zones identify significant, mature native trees that require specific protections.

4.2 Seasonal constraints

Fauna surveys must be scheduled within their respective seasonal constraints, both to achieve maximum likelihood of detection and avoid months when wildlife is highly vulnerable. The optimal period to undertake the proposed works is between **1 October and 30 April** when native fauna are reliably active and have the highest detection probability. Further details for specific fauna groups are provided below.

Bats: For sites requiring felling trees with potential roost features: acoustic bat surveys or visual roost inspections may only take place between **1 October and 30 April** during fine weather (see Bat Roost Protocols in Appendix 3 for details). During cold weather and winter months bats spend more time in a state of torpor (short hibernations) and are highly vulnerable.

Lizards and frogs: Herpetofauna surveys can only take place during periods of warm weather when they are most active (generally between **1 October and 30 April**). Animals will be more resilient to handling and disturbance during this time.

Native birds: The peak nesting period for native forest birds is **between September and March.** Native bird nest checks must be carried out before any tree felling or trimming in this period.

Kauri snails: There are no strict guidelines for kauri snail survey timing in the literature, however they are likely to be more active in warm, humid weather and during rainfall events.

4.3 Tree felling / trimming fauna procedures

4.3.1 Fauna at risk

Tree felling and trimming is required to enable drilling equipment and people to reach the borehole sites, as well as for the drill to operate safely in each location. Activities involving tree felling and trimming pose the highest risk to arboreal fauna through the following mechanisms:

- **Native forest birds:** disturbance, habitat loss, harm/death (eggs and chicks extremely vulnerable during nesting season).
- **Geckos:** disturbance, habitat loss, harm/death.
- **Long-tailed bats:** disturbance, potential habitat loss of active roost features, harm/death (vulnerable when roosting due to being in a state of torpor).

4.3.2 Fauna management

Ecological management for tree felling and trimming must be conducted in warm weather between 1 October and 30 April when lizards and bats are reliably active.

Refer to Appendix 3 for specific methods and use checklist provide to record results.

Fauna management schedule for tree trimming or felling

1. Vegetation scheduled for trimming/felling to be clearly identified by arborist.

2. Suitably trained ecologists will inspect individual impacted trees to determine if they provide value for

a) native bird nests

b) long-tailed bat roosts[6]

c) gecko habitat

3. Bird nest checks, if applicable:
    - Visual search for active native bird nests
    - All canopy trees felled same day as nest checks if no active native bird nests are detected.
    - If active native bird nests are detected, works must cease in a 20m buffer around nest until chicks have fledged or the nest has failed.
4. If potential bat roost features must be removed, these must be inspected:
    - Acoustic surveys must achieve minimum of two consecutive valid survey nights with no bat activity detected.
    - OR trees climbed and potential roost features inspected by Bat Ecologist, or under their supervision.
    - Trees with potential roost features must be felled same day if no bats are detected.
    - If bats are detected, works must pause until bats have vacated impacted roosts.
5. Gecko salvage, if applicable:
    - Once bird and bat surveys complete, trees can be trimmed/felled and vegetation carefully lowered under supervision of Project Herpetologist on WAA permit.
    - Felled vegetation must be searched for lizards and then left in situ for 72 hours.
    - Vegetation must be re-searched (destructively if necessary) 72 hours after felling.
6. Once these protocols are complete, the Project Ecologist will notify the Project Arborist and cleared vegetation may be stacked in suitable places within the Site.

4.4 Ground clearance fauna procedures

4.4.1 Fauna at risk

Clearance of ground vegetation is required to enable drilling equipment and people to reach the borehole sites, as well as for the drill to operate safely in each location. Activities involving

[6] Trees >50mm DBH with flaky bark, crevices, holes as specified in BRP 2021

clearance of vegetation and debris on the ground poses risks to terrestrial fauna that may be present through the following mechanisms:

- **Terrestrial lizards:** disturbance, habitat loss, harm/death.
- **Kauri snails:** disturbance, habitat loss, harm/death.
- **Hochstetter's frogs:** disturbance, habitat loss, harm/death.

4.4.2 Fauna management

In areas where ground clearance is required, the following protocols must be completed.

Ecological management related to ground clearance must be conducted in warm weather between 1 October and 30 April when lizards are most active.

Refer to Appendix 3 for specific methods and use the checklist provided to record results.

Fauna management schedule for clearance of ground vegetation, leaf litter and woody material is as follows:

1. The area scheduled for ground clearance must be clearly identified by the Project Arborist
2. Suitably trained ecologists will conduct thorough searches of leaf litter, groundcovers, and debris:
    - Ecologists will salvage any lizards and kauri snails found during searches.
    - Ecologists will translocate salvaged fauna to the release site at Spraggs Track.
    - Any Hochstetter's frogs detected will trigger a 'stop works' and the Project Ecologist will notify DOC for further advice.
3. A nocturnal search of the cleared area must be conducted by the Project Ecologist in at the earliest opportunity in wet conditions to capture any kauri snails that may have been missed during the habitat clearance.
4. Once these protocols are complete, the Project Ecologist will notify the Project Arborist and the accessways and drill sites can be fenced to exclude fauna.

4.5 Fauna salvage and release

4.5.1 Methods

Kauri snails, geckos, and skinks may be captured for translocation during pre-clearance surveys or during clearance works. All captured wildlife must be photographed, and details recorded for reporting purposes. Hochstetter's frogs may be moved out of the works area, but this will trigger a 'stop works' in the surrounding area and DOC will be notified for further advice.

Handling, transport and release requirements are provided in Table 2.

Table 2: Fauna salvage capture and release requirements.

Species	Capture	Data	Container	Holding	Release
Lizards	Project Ecologist, by hand	Species Snout-vent length Injuries	Place into breathable cloth bag with debris and then into a hard sided container	Max 4 hours in shade	Lizards will be released at the release site at Spraggs Track. Place geckos onto complex foliage or trunks of appropriate trees, or arboreal ACOs. Release skinks into leaf litter or complex grasses.
Kauri snails	Anyone, by hand	Width, Height Length of shell Note scars	Place into hard sided container with moist debris	Max 4 hours in shade	Place into individual moist refuges with abundant ground cover
Hochstetter's Frogs	Project Ecologist, with gloves	Snout-vent length	Place into clean plastic bag with moist debris and then into a hard sided container	Max 4 hours in shade	Place frogs into individual moist refuges near edges of streams within the Project Site where there is ample leaf litter. Notify DOC.

4.5.2 Release site

The release site for native lizards and kauri snails is in the area surrounding Spraggs Track, the bush adjoining Parau Sludge Disposal Site to the west and east of Lower Nihotupu Reservoir (Figure 3).

Wide scale pest control, targeting rats, mice, mustelids, hedgehogs and wasps is described in the Lizard Pest Control Plan (BML 2024b).

4.6 Accidental discovery and mortality protocols

It is possible that fauna may be accidentally discovered (intact, injured or deceased) during Project works, and an ecologist may not be on site to assist.

In the event of fauna mortality:

Bats

If a bat (intact, injured or dead) is discovered on the ground or in vegetation at any point during site clearance or geotechnical works, works should pause immediately and the DOC Hotline should be called (0800 DOC HOT, 0800 362 468). Works may not resume without approval from DOC. More detailed instructions for managing bat discovery during vegetation maintenance works can be found on page 13 of the 2021 DOC Bat Roost Protocols (Appendix 3).

Lizards, frogs and snails

If a native skink, gecko, Hochstetter's frog or kauri snail is discovered intact, injured or dead, the animal should be placed in a box or container with holes in the lid and moist earth/leaf litter from the site and kept in a cool, shaded place. The Project ecologist should be contacted immediately and they will notify DOC.

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Data Sources: Eagle Technology, Land Information New Zealand, GEBCO, Community maps contributors

Projection: NZGD 2000 New Zealand Transverse Mercator

LEGEND

- Bait Station Locations 25m
- D Rat Trap Locations 50m
- DOC 250 Trap Locations 100m
- Vertex Wasp Bait Locations 50m
- Predator Management Buffer (50m)
- Indicative Release Site

HUIA WTP ENVIRONMENTAL COURT

Lizard Release Site Potential Trap Locations

Date: 11 June 2024 | Revision: 0

Plan prepared for Watercare Services Limited by Boffa Miskell Limited

Project Manager: ian.boothroyd@boffamiskell.co.nz | Drawn: LJa | Checked: LMa

Map 3

5.0 Reporting requirements

Methods and results of all ecological surveys related to geotechnical works must be recorded and reported to Auckland Council for compliance purposes.

Records should include:

- Extent of vegetation clearance
- Survey efforts in person hours
- Details of any fauna that has been captured and translocated
- Details of any fauna that has been seen but not captured
- Release site GPS locations of any translocated fauna.
- Details of any accidentally discovered fauna and steps taken following discovery.

6.0 References

Boffa Miskell Limited 2019. Huia Water Treatment Plant Replacement: Assessment of Ecological Effects. Report prepared by Boffa Miskell Limited for Watercare Services Limited.

Appendix 1: Relevant consent conditions

C. Ecological Management Plan

20. The Consent Holder shall prepare a final Ecological Management Plan (EMP) for the Project Site. The objective of the EMP is to identify how the Project will avoid, remedy and mitigate potential adverse effects on the ecological values and biodiversity of the land within the Project Site, as well as a methodology for pre- and post-works monitoring.

21. The EMP shall be prepared in accordance with the Draft EMP and shall address how the Project will avoid, remedy and mitigate actual and potential adverse effects on ecological values including:

    1) individual large trees close to the works footprint;
    2) herpetofauna (lizards and frogs);
    3) kauri snails;
    4) bats;
    5) avifauna (birds); and
    6) vegetation / habitat.

    Advice Note:
    For avoidance of doubt, the EMP sets out the vegetation and fauna management protocols to be undertaken at all stages of the works to minimise potential effects on flora and fauna. This includes protocols to be undertaken prior to, and during, the initial site preparation works including geotechnical investigations, vegetation clearance, ~~and~~ topsoil and surficial soil disturbance, clearance and disposal phases, along with the subsequent bulk earthworks phase.

22. The protocols to manage the risk of introducing or spreading *Phytophthora* species within or off the Project Site are to be set out in the *Phytophthora* Risk Management Plan (PRMP) required under Condition 26. The EMP shall be implemented in accordance with the relevant PRMP protocols, Traffic Light System and in accordance with Conditions 36 to 62 '*Staging of Works*'.

23. The EMP shall provide detail on site-specific ecological management and mitigation measures that will be implemented on the Project Site which shall include:

    (a) Vegetation protection and clearance protocols, including surveying and demarcation of the works area and other protocols for minimising accidental encroachment and damage to individual trees and vegetation outside of the works footprint for the duration of earthworks and construction activities. These shall include, but not be limited to:

        - A tree protection methodology for works within the Tree Protection Zone (TPZ) (note: Kauri Containment Zones (KCZ) identified in accordance with Condition 28(f) represent the TPZ for works within the vicinity of kauri trees). This shall include:

(i) Arborist supervision to monitor, supervise and direct all works within the TPZ of identified trees near the perimeter of the construction footprint;
(ii) Tree protection measures and protection plans, including fencing, for trees where works are to occur within the TPZ.

- A tree risk register;
- Root pruning and remediation methodology;
- Protocols for concrete deliveries and pours within the vicinity of trees and within the TPZ;
- On-going monitoring of tree protection measures by a suitably qualified arborist for the duration of construction works.

In addition to the above:

- Any tree pruning or removal required to facilitate the works must be undertaken by an Auckland Council approved arborist.
- Within the seepage range of any TPZ there shall be no refueling of equipment or machinery and no storage of fuel or any other substance detrimental to tree health.

(b) Management measures and protocols to avoid, remedy or mitigate the impact of activities (vegetation clearance, earthworks and construction) on flora and fauna within the Project Site, including:

(i) Fauna Management Protocols (FMP) prepared by a suitably qualified ecologist holding the appropriate Wildlife Act Authority (incl. in the case of herpetofauna, a Department of Conservation (DoC) approved herpetologist) to handle fauna. The FMP shall specify kauri snail, lizard and Hochstetter's frog surveys, capture, salvage and relocation programmes. The FMP are to be implemented within the delineated earthworks footprint agreed by the ecologist and the DoC approved herpetologist immediately prior to and during any vegetation clearance.

The FMP shall include (in order of preference):

- Visual inspection and destructive searching of potential habitat features (including trees and ground cover habitats). Inspection methods are to include search techniques suitable for lizards and kauri snails.

- Supervised felling where high-quality lizard habitat cannot be adequately searched (e.g. tall, dense tree species), felling should be supervised to allow a herpetologist to search through fallen trees for resident lizards.

The FMP shall also set out the procedures to be followed in the event Hochstetter's frogs are encountered. These procedures are to be developed in consultation with the DoC's Frog Recovery Group.

(ii) Subject to obtaining the necessary landowner approvals, Spragg's Track (the bush adjoining Parau Sludge Disposal Site to the west and east of

Lower Nihotupu Reservoir) is the preferred location to release relocated fauna. This area is shown in the Huia Replacement WTP Project – Indicative Lizard Release Site. Pest control (in accordance with Condition 118 Table 2) is required in and around release site(s) prior to relocation of any target fauna. These measures are to enhance relocation success for native fauna. Where relocated fauna is released at this location, pest control shall be undertaken for a duration of 10 years post-release.

(iii) Native bat management procedures prepared by a suitably qualified and experienced field ecologist holding a permit from DoC certifying the holder as competent for bat research and management skills. The bat management procedures shall detail:

- Pre-vegetation removal bat survey methodology including a native bat survey monitoring programme;
- Procedures if no bat activity is recorded;
- Procedures to be followed if bat activity is recorded;
- Procedures in the event of finding dead or injured bats.

Where applicable, the native bat management procedures shall be in general accordance with the most recent DoC guidelines "*Tree removal protocols for areas where bats are present*".

(iv) A detailed schedule of seasonal constraints and optimal work intervals shall be included in the final EMP to ensure that vegetation clearance is carried out with consideration for bird, lizard, bat, frog and kauri snail seasonal constraints.

Advice note: Vegetation clearance within each of the project footprints (being the Replacement WTP, Reservoir 1 and Reservoir 2) should, as far as practicable, be completed in a single season and outside of winter months. For the avoidance of doubt, this applies separately to each of the project footprints (i.e., it is anticipated that vegetation clearance within each of these areas will occur at different stages of construction).

(c) Vegetation clearance within the works footprints shall, as far as practicable, take place outside the native bird breeding season (August-February inclusive). If vegetation clearance is undertaken during the main breeding season, a bird and nest survey shall be undertaken by an appropriately qualified and experienced field ornithologist ("Project Ornithologist"). The Project Ornithologist shall undertake all avifauna work including the sighting and deployment of acoustic recorders, analysis of sound files and nest surveys. The bird and nest survey protocol is as follows:

- Any vegetation scheduled for removal shall be surveyed for any native bird nests within 24 hours prior to clearance.
- If an active native bird nest is identified during the visual inspection, all vegetation removal within 20m of the nest shall cease until the Project

Ornithologist has confirmed that the nest has failed, or the chicks have fledged. This area shall be clearly demarcated to ensure the vegetation is not accidentally felled.

- Once an area of vegetation has been confirmed clear of active native bird nests, vegetation clearance shall be initiated as soon as possible to prevent birds establishing further nests.

(d) A Revegetation Plan with a 10-year maintenance period shall be prepared for all parts of the Project Site that are outside the Project development area. This shall utilise plant material eco-sourced from the Waitakere Ecological District for riparian planting, mitigation planting and restoration planting such as:

a) Exposed bush edges, old tracks and open areas shall be revegetated with fast growing forest edge species to buffer the forest interior, inhibit weed encroachment and accelerate regeneration. These new edges shall be planted with low-growing, lizard-friendly species such as pohuehue and shrubby *Coprosma* species to enhance these areas as habitat for lizards; and

b) Riparian buffer zones adjacent to watercourses within the Project Site shall be planted with species to buffer and enhance the watercourse and adjacent forest areas with a minimum width of 10m for the true right bank of the Armstrong-Manuka Stream.

24. The EMP shall be prepared in consultation with DoC, the Royal Forest and Bird Protection Society of New Zealand ('Forest and Bird'), Te Kawerau ā Maki and the CLG. The EMP shall be provided to DoC for its review, prior to the EMP being finalised. If comments are provided by DoC within 20 working days, the Suitably Qualified and Experienced Person who prepared the EMP shall amend the EMP where appropriate, noting why DoC's recommendations were or were not adopted. The amended EMP shall be provided to the Council for written approval in accordance with Condition 19.

25. The Consent Holder shall submit the final EMP to the Council at least twenty (20) working days prior to the commencement of works (excluding site investigations, demolition and removal of buildings and structures, and establishment of site entrances and fencing) for written approval that the EMP complies with the requirements of Conditions 20 to 23, as applicable. The EMP shall be prepared by a suitably qualified person with reference to relevant specialists as required. No works shall commence until the EMP, or the EMP for that stage of works, has been approved by Council.

Appendix 2: Drilling methods statement

Appendix 3: Fauna protocol details

Birds

Vegetation clearance within the works footprints shall, as far as practicable, take place outside the native bird breeding season (August-February inclusive).

For work occurring in the months of March to July, no bird management is required.

If vegetation clearance is undertaken during the main breeding season, a bird and nest survey shall be undertaken by an appropriately qualified and experienced field ornithologist ("Project Ornithologist"). The bird and nest survey protocols are:

- Any vegetation scheduled for removal shall be surveyed for native bird nests within 24 hours prior to clearance, this includes examining crevices and holes for ruru and kingfisher nests.
- If an active native bird nest is identified during the visual inspection, all vegetation removal within 20m of the nest shall cease until the Project Ornithologist has confirmed that the nest has failed, or the chicks have fledged. This area shall be clearly demarcated to ensure the vegetation is not accidentally felled.
- Once an area of vegetation has been confirmed clear of active native bird nests (i.e. the chicks have fledged or the nests have failed), vegetation clearance should commence as soon as possible to prevent birds laying a second clutch.

Geckos

An approved herpetologist must be present during all tree felling to capture and translocate geckos to the lizard release site. Tree felling must be carried out between 1 October and 30 April.

- Suitable trees, likely to be occupied by geckos (as assessed by the herpetologist) will be carefully felled (in pieces, if required) and lowered.
- Felled trees will be placed outside of the accessway or drill site location and will be searched to capture geckos.
- Trees will be left in situ and re-searched after 72 hours.

Skinks, kauri snails and frogs

Skinks, kauri snails and frogs occupy groundcovers including leaf litter, ferns and woody debris. Clearance of these habitats to establish accessways and drill sites must be carried out between 1 October and 30 April.

- Deep groundcovers and other potential habitat that requires clearance must be carefully and thoroughly searched by hand during the day.
- Habitat material should be carefully moved out of the works footprint to reduce the likelihood of fauna dispersing back into those areas.
- The checked areas should be raked to remove any remaining habitat to bare ground.

Bats

Bat management procedures shall be in general accordance with the most recent DOC guidelines “Tree removal protocols for areas where bats are present”(Appendix 4).

Tree felling must be carried out between 1 October and 30 April when bats most active so are easier to detect and less vulnerable to disturbance.

- Acoustic bat monitors (ABMs) should be used to detect bat activity in the first instance.
- A minimum of two consecutive fine nights with no bat activity are required to have confidence that bats are not roosting in the Project Site.
- If there is uncertainty, and indications of a bat roost (e.g., crevice with staining) a trained arborist may climb the trees to check for bats under the direction of an approved bat specialist.
- If a bat is detected, surveys must continue until the bat(s) has moved to a new roost.

Simplified bat management protocols, consistent with DOC guidelines are provided below.

Bat Management Protocols for Vegetation Maintenance

The key purpose of this Bat Risk Adaptive Management Plan is to minimise the risk of harm to bats during vegetation management. This management plan is a living document that can be amended, in discussion / agreement with Auckland Council, to reflect best-practice guidance.

1. Identify and measure encroaching vegetation that needs to be removed.
a) Impacted trees are < 15 cm DBH **Go to i**
b) Impacted trees are ≥ 15 cm DBH **Go to 2.**

2. Classify the largest level of vegetation removal required at the Site.
a) Trimming only (fresh green growth or woody limbs with maximum diameter less than 50mm, and removal constrained to less than 10% of the canopy cover in a 12 month period) **Go to i**
b) Pruning (removal of woody limbs with maximum diameter >30mm, or removal of >10% of the canopy cover in a 12 month period) felling. **Go to 3**
c) Complete felling. **Go to 3**

3. Identify potential roost features (PFR's) in veg that must be removed. Includes knot holes, cracked limbs, flakey bark, crevices, dead wood with holes or any other features that could provide shelter for a bat.
a) No PFR's visible in relevant veg. **Go to i**
b) PFR's present or unsure **Go to 4**

4. Arborist to reassess necessity and scope of vegetation maintenance. Is it safe to avoid removing PFRs and remove less than 10% of the canopy cover in a 12 month period?
a) Yes, it is safe to avoid removing all PFRs and less than 10% of the canopy cover will be removed in a 12 month period **Go to i**
b) No, at least one PFR must be removed and/or more than 10% of the canopy cover must be removed in a 12 month period. **Go to 5**
c) It is safe to delay this work for months/years. **Go back to Step 1** when vegetation maintenance work is revisited.

5. Engage Specialist Bat Ecologist (SBE) to deploy acoustic bat monitors deploy acoustic bat monitors on site (ABMs) and analyse data to detect bat activity. Must be deployed 1 Oct to 30 April in suitable weather, and be operational for at least two consecutive valid survey nights immediately prior to veg removal.
a) No bat activity detected for two consecutive valid survey nights **Go to ii**
b) Low bat activity detected (less than 10 passes per night?) **Go to 5**
c) High bat activity detected **Go to 6**

6. Option to re-deploy ABMs and continue to analyse data until two consecutive fine nights of no activity achieved. Continue up to a maximum deployment period of 10 valid survey nights.
a) Two consecutive valid survey nights of no activity achieved. **Go to ii**
b) Ongoing bat activity detected **Go to iii.**

Negligible bat-risk

i

No bat management required. Remove vegetation at any time of the year in accordance with other fauna management protocols (i.e. bird nest checks, lizard surveys).

Low bat-risk

ii

Vegetation maintenance may proceed on the day immediately following two consecutive fine nights of no bat activity. If maintenance works are not complete at the end of this day then go back to Step 4.

High bat-risk

iii.

Trimming poses high risk of harming or disturbing bats due to ongoing local bat activity. Requirement to reassess necessity and urgency of the relevant vegetation removal.
If work cannot be avoided or delayed, contact DOC/council as soon as possible and engage a Specialist Bat Ecologist (SBE) with DOC bat competencies.
Management will be site-specific under advice from SBE and discussion with DOC/council, but will likely include;
- application for a Wildlife Act Authority to permit potential for harming or disturbing bats.
- tree-climbing to visually inspect PFRs under supervision from SBE
- searching felled vegetation for bats

Discovery of bat during maintenance works

If a bat (intact, injured or dead) is discovered on the ground or in vegetation at any point, works should pause immediately and the DOC Hotline should be called (0800 DOC HOT, 0800 362 468). Works may not resume without approval from DOC. See page 13 of the 2021 DOC Bat Roost Protocols (Appendix 3) for more detailed instructions for managing bat discovery.

CHECKLIST: TREE TRIMMING / FELLING:

Date:_____ Site / Area:_____

Completed by (name):_____

Are any of the following present / likely present:

Native bird nests (go to 1)	Yes	No	Unsure
Long-tailed bat roosts (go to 2)	Yes	No	Unsure
Gecko habitat (go to 3)	Yes	No	Unsure

Confirm the following checks have been completed and add additional notes. Provide to the Project Arborist and Site Manager.

1. **Birds**

Bird nest checks complete ☐

Trees felled on same day ☐

OR

Nest detected and buffer around nest established ☐

Describe ongoing monitoring and date that nest is vacated:

_____

_____

Confirm nest is vacated and tree can be felled ☐ _____ (date)

2. **Bats**

Acoustic surveys / roost inspection conducted ☐

Tree felled on same day ☐

OR

Works paused until roost is vacated ☐

Describe ongoing monitoring and date that roost is vacated:

_____

_____

Confirm roost is vacated and tree can be felled ☐ _____ (date)

3. Geckos

Felling supervised by herpetologist and material checked for geckos ☐

Trees left carefully placed outside of works area and left in situ for 72 hours ☐

Trees rechecked for geckos ☐

Notes (e.g. species recovered, relocation to release site): _____

_____

_____

Confirm that gecko salvage is complete ☐ _____ (date)

CHECKLIST: GROUND CLEARANCE

Date:_____ Site / Area:_____

Completed by (name):_____

Clearance footprint delineated ☐

Pre-clearance searches completed ☐

Kauri snails detected & relocated ☐

Native skinks detected & relocated ☐

Hochstetter's frogs detected and DOC notified ☐

Any fencing required? Describe and add any additional notes: _____

_____

_____

Confirm that ground clearance is complete ☐ _____ (date)

Appendix 4: DOC Bat Roost Protocols (BRP)

Protocols for minimising the risk of felling bat roosts

(Bat Roost Protocols (BRP))

Version 2: October 2021 approved by the New Zealand Department of Conservation's Bat Recovery Group

The use of these protocols should be a final step in the avoid/remedy/mitigate hierarchy. Avoidance of felling bat roost trees should be the first step in any project.

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 roost 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

The status of New Zealand bats

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 comprise 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

[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.

tree[2]. 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[3].

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 are occupied to fulfil specialised requirements, felling breeding 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.

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 blackwoods.

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 (May – September). Heavily pregnant bats are slower and less agile, and young bats cannot fly, 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.

During winter bats use torpor (a type of hibernation) more often than during other times of year, so if trees are cut down in winter, 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 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. Bat roost protocols only attempt to minimise the number of bats killed by tree felling, therefore implementing bat roost protocols where bats are present should be considered a last resort after following the RMA hierarchy of "avoid, remedy, mitigate, offset, compensate".

[2] Whilst we use the word tree frequently in this document, we acknowledge that bats also use non-tree vegetation as roosts and the terms tree and vegetation should be considered as interchangeable in the context of this document. We acknowledge that there are also non-vegetation roosts that are used and require protection. These include rocky bluffs, caves and occasionally buildings.

[3] Many references available, for example, Borkin KM; Parsons S. 2011. Sex-specific roost selection by bats in clearfell 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.

This protocol has therefore been framed following the RMA 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 a competent bat ecologist.

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.

Bat roost protocols and the Wildlife Act 1953

NZ 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 any bats that may be present. Following the bat roost protocols minimises the chance of killing or injuring bats.

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. In addition, this method removes roosts from the landscape that bats are dependent on.

Definitions

Competencies: a set of competencies developed by the NZ Bat Recovery Group[4] 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' 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).

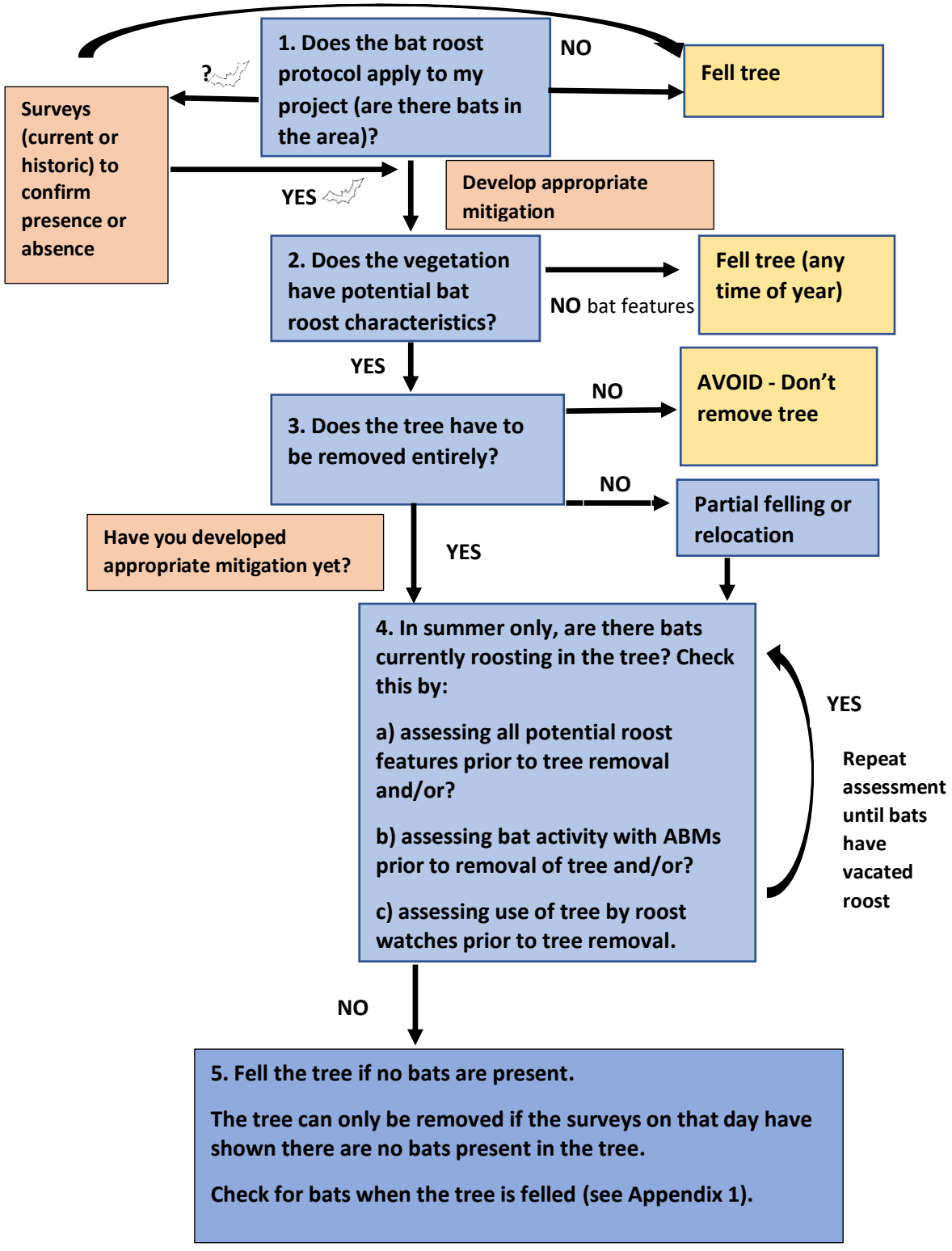
Authorised competent bat worker: A bat worker who has met the required ethical standards to be registered as a competent, authorised bat worker by the New Zealand Bat Recovery Group for the work which they are undertaking.

ABM: automated bat monitoring unit/detector

[4] A group of bat specialists that advise on bat issues and assess bat competencies

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.



Mitigation/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 a future research need.

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, 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?	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 an experienced bat ecologist to adequately cover the Project Area[7] (see note below).	Acoustic surveys to determine presence should be undertaken when bats are most active and environmental conditions are suitable (October 1st to April 30th)[8]. Surveys undertaken at other times of year are considered less reliable for determining absence.
c) Is the tree known to provide a roost location for bats? (Previous knowledge).	c) If yes, go to step 3 If no (but bats are present in the project area), go to step 2.		

Notes for Step 1

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

[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] Adequately covering the project area means including all habitat that are likely to be used by bats bearing in mind that the detectors most commonly used (DOC-manufactured AR4s) have an estimated 30-60m radius within which they can record bats.

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

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.

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)[9]?	If yes, further assessment is required (2b). If no, the vegetation can be removed at any time[10].	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? 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 This may require climbing the tree if you can't see all the tree from the ground.	If yes go to step 3 If unsure, further assessment is required. This may include climbing the tree. If no potential roost features are present, the vegetation can be removed at any time[11], but if upon felling you find a bat follow section 5.	Anyone that can identify these features.[12] If further assessment required, then use an approved person at Competency Level 3.3.	Visual inspections can occur at any time. If there are **NO** potential roost features, felling can occur at any time of year.

[9] 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.
[10] Note that there may be roosts that have smaller diameter at breast height (DBH). If any vegetation is suspected to have a bat roost present, then removal shall be halted immediately, and protocols reviewed.
[11] 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 will be repeated. This is intended to account for any changes in trees which may occur over time.
[12] It is intended that training on identifying roost features will be developed.

Step 3. Does the tree have to be removed entirely?	Response	Who can make this assessment?	When?
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	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 authorised bat ecologist with all competencies of level 3: 'High risk activities – Roost felling'.

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 re-consider again	An approved person at Competency Level 3.3 or an experienced tree-climber (e.g., an arborist) working with an approved person at Competency Level 3.3. If the latter, the tree climber must provide information along with photographs or video footage, to the approved person at Competency Level 3.3 who assesses and decides whether the tree can be removed.	October 1st to April 30th when the temperature is 7°C or greater at official sunset in the South Island or 10 °C or greater in the North Island.

	whether this tree must be felled. Advice must be obtained at a project level in writing from DOC prior to felling the tree.	If roosts are known or confirmed through this process, then this information must be communicated to the nominated DOC bat ecologist for this project.	
b) Is bat activity recorded at any time during two consecutive, valid survey nights preceding tree felling[13]? 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.	<u>If yes (bats are detected)</u>, survey must continue on subsequent nights[14] 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 as in 3. <u>If bat activity is consistent in the area and 2 nights with zero bat passes cannot be obtained</u>, Go to 4c or 4a. <u>If no bats are detected for two consecutive nights</u>, the vegetation can be removed on the day immediately following the survey nights using the method in 5.	An approved person at Competency Level 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 entering the vegetation? This involves watching vegetation to identify bats returning to or exiting roosts. It should only be used in combination with previous ABM monitoring (4b) (see notes 4c for method). At	<u>If yes (bats are seen at either watch)</u>, it is a confirmed roost. Removal of a roost should be avoided to minimise effects	An approved person at Competency Level 3.2[15].	Between October 1st and April 30th only **AND** when weather parameters meet

[13] 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.

[14] Subsequent nights may be those immediately following bat detection or later dates.

[15] If more than one person is required for a roost watch at a tree, a minimum of one approved person at Competency Level 3.2 must be present on site for the duration of the roost watch to supervise.

least two nights are required as it is possible for bats to enter or leave a roost without being detected, or to not leave the roost for a night.	of vegetation removal on bats. Techniques used previously to ensure previously active roosts are no longer active have included the following: Watches must continue on subsequent nights until no bats are observed entering or exiting the roost for two consecutive nights (to indicate the roost is no longer active) prior to felling. <u>If no bats are observed entering or exiting for two consecutive nights</u>, the vegetation can be removed on the day immediately following the survey nights using the method in 5.		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 [16] (South Is) or 10 °C (North Is) or greater at official sunset on the night previous to 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.

[16] 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.

- 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?

4b) ABM survey work

Bat activity is to be recorded using ABMs. Location of ABMs must provide sufficient coverage to be able to determine if bat roosts are present in one or more of the trees[17]. 'Valid' survey nights must have the following features:

- Begin one hour before official sunset and end one hour after official sunrise.
- Temperature 10°C or greater for the first four hours after official sunset time for the North Island and 7°C for the South Island[18].
- Precipitation < 2.5 mm in the first 2 hours after official sunset, and < 5 mm in the first 4 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 10°C all night between official sunset and sunrise for the North Island and 7 °C for the South Island.
- Precipitation < 2.5 mm for each two-hour period between official sunset and sunrise

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 initially from sunset until it becomes too dark to see by sufficient people to observe all potential exit points. This must be supported by the use of handheld detectors. The aim of emergence watches is to identify potential roost locations within the vegetation. Infra-red and thermal imaging cameras may be useful in this process.

[17] 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 detector (S. Cockburn, Department of Conservation, pers. Comm.). This is similar to detection distances of other detector types.

[18] South Island temperatures are based upon O'Donnell (2000) as above. North Island temperatures are based on data collected in Kinleith plantation forest, centred around Tokoroa, Central North Island; Smith D, Borkin K. 2017. Appendix B: Influence of climate variables on long-tailed bat activity in an exotic conifer plantation forest in the central North Island. P 136-145. In: Smith, D, K Borkin, C Jones, S Lindberg, F Davies and G Eccles (2017). Effects of land transport activities on New Zealand's endemic bat populations: reviews of ecological and regulatory literature. NZ Transport Agency research report 623. 249pp.

Roost re-entry watches

The time when bats return to roosts can vary based on temperature and time of year.[19,20]

- 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 bat ecologist, 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 a bat ecologist representing the council and DOC detailing the results of the survey and outlining the measures for protection or relocating the roost tree.
- A record (including photos) of any vegetation containing bat roosts shall be kept detailing the date; size, location and species of tree or other vegetation; roost type, e.g., cavity, peeling bark, broken branch; detail outlining how presence of bats was confirmed; the number of bats present; and species present, if known.

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 night 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 FOLLOWING SURVEY COMPLETION** (i.e., if the survey ends in morning the tree can be felled the same day only).		People who are familiar with the document shown in footnote[21], and physically able to check/inspect tree for signs of bats once felled.	When the inspection method chosen allows.

[19] Dekrout AS 2009. Unpublished PhD thesis. University of Auckland, New Zealand Pp 168.
[20] 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.
[21] https://cdn.ymaws.com/www.nzva.org.nz/resource/resmgr/docs/other_resources/Bat_Care_Advice.pdf

Trees must be inspected for signs of bats once felled and before removing from the site, if safe to do so. Follow Appendix 1 if bats are detected during vegetation removal.			

Appendix 1. 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 or two consecutive nights of ABM data have confirmed that there are no bats present. 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[22] 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 bat ecologist at Competency Level 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 bat ecologist at Competency Level 2.1.

If bats are detected once the tree has been felled**,** all further work must stop, and DOC and an approved bat ecologist at Competency Level 2.1 must be contacted. The felled tree must be thoroughly inspected by the approved bat ecologist 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. A maximum of two bats should be kept in one bag. After delivering the bat to the vet, contact an approved bat ecologist at Competency Level 2.1 in consultation with the vet and DOC (0800 DOC HOT, 0800 362 468).

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[23]. 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 bat ecologist at Competency Level 2.1 and 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.

[22] https://cdn.ymaws.com/www.nzva.org.nz/resource/resmgr/docs/other_resources/Bat_Care_Advice.pdf

[23] https://cdn.ymaws.com/www.nzva.org.nz/resource/resmgr/docs/other_resources/Initial_Vet_Care_NZ_Bats.pdf

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