Waikato Thoroughbred Racing
Greenfields Hub

DRAFT
Pekapeka-tou-roa
Bat Management Plan



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ecological assessment + restoration

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Front cover photo: Long-tailed bat in flight – with permission from Andrew Styche - Department of Conservation

1 INTRODUCTION

1.1 PURPOSE

This Bat Management Plan (BMP) sets out the protocols, performance standards and implementation measures by which potential adverse effects on long-tailed bats (pekapeka-tou-roa, *Chalinolobus tuberculatus*) and their habitat will be avoided, minimised, remedied and, where residual effects remain, compensated during the construction and operation of the proposed Waikato Thoroughbred Racing Greenfields Hub ("the Site").

The BMP applies to all construction and operational activities across the approximately 164 ha Site that could adversely affect bats or their habitat at any time of year, including vegetation clearance, earthworks, lighting installation and operation, track and facility operation, and progressive residential and commercial development. Figure 1 shows the current values of the site and Figure 2 outlines the Masterplan of the proposed development.

The plan is designed to support the substantive Fast-track application and is intended to be certified against the final consent conditions. Its structure and safeguards draw on accepted best practice.

Long-tailed bats are classified as Threatened – Nationally Critical and are absolutely protected under the Wildlife Act 1953.

1.2 STRUCTURE OF THIS BMP

- Long-tailed bat values and habitat at the Site - section 2.
- Bat roost tree felling protocols - section 3.
- Minimising disturbance from construction activities - section 4.
- Minimising effects of the operational hub, including lighting - section 5.
- Habitat protection, corridor and restoration - section 6.
- Residual-effects compensation programme - section 7.
- Monitoring requirements - section 8.
- Review and reporting - section 9.

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1.3 KEY PERFORMANCE STANDARDS

1.3.1 ACCREDITED BAT ECOLOGIST

Implementation of this BMP shall be overseen by a suitably qualified and experienced bat ecologist ("BE") who has met the required ethical and competency standards to be registered as a competent, authorised bat worker by the New Zealand Bat Recovery Group (Department of Conservation) for the tasks being undertaken. Supervision of potential bat roost tree removal is solely entrusted to an authorised competent bat worker holding the relevant high-risk (roost felling) competencies. The BE shall be readily available during vegetation clearance and construction to provide guidance and ensure adherence to this BMP.

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).

1.3.2 DEPARTMENT OF CONSERVATION PROTOCOLS

All assessment, monitoring and felling of potential bat roost trees shall follow the most recent edition of the DOC Bat Recovery Group Protocols for minimising the risk of felling bat roosts (Bat Roost Protocols - Version 4: October 2024, or any subsequent update), attached as **Appendix I**.

1.3.3 WILDLIFE ACT

The long-tailed bat is absolutely protected under the Wildlife Act 1953. Nothing in this BMP authorises the disturbance, injury or killing of bats; any incident is managed under section 3.5 and reported to DOC.

This draft plan does not replace obligations under the Wildlife Act 1953, which apply regardless of resource consent status, and it does not authorise the disturbance of bats or destruction of occupied roosts.

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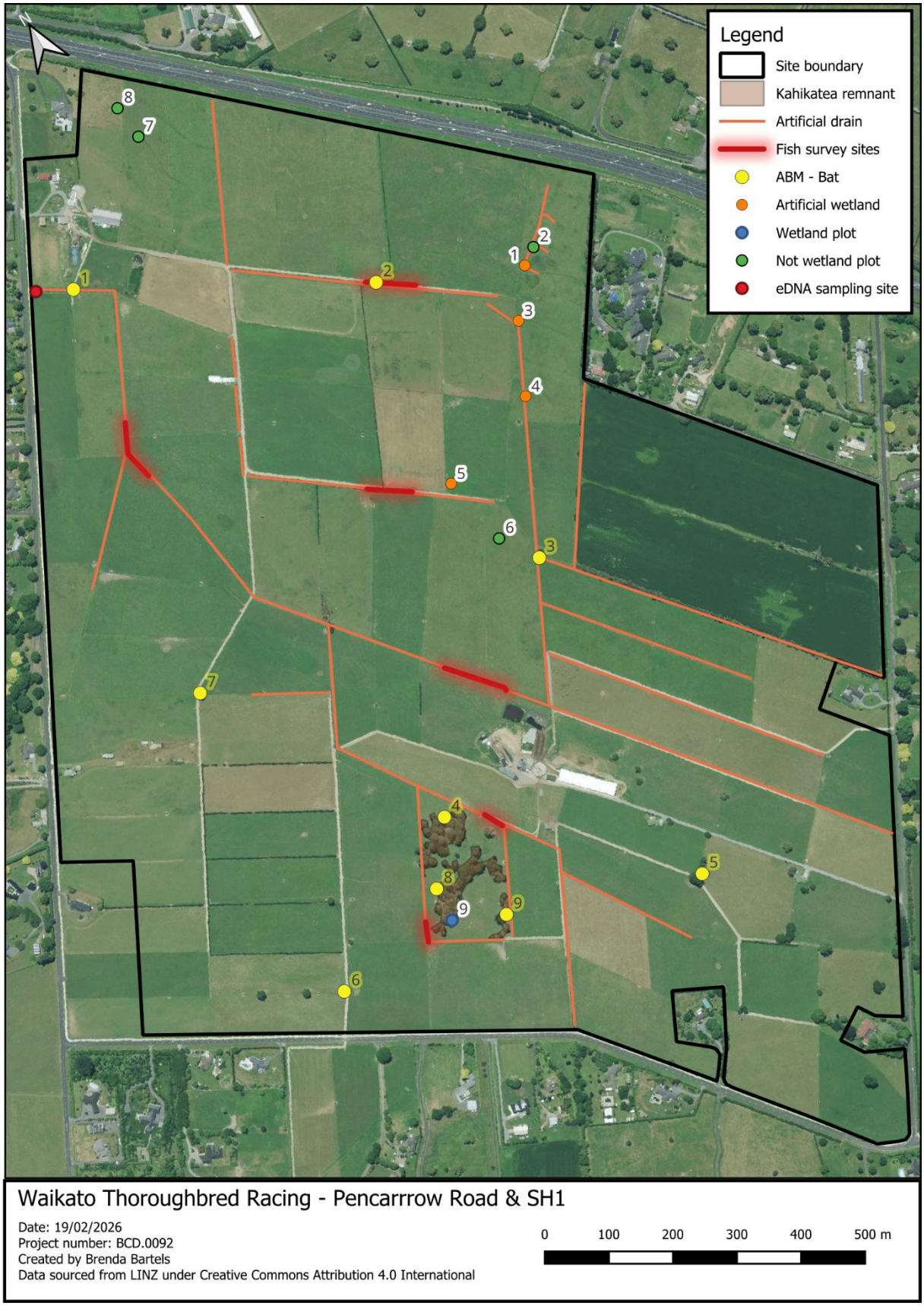


Figure 1: Waikato Thoroughbred Racing Greenfields Hub showing ecological features

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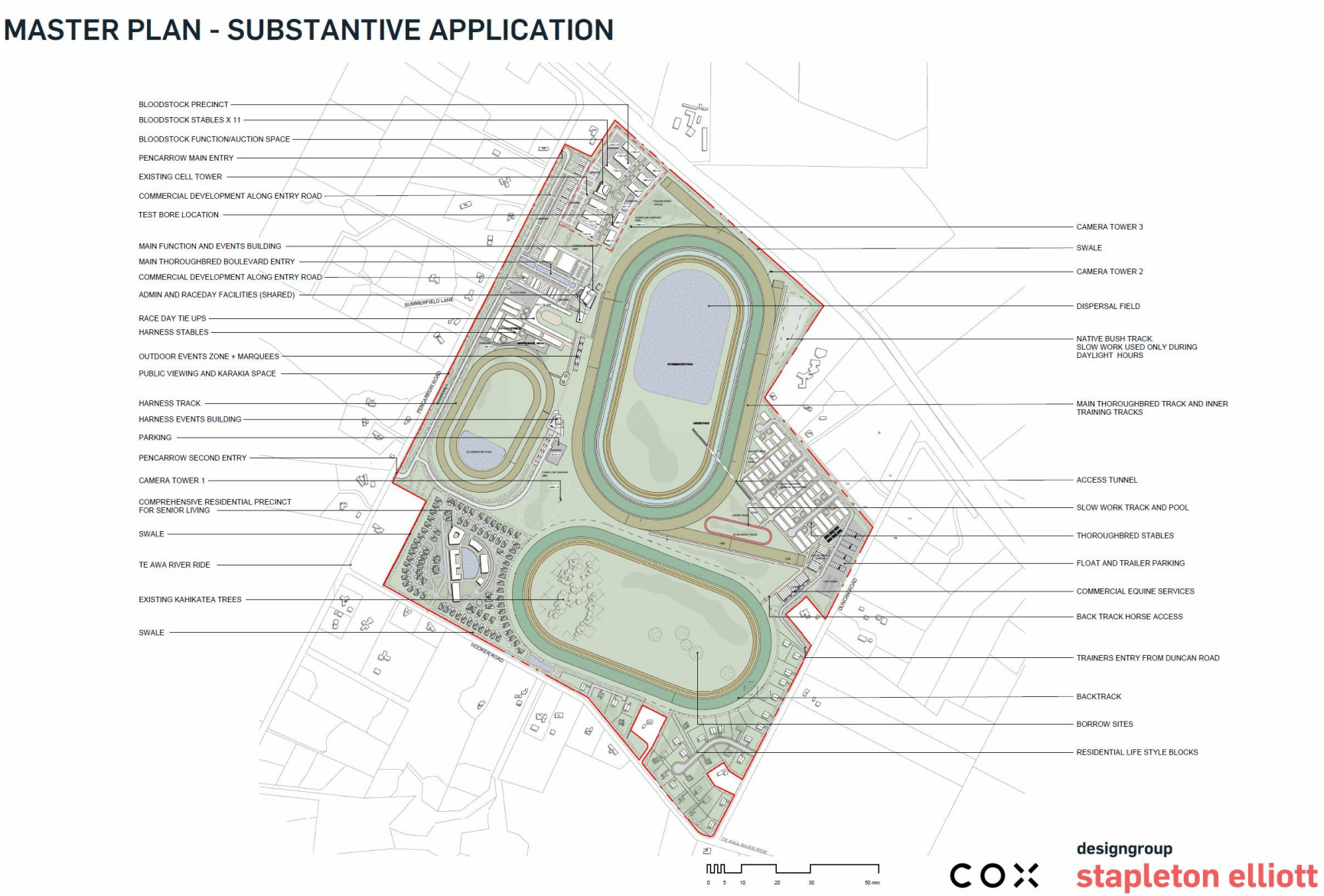


Figure 2: Master Plan of the Site development proposal

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2 LONG-TAILED BAT VALUES AND HABITAT AT THE SITE

2.1 SPECIES CONTEXT

The long-tailed bat is classified as Threatened - Nationally Critical. Its threat status reflects habitat loss and predation by introduced mammals including rats, mustelids, possums and cats. Long-tailed bats are edge-adapted aerial insectivores that forage along vegetation edges, over water bodies and above canopies, roost in native and exotic trees bearing cavities, cracks, crevices and flaking bark, and use linear landscape features as commuting corridors. Long-tailed bats exhibit the following habitat use and behavioural traits:

- Roosting: cavities, splits, hollows and under peeling or exfoliating bark of indigenous and exotic trees, large hollow stumps, caves and crevices in rocky bluffs. Colonies use many roosts (a social group may use more than 100 roost trees) and switch roosts frequently.
- Site fidelity: although highly mobile (roosting movements of 10 km to more than 25 km), colonies return to traditional roosting areas — retaining existing roosting habitat is therefore critical (O'Donnell et al. 2023)[1].
- Vulnerability: bats are least able to escape a felled roost from November to February, when females are heavily pregnant or young cannot yet fly, and in winter or on cold days when bats are in torpor.
- Tree stands, pasture and shelterbelt use: bats use agricultural landscapes for commuting and foraging, particularly along streams, roads and edges, and generally roost in the oldest stands.

2.2 SITE SURVEY RESULTS AND HABITAT PROFILE

Nine automated bat monitors were deployed across the Site in November 2025. Eight recorded long-tailed bats, with 191 passes in total. Activity was highest at the northern and southeastern edges of the remnant kahikatea stand: Site 4 recorded 129 passes (averaging 9.2 passes per night) with seven feeding buzzes, and Site 9 recorded 42 passes (averaging 7 per night) with six feeding buzzes. This confirms regular commuting and foraging use, and nearby roosting cannot be excluded.

The key habitat features for bats at the Site are:

- The 2.7 ha remnant kahikatea stand and wetland - the focal high-value habitat, containing moderate-to-high potential roost trees (with cavity bearing properties).
- Large exotic trees and shelterbelts - potential roosting, navigation and foraging features.
- Open dark pasture and vegetated edges - permeable commuting and opportunistic foraging habitat.

[1] O'Donnell, C. F. J., Borkin, K. M., Christie, J., Davidson-Watts, I., Dennis, G., Pryde, M. & Michel, P. (2023) Conservation status of bats in Aotearoa New Zealand, 2022. New Zealand Threat Classification Series 41. Department of Conservation, Wellington.

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3 BAT ROOST TREE FELLING PROTOCOLS

3.1 POTENTIAL ROOST TREE CLEARANCE

Where bats could be roosting , bat sensitive vegetation removal protocols aimed at minimising potential injury and mortality of bats during tree felling are a core aspect of a BMP.

The Bat Roost Protocols (BRPs) detail measures required to mitigate direct or indirect injury and or mortality risks to bats during clearance of potential bat roost trees (Bat Roost Protocols - Version 4: October 2024, or any subsequent update), as detailed in **Appendix I**.

The key quality assurance and seasonal restrictions checklist items are as follows

- The felling of potential bat roost trees may only be undertaken between 1 October and 30 April in any calendar year.
- The DOC protocols apply to all trees, tree ferns and other vegetation ≥15 cm diameter at breast height (DBH) that meet the criteria for a potential bat roost, whether native or exotic, anywhere on the Site.
- No tree or vegetation identified as a potential roost may be felled or cleared without the prior written approval of the BE.
- Before pre-felling surveys begin, all automated bat monitors (ABMs) shall be tested; faulty or suspect units shall not be deployed.
- Roost habitat assessments may be undertaken at any time of year.
- If no bats are sighted or detected, the BE shall advise the vegetation clearance supervisor in writing that the affected tree(s) may be removed under direct BE supervision in accordance with Appendix I.
- If bats are sighted or detected, the BE shall advise that the affected vegetation cannot be cleared, and the occupied-roost provisions of Appendix I apply.

3.2 INCIDENTAL DISCOVERY PROTOCOLS

If a bat, or a suspected occupied roost, is accidentally discovered at any time during construction works (including in a felled tree) the following steps shall apply:

a) Before construction begins, a clearly labelled bat response kit shall be kept at the site office or another readily accessible location. The kit shall include a cloth bag, secure ventilated container, clean soft cloths, disposable gloves, a copy of the incidental discovery protocol and current contact details for the bat ecologist, DOC and the nominated veterinary provider. The cloth bag and container is for temporary emergency containment only, pending advice from the project ecologist, DOC or a veterinarian.

b) Stop work immediately within 50 m of the find. Shut down machinery in the immediate vicinity and keep people clear.

c) Do not handle the bat unless it is in immediate danger; if handling is unavoidable, use gloves or a cloth and place the bat in a ventilated box in a cool, quiet, safe place.

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d) Notify the Site manager, who will contact the BE and the DOC hotline (0800 DOC HOT / 0800 362 468).

e) Photograph the bat/roost and record location (GPS), time, tree details and circumstances.

f) If a felled tree contains bats, leave the tree and its immediate surrounds undisturbed (do not process, shift or stack it) until the BE arrives and assesses the situation.

g) Injured bats are to be cared for per 'Initial veterinary care for New Zealand bats' under ecologist/DOC direction.

g) Work in the affected area recommences only when the BE (in consultation with DOC where required) confirms it may.

3.3 REPORTING OF PROTOCOL IMPLEMENTATION

The outcomes of each bat roost protocol implementation shall be reported to the consenting authority within 20 working days of the conclusion of each vegetation clearance event, including tree size, location, type and weather records. Survey results shall also be supplied to DOC for the national bat distribution database within 20 working days of analysis.

4 MINIMISING DISTURBANCE FROM CONSTRUCTION ACTIVITIES

4.1 PRECONSTRUCTION BASELINE SURVEYS

Acoustic surveys shall be completed before enabling works in order to:

- update understanding of spatial and temporal use of the Site by bats; and
- refine kahikatea stand interface effects management solutions.

Any further pre-construction baseline or verification survey work shall be undertaken in accordance with a survey design prepared by the BE, having regard to the existing survey dataset, final project design, the corridor and stand interfaces requiring assessment and access constraints.

4.2 EXCLUSION ZONE

An Exclusion Zone shall be established and clearly demarcated around the kahikatea stand and its buffer planting. Construction activity within these zones is limited to approved ecological restoration related works, and zone boundaries shall be communicated to all construction staff. Security lighting and any other related lighting during construction will avoid direct light shine onto the Exclusion Zone.

4.3 INDUCTION

A site induction for all employees and contractors is required to inform them of the specific bat habitat constraints and requirements of the site. This should be completed prior to commencement of infrastructure construction. A record of induction shall be kept. This induction can either be stand-alone or integrated into the health and safety/environmental induction process. This induction should include, at a minimum:

- All machine operators and supervisors shall receive a bat awareness induction before starting on site, covering: what long-tailed bats look like (including size — smaller than many expect), roost types and roost features, the marked exclusion areas, the incidental discovery protocol, and who to call.

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- A one-page bat response card shall be kept at the site office and with vegetation-clearance crews.

5 MINIMISING EFFECTS OF THE OPERATIONAL HUB

5.1 OPERATIONAL LIGHTING

New Zealand research indicates that artificial light at night (ALAN) reduces long-tailed bat detection rates and can deter or exclude bats from foraging habitat (refer to Schamhart et al. 2026[2]; NZTA Bat Management Guide (October 2025)[3]; and DOC Interim Advice Note: Steps to take to reduce the impact/effect of artificial light on pekapeka (bats): Version 1: 19 August 2025[4]).

At the edges of the kahikatea stand and its buffer development-attributable ALAN illuminance shall not exceed 1 lux vertically or horizontally at the mapped outer edge of the buffer planting. If this cannot be met, compensatory bat habitat enhancement measures may be required to be applied as outlined in section 7.

Supporting controls in the Residential LifeStyle Blocks area shall include outdoor ALAN lighting with warm-spectrum luminaires (≤2700 K), hoods and louvres, lowest practicable mounting heights and outputs, dimming and switching controls, minimisation of blue-rich and upward light, and management of vehicle headlights through access design, planting, screening, road orientation and parking layout.

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[2] Schamhart, T., Borkin, K.M., Browne, C.M. et al. Effects of nominal 2700 K amber LED with a blue cut filter and 4000 K white LED on nightly activity of light-naïve New Zealand long-tailed bats (Chalinolobus tuberculatus). Mamm Biol 106, 873–885 (2026). https://doi.org/10.1007/s42991-026-00590-7

[3] https://www.nzta.govt.nz/assets/resources/bat-management-guide/bat-management-guide.pdf

[4] https://www.doc.govt.nz/globalassets/documents/conservation/native-animals/bats/bat-recovery/reduce-impact-artificial-light-pekapeka.pdf

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6 HABITAT PROTECTION, CORRIDOR AND RESTORATION

6.1 LEGAL PROTECTION

The restored 2.7 ha kahikatea stand, its wetland and ecotone buffer, retained potential roost trees, the southern bat corridor and on-site restoration areas shall be legally protected in perpetuity (covenant, consent notice or equivalent). No buildings or lighting infrastructure shall be located within protected areas other than approved ecological works.

6.2 KAHIKATEA STAND REHABILITATION AND BUFFER

The stand shall be fenced, weeded and rehabilitated, and a functionally adequate ecotone buffer planted around it, in accordance with the restoration requirements of the project Ecological Impact Assessment.

Revegetation shall incorporate canopy species with cavity-bearing properties to provide future roosting opportunities.

6.3 RESIDENTIAL LIFESTYLE BLOCK ARAS

The Residential LifeStyle Block areas shall be subject to outdoor lighting controls as described in section 5.1.

7 RESIDUAL-EFFECTS COMPENSATION PROGRAMME

Residual adverse effects on long-tailed bat habitat and connectivity may remain after implementation of the avoidance, minimisation and remediation measures in this BMP.

If more-than-minor residual effects remain after the effects-management hierarchy is applied, options to address this residual effect may include:

- biodiversity offsetting if the required principles can be met;
- biodiversity compensation if a true offset is not achievable;
- staged consent-condition processes requiring later submission of a compensatory package;
- negotiated habitat enhancement / pest control / restoration measures linked to the local bat population.

Following analysis of data collected from additional monitoring to be undertaken over the 2026-2027 spring/summer seasons, residual-effects and compensation analysis may be recommended to address possible any residual adverse effects on bats and their habitat on the site. It is therefore possible that a rationally derived compensation payment, the quantum of which is determined by suitably experienced and qualified bat ecologists, is recommended to a competent conservation provider for pest control and/or other proven habitat enhancement measures in a number of smaller high-potential bat-roost habitats within the home range of this population of bats.

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8 MONITORING REQUIREMENTS

8.1 MONITORING PROGRAMME

Tabel 3 below outlines the bat monitoring programme. Any acoustic monitoring required under this BMP shall be undertaken to an agreed survey design prepared by the BE, using suitable equipment, weather criteria, best practice deployment duration and analysis methods.

Table 3: Summary of monitoring requirements

Phase	Monitoring	Timing
Pre-construction (baseline update)	Acoustic surveys plus targeted assessment of high-potential roost trees	Before enabling works
Vegetation clearance	Pre-felling acoustic surveys and roost inspections per DOC protocols (Appendix I)	Within two nights before any potential roost tree removal
Operational phase	Annual acoustic monitoring (Oct – April window), and vegetation establishment audits	Annually for at least 5 years after completion of each stage

9 REVIEW AND REPORTING

An annual report shall be prepared by the BE and submitted to the consenting authority during construction and at least five years following operation of the racing hub and residential areas covering: monitoring data and analysis; vegetation establishment; any injured or dead bats; bioacoustic trends against baseline; and recommended changes to this BMP, monitoring methods, lighting, planting or compensatory measures. Survey results shall also be provided to DOC for the national bat distribution database.

This BMP shall be reviewed annually following commencement, and amended as needed to reflect changes in staging, design or monitoring results. Amendments shall be certified in accordance with the relevant consent conditions.

Compliance reporting for vegetation clearance events follows section 3.

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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.

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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.

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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

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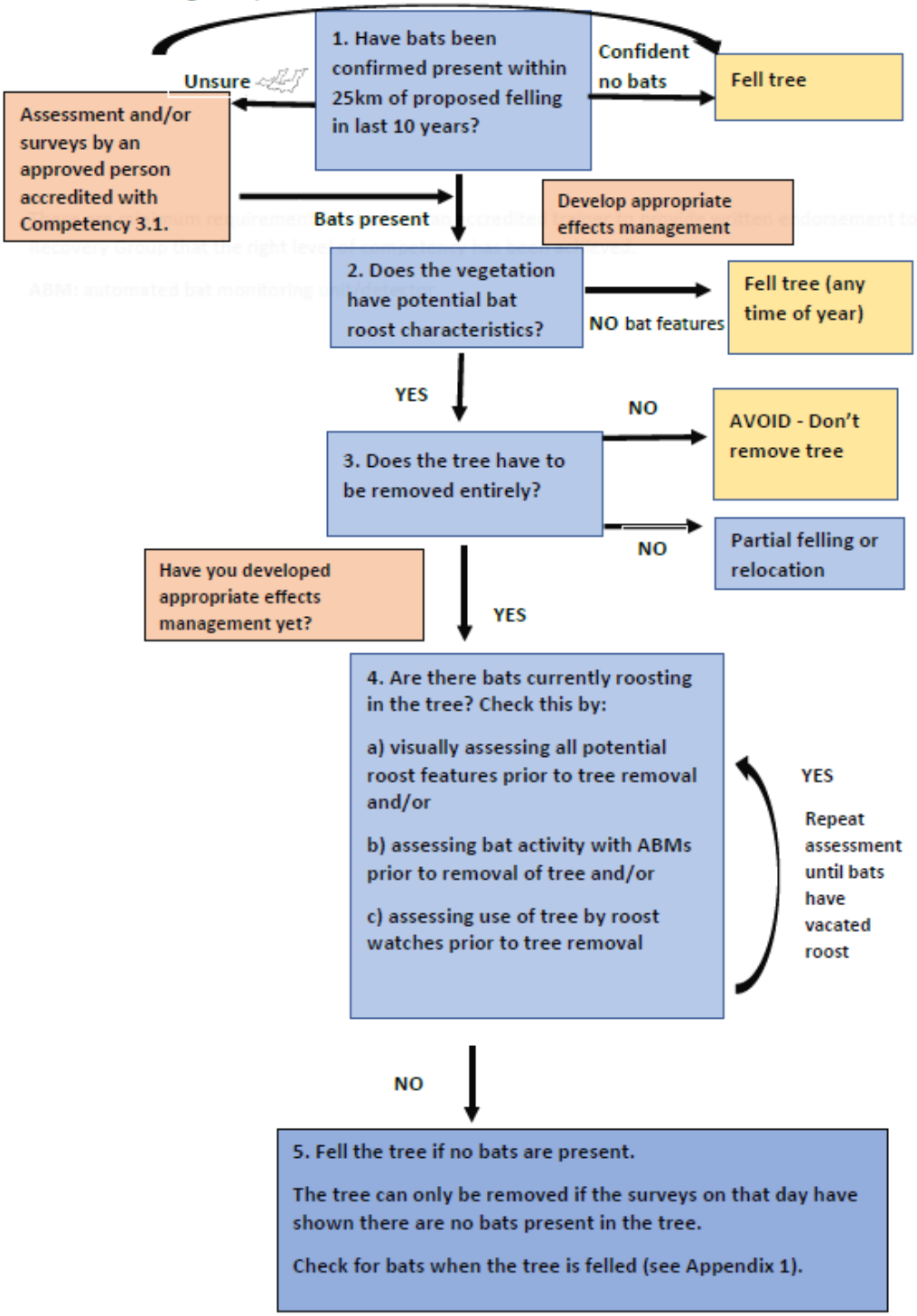
These are minimum requirements and rely on an accredited trainer to provide written endorsement to the Bat Recovery Group that the right level of competency has been achieved.

ABM: automated bat monitoring unit/detector

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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.



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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.

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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.

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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.

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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.	

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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

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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

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