Ecology and Landscape Management Plan

March 2018

Mt Messenger Alliance

NZ TRANSPORT AGENCY WAKA KOTAHI
Mt Messenger Bypass
New Zealand Government

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Revision schedule		
Rev. Number	**Date**	**Description**
A	March 2018	Draft for discussion

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Contents

Glossary

Acronym / Term	Definition
AEE	Assessment of Environmental Effects
CEMP	Construction Environmental Management Plan
ELMP	Ecology and Landscape Management Plan
LEDF	Landscape and Environmental Design Framework
MfE	Ministry for the Environment
NPDC	New Plymouth District Council
TRC	Taranaki Regional Council
DOC	Department of Conservation
MRMP	Myrtle Rust Management Plan
PPMP	Pest Plant Management Plan
PAMP	Pest Animal Management Plan
SH3	State Highway 3
The Project	The Mt Messenger bypass Project
Designation	The Parameters of the land parcel affected by the Project
Transport Agency/NZTA	NZ Transport Agency
RMA	Resource Management Act 1991
BBOP	Business and Biodiversity Offsets Programme
PMA	Pest Management Area
AWA	Additional Works Area
MPI	Ministry for Primary Industries
SEV	Stream Ecological Valuation
BMP	Bat Management Plan
Wildlife Act	Wildlife Act 1953

Acronym / Term	Definition
VRP	Vegetation Removal Protocols
ABM	Acoustic Bat Monitor
LED	Light Emitting Diode
AMP	Avifauna Management Plan
LMP	Lizard Management Plan
ACO	Artificial Cover Object
CCFC	Closed Cell Foam Cover
SVL	Snout to Vent Length
CWMP	Construction Water Management Plan
FRRP/FR&RP	Fish Recovery and Rescue Protocols
E & SC	Erosion and Sediment Control
SCWMPs	Specific Construction Water Management Plans
SRP	Stream Restoration Plan
SQP – E	Suitably Qualified Practitioner in Freshwater Ecology
COPMA	Core Offset Pest Management Area
RTC	Residual Trap Catch Index
RTI	Rat Trapping Tunnel Index
PAPP	Para-aminopropriophenone
CCI	Possum chew card activity/Chew Card Index
NPCA	National Pest Control Agencies
HSNOA	Hazardous Substances and New Organisms Act 1996
VTA	Vertebrate Toxic Agent
IUCN	International Union for Conservation of Nature
PTP	Peripatus Translocation Plan
AMRMC	Alliance Myrtle Rust Management Coordinator

Acronym / Term	Definition
MRNMP	Myrtle Rust Nursery Management Protocol
ABC	Alliance Biosecurity Coordinator
TRoNT	Te Runanga o Ngāti Tama

1 Introduction

This Ecology and Landscape Management Plan (ELMP) has been prepared for the NZ Transport Agency's Mt Messenger bypass Project (the Project).

1.1 Purpose and objectives of the ELMP

The ELMP has been prepared to identify how the Project will avoid, remedy, mitigate and offset potential adverse effects on the ecological, landscape and biodiversity values of the land within the Project area and its surrounds.

Specifically, the Plan outlines how the Project will avoid, remedy, mitigate, and offset effects on ecological and landscape values, including:

- Vegetation and habitat (including wetlands);
- Herpetofauna (lizards);
- Bats;
- Avifauna;
- Invertebrates (including peripatus species);
- Fish, kōura and kākahi;
- Streams; and
- Rehabilitation and restoration planting.

The ELMP also provides detail on the following ecological and landscape mitigation and offset measures to be implemented as part of the mitigation and biodiversity offset package for the Project, which is focused on achieving a net gain in biodiversity in the medium term following the completion of construction:

- Management measures and protocols to avoid, remedy or mitigate the impact of construction on flora and fauna within the Project area (such as vegetation clearance protocols, lizard salvage and relocation protocols, bat roost surveys etc) as outlined in the respective management plan chapters of this ELMP;
- Pest management measures, particularly the control of introduced animals rats, mustelids, possums and goats) and livestock;
- Restoration planting (including swamp forest planting), and replacement planting for significant tree species removed;
- Riparian planting and exclusion of livestock from existing streams;
- Relocation or cultivation of threatened plants found within the Project Area;
- Provision of fish passage;
- The physical mechanisms (e.g. fences) to protect the restoration and riparian planting from clearance and / or livestock on an ongoing basis;
- Landscaping design and treatments (landform and planting), including rehabilitation of all areas used for temporary work and construction yards; and
- The staging of planting and landscape treatments for the Project

The Plan also outlines monitoring to be undertaken both pre and post construction with the individual monitoring requirements described in the individual chapters of this ELMP.

The ELMP is an appendix to the Construction Environmental Management Plan (CEMP) for the Project. The construction methodology for the Project is detailed in the CEMP; and the Assessment of Effects on the Environment (AEE) or the Project.

1.2 Status of the ELMP

This draft ELMP has been prepared following initial discussions with Te Runanga o Ngāti Tama (TRoNT) and the Department of Conservation (DOC) in relation to managing the adverse ecological effects of the Project. Discussions will remain ongoing over the coming months as the Project progresses and the ELMP is finalised.

The ELMP will be reviewed and updated over the course of the Project in accordance with the designation and resource consent conditions, to reflect significant changes associated with construction techniques, communication, mitigation or the natural environments. The review process for the final CWMP is set out in Section 13.

Amendments to the ELMP may be made subject to the requirements set out in Section 13.

1.3 ELMP Structure

The ELMP provides an overview of the ecological and landscape values within the Project area, along with the general approach to manage the ecological and landscape effects resulting from construction of the Project. This is followed by a series of discipline specific management plan chapters that outline in detail the measures to be implemented during the works to avoid, remedy, mitigate or offset ecological and landscape effects. The specific management plan chapters have been prepared by the Project ecology and landscape specialists who authored the AEE Ecological Technical Reports, which have informed this Plan (refer to Section 1.4).

The ELMP is set out as follows:

- Section 1 – Introduction (this section);
- Section 2 – Ecological values and effects summary;
- Section 3 – Ecological mitigation strategy and framework;
- Section 4 – Landscape and Vegetation Management Plan;
- Section 5 – Bat Management Plan;
- Section 6 – Avifauna Management Plan;
- Section 7 – Herpetofauna Management Plan;
- Section 8 – Freshwater Management Plan;
- Section 9 – Pest Management Plan;
- Section 10 – Peripatus Management Plan;
- Section 11 – Biosecurity Management Plan (addressing the management of Myrtle Rust, plant pests and animals (excluding those to be managed in the Pest Management Area));

- Section 12 - Roles and responsibilities and training requirements; and
- Section 13 – ELMP review process

1.4 Associated documents

1.4.1 Technical reports

As outlined above, this ELMP has been informed by the assessment of ecological and landscape effects and management measures outlined in the relevant technical and supplementary reports supporting the AEE for the Project including

- Assessment of Ecological Effects – Vegetation (Technical Report 7a);
- Assessment of Ecological Effects – Freshwater Ecology (Technical Report 7b);
- Assessment of Ecological Effects – Invertebrates (Technical Report 7c);
- Assessment of Ecological Effects – Herpetofauna (7d);
- Assessment of Ecological Effects – Avifauna (7e);
- Assessment of Ecological Effects – Bats (7f);
- Assessment of Ecological Effects - Marine Ecology (Technical Report 7g);
- Assessment of Ecological Effects – Ecological Mitigation and Offset (7h);
- Landscape, Natural Character and Visual Assessment (Technical Report 8a); and
- Landscape and Environment Design Framework (LEDF) (Technical Report 8b), which sets out the landscape and environmental design elements for the Project. The purpose of the LEDF is to guide the detailed design and construction method development so that the Project's temporary and permanent works are integrated into the surrounding landscape and topography; having regard to the local landscape character and context.

1.4.2 Management plans

Implementation of this ELMP and the management of ecological and landscape effects has a number of linkages to other management plans prepared for the Project, including:

- **The Construction Environmental Management Plan (CEMP)**, which provides the overarching framework for managing adverse effects during construction of the Project. The CEMP outlines:
    - the Project construction methodology, including key works that may adversely affect ecological and landscape values;
    - the environmental and cultural management framework for the Project;
    - roles and responsibilities and training requirements (including Project induction and environmental awareness training);
    - emergency and incident response protocols; and
    - monitoring, reporting and review requirements.
- **The Construction Water Management Plan (CWMP)**, which sets out the overall approach to erosion and sediment control site management during construction of the Project, so that discharges of sediment from the site are minimised to the greatest extent

possible. The Plan also addresses the management of other contaminants, such as concrete and fuel use which may also directly or indirectly discharge into receiving environments from construction works.

- **Specific CWMPs**, erosion and sediment control plans prepared for specific work areas or activities within the site. The SCWMPs take into account environmental and ecological values and risks to determine the most effective and appropriate form of erosion and sediment control practices to manage construction water on a location and/or activity basis. The plans also outline detailed design information, specific erosion and sediment control measures and the staging and sequencing of works relevant to the specific location / activity.
- **The Dust Management Plan**, which outlines the measures to be implemented during construction to avoid, remedy or mitigate the adverse effects of dust and odour from the construction works, including on ecological receptors.

1.5 Gaining kaitiaki inputs to ELMP implementation

Ngāti Tama are the iwi and exercise mana whenua for this part of Taranaki.

The Project traverses land returned to Ngāti Tama through the Treaty of Waitangi Settlement process. The Transport Agency has consulted directly, and worked collaboratively, with Ngāti Tama through the process of developing the Project.

Ongoing engagement with Ngāti Tama will occur as the Project progresses to enable Ngāti Tama to provide their kaitiaki inputs into the design, construction and operational phases of the Project. A process for gaining kaitiaki inputs is being developed with Ngāti Tama. The process will likely involve:

- A specific forum being established for Ngāti Tama and the Transport Agency (through the Mt Messenger Alliance) to work collaborative on kaitiaki matters (the 'Kaitiaki Forum').
- Kaitiaki matters being developed and progressed through the Kaitiaki Forum by way of a sequential process to a conclusion, generally involving:
    - Identifying the kaitiaki matter.
    - Determining the work required to develop the matter and the parties that need to be involved to progress the work.
    - Completing the required work.
    - Reviewing the outcomes / output and determining if additional work is required to progress the outcome / output.
    - Completing more work if needed.
    - Implementing the final outcome / output.

The Transport Agency will continue to work collaboratively with Ngāti Tama through the Kaitiaki Forum to ensure that Ngāti Tama's kaitiaki aspirations are provided for in Project outcomes. Examples of matters that may be progressed through the Kaitiaki Forum could include:

- The representation of cultural artwork in Project designs.
- Development and implementation of the pest management programme.
- The development and implementation of cultural indicators and cultural monitoring.
- Tikanga and cultural practice in relation to Project activities.

This kaitiaki process and associated outcomes will be relevant to the implementation of this ELMP.

2 Ecological and landscape values and effects

2.1 Introduction

Ecological and landscape values and effects of the Project within and around the Project area are described in detail in the following AEE and supporting technical reports:

- Assessment of Ecological Effects – Vegetation (Technical Report 7a);
- Assessment of Ecological Effects – Freshwater Ecology (Technical Report 7b);
- Assessment of Ecological Effects – Invertebrates (Technical Report 7c);
- Assessment of Ecological Effects – Herpetofauna (Technical Report 7d);
- Assessment of Ecological Effects – Avifauna (Technical Report 7e);
- Assessment of Ecological Effects – Bats (Technical Report 7f);
- Assessment of Ecological Effects - Marine Ecology (Technical Report 7g);
- Assessment of Ecological Effects – Ecological Mitigation and Offset (7h);
- Landscape, natural character and visual assessment (Technical Report 8a);
- Landscape and Environment Design Framework (Technical Report 8b);
- Ecology Supplementary Report – Vegetation;
- Ecology Supplementary Report – Freshwater Ecology;
- Ecology Supplementary Report – Terrestrial Invertebrates;
- Ecology Supplementary Report – Herpetofauna;
- Ecology Supplementary Report – Avifauna;
- Ecology Supplementary Report – Bats; and
- Ecology Supplementary Report – Ecological Mitigation and Offset.

A summary overview of ecological and landscape values and effects is provided in this chapter. The locations of important ecological values and constraints within the Project footprint are shown on the Ecology Constraints Map provided in Appendix A.

The Project traverses an area forested with indigenous native vegetation, which is part of a wider vegetation sequence running from the coastal margins inland to the lowland mountains. It straddles an ecological boundary between two broad forest classes with podocarp, broadleaved forest largely in the Mimi catchment and the upper Mangapepeke Valley, and podocarp, broadleaved, beech forest within the lower Mangapepeke Catchment and northwards (Figure 2.1).

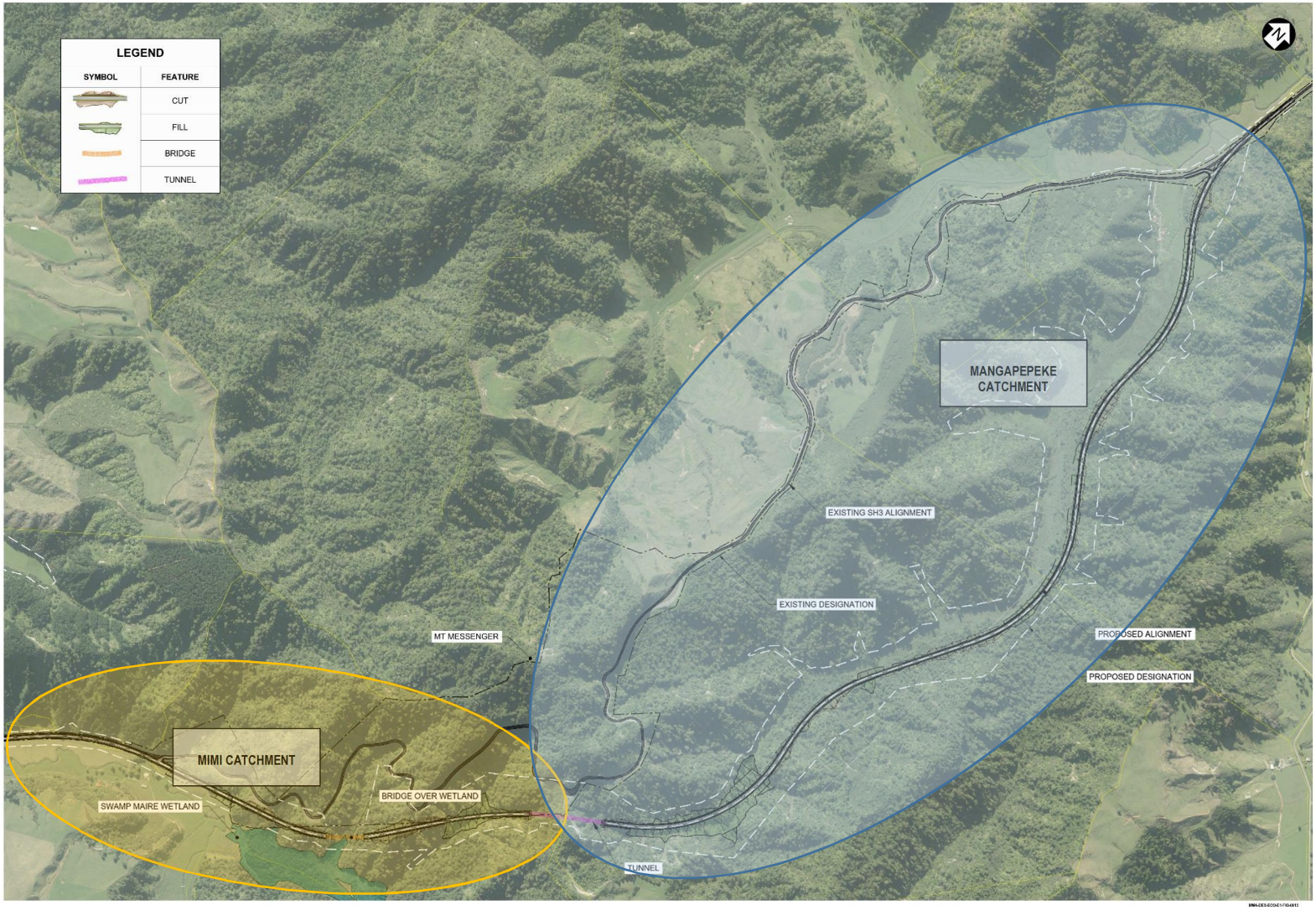

Figure 2.1 - Aerial plan of the wider Project area showing the main catchments and swamp forest

2.2 Summary of ecological values

The dominant forest on the Ngāti Tama block to the east of the existing SH3 corridor would have originally been very similar to the Parininihi land located to the west; however, it has not had consistent pest control (Figure 2.1). Consequently, the ecological condition of this area is poorer, with fewer palatable canopy trees remaining, such as thin-barked totara (*Podocarpus laetus*) and northern rata (*Metrosideros robusta*). Within the Mangapepeke Stream catchment, vegetation communities are more modified and have been affected by long-term stock grazing, fire and logging with the result being a transition to large open and grazed rushlands and poor quality pastureland further down the valley towards SH3. This valley bottom would once have been dense swamp forest.

Of greatest ecological significance in the wider Project area to the east of SH3 area is the hydrologically intact swamp forest and non-forest wetland areas in the valley floor of the northern Mimi River catchment (Figure 2.1). The valley floor sequence within the northern tributary of the Mimi River represents a full range of swamp forest, scrub and non-forest wetland communities that would once have been more common throughout this area.

Ecosystem and habitat types within the Project footprint are summarised in Table 2.1 and a summary of ecological values is provided in Table 2.2.

Table 2.1 - Ecosystem / habitat types within the Project footprint (ha) and ecological values

Potential Ecosystem Type	Vegetation community	Project footprint total	Ecological value*
WF8: Kahikatea pukatea forest	Kahikatea swamp maire forest	0.159	High
	Kahikatea forest	0.525	High
	Kahikatea treeland	0.641	Moderate
	Pukatea treefern treeland	0.722	Moderate
	Manuka scrub	0.582	Low
	Exotic rushland	5.826	Low (not significant)
WF13: Tawa kohekohe, rewarewa, hinau, podocarp forest	Tawa rewarewa kamahi forest	6.457	High
	Tawa nikau treefern forest	8.507	Moderate
	Miro rewarewa kamahi forest	0.536	High
	Pukatea nikau forest	1.347	High

Potential Ecosystem Type	Vegetation community	Project footprint total	Ecological value*
	Secondary mixed broadleaved forest	2.231	Moderate
	Manuka treefern scrub	0.146	Low (not significant)
	Manuka succession	0.514	Moderate
WF14: Kamahi, tawa, podocarp, hard beech forest	Hard beech forest	0.288	Moderate
	Tawa rewarewa kamahi forest	0.526	Moderate
	Manuka treefern rewarewa forest	3.291	Low-Moderate
	Manuka treefern scrub	3.164	Low
	Treefern scrub	0.080	Low
	Manuka scrub	1.560	Low
CL6: *Hebe*, whahariki flaxland/ rockland	Dry cliff	0.399	Moderate
Total ha		**31.676**	**High**

***** Refer to section 4.2 in Technical Report 7a – Vegetation (December 2017)

Table 2.2 - Summary of Ecological Values

Ecological aspect	Ecological values
Terrestrial vegetation	• The Mt Messenger – Parininihi area is characterised by mature podocarp broadleaved forest dominated by tawa, rewarewa and locally kamahi and pukatea, and occasional rimu, miro, northern rata and thin-barked totara. Areas of secondary scrub and forest also occur dominated by manuka, kanuka, tree ferns and small-sized canopy trees. Small areas of kahikatea (*Dacrycarpus dacrydioides*), pukatea (*Laurelia novae-zelandiae*) and swamp maire (*Syzygium maire*) forest and associated wetlands occur in valley floor areas (see Table 2.1 above for exact areas of each ecosystem type and ecological values). • 17 large, native trees that are required to be felled[1] for the Project are determined as being significant

[1] Removal of one rimu may be able to be avoided through modifications in design and construction.

Ecological aspect	Ecological values
	• The Project will result in the combined loss of 31.277ha of indigenous dominant forest and secondary scrub vegetation (Table 1).
Freshwater	• The waterways in the wider Project area provide high quality habitat for freshwater fish and invertebrates. • Waterways draining north to the Mangapepeke Stream and headwater tributaries draining to the Mimi River on the south side of Mt Messenger all present high ecological values. • The lower section of the Mangapepeke Stream has an aquatic macroinvertebrate community that indicates good water quality and there is a good diversity of fish present including adult inanga (*Galaxias maculatus*), longfin eel (*Anguilla dieffenbachia*), koura/crayfish (*Paranephrops planifrons*) and redfin bully (*Gobiomorphus huttoni*) (all classified as At Risk – Declining), whilst common bully (*Gobiomorphus* cotidianus) and paratya shrimp (Not Threatened) are also present. • The main tributaries in the upper catchment are dominated by indigenous forest and macroinvertebrate communities that are indicative of excellent water quality/habitat. • 3.822 km of stream loss will occur as a result of the project and a stream area of 3361 m^2 will be lost.
Bats	• The North Island long-tailed bat (*Chalinolobus tuberculatus*) is a Nationally Vulnerable species and is present in the wider Project area. • Central lesser short-tailed bats (*Mystacina tuberculate rhyacobi*), listed as At Risk – Declining, may also be present in the wider Project area although they have not been detected in surveys. Lesser short-tailed bats are dependent on large tracts of old growth native forest and the wider Project area overlaps with the known national distribution of this sub-species.
Herpetofauna	• Herpetofauna records show that the goldstripe gecko (At Risk – Relict), striped skink (At Risk – Declining), copper skink (*Cyclodina aenea*) (Not Threatened), forest gecko (At Risk – Declining), Hochstetter's frog (*Leiopelma hochstetteri*) (At Risk – Declining) and Duvaucel's gecko (*Hoplodactylus duvaucelii*) (At Risk – Relict) have all been found within a 50km radius of the wider Project area. No herpetofauna species were found in artificial retreat surveys, although 4 copper skinks (*Oligosoma aeneum*) were found in visual encounter surveys near the existing SH3, although outside the Project footprint.
Avifauna	• A total of 36 diurnal and two nocturnal bird species were recorded during the first set of surveys in the wider Project Area, 23 of which are indigenous. • In total, seven 'At Risk' species were recorded in these surveys or in subsequent field investigations in the Project footprint and proposed pest management area. These species include fernbird (*Bowdleria punctata*), North Island brown kiwi (*Apteryx mantelli)*, North Island robin (*Petroica longipes*), long-tailed cuckoo (*Eudynamys taitensis*), whitehead (*Mohoua*

Ecological aspect	Ecological values
	albicilla), pipit (*Anthus novaeseelandiae*) and black shag (*Phalacrocorax carbo*). • 10 potential kiwi pairs were detected within or in close proximity to the Project footprint during listening watches. It is anticipated that the road alignment is likely to encroach or bisect territories of between 10-15 pairs of kiwi. • North Island kōkako (*Callaeas wilsoni*; Threat Status: 'At Risk – Recovering') were released into the western part of the Parininihi area in winter 2017. The release site was approximately 2 km north of the nearest part of SH3, and approximately 3.5 km from the summit of Mt Messenger and the nearest parts of the Project footprint. Young kōkako typically do not disperse far from natal areas and the natural rate of spread of a populations from a source location is slow. This indicates that kōkako of Parininihi origin are unlikely to colonise the Project area for years, and possibly decades.
Invertebrates	• Invertebrate fauna that has been found in the area is 'typical' of communities inhabiting primary forests of the southern portion of the North Island. The forest habitat available to invertebrates is considered to be of high quality, with deep leaf litter layers, an abundance of dead wood and numerous potential plant hosts. • Two species of peripatus, *P. suteri* and *P. novaezealandiae* were found within the Project footprint. *P. suteri* is classified as 'Vulnerable' on the IUCN Red List of Threatened Species.

The ecological values present in the Project footprint and adjacent forested and wetland areas are high, although considerably diminished from their full potential because of the long term and largely unchecked impact of farm livestock and animal pests.

The Project will result in the combined loss of 31.277 ha of indigenous dominant forest and secondary scrub vegetation, as well as the removal of up to 17 significant large trees, and 3.8 km of freshwater habitat. This, combined with the diverse and high value nature of the ecology, means that the potential adverse ecological effects generated by the construction, operation and maintenance of the new road will also be high.

2.3 Summary of ecological effects

Potential adverse effects associated with the construction and operation of the Project will primarily occur through habitat loss associated with vegetation clearance, earthworks and stream culverting and diversions. The actual and potential adverse ecological effects associated with construction of the Project are described in detail in the AEE and supporting technical reports and summarised in Table 2.3 below.

Table 2.3 - Actual and potential adverse ecological effects

Ecological aspect	Adverse construction effects
Terrestrial vegetation	• Loss of 31.277 ha of indigenous dominant vegetation communities, including communities that are now rare, highly representative and of high ecological value. An additional 5.83 ha of exotic rushland will also be lost. • Loss of up to 17 large significant trees, which provide significant habitat and resources for a range of other species. • Loss of plants classified as 'at risk – declining'. Potentially 25 individual plants of kohurangi (*Brachyglottis kirkii* var. *kirkii*), and small populations of two regionally distinctive species, swamp maire (*Syzygium maire*) and *Pittosporum kirkii*, will be lost. • Although unlikely, potential sedimentation may occur through the high value wetland and alluvial flood plain of the northern tributary of the Mimi River if control measures are overwhelmed during significant storm events.
Bats	• Loss of roosts and effects on roosting bats. • Loss of foraging habitat. • Habitat fragmentation, severance and isolation. • Impact of construction noise, vibration, light disturbance during night works, and operational lighting. • Mortality or injury on roads through vehicle strike.
Avifauna	• Direct removal or degradation of habitat used for nesting or foraging. • Direct mortality of nests and their contents. • Habitat fragmentation and isolation. • Construction noise disturbance. • Sediment runoff to wetlands and watercourses affecting the quality of wetland bird habitat.
Herpetofauna	• Habitat loss. • Habitat fragmentation. • Vehicle strikes.
Freshwater	• 3.822 km of stream loss and 3361 m^2 stream area will be lost. • Sedimentation resulting from vegetation clearance and construction activity. • Direct removal of fish from streams. • Short-term loss of fish passage in some areas.

Ecological aspect	Adverse construction effects
	• Short term loss of stream habitat where temporary culverts are used. • Contamination of water when in direct contact with wet concrete. • Water takes for the purpose of dust suppression.
Marine ecology	• The overall risk of potential adverse effects on marine ecological values arising from the release of sediment during construction ranges between low or no ecological effect depending on the habitat or species.
Terrestrial invertebrates	• Habitat loss and degradation. • Habitat fragmentation and isolation. • The creation of habitat edge effects. • Introduction of new exotic invertebrate taxa during construction. • Direct mortality of invertebrates (including peripatus) during vegetation clearance and earthworks.

2.4 Summary of landscape values

The landscape quality and capacity of the character sub-units directly impacted by the project to accommodate landscape change are summarised below (see Technical Report 8b Section 3.1.4).

Landscape **quality** was assessed taking into account the following matters:

- biophysical values such as the natural science values of landform, vegetation, waterways;
- perceptual values such as aesthetic quality, legibility (way-finding and orientation), distinctiveness and memorability;
- associative factors such as historical associations, recreational values, or values that tangata whenua and others might associate with a landscape.

The **highway absorption capability** is an appraisal of the likely degree of effects that would result from a highway of the type proposed taking into account such matters as:

- likely modification to natural landforms, waterways or vegetation;
- likely prominence, including density of dwellings, proximity to settlements, the ability to fit a road to the contours, potential screening by vegetation or topography; and
- likely extent of change to existing character – taking into account the landscape's complexity and existing degree of modification.

The Project is contained within Sub-Unit vii (the Mangapepeke Valley) in the north and crosses a small section of the wider Sub-unit ii – Upper Mimi Valley. The quality and capacity of these units (as reported in the MCA process is described below.

Sub unit ii - Upper Mimi Bush Valley

- Very Steep Bush Hill country (includes DoC estate)
- Complex stream systems
- Sensitive Wetland / stream system (Mimi System and confluence)
- Includes existing SH3 corridor in the Northwest.
- Modified lowland valley
- SH3 roadway south of Mt Messenger
- High quality / Moderate to Low capacity for landscape change

Sub unit vii- Mangapepeke Bush Valley

- Well defined and visually contained bush valley
- Moderate ecological values
- Partially modified (grazed in the north) with an unmanaged 'scruffy' rural
- character partially in the valley floor
- Assumed cultural landscape values associated with land ownership
- *Moderate quality / Moderate capacity to accommodate landscape change*

In summary, the Project is predominantly within a contained valley system that has a moderate capacity to accommodate landscape change and crosses the north-western section of a higher quality landscape sub-unit (sub unit ii) in proximity to the existing SH3 corridor and the lesser quality lowland pastoral margins.

The landscape context of the wider Project area includes (see Technical Report 8b Section 3.1):

- the steep to very steep bush hill country from the coastal terraces south of the Tongaporutu River;
- south to the pastoral flats of the Mimi Valley;
- west to the coast and the Parininihi Cliffs; and
- east to the Mangaonga Road Corridor and the Mount Messenger Forest.

The wider Project area is set within an important cultural landscape. Ngāti Tama are acknowledged as mana whenua and the project traverses Ngāti Tama Treaty settlement lands which are located to the east and west of the existing SH3 alignment.

The combination of high ecological and cultural landscape values is reflected in the Regionally Significant Landscape notation of land to the west of Mount Messenger in the NPDP including notable features of the Parininihi Cliff and the Waipingao Catchment – home to the Parininihi Protection Project.

2.5 Summary of landscape effects

Potential adverse effects associated with the construction and operation of the Project will primarily occur through vegetation clearance, earthworks, stream culverting and diversions and the addition of structures into the landscape which have an impact on biophysical, perceptual and associative values. The actual and potential adverse landscape effects associated with construction of the Project are described in detail in the AEE and supporting technical reports and summarised in Table 2.4 below.

Table 2.4 - Actual and potential adverse landscape effects

Landscape aspect	Adverse construction effects
Landscape and visual	• Introduction of a highway into two valleys that currently have a quiet, remote rural character – albeit exposed in places to the existing highway on the western flanking hills; • The introduction of additional built elements into the landscape including ancillary structures such as hydrant tanks and a tunnel control building; • Clearance of 31.277 ha of indigenous vegetation and secondary scrub at the top of the valleys in particular; • Earthworks including batters cut into the side slopes of the valley in some cases up to approximately 60 m; • Creation of permanent disposal areas; and • Crossing, filling and diversions of 3.8 km of streams.

3 Ecological and landscape mitigation strategy and framework

This section summarises the general approach to the management of actual and potential ecological and landscape effects associated with the Project. The measures referred to in this section are set out in detail in the management plan chapters that follow.

3.1 General approach and guiding principles

The purpose of the Resource Management Act 1991 (RMA) is to promote the sustainable management of natural and physical resources on private and public land, while avoiding, remedying, or mitigating adverse effects on the environment. While there is no statutory hierarchy for the application of these terms, international guidelines on the management of ecological effects, particularly those espoused by the Business and Biodiversity Offsets Programme (BBOP), promote a "mitigation hierarchy" or an "effects management hierarchy" that prioritises the sequence with which management of the effects should be approached:

AVOID ⇨ REMEDY ⇨ MITIGATE

The term *mitigate* in the RMA does not include "biodiversity offsetting" as the mitigation relates to the reduction of effects at or on the site where the effects were created. Instead offsetting provides new positive effects at another location (ideally close by). While recognising that the RMA is not a "no effects" statute, development of offsetting in the New Zealand context has led to an extended effects management hierarchy or order of priority:

AVOID ⇨ REMEDY ⇨ MITIGATE ⇨ OFFSET ⇨ COMPENSATE.

"Compensate" in this regard refers to less conventional approaches, such as cash payments towards achieving an environmental benefit, where mitigation and offsetting may not be possible.

This discussion is relevant to the management of ecological effects on the Project because, as is highlighted in sections below, it is not possible to avoid, remedy or fully mitigate the net residual ecological effects within the Project footprint. Significant ecological effects created by the construction and operation of the Project will need to be offset.

3.2 Avoidance and minimisation of effects

The nature and extent of potential effects of the Project on ecological and landscape values have been considerably reduced through the route selection and design refinement process.

A large number of route options were considered before the Project route was selected. The assessment of effects of the various options played an important part in route selection. The options assessment process has meant routes affecting Parininihi have been avoided.

Before and after the selection of the preferred route, significant alterations to the road design have occurred to minimise the likely effects. These include:

- Inclusion of an approximately 240 m long tunnel through the ridge dividing the Mangapepeke and Mimi catchments. The tunnel has greatly reduced the size of the cut and fill area that would otherwise have been required and has preserved the important east – west connectivity of habitat (ridge to coast) and mobile animal movement (especially bats).
- Incorporation of an approximately 120 m long bridge across a tributary valley of the Mimi River on the south side of the route. This bridge sits very close to the ecologically significant wetland area and has significantly reduced the effects that a cut and fill approach would have had on the wetland.
- Introduction of construction techniques to reduce effects. For example, the bridge mentioned above has been designed in a way that will allow it to be constructed from each side rather than from the valley bottom. This will reduce the amount of ground and vegetation disturbance compared to a more conventional approach of building the bridge from the valley bottom, and it will also reduce the risk of sediment erosion down into the wetland.
- Minor adjustments to the route to minimise the need to remove significant trees. The number of significant trees potentially needing to be removed has been reduced from 22 to 17 by this means.
- Realignment of the road corridor, including shifting part of the corridor further from the ecologically significant wetland area.
- Location of construction yards, laydown areas, construction access tracks and haul roads away from sensitive/significant areas to minimise the extent of disturbance and vegetation clearance.
- Use of retaining walls to avoid loss of significant trees where possible.
- Location of spoil fill areas in areas likely to cause the least ecological effect.
- Implementation of vegetation removal, construction and sediment management best practices to minimise effects on adjoining vegetation, habitat and fauna.
- Physical delineation (such as fencing or flagging tape) will be used to clearly mark the extent of vegetation clearance to be undertaken, along with vegetation to be protected.
- Installation of an effective waste management system to minimise the chances of attracting pest mammals.
- Having ecologists on site to advise the construction teams and recover important vegetation and animals, when vegetation is being cleared.
- Management of light spill associated with construction lighting through careful consideration of the layout and arrangement of temporary lighting (including shrouding and spectrum limits to minimise impacts on adjacent ecological habitats).

3.3 Project footprint rehabilitation and restoration

Only a small amount of ecological mitigation can occur within the physical Project footprint. This is because mature indigenous forest that is the habitat of many indigenous animal species will be removed to construct the road and this cannot immediately be replaced.

Most of the effort required to generate a "no net loss of biodiversity" outcome will need to occur as offset on adjacent land and stream margins where existing conditions are more suited to assisted ecological recovery.

However, it is the intention to work with the natural landscape and restore ecological processes to the extent possible along the new road margins. As stated in the 'Landscape and Environment Design Framework' (LEDF) the landscape design and rehabilitation objectives for the Project footprint are based around four overarching landscape design principles:

- "Keeping low in the landscape" – thereby minimising physical landscape effects
- "Letting the landscape speak" - a clean uncluttered highway where the surrounding landscape provides the scenic amenity
- Recognising culture – which means appropriately recognising human relationship to the land, including continuing the partnership with Ngāti Tama through the detail design process to express their mana whenua and kaitiakitanga
- Connecting 'Landscape' and 'Ecology' – responding to and reflecting natural elements, patterns and processes through design.

The ecological objective for the site rehabilitation work is to repair some ecosystem processes on altered landscapes, however the trajectory and endpoint may well be different from any previous state because of the works required to create the road.

Rehabilitation work is required to the altered and modified areas of the proposed alignment, such as fill and cut slopes, vegetated swales, stream diversions, temporary works areas and stockpile sites. Specific objectives that support the aim of 'rehabilitation' are:

- to support natural regeneration and succession to native shrubland and eventually forest, and
- to minimise medium-term maintenance.

The rehabilitation strategy (Chapter 4 of the ELMP) aims to work with the natural landscape, taking opportunities to harness and speed up natural processes, including the use of salvaged material including woody debris, organic matter and topsoil, to better the chance of successfully rehabilitating areas affected by the works.

3.4 Mitigation of effects

Mitigation of effects will occur within and along the margins of the Project footprint. This will occur through the application of a number of management approaches designed to reduce the severity of effects, reduce the likelihood of prolonged effects, and to neutralise effects by recreating replacement habitat as quickly as possible. Mitigation measures (detailed in later chapters in the ELMP) include:

- Implementation of the bat vegetation removal protocol to minimise the likelihood of bats being harmed when trees are felled
- The relocation of peripatus in their woody habitat (stumps and logs) from the footprint to the neighbouring forest which will be subject to ongoing pest management

- Search, capture and relocation of herpetofauna from the Project footprint
- Construction of kiwi protection fencing at locations along the footprint margin to reduce the risk of kiwi mortality due to road kill)
- Replanting within the Project footprint, wherever soil conditions and hydrology remain essentially the same as prior to construction, with early successional plant species similar to or the same as those removed. It is expected that these areas of mitigation planting will resemble what is removed in a matter of a few years.

There will not be enough areas suitable for mitigation planting within the Project footprint to achieve no net loss of vegetation values, so additional mitigation planting areas will be established on land adjacent to the footprint that currently has a cover of pasture or low quality scrub. The aim with this will be to recreate areas of native vegetation that are of no less ecological or landscape value than the areas cleared, and in many cases, considerably better. Where planting conditions allow, mid and later successional native plant species will be mixed in with the early successional species. This will promote a more speedy transition to a forest state than would otherwise occur.

3.5 Offsetting of residual ecological effects

The objective of the ecological offsetting work is to restore a range of ecosystem processes (and therefore ecosystem function and landscape values) that have been degraded by human activity and the presence of animal pests and livestock by:

- intensive multi-species pest management in perpetuity;
- the re-establishment of swamp forest and wetland habitat to areas that were once swamp forest and wetland and which retain the environmental conditions suitable for re-establishment; and
- the restoration of stream habitat by pest and stock exclusion and riparian planting.

In summary, we are setting out to “kick start” natural processes in an environment that has enough of its original components to be restored to a state close to what it might have been previously. Our stated target for the mitigation and offset package (and therefore the ecological restoration) is to achieve no net loss in biodiversity 10 years following the completion of road construction and a net gain from 15 years.

3.5.1 Pest management in perpetuity

The pest management proposed has a multispecies focus (rats, mustelids, possums and goats) with the intention to hold all species to low densities in perpetuity sufficient to allow the permanent recovery of many indigenous plant and animal communities.

Based on evidence from other locations, particularly the adjacent Parininihi, the proposed pest management programme can be expected to generate biodiversity benefits for a wide range of plants and animal species. Plant biomass and diversity will increase as grazing and browsing pressure is reduced, the diversity and abundance of more palatable species will increase as seedling survival improves, and the health of old emergent forest giants especially rata and totara will improve as their foliage rebounds in the absence of possums in particular.

As forest and vegetation health improves in the low-pest environment, the carrying capacity within the PMA for many indigenous animal species will increase substantially. This will result in spill over benefits for surrounding areas as juvenile birds and bats disperse. Because the pest management is proposed in perpetuity (or until such time as pest management in the form we know of it today is no longer necessary to sustain the levels of biodiversity created) the ecological and landscape benefits throughout the region should be permanent.

3.5.2 Swamp forest restoration planting

The intention of the restoration planting is to transform those grass-, rush- and sedge-dominated areas that are suitable for planting swamp forest into stands of kahikatea, pukatea and swamp maire, with small areas of rimu and matai where ground conditions are not as saturated.

While transition to a diverse mature swamp forest will take many decades, the ecological value will begin to improve immediately because of the removal of livestock and the management of pests. Ultimately the upper Mangapepeke valley will transform into a diverse, high value swamp/wetland ecosystem.

3.5.3 Riparian fencing and planting

Stream buffer plantings will consist of a mix of indigenous riparian margin sedges, shrubs and trees. The primary objective will be to provide shade and organic matter to the stream channel to improve the quality of habitat for native fish and invertebrates. A reduction of sediment and nutrient loads entering the streams, compared to the current situation, will also be achieved by fencing and planting, especially along the stream sections that pass unfenced through farmland.

Where the swamp forest restoration planting and stream restoration planting areas can coincide, the net ecological and landscape benefit will be substantial and considerably greater than if the swamp forest and riparian forest restoration plantings were undertaken in fragmented fashion. The result will be the conversion of these valleys back to fully-forested and connected swamp and riparian forest and the elimination of forest edge.

3.5.4 Effects not directly accounted for by the Biodiversity Offsets Accounting Model

The offsetting proposed to address the ecological effects has been developed using the Biodiversity Offsets Accounting Model. [2]

The Model requires certainty of data, to allow for net loss and then net gain to be calculated.

The achievement of no net loss and then net gain will be measureable for vegetation, stream habitat, and many bird species. However, research suggests that measurement of no net

[2] Maseyk, F., Maron, M., Seaton, R. and Dutson, G. 2015. A biodiversity offsets accounting model for New Zealand. March 2015. The Catalyst Group 1-67.

loss for long tailed bats, lizards, and invertebrates may not be possible (refer to the monitoring section in Chapter 9 of this ELMP). This is not necessarily because the proposed measures will not result in a beneficial effect, but because the monitoring methods available are not necessarily able to detect it.

Part of the reason for this is that, despite extensive monitoring effort, we have not been able to gain a definitive understanding of the nature and size of the populations of these animals, which have low levels of detectability (lizards), species complexity (invertebrates) or are highly mobile within large ranges (bats). With limited data to feed into the Biodiversity Offsets Accounting Model[3] the model cannot generate an appropriate offset for those animals. The offset derived from the application of the Model has not directly accounted for effects on these values.

The residual effects of this Project that have not been accounted for by the Biodiversity Offsets Accounting Model have been addressed by the provision of additional ecological restoration effort. The size and nature of the additional efforts has been based on the best available science and the professional opinions of fauna experts, and is considered to be more than sufficient to generate net biodiversity gain from 15 years following construction. The additional ecological measures proposed include:

- Additional 855 ha of pest management in perpetuity (over and above the 230 ha required as calculated through the use of the Model)
- The planting of 200 seedlings of the same species for every significant tree that will be removed within the Project footprint (3400 seedlings in total if 17 trees are removed)
- Construction of a pest free soft-release pen for lizards.

[3] Maseyk, F., Maron, M., Seaton, R. and Dutson, G. 2015. A biodiversity offsets accounting model for New Zealand. March 2015. The Catalyst Group 1-67.

4 Landscape and Vegetation Management Plan

4.1 Introduction

This chapter outlines the management processes required to avoid, remedy, mitigate and offset adverse effects on vegetation, habitat and landscape values as a result of the Project, including:

- avoiding adverse effects on flora, associated species and habitat on the margins of the project footprint;
- habitat restoration;
- like for like mitigation;
- ecological offsetting to address residual habitat loss; and
- rehabilitation planting and plant establishment to address landscape and visual effects; provide amenity and screening and as part of measures proposed to control stormwater; and to provide for cultural expression and recognition, in conjunction with Ngāti Tama.

It also includes information about the use of materials for cultural purposes such as harvesting timber, and forest resources for restoration and site rehabilitation purposes.

4.2 Baseline vegetation ecology survey results

All information pertaining to vegetation, biodiversity offsetting and mitigation in the Project footprint is included in the following reports:

- Technical Report 7a – Vegetation (December 2017)
- Ecology Supplementary Report – Vegetation (February 2018)
- Technical Report 7h – Mitigation and Offset (December 2017) and Appendix A – Biodiversity Offset Calculations (December 2017)
- Ecology Supplementary Report – Mitigation and Offset (February 2018) and Appendix A Ecology Supplementary Report – Biodiversity Offset Calculations (February 2018)

Technical Reports 7a – Vegetation and 7h - Mitigation and Offset were finalised in December 2017 for lodgement as part of the AEE and include information regarding field surveys undertaken from January to August 2017. Additional field work was subsequently undertaken to address knowledge gaps, specifically within private land in the Mangapepeke Valley. The results are described in the Ecology Supplementary Report – Vegetation and Ecology Supplementary Report – Mitigation and Offset.

Vegetation loss has been assessed at 31.3 ha of forest and scrub loss. This area includes the permanent road corridor, the additional works area (AWA) and an additional 5m buffer for edge effects — together the Project footprint. The additional works area includes a 5 – 20m margin either side of the road footprint and all access roads and other temporary work

areas associated with construction. Where habitat of high ecological value adjoins the road footprint, the margin of vegetation clearance is 5m, while 20m has been allowed in areas of lower ecological value. The additional loss of 5m for edge effects has been included to account for loss or modification during and following completion of the project. It is likely that overall vegetation loss at the completion of the project will be less than estimated.

4.3 Landscape and Environmental Design Framework

The Landscape and Environmental Design Framework (December 2017) (LEDF) sets out the landscape and environmental design elements for the Project. The approvals version of the LEDF was lodged with the resource consent application in December 2017 (Technical Report 8b) but the LEDF is intended as a 'living' document. The LEDF will inform the development of detailed design and construction methods so that the Project's temporary and permanent works are integrated into the surrounding landscape and topography, having regard to the local landscape character and context.

4.4 Measures during construction to avoid and minimise adverse effects on vegetation and the habitat of associate species

A range of measures will be undertaken to avoid and minimise adverse effects on vegetation and habitat of associate species. These include:

- Specifically avoiding damage to adjoining vegetation in high value vegetation areas
- Removal and relocation of forest resources
- Mulching and storage of wood and soil material

4.4.1 High value vegetation areas

High value vegetation areas adjoining the Project footprint were identified during the design process. In these areas the margin of vegetation clearance within the AWA is typically 5m wide. These areas are shown in Figures 4.1 & 4.2 and in the Ecology Constraints Map (Appendix A to the ELMP). In these areas, the edge of both the road footprint and the AWA will be clearly physically delineated. Within the AWA, vegetation clearance will be minimised to ensure a vegetation buffer remains as large as practical and clearance does not trespass into high value ecological areas.

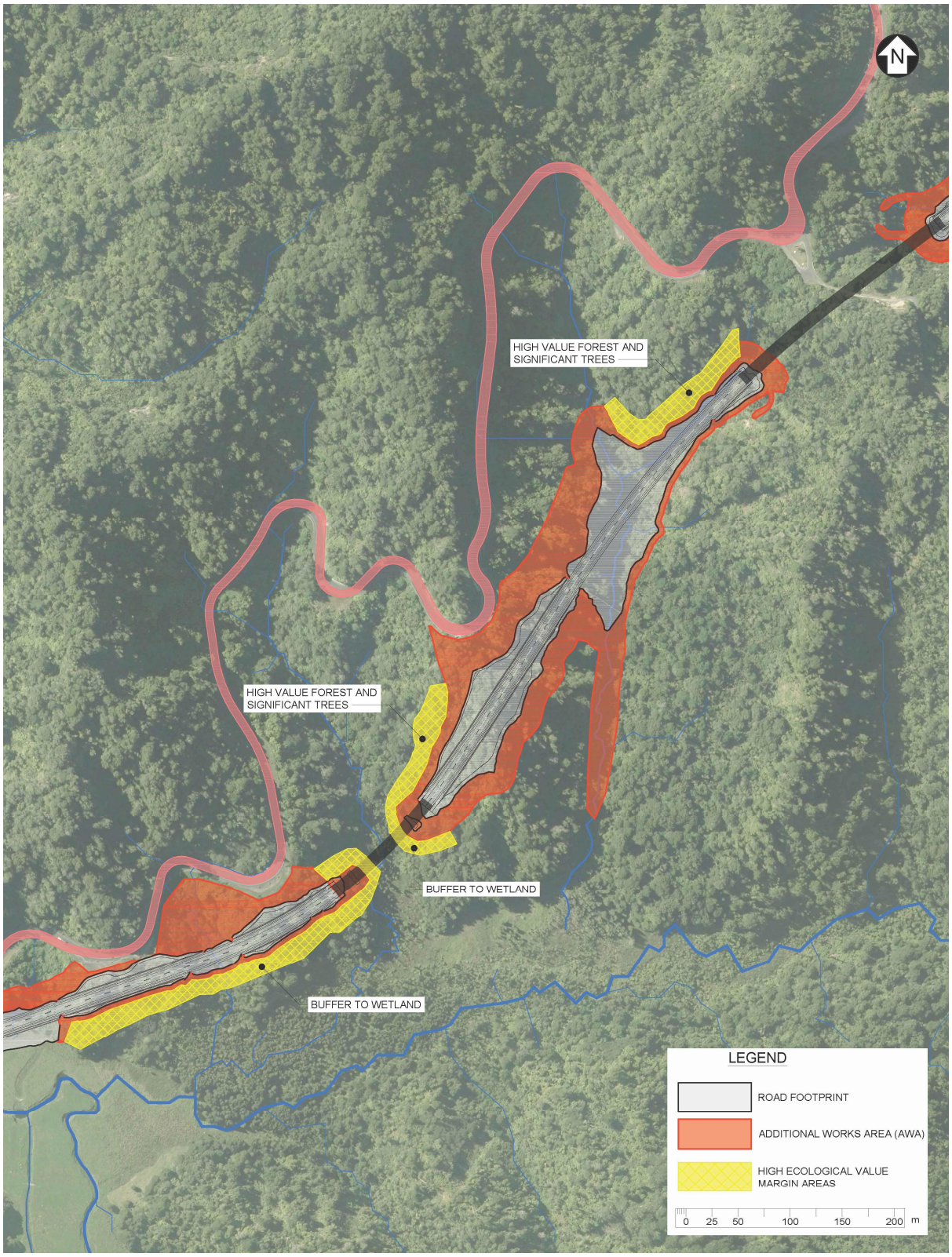

Figure 4.1 - Margin areas of high ecological value in the Mimi Catchment

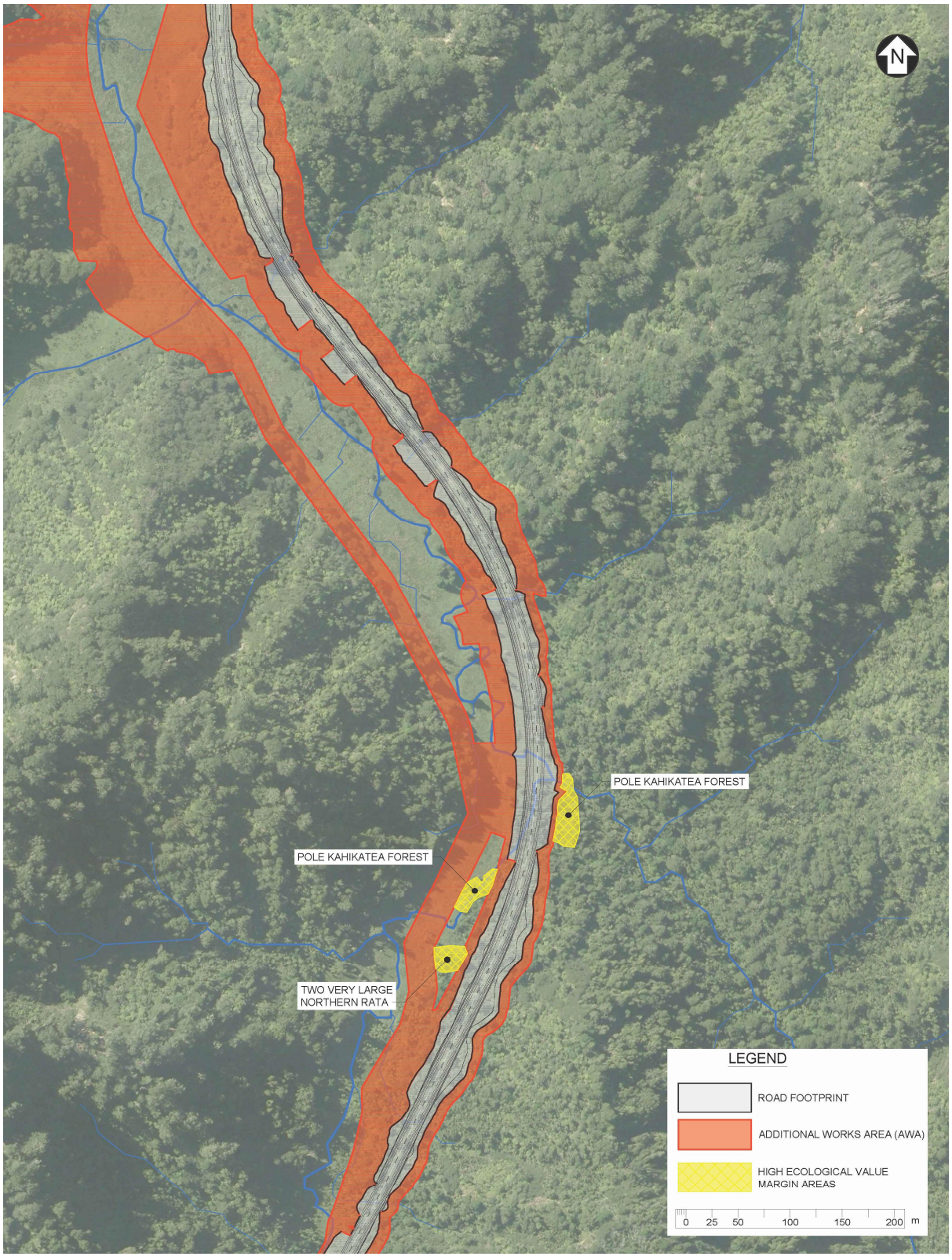

Figure 4.2 - Margin areas of high ecological value in the Mangapepeke Catchment

4.4.2 Removal and relocation of forest resources and threatened, regionally distinctive plants and hosts of other threatened species

Fallen trees are ecologically important to forest regeneration processes and as habitat for a wide range of species. Fallen wood provides habitat for decomposers including invertebrates, fungi and bacteria and sites for plant regeneration. Of significance is the presence of the velvet worm (*Peripatus suteri*) a species regarded as "Vulnerable" on the IUCN Red List of Threatened Species. Fallen trees also provide habitat for lizards and kiwi regularly nest beneath them. They are also very important as habitat for plant regeneration, including regeneration of kamahi which is locally an important canopy dominant.

For these reasons it is desirable to leave large fallen logs and as much cut vegetation in-situ as possible, targeted for relocation to suitable sites outside of the Project footprint where avoidance of vegetation damage is possible. As construction will take place over several years, regeneration will likely have naturally initiated in these locations during this time.

For practical reasons, however, most vegetation will need to be mulched and removed and used for either for sediment/ erosion control during construction or combined with site-won topsoil and used for site rehabilitation and ecological restoration purposes. Some whole vegetation, such as tree ferns, will also be used for sediment control as required. Procedures to avoid impacts to lizards, birds, bats and fish during the vegetation clearance process are included in Chapters 5, 6, 7 & 8, such as removal or fish and lizards before vegetation clearance.

Where suitable sites exist, large fallen and decaying logs and a proportion of cleared vegetation will be left in-situ adjoining the road footprint. Suitable sites occupying approximately >0.6 ha occur within and adjoining the AWA in the Mangapepeke Valley, down slope of the road footprint. Elsewhere suitable smaller sites include open clearings dominated by pasture and rushland, canopy gaps within forest areas and beneath tall forest where sparse understory vegetation exists.

Vegetation left in-situ should be placed into small and compact windrows within defined areas. Windrows should not be placed in locations where material could move and enter the Mangapepeke Stream or within any of the smaller streams. In forest areas smaller volumes of material can be placed with minimal damage to existing sub-canopy and ground cover vegetation. Larger logs (of greater than 50cm diameter or more than 5m long) will likely need to be cut into manageable sections.

Priority plant material for leaving in-situ includes:

- Large (>50 cm diameter) fallen (rotting) logs — these are habitat for invertebrates such as the threatened velvet worm (*Peripatus suteri*) and lizards
- The heads of large trees (>50 cm diameter) typically covered in epiphytes — these tree heads will be habitat for invertebrates and potentially lizards
- Large tree trunks (>50 cm diameter), especially any which are partially rotten and contain cavities. These should be cut up into manageable portions (3–5 m sections).

The Project footprint contains a small number of the *At Risk* plant kohurangi (*Brachyglottis kirkii* var.*kirkii*) and two regional distinctive plants, *Pittosporum cornifolium* and swamp maire (*Syzygium maire*). Both kohurangi and *P. cornifolium* are small epiphytic shrubs that grow in the tops of large trees such as rimu and matai, and are known to occur on at least three significant trees in the Mangapepeke Valley.

Cultivation of these two species will be attempted by collecting cuttings, seed or potentially whole plants (if practical) from fallen host trees. Cultivation methods for these species, in order to reintroduce them back into suitable habitat, are relatively new and therefore success has not been measured. For these reasons a small number (up to 30 for each species) will be trialled on dead ponga which will likely be introduced to a suitable location within restoration areas. Swamp maire will be propagated from local sources and planted especially within valley floor swamp forest sites.

The forest ringlet butterfly (*Dodonidia helmsii*), an 'At Risk: Relict' species, is known from the North Taranaki Ecological District. Two host species, *Gahnia pauciflora* and *G. setifolia*, occur in the general area and some plants also occur within the footprint on steep ridges. Gahnia is ideally suited to dry and exposed sites such as the top of cuttings. Plants known or found within the Project footprint will be harvested, cultivated and returned to suitable restoration sites. Harvesting *Gahnia* and threatened plants known or found within the Project footprint will be a responsibility of the onsite ecologist.

4.4.3 Setting aside wood for stream restoration

Large wood is an important component of natural stream channels, providing habitat and food for insects, koura, fish and birds. In low gradient streams with fine sediment substrate, large wood is an important stable microhabitat. Large wood is usually defined as >100 mm diameter and >1 m long, however larger pieces with more complexity provide for better stability and habitat.

During the process of vegetation removal some large wood will be stockpiled for use in stream restoration including: root wads and hole tree tops and cover a range of sizes in diameter classes of 150-300 mm, 300-600 mm and >600 mm. Some lengths should be long, i.e. about 6m. The number of logs required in each size class shall be finalised as part of the detailed design.

The harvest of wood for in stream work should focus on denser woods such as tawa, maire, hinau, and kamahi. Additionally large manuka and kanuka will be harvested to secure wood to stream beds (sized about 100-200 mm diameter, and >1.2 m long).

4.4.4 Mulching and storage of wood and soil

Vegetation which is not left in-situ will be mulched on-site using a mulching head on a large excavator. This process will result in mulch being distributed across the Project Area. With the forest duff and top soil layers this will all be harvested together and stored in windrows for site rehabilitation and selected ecological restoration use, such as dryland mitigation areas. Larger trees not able to be mulched on-site will be felled and removed, with some being used for stream habitat restoration or sediment and erosion control purposes.

Mulching trees potentially could result in mulch entering small streams, causing smothering of stream habitat, and deoxygenation as green leaf and woody material decomposers. This ultimately could cause stream invertebrates and fish life to die downstream. To avoid this occurring, mulching needs to be undertaken in a manner that prevents mulch entering small streams. Where practicable, this will involve manually chipping in to the back of a truck, removing any vegetation that falls within 10–20 m of a stream and mulching this at a suitable location. See Ecology Constraints Map (Appendix A to the ELMP).

Mulched wood and soil will be removed from the Project footprint and placed into stockpiles. In this process the focus should only be on removing the A (organic) and B (organic stained subsoil) soil horizons. Care will be needed to minimise the incorporation of subsoil and parent material (papa mudstone) layers when this process is undertaken.

Invasive weeds are likely to grow on soil stock piles, especially species which are currently known from the Project footprint such as African clubmoss, tradescantia, wild ginger and gorse. Wind dispersed species such as pampas grass will also likely rapidly colonise. As the intention is to utilise soil stock within rehabilitation sites and selected ecological restoration areas, weed surveillance and control will occur at six-monthly intervals in spring and autumn. Any weeds found will immediately be controlled using appropriate methods.

4.5 Cultural use of significant trees

The Project Area will likely result in the loss of up to 17 significant trees, including 11 rimu, 2 totara, and one tree each of hinau, matai, miro and pukatea. Ngāti Tama has expressed a desire to use some of the best timber for cultural use. Of these trees the matai and at least two rimu have heart rot and would be unsuitable for milling. Other rimu trees may also be similarly affected with heart rot given their large size.

Harvesting and milling of native timber is administered by the Ministry of Primary Industries. As vegetation removal is for public works and will be undertaken by consent, the appropriate process to utilise any timber is to obtain a milling statement under the Forests Act (1949). The application for a milling statement is fairly straight forward and requires information about landownership, tree species, location, volume, proof of entitlement and preferably photos of each tree.

Application for a milling statement should occur once resource consent has been granted and prior to vegetation removal. All trees suitable for cultural use will be visited and assessed for heart rot, volume and permanently marked for this purpose — providing the basis of the milling statement. Additional milling statements may be applied for additional millable trees, if identified during vegetation clearance.

Any tree chosen for cultural use will need to be felled in such a way as to minimise damage to vegetation margins, the tree itself and also to enable extraction. Trees felled for timber will also need to be transported promptly to a suitable approved mill, to avoid sap stain rot developing and the timber becoming spoiled.

4.6 Proposed measures to offset and mitigate residual adverse effects on vegetation and the habitat of associate species

A range of measures will be undertaken to mitigate and offset the residual adverse effects on vegetation and the habitat of associate species. These include:

- Offset restoration of 6 ha of kahikatea dominant forest (referred to as kahikatea/swamp forest restoration and Type 4 in the LEDF)
- Offset riparian planting of a length of 8.627 km of stream habitat (which equates to approx. 17.2 ha of terrestrial riparian margin)
- "Dryland" mitigation planting of 8.38 ha (referred to as Type 3 in the LEDF)
- Establishment of an integrated pest management area over 1085 ha of native forest including a core area of approximately 250 ha to offset most vegetation removal.
- Planting of 3400 seedlings as replacement plants for the (up to) 17 significant trees that will be felled (see section 4.5 above)
- Total area of offset and mitigation planting is 31.58 ha.

Additionally, rehabilitation of site works will occur on modified landscapes (12.9ha) resulting in a total area of planting associated with all aspects of the Project of approximately 44 ha.

All rehabilitation and restoration areas used will require the Transport Agency to acquire the necessary rights to implement the rehabilitation and restoration programme. Details about the management of all of these, excluding the pest management, can be found in sections below. The establishment and management of a Pest Management Area is addressed specifically in chapter 9.

4.6.1 Propagation material

All native plants produced for rehabilitation and mitigation and offset planting (ecological restoration) must be grown from propagation material sourced from naturally occurring plants in the North Taranaki Ecological District. This is to ensure that propagation material used for rehabilitation and restorative planting and plant establishment is genetically suitable for the local environment.

Where possible, plants should be grown from seed. For those species that are not easily propagated from seed, production of plants from cuttings or wildlings (naturally occurring seedlings) is acceptable where the wildings will otherwise be destroyed as the road is built. For site rehabilitation, and particularly where there are steep slopes and planting is not practicable, other measures will be used to encourage plant establishment, through assisted and natural regeneration.

4.6.2 Kahikatea dominant swamp forest restoration

Technical Report 7a – Vegetation (December 2017) states that 2.63 ha of valley floor vegetation communities will be lost, of which 1.325 ha is dominated by kahikatea. Intensive,

multi-species pest management will offset the loss of associate species within much of these communities; however, this method is regarded as being insufficient to offset for the loss of kahikatea trees.

Six hectares of valley floor kahikatea forest restoration planting is proposed to fully offset the loss of the kahikatea component affected by the Project. Increasing the area of this forest type by planting, when supported by pest management in perpetuity, will improve the likelihood of swamp forest species and kahikatea forest expanding naturally back into suitable habitat in the wider Project area.

4.6.2.1 Potential kahikatea / swamp forest restoration planting locations

There are several suitable potential sites for the establishment of new kahikatea and swamp forest. Since most of the potential sites are also preferred locations for stream and riparian restoration, the areas given below, as available for kahikatea / swamp forest restoration, are after deduction of the area required for stream restoration.

1. Mangapepeke Valley

The Mangapepeke valley is considered to be the best location for kahikatea / swamp forest restoration because the kahikatea and swamp forest plantings can be linked to the riparian margin plantings to create a fully reforested valley, generating a substantial additional net biodiversity benefit. It is also the area closest to the vegetation removed by the Project so delivers on the best practice principle of proximity.

The required 6ha of area suitable for kahikatea / swamp forest restoration exists along the Mangapepeke Stream valley within Ngāti Tama land and the Pascoe property (determined by ground survey in December 2017; Figures 4.3 and 4.4).

The Mangapepeke Valley is a mosaic of:

- Small permanently water logged areas which are not suitable for kahikatea or swamp forest tree planting. These areas will be planted with native sedges and rushes that are tolerant of being planted into permanently water logged or water covered soils.
- Intermittently wet areas which are ideal for kahikatea / swamp forest tree and wetland shrub planting.
- Imperfectly drained areas, which may be periodically flooded and are ideally suitable for planting with wetland margin species including kahikatea. The most suitable of these areas will be used to make up the full 6ha valley floor / swamp forest restoration planting requirements; the rest will be planted as part of the 8.38 ha of mitigation planting.

Areas that remain permanently saturated are not suitable for the establishment of swamp forest because nursery-raised seedlings of most swamp and wetland species are not tolerant of being planted in open water. Only some wetland sedge, rush and reed species will survive open water planting.

2. Upper Mimi Valley

There are additional areas adjacent to the Project Footprint that are suitable for kahikatea / swamp forest restoration planting if all or some of the Mangapepeke Valley is not available (property negotiations were continuing at the time of writing this version of the ELMP).

Adjoining kahikatea forest in the proposed offset site in the Mimi Stream, 2.3ha of land suitable for kahikatea / swamp forest restoration exists within Mt Messenger Conservation.

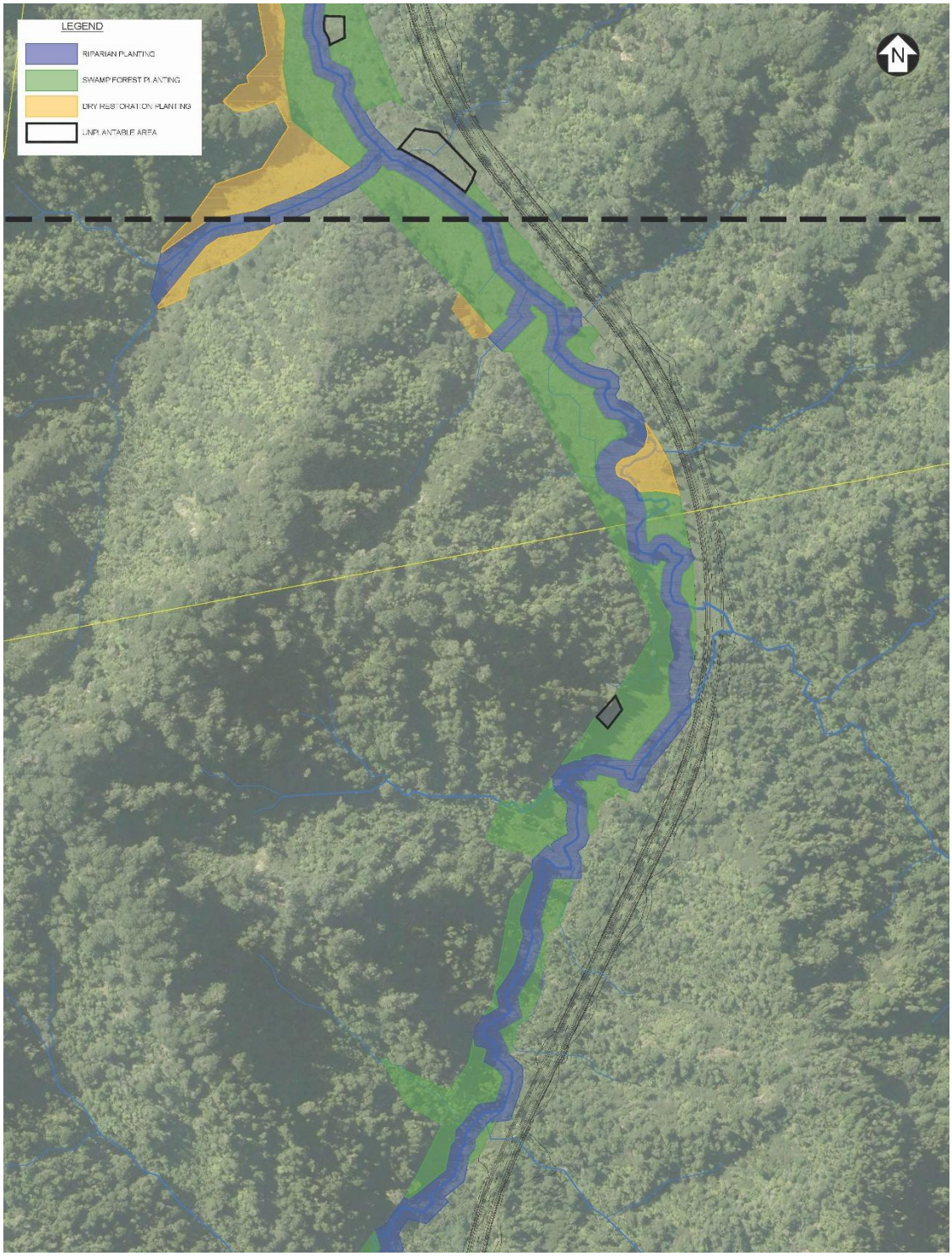

Figure 4.3 - Upper section of the eastern branch of the Mangapepeke Stream showing areas suitable for kahikatea / swamp forest or wetland planting (green colour), or mitigation replacement planting (beige). Sections of the stream and its tributaries that are suitable for riparian restoration are marked in blue. Black encircled areas are permanently water covered and are unplantable. Figures 4.3 and 4.4 join at the black dotted line.

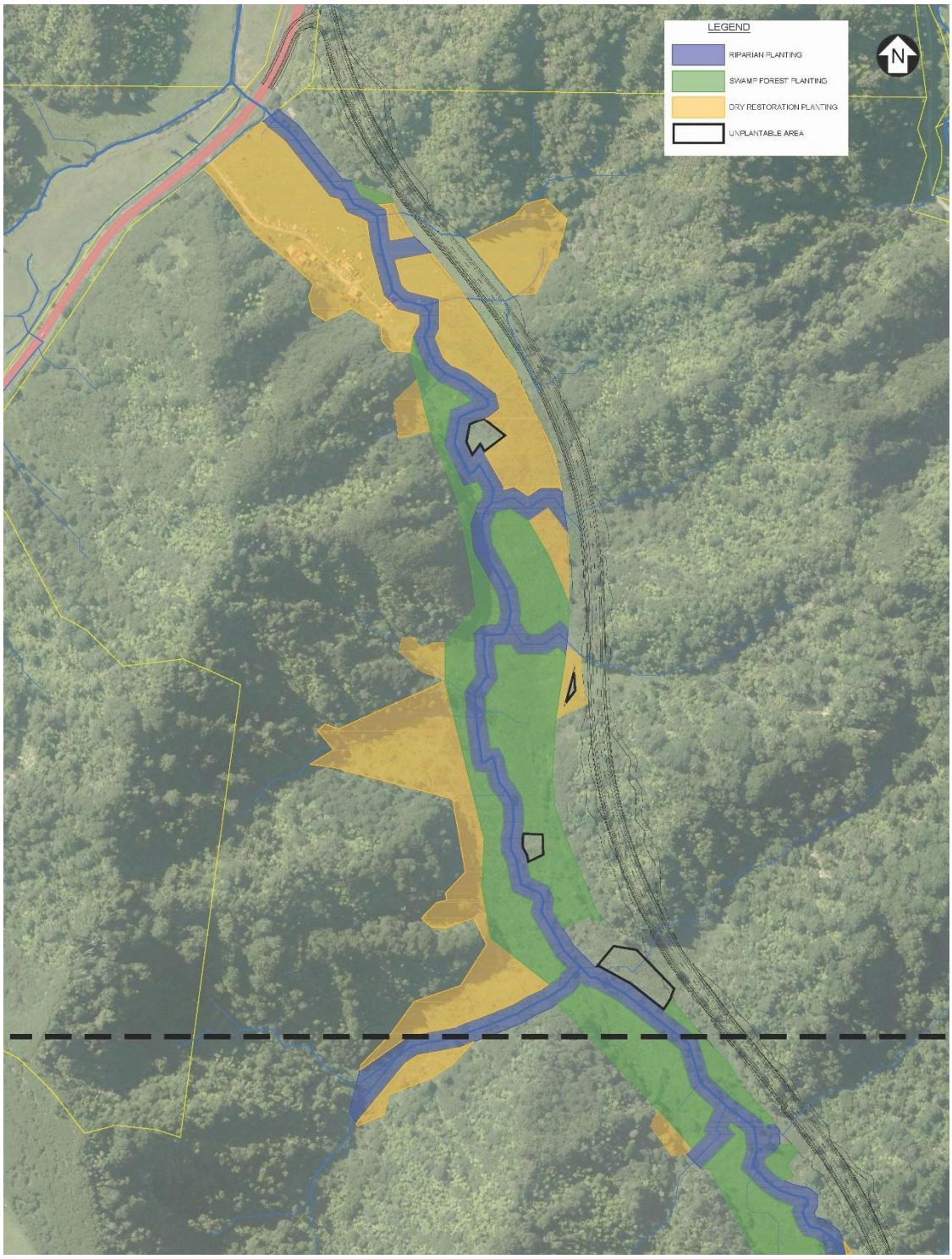

Figure 4.4 - Lower section of the eastern branch of the Mangapepeke Stream showing areas suitable for kahikatea / swamp forest or wetland planting (green colour), or mitigation replacement planting (beige). Sections of the stream and its tributaries that are suitable for riparian restoration are marked in blue. Black encircled areas are permanently water covered and are unplantable. Figures 4.3 and 4.4 join at the black dotted line.

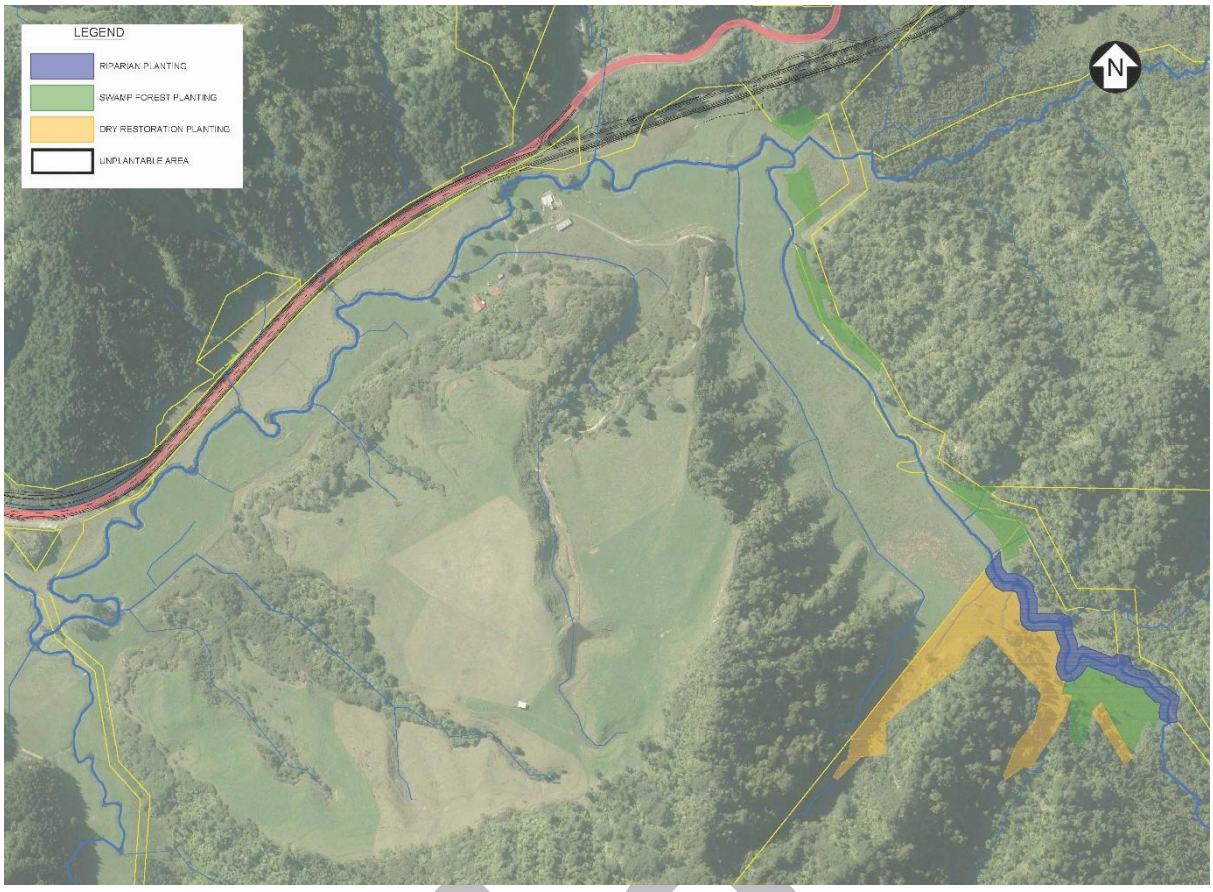

Figure 4.5 - Upper tributary and main branch of the Mimi Stream showing areas suitable for kahikatea / swamp forest or wetland planting (green colour), or mitigation replacement planting (beige). Sections of the stream and its tributaries that are suitable for riparian restoration are marked in blue. Black encircled areas are permanently water covered and are unplantable.

Area (outside the designation; Figure 4.5). As this area adjoins existing kahikatea forest area immediately upstream, it would expand the extent of this remnant and be colonised by associate species, some not found in the Mangapepeke Valley.

3. Other potential kahikatea / swamp forest planting sites

Other wet valley floor areas that would once have been swamp or kahikatea forest and are potentially suitable for kahikatea / swamp forest restoration exist in the surrounding landscape, on public conservation land and private property. While these areas are somewhat removed from the Project site and are less favoured than the Mangapepeke and upper Mimi valley sites it is likely that 6ha of suitable planting sites could be found if required.

4.6.2.2 Nature of the kahikatea / swamp forest restoration and likely outcomes

The intention of the restoration planting will be to transform grass, rush and sedgeland dominated areas that are suitable for kahikatea, pukatea and swamp maire, with small areas of rimu and matai where ground conditions are not as saturated. Initial planting in the more

exposed zones will need to consist of hardy, early successional species including manuka, hukihuki, ramarama, houhere, putaputaweta, kaikomako, wineberry, koromiko, karamu, toetoe and whararikі. Whararikі has specifically been chosen because this is growing on the margin of the upper Mimi Stream and harakeke or swamp flax is absent. The tree species can be inter-planted once the initial shrub and small tree layer is established.

While transition to a diverse mature swamp forest will take many decades, the ecological value will begin to improve immediately because of the removal of livestock and the management of pests and weeds. Ultimately the valley will transform into a diverse, high value valley floor kahikatea, pukatea, swamp maire forest, with small areas of hukihuki/ carex sedge-shrublands in the small permanently saturated areas. The biodiversity offset targets for all valley floor planting are to obtain a near complete cover of indigenous species across the valley (including riparian areas) by year 10 (target 80% canopy cover) and to have kahikatea contribute 65% of the forest canopy by year 35.

4.6.2.3 Kahikatea / swamp forest plant and planting specifications

The design and management of the swamp forest restoration will need to be supervised by an appropriately qualified restoration ecologist or landscape architect who has an understanding of the ecological requirements of kahikatea and other species involved, including their tolerance of flooding, and a good knowledge of the environmental conditions prevalent in the Mt Messenger area. Details of the planting zones, the specific plant mixes for each zone, the planting prescription (including species-specific planting spacings), and pre- and post-planting maintenance treatment will be contained in the swamp forest design specifications. Conceptually, the objective of the planting will be to restore ecologically appropriate vegetation communities across the valley floor (Figure 4.6)

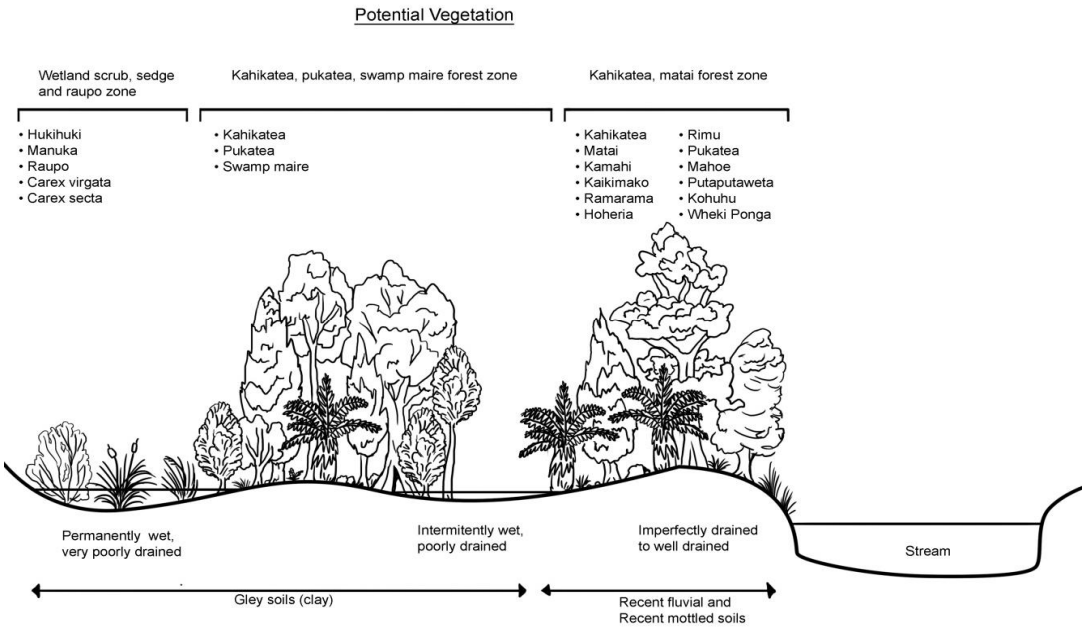

Figure 4.6 - Vegetation communities proposed to be restored (based on communities present in the north branch of the Mimi Stream)

The Mangapepeke and upper Mimi valleys are a mosaic of zones with different and variable soil moisture conditions. Growing conditions vary considerably over small distances and plant species selections will need to be altered accordingly to ensure plant tolerances are matched to site conditions to achieve high plant survival. Some initial small scale planting trials will be undertaken, especially in the wettest zones, to ensure the species selected are tolerant of the site conditions through 12 months of the year.

Planting zones will be physically marked out with stakes immediately prior to planting to delineate the highly variable nature of the valley floor areas where the swamp forest (and other plant communities) will be planted. This will be undertaken under instruction from the supervising ecologist or landscape architect.

The following management approach will apply to the swamp forest restoration planting:

Pest and livestock management

- Prior to planting, all livestock will be removed from planting sites and goat and pig numbers reduced to low levels in and around the planting areas and surrounding habitat (refer to Chapter 9 – Pest Management). See Section 4.6.2.4 below for details.

Plant specifications

- All plant material will be eco-sourced as prescribed in Section 4.6.1.
- Trees and shrubs grown for the kahikatea / swamp forest restoration planting will be grown to sizes that are larger / taller than is typical for new road revegetation planting. Upright growing species will stand at least 50cm above the planter bag or pot to be suitable for planting. This is because the majority of the kahikatea / swamp forest plants will be planted in amongst existing vegetation (mostly rushes and sedges) and will need this height to avoid being overgrown.
- All plants will be:
    - grown to specification;
    - well grown with well-formed root systems that fill the growing container but that are not root bound, and with well-formed foliage above ground; and
    - well-hardened before delivery to the planting site.
- All plants will be inspected at the supply nursery prior to delivery and any not meeting specifications will be rejected.

Planting requirements

- The full swamp forest planting area will have the planting zones pegged prior to the commencement of planting. Four main planting zones will be pegged:

i. Zone 1: Areas that are permanently covered in water or have saturated and sticky clay soils (gley soils) and have a dominance (>50%) of indigenous plants such as *Carex virgata* and *Juncus edgariae*. No planting is required in these zones.

ii. Zone 2: Areas that are permanently covered in water or have saturated sticky clay soils (gley soils) and are dominated (>50%) in exotic plant species. The species chosen will be tolerant of being planted in shallow open water areas. Only sedge and

rush species known to survive in shallow water will be planted into areas covered in water, to a maximum depth of 30cm.

iii. Zone 3: Areas that are in transitional zones which are intermittently wet (but not covered in water for prolonged periods). These areas will be planted in swamp / wetland shrub and early successional species, with a gradient of wetland shrubs close to the wettest edge. Where planting conditions are suitable (ie. sheltered from wind and frost) swamp forest tree species including swamp maire, pukatea and kahikatea will be inter-planted with the other species. In more exposed sites, tree species will be inter-planted amongst the hardier species, such as manuka, between years three and five, following the initial planting. No tree species will be planted into open water (because they would die). If areas within this zone are saturated, planting will be delayed until dry.

iv. Zone 4: Imperfectly drained with recent silty and mottled fluvial soils will be planted valley floor podocarp forest species. In areas sheltered from wind and hard frost, tree and later successional species including kahikatea, kaikomako, occasional matai and rimu, cabbage tree and ramarama will be inter-planted with the hardier shrubs; otherwise, they will be inter-planted three to five years following the initial planting when some shelter has developed.

Any areas with moderately well drained soils (ie. lower soil moisture) will instead be used for mitigation "dryland" planting. Planting of most significant tree species will be focused in these areas. If excessive failure of plant establishment occurs for hydrological reasons such as excessive flooding, species more suited to the conditions will be planted.

Spacings of plantings

- Plant spacings will vary across the different planting zones and depending on the amount of native vegetation already present. However, for areas planted in trees and shrubs, the aim will be for plants not to be further apart than 2 metres, and in sedge and rushland areas plants should not be further apart than 1.5 m. In some zones canopy tree species may be spaced out through the planting at 4 to 6m spacings with shrubs in between, whereas kahikatea may be planted in small discrete groves where the trees are only 1.5 m apart, such as on imperfectly drained soils.
- The detail of plant spacing's will be prescribed in the swamp forest design specifications.

Planting site weed management and releasing

- All invasive weed species and those likely to compete with the newly planted natives will be controlled to zero-density with herbicide or mechanically removed prior to planting. Herbicides that are likely to be harmful to adjacent existing native plant species, or those that contain a residual factor that may be harmful to natives, will not be used. Mechanical removal of weed species will occur if it is unsafe to use herbicides.
- See also section 4.6.2.6 for weed management requirements in the wider area.
- All planted seedlings will be released from weed competition for 6 years following planting. Dead plants will be replaced (blanking) annually throughout the 6 year period.

- While some of the releasing may be achieved by the application of herbicide some zones may require mechanical releasing because of the intolerance of many native wetland rush, sedge and reed species to chemical herbicide exposure. It may also be necessary to trim sedges and faster growing native shrubs to promote the growth of slower growing shrub and canopy tree species.

Timing of planting

- The period suitable for kahikatea / swamp forest planting is narrow and will vary from year to year depending on the wetness of the winter and spring seasons, because of the variable hydrology and soil moisture conditions in the Mangapepeke and Mimi valleys. Almost all nursey raised native plant species (with the exception of some rushes, sedges and reeds) will not survive planting into open water. As they grow they will become increasingly tolerant of prolonged saturated conditions, particularly once they are established and have developed good root systems, pneumatophore 'air roots' and mycorrhizal associations. Consequently, the swamp forest area will be planted in the narrow window when the soil moisture conditions are no longer fully saturated or water covered and before ground conditions become too dry and hard. In 2017, the ideal planting time was in the last week of October and the first week in November but this is likely to vary from year to year.

Site biosecurity

- A comprehensive biosecurity plan for the Project (refer to Chapter 11) has been produced to minimise the risk of myrtle rust spread and to reduce the likelihood of importation of other problematic pest animals, weeds and diseases to the Project and offset sites. All aspects of the Biosecurity Plan will be adhered to by everyone involved in the Project.

4.6.2.4 Livestock and ungulate pest animal exclusion

All farm livestock (cattle, horses, sheep and domestic pigs) must be permanently removed from the planting site – that is, the Mangapepeke Valley - before planting can commence. Cattle and horses currently have access along the full length of the Mangapepeke valley.

The removal of cattle from the valley floor areas too long in advance of planting may create weed and plant competition problems, as invasive weed species will rapidly occupy open grass areas when grazing pressure is removed. Ideally, as much of the kahikatea / swamp forest planting as possible should be undertaken immediately after cattle removal. The construction programme may, however, prevent this from occurring in which case a concerted and regular weed management programme will need to be undertaken from the time cattle are removed until all planting is concluded.

Control of feral goats and pigs within the Project footprint and offset planting areas (as part of the goat and pig management programme for the whole Pest Management Area) will need to begin well before the commencement of any planting to minimise goat damage, especially to new seedlings. Goat numbers are currently at a high density in the forested sections of the Mangapepeke and Mimi valleys (reportedly similar densities to 20 'kills'

/man-day[4]). Goat densities in the vicinity of the planting area will be reduced to <5 kills / man-day before planting is recommended. The medium and long term target for goats over the Pest Management Area is 1 kill / man-day or less.

Where goat and pig reinvasion from unmanaged adjacent land is a risk, boundary fences may need to have appendages added that will stop or reduce the rate of reinvasion. Details of the fence appendage requirements to exclude goats can be found in Chapter 9: Pest Management.

4.6.2.5 Small mammal pest and pukeko management

Possums and rats are unlikely to cause any major damage to newly planted seedlings and both will be substantially reduced in numbers when the pest management programme commences. For this reason, these pests will not cause a significant problem to the kahikatea / swamp forest restoration programme.

Pukeko, while currently not particularly abundant in either the Mangapepeke or upper Mimi valleys, can occasionally be problematic when new plantings occur in wetland and wet margin areas. They have the habit of pulling out small seedlings and large pukeko populations can extract many hundreds of seedlings over a few days if given the opportunity. This is only likely to be a problem in wetland planting areas where smaller grade plants will be used. Pukeko are game birds so can be hunted during the game season to reduce this pressure if it arises.

4.6.2.6 Pre-planting weed management

Weed management will commence within the proposed swamp forest planting areas as soon as the land is made available to the Project, and will extend to all adjacent parts of the Mangapepeke and upper Mimi catchments (if the latter is included in the planting area). Invasive weed management of biosecurity threats such as wild ginger and pampas is additional to this and is described in Chapter 11. Invasive weed species currently present, and if not appropriately managed, will pose a significant threat to the success of these plantings.

The objective of this wider weed management effort is to prevent the establishment of any problematic or invasive weed species up until the commencement of kahikatea / swamp forest planting. Once planting starts within the planting area, the releasing and maintenance programme will keep any weeds that establish to very low levels.

4.6.2.7 Kahikatea / swamp forest restoration performance measures

The performance targets for the kahikatea / swamp forest restoration plantings are:

i. 80% canopy cover 10 years following planting in the zones where trees and shrubs are planted
ii. Kahikatea forming 65% of the tree canopy (ie. 65% of the area where trees are planted, excluding those areas where trees are not planted) by year 35

[4] Paul Pripp pers. comm. (via Richard Nichol).

iii. 90% of the full diversity of species planted remain in the planted areas 6 years following planting

iv. The absence of any significant exotic weed infestations

v. No livestock are present in the swamp forest areas and mammalian pests are held to low densities causing minimal damage to swamp forest flora and fauna.

4.6.3 Dryland mitigation planting

The Mitigation and Offset Report (December 2017) and subsequent Supplementary report (February 2018) recommends one-for-one replacement mitigation planting for all early successional indigenous dominant vegetation that will be lost or affected by the Project. This planting is mitigation, not offset, because the species composition, age and habitat value of this vegetation can be replicated or even improved reasonably quickly.

The area required for this planting, as stated in the Supplementary Mitigation and Offset Report (February 2018), is 8.38 ha.

4.6.3.1 Potential dryland mitigation planting locations

There will be two distinct types of dryland mitigation planting:

1. Replacement planting along the margins of the Project footprint that have retained the same or similar soil characteristics with respect to topsoil and hydrology to those pre-construction
2. New planting areas beyond the Project footprint that are suitable for the establishment of early successional species similar to those removed from the Project footprint.

Project footprint margins

The sites along the Project footprint margins that are suitable for mitigation planting will not be known until road construction is well advanced and the impact of construction can be assessed. The area available for replacement planting along the road margins is likely to be only a small proportion of the 8.38 ha required in total.

New dryland mitigation planting areas

Most of the mitigation planting will need to occur on new sites. Ideally, to magnify the ecological benefits, this planting will occur on land adjoining the new road margins and the kahikatea / swamp forest and riparian restoration areas. For this reason, the lower Mangapepeke Valley (Figure 4.4) is the preferred mitigation planting location. The valley area between the proposed kahikatea / swamp forest restoration zones and the existing SH3 is sufficient area for all of the mitigation planting to be accommodated (after road margin replacement planting is undertaken) and should result in the Mangapepeke valley floor being fully planted.

Several potential alternative dryland mitigation planting sites exist within 2 or 3 km of the Project footprint if the Mangapepeke Valley is not available, although none are physically connected to the footprint. A combination of any of these sites would be appropriate if required.

4.6.3.2 Nature of the dryland mitigation planting and likely outcomes

5.467 ha of predominantly indigenous vegetation that will be removed or disturbed by the Project will not be offset by pest management or swamp forest restoration planting. This vegetation consists of early successional plant material including manuka-treefern scrub, manuka scrub, treefern scrub and manuka succession vegetation and will be mitigated for by one-for-one replacement planting.

In addition, 5.826 ha of exotic rushland will be mitigated for by replacement planting at a ratio of 0.5 ha replacement planting for every hectare removed. Although comprised of almost entirely exotic species, 50% replacement planting is considered appropriate because the exotic rushland vegetation has some value as habitat, especially for wetland birds.

The aim of the dryland mitigation planting is to plant species equivalent to those lost and, where possible, interplant with the next stage of successional species (i.e. those that would be expected to next arrive in time naturally). In other words, the objective is to speed up the successional process where growing conditions are suitable. The long-term aim is to set these newly planted areas on a course to becoming indigenous dominant forest, except where permanently saturated ground conditions exist, which are more suitable for non-forest sedge and rush wetland habitat.

Planting conditions are likely to consist of open pasture, low quality pasture / rushland mosaic, exotic, mixed native wetland margins, and within open remnant manuka stands. The species selected for planting will match the growing conditions.

4.6.3.3 Dryland mitigation and plant and planting specifications

Details of the site-specific planting zones, plant mixes for each zone, planting prescription (including species specific planting spacing's), and pre- and post-planting maintenance treatment will be contained in the dryland mitigation planting design specifications.

The dryland mitigation planting will include the following aspects:

<u>Pest and livestock management</u>

- Prior to planting, all livestock will be removed from planting sites and goat and pig numbers reduced to low levels in and around the planting areas and surrounding habitat (refer to Chapter 9 – Pest Management). See Section 4.6.2.4 below for details.

<u>Plant specifications</u>

- All plant material will be eco-sourced as prescribed in Section 4.6.1.
- Standard revegetation grade plants (grown in 1 and 2 litre containers) will be suitable for the dryland mitigation planting areas.
- All plants will be:
    - grown to specification;
    - well grown with well-formed root systems that fill the growing container but that are not root bound;
    - no shorter than 30cm above the growing container (for upright plants); and
    - well-hardened before delivery to the planting site.

- All plants will be inspected at the supply nursery prior to delivery and any not meeting specifications, including biosecurity requirements (Chapter 11), will be rejected.

Planting requirements

- The dryland mitigation planting zones will be physically pegged out prior to planting by an appropriately experienced ecologist or landscape architect.
- The species mixes for each planting zone will be as specified in the dryland mitigation planting design specifications. Zones will be determined by soil conditions, wetness and exposure to wind and frost.
- Manuka will form the basis of much of the dryland mitigation planting because it is the early successional species that will be removed from the Project footprint in greatest quantities. The spread of myrtle rust may influence this, though it is preferable to plant manuka which has a level of natural resistance, than not plant it entirely. A mix of additional coloniser and early successional native plant species will be selected to match the growing conditions of each planting zone.
- Hardier canopy and sub-canopy tree species will be inter-planted in more sheltered sites. These species will include totara (thin-barked/Hall's totara), rewarewa, white maire, pigeonwood, hinau, kamahi, tanekaha (in the drier soils), pokaka, northern rata, kahikatea and rimu. Species will be matched to zones with appropriate growing conditions.
- Plant spacings for areas planted in trees and shrubs will be at 1.5 metres. In some zones canopy tree species may be spaced out through the planting at 4 to 6m spacings with shrubs in between.

Planting site weed management and releasing

- All invasive weed species and those likely to compete with the newly planted natives will be killed with herbicide or mechanically removed prior to planting. Herbicides likely to be harmful to adjacent existing native plant species, or those that contain a residual factor that may be harmful to natives, will not be used. Mechanical removal of weed species will occur if it is unsafe to use herbicides.
- See also section 4.6.2.6 for weed management requirements in the wider area.
- All planted seedlings will be released from weed competition for five years following planting. Dead plants will be replaced (blanking) annually throughout the five-year period.

Timing of planting

- Spring (late August to the end of October) is the preferred season for the dryland mitigation planting in areas exposed to winter flooding (e.g. the lower Mangapapeke valley) or likely to experience hard winter frosts. Autumn planting will also be possible on drier, elevated sites not prone to hard frosts.

Site biosecurity

- A comprehensive biosecurity management plan for the Project (refer to Chapter 11) has been produced to minimise the risk of myrtle rust spread and to reduce the likelihood of importation of other problematic pest animals, weeds and diseases to the

Project and offset sites. All aspects of the biosecurity management plan will be adhered to by everyone involved.

Planting zone marking

- An appropriately experienced restoration ecologist or landscape architect will determine and mark out the planting zones for the dryland mitigation planting sites.

4.6.3.4 Livestock and ungulate pest animal exclusion

Refer to Section 4.6.2.4 for details on livestock and ungulate management.

4.6.3.5 Small mammal pest and pukeko management

Refer to 4.6.2.5 for information about small pest management.

4.6.3.6 Dryland mitigation planting performance measures

The performance targets for the dryland mitigation plantings are:

i. 80% indigenous plant cover at 10 years following planting;
ii. 90% of the full diversity of species planted remain in the planted areas 6 years following planting;
iii. very low significant exotic weed infestations with most invasive species managed to zero-density; and
iv. livestock are excluded in the dryland mitigation areas and mammalian pests are held to sufficiently low densities to allow seedlings to flourish.

4.6.4 Riparian offset restoration planting

The waterways that will be affected by the Project have been assessed in the Freshwater Ecology Technical Report using the Stream Ecological Valuation (SEV) calculator. Technical Report 7b – Freshwater Ecology (December 2017) assessed that 3361 square metres of stream surface area of variable ecological value will be adversely affected by the construction and operation of the Project. The SEV model has calculated that restoration (fencing and planting) of 8157 square metres of stream will be necessary to offset those impacts. This equates to approximately 8,627 lineal metres of stream length (generally the streams affected have an average width of approximately 1 metre). This equates to approx. 17.2 ha of terrestrial riparian margin required.

4.6.4.1 Potential stream restoration planting locations

As is the case for all biodiversity offsetting, it is best practice to undertake stream restoration efforts close to the affected area and in similar environmental conditions. Suitable stream restoration sites exist in the areas adjacent to and near the Project but all will require landowner approval to be used.

The following areas, in descending order of preference, are considered suitable sites for stream-riparian restoration:

- 2600 m length of the Mangapepeke Stream that passes through pasture and exotic rushland on Ngāti Tama land (1000m) and the Pascoe property (1600 m).

- Up to 800 m of tributary streams that flow into the Mangapepeke Stream, mostly on the Pascoe property, that are currently in pasture or sedges/rushes.
- Approximately 1000 m of the eastern branch of the Mimi Stream on DOC land and on the Thomson property down to where the branch of the stream meets SH3.
- Up to 3500 m of the Mimi Stream, through multiple properties (Thomson, Anglesey and Scott), as it flows south parallel to SH3.
- Up to 2100 m of main channel along the western branch of the Mangapepeke Stream on the Washer and Pascoe properties, an additional 1400 m along the western secondary channel (assuming it is practical to fence and plant both this and the main channel), and a further 2700 m of tributaries flowing into both channels from the bush.

All riparian restoration areas used will require the Transport Agency to acquire the necessary rights to implement the restoration programme.

4.6.4.2 Nature of the stream restoration and likely outcomes

Stream restoration work will consist mostly of planting of a 10 m buffer (on average) on each side of the channel and fencing of the stream and buffer plantings from livestock. None of the streams under consideration are currently fenced.

Stream buffer plantings will consist of a mix of indigenous riparian margin sedges, shrubs and trees. The primary objective will be to provide shade and organic matter to the stream channel to improve the quality of habitat for native fish and invertebrates. A reduction of sediment and nutrient loads entering the streams will also be achieved by fencing and planting, especially along the stream sections that pass unfenced through farmland.

With the necessary rights to implement the restoration programme, swamp forest restoration planting and stream restoration planted in adjoining areas will provide greater ecological outcomes than either in isolation. Potential sites where this could likely occur include along the Mangapepeke Stream valley (through Ngāti Tama and Pascoe land) and the eastern branch of the Mimi Stream valley (through Thomson land and immediately adjacent to public conservation land). The net ecological benefit will be substantial and will result in the restoration of entire valley floors, connecting swamp and riparian forest with hill-slope forest and the elimination of forest edge.

Not all of the 8.627 km of stream length required for riparian retirement will lie adjacent to swamp forest or dryland mitigation planting. Where this is the case the objective will be to attempt to secure those riparian areas closest to the Project footprint, and contiguous sections of stream that link to existing headwater bush areas. This will, in turn, provide the greatest ecological benefit for aquatic life, especially for whitebait fish species that struggle to move between isolated shaded stream sections when water temperature exceeds 22 to 23 degrees in mid-summer.

4.6.4.3 Individual property Riparian Fencing and Planting Plans

The proposed stream restoration works will be designed and managed by an appropriately qualified and experienced ecologist or landscape architect who also has considerable practical experience in restoring waterways in challenging natural conditions.

The required 8.627 km of stream length in proximity to the Project needed to meet the offset requirement for effects on stream ecology will, predominantly, need to involve multiple properties of private farmland. In most cases, landowners will be providing their land voluntarily with the retired riparian area remaining part of the property but protected by way of an enduring encumbrance attached to the land title.

On many of the farms, the streams meander through relatively narrow pasture-covered flood plains. To facilitate continued ease of operation of each farm, or conversely, to prevent the creation of significant stock and vehicular access problems, detailed site-specific design of each fence line and planting area needs to be undertaken with each property owner and/or farm manager. This detailed design will include stock crossings (ie. culverts) where these are necessary; narrowing of the margin between fence and stream where this needs to occur to allow continued vehicle and stock access; provision for water passage out into secondary flood channels and back into the main stream to prevent accentuated flooding during heavy rain events; and widening of the riparian margin in places (eg. oxbows) to facilitate stock movement.

The details of the fence lines, planting areas, site preparation activities (including willow removal or retention and existing weed removal), plant species mixes, post-planting maintenance programme and a programme and schedule of works will be included in separate Riparian Fencing and Planting Plans for each property. Each property owner will have the opportunity to review the plan and propose changes where farming or domestic activities are compromised. The final approved property plan will then form part of a legal agreement between the Transport Agency and the property owner.

In some sections of stream it will be necessary to reduce riparian widths to less than 10 metres to accommodate farm operational requirements. Where this occurs, the restoration ecologist designing the riparian planting areas and writing the plan will endeavour to create effective riparian habitat (shade and habitat) on the opposite side of the stream to create favourable instream conditions. Where effective stream shading cannot be achieved, and fences need to be close to the stream edge, that section of stream will not be counted as part of the 8.627 km offset requirement.

Elsewhere there will be opportunities to fence and plant riparian margins that are wider than 10 metres (eg. on the inside bends of stream meanders). The restoration ecologist will propose widened riparian areas where appropriate with the aim overall to achieve an average 10 metres of riparian width along all 8.627 km of restored stream length.

4.6.4.4 Plant specifications

<u>Species mixes</u>

Two main plant mixes will be used for most of the riparian planting.

Sedges (*Carex* spp.) and rushes will be planted on steeper erosion prone and flood prone river banks and in secondary flood channels. These monocots are tolerant of periodic immersion in flood waters and sediment deposits and do not greatly restrict flood flows, unlike woody species.

Riparian shrubs and small trees along with whaririki flax and toetoe will be planted on the upper river banks and terraces where they can provide good shade to the water column but are less likely to constrain flood flows.

In wider planting areas (such as oxbows) a greater diversity of tree species will be included (such as kahikatea and Hall's totara).

All species used will need to be tolerant of frosts and wet conditions in winter and dry, and of hot and windy conditions in summer.

Plant grades

Plant grades will vary from plants in 1 litre pots to 3 litre pots, depending on the species and competition from existing vegetation.

Timing of fencing and planting

Spring (September to November) will be the period when most planting is undertaken but the timing of planting of the riparian areas will depend to a large extent on soil wetness and stream flows.

Within the range of suitable planting months, the property owner will determine when he/she would like the fencing and planting done and the decision about timing will be governed by farming activities, especially calving. The determination of suitable fence stripping, fence construction and planting times will be undertaken by agreement between the landowner and the Alliance restoration ecologist leading the riparian offset works.

Supervision of planting

An ecologist, landscape architect or professional experienced in riparian restoration and fencing and with knowledge of farming systems and farm requirements will oversee all riparian works on private properties and will liaise on a day to day basis with each affected landowner.

4.6.4.5 Livestock and ungulate pest animal exclusion

All riparian areas adjoining farmland will be permanently fenced with 7- or 8-wire post and batten fencing to exclude all stock.

Where feral goats are likely to be a persistent problem (especially distant from the Pest Management Area) changes to fence design to reduce goat passage will be necessary (eg. box stays and an electric hot wire).

4.6.4.6 Small mammal pest and pukeko management

While possums and rats are not likely to cause damage to new plantings, pukeko may pull new plantings especially in damp pasture areas. Larger grade plants (2 and 3 litre containers) will be used where this is determined to be a likely problem.

4.6.4.7 Pre and post-planting site preparation

Where vegetation has established, spot spraying with approved herbicide will be required at least one month before planting. The spot spraying shall be 50% of the planting spacings i.e. 1.0 m planting centres equals 0.5 m spot spray; 0.75 m planting centres equals 0.375 m spot spray. Where desirable natives have naturally established, these shall be retained and released, clearing them of competing vegetation.

The riparian planting sites will require releasing from weed competition and periodic blanking to replace plants that have died, over at least 6 years following planting.

Most of the releasing will be done with the application of herbicide although some zones, especially those where existing native sedge and rush vegetation occurs, may require mechanical releasing because of the intolerance of many native wetland rush, sedge and reed species to exposure to chemical herbicides.

4.6.4.8 Riparian restoration offset planting performance measures

The performance targets for the riparian restoration are:

i. 80% indigenous plant cover from one metre inside the fence line (ie. out of cattle browsing reach) to the top of the bank or to the water's edge, whichever is appropriate for planting) 10 years following planting;
ii. at least 50% effective shading of the water column (measured from sunrise to sunset in midsummer) by year 15;
iii. the absence of any significant exotic weed infestations; and
iv. no livestock are present in the riparian areas.

4.6.5 Addressing the loss of significant tress (200 seedlings programme)

The loss of long-lived significant trees will be addressed by planting 200 seedlings of the same species for every significant tree felled within the Project footprint. The Ecology Supplementary Report - Vegetation (February 2018) states that up to 17 significant trees may have to be removed during road construction. While efforts will be made to reduce the number of these trees, if all 17 are lost, 3400 seedlings will be required to be planted in their place.

As described in section 4.5 of this report, the significant tree species that may be removed are rimu (11), totara (2), and one each of matai, hinau, miro, and pukatea. Every endeavour will be made to avoid removing these trees and it is possible that fewer than 17 will ultimately be felled.

Most of these tree species have quite specific site preferences. There are only limited suitable sites for rimu in particular; selection of suitable planting sites will be undertaken by an experienced field botanist or restoration ecologist and it may be necessary to plant some early successional species in advance, or with these to provide the necessary shelter.

The deforested tributary valleys of the Mangapepeke, especially along the forest edges, offer the best planting sites for these seedlings including the margins and beneath areas of

existing manuka and kanuka, especially on shallow sloping hillslopes, and in small gullies and sites with shelter and dappled light.

Details of where and when these seedlings will be planted will be provided in the swamp forest and dryland mitigation design specifications.

4.7 Programme

To provide eco-sourced plants in time for the Project, seed collection started in February 2018 from within the area. The timing of the planting will be governed by when areas become available for planting plant establishment. The planting or seed dispersal at the top of the cuts may happen as the cuts are gradually lowered to avoid working at heights above the full cut.

Every year after planting, replacement plants will be planted to fill in any gaps that occur. Once the initial planting is providing shelter and shade other species that are desirable but hard to establish can be planted.

The maintenance period will be for up to six years. Maintenance shall be carried out every year after planting to provide the optimal conditions for plant growth. This will include the control and removal of unwanted exotic weeds/plants and releasing/removing competing growth around desirable plants.

4.8 Supervision protocols for vegetation and habitat clearance and potential impacts to associated species

Table 4.1 summarises the ecological management protocols which will be implemented to minimise vegetation loss within the AWA and damage to adjoining areas. It also provides details for the specific removal of species of value within the Project footprint.

Table 4.1 - Ecological Management Protocols

Ecological Protocol	Protocol Details
Vegetation clearance	• Methodology for the removal and pruning of vegetation, and protection of vegetation to be retained during construction includes: o Physical delineation (such as fencing or flagging tape) of both the road margin and the AWA to show the extent of vegetation clearance and where vegetation should preferentially be retained. o Vegetation will be cleared only prior to construction works beginning in the Project footprint in order to reduce habitat effects and reduce the potential for erosion and sediment generation. o Vegetation will be directionally felled away from the physically marked edge, to prevent vegetation damage to the AWA and high ecological value area, unless deemed to be unsafe and hazardous. Methods for undertaking vegetation

Ecological Protocol	Protocol Details
	removal will be site specific and commonly will include use of an excavator, grapple and chainsaw on suitable land, and directionally felling trees using experienced tree-fellers. o Vegetation removal will be minimised within the AWA and will include only areas and trees which are essential for construction purposes. Where the AWA adjoins high value areas, ideally minimal vegetation removal will occur within the AWA. o Within the AWA vegetation removal will be managed by experienced arborists to reduce tree damage and to accommodate construction. This will preferentially involve pruning branches of large trees rather than felling where this would accommodate the construction requirements. o Supervision of vegetation clearance will also be undertaken by a suitably qualified ecologist. • Methodology for the removal and relocation of forest resources includes: o Fallen decaying logs of greater than 50cm diameter and shall be placed in-situ. o Forest resources such as the heads of trees containing large epiphyte loads and logs deposited in-situ shall be managed so as to minimise indigenous vegetation damage, e.g. by placing logs perpendicular to the slope so they don't roll down hill and placing logs within canopy gaps. o Propagules of any threatened or regionally distinctive plant within the Project footprint will be harvested and material cultivated from these plants will be returned within restoration planting areas. o Gahinia (host of the 'At-risk' forest ringlet butterfly) found on any ridgelines will be harvested. Material cultivated from these plants will be returned within restoration planting areas. o Stock piles of logs and forest resources shall be placed within canopy gaps and clearings. Stock piles shall be proportional to the size of the gap, of a relatively low height (<2 m) and be contained to minimise the footprint. o Forest resources will not be placed into water courses unless this is by design for stream restoration purposes. • Methodology for mulching and stockpiling wood/topsoil includes: o Mulching will be undertaken in a manner to prevent wood chips entering streams and ephemeral gullies. o Stockpiles will be managed to prevent anaerobic conditions and leachate developing.

Ecological Protocol	Protocol Details
	o Stockpiles will be located away from drains and streams and managed with sediment control measures to prevent sediment entering waterways. o Weed management will occur on soil stockpiles to prevent weed spread into rehabilitation areas where soil will be reused.
Lizard Management	• Pre-construction surveys to detect the presence of herpetofauna species, and the habitats they occupy. • Methodology for salvage and relocation to minimise loss of herpetofauna within the Project footprint, including timing and construction supervision details. • Release site/s selection based on habitat suitability assessment and capability of supporting additional herpetofauna. • Habitat enhancement at the release site(s), including provision of refugia.
Bat Management	• Trapping, banding and radio tracking of bats to locate and describe bat roosts within the Project footprint, and identify important foraging areas prior to construction. • Protocols for identification of potential bat roost habitat. • Implementation of tree removal protocols when clearing vegetation which could potentially offer roosting habitat for bats. • Protocols for bat injury and mortality.
Avifauna Management	• Pre-construction surveys to detect the presence of avifauna species, and the habitats they occupy. • Vegetation clearance methodology (links to the vegetation clearance protocol). • Specific management to avoid or mitigate effects on the North Island Brown Kiwi. • Timing of works to minimise disturbance during bird breeding season as practicable.
Fish Rescue and Relocation Protocols	• Methodology to minimise direct effects of construction on fish, kōura and kākahi (freshwater mussels) prior to works instreams. This will address: o Recovery of fish prior to instream works o Rescue of fish from any spoil o Relocation of fish o Reporting. *Note: The CWMP and SCWMPs will detail the protocols for works in streams including the diversion and realignment of watercourses and activities such as culverting and the installation of erosion protection structures.*

5 Bat Management Plan

5.1 Introduction

5.1.1 Purpose and Objectives

The overarching ecological aim for the Mt Messenger Bypass (the Project) is to ensure, at a minimum, there is no net loss of biodiversity values, or to achieve a net benefit of biodiversity values, within the medium term.

To this end, the purpose of this Bat Management Plan (BMP) is to specify procedures to avoid, remedy or mitigate adverse impacts on Long-tailed bats (*Chalinolobus tuberculatus*) and central lesser short-tailed bats (*Mystacina tuberculata rhyacobia*) that may be affected by construction and operation of the Mt Messenger Bypass.

The BMP includes the following:

- a summary of the current knowledge of bat populations within the area surrounding the Project;
- potential adverse effects on bats that may eventuate during construction; and
- measures to avoid, remedy or mitigate potential adverse effects where possible.

Key objectives of the BMP include the establishment of procedures and protocols to guide impact management during vegetation clearance.

The BMP has been guided by recommendations within the Mt Messenger 'Assessment of Ecological Effects – Bats' (Chapman and Choromanski 2017) and the Ecology supplementary report – Bats (Chapman, 2018). The NZ Transport Agency (the Transport Agency) research report 623 'Effects of land transport activities on New Zealand's endemic bat populations: reviews of ecological and regulatory literature' (Smith et al. 2017) has been considered during the development of this BMP.

5.2 Responsibilities and competencies

Appropriately qualified and experienced bat ecologist(s) will implement this BMP and various phases of bat-related work on this Project. The bat ecologist(s) will have the relevant competency classes for the type of bat work being undertaken, as listed in Appendix B of the ELMP (Smith et al. 2017).

5.3 Regulatory framework

All bats are protected under the Wildlife Act 1953 (Wildlife Act) (s 3). The protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna (including native bats) is a matter of national importance in the Resource Management Act 1991 (s 6(c)).

Wildlife Act permits issued by the Department of Conservation (DOC) will be required in order to undertake vegetation clearance during enabling works, to allow for the possibility

of accidental mortality of bats. These permits will have conditions attached, which may necessitate revision of this plan.

5.4 Baseline survey

Initial acoustic survey efforts focused on detecting the presence and broad-scale habitat use by long-tailed bats and short-tailed bats in the area surrounding several early alignment options that were under consideration at that stage. Additional areas, most notably areas east of the existing SH3 alignment, were surveyed for bat activity as Project alignment options were refined. Data from those acoustic surveys were used to inform the design of a subsequent radio telemetry study undertaken at the end of 2017, aimed at locating and describing active bat roosts within the Project footprint and wider Project area, and identifying important foraging and commuting habitat.

For further information regarding the baseline bat surveys refer to the Mt Messenger 'Assessment of Ecological Effects – Bats' (Chapman and Choromanski 2017) and Ecology supplementary report - Bats (Chapman, 2018). These reports describe the locations of surveys within the wider Project area, the methodologies used, the timing of the surveys and results.

5.5 Current understanding of Mt Messenger bats

The results of bat survey work undertaken within the Project footprint and wider Project area in the last 12 months confirm that:

- Short-tailed bats have not been detected and are unlikely to be present in the immediate vicinity of the Project footprint, but their presence cannot be ruled out.
- Long-tailed bats are present, and their activity is widespread within the Project footprint and wider Project area.
- Multiple potential long-tailed bat roost trees are present in the wider area; it is possible that some exist within or near the Project footprint.
- Despite significant effort, the failure to capture and radio-track long-tailed bats has contributed to a lack of knowledge regarding active roost locations, specifics of bat habitat use (e.g. commuting routes) and population demographics which could be used as baseline information.

5.6 Summary of potential effects on bats

Potential adverse effects of the Project on bats were assessed in the Mt Messenger 'Assessment of Ecological Effects – Bats' (Chapman & Choromanski 2017) and Ecology supplementary report - Bats (Chapman, 2018). Key potential adverse effects include:

- loss of unoccupied roost habitat;
- mortality and injuries through clearance of occupied bat roosts;
- loss of foraging habitat;
- habitat fragmentation; and
- effects of night works and lighting.

This chapter describes mitigation measures aimed at addressing the potential loss of unoccupied roost habitat, mortality and injuries through clearance of occupied bat roosts, and effects of night works and lighting. Potential habitat loss and fragmentation effects on all species are addressed elsewhere in this ELMP.

5.7 Management of effects on bats

5.7.1 Vegetation Removal Protocols

Vegetation Removal Protocols (VRP) will be used to avoid effects on occupied bat roosts, and will detail the techniques that will be used to detect roosting activity (including the use of ABMs, visual and roost emergence surveys) prior to clearance of vegetation, and procedures to guide the clearance process.

The VRP therefore aim to:

1. locate bat colonial (and where possible, solitary) roost trees that exist within the alignment prior to tree removal;
2. provide clear, concise procedures that are to be followed prior to removal of all trees along the Project alignment, with the aim of avoiding mortality or injury to bats in the event that they are found; and
3. Set out how any bat injury or mortality that does occur will be dealt with.

There are three protocols to be followed, all of which are set out below:

- Protocol A: Identification of Potential Bat Roost Habitat;
- Protocol B: Pre-Felling Procedures; and
- Protocol C: Bat Injury or Mortality.

A flow chart of the protocol steps that will be adhered to can be found in Appendix C to the ELMP.

5.7.2 Definitions

High Risk Roosting Trees

For the purpose of this protocol, trees offering high potential as bat roosts will be considered 'High Risk'. High Risk trees are defined as being ≥50cm Diameter at Breast Height (DBH), with one or more of the following features:

1. cracks, crevices, cavities and/or fractured limbs large enough to support roosting bat(s);
2. sections of loose flaking bark large enough to support roosting bat(s);
3. a hollow trunk, stem or branches;
4. deadwood in a canopy or stem of sufficient size to support roost cavities or hollows; and
5. bat droppings, grease marks and/or urine staining around cavities.

Low Risk Roosting Trees

Trees with evidence of bat droppings, grease marks and/or staining around cavities will be noted and investigated as 'High Risk' probable roost trees, regardless of size. All trees ≤50 cm DBH that lack these features may be felled, without the need for further assessment or monitoring, and without the need for an approved ecologist to be present. These trees will be considered 'Low Risk'.

Dusk and Dawn

For the purposes of the VRP, 'dusk' and 'dawn' are defined as official civil dusk and dawn times.

Approved Ecologist

All pre-felling tree assessments, and assessments of acoustic monitoring data and behavioural observations, will be made by an appropriately qualified and experienced bat ecologist(s) as defined in Section 2 above and in Appendix B.

5.7.2.1 VRP Protocol A: Identification of Potential Bat Roost Habitat

- All trees to be removed along the Project alignment will be surveyed by the Project bat ecologist(s) (Competency Level C2) and assessed prior to tree removal as being either 'High Risk' or 'Low Risk' in terms of providing potential bat roost habitat. See Ecology Constraints Map in Appendix A to the ELMP for broad-scale areas of potential bat habitat within the Project footprint. All 'High Risk' trees will be clearly marked with flagging tape and/or fluorescent spray paint, and the tree locations will be recorded with hand-held GPS units.
- All trees and tree groups identified as 'High Risk' will undergo a pre-felling assessment and acoustic monitoring to check for bat presence as per Protocol B. Pre-felling tree assessments and acoustic monitoring shall be undertaken by the Project bat ecologist(s).

5.7.2.2 VRP Protocol B: Pre-Felling Procedures

- 'High Risk' trees will be removed between October 1st and April 30th where possible.
- All 'Low Risk' trees may be felled at any time without the need for acoustic survey.
- An appropriately qualified and experienced bat ecologist(s) will be onsite for removal of all 'High Risk' trees. The appropriately qualified and experienced bat ecologist(s) is not required to be present for removal of 'Low Risk' trees but should be available if their presence becomes necessary in the event that bats are discovered.
- All 'High Risk' trees or areas of 'High Risk' trees to be removed will be clearly marked by an appropriately qualified and experienced bat ecologist(s) in advance of removal. To determine roosting, 'High Risk' trees will be acoustically monitored with ABMs overnight (from one hour before official dusk to one hour after official dawn) for a minimum of three nights (with suitable weather conditions) immediately prior to removal. These nights may be non-consecutive depending on weather conditions. Suitable weather conditions must comprise:

a) overnight minimum temperature no less than 5 degrees Celsius; and
b) mean overnight wind speed no greater than 20 km/h; and
c) maximum overnight wind gust of no greater than 60 km/h; and
d) ≤2.5mm rainfall during the first two hours after dusk.

- No monitoring should take place during a full moon, or one night either side of a full moon.
- Where a night of monitoring is lost or interrupted due to non-suitable weather conditions, a further night of monitoring must take place to compensate, until a total of three nights of monitoring is achieved.
- All ABM data gathered during the pre-felling survey shall be reviewed the same morning the survey specified in Protocol B ends, in order to give the tree felling contractor sufficient time to fell trees prior to dusk if no bats are recorded.
- If no bats are detected, or if no bat activity is detected on the last two out of three valid monitoring nights, the bat ecologist(s) shall inform the Construction Site Manager or Environmental Manager within one hour of reviewing the data to give permission for the affected tree(s) to be felled.
- If the bat ecologist considers that bat activity patterns recorded on the ABM(s) suggest that bats may be roosting in the vicinity of the ABM, or if a bat roost is observed, the bat ecologist shall inform the Construction Manager or Environmental Manager, within one hour of reviewing the data or of observing the roost, that the affected tree(s) cannot be felled until further investigations of the trees have been undertaken. In this case the tree will be identified as a 'likely roost tree'.
- Where a likely roost tree is identified:
    - If considered appropriate by the bat ecologist(s), likely roost trees will be climbed by an arborist trained to identify bat roosts. The arborist must take care when climbing so as not to harm or disturb any roosting bats. The arborist will take photographs of any roosts or roost evidence found. If necessary, an endoscope and hand-held bat detector will be used to examine potential roost features suspected of housing bats.
    - If climbing is not considered safe or appropriate by the arborist and bat ecologist(s), the likely roost tree or trees may be observed with a thermal imaging camera and/or observed by bat ecologists with hand-held bat detectors over the first two hours following dusk and the four hours prior to dawn on the next suitable night, to observe bats leaving or entering a roost within the tree or group of trees.
    - If the check or observation reveals no roost is present, the Construction Manager or Environmental Manager will be informed that the tree can be felled on the day of climbing inspection or the day following nocturnal thermal observation.
    - If bats are confirmed to be roosting within the tree, it will not be removed until further monitoring confirms that the bats have abandoned the roost. Trees should be clearly marked and all relevant staff briefed to ensure the tree is not removed. Representatives of DOC and NPDC will be informed by

email with relevant information such as photos provided. Acoustic monitoring will continue for a further seven nights.

- If bats are still roosting in the tree after seven nights, the bat ecologist will contact the Environmental Manager and representatives of DOC and NPDC to arrange a meeting or teleconference to be held within three days to decide an appropriate way forward. Appropriate measures may include flood-lighting to deter bats from entering the tree or sectioning the tree and relocating the bat roost once bats have vacated.

- Any 'High Risk' trees will be inspected for bats and evidence of bat roosts by the bat ecologist(s) following felling.

5.7.2.3 VRP Protocol C: Bat Injury and Mortality

- Any living bats found during or after tree that are not able to fly away unassisted will be taken to a vet immediately for assessment. Bats will be placed in a clean, cool, dark cotton bag by or under the direction of the bat ecologist (s) to ensure the animal is handled appropriately. The initial contact vet is:

  Dr Andrew Gore

  Hamilton Zoo

  Brymer Road

  Hamilton

  07 838 6720

- The Environmental Manager and relevant representatives of DOC and NPDC will be notified at the earliest opportunity within 24 hours after an injured or dead bat is found.
- Any bat that is found dead or injured and subsequently euthanised will be returned to DOC as required by the Wildlife permit.
- Bats assessed by the vet as uninjured will be transported back to site in the cotton bag and placed in an open, temporary artificial roost box suspended within a tree as close as possible to the site the animal was found, but outside of the Project footprint. The roost box will be open to allow the animal to come and go as it chooses, and will be placed within the tree prior to dusk on the same day the bat is found.

5.7.3 Night works and lighting

Night works are planned. The requirement for lighting along roads is governed by the following standards:

- AS/NZS 1158.1.1:2005 Lighting for Roads and Public Spaces – Vehicular Traffic
- AS/NZS 1158.6:2010 Lighting for Roads and Public Spaces – Luminaires
- NZTA M30:2014 Specification and Guidelines for Road Lighting Design
- CIE 88 – Guide for the Lighting of Roads Tunnels and Underpasses

The effects of particular lighting regimes are likely to be species-specific (e.g. Stone et al., 2012). However, where required, LED lighting should be highly directional (baffled if necessary) to minimise light spill into the surrounding environment, as well as of low intensity, longer-wavelength and lower colour temperature if practicable.

Shorter-wavelength, whiter LEDs should be avoided as these attract more invertebrates. LED colour temperature may not influence the attraction of invertebrates to LEDs in New Zealand (e.g. Pawson and Bader, 2014).

If technological advances allow, the use of LED lights that mix coloured light from three or more monochromatic LED sources will be investigated as this would potentially provide a high level of control over emitted wavelengths to allow adjustment if necessary. Ultimately, however, lighting design will be determined by human health and safety considerations.

5.7.4 Reporting

Regular reporting will be an important component of the management process during construction. A summary letter will be provided to TRC, NPDC and DOC every six months detailing any specific findings from the above VRP in relation to the specific wildlife permit for bats.

5.8 References

Chapman, S. and Choromanski, M. 2017. Assessment of Ecological Effects – Bats. Technical Report 7f, Volume 3 of Assessment of Ecological Effects, Mt Messenger Bypass project.

Chapman, S. 2018. Ecology supplementary report – Bats.

Pawson, S.M. and Bader, M.K.-F. 2014. LED lighting increases the ecological impact of light pollution irrespective of color temperature. *Ecological applications* 24(7): 1561-1568.

Smith, D., Borkin, K., Jones, C., Lindberg, S., Davies, F. and Eccles, G. 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.

Stone, E.L., Jones, G. and Harris, S. 2012. Conserving energy at a cost to biodiversity? Impacts of LED lighting on bats. *Global Change Biology* 18: 2458-2465.

6 Avifauna Management Plan

6.1 Introduction

6.1.1 Scope and purpose

The purpose of this Avifauna Management Plan (AMP) is to specify additional procedures to avoid, remedy or mitigate potential adverse effects on native birds that may be affected by construction and operation of the Project.

Ongoing intensive pest control in the pest management area (PMA, see Figure 9.1 in Chapter 9), and restoration planting, are proposed as the main methods to address residual effects on birds that cannot otherwise be avoided or completely mitigated. Full details of the overall mitigation approach for the Project and pest management plan are provided in chapters 3 and 9 of this ELMP respectively.

The populations of at least six native bird species currently resident within the proposed PMA (whitehead, tūī, bellbird, kererū, long-tailed cuckoo, North Island brown kiwi) are likely to increase significantly within the first decade of pest control, with kiwi potentially being the single largest respondent. A further four native bird species (kākā, falcon, kōkako and rifleman; all *Threatened* or *At risk*) may also benefit, if colonists from nearby populations move into the treatment area following the onset of predator control.

6.1.2 Statutory context

The provision of management to avoid, minimise and mitigate adverse effects on native wildlife and associated habitat is a requirement under the Resource Management Act 1991 (RMA) and all native birds are legally protected under the Wildlife Act 1953 (Wildlife Act).

6.1.3 Identification of key species

Key *Threatened* and *At Risk* species of interest for which breeding habitat occurs within the Project footprint are (Baber and McLennan 2017, Opus 2017):

- North Island brown kiwi (*Apteryx mantelli*);
- North Island fernbird (*Megalurus punctatus vealeae)*; and
- North island Robin (*Petroica longipes)*.

6.1.3.1 Kiwi

The Project footprint is likely to encroach on or bisect the territories of approximately 10-15 pairs of North Island brown kiwi. These pairs are likely located in both the Mangapepeke and Mimi catchments (Ecology supplementary report - Avifauna; McLennan 2018).

6.1.3.2 Fernbird

Based on detailed surveys, six pairs of fernbird were confirmed in wetlands within the Mimi River catchment, mainly in a tributary immediately below the southern end of the proposed alignment (see Figure 2.2, Section 2.3.1.3 in McLennan 2018). No fernbird were found in the Mangapepeke Stream catchment or elsewhere within the Project footprint.

6.1.3.3 General forest bird community

The bird community within the Project footprint, proposed pest management area (PMA), and wider Project area has a diverse and near complete assemblage of small forest insectivores, with rifleman (*Acanthisitta chloris*) the only notable absence. Kererū (*Hemiphaga novaeseelandiae*) and nectarvores were recorded in moderate numbers. No surveys detected falcon (*Falco novaeseelandiae*), kākāriki (*Cyanoramphus novaezealandiae*), kākā (*Nestor meridionalis*) or kōkako (*Callaeas cinerea wilsoni*). By national standards, the bird count results are generally typical of those in large forest tracts elsewhere in the North Island, and they are dominated by 'widespread and secure' species.

6.2 Potential ecological effects on avifauna

The Project's potential effects on avifauna as a result of construction include (Technical Report 7e, Volume 3 of the AEE; Baber and McLennan 2017) and Ecology supplementary report – Avifauna (McLennan 2018):

- direct removal or degradation of habitat used for nesting or foraging;
- the creation of habitat edge effects;
- direct mortality of nests and their contents;
- habitat fragmentation and isolation;
- construction noise disturbance; and
- sediment runoff to wetlands and watercourses affecting the quality of wetland bird habitat.

Potential ongoing effects resulting from operation and maintenance of the road include:

- effect of vehicle noise on birds;
- decreased landscape and habitat connectivity through fragmentation;
- mortality or injury on roads through bird strike or road kill;
- potential effects associated with the increased presence of people and introduced species in previously less accessible areas;
- lost opportunities for creating wildlife corridors; and
- degradation of the quality of the wetland and riparian habitat of wetland bird species.

6.3 Managing effects

Measures to avoid, minimise and mitigate potential effects of the Project on the key native bird species identified from the baseline surveys are set out below. They key focal area for avifauna management has been identified as North Island brown kiwi management. All other bird species are covered under the accidental bird injury protocol (Section 6.4).

These are additional to the pest management and restoration planting measures set out elsewhere in the ELMP, which will have significant positive effects on native birds.

6.3.1 Kiwi Management

6.3.1.1 Pre-construction kiwi management

Kiwi catching and kiwi radio tracking programme

A pre-construction kiwi catching programme will be undertaken with certified specialist kiwi dogs to locate and catch those kiwi known from the December (2017) nocturnal surveys to be living in or near the Project footprint. The Ecology Constraints Map in Appendix A to the ELMP shows the high-risk habitat areas for kiwi where these surveys will occur. Trained dogs are a long-established means of locating kiwi. Most dogs are used solely for finding kiwi in their daytime shelters, but a small number of dogs are specifically certified to be used at night to indicate the presence of kiwi nearby (Robertson and Colbourne 2017).

The catching effort will be undertaken by experienced kiwi dogs and handlers, working closely with survey staff, who will listen for calling kiwi in the last few hours of darkness of each night, then direct the dog teams to locations where kiwi are known to be roosting. Department of Conservation (DOC) regards the handler and dog as a team, and this team must be duly certified and permitted under the Wildlife Act before working with kiwi. The certification process, standard operating procedures and reporting forms are available in DOC's *Conservation Dog/Handler Standard Operating Procedure* (DOC 2016). Full details of kiwi dog requirements and best practice methods are provided in the *Kiwi Best Practice Manual* (Robertson and Colbourne 2017), which will be followed during the catching effort.

Once caught, each kiwi will be radio-tagged with a 'smart egg-timer' transmitter, using standard methods of attachment. On adult kiwi, the radio transmitters will be checked and replaced after 12 months: on juveniles, the transmitter and straps will be checked and changed more frequently, depending on the age of the juvenile and its rate of growth. Transmitters that are specially designed for kiwi have been developed in New Zealand and will be used in this programme.

The Project is anticipated to take four years to construct, meaning that some kiwi along or near the alignment could be radio-tagged for that period. Paired adults usually lay two clutches of two eggs between July and February, with the main egg-laying season being mid-June to December (Table 6.1) The 'egg-timer' transmitters signal when males start to incubate, and thus enable observers to detect the onset of breeding without actually approaching (and potentially disturbing) nests. Best practice radio tracking protocols will be followed, as detailed in Neill and Jansen (2014). Full details of handling, measuring and marking requirements that will be followed are provided in the *Kiwi Best Practice Manual* (Robertson and Colbourne 2017).

Once tagged, each kiwi will be tracked during the day and night for approximately one month (dependent on how long it takes to locate the birds) to determine the approximate shape and size of its territory, and the extent to which its territory overlaps with the alignment. Within the one month tracking period, a total of 50 independent locations will be obtained for each kiwi, in order to establish whether or not each kiwi resides predominately inside or outside the Project footprint. These tracking locations will also reveal the whereabouts of its daytime shelters, information that could prove useful if the birds ever

have to be moved out of harm's way during the construction process (see below). Kiwi change roosts regularly, often re-using roosts that they occupied some days or weeks ago, but seldom using the same one for two days in a row. The pre-construction monitoring of kiwi will show where the kiwi territories are and associated maps will be produced to guide further work. Once any at risk kiwi within the Project footprint have been identified and located, these birds will become the focus of monitoring during construction.

Timing

The catching effort for radio tagging kiwi will be undertaken in early to mid-autumn 2018. The first round of transmitter replacements will be undertaken in autumn 2019. These catching and handling periods coincide with the non-breeding season of kiwi and have been selected to minimise disturbance or harm to nesting birds.[5]

Kiwi capture techniques

Catching kiwi is stressful for the birds, and can cause injury to the bird or handler, or the desertion of nests. The activities in this management plan will require appropriate permits issued by DOC under the Wildlife Act, and will be carried out in accordance with those permits. All captures must be made by suitably accredited handlers. Full details of capture, handling, radio tracking and translocation techniques are documented in the *Kiwi Best Practice Manual* (Robertson and Colbourne 2017).

6.3.1.2 During-construction kiwi management

The main objective of the during-construction kiwi management protocols is to prevent kiwi and their eggs and chicks from being harmed or killed by machinery during vegetation clearance and substrate disturbance.

The following protocols will be followed and undertaken by Project ecologists and appropriately trained contractors:

Kiwi relocation

When machines are working within or in close proximity (within 40m) to a known kiwi territory, the kiwi resident in that territory will be radio-tracked each day to ensure they are not in the critical path of clearance works.

These safety checks will be undertaken at dawn, in a 30 minute to 60 minute window, when kiwi have ceased moving and settled in daytime roosts, but before the onset of the day's construction activities.

If kiwi are found to be at risk of harm, they will be physically picked up and moved immediately in an approved kiwi box to another roost in a safe location (at least 40m away) in another part of their territory. The location of alternative roosts will be identified by pre-construction kiwi territory mapping (see section 6.3.1.1).

[5] There is some evidence that handling birds shortly before breeding will delay breeding or prevent it altogether for the season, and handling adult birds on nests will almost certainly cause nest desertions (DOC 2017).

Construction team members appropriately trained in radio tracking and kiwi handling will be responsible for the daily radio tracking checks and for moving the birds (see section 6.7).

Nesting kiwi and eggs

Throughout the kiwi breeding season (July to February) the signals from egg timer transmitters on male kiwi will be checked weekly to determine which birds are incubating and when they began doing so. Nesting kiwi potentially at risk of disturbance (i.e. within 40 m of construction activities) will be identified and left to incubate naturally until the risk of disturbance triggers the intervention threshold (i.e. construction activities approach within 40 m).

Where construction activities encroach within 40 m, the nests will then be located exactly, and their contents removed, following the procedures and protocols recommended in the *Kiwi Best Practice Manual* (Robertson and Colbourne 2017). All eggs and young chicks recovered from nests will be taken to a permitted incubation and chick-rearing facility, most likely Kiwi Encounter in Rotorua. Later, the resulting offspring will be released back into the PMA, or elsewhere. Release sites will be determined by the Project ecologists taking into account Ngāti Tama and DOC advice.

In all cases, eggs will be uplifted only when they have been incubated naturally for at least 20 days.[6] If a recently established nest is found in a disturbance zone, construction activities (within 40m) in that area will cease until the eggs can be safely uplifted at 20+ days of age.

6.4 Accidental bird injury and mortality during construction

In the event of finding a dead or injured native bird during construction of the Project, the following procedures will be implemented:

(i) Injured native birds will be taken immediately to a vet approved by DOC for assessment (see Table 6.1 for details).

(ii) Birds will be placed in a cool, dark, material-lined box/bag by or under the direction of a Project ecologist to ensure the bird is handled appropriately.

(iii) The local DOC office or DOC hotline (if after hours) will be contacted no longer than two hours after the injured or dead bird is found (see Table 6.2 for details).

Table 6.1 - Contact information for approved contact in the event of native bird injury or mortality

Vet clinic/zoo or other specialist	
Name	To be advised by DOC
Contact details	
Address	

[6] Eggs taken before this time (i.e. within three weeks of laying) generally have low hatch rates, or sometimes produce young with development problems (DOC 2017).

Table 6.2 - DOC contact information

Local DOC office	
After hours	0800 DOCHOTLINE (0800 362 468)

DOC and veterinary advice shall be sought in conjunction with a suitably trained Project ecologist when considering the rehabilitation requirements of any injured native birds (for example, legislative requirements will need to be considered). Once the vet has made an assessment, the Project ecologist will, taking into account the advice from the vet, determine any rehabilitation action required and the longer-term future for the bird/s.

If the bird is dead or euthanised by the vet, it must be taken to the local DOC office as soon as practicable.

6.5 Reporting

Regular reporting will be an important component of the management process during construction. A summary letter will be provided to TRC, NPDC and DOC every six months during construction detailing any specific data from the proposed kiwi management in relation to the specific wildlife permit for kiwi.

6.6 Permitting requirements

Permits are to be obtained for any manipulation of kiwi under the application of the Wildlife Act. The activities involved in executing this management plan are indicated in Table 6.3.

Table 6.3 - Kiwi activities involved in this Project for which DOC requires a Wildlife Permit

Kiwi activity that require Wildlife Permit	Activity involved in this Project
Using dogs to locate kiwi	ü
Catching and handling kiwi	ü
Photographing kiwi in nests	ü
Marking kiwi with bands, wing tags or transponders	ü
Attaching radio-transmitters to kiwi	ü
Taking blood or feather samples from kiwi	ü
Transferring kiwi to a new site	ü
Uplifting eggs or chicks from a nest as part of Operation Nest Egg™ (ONE)	ü
Holding dead kiwi, including for kiwi aversion training	

Kiwi activity that require Wildlife Permit	Activity involved in this Project
Holding kiwi in captivity	

6.7 Training requirements

Training / accreditation requirements for Project team members involved in the management of kiwi are as follows:

- Accredited handlers will be involved in the kiwi radio tracking programme detailed in section 6.3.1.
- Project ecologists and contractors involved in relocating kiwi during construction works will be formally trained in handling kiwi and radio tracking techniques and shall be officially accredited. The Kiwi Recovery Group maintains a register of accredited handlers trained to ensure the welfare of kiwi is the top priority when they are being manipulated in any way.
- To be added to the register of accredited handlers, the Project ecologists and contractors will declare that they have and will comply with the relevant sections of the *Kiwi Best Practice Manual* (Robertson and Colbourne 2017), and will also supply a letter of recommendation from an accredited trainer for the particular task(s) being registered for, e.g. catching, holding, measuring or blood sampling kiwi.
- Two members of the team undertaking kiwi handling and radio tracking activities shall be approved trainers.
- The Project ecologists and contractors will be made aware of the health and safety considerations and risks associated with kiwi handling, as documented in the *Kiwi Best Practice Manual* (Robertson and Colbourne 2017).

6.8 References

Baber, M and McLennan, J.A. 2017. Technical Report 7e Assessment of Ecological Effects - Avifauna, in Volume 3 of the Assessment of Effects on the Environment, SH3 Mt Messenger Bypass

Dawson, D.G and Bull, P.C. 1975. Notornis. Vol 22. Part 2. 101-109.

Department of Conservation 2016. Conservation Dog-Handler Team Standard Operating Procedure. DOCDM-749.423.doc. 24 p.

McLennan, 2018. Ecology supplementary report - Avifauna. February 2018.

Neill, E. and Jansen, P. 2014: Ground-based radio tracking: a best practice protocol. Department of Conservation, Wellington, 19 p

Opus 2017. Mt Messenger Bypass Investigation: Bird Baseline Survey and Preliminary Assessment of Effects. New Zealand Transport Agency.

Robertson, H. and Colbourne, R. 2017: Kiwi Best Practice Manual. Department of Conservation, Wellington, 113 p

7 Lizard Management Plan

7.1 Introduction

This Lizard Management Plan (LMP) includes:

- A summary of the potential effects of the Project on indigenous lizards within the Project footprint;
- Methods for the salvage and recovery of indigenous lizards present within identified habitats within the Project footprint;
- Specified protocols for salvage and release of indigenous lizards (including 'At Risk' and 'Threatened' lizard species) captured within the Project footprint; and
- Details of a suitable lizard release site including location and site preparation.

Some of the lizard species present in the wider Project area are also likely to benefit from the broader pest management, restoration planting and other general measures set out elsewhere in this ELMP (see chapters 3 and 9 for an overview).

All indigenous lizards are legally protected under the Wildlife Act 1953 (Wildlife Act), and the importance of vegetation and landscape features that provide significant habitat for native herpetofauna are recognised by the Resource Management Act 1991.

This LMP will be used to support a Wildlife Act permit application to the Department of Conservation (DOC) to authorise the following:

- Handling of lizards (including non-threatened, 'At Risk' and 'Threatened' lizard species);
- Capture, relocation and release of lizard species from the Project footprint; and
- Accidental lizard injuries and mortality during construction.

7.2 Baseline lizard survey results

Baseline lizard survey results are included within the Assessment of Ecological Effects – Herpetofauna (Technical Report 7d, Volume 3 of the AEE), with updated information within the Ecology supplementary report – Herpetofauna. The methodologies employed for the baseline lizard surveys are set out in those reports.

The ecosystems in which the Project footprint sits provide suitable habitats for a number of indigenous lizard species. These onsite habitat types range from terrestrial forest floor micro-habitats including woody debris items, clumping vegetation and dense litter, to arboreal micro-habitats including epiphytes, canopy foliage and loose bark. Habitat assessments conducted during the 2017 field seasons identified the following broad habitat types:

- Mature/late regenerating forest;
- Early successional/scrub;

- Wetland; and
- Rank pasture grass.

As described in the above-mentioned reports, intensive targeted surveys utilizing multiple survey techniques failed to detect the presence of herpetofauna species within the Project footprint.[7] The lack of lizard detections within the Project footprint does not provide evidence for their absence, but can be interpreted as local lizard populations being at or below levels of detectability.

Due to no known native frog habitat being identified within the Project footprint, they have been excluded from the below protocols. However, the presence of the 11 indigenous lizard species (skinks and geckos) cannot be ruled out. Potential effects on these species will be mitigated based on a conservative approach that assumes that any or all of those species may be present within the Project footprint.

7.3 Potential adverse effects on lizards

The potential effects of the Project on lizards have been assessed as:

- Lizard injury or death, including during construction activities;
- disturbance; and
- loss of habitat.

The protocols set out in this plan, together with the broader measures described in Chapter 3 of the ELMP, address those potential effects.

7.4 Protocols

7.4.1 Introduction

The protocols specified below are consistent with standard methodologies from DOC's *Inventory and Monitoring Toolbox: Herpetofauna* (DOC 2012), and have been applied successfully on many NZ Transport Agency road construction projects. The protocol methodologies have been adapted for local site conditions. Table 7.1 below outlines the indigenous lizard habitat risk framework used to inform the Ecology Constraints Map in Appendix A to the ELMP which identifies areas were the protocols will be implemented.

7.4.2 Project lizard ecologist

The Project ecologist responsible for leading all lizard surveys and salvage will be a suitably qualified lizard ecologist. More than one Project lizard ecologist may be appointed to work on the Project. All decision-making and technical inputs on fieldwork will be the responsibility of the Project lizard ecologist(s). All ecologists and sub-contractors that will contribute to the herpetofauna work required before, during and after construction shall be suitably experienced in lizard surveys and safe handling of lizards.

[7] A copper skink (*Oligosoma aenea*) population was detected less than 1km from the Project footprint, where four adults were observed, including a gravid (pregnant) adult female.

7.4.3 Protocol A: Identification of lizard habitats

All habitats along the Project alignment will be surveyed by the Project lizard ecologist(s) to inform the preparation of an Ecology Constraints Map (Appendix A to the ELMP) of 'Zero Risk', 'Low Risk', 'Medium Risk' and 'High Risk' lizard habitats. 'High Risk' habitats may include individual trees, groups of trees or areas of habitat, whereas other risk categories are likely to apply to areas of habitat rather than individual trees or habitat features. The Ecology Constraints Map will be used to guide the selection and location of the salvage methodologies as described in Table 7.1 below. The locations of all 'High Risk' lizard trees (also identified by the survey) and high risk habitat areas will be recorded with hand-held GPS units and, where appropriate, clearly marked with flagging tape and/or fluorescent spray paint. Areas of lizard habitats in all other risk categories will be mapped but not marked onsite.

7.4.4 Protocol B: Lizard salvage

Salvage methodologies will only be undertaken during the period from 1st September to 30th April inclusive. Lizard salvage will be undertaken using the methodologies described below. Specific salvage methodologies to be utilised will be guided by the Project lizard ecologist based on their assessment of the lizard habitat risk level with discretion to include or exclude areas based on the type and quality of habitat being cleared.

7.4.4.1 Artificial Cover Objects

Artificial Cover Objects (ACOs) comprised of single layered rectangular or square Onduline sheets measuring approximately 500 mm x 450 mm. ACOs will be deployed within areas of 'Low Risk', 'Medium Risk' or 'High Risk' for lizards within the Project footprint deemed by the Project lizard ecologist to be suitable for this methodology. Within areas of 'Low Risk', 'Medium Risk' or 'High Risk' deemed suitable for ACO deployment, ACOs will be deployed in transects containing 10 ACOs spaced at 5 m to 20 m apart. ACOs will be deployed at a density of 20 ACOs per hectare of 'Low Risk', 'Medium Risk' or 'High Risk' deemed suitable for ACO deployment.

After a minimum 'settling in' period of a minimum of four weeks, ACOs will be checked twice a week for approximately 4 weeks resulting in eight checks in total. ACO checks will be undertaken during weather conditions and timeframes deemed by the Project lizard ecologist to be suitable for ACO-based lizard capture.

7.4.4.2 Funnel traps

Funnel traps (Gee's Minnow Traps or similar) will be placed in arboreal epiphytes to capture arboreal native geckos and skinks. Funnel traps will be installed into 'High Risk' trees ≥ 40 cm DBH which the Project lizard ecologist considers contain structural elements (e.g., abundant epiphytes) favourable for arboreal lizards. Up to four funnel traps baited with fruit (e.g., fresh banana or canned pear) will be placed in each 'High Risk' tree for no less than 48 hours prior during the four weeks leading up to removal.

If no lizards are captured in the trap(s) then the traps will be removed, and no further funnel trapping will be undertaken in that tree.

If one or more lizards are captured in the funnel trap(s) in a tree, then trapping will continue in that tree until no lizards have been captured for 48 hours.

All funnel traps will be checked no less than once every 24 hours following installation. Care will be taken to ensure that each funnel trap can easily be taken down with minimal risk of becoming stuck.

It is difficult to set funnel traps at heights greater than 15m above the ground therefore larger 'High Risk' trees will be also be targeted with the arboreal salvage methodologies described in section 7.4.4.3 and 7.4.4.4 below.

7.4.4.3 Nocturnal searches

All areas within the Project footprint identified by the Project lizard ecologist as 'Medium Risk' or 'High Risk' habitat will be searched on a minimum of two separate nights during the four weeks leading up to the commencement of vegetation clearance. Nocturnal searches will be undertaken by using powerful torches and binoculars to 'spotlight' and capture lizards. The focus of nocturnal searches will be forest and shrubland edges, and any other habitat features deemed by the Project lizard ecologist to be suitable for nocturnal searching.

An initial 20 person-hours of nocturnal searching per hectare will be undertaken within 'Medium' and 'High Risk' lizard habitats. No further nocturnal searching will be undertaken in any habitat areas where no lizards are found during the initial 20 hours of nocturnal searching in areas. If one or more lizards are found in a hectare of 'Medium Risk' or 'High Risk' habitat, then further searching will be carried out in that area until no further lizards have been found for 10 person-hours of searching. If lizards continue to be found, then a maximum of 100 person-hours of searching per hectare will be applied for each area of 'Medium Risk' or 'High Risk' lizard habitat.

7.4.4.4 Manual, destructive and machine-assisted salvage

Systematic manual, destructive and/or machine-assisted searches will be undertaken during the month leading up to the commencement of vegetation clearance, and during and immediately following, vegetation clearance. These methodologies will be used where deemed appropriate by the Project lizard ecologist within 'Low Risk', 'Medium Risk' and 'High Risk' lizard habitats.

The Project lizard ecologist will be present during the felling of any 'High Risk' trees. When a 'High Risk' tree has been felled, and the supervisor of the vegetation clearance contractors has deemed it safe to approach the felled tree, the Project lizard ecologist will immediately commence searching the felled tree for lizards. The tree may be cut into sections to facilitate safe searching and/or destructively searched (e.g., by manually dismantling epiphyte clumps, or by using a chainsaw to access tree cavities which may be occupied by

lizards). Where it is not safe to search a felled tree, the tree will instead be cut into sections that will be positioned and stored adjacent to suitable lizard habitat to maximise the likelihood that any lizards present will find their way back to habitat outside the Project footprint.

In addition to 'High Risk' trees, destructive salvage will also be undertaken within 'Medium Risk and 'High Risk' habitat areas deemed by the Project lizard ecologist to be suitable for the application of this salvage methodology. Habitat areas in which destructive salvage may be appropriate is likely to include areas with one or more of the following structural features/elements: deep leaf litter, rock piles, low growing epiphytes/vines, dense low-growing vegetation, loose tree bark, fern skirts and woody debris. The methodology involves searching for lizards while dismantled either manually or with the assistance of appropriate machinery or tools (e.g., digger, chainsaw, rake, etc.).

During the supervised removal of 'High Risk' trees, the Project lizard ecologist may select larger intact epiphytes to be translocated either to the lizard release site. These will be removed from branches if necessary and transported in shade cloth (or similar) and stacked against mature trees within the designated release site outside of the Project footprint promoting self-relocation of any indigenous species that could potentially be present.

To minimise mortality and injury to indigenous lizard not detected during the above salvaging operations, felled trees may be cut into sections and stockpiled at the edge of remaining native vegetation for a minimum of one month, or until all foliage has fallen off. It is expected that indigenous lizards will disperse out of stockpiles and into the adjacent forest. The stockpiles can then be removed from the site and/or mulched with no further restrictions.

Table 7.1 - Lizard salvage methodologies based on risk level of potential lizard habitat

Lizard habitat risk	Salvage requirements
Zero	· No salvage works required (i.e. construction works can commence without the need for any lizard salvage).
Low	· Manual, destructive and machine assisted searching where deemed appropriate by the Project lizard ecologist (e.g., patches of dense vegetation and under debris) · ACO transects may be deployed in 'Low Risk' lizard habitat areas at the discretion of the Project lizard ecologist.
Medium	· Nocturnal searches and manual, destructive and machine-assisted searches. · ACOs to be deployed along forest/shrubland-grassland interfaces (i.e., habitat edges). ·
High	· Funnel trapping in high risk trees, nocturnal searches and destructive searches;

7.4.5 Protocol B: Capture, handling and release

The following steps will be undertaken by the Project lizard ecologist to ensure appropriate handling of lizards occurs. Capture, handling and release of lizards will be undertaken in accordance with the below methodologies:

- All field equipment that indigenous lizards may come into contact with (e.g., plastic enclosures, collection bags, scales, etc.) will be sterilized, as well as hand sterilisation. All equipment used in their capture will subsequently be disinfected before reuse;
- Salvaged lizards will be either transported in cloth bags (only during salvage, not during transportation) or in suitable ventilated plastic containers. Care will be taken so that the bags and containers will be kept at a constant ambient temperature;
- Where practical, indigenous lizards will be placed individually in ventilated two litre plastic containers for no longer than 8 hours and will be released in the relocation site; and
- Salvaged lizards will be released into appropriately prepared and protected habitat (see 7.4.7 below), or others identified within the project area, suitable for the lizard species being relocated.

7.4.6 Protocol C: Lizard injury or death

The following steps will be implemented if any injured or dead lizards are found during lizard salvage:

- The Environmental Manager and relevant representatives of DOC, TRC and NPDC will be notified at the earliest opportunity within 24 hours after an injured or dead lizard found.
- Injured lizards found during salvage will be taken to a suitably qualified vet as soon as possible for assessment and treatment. Injured lizards will be kept in an appropriate portable enclosure (i.e., a clean, well-ventilated plastic container) under the direction of the Project lizard ecologist to ensure the animal is handled appropriately until the lizard(s) can be assessed and treated. The initial contact vet is:

  Dr Andrew Gore
  Hamilton Zoo
  Brymer Road
  Hamilton
  07 838 6720

  The initial vet contact may refer the lizard assessment and treatment to an alternative specialist if appropriate.
- An injured lizard may be euthanised immediately if it is deemed by the Project lizard ecologist that the injuries are not survivable, and that maintaining the lizard alive is highly likely to cause it inhumane levels of pain and stress.
- Any lizard that is found dead or injured and subsequently euthanised will be returned to DOC as required by the Wildlife permit.

- Lizards assessed by the vet or alternative specialist as uninjured, or otherwise in suitable condition for release, will be transported to the lizard release site in the portable enclosure and released into habitat suitable for the species being released.

7.4.7 Protocol D: Release site

The physical indigenous lizard release site will be located within the pest management area (PMA) described in chapter 9 of this ELMP, or appropriate sites within the wider project area. This site should be a minimum area of 400 m^2.

The key aspects of the physical indigenous lizard release site are:

- Farm livestock will be excluded completely by the construction of permanent eight-wire post and batten fences wherever effective fences do not currently exist.[8];
- The release site will contain suitable habitat for indigenous lizards (ground skinks and arboreal skink and gecko species);
- Any indigenous lizards salvaged will be relocated to suitable habitat(s) within the release site;
- As required, additional mitigation measures within the release site may include artificially created mounds made from rock as well as the importation of woody debris recycled from trees, logs and epiphyte clumps that are proposed to be removed from the Project footprint; and
- No pre and post indigenous lizard monitoring is proposed within the release site. This is because of the inherent difficulties associated with obtaining and interpreting meaningful 'before' and 'after' comparative data on population densities. It is assumed that removing any relic population of indigenous lizards from predator pressure will result in extra carrying capacity to accommodate the release of any salvaged indigenous lizards.

Soft-release pen specifications

If required the release pen will be constructed covering an area of at least 20 x 20 m, to be constructed as the terrain and existing vegetation allows. The pen construction will involve mouse-proof fencing constructed from wire mesh, shadecloth and a 500mm Colorsteel® section with rolled hood (similar to the schematic shown in Figure 7.1). The fence will be 1300mm high, with a 400mm skirt pinned to the soil surface.

Pest control will be established in and around the lizard release pen (with a minimum buffer of 50 m) targeting rats, mice, stoats and possums. The pen and pest control will be established at least 1 month before construction start, and will have to be proven to be effective before any lizard is released into the pen. Based on estimates, a pen of this size should provide habitat for at least 40 copper skink (Porter 1987), or up to 100 animals (Towns and Elliott 1996).

[8] Livestock will be excluded from the the core part of the PMA, rather than the specific physical indigenous lizard release site.

The fence around the pen is to be removed one year after construction is complete, allowing any released lizards to settle into their new habitat. Ongoing observations and management of vegetation (weeds) and quality of the habitat including refuge numbers and food sources will be required until then.

If large numbers of lizards are found exceeding the capacity of the initial pen, additional release pens may need to be constructed to avoid the need for animals to be kept in captivity.

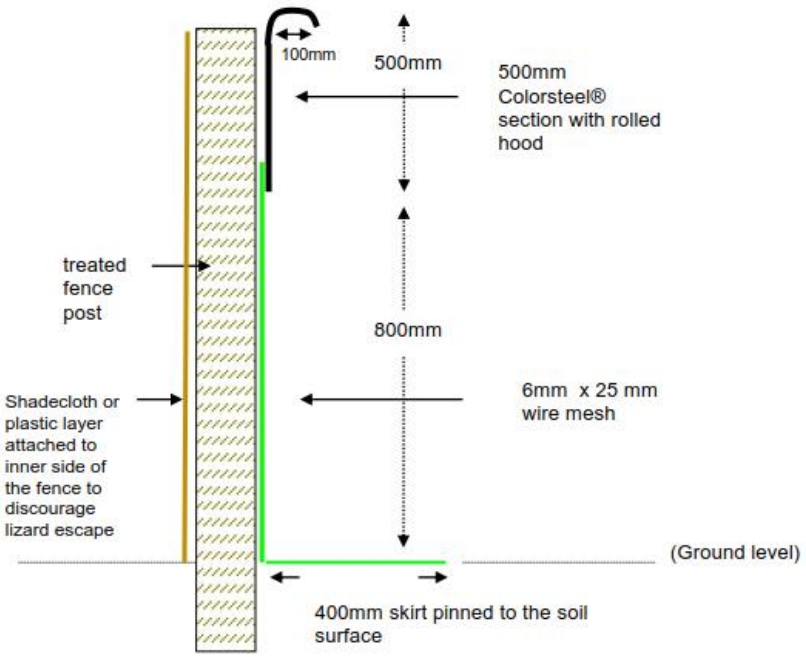

Figure 7.1 - Mouse, rat, mustelid and possum proof fence design

7.5 Reporting and communication

The following data will be recorded for all lizards captured:

- Capture location and release location (GPS coordinates)
- Date and time of capture;
- Species;
- Capture methodology;
- A minimum of one photograph of the lizard including at least one photograph showing the dorsal surface clearly;
- Sex and age class;
- Weight;
- Snout to vent length (SVL);
- Health/condition;

- Weather conditions at time of capture; and
- Habitat type at capture location.

Copies of all records will be submitted to DOC's national data repository for lizard records (the BioWeb Herpetofauna database) no later than the 20th day of the month following the month of capture. In addition if lizards are found within the project area, every three months (i.e., quarterly) from the commencement of vegetation clearance, the above data will be compiled, summarised and submitted to DOC, TRC and NPDC in a letter or memorandum which, as a minimum, will include the following information:

- DOC Wildlife Act authority number and Project name and location;
- A summary of the species, numbers and age/sex classes of lizards captured;
- Locations of lizards captured; and
- Summary of salvage methodologies, effort and success;

Quarterly reporting will cease once lizard salvage has been completed and all captured lizards have been released into the release pen. A final report summarising the outcomes of LMP implementation will then be prepared and submitted to DOC, TRC, NPDC and iwi within three months following the final lizard release.

7.6 References

Anderson, P.; Bell, T.; Chapman, S. and Corbett, K. (2012). *SRARNZ New Zealand Lizards Conservation Toolkit – a resource for conservation management of the lizards of New Zealand*. A SRARNZ Miscellaneous Publication. Society for Research on Amphibians and Reptiles in New Zealand.Hitchmough, R.; Anderson, P.; Barr, B.; Monks, J.; Lettink, M.; Reardon, J.; Tocher, M.; Whitaker, T. (2013). Conservation status of New Zealand reptiles, 2012. *New Zealand Threat Classification Series 2*. Department of Conservation, Wellington.

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Porter, R. (1987). An ecological comparison of two cyclodina skinks (Reptilia: Lacertilia) in Auckland, New Zealand. New Zealand Journal of Zoology 14 (4): 493–507.

Speedy, C., Day, T., & Innes, J. (2007). Pest eradication technology-the critical partner to pest exclusion technology: the Maungatautari experience. *Managing vertebrate invasive species*.

Towns, D. R., and Elliot, G. P. (1996). Effects of Habitat Structure on Distribution and Abundance of Lizards at Pukerua Bay, Wellington, New Zealand. New Zealand Journal of Ecology 20(2): 191–206.

Chapman, S. & Chroromanski, M. (2017). Assessment of Ecological Effects – Herpetofauna (Technical Report 7d, Volume 3 of the AEE),

Ecology New Zealand Ltd. (2018). Ecology supplementary report – Herpetofauna.

8 Freshwater Ecology Management Plan

8.1 Introduction

This Freshwater Ecology Management Plan outlines the management processes required to mitigate adverse effects on freshwater ecology as a result of the Project, including minimising effects on aquatic habitats and fauna, aquatic habitat restoration, like-for-like mitigation (new stream diversions) and ecological compensation to address residual habitat loss.

Freshwater effects and mitigation are also considered in the following chapters of this ELMP and other plans:

- Construction Water Management Plan (CWMP) (covers construction water discharges (including erosion and sediment generation), that could result in adverse effects on water quality);
- Ecological mitigation strategy and framework (ELMP Chapter 3); and
- Landscape and Vegetation Management Plan (ELMP Chapter 4).

The locations of monitoring sites referred to in this plan are provided in the Freshwater Ecology Constraints Map (Appendix A to this ELMP).

8.2 Baseline freshwater ecology

All baseline information pertaining to freshwater ecology in the Project footprint, including the results of field surveys, is included in the following reports:

- Technical Report 7b – Freshwater Ecology (December 2017); and
- Ecology supplementary report – Freshwater Ecology (February 2018).

8.3 Mitigation and offset measures

8.3.1 Fish Recovery and Rescue Protocols (FRRP)

Works within waterways have the potential to cause the direct removal/stranding of or injury to aquatic life. In particular, work in low gradient streams could affect species including inanga, longfin eel, redfin bully, giant kōkopu, kōura and kākahi; and work in steeper gradient streams could affect banded kōkopu, longfin eel, redfin bully and kōura.

The direct effect of earthworks on freshwater species (ie fish, kōura and kākahi) can be considerably minimised and mitigated by implementing FRRP prior to dewatering, diverting or excavating streams.

The FRRP are provided in Appendix A to this chapter. These protocols describe the methods that will be undertaken to minimise direct effects of construction on fish, kōura and kākahi (freshwater mussels) in waterways affected by the Project. They cover procedures and locations for:

- recovery of fish prior to instream works;

- rescue of fish from any spoil; and
- relocation of fish.

8.3.2 Sediment control – kahikatea swamp forest

Fine sediment is a typical feature of the substrate in streams around Mt Messenger due to the papa mudstone geology. However, construction activities have the potential to accelerate erosion and sedimentation, with consequential adverse effects on aquatic life.

Accelerated erosion and sedimentation will be minimised and mitigated by ensuring good Erosion and Sediment Control (E&SC) practices, as described in the CWMP.

The part of the Project area most sensitive to additional sedimentation is the tributary of the Mimi River draining the southern tunnel portal (monitoring site E6 in the Freshwater Ecology Report).) The tributary runs into a raupo reedland / rautahi swamp and adjacent kahikatea / swamp maire forest. The kahikatea swamp maire forest is a pristine example of this habitat type. Although the raupo reedland buffers the kahikatea swamp maire forest from sediment, particular care will be taken at this location to ensure appropriate E&SC as set out in the CWMP. Additional monitoring will be undertaken here, to confirm that the Project does not cause sedimentation within the swamp forest (refer to Section 8.4).

8.3.3 Vegetation Clearance Protocols

Vegetation clearance can have a number of potential effects on streams. Felling and removal of trees can expose soil, making it more prone to erosion. In addition, the accumulation or storage of sawdust, chip or mulch near or over waterways can leach dissolved organic matter that can promote heterotrophic growths or deplete dissolved oxygen in stream water.

Any adverse effects arising from vegetation clearance will be minimised by following procedures in the Landscape and Vegetation Management Plan and associated Vegetation Clearance Protocol (Chapter 4 of this ELMP). This includes procedures for:

- minimising the area and duration of soil exposure from vegetation clearance;
- minimising the volume of vegetation to be mulched;
- locating wood residue piles with an appropriate separation distance from any waterways (either permanent, intermittent or ephemeral); and
- setting aside sections of trees to be used as part of restoration work (e.g. root balls, trunks and branches).

If vegetation clearance adjacent to streams occurs prior to fish recovery, then care will be taken to ensure direct effects on the stream are minimal and logs and branches do not prevent access to the stream (see Chapter 4).

8.3.4 Fish passage

Many New Zealand fish are diadromous and need to migrate between fresh water bodies and the sea in order to complete their life-cycle. The upstream migration seasons for the migratory fish species present in the Mimi River and Mangapepeke Stream span most of the

year (August to April inclusive), but for most of these species, the peak migration occurs during spring to early summer (August to December).

Project work includes the installation and/or extension of culverts and the diversion of waterways resulting in the loss of existing stream habitat. The potential effects of these works on fish passage will be minimised by following procedures described in Chapter 6.6 of the CWMP. This includes:

- timing of online stream diversion works to avoid peak fish migration and spawning seasons as practicable;
- where possible, timing works for a suitable fine weather window forecast;
- providing appropriate fish passage for culverts;
- undertaking work offline (outside the active stream channel) where practical; and
- following the FRRPs.

The specific design to enable fish passage will be confirmed in the Specific Construction Water Management Plans (SCWMPs). A SCWMP will be prepared for each section of stream works to confirm:

- design specifications;
- the method of construction;
- stream dewatering and reclamation;
- stream diversion method (online or offline) to allow construction near or within the active stream channel;
- timing of works to avoid peak fish migration and spawning as practicable; and
- fish passage provisions, informed by NZ Transport Agency's "*Fish passage guidance for state highways"* (August 2013) guidelines.

8.3.4.1 Timing of works

One way to reduce the potential effects of earthworks on fish spawning and migration is to avoid or minimise works during months when key fish species in the catchment may be migrating or spawning. For the Mt Messenger Project there are practical constraints in seasonally stopping work across the whole site and it may increase the risk of erosion if it means the construction phase takes appreciably longer. However, there may be opportunity to adjust the timing of works in particular catchments.

Generally, it is more important to maintain unimpeded fish passage during peak migration periods for streams with larger upstream catchments than those with small upstream catchments. This principle can be used to direct the timing of works in different parts of the catchment. Priority will be given, where practicable, to avoiding works during peak migration period (August to December inclusive) within the larger streams e.g. the main stem Mangapepeke Stream and tributary located at monitoring site Ea10.

8.3.4.2 Fish passage through temporary culverts

Measures to mitigate the short-term effects of culvert construction on fish passage are described in the Construction Water Management Plan (CWMP). These include minimising the length of time construction activities cause a fish passage barrier by constructing culverts and diversions in the dry, where possible.

In the large area of fill near the tunnel portals, the short-term effects on fish passage will be mitigated either by installing spat rope through the culvert or by implementing trap and transfer. The approach is dependent on the timing and duration of works, and on physical stream characteristics such as stream flow. The method will be confirmed detailed within the SCWMP.

8.3.4.3 Fish passage through permanent culverts

A description of culvert design and approach to fish passage for each culvert is provided in the Culvert Schedule and Typical Drainage Details (Drawing Number MMA-DES-DNG-CO-DRG-4006). This includes culvert dimensions, length, grade and general approach to fish passage. The general approach taken for fish passage is:

- Type 1 fish passage, Steep gradient (ca. >1%) fish passage will be provided by installing baffles within the culvert. Baffles will be appropriately spaced for the culvert gradient to ensure continuous fish passage.
- Type 2 fish passage, Shallow gradient (ca. <1%) the culverts will be sufficiently sized to allow for fish passage and the inverts depressed by about 20% of the culvert diameter so that stream substrate is retained in the base of the culvert. Baffles may also be installed to ensure substrate retention.
- Energy dissipation structures or erosion protection structures at culvert inlets and outlets will not impede fish passage, as these will be set at or below stream bed level to allow the voids to infill with deposited stream bed material and natural substrate.

The detailed design of culverts will be provided within each SCWMP. Permanent culvert dimensions, grades, inverts, and improvements for fish passage (e.g., baffles, aprons, resting pools) will also be designed in general accordance with the NZ Transport Agency fish passage guidance for state highways (2013). Each SCWMP will provide details to ensure fish passage through permanent culverts, including:

- The type and spacing of any baffles.
- Identification of locations where spat rope approach will be used. This will be limited to situations where other solutions are not practicable and where natural barriers (waterfalls) restrict the upstream fish community to climbing species.
- Outlet structure design to provide a resting pool near the outlet and ensure at least 100mm of water depth is retained at the culvert outlet and over the apron (for example using V-vanes (cross-vanes) made from boulders).

8.3.5 Minimising adverse effects from in-stream works

During construction, the Project Freshwater Ecologist will communicate with the Construction Manager to discuss optimisation regarding fill disposal sites, to attempt to reduce the overall length of culverts and stream diversions if practicable.

8.3.5.1 Stream diversion design

The detailed design of stream diversions is in progress. The aim of the design to match existing habitat types and follow the general principles that are provided in Stream Ecological Design Principles (Appendix B to this chapter). These general principles address:

- structure and morphology;
- substrate on stream bed and banks;
- stream bank stabilisation; and
- riparian vegetation.

8.3.6 Offsets of stream loss

8.3.6.1 Restoration to offset stream loss

This Project has included measures to avoid, minimise and mitigate effects on freshwater ecology; however, biodiversity offsets are required to achieve 'no net loss of ecological values' or a 'net positive gain'. This will take the form of riparian restoration on streams outside of the directly-affected area to improve ecological functions at those locations. The amount of stream restoration work required to offset effects on waterways was calculated using the Stream Ecological Valuation (SEV) approach. This needs to be confirmed when the areas being used for restoration are known or if there are substantial design changes during the consent process.

The overall mitigation approach for the Project and the restoration work being used for the purposes of offsetting are described in Chapter 3 of this ELMP.

8.3.6.2 Stream Restoration Plan (SRP)

A Stream Restoration Plan (SRP) was recommended in the AEE to guide restoration and improve certainty that the assumed restoration outcomes will be achieved. However, there is considerable spatial overlap between restoration of stream diversions and restoration undertaken for the purpose of offset mitigation. To avoid duplication and inconsistencies, a stand-alone Stream Restoration Plan is not proposed, as the content of an SRP is captured in the Ecological Design Principles and in Chapter 4.6 of this ELMP (Landscape and Vegetation Management Plan).

8.3.7 Water takes

8.3.7.1 Water take

The Project requires two water takes for the purpose of dust suppression. These are:

- up to 150 m3/day from the Mimi River near site Ea24; and

- up to 300 m3/day from the Mangapepeke Stream near the confluence of the west branch.

The potential adverse effect of the water takes on stream habitat will be minimised by monitoring water take volume and stream water level downstream of the water take location.

8.3.7.2 Water intake structure

The water intakes (e.g. for dust suppression or when pumping to dewater an area) will be designed to exclude fish. This will include:

- an equivalent screen mesh size 3 mm or less (side of square); and
- an intake surface area of sufficient size that water velocities through the intake are less than 0.12 m/s.

8.4 Monitoring

This section describes monitoring that will be undertaken to assess potential effects of the Project on stream habitat and aquatic life. Baseline ecological information has been collected for the Mangapepeke Stream and Mimi River during field investigations in February 2017, June 2017, August 2017 and November 2017.

Monitoring will comprise:

- pre-construction monitoring;
- construction monitoring – routine; and
- construction monitoring – event based.

8.4.1 Monitoring sites

Monitoring site locations (see Ecology Constraints Map, Appendix A to the ELMP) and methods are summarised in Table 8.1. Coordinates represent the proposed water quality sampling point. Coordinates for the exact survey reaches will be collected during the first survey round.

Table 8.1 - Stream monitoring locations and method summary

Notes F = fish, M = Macroinvertebrates, Se = Sedimentation Plates, W = water quality

Site		Coordinates (NZTM)		Type	Description and notes
	Catchment	Latitude	Longitude		
E2	Mangapepeke	-38.870796	174.598444	M, F,	Downstream location on Mangapepeke Stream
Ea10a	Mangapepeke	38.883153	174.605548	M, F	Tributary to Mangapepeke upstream of works
	Mimi	38.902103	174.596491	Se	Sediment deposition
Ea25	Mimi	38.903034	174.594584	F	Event based monitoring
Ea26	Mimi	38.903309	174.591411	W, M, F	Near downstream on Mimi River tributary. Near sediment monitoring site.
Ea27	Mimi	38.905399	174.591865	M, F	Upstream of works. Potential restoration area.

8.4.2 Pre-construction monitoring

8.4.2.1 Water quality during rain events

Water quality during rain events is currently being monitored in the Mangapepeke Stream and the Mimi River using passive samplers. In each catchment there is an impact site near the downstream extent of the works and a control site in an adjacent paired catchment. This monitoring is described in the CWMP.

8.4.2.2 Sediment deposition

Sediment plates[9] have been established at the end of the stream channel downstream of site E6. This site is within the raupo reedland, downstream of the Mimi River tributary draining the tunnel portal, located upstream of the kahikatea swamp forest.

The purpose of the sediment plates is to monitor any sediment deposition that might extend from the end of the stream to the kahikatea swamp forest. The plates will be monitored following heavy rain events during the baseline period and weekly during construction but are primarily intended to be monitored if there is a sediment release event in the upstream catchment.

8.4.3 Monitoring during construction

Construction monitoring will commence when construction begins upstream of a section of stream and finish when construction activities affecting any given catchment are complete.

8.4.3.1 Fish monitoring

Annual fish monitoring will be undertaken at sites E2, Ea10, Ea25 and Ea26 during the construction period. These sites provide an impact site near the downstream extent of the works and a control site in an adjacent paired catchment.

During the first year, fish surveys shall be undertaken during spring (October, November inclusive) and late summer (February, March inclusive). This provides seasonal data to assist with comparisons with baseline fish surveys undertaken for the AEE. After the first year, fish surveys will be undertaken in once during the period 1 November to 30 March.

Fish surveys will use methods consistent with the protocols in Joy et al. (2013).

8.4.3.2 Event-based monitoring

Event-based monitoring will occur in response to an event such as heavy rainfall, exceedance of a trigger, an unscheduled event like a failure of sediment control devices, or a chemical spill or construction accident.

Water quality monitoring during rain events and monitoring associated with chemical spills is outlined in the CWMP. The CWMP treats the whole construction site as high risk of erosion events; however, some receiving environments are more sensitive to sedimentation, in particular the kahikatea swamp forest in the Mimi catchment downstream of the tunnel portal. Additional event-based monitoring will therefore occur in this area if triggered by an event. The CWMP provides trigger values for when additional ecological monitoring will be required.

[9] A sediment plate is a hard plate placed flush with the sediment surface; accumulation is measured on top of the plate. Fine sediment is measured as millimetres deposited on the plate, recorded as the average of three readings per plate.

Event-based monitoring will take place (as described below) when there is:

- risk of sediment deposition in the Kahikatea Swamp Forest (Mimi River); and / or
- major spill or leaching of contaminants.

Risk of sediment deposition in the Kahikatea Swamp Forest (Mimi River)

Trigger: Turbidity over <value to be determined based on baseline monitoring>, or failure of sediment retention pond.

Monitoring action 1: Visual inspection of extent of sediment deposition in Raupo reedland and around stream. Measure sediment deposition on sediment deposition plates. If there is sediment deposition greater than 5mm at any point along the line shown in Figure 8.1 and it is likely to be associated with the Project, then undertake further ecological monitoring in the kahikatea swamp forest.

Monitoring action 2: The additional monitoring in the kahikatea swamp forest will involve suitably qualified Project ecologists assessing the extent of any effect on the kahikatea swamp forest including: visual inspection of any sediment deposition, vegetation condition survey, and fish survey. The suitably qualified ecologists shall prepare a report that includes an assessment of the overall magnitude of any effects associated with the Project on the kahikatea swamp forest (ie. 'negligible', 'very low', 'low', 'moderate', 'high', 'very high') and recommendations for further monitoring or remedial actions.

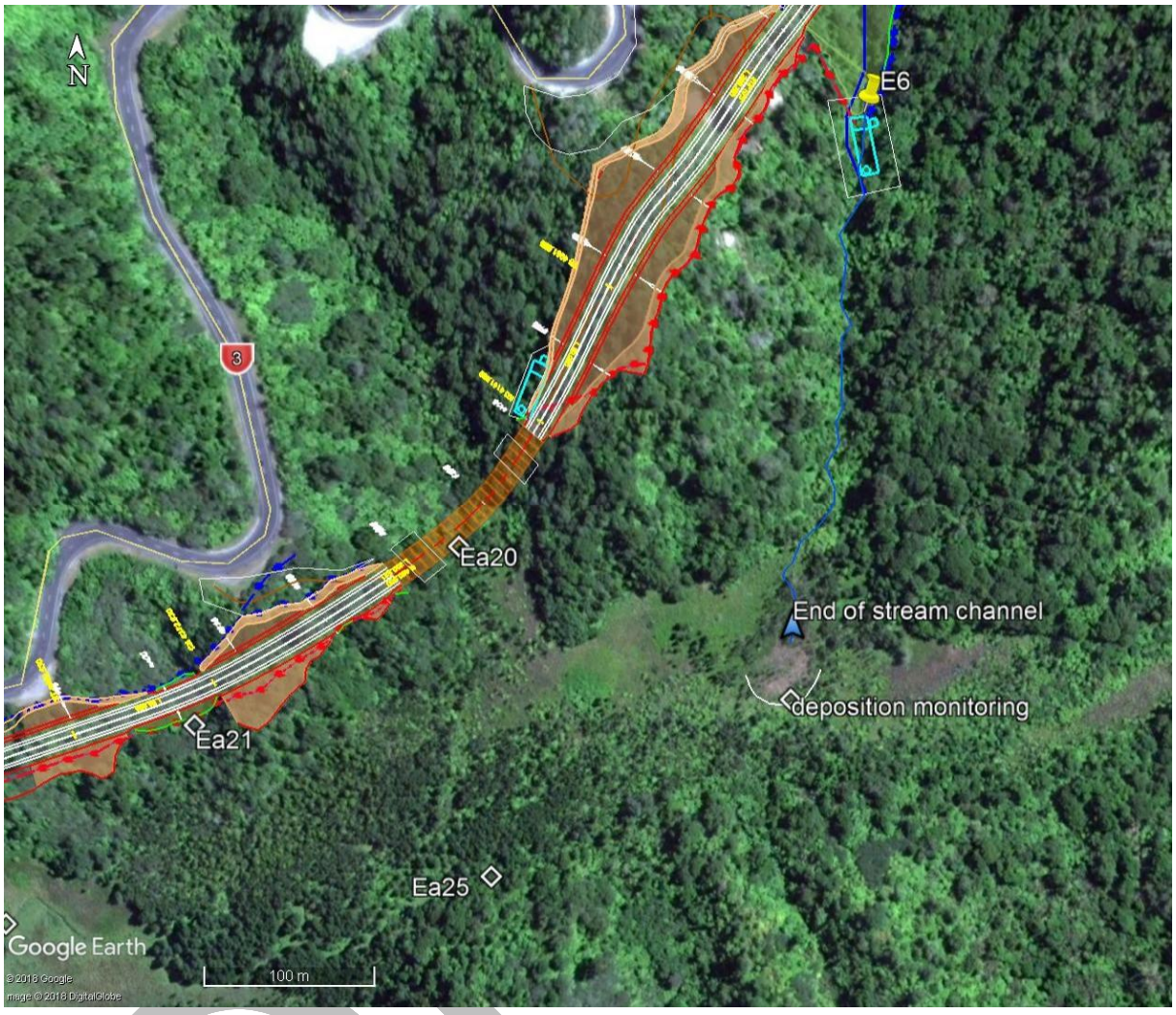

Figure 8.1 - Location of stream channel entering raupo wetland and location of event-based sediment deposition monitoring near the northern extent of the kahikatea swamp forest

8.4.4 Fish passage through culverts

8.4.4.1 Post construction inspection

Culverts have been designed to provide for fish passage. All permanent culverts, and associated inlet and outlet structures, shall be inspected following their construction to ensure that they meet the design requirements to provide for fish passage. The inspection shall be done by a suitably qualified ecologist or engineer. The inspection shall assess installation and spacing of baffles or spat rope, sediment retention and water depth within the culvert, water depth over aprons and outlet structures, potential barriers in the form of shallow water, high water velocity or perches. A report shall be prepared identifying whether the culverts meet their design specification, any potential fish passage barriers and recommendations on how to rectify any potential fish passage barriers.

8.4.4.2 Fish passage monitoring

Actual fish passage through culverts shall be monitored at the two culverts with the largest upstream catchments. These are:

- culvert 9 (site Ea10a) with a 67 ha catchment upstream; and
- culvert 15 (site Ea16) with a 36 ha catchment upstream.

Fish passage monitoring will occur after peak upstream migration (August – December) upstream of culverts 9 and 15 annually for 2 years after construction is completed. The monitoring will be used to determine if recruitment is occurring by assessing if a suitable age structure (juvenile and adult fish) is present within the fish population above culvert 9 and culvert 15.

Baseline fish monitoring has occurred at site Ea10a but has not occurred at site Ea16 due to safety constraints involving climbing a waterfall downstream of the site. Prior to the culverts being installed a fish survey will occur at site Ea16 to provide a baseline information on fish species and age structure. This may occur in association with fish recovery prior to operations.

If after 2 years the recruitment of young fish is not occurring then refinements to the culverts fish passage devices will be made, where practicable, to remedy any barriers to upstream fish migration.

8.5 Reporting

Annual freshwater ecology reporting will be completed at the end of each earthworks season during construction. Annual reporting will be provided each June in memorandum format to Taranaki Regional Council and include:

- fish rescued as described in the FRRP;
- location and description of culverts installed; and
- location and description of stream diversions stated.

Event-based reporting will be provided to TRC within 15 working days of ecological response to an event, and will include the following information:

- the causes of the discharge, the response to remedy the cause and measures proposed to avoid a recurrence of this cause; and
- an assessment undertaken by a suitably qualified and experienced aquatic ecologist which details any effects of the exceedance.

The report required above will detail what remedial and mitigation measures are proposed and the timeframes for implementing those measures.

8.6 Training

A suitably qualified practitioner in freshwater ecology (SQP-E) shall oversee the implementation of management measures and monitoring outlined in this management plan.

The SQP-E will also train construction teams in appropriate implementation of the Fish Rescue and Recovery Protocols.

8.7 References

Joy M, David B, Lake M 2013. *New Zealand Freshwater Fish Sampling Protocols: Part one – wadeable rivers and streams*. Massy University, Palmerston North.

New Zealand Transport Agency 2013. *Fish passage guidance for state highways*. Version 1.0. ISBN 978-0-478-40716-7

9 Pest Management Plan

9.1 Introduction

The ecology technical reports prepared for the Project (Volume 3 of the AEE) have identified introduced animal pests as having significant impact on the indigenous plants and animals in the forest and wetland areas within and adjacent to the Project footprint. Intensive, enduring pest management is therefore the priority focus for offsetting as it will result in the most immediate and largest net ecological gain.

9.2 Pest management programme overview – expected results and outcomes

The intention is to manage target pest species over a 1000 ha largely forested area (the Pest Management Area – PMA) adjacent to the Project Area and intensively manage target pest species over a central 250 ha Core Offset Pest Management Area (COPMA) within the PMA. The primary objective is to reduce all target animal pests and manage them permanently at or below target densities within the COPMA, and close to low density targets for most species over the wider PMA.

The Pest Management Programme will target feral goats, feral pigs, possums, mustelids (especially stoats), and rats. Feral cats and hedgehogs are also likely to be effectively controlled as a result of the Pest Management Programme but they are not target pests for this programme because their impact is likely to be less significant. Farm livestock will also be excluded by the construction of permanent fencing where necessary.

Intensive, effective and enduring pest management, with a focus on controlling all target pest species, can be expected to generate biodiversity benefits across a wide range of plants and animals. Bats (long-tailed and short-tailed, assuming the latter exist in this area), many forest birds species, and most wetland bird species will increase in number as predatory pressures are greatly reduced and habitat recovery increases local carrying capacities. Kiwis that remain within the Pest Management Area will benefit from the reduced stoat numbers although the propensity of juveniles to disperse large distances may mean that the benefits to the kiwi population are not as great as for other birds. The extension of the PMA to 1085ha has been proposed in part to improve the likelihood of increased kiwi recruitment.

Reptiles and invertebrates will benefit from the increased diversity and abundance of habitat but may not benefit from the management of possums, rats, stoats and ungulates to the same extent as birds and bats.

Rapid recovery of palatable sub-canopy, canopy and emergent forest giants, such as kamahi, northern rata and totara, is expected to occur within 10 years, as a result of possums being controlled to very low levels. As grazing and browsing pressure is reduced on the forest floor as a result of ungulate removal, the abundance of palatable shrub and fern species and tree seedlings is also expected to rapidly improve.

With habitat improvements in a low-pest environment, the carrying capacity within the PMA for many indigenous animal species will increase substantially. This will result in spill over benefits for surrounding areas as juvenile birds and bats disperse.

The pest management proposed is in perpetuity (or until such time as pest management in the form we know of it today is no longer necessary to sustain the levels of biodiversity created). This will result in permanent ecological benefits within the PMA. When combined with the pest management occurring at Parininihi, some wider benefits will also accrue such as increasing the area of suitable habitat for kokako.

The western Ngāti Tama block (Parininihi) has been intensively managed for pests for 15 years now and the evidence of the value of an intensive pest management approach is visually very apparent, with the canopies of “old man” rata and totara in good condition and the diversity and volume of forest regeneration far greater than in the unmanaged Ngāti Tama Eastern Forest block.

9.3 Pest Management Area

The Biodiversity Offset Calculation supplementary report (February 2018) has determined that an area of 230 ha, is required to be managed for pests to achieve a high level of ecological integrity. The preferred Core Offset Pest Management Area (COPMA) to meet the offset requirements for the Project is located in the upper Mimi catchment to the east of SH3. It includes a small area of Ngāti Tama land in the northwest corner and a larger block of DOC managed Mt Messenger Conservation Area to the south of the Ngāti Tama block (Figure 9.1).The proposed COPMA includes sufficient areas of all of the vegetation communities required for offset, including the required 22 ha of swamp forest habitat in the Mimi Catchment, 190 ha of tawa, kamahi, rewarewa forest and 18 ha of hard beech dominant forest. To create a manageable shape we have increased the OPNA to 250 ha.

Due to the contiguous forest cover and the speed of pest reinvasion it would not be possible to maintain a 250ha area at permanently low pest numbers, without also managing a sizeable buffer around the COPMA. Mobile pests, especially stoats and goats, have large home ranges and will travel substantial distances to find prey or to feed. Possums and rats will also move quickly to occupy vacant territories. Consequently, a buffer Pest Management Area around the COPMA is proposed (refer to Figure 9.1). The buffer will, where possible, extend up to 1km deep especially where favourable habitat (ie. forest) adjoins the core area.

The buffer required to encircle the COPMA would be approximately 350ha in size, creating a total PMA of about 600ha. However, we have increased the total PMA (including the 250ha COPMA) to 1085ha to achieve the following additional benefits:

1. Provide effective pest management buffers in the forested land to the south, southeast, east and north of the COPMA;
2. Link the PMA directly to the actively pest managed Parininihi to the west by including the NZTA administered road corridor in the PMA;
3. Provide pest management in perpetuity over the 6ha of swamp forest restoration planting, the 5.2ha of riparian planting, and 8.38ha of dryland mitigation planting that will occur in the Mangapepeke Valley; and

4. Create a substantially more effective barrier to pest reinvasion than would otherwise be the case by applying pest management over most of the forest the lies to the north of the COPMA. This area is also expected to provide significant benefits to Parininihi, including reduced invasion of goats, possums and predators on the eastern side.

The extra 855 ha of PMA, in excess of the 230 ha required to meet offset requirements, and the ecological benefits this larger area provides, ensures that the ecological effects of the Project are appropriately addressed.

The availability of properties for pest management, as shown in Figure 9.1, has yet to be confirmed. Should negotiations result in some properties not being available for pest management it may be necessary to reconfigure the size and shape of the buffer zone.

9.4 Proposed pest management strategy

The pest management will include:

- A combined aerial and ground-based approach over the full Pest Management Area to reduce and maintain rats, possums, and mustelids to low levels in perpetuity; and
- A hunting programme to reduce and maintain feral goats and pigs to low densities in perpetuity.

9.4.1 Pest management methodology

9.4.1.1 Adaptive management approach

The long term strategy for possum, rat and mustelid control will be based on achieving very low pest abundances from three-yearly aerial 1080, which will be maintained by the ground based trapping network across the entire Pest Management Area. An adaptive management approach will be adopted for each animal pest in the choice of pest management methods used and trap and/or bait station intensity. If target pest density performance standards are not achieved with one method, the method or approach will be varied, based on experience and research, until target levels are consistently achieved. Methods that have been successful at other New Zealand sites may not be as successful at Mt Messenger due to factors such as the nature of the terrain and weather conditions. An adaptive management approach will result in the determination of the best combination of methods for the PMA and will also allow for continuous improvement as new pest management technology becomes available.

9.4.1.2 Aerial toxin programme

Pest management will begin with an aerial 1080 toxic bait application to quickly reduce possums, rats and predators to low levels over the full 1085 ha PMA. This operation will involve a minimum of one pre-feed with non-toxic bait followed by toxic bait application ideally 10 days after. Aerial 1080 operations will be timed to coincide with the start of the bird breeding season (July to September) to ensure pest densities are as low as possible early in the season. Aerial application will ensure even coverage of toxin across the entire treatment area including areas where extremely steep terrain prevents the safe establishment of control devices. This is expected to result in a uniform reduction of pests

which is critical for the ongoing success of ground-based control methods, to maintain possums, rats and predators to below target densities between aerial applications.

Aerial 1080 operations will be repeated on a three-yearly time frame and ideally will be synchronised with the current cycle applied to the adjoining Parininihi pest management area.

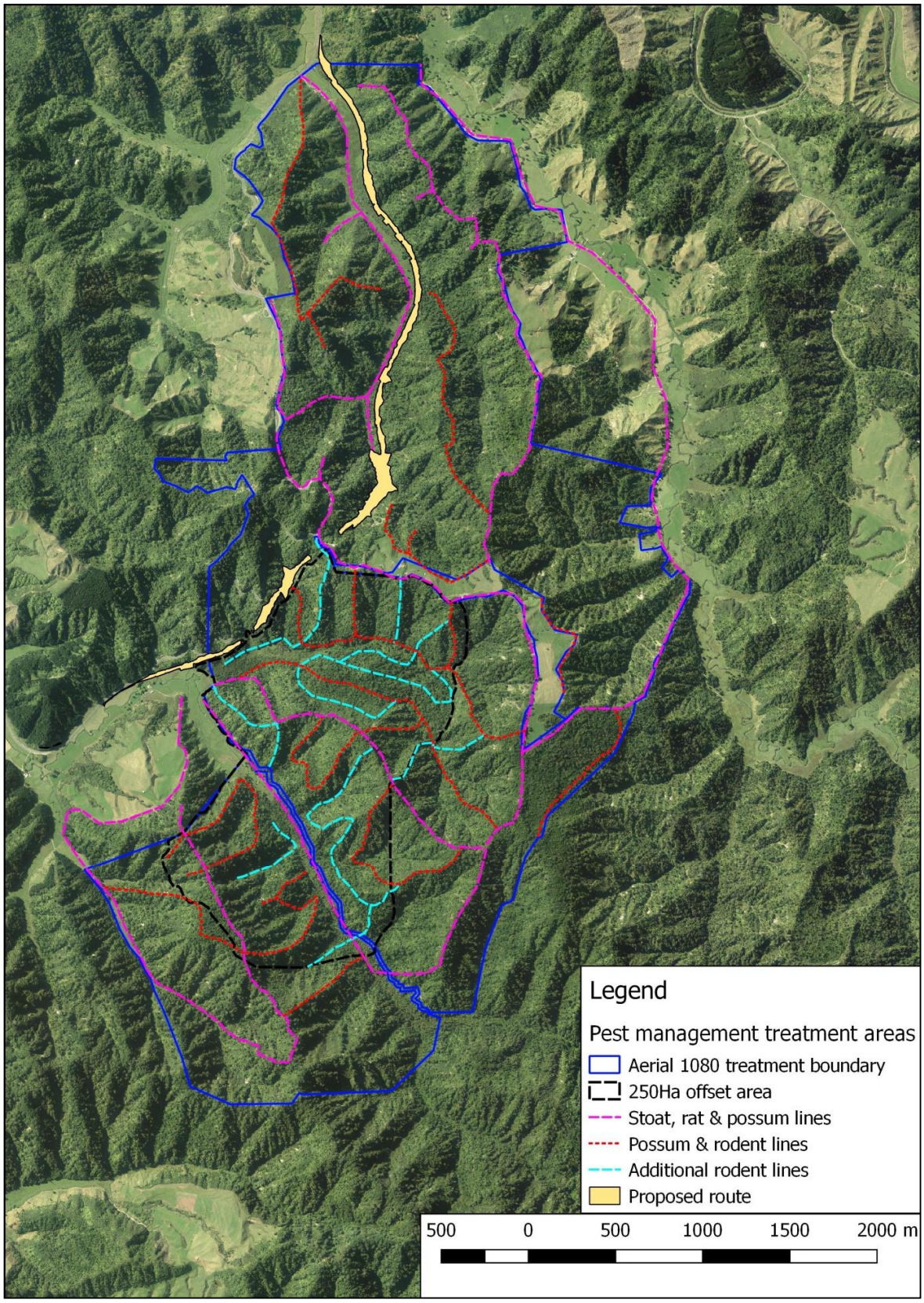

Figure 9.1 - Proposed pest management treatment areas. Pest Management area (blue) which aerial 1080 and ungulate control will occur in, the 250Ha offset area and trap lines for stoat, possum and rat control.

9.4.1.3 Ground-based trapping grid for rates, possums and mustelids

An intensive ground-based trapping grid network will be used to hold pest densities down to target levels between the three yearly aerial 1080 drops. The trap grid will consist of cut and marked trap-lines which have been specifically located to ensure adequate coverage of pest control devices.

The initial trapping strategy to be adopted will be permanently mounted Goodnature A24 (for rats and stoats) and Trapinator kill traps for possums, ferrets and stoats installed at regular intervals along the trapping grid. The Goodnature A24 traps are self-resetting (up to 24 resets per CO_2 canister) multi-species kill *traps that have proven very effective as rat and stoat traps.*

(a) *The southern PMA area (Mimi catchment including the COPMA; approx. 480ha)*

The southern Mimi catchment portion of the PMA which includes the COPMA will be managed for rats, possums and mustelids as follows:

- Rats and stoats – Goodnature A24 traps at close to 100 metre spacings (approximately one trap per hectare).
- Possums – Trapinator kill traps at a trap density of 1 trap per 1.34 ha.

For stoats the trap density proposed in this block is close to double that recommended for effective stoat control (DOC 2015 a and b). The possum trap density is close to double that recommended for the Trapinator kill trap and the rat trap density has been shown to be effective at holding rats below 5% RTC in a recent DOC study (DOC 2015). Trapinator kill traps are also an approved ferret and cat control device. They will be baited with meat to attract these pests if cats or ferrets are detected in the PMA.

(b) The northern PMA area (Mangapepeke catchment)

The northern Mangapepeke catchment portion of the PMA will be managed for rats, possums and stoats as follows:

- Stoats – trap lines with Goodnature A24 traps set at a trap density 1 per 3.5ha
- Possums – Trapinator kill traps at a density of 1 trap per 2.76ha.
- Rats – Primary rat control will occur after aerial 1080 control operations with some localised control achieved by the A24 stoat traps. It is acknowledged that rat densities are likely to increase above 5% tracking between aerial 1080 control operations.

Note the steepness of the terrain within parts of the OPMA may result in traps being located further apart than is ideal.

This trapping strategy, when accompanied by 3 yearly aerial 1080 drops, is expected to hold rat, possum and stoat densities below 5% RTC / RTI within the OPMA and the Mimi catchment PMA. The trapping network in the rest of the PMA can be expected to control stoats and possums to 5% RTC but rat densities are likely to increase above 5% between 1080 drops.

The self-resetting traps will be visited 6 times per year to refresh the lure and between 6-monthy and yearly (depending on pest densities) to replace the CO_2 canisters that drive the trap mechanism.

9.4.1.4 Backup alternative trapping

The Goodnature A24 and Trapinator kill traps have proven to be effective tools for the control of rats, stoats and possums, however, if additional pest management tools are needed especially to achieve stoat control targets, DOC200 and DOC150 predator kill traps will be used in addition to or in place of the Goodnature A24 traps. The DOC trap series have proven to be humane and effective killers of stoats when set in prescribed trap-set tunnels. Pest density performance monitoring of each target species will determine whether alternative trap types are needed.

Traps will be placed at recommended spacings along the rat, possum and stoat grid lines. Traps will be set and checked at least 12 times each year and freshly baited with fresh or salted rabbit meat, Erayz® dried rabbit lures or fresh hen eggs each time.

Rats will get caught in stoat traps so to optimise effort against stoats it is recommended that trap sets for stoats follow the initial rat knock down effort so that there is less rat interference with the traps.

9.4.1.5 Bait stations

n the event that trapping is not able to keep rat, possum or stoat densities to target levels ground-based bait stations (eg Philproof bat stations) will be deployed to complement the trapping effort.

If bait stations are used repeatedly, annual rotation of toxin types used will be necessary to reduce the likelihood of aversion to a particular toxin/bait type developing. Animals, especially rats, that survive poisoning from one bait type can develop a strong aversion to that bait type, hence the need to rotate bait types from season to season.

Between periods of 1080 use (by air or in bait stations) first generation anti-coagulants particularly diphacinone and pindone will be used for rat control. Because these toxins are cumulative and the animals do not feel ill-effects for some time after consumption they do not associate the bait with the effects and so are less likely to build up an aversion. For this reason pre-feeding is not required. Rats need to feed on this bait type for between 3 and 7 days before a fatal dose is consumed so bait stations need to be filled on a daily basis especially if rat numbers are high. First generation anticoagulants begin to lose their potency after about 3 days, another reason why a daily bait replenishment programme is required.

First generation anticoagulants are considerably less effective against possums. Consequently, an alternative cyanide based toxin will be used for possum control when 1080 is not being used. Feratox Strikers (a biodegradeable bait station containing encapsulated potassium cyanide) can be used in conjunction with the permanent bait station regime to control possums and minimise the amount of anti-coagulant bait that possums eat before rats can get to it. Feratox Strikers are highly effective on possums, with possums needing to consume only one pill for a fatal dose.

PAPP (para-aminopropriophenone) is a toxin that has shown potential in the control of stoats and feral cats and may offer an alternative to trapping if additional tools are needed to lower stoat numbers to the performance targets set. A Controlled Substances Licence is required to use PAPP, and will be obtained if necessary.

9.4.1.6 Hunting and the use of Judas animals

Goats and pigs will need to be controlled by hunting.

Goats

Goat densities across the Pest Management Area are considered to be high currently. Initially, an experienced goat culler should be able to reduce goat numbers to moderately low levels with concerted effort. Further reduction of goats to target levels below 1 goat kill per hunter day is likely to be more challenging and require the use of additional tools to locate and kill those remaining. These will include (as required):

- Judas goats - Judas goats are animals that have been caught and fitted with a radio collar before being released back into the target area. These goats usually link up with other goats and can be tracked to find their location.
- Dogs - Dogs can be used in more open areas and pasture margins to flush out goats but this method tends to be less effective in thick bush on steep terrain.
- Aerial thermal imaging - Thermal imaging and drone technologies have advanced considerably over the past decade to the point where it is now possible to detect warm-blooded animals the size of a possum and larger through a forest canopy. Drone mounted thermal imaging will be used periodically to detect residual feral goats, pigs and deer (if any) across the Pest Management Area.
- Fencing - Reinvasion by goats from unmanaged neighbouring scrubland may be an occasional problem around the perimeter of the Pest Management Area, especially along the north-eastern and southern boundaries. The addition of goat proof appendages to boundary fences will be undertaken if the risk of goat reinvasion from unmanaged neighbouring properties is considerable. Determination of where goat-proof fencing is required will be confirmed when the land areas that will be used for all of the offset and mitigation works are confirmed. To be effective against goats:
    - the fence needs to be an 8 or 9 wire post and batten fence with posts at 4 or 5 metre spacings and battens at 1 metre spacings;
    - box stays rather than angle stays are needed to prevent goats climbing the fence and an electric hot wire may be needed near the top of the fence;
    - tie-downs need to be installed at every depression to prevent goats pushing under the fence; and
    - well-tensioned wire netting can also be used instead of 8 or 9 single wire strands but this must be well pinned to the ground.

Feral pigs

Feral pigs will be managed by hunting using experienced pig hunters and with the assistance of good pig dogs. Because pigs often occupy thick bush pig dogs are needed to

find and flush out pigs. The appointed contract pig culler will need to be experienced at operating in steep, mudstone country such as that found in the Mt Messenger area. The Pest Management Area has many hidden, slippery bluffs that are dangerous for hunters and pig dogs.

As for goats, there are additional tools that can be used to find and cull pigs that remain hard to find. The decision as to which of these tools are used and where and when they are used will occur after the effectiveness of initial hunting efforts are evaluated, and will be made by the Alliance manager in charge of pest management following discussions with the pig control contractor and the Department of Conservation. Additional expertise may be consulted where necessary.

The additional tools that could be implemented for pig management include:

- Trapping - Specialised pig traps can be used particularly if pigs come out on open pasture at predictable locations. Captured pigs need to be head shot by an experienced and licensed shooter. This method will be used if there are locations where it can be used cost-effectively.
- Aerial thermal imaging - As for goats, thermal imaging and drone technology is likely to be very useful in detecting remaining pigs in steep and bush covered terrain and will be adopted on the Project Pest Management Area.
- Toxins - There are no toxins currently registered for pig control in New Zealand and therefore, pigs cannot be legally poisoned. Secondary poisoning of pigs can occur following possum poisoning using 1080 but the general consensus is that secondary poisoning has relatively little effect on pig populations.
- Judas pigs - The use of Judas pigs is generally only an effective technique when densities are very low and dogs have been unable to find the last animals present. It is not effective against older boars who tend to be less sociable than other pigs.
- Fencing - Effective pig barrier fences can be built along boundaries by appending materials to existing boundary fences. This may be necessary where unmanaged pig populations occur on neighbouring land. Chainlink mesh is the most effective material to use on a pig barrier fence. Steel standards (Waratahs) need to be rammed into the ground at 1 metre spacings; the chainlink needs to be well pinned to the ground and a tensioned barbed wire is required along the base of the fence at ground level. The fence also needs to be held down into all depressions by tie-downs.

9.4.2 Timing of pest management

Aerial and/or ground based toxin pest management programmes are most effective in very late winter or early spring when possums and rats are most hungry and natural food supplies are at their lowest. Pests are more inclined to eat baits when hungry and in quantities that will lead to their death. Autumn and early winter should be avoided because forest foods are abundant at this time.

In the Mt Messenger area the optimum time for each toxin-based control effort is likely to be from late August and through September.

Trapping effort can occur all year round and this should be the case initially until pest numbers are reduced to target levels. When pest densities are low focused pest management in spring immediately preceding bird and bat breeding season will help to improve breeding success and recruitment. Continued pest management effort through the summer, especially targeting rats, will reduce predatory pressure on lizards and insects especially and aid increased breeding success.

Goat and pig control effort can occur throughout the year but control will be easier to undertake in the Pest Management Area when ground conditions are drier. Goat control will commence in areas adjacent to the offset and mitigation areas well before any planting is planned. This is because goats have a preference for several of the plant species likely to be included in the planting mixes and will cause considerable damage to new plantings if they are present when planting begins.

9.5 Performance standards and monitoring

9.5.1 Existing pest densities

Interim pest monitoring data from rat and possum surveys undertaken within the Pest Management Area from November 2017 to January 2018 suggest moderately high densities of both. Possum chew card activity (CCI) has ranged from 25% to 30% and rat tracking tunnel activity (RTI) has ranged between 53% and 60% (Baseline Monitoring for Vertebrate Pests – Interim Report (February 2018); Richard Nichol pers comm). Further rat, possum and mustelid surveys are being undertaken through until the end of March 2018 and this information will be available to inform the authors of the Pest Management Operational Plan (see section below).

Local goat hunting specialists have suggested that current goat densities could be equivalent to around 20 kills/man day[10].

9.5.2 Pest management targets

The performance targets for effective pest management within the Core Offset Pest Management Area are as listed below. The targets set are performance indices of relative pest density for each species adopted by DOC and other agencies when undertaking pest control activities. Achievement and maintenance of pest densities below these target indices is expected to result in substantial ecological recovery across the Pest Management Area and achieve the biodiversity outcomes outlined in the Ecological Mitigation and Offset Reports. The targets will also serve as performance targets for the pest management contractors employed to deliver the pest management programme.

The pest management performance targets with in the COPMA are:

- Possums –5% or lower RTC (Residual Trap Catch Index) or 5% or lower CCI (Chew Card Index).
- Rats – 5% or lower RTI (Residual Trapping Tunnel Index).

[10] Paul Prip, Taranaki Regional Council pers comm via Richard Nichol

- Feral goats – less than 1 kill/man day.
- Stoats – no detections.
- Feral pigs – less than 1 kill / man day then no fresh pig sign or pig detections.
- Farm livestock – zero presence

Pest management performance targets in the buffer pest management areas (that is, outside the COPMA) will be the same as in the COPMA for all target pests except rats. In the buffer pest management areas, rats will be expected to be reduced to target RTC's / RTI's immediately following a 1080 drop.

9.5.3 Performance and compliance monitoring

9.5.3.1 Pest density performance monitoring

Pest density performance monitoring will be undertaken in the Core Offset Pest Management Area on an annual basis for 5 years following the commencement of the pest management programme. Thereafter, monitoring will occur every 2 years until year 10, and then at 3 year intervals ongoing. However, should the performance target indices for a target species be exceeded in any one year monitoring will be undertaken in the subsequent year for that species and will continue annually until the target indices are met. Where targets are exceeded, annual monitoring for that species will continue for one year following the achievement of performance targets after which monitoring will revert back to every 2 years if within the first 10 years post construction, or every 3 years if more than 10 years has passed. Pest management effort within the COPMA will increase until the target thresholds are met.

Performance monitoring will occur annually in the buffer areas of the PMA until target densities are achieved after which performance monitoring will only occur every 3 years immediately following a 1080 drop. However, if target densities are not met for any pest species following a 1080 drop ground based pest management effort will be increased until target densities for that species are achieved. Performance monitoring will also continue on an annual basis until the target thresholds are met.

Compliance monitoring of contractors will be undertaken by insisting that all contractors undertaking pest control activities maintain GPG logs of daily activity. This information must be provided to the project manager and will be a requirement of payment. This also will ensure that all lines are being visited.

Feral pigs will be excluded from pest density performance monitoring once pigs have been reduced to low densities. This is because there are no reliable methods for determining relative pig density when numbers are low. Instead pig hunters will be called in when fresh pig sign is detected by those undertaking independent monitoring of the other pest species.

All monitoring will be undertaken only by personnel certified by the National Pest Control Agencies (NPCA) as trained monitoring personnel, and monitoring will be undertaken in accordance with the NPCA Standard National Protocol.

9.5.3.2 Outcome monitoring within the PMA

Outcome monitoring will be undertaken for vegetation and selected forest bird species. With the exception of kiwi, outcome monitoring will primarily occur within the 250ha offset area in the Mimi catchment. The primary objectives of outcome monitoring are to measure the (expected) positive trends in ecological integrity indices resulting from pest management.

Outcome monitoring for bird species

The purpose of outcome monitoring for bird species is to provide sufficient evidence that the stated benefits of the pest control programme on those species affected by the project will be achieved.

Bird monitoring will focus on tui, bellbird, kereru and kiwi. These species are commonly used as biodiversity outcome indicators for pest management programmes on the basis that:

- They are of high ecological importance: kiwi are nationally 'Threatened' and while not 'Threatened' bellbird, tui and kereru provide critical pollination and seed dispersal services. In doing so these species are essential to the ecological health of forest ecosystems and serve as surrogates for the overall integrity of forest ecosystems
- There is evidence to suggest that these species respond positively to pest control through reduced predation pressure and/or increased food or habitat availability
- These species can be readily monitored through standardised and commonly used techniques to detect statistically measurable trends in relative abundance
- These species that can be monitored in a cost-effective and efficient manner, i.e. forest bird monitoring that can be covered in the same technique (five-minute bird counts).

The performance target for birds is set at a 20% increase in relative abundance within 12 years of road construction for all four indicator species within the COPMA. Coupled with revegetation efforts, we consider that a 20% increase in relative abundance for these species within the 250 ha COPMA (and most likely a similar increase the entire 1085 ha PMA) is necessary to adequately address the loss of approximately 31 ha of forest bird habitat attributed to the Project.

Kiwi monitoring

A kiwi survey will be conducted every three years for 12 years following completion of road construction. Nocturnal kiwi surveys will be undertaken following the same method used in the baseline survey (see Baber and McLennan 2017 for detailed methods) and the locations of calling kiwi at different stations around the completed road will be mapped. These data will then be compared against the baseline survey results documented in Baber and McLennan (2017).

Forest bird monitoring

Outcome monitoring of selected forest birds will occur within the 250ha COPMA and will be conducted for up to 12 years, at 3-yearly intervals, following the onset of integrated pest control. The main focus will be on measuring changes in abundance of functionally important pollinator and seed dispersal species including tui, bellbird and kereru. Daytime bird counts will occur at the 355 bird count stations using the standard 5-minute bird count methodology (Dawson and Bull, 1975), which will also be used for the baseline pre-construction surveys. These data will then be compared against baseline survey results documented in Baber and McLennan (2017). It is expected that forest bird monitoring will also provide the opportunity to pick up the presence and increase of kokako when they disperse from the adjacent Parininihi Reserve

Vegetation monitoring

Outcome monitoring for vegetation will focus on measuring the recovery of palatable species within the ungulate browse tier and improvements in canopy condition from a reduction in possum abundance. Vegetation monitoring will be established prior to any control of ungulates and will measure the survival and growth of tagged indicator species (>35cm) within the understorey tier in permanent Recce plots. Indicator species will likely include; tawa, kamahi, mahoe, hangehange, large-leafed coprosma shrubs, pate and pikopiko — species which represent most tiers of the forest structure. The target performance outcome will be 75% of tagged palatable individual plants in the browse tier of the Recce plots showing no sign of animal pest browsing 5 years after the completion of road construction.

Canopy health monitoring will likely use a combination of methods including FBI monitoring of highly palatable species and significant trees such as swamp maire, northern rata and thin-barked totara. General measurements of canopy density (by measuring chlorophyll) will be trialled using drone imagery. The outcome performance target is to achieve a statistically significant improvement in canopy density by year 5. Additional monitoring plots will be placed within the valley floor areas, as the recovery of these communities from pest management has not been commonly monitored. In these communities additional indicator species will likely be measured, such as pukatea which seedling regeneration is currently being suppressed by cattle browsing, though this species is generally unpalatable to goats.

9.5.3.3 Adaptive pest management response to monitoring targets

In the event that pest density targets are not achieved and/or more than one of the biodiversity outcome monitoring targets are not met, for reasons associated with the impact of pests or the effects of the road, the pest management programme will be reappraised and the intensity or methods used changed to be more effective at addressing the pests or aspects of biodiversity that have not reached the outcome targets. The pest management methods and intensity will continue to be adapted until all pest density targets and biodiversity indicator targets have been met.

It is conceivable that variables not associated with the relative effectiveness of the pest management programme or the effects of the road (eg. plant or animal disease, or extreme

weather events) may be contributing to poorer than anticipated recovery of one or more of the monitored biodiversity indicators. Adaptive improvement of the pest management programme will only occur where less than expected monitoring outcomes are likely to be the result of continued animal pest impacts or the direct effects of the road.

9.6 Appointment of pest management contractors and development of a Pes Management Operational Plan

Experienced, appropriately qualified pest control contractors will be appointed at the commencement of the Project to undertake the Pest Management Programme. One or several separate contractors may be appointed to undertake individual components or all components of the Pest Management Programme. The components will include:

- Ground-based management of rats, possums and mustelids using traps (and possibly toxins);
- Aerial application(s) of 1080;
- Ground-based hunting of feral goats and feral pigs;
- Possible aerial hunting of goats and pigs; and
- Fencing to exclude farm livestock and possibly goats and pigs, where necessary.

The Principal or Lead Pest Management Contractor will produce a **Pest Management Operational Plan** in accordance with DOC requirements (note that all pest control operations on DOC land require an operational plan). This plan will detail all aspects of the intended pest management programme including:

- the location of the planned pest management;
- control methods to be used;
- timing of the programme elements;
- legislation and regulations that need to be complied with, consents, approvals and permits that need to be obtained;
- evidence of adherence to industry best practice;
- resources to be used;
- health and safety provisions;
- details of a public consultation and communications plan; and
- performance and outcome monitoring and independent auditing and reporting.

Each pest management contractor will be required to achieve the pest density performance standards and adhere to all consent and permit conditions, access agreements, and rules and regulations.

As the Pest Management Programme will continue in perpetuity (or until such a time that pest management is no longer required to sustain biodiversity values), it is envisaged that new / replacement contractors will be employed from time to time. A review of the Operational Plan will occur each time the principal contractor is replaced or every 5 years, whichever occurs sooner.

9.7 Legal mechanisms and governance

Pest management activities are governed by several Acts and legal requirements including Hazardous Substances and New Organisms Act 1996 (HSNOA), the Agricultural Compounds and Veterinary Medicines Act 1997, the RMA, the Trespass Act 1980, and the Wild Animal Control Act 1977. Adherence to all relevant clauses in these Acts will be required, and addressed in the Pest Management Operational Plan.

All approvals, particularly those relating to toxin use, will be obtained prior to the commencement of control work. The following approvals are likely to be needed to implement the Pest Management Plan at the Project site:

- Ministry of Health / Public Health Unit approval/consent to use a vertebrate toxin (with associated requirements for public notification and communication);
- DOC approval for application of a vertebrate toxic agent (VTA) on DOC estate (under Section 95A of the HSNOA), assuming some of the Pest Management Area will be on DOC estate;
- Access permission from all landowners to undertake pest management activities on their land; and
- Consents from the Taranaki Regional Council and/or New Plymouth District Council.

9.8 Management of farm livestock

While the focus of the Pest Management Plan is to reduce the densities of feral mammalian pests, the removal and exclusion of farm livestock (cattle and horses) is also critical if the proposed ecological recovery is to be achieved.

Cattle have grazed the unfenced upper Mangapepeke Valley for decades and have contributed to the current denuded state of the forest understorey on and adjacent to the valley floor in a major way. Cattle also have access to the parts of the Mimi catchment and will need to be adequately excluded through fencing. All stock will need to be removed from the Pest Management Area before toxin application commences. The current plan assumes no livestock will be farmed in the Mangapepeke Valley and will also be excluded from the Mimi catchment.

9.9 Programme

The timing of the Pest Management Programme cannot be confirmed until the required land access is obtained and a construction start date is determined. However, the broad sequence of pest management related events will be as follows (assuming a spring or early summer 2018 start to works):

i) First summer (2018-19)
   - Establishment of baseline vegetation monitoring prior to pest control commences.
   - Appointment of goat and pig cullers and commencement of goat and pig control in and adjacent to the swamp, mitigation and riparian (where

possible) planting areas, with the initial effort to serve as the baseline population density estimate.

- Appointment of the Principal Pest Management Contractor and development and submission of the Pest Management Operational Plan to DOC.
- Possible commencement of planning for the first 1080 drop if that is to occur in August/September at the end of the first construction year.
- Cutting and marking of the ground-based trap lines.
- Pre-control tracking tunnel and chew card monitoring of rats, possums and mustelids to serve as the baseline for pest management performance.

ii) Late winter – early spring, start of year 2 (2019):

- Possible aerial 1080 drop (if one is scheduled) or commencement of ground-based trapping effort if no aerial drop is planned.
- Removal of cattle prior to any aerial 1080 drop.
- Potential reintroduction of cattle into the Mangapepeke Valley after the mandatory stand down period post-1080 drop to control pasture and weed growth prior to commencement of swamp forest, riparian and mitigation planting in the upper valley.

iii) Summer year 2 (2019-20):

- Continuation of ground-based trapping effort for rats, possums and mustelids and hunting effort for pigs and goats.

iv) September start of year 3 (2020)

- First pest management independent performance monitoring survey.

9.10 References

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10 Peripatus Management Plan

10.1 Introduction

10.1.1 Scope and objectives

The purpose of this Peripatus Management Plan is to specify procedures to avoid, remedy or mitigate adverse effects associated with the construction and operation of the Project on peripatus species.

Key objectives of the Peripatus Management Plan are to:

- outline potential impacts on peripatus that may eventuate during- and post-construction; and
- outline management measures to avoid, minimise and mitigate potential adverse effects of the Project on peripatus.

10.1.2 Survey overview and results

As documented in the Ecology supplementary report – Terrestrial invertebrates (Watts, 2018), the following peripatus species were found during baseline invertebrate surveys along the Project footprint conducted in November 2017:

- Two individual Peripatoides suteri (Figure 10.1).
- One individual Peripatoides novaezealandiae (Figure 10.2).

Figure 10.1 - P. suteri found within the Project footprint

Figure 10.2 - P. novaezealandiae found within the Project footprint

The locations of the peripatus specimens found within the Project footprint are documented in the Ecology supplementary report – Terrestrial invertebrates (Watts, 2018).

10.2 Statutory context

The provision of management to avoid, minimise and mitigate adverse effects on native wildlife and associated habitat is a requirement under the Resource Management Act 1991 (RMA).

P. suteri is not included on the New Zealand Threat Classification System listing as a threatened species. However, it is listed as 'Vulnerable' in the IUCN Red List of Threatened Species (2012). *P. novaezealandiae* is considered widespread throughout New Zealand (Department of Conservation 2014) and is not currently included in the New Zealand Threat Classification System listing as a threatened species.

Peripatus are not specified in Schedule 7 of the Wildlife Act 1953 and therefore are not deemed to be "animals" subject to protection under the Act.

10.3 Ecological impacts on peripatus

The Ecology supplementary report – Terrestrial invertebrates (Watts, 2018) has identified the following potential effects of the construction and operation of the Project on peripatus:

- direct mortality of peripatus during vegetation clearance and/or earthworks;
- habitat loss; and
- habitat modification and disturbance.

10.4 Peripatus Ecology

Peripatus are classified in the distinct phylum Onychophora. They are considered to be a possible ancient link between worms (Annelida) and insects, spiders and centipedes (Arthropoda). In New Zealand, nine species within two genera have been described, and another 20-30 species await formal description (Gleeson and Ruhberg, 2010). Few studies have been conducted on the ecology or biology of peripatus species (including *P. suteria* and *P. novaezealandiae*), or on their threats.

Peripatus are forest floor dwellers that occupy rotting or decaying logs, tree stumps, wood and leaf material on the forest floor. The specific habitat preferences of New Zealand

peripatus remain unknown. However, we do know they are vulnerable to dehydration when exposed to open areas and sunlight (since they are unable to control bodily water loss), and so generally require cool, constantly moist conditions year-round to survive. Consequently, forested or bush-covered south-facing slopes that remain moist all year round provide ideal habitat. They can also be found in marginal habitats, such as in logs in tussock grassland and exotic plantations, and under rocks near glaciers (see references in Department of Conservation (2014)). The abundance of decaying woody debris and stumps on the forest floor may contribute to the density of the population. The cracks and crevices that develop in stumps and logs provide moist, cool conditions for peripatus and possibly equally critically, safe refuge from introduced mammalian predators, especially rodents and hedgehogs (Department of Conservation 2014).

The only estimation of the dispersal ability of peripatus (20 m per year) has been reported for a Tasmanian species inhabiting suitable habitat (Fox et al. 2004). In New Zealand, peripatus are often found in decaying logs as individuals or occasionally in clusters especially when nurseries are formed (Department of Conservation 2014). One notable exception is *P. novaezealandiae* in Caversham Valley, where large clusters (of up to 2000 individuals) have been observed.

DOC (2014) reviewed the potential threats to New Zealand peripatus and suggested that habitat loss was a significant threat to their survival. At a microhabitat scale, the removal of intact tree canopy can be a major cause of peripatus decline. Removal of trees greatly alters the moisture and temperature regimes at ground level. Increased exposure to frost and sunshine increases moisture loss and daily temperature fluctuations - conditions that cannot be tolerated by peripatus. Consequently, peripatus populations are vulnerable to becoming isolated when tree cover is removed (Department of Conservation 2014).

Applying the limited knowledge that exists on peripatus, the most favourable habitat is likely to include all of the following:

- south-facing moist slopes;
- contiguous stands of forest trees with a well formed, linked canopy;
- abundant decomposing woody material and organic matter on the forest floor;
- plenty of cracks and crevices that are not accessible to rodents; and
- minimal disturbance (i.e. low levels of human activity).

10.5 Peripatus management within Project footprint

10.5.1 Avoidance, minimisation and mitigation

Effects on peripatus will be avoided or minimised through salvaging peripatus and relocating peripatus habitat elements into a suitable relocation site outside of the Project footprint. The measures that will be employed to avoid or minimise effects on peripatus are:

(i) conduct a pre-construction habitat assessment;

(ii) execute a peripatus translocation plan (PTP); and

(iii) relocate habitat elements suitable for peripatus outside of the Project footprint.

10.5.2 Pre-construction habitat assessment

A peripatus habitat assessment will be conducted along the Project footprint prior to construction in order to:

(i) establish 'high risk' habitat areas within the Project footprint where peripatus salvage efforts will be focussed;

(ii) gain an estimate of the quantity of peripatus habitat to be translocated so that suitable release sites can be prepared; and

(iii) determine the nature of the habitat occupied by peripatus, enabling the logistics of transporting habitat features to a new site to be planned (so as to minimise potential animal disturbance and reduce the likelihood of habitat translocation failure).

A detailed walk-through survey in areas within the Project footprint that are deemed 'high risk' potential habitat for peripatus and are safely accessible will be conducted by the Project Invertebrate Ecologist to identify key habitat for peripatus.

The potential habitat areas for peripatus are outlined in the Ecology Constraints Map (Appendix A to the ELMP). Habitat features will be clearly marked using flagging tape or mesh and will be the focus of the pre-translocation search and salvage effort and the habitat salvage operation outlined in the PTP.

10.5.3 Peripatus Translocation Plan (PTP)

10.5.3.1 Purpose and objectives

Translocation of peripatus found within the Project footprint will be undertaken in accordance with this PTP to maximise the likelihood of success. The PTP provides guidelines for the successful search, capture, translocation and release of peripatus from within the Project footprint to suitable alternative habitats.

The intention of the peripatus translocation is to locate and capture as many peripatus as possible from the proposed Project footprint, and to successfully release them at predetermined release sites, immediately adjacent to the Project footprint, with minimal stress caused to the animals.

There is only one example of a planned and documented peripatus translocation in New Zealand. This PTP has been developed and refined on the basis of existing knowledge of the Caversham peripatus (*P. novaezealandiae*) and the well-documented *Caversham Valley Safety Improvements Peripatus Translocation Plan* and associated monitoring (MacGibbon 2012; Connolly 2013; Randle 2014; MacGibbon 2017).

The following sections outline procedures for:

- site preparation;
- timing of translocations;
- peripatus and habitat transportation; and
- the re-positioning of peripatus-occupied material/habitat elements.

10.5.3.2 Pre-translocation survey in 'high risk' habitat areas

- Following the pre-construction habitat assessment, areas of potentially 'high-risk' habitat (that is, habitat that offers high potential for peripatus) will be the focus of a pre-translocation survey. A thorough walk-through survey of the Project footprint will be conducted by the Project inverterbrate ecologist to identify these habitat features.
- A total of 32 person hours will be spent demarcating suitable peripatus habitat across the entire Project footprint during a walk-over survey, in safe to access areas, prior to commencement of vegetation clearance. This survey will involve a thorough search of substrates that may offer potential habitat for peripatus. These potential habitat elements will be carefully examined until peripatus are found or it becomes apparent that they are not present. Typical search areas will include tree stumps, decaying logs and branches, within stacks of wood, and under any objects or material lying on or near the ground where cool, moist conditions are likely to prevail.
- When the first peripatus is found, no further disturbance of that site will occur within a 5m radius. The locations of any peripatus found within the Project footprint will be clearly marked using flagging tape or fleuro mesh, so that there is no risk of habitat damage. Before construction begins, demarcation of all surrounding (within 5m) habitat elements(identified as suitable for peripatus) will take place. These habitat elements will then be relocated to an appropriate release site outside the Project footprint (refer to Section 10.5.3.4).
- If no peripatus are found during the pre-construction habitat assessment, any potential (unoccupied) habitat will be marked with mesh and moved with a digger to an appropriate site outside the Project footprint prior to any vegetation clearance activities. These meshed habitat features will be deposited either side of the Project footprint in similar habitat they were removed from.

10.5.3.3 Pre-translocation survey timing

Pre-translocation surveys will be carried out in spring to early summer (September – December) and / or during autumn (April-May) when the ground and habitat conditions are warmer and moist (Department of Conservation 2014).[11]

10.5.3.4 Translocation release site

- A survey of potential release sites immediately adjacent to the Project footprint will be undertaken by the Project Invertebrate Ecologist two weeks before the commencement of the pre-translocation survey. The Project Invertebrate Ecologist will identify appropriate options for the translocation release site, taking into account the following:
    - Ideally sites will have a provision of woody material in various stages of decay for medium- to long-term occupation by peripatus and their food. Peripatus

[11] In cold (winter) and dry (summer) ground conditions, peripatus move further into logs and stumps where they become increasingly hard to find.

appear to be unaffected by habitat edges, so suitable logs can be placed up to the edge of an area (Department of Conservation 2014). It is essential that there are less-decayed wood supplies adjacent to the release sites, as these will provide suitable future habitat.

- To maximise the success of the peripatus translocations, translocations should if reasonably practicable occur into the Pest Management Area (PMA, see Chapter 9).

10.5.3.5 Peripatus search, capture and translocation process

In the event that peripatus are found during the pre-translocation survey in high-risk habitats (as outlined above), the process of search, capture, transport and release is documented below.

- Peripatus are nocturnally active, so search and release will occur within daylight hours when they are least active. The period between the capture and release of each animal should be kept to a minimum (up to four hours maximum).
- The extraction and translocation of peripatus and their habitat, especially those to be moved by digger, can occur once contractor machinery is moved to the site to commence site clearance. However, translocation must occur before any site clearance begins to ensure no habitat is inadvertently damaged. It is essential that the logs and stumps marked for translocation are not disturbed at all until extraction and transport occurs, and each log or stump must be repositioned at the release site quickly (not more than four hours following extraction).
- To align with the planned staging of site clearance along the Project footprint, it will be acceptable to also translocate peripatus in stages, provided all material occupied by peripatus in any particular section is moved to the release site before that section of the footprint is cleared of vegetation.
    - It is also essential that the Project invertebrate ecologist is informed in advance of the intention to clear a section of the Project footprint and an experienced invertebrate ecologist is always present on site when peripatus are translocated.
- Wherever reasonably practicable, peripatus will be translocated with their habitat (e.g. whole stumps and logs relocated using a digger). In this way all peripatus located in the stump and log are likely to be translocated with minimal disruption.
- Some of the marked woody habitat in the Project footprint may be too fragile and will need to first be wrapped in breathable material (i.e. cloth) to minimise breakage. Some sections of the Project footprint may be inaccessible by digger, and habitat elements within these areas will need to be sectioned and moved manually.
- The extraction and transport of woody habitat containing peripatus will need to be done as gently as possible so as not to force the animals to leave, and completed quickly (i.e. within four hours) before environmental conditions (e.g. temperature and moisture) in the wood change significantly. Extra care will also need to be taken when moving peripatus and habitat by digger so not to cause unacceptable damage to the release site, especially to what may be existing peripatus habitat.

- Moving individual peripatus by hand is the least favourable option for translocation. However, if this is necessary, each peripatus will be placed in a container (such as a 2L ice-cream container), which is rodent proof and has small air holes inserted into the lid.
    - A thick wad of damp paper towel should be placed on the bottom of the container, and a piece of decaying woody material added for the peripatus to hide in. Soil should not be included.
    - It is very important that peripatus are kept cool and out of direct sunlight.
    - Noise and vibrations should be minimised and boxes kept upright and moved with care.
    - Cupboard cat boxes or chilly bins are ideal for carrying a number of peripatus containers.

Release procedure

- Where reasonably practicable, peripatus will be deposited at the release site in their woody habitat. Once the logs or stumps are positioned at the designated locations, organic material and leaves should be pushed up around the logs and stumps to seal in moisture. Each piece of translocated habitat should be numbered and its origin recorded with a GPS.

10.5.3.6 Salvage of habitat elements

The exact locations of habitat elements suitable for peripatus will be confirmed during the pre-translocation habitat assessment outlined above. In the event that no peripatus are found and salvaged during the pre-translocation survey, vacant habitat elements that are demarcated will be transferred to the release sites identified immediately adjacent to the Project footprint.

10.5.3.7 Potential risk and risk management

The translocation of peripatus from the Project footprint to a new site will create some risks to those animals captured and moved. To minimise the risk of peripatus mortality during translocation, experienced invertebrate ecologists will be involved in the translocation exercise and will contribute to the refinement of the methodology adopted for search, capture and handling; the selection of release sites and animal release.

The plan and translocation procedure will be reviewed and if necessary, updated as work is undertaken.

10.5.3.8 Post-translocation monitoring

Anecdotal information derived from informal, localised ‘translocations’ suggests that there is no guarantee that released peripatus will remain at the release site; consequently, it may not be possible to determine the success of translocation.

MacGibbon (2017) confirmed the presence of peripatus in artificial monitoring stacks in Caversham Valley two years after their translocation, during post-translocation monitoring

surveys. This population, however, was isolated in an urban area within habitat dominated by introduced tree species (e.g. *Pinus* and *Eucalyptus* species).

In contrast, since the wider Mt Messenger Project area is located within a large tract of native forest habitat, post-translocation monitoring is not necessary given the considerable amount of available habitat in which any translocated peripatus could thrive.

10.6 Reporting

The following reports (and associated data) will be prepared and made available to the Department of Conservation (DOC) and Taranaki District Council following completion of associated work activities, as outlined in previous sections of this management plan:

1. An annual peripatus management report during-construction.
2. A one-off post-translocation peripatus report providing an overall summary of the peripatus management activities undertaken once the Project has reached completion.

10.7 Permitting requirements

As indicated in section 10.2 above, peripatus are not specified in Schedule 7 of the Wildlife Act 1953 and are thereby not declared to be animals under the Act. A wildlife permit is therefore not required for the protocols outlined in this management plan.

10.8 References

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11 Biosecurity Management Plan

11.1 Introduction

There are a range of invasive plant and animal species, and diseases of native plants and animals that are either not currently present in the Project Area, or not present throughout the Project Area. The purpose of this Biosecurity Management Plan is for all people involved in the Project to be aware of and implement procedures that will minimise the likelihood of spread or introduction of these invasive organisms as a result of Project-related activities.

This plan does not include management of pest organisms that are already present and widespread in the Project Area. Several of these, especially mammalian pests and invasive weed species, will be managed as part of the Project ecological mitigation and offsets programme, as described in chapters 3 and 9 of this ELMP.

This management plan contains three sections, each of which sets out monitoring requirements and protocols for managing biosecurity for the Project:

- Myrtle rust management (section 11.2)
- Plant pest management (section 11.3)
- Pest animal management (section 11.4).

11.2 Myrtle rust management

11.2.1 Myrtle rust and the Project

The Mt Messenger bypass will be constructed through forest which contains many Myrtaceae species susceptible to myrtle rust, such as ramarama, northern rātā, mānuka, kānuka, swamp maire and other *Metrosideros* species (especially climbing ratas). Ecological values within and around the Project area are described in detail in the AEE and supporting technical reports (in particular Technical Report 7h – Ecological Mitigation and Offset). Moreover, as part of the Project's mitigation and offsetting, many of these species will be required to be replanted after the road has been built.

Myrtle rust has the potential to attack new growth on plants, therefore the cost of planting, plant growth and establishment is highly conditional on ensuring that myrtle rust is kept out of as much of the Project footprint and offset restoration areas as possible.

We recognise the significance of myrtle rust, however due to recent discovery of myrtle rust within the Project area and the potential breadth of that incursion, the development of the myrtle rust management plan will take place over the coming months. This will be developed in conjunction with MPI and DOC.

11.3 Pest plant management

11.3.1 Purpose of pest plant management

The purpose of this pest plant management section is to:

- Provide background information on pest plants in the Project footprint and potential invasive pest plants;
- Describe how pest plants may affect the ecological values of the Project area;
- Describe actions to be undertaken as part of the Project to minimise the likelihood of pest plants spreading or invading; and,
- Recommend actions to take in the case of new pest plant incursions.

11.3.2 Pest plant adverse effects

Pest plants or weeds are detrimental to human health, the economy and the environment (Williams & Timmins, 1990). Pest plants continue to invade and spread in New Zealand, and invasion pathways tend to be facilitated by human mediated dispersal and other anthropogenic activities. In addition, with the onset of climate change, it is predicted that the rate of pest plant naturalisation in New Zealand is likely to increase (Sheppard *et al.*, 2016).

The construction of roads can lead to the loss of native vegetation, increase in habitat fragmentation and forest edges, and increased movement of vehicles and personnel throughout an area. Altogether, these effects can substantially increase the spread and establishment of pest plants (Murcia, 1995; Meunier & Lavoie, 2012). Construction projects also result in areas left ungrazed, unmowed or unplanted which can be readily invaded by pest plants. Any movement of soil also has the potential to spread pest plants, as pest plant seeds may remain viable in soils for decades.

Pest plants have the potential to smother, shade or outcompete native vegetation. Freshwater pest plants degrade New Zealand's wetlands and waterways. A reduction in the function of waterways can have many flow-on effects, such as reducing oxygen levels in streams which adversely effects freshwater faunal communities.

11.3.3 Mt Messenger context

The Mt Messenger Bypass is located in an area of high ecological value, which hosts large tracts of mature forest and an array of nationally threatened animal and plant species (NSES Ltd, 2017). The high biodiversity value of Mt Messenger requires stringent precautionary biosecurity measures to ensure these values are not compromised by the accidental introduction of pest plants and animals.

11.3.3.1 Pest plants at Mt Messenger

The current Project footprint is dominated by native forest, however a number of highly invasive pest plants are present in some areas, including African clubmoss (*Selaginella kraussiana*) and tradescantia (*Tradescantia fluminensis*) in the undergrowth, pampas (*Cortaderia selloana*) and gorse (*Ulex europaeus*) on newly created slips, and wild ginger (*Hedychium gerdnerianum*) on the edge of the existing SH3 bypass. Other pest plants include exotic willow weed (*Persicaria* sp.), Spanish heath (*Erica lusitanica*), Chinese privet (*Ligustrum sinense*), cotoneaster (*Cotoneaster franchetii*), arum lily (*Zantedeschia aethiopica*) and exotic grasses (NSES Ltd, 2017). The location of known pest plant eradication sites can

be seen in Figure 11.1. These locations are also marked on the Ecology Constraints Map in Appendix A to the ELMP.

Altogether these pest plants are comparatively uncommon in the Project footprint. However, it is predicted that constructing the alignment without preventative measures would facilitate the spread of weeds. Given the low density of pest plants currently, the high ecological value of the area and the importance of mitigation/off-set plantings, restricting the spread of pest plants is of high importance.

11.3.4 General biosecurity management

The Alliance shall appoint an appropriately qualified senior manager as Alliance Biosecurity Coordinator (ABC) prior to the commencement of construction. The ABC will be responsible for coordinating pest plant, skink and ant prevention and management activities required on the Project and will be the primary point of contact for the Alliance management team and the Transport Agency on all matters related to pest plant, skink and ant management.

To ensure pest plant control and mitigation is undertaken safely and effectively, the following general guidelines are to be adhered to:

- all weed management shall be carried out by suitably qualified weed management staff;
- herbicide use shall only be undertaken in fine weather to prevent spray drift;
- herbicide use shall be undertaken predominantly between the months of November through April when pest plants are actively growing;
- manufacturer's guidelines are to be adhered to regarding mixing and application;
- care is to be taken around new plantings, and herbicides shall be marked with a dye to indicate spray coverage;
- herbicides shall be used with appropriate safety gear to prevent any health and safety issues;
- pest plants shall be disposed of on-site (unless specifically determined otherwise by the ABC); and

spray used within 10 m of any waterway, or in areas where there is high potential for spray to runoff into waterways shall be undertaken only with those herbicides approved for use around waterways.

11.3.5 Pest plant prevention measures

Pest plants shall be controlled to prevent their spread and to prevent any new introductions of pest plants. Along the entire alignment, pest plant growth will be prevented as far as practicable in order to produce a clean edge. In addition, pest plants shall be controlled to a low level throughout the Project area and mitigation planting areas. As it is more cost-effective to prevent pest plant invasions with a number of prevention measures than to control infestations once establishment has occurred (Tane's Tree Trust, 2011), emphasis is on the prevention of pest plants spreading and establishing.

Pest plant species identified within the Project footprint can spread via plant fragments (tradescantia and African clubmoss), wind (pampas), animals (Chinese privet) and seed capsule explosion and soil movement (gorse), therefore any preventative methods must be robust to different methods of pest plant movement. Pest plant preventative actions are outlined in Table 11.1.

Table 11.1- Tools and hygiene protocols to be adhered to in order to mitigate the establishment and spread of pest plants throughout the Project.

Tools and potential weed vectors	Actions to be undertaken
Inductions	• All personnel (including visitors) to be inducted on cleaning protocols and the importance of cleaning gear to prevent the spread of weeds.
Vehicles and machinery	• Provision of vehicle wash-down facilities at Project site entry/exit locations to be used by all vehicles entering and leaving the Project site to remove any soil and plant material. • Soil and plant material to be removed from vehicles when exiting or entering the work site. Where diggers and other construction vehicles are required to move between sites, soil and plant material is to be cleaned off.
Personnel and equipment	Provision of hoses and foot wash stations at site entrances for cleaning gear and equipment of soil and plant matter for when moving between the northern Mangapepeke catchment and the southern Mimi catchment.
Restricted access	In the case of an incursion of a significant pest plant species, exclusion zones with fencing and signage may be required to restrict access into these areas until eradication has taken place.
Mulch, topsoil and potting mix	• There is a high chance that site-won soil will contain tradescantia or African clubmoss fragments. An appropriate pre-emergent herbicide shall be used before soil that has been taken from areas containing these plant species is reused on site. • Breaking up existing soil may also release pest plants in the seed bank such as gorse. Where gorse has been previously identified, such soil such be treated with appropriate herbicides. All invasive weed species that germinate in placed mulch or topsoil will be treated with the appropriate herbicide.
Design controls	• Design of an interface area between road side barriers, swales and chip seal area that minimises weed growth. • Swales and drainage sediment traps to be treated with pre-emergent herbicide.

Tools and potential weed vectors	Actions to be undertaken
	• Swales shall be lined with geo-fabric, rocks, concrete or grass to reduce the need for spraying. • Sediment shall be removed from sediment traps to avoid a medium for weed growth. • Where weeds are unable to be inhibited fully by design, they shall be managed and controlled with herbicide and manual removal. The Project area and all Project related plantings will be managed for pest plants and general weeds throughout the construction phase and for 5 years following construction.
Control of existing weeds	Refer to Section 11.3.7
Mitigation and off-set planting pest plant guidelines	Refer to Section 11.3.9

11.3.6 Controlling pest plants around waterways

For staff undertaking works in or around waterways, all equipment and gear (including waders) shall be checked for plant material, cleaned (preferably with Sterigene), and dried before and after accessing waterways.

11.3.7 Pest plant control

Control of pest plants shall consist of chemical and physical control. Chemical control relates to the use of herbicides to control pest plants. This is usually the most effective method for controlling pest plants; however, overuse of herbicides may have adverse impacts on the environment. Chemical control can be undertaken by spraying, 'cut and paste' or 'drill and fill/injection of herbicides' or the use of granules. Each method of chemical control may be suitable for different species/age classes. Aerial spray is not necessary for the weeds currently present in the Project area. Physical control refers to using physical means to remove pest plants, such as shading, hand weeding, ring barking, grubbing, felling and mulching.

Control of pest plants shall follow best-practice for the particular species, as well as take into account effects on the local environment (e.g. some herbicides are more persistent in the soil and can limit future planting success). Some species (such as gorse) may require a combination of chemical and physical control (Tane's Tree Trust, 2011). Weed contractors are to refer to the Weedbusters Weed Control Handbook (2011) for best practice control of each species.

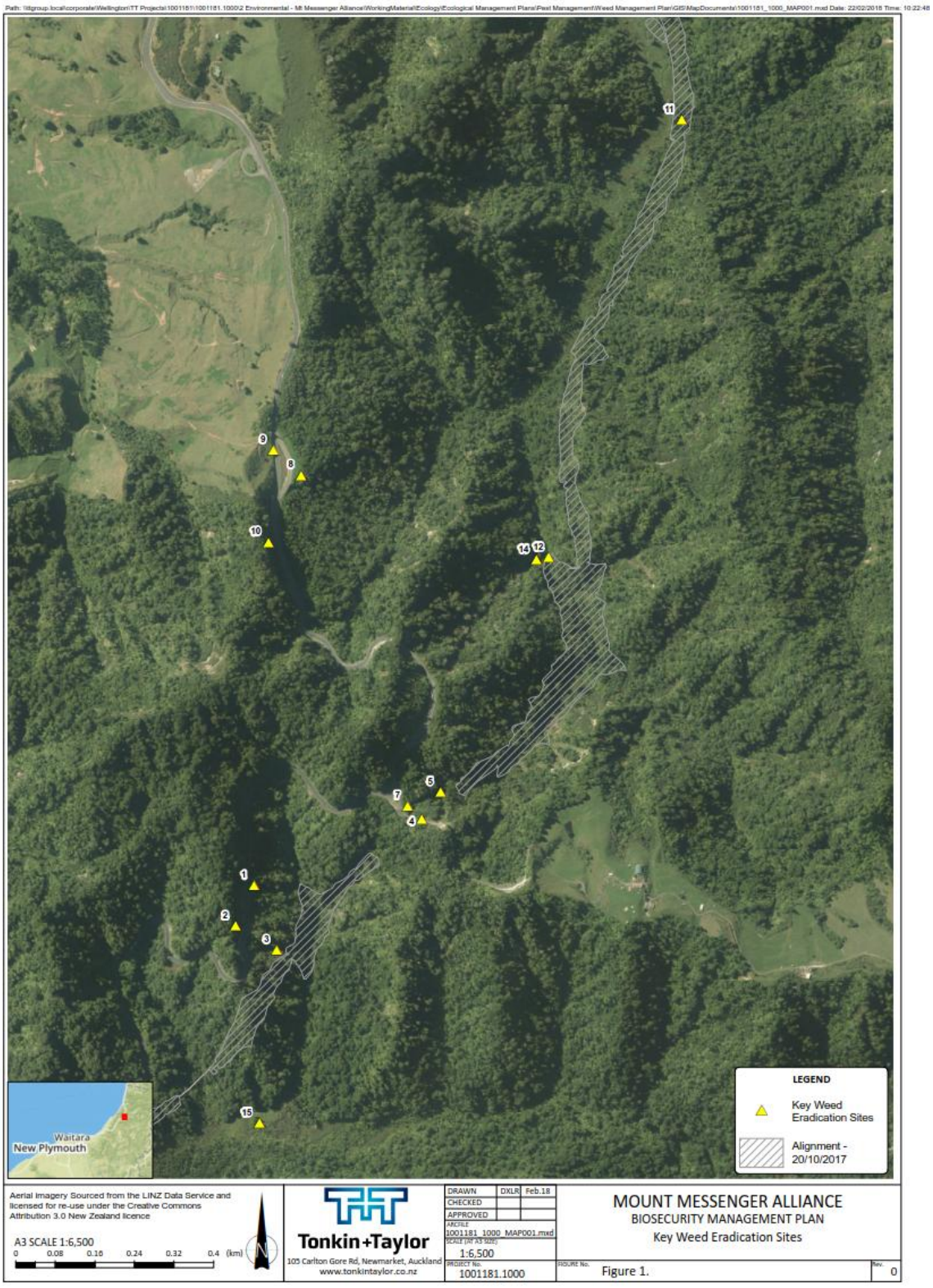

Figure 11.1 - Approximate locations of key pest plant eradication sites to prevent further pest plant issues. 1 = cotoneaster, 2 = gorse and pampas, 3 = pampas, 4 = wild ginger, 5 = wild ginger, 7 = tradescantia, 8 = Chinese privet, 9 = barberry, 10 = Spanish heath, 11 = wild ginger, tradescantia, 12 = tradescantia, 14 = arum lily, 15 = gorse and pampas.

11.3.8 Control of novel pest plants

Monitoring for newly arrived pest plant species shall be undertaken every quarter by the Ecology Team and other environmental personnel active on the Project.

If a newly suspected pest plant has been identified, the following protocols are to be adhered to:

- ABC notified immediately who will then inform the wider Alliance team;
- GPS coordinates of the weed species or infestation noted;
- Species cross-checked with the National Pest Plant Accord to determine its legal status;
- If determined to be an unwanted or notifiable species, (or determined to have the potential to have significant adverse ecological effects) a delineating survey undertaken to assess the extent of infestation;
- Eradication undertaken (if considered feasible by ABC);
- Monitoring and further control at infected site 3 months after eradication, and then scaled back to 6 months and 1 year after eradication assuming no new infestations.

These steps may require a temporary halting of construction within 100m of the affected site, and additional cleaning protocols may be required depending on the weed species identified. Any eradication attempted of novel pest plants shall be undertaken with regard to specific life-history traits and best-practice techniques.

The presence of the following species within the Project footprint should be noted as a high priority:

- Woolly nightshade (Solanum mauritianum);
- Barberry (Berberis glaucocarpa); and
- Climbing spindle berry (Celastrus orbiculatus).

These species are located relatively close to the Project footprint, and any sign of their presence requires control.

In addition, the proposed Regional Pest Management Plan for Taranaki (May 2017) contains objectives to eradicate certain pest species. The Taranaki Regional Council Biosecurity Strategy 2017-2037 states a goal of eradicating:

- Climbing spindle berry
- Giant reed
- Madeira (mignonette) vine
- Moth plant (RFB)
- Senegal tea.

Any sign of these species within the Project footprint shall require eradication if feasible, and if not, control to a low level. Taranaki Regional Council should be advised of the presence of these species.

11.3.9 Mitigation and offset plant maintenance

Poor pest plant control has resulted in the highest death rate of planted native trees and shrubs in planting programmes throughout New Zealand over the last century (Bergin and Gea, 2007). Plantings can become overrun and impacted by weed growth, therefore a pest plant management programme is required to ensure plant health is maintained, and mitigation and off-setting targets are achieved. Sites to be planted are likely to be highly variable; from weed-ridden farm tracks to engineered fill. Weed control regimes will need to incorporate timelines for site preparations to take into account any likelihood of re-infestation.

To ensure healthy plant growth and prevent adverse effects of pest plants, sites for mitigation planting will be prepared, planted and maintained in accordance with Chapter 4: Landscape and Vegetation Management Plan.

11.4 Pest animal management

11.4.1 Purpose of pest animal management

The purpose of the pest animal management section of this plan is to:

- provide background information on pest animals currently absent in the Project footprint with potential to adversely affect the ecological values there;
- describe how an incursion of new pest animals may affect the ecological values of the Project area; and
- describe actions to be undertaken as part of the Project to minimise the likelihood of pest animals invading.

11.5 Pest animals absent in Mt Messenger

The management of pest mammals already present on the Project is addressed in the Pest Management Plan (Chapter 9, ELMP). There are two pest animal species which are not present in Mt Messenger which have high invasion potential, and whose invasion may cause particular ecological harm. These are plague skinks (*Lampropholis delicate*) and argentine ants (*Linepithema humile*).

11.5.1 Plague skinks

Plague skinks (also known as rainbow skinks) are native to Australia and first recorded in Auckland in the 1960s. Their range encompasses Northland, Waikato, Bay of Plenty and outlying populations in Whanganui, Palmerston North and Foxton Beach (Department of Conservation, n.d.). A single plague skink can lay up to 24 eggs per year (over five times more than native skinks). Plague skink eggs readily spread in potting mix and other soil movement. They can reach high population densities in short timeframes, and compete with native lizards and other native fauna for food and habitat.

11.5.2 Argentine ants

Argentine ants are an introduced ant species ranked as one of the world's 100 worst invaders (Global Invasive Species Database, 2018) and have the ability to form large 'supercolonies' which can outcompete New Zealand's native ant species. Their current distribution in New Zealand ranges from Northland, Auckland, Bay of Plenty, Hawke's Bay, Wellington, Nelson and Christchurch, and in 2006 were found in Taranaki (Waitara, Bell Block, Oakura, New Plymouth, Patea and Waverly; Taranaki Regional Council, n.d.). They spread predominantly via the transportation of queens and nests, often when a potted plant is moved with a nest in its soil, or if nests establish on vehicles and freight. Human mediated dispersal has resulted in their long distance spread in New Zealand (Ward *et al.*, 2005). Argentine ants pose a threat to native invertebrates and other fauna present at Mt Messenger, and have been known to kill baby birds (Moller, 1996).

11.6 Prevention of pest animal invasions

Any suspected sign of plague skinks or argentine ants shall immediately be reported to the ABC. A number of precautionary measures are to be undertaken to prevent the spread of these organisms (Table 11.2).

Table 11.2- Actions to be undertaken to prevent the introduction of plague skinks or argentine ants to the Project Area.

Tools and potential plague skink / argentine ant vectors	Action for plague skinks	Action for argentine ants
Inductions	All personnel (including visitors) to be inducted on cleaning protocols and the importance of cleaning gear to prevent the spread of plague skinks. Pictures of plague skinks and their eggs presented.	All personnel (including visitors) to be inducted on cleaning protocols and the importance of cleaning gear to prevent the spread of argentine ants. Description of argentine ants presented.
Restricted access	In the case of an incursion of plague skinks, exclusion zones with fencing and signage may be required to restrict access into these areas until eradication has taken place.	In the case of an incursion of argentine ants, exclusion zones with fencing and signage may be required to restrict access into these areas until eradication has taken place.
Imported potting mix	Potting mix is one of the most frequent vectors of plague skinks and their eggs. All potting mix shall be inspected for plague	All potting mix shall be inspected for argentine ants prior to importation to site. No mulch or topsoil be will brought on to site.

Tools and potential plague skink / argentine ant vectors	Action for plague skinks	Action for argentine ants
	skinks and eggs prior to importation to site. No mulch or topsoil be will brought on to site.	

11.7 Adaptive management

Pest plants and animals can spread rapidly, and have the potential to a) prevent mitigation and off-setting success, and b) compromise the health of the high ecological values in Mt Messenger. Adaptive management will be essential in ensuring pest plants and animals do not have an adverse effect on the environment, and that the Project does not facilitate their spread. Adaptive management will be undertaken by:

- keeping up-to-date with any new scientific papers and guidelines to stay on top of current best practice;
- ensuring any updates regarding pest plants and organisms from MPI and Taranaki Regional Council are adhered to; and
- adapting prevention and control behaviours to any new or particularly severe pest plant or animal infestations on the project.

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12 Roles, Responsibilities and Training

12.1 Roles and Responsibilities

This section outlines the roles and responsibilities of the key organisations in relation to this ELMP.

Table 12.1 - Key organisational roles and responsibilities

Organisation	Responsibilities
Transport Agency	· Overall responsibility for compliance with the Resource Management Act 1991 (RMA) and conditions of the designation and resource consents · Review of ELMP as required during construction
Mt Messenger Alliance	· Overall responsibility for environmental management during construction · Implementation of this ELMP · Review of this ELMP, and consequential changes to other management plans · Training of staff, including sub-contractors, in relation to this ELMP · Inspection of works to assess compliance with this ELMP · Monitoring and reporting in accordance with this ELMP
Taranaki Regional Council and New Plymouth District Council	· Review and comment on the draft ELMP · Compliance monitoring / auditing during construction to check compliance with this ELMP
Department of Conservation	· Review and comment on the draft ELMP · Authority responsible for administering Wildlife Permits in accordance with the Wildlife Act 1953
Te Runanga o Ngāti Tama	· Review and comment on the final ELMP · Advising on relevant cultural protocols

12.2 Training

This section provides an overview of training requirements in relation to the ecological and landscape aspects of the Project. Detail on other Project training requirements is outlined in the CEMP.

12.2.1 Inductions

All people working on-site, or with site responsibilities shall undertake a formal site induction as outlined in the CEMP. No person will be permitted to work on the site until they have completed the induction process.

Part of this induction process will be based on environmental management. The induction will include information on:

- the ecological, landscape and cultural values of the area;
- sensitive areas within the Project footprint;
- the suite of management plans, including this ELMP, that shall be implemented during construction works to avoid, remedy, mitigate or offset adverse effects.

12.2.2 Training

The Alliance Management Team, Construction Manager, Site Managers, superintendents and environmental and ecology team members (responsible for implementation of this ELMP), will undergo environmental awareness training to make all aware of their responsibilities relating to this ELMP.

Training requirements are described in further detail within the CEMP with specific training requirements relating to this Plan including:

- the ecological, landscape and cultural values of the area;
- sensitive areas within the Project footprint;
- key ecological protocols / environmental control measures outlined in the ELMP that shall be implemented to avoid, remedy, mitigate or offset adverse effects; and
- Ecology Constraints Map that accompanies this ELMP (refer Appendix A).

It should be noted that a number of ecological aspects, such as bat surveys, lizard salvage and relocation, kiwi management, fish capture and relocation, peripatus management will only be undertaken by suitably qualified ecologists as outlined in the specific management plan chapters, hence are not included in Table 12.2 below.

Table 12.2 - Ecological Training

Environmental Aspect	Specific Training
Vegetation Clearance	• A briefing on the values of any significant areas of vegetation that are to be retained. • Briefing of the Project Vegetation Clearance Protocol: - the methods that shall be used to protect vegetation remaining during construction - the removal and relocation of forest resources - methodology for mulching and stockpiling wood and topsoil
Stream works	• Briefing on the values of waterbodies within and downstream of the Project area and the sensitivity of the receiving environment to sediment discharges. • The objectives of the stream design including fish passage requirements. • Briefing on the Project Fish Rescue and Relocation Protocol, which contains the methodology to minimise direct effects of construction

Environmental Aspect	Specific Training
	on fish, kōura and kākahi (freshwater mussels) prior to draining, diverting or excavating streams. • Construction method requirements for stream works (stream diversions, culverting or other in-stream work), including the set-up of fish passage barriers for isolating sites prior to in stream works (for those involved in this work)
Erosion and Sediment Control / Construction Water Management	• Relevant TRC and Transport Agency erosion and sediment control guidelines. • Design details for the erosion and sediment control and construction water management measures and associated methodologies during construction. • The performance standard as defined in the CWMP to be achieved by all erosion and sediment controls on site. • The sensitivity of the receiving environment to sediment discharges. • Understanding the construction water risk for specific activities and/or locations. • SCWMP requirements.

A record shall be kept of all training, including the information presented and a list of attendees (refer to the CEMP for further detail).

The Environmental Manager will identify staff that require additional training in relation to their roles and responsibilities for specific aspects of this ELMP.

12.2.3 Toolbox talks

Environmental issues, including ecological management, will form a regular part of toolbox meetings to ensure all workers are aware of the key issues.

13 ELMP Review

13.1 Review process

A review of the ELMP will be undertaken at least annually by the Alliance. The management review will be organised by the Environmental Manager and the Project team will be informed of any changes to this ELMP through the regular Project communications processes. The review will take into consideration:

- Compliance with the Project consent / designation conditions, the CEMP and other management plans (including timeframes).
- Any significant changes to construction activities or methods.
- Key changes to roles and responsibilities within the Project team.
- Changes in industry best practice standards.
- Results of inspections, monitoring and reporting procedures associated with the management of adverse effects during construction.
- Relevant comments or recommendations from TRC or NPDC on all other management plans.
- Comments or recommendations from TRC, NPDC, TRoNT and DOC regarding the ELMP and the PMP.
- Unresolved complaints and any response to complaints and remedial action taken to address the complaint.

The outcomes of any review will be provided to TRC and NPDC.

Where the ELMP is updated as part of a review, the on-site version shall be updated promptly and prior to any works associated with the amendment being implemented.

13.2 Reasonable amendment

In accordance with the designation and consent conditions, reasonable amendments may be made to the finalised ELMP at any time. Reasonable amendment is any amendment where the adverse environmental effect arising from the amendment is the same or less than the effect anticipated in the (original version of the) final management plan.

Any changes to the ELMP shall remain consistent with the overall intent of the original version of the finalised ELMP.

The Alliance shall provide TRC and NPDC with a copy of any amendment as soon as practicable and before any construction works associated with that amendment are implemented.

13.3 Material Amendment

Material amendments to this ELMP, which would result in an adverse (beyond de minimis) effect on the environment above that anticipated in the (original version of) the final ELMP,

may be made at any time subject to certification by TRC and NPDC (in accordance with the designation and consent conditions).

Any material amendments shall be consistent with the overall intent of the original version of the finalised management plan.

In the event of material amendment:

- The amendment shall be submitted to TRC and NPDC for certification 20 working days before the commencement of works to which the amendment applies.
- If TRC and NPDC have not provided comment or certification within 10 working days, the amended management plan can be finalised.
- A copy of the amended management plan shall be provided to TRC and NPDC 5 working days before the commencement of the relevant works.

Appendices

Appendix A: Ecology Constraints Map

- **Note: The Ecology Constraints Map is to be provided when available.**

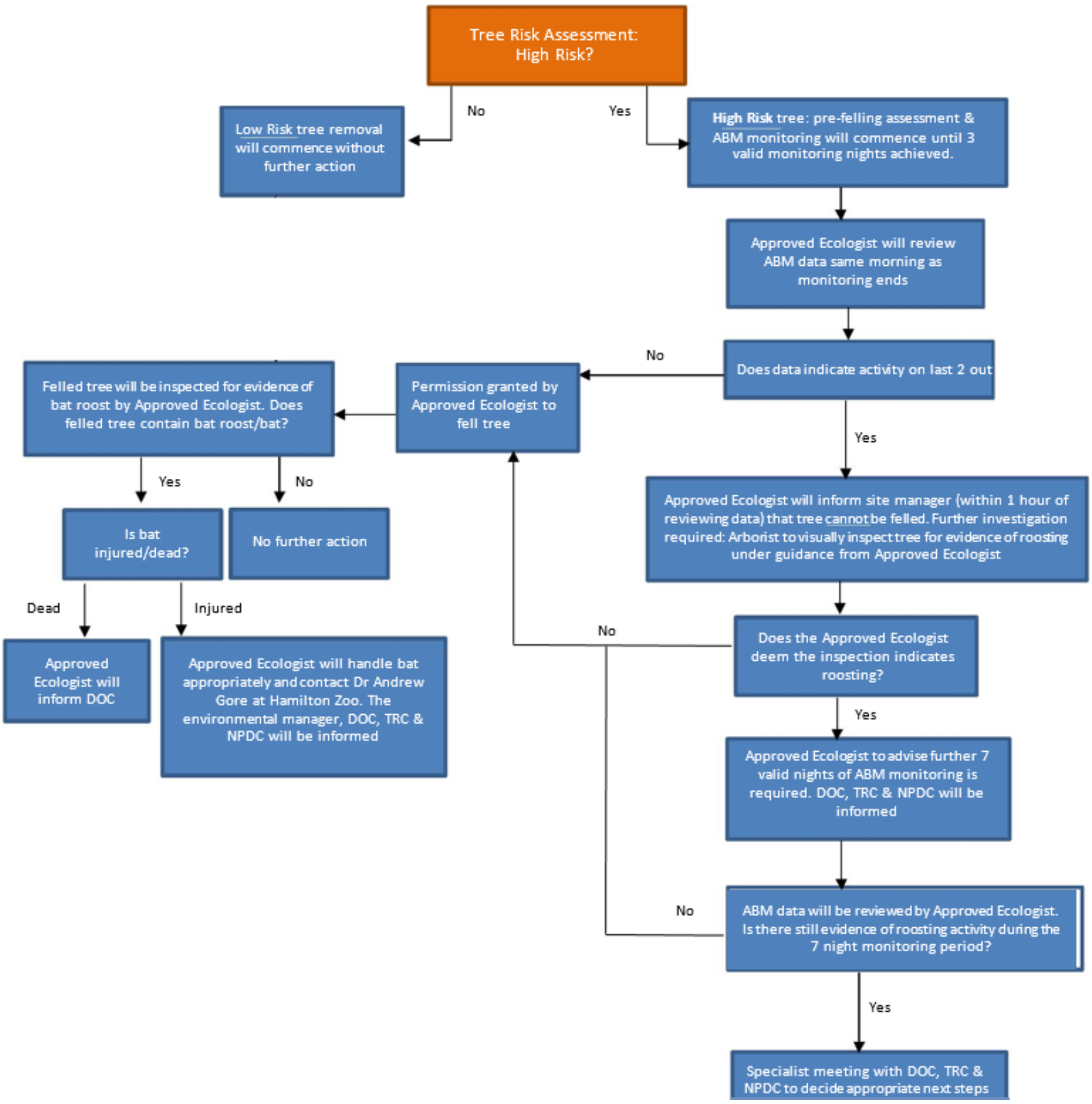
Appendix B: Bat competency classes table

· From Smith et al. (2017)

Class	Key Field Activity	Competency	Individual experience/knowledge
A	ABMs	Setting up automatic bat detector systems (ABMS)	Recent previous experience in installing ABMS in at least 2 comprehensive surveys.
B	Analysing ABM data	Setting up ABMS, and analysing and interpreting results.	Recent previous experience at analysing and interpreting ABMS results in at least 2 comprehensive surveys.
C1	Identifying bat roosts (short-tailed bats)	Finding and identifying short-tailed bat roosts that are either occupied or unoccupied. This competency may also include arborists.	Recent extensive experience in searching for and finding active and inactive roosts (by radio tracking, exit observations, and/or visual inspections)
C2	Identifying bat roosts (long-tailed bats)	Finding and identifying short-tailed bat roosts that are either occupied or unoccupied. This competency may also include arborists.	Recent extensive experience in searching for and finding active and inactive roosts (by radio tracking, exit observations, and/or visual inspections)
D	Handling bats	Handling bats (in one or more field methods), as outlined in DOC's best practice manual (Sedgeley et al 2012).	Has undertaken field training from a competent trainer demonstrating the required technique to the trainer's satisfaction and meets DOC's best practice manual standards (Sedgeley et al 2012) to carry out one or more of the following specialised field methods: · extracting bats from mist nets · using harp traps at roost sites · handling bats · marking bats (eg forearm band, temporary marks) · using wing biopsies for genetic sampling · attaching transmitters · inserting transponder tags · applying release techniques.
E	Trainer for class	Competent at the relevant class plus capable of training staff.	Has a high level of knowledge and experience regarding the competency they are training people in.
F	Bat management	· Survey/monitoring programme design (may be individual or a team) · Survey data analysis and interpretation · Preparation of bat effects assessment reports · Can recommend impact management strategies (eg mitigation) for projects · Prepare, co-author, or certify the appropriateness of BMMPs	· Competency in 3 or more of class A/B/C/D activities (field experience relating to competency classes A/B/C/D activities). · Experience writing ecological assessments and/or species restoration or recovery plans. · Thorough knowledge of available bat survey techniques and methodology, and their limitations.

Class	Key Field Activity	Competency	Individual experience/knowledge
		· Presentation of expert evidence for projects impacting bats.	· Thorough knowledge of the threats bats face and national recovery actions. · Thorough knowledge of measures to avoid, mitigate or compensate for impacts of infrastructure projects on bat populations. · Understands seasonality and conditions of bat activity, and how these might affect surveys. · Can recognise and articulate how the practical constraints of a survey affect the conclusions in an impact assessment. · Understand the importance of sampling design and sample size (effort) in determining whether monitoring results will have sufficient statistical power to detect changes in the variable of interest.

Appendix C: Vegetation removals flow chart


Tree Risk Assessment: High Risk?
No
Yes
Low Risk tree removal will commence without further action
High Risk tree: pre-felling assessment & ABM monitoring will commence until 3 valid monitoring nights achieved.
Approved Ecologist will review ABM data same morning as monitoring ends
Does data indicate activity on last 2 out
No
Yes
Permission granted by Approved Ecologist to fell tree
Felled tree will be inspected for evidence of bat roost by Approved Ecologist. Does felled tree contain bat roost/bat?
Yes
No
Is bat injured/dead?
No further action
Dead
Injured
Approved Ecologist will inform DOC
Approved Ecologist will handle bat appropriately and contact Dr Andrew Gore at Hamilton Zoo. The environmental manager, DOC, TRC & NPDC will be informed
Approved Ecologist will inform site manager (within 1 hour of reviewing data) that tree cannot be felled. Further investigation required: Arborist to visually inspect tree for evidence of roosting under guidance from Approved Ecologist
Does the Approved Ecologist deem the inspection indicates roosting?
No
Yes
Approved Ecologist to advise further 7 valid nights of ABM monitoring is required. DOC, TRC & NPDC will be informed
ABM data will be reviewed by Approved Ecologist. Is there still evidence of roosting activity during the 7 night monitoring period?
No
Yes
Specialist meeting with DOC, TRC & NPDC to decide appropriate next steps

Appendix D: Fish Recovery and Rescue Protocols

- **Note: The Fish Recovery and Rescue Protocols are to be provided when available.**