Southern Links Project

Hamilton City Council and NZ Transport Agency

06-Sep-2019

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Environmental Management and Monitoring Plan (EMMP)

Southern Links Project - Hamilton City Council Section

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Southern Links Project - Hamilton City Council Section

Client: Hamilton City Council and NZ Transport Agency

Co No.: N/A

Prepared by

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Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
1	27-Feb-2019	Draft	Andrew Curtis Technical Director - Air Quality	Andrew Curtis
2	02-Apr-2019	Final Draft	Andrew Curtis Technical Director - Air Quality	Andrew Curtis
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4	06-Sept-2019	Updated EMMP for Certification	Andrew Curtis Technical Director - Air Quality	

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Acronyms and Abbreviations

Acronyms / Abbreviations	Descriptions
ABM	Automatic Bat Monitor.
ACO	Artificial Cover Object.
AECOM	Architecture, Engineering, Consulting, Operations, and Maintenance.
AEE	Assessment of Ecological Effects / Assessment of Environmental Effects.
dbh	Diameter at breast height.
DOC	Department of Conservation.
CMP	Construction Management Plan.
cm	Centimetres.
EMMP	Environmental Management and Monitoring Plan.
ha	Hectares.
HCC	Hamilton City Council.
ICMP	Integrated Catchment Management Plan
m	Metres.
m^2	Metres squared.
MCP	Minimum Convex Polygons.
mm	Millimetres.
MPI	Ministry of Primary Industries.
MSCG	Mangakotukutuku Stream Care Group.
PRP	Proposed Regional Plan.
RA	Requiring Authority.
RESI	Riverlea Environment Society Inc.
SEV	Stream Ecological Valuation.
SH1	State Highway 1.
SH2	State Highway 2.
SH3	State Highway 3.
TWWG	Tangata Whenua Working Group.
TA	Territorial Authority.
Transport Agency	NZ Transport Agency.
T+T	Tonkin and Taylor Ltd.
Waikato DC	Waikato District Council.
WRC	Waikato Regional Council.
Waipa DC	Waipa District Council.

Executive Summary

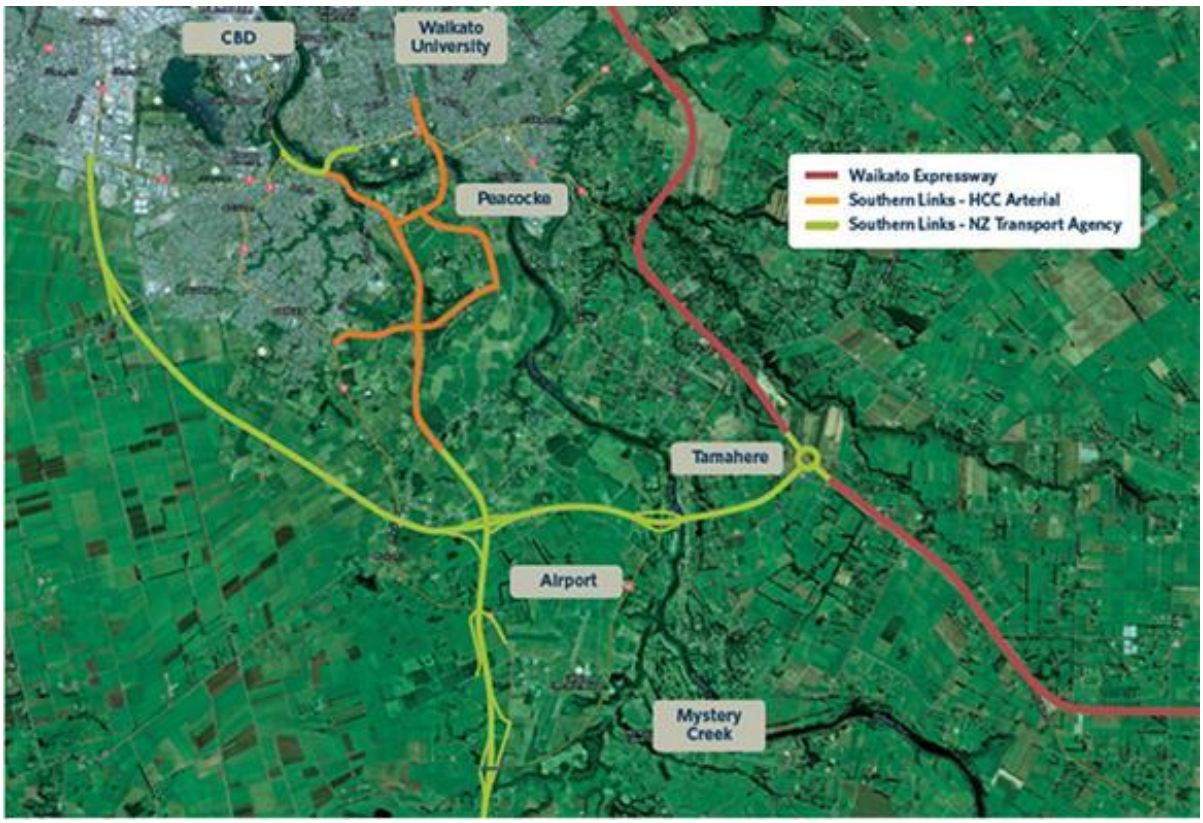
Hamilton City Council – Requiring Authority (HCC (RA)) and the NZ Transport Agency (Transport Agency) commissioned AECOM New Zealand Limited (AECOM) to produce an Ecological Management and Monitoring Plan (EMMP) for the Southern Links Project (the 'Project').

The Project and consequently the designation cross the boundaries of three Territorial Authorities (TA's); Hamilton City Council (HCC), Waipa District Council (Waipa DC) and Waikato District Council (Waikato DC). The HCC designation conditions relate to the section of the Project to be delivered by HCC (RA). The Waipa DC and Waikato DC designations conditions relate to the section of the Project to be delivered by the Transport Agency. The designation conditions require this EMMP to be lodged with HCC (as TA) for certification in accordance with Condition 2 (refer to Section 2.0).

Funding is currently available for the detailed design and construction of part of the area of the Project to be delivered by HCC. The Transport Agency section of the Project is currently unfunded for detailed design and construction. This EMMP is focused on meeting HCC designation conditions for the Project. Separate EMMPs will be produced to meet the Transport Agency Waikato DC and Waipa DC designation conditions. All references to mitigation and / or offset activities outside of HCCs jurisdiction referencing the Transport Agency are not being delivered by HCC (RA) and are not part of its designation requirements. Therefore, these activities should be viewed as recommendations to the Transport Agency and will be considered by the Transport Agency when they produce their EMMP to meet their designation conditions.

Notwithstanding, this EMMP does present how the Project as a whole will achieve its overall objective of "no-net-loss" and the enhancement of habitat for long-tailed bats (bats), avifauna (birds) and lizards.

Table 1 presents a summary of the mitigation to be delivered as part of the respective Project Packages by the contractor or as part of the project wide EMMP Implementation Plan, which will be led by HCC (RA). Responsibility for delivery of some of the mitigation measures will span the two teams (Project Packages and EMMP Implementation Plan). An example of this is the delivery of Stream Restoration Plans. In areas of stream re-alignment that are required to enable the construction of the road it will be the contractor's responsibility as part of the Project Package to prepare the Stream Restoration Plan and undertaken stream restoration. In areas where stream offset is required away from the main transport corridor the Stream Restoration Plan and consequently the restoration works will be undertaken by the EMMP Implementation Plan team.



Southern Links Project Area.

Table 1 EMMP deliverables - Hamilton City Council and NZ Transport Agency.

Deliverable / Task No.	Deliverable / Task	Project-wide - EMMP Implementation Plan	Project Package		
			Pre-construction	Construction	Post-construction
Terrestrial habitat					
1	Identify restoration sites as required by the designation conditions (Section 6.3.1) ('Designation Restoration Sites' Appendix B).	Yes	-	-	-
2	Identify additional restoration opportunities including Whatukoruru Pa and private properties (Section 6.3.1.2).	Yes - Specific to property	-	-	-
3	Produce a Restoration Plan for each of the sites (Section 6.3.2).	Yes	-	-	-
4	Obtain Resource Consent as required for delivery of the Designation Restoration Sites.	Yes - HCC Resource Consent Transport Agency Resource Consent	-	-	-
5	Undertake advance habitat restoration of the Designation Restoration Sites in line with each site Restoration Plan, once the sites have transferred in to HCC (or Transport Agency) ownership (Section 6.3.2).	Yes	-	-	-
6	Identify and fence off safeguard zones, adjacent to working area, to retain vegetation along the Mangakotukutuku Gully and the Waikato River adjacent to bridge structures to maintain habitat linkages. In addition, safeguards zones will be established to protect areas of early restoration planting from accidental or intentional disturbance (Section 6.3.3).	N/A	✓	-	-
7	Maintain fencing of safeguard zones adjacent to working area (Section 6.3.3).	N/A	-	✓	-
8	Undertake additional plantings on conclusion of construction work to re-instate or reinforce habitat linkages (Section 6.3.4).	N/A	-	✓	-

Deliverable / Task No.	Deliverable / Task	Project-wide - EMMP Implementation Plan	Project Package		
			Pre-construction	Construction	Post-construction
9	Maintain vegetation within the Designation Restoration Sites, buffer planting, Stream Restoration Sites, bat hop-overs, Lizard Restoration Sites (Appendix B, Section 6.3.1.1, 6.5.4.3, 6.4.9, 6.5.1 and 6.6.2).	Yes	-	-	-
10	Monitor the establishment of vegetation at the Designation Restoration Sites, linkage planting sites, stream compensation sites, bat hop-overs, Lizard restoration sites (Section 7.0).	Yes	-	-	-
Stream habitats					
11	Identify offset sites (Stream Restoration Sites) for stream loss (Section 6.4.1) (Appendix B).	Yes	-	-	-
12	Obtain Resource Consent as required for delivery of the Stream Restoration Sites.	Yes - HCC Resource Consent Transport Agency Resource Consent	-	-	-
13	Produce a Restoration Plan for each of the Stream Restoration Sites (Section 6.4.1).	Yes	✓ Stream restoration works may be delivered by the Project Packages when in connection with stream diversions e.g. north / south arterial.	-	-
14	Undertake stream offset works in accordance with the site Restoration Plan (Section 6.4.9).	Yes	-	✓ Stream restoration works may be delivered by the Project Packages when in connection	-

Deliverable / Task No.	Deliverable / Task	Project-wide - EMMP Implementation Plan	Project Package		
			Pre-construction	Construction	Post-construction
				with stream diversions e.g. north / south arterial.	
15	Programme instream works along the Mangakotukutuku to occur between January – April to avoid key fish migration periods, or in accordance with Resource Consent conditions (Section 6.4.4).	N/A	✓	✓	-
16	Install sediment control measures in line with an Erosion and Sediment Control Plan, which will be a requirement of the WRC Resource Consent (Section 6.4.6).	N/A	-	✓	-
17	Stormwater devices to be designed to in accordance with the Comprehensive Stormwater Discharge Consent, Regional Infrastructure Technical Specifications (RITS) (Waikato LASS), Waikato Stormwater Management Guidelines and the Mangakotukutuku Integrated Catchment Management Plan (ICMP) (once completed). Devices to be monitored in accordance with their resource consent (Section 6.4.7).	N/A	-	✓	✓
18	Obtain or appoint an ecologist who holds a Wildlife Authorisation Permit from DOC to undertake electro fishing and a Permit from Ministry of Primary Industries (MPI) to take and translocate native fish. This will be required to undertake fish recovery in all areas to be dewatered for instream works (Section 6.4.5).	Yes	-	-	-
19	Undertake fish recovery prior to instream works commencing (Section 6.4.5).	N/A	-	✓	-
20	Review whether the culvert at HCC 8 and 13 could be replaced by a bridge or an arch culvert (Section 6.4.3).	N/A	-	✓	-

Deliverable / Task No.	Deliverable / Task	Project-wide - EMMP Implementation Plan	Project Package		
			Pre-construction	Construction	Post-construction
21	Include in the design, measures that will enable fish passage within relevant culverts in accordance with current guidelines (NIWA, 2018) (Section 6.4.3) (refer to Task 20).	N/A	✓	-	-
22	Install culverts with fish passage measures (Section 6.4.3).	N/A	-	✓	-
23	Project Engineers will design the stream re-alignment in co-ordination with Project Ecologist (Section 6.4.8).	N/A	✓	-	-
Long-tailed bats					
24	Implement the vegetation removal protocol to manage the risk that bats maybe roosting in locations not identified during the bat radio tracking. A Wildlife Authorisation Permit will **not** be obtained for these works (Section 6.5.5 & Appendix I).	Yes	✓	✓	✓
25	HCC to install up to 100 Kent bat boxes[1] or similar with predator bands to compensate for potential roost loss in the short term. Transport Agency to install up to 50 Kent bat boxes[1] or similar with predator bands to compensate for potential roost loss in the short term (Section 6.5.4.1 & Appendix H).	Yes HCC up to 100 Kent bat boxes or similar. Transport Agency up to 50 Kent bat boxes or similar	-	-	-
26	Project Ecologist to look for cavities within trees that would be of a suitable size and shape for bats that could be kept and installed as natural bat boxes (Section 6.5.4.1).	Yes	✓	-	-
27	Opportunistic installation of natural bat boxes (sourced from removed trees) with predator bands to	Yes	✓	-	-

[1]Final number is dependent on the availability of suitable trees.

Deliverable / Task No.	Deliverable / Task	Project-wide - EMMP Implementation Plan	Project Package		
			Pre-construction	Construction	Post-construction
	compensate for potential roost loss in the short term (Section 6.5.4.1 & Appendix H).		Natural box boxes found / identified by the Project Ecologist during vegetation clearance works will be installed within the Project wide restoration sites.		
28	Monitor the success (i.e. use by bats) of the man-made and natural bat boxes (year 2 and 5 after installation) (bat emergence survey or internal inspection of the roost with an endoscope) (Section 7.0).	Yes	-	-	-
29	Relocate the roost cavity of known bat roosts as a natural bat box. If the roost is beneath loose bark replace the roosting site with a Kent bat box. All replacement roosts to be located in areas known to be of value to the local bat population (Section 6.5.4.1).	Yes Sandford Park - HCC Narrows – Transport Agency Works in these areas are currently funded.	-	-	-
30	Monitor relocated bat roosts in year 1, 3 and 5, post relocation (bat emergence survey or internal inspection of the roost with an endoscope) (Section 7.0).	Yes Sandford Park - HCC Narrows – Transport Agency	-	-	-
31	Plant exotic trees within the Designation Restoration Sites. The tree species selected are fast growing and are known to produce potential roost features within 10-	Yes	-	-	-

Deliverable / Task No.	Deliverable / Task	Project-wide - EMMP Implementation Plan	Project Package		
			Pre-construction	Construction	Post-construction
	40 years. The exotic trees will compensate for potential roost loss in the medium term (Section 7.0)				
32	Design sensitive lighting including; warm white LED lights, shields on all lighting to focus light onto the road and reduced height columns at hop-overs (including where relevant on bridges) (Section 6.5.2).	N/A	✓	✓	-
33	Locate any formal cycle and pedestrian footpaths at the top of the Mangakotukutuku minimise disturbance within the gully (Section 6.5.2).	N/A	✓	-	-
34	Install any formal cycle and pedestrian footpaths at the top of the Mangakotukutuku to ensure that the gully remains dark minimise disturbance within the gully (Section 6.5.2).	N/A	-	✓	-
35	Identify and fence off safeguard zones immediately adjacent to working area to retain vegetation along the Mangakotukutuku Gully, Mystery Creek (Transport Agency) and the Waikato River that is known to be of value for bats. In addition, safeguard zones may be created around matures trees with moderate or high bat roost potential that can be retained towards the edge of the designation corridor and will be used to protect areas of early restoration planting from accidental or intentional disturbance (Section 6.5.3).	N/A	✓	-	-
36	Maintain fencing of safeguard zones adjacent to working area (Section 6.5.3).	N/A	-	✓	-
37	Plant vegetation at identified locations (Appendix B) along the Project to provide bat hop-overs or underpasses to ensure habitat connectivity is maintained and to avoid bat strike (Section 6.5.1).	Yes If undertaken outside the Project Package boundary.	✓	✓	-

Deliverable / Task No.	Deliverable / Task	Project-wide - EMMP Implementation Plan	Project Package		
			Pre-construction	Construction	Post-construction
38	Maintain bat hop-overs and underpasses while they are establishing (Section 6.3.2.1). Monitor canopy closure and weed levels. Take corrective action as required. Consider further options should interventions prove ineffective at reducing bat strike risk (Section 7.0).	Yes If undertaken outside the Project Package boundary.	-	✓	✓
39	Bridge designers to investigate, if practical (as determined by the RA), including structures on existing and proposed bridges that would work with vegetation to lift the height of bats travelling over the bridge deck and help contain light within the road corridor (Section 6.5.1).	N/A	✓	-	-
40	Undertake thermal imaging surveys at bridge sites. Consider further options to improve connectivity should interventions do not lead to the continued movement of bats along the Mangakotukutuku or Waikato River (Section 7.0).	Yes	-	-	-
41	Undertake buffer planting in areas beyond the Designation Restoration Sites which are located in areas of high value to bats. Landownership means that the delivery of restoration is confined to the road reserve (Section 6.5.4.3).	N/A	✓	✓	-
42	Implement good site and programme management practices (e.g. no works buffer around roost trees, careful placement of site cabins etc.) to avoid / minimise impacts to roosting and foraging bats as determined by the Project Ecologist and Project Manager (Section 6.5.6)..	N/A	-	✓	-
43	Implement management within the Designation, Lizard and Stream Restoration Sites (6.3.2.1).	Yes	-	-	-

Deliverable / Task No.	Deliverable / Task	Project-wide - EMMP Implementation Plan	Project Package		
			Pre-construction	Construction	Post-construction
44	Project Ecologist will undertake a review of the significant bat roosts identified during radio tracking to determine whether the installation of predator bands would be effective in the protection of the known bat roost.	Yes	-	-	-
45	Engage with private landowners who are known to have significant bat roosts on their property with a view of providing advice and financial support for them to install predator bands (Section 6.5.7).	Yes	-	-	-
46	Maintenance of bat boxes and their predator bands for the duration of the construction phase of the Project. Bands will be checked during bat box surveys (Section 6.5.9).	Yes	-	-	-
47	Monitor bat activity using Automatic Bat Monitors (ABMs) at all sites every two years for the duration of the construction phase (all stages) and for five years post operation. The methodology for this monitoring (location and period) is defined by the baseline surveys (Section 7.0).	Yes	-	-	-
48	Undertake emergence surveys at the bat boxes within Sandford Park (erected prior to the Project) in February / March post bridge vegetation clearance works and on operation of the bridges along the Mangakotukutuku Gully. The purpose of this monitoring is to determine whether bridges along the Mangakotukutuku Gully are impacting on the bats ability to commute to Sandford Park from the known maternity habitats to the south of the city (Section 7.0).	Yes	-	-	-

Deliverable / Task No.	Deliverable / Task	Project-wide - EMMP Implementation Plan	Project Package		
			Pre-construction	Construction	Post-construction
Lizards					
49	Implement phased vegetation removal in the designation corridors in grassland habitat that has been found to support copper skink (Section 6.6.6). Create log piles and piles of wooden discs within area of grassland clearance to increase habitat complexity in adjacent area provide additional refuge for displaced lizards (Section 6.6.3).	N/A	-	✓	-
50	Manage future construction sites to discourage conditions that might encourage lizards to population them (e.g. cut grass in areas where grazing is removed).	N/A	✓	✓	-
51	Identify specific Lizard Restoration Sites (Section 6.6.1) (Appendix B). The Lizard Restoration Sites are in addition to the Designation Restoration Sites.	Yes HCC (part funded by Transport Agency)	-	-	-
52	Produce Site Restoration Plan / Lizard Management Plan (Section 6.6.1)	Yes HCC (part funded by Transport Agency	-	-	-
53	Undertake restoration at lizard sites (Section 6.6.2).	Yes HCC (part funded by Transport Agency	-	-	-
54	Survey the lizard population at the Lizard Restoration Sites prior to restoration, to gain an understanding of the presence or absence of lizards (Section 5.4 & 7.0).	Yes HCC (part funded by Transport Agency	-	-	-
55	Implement pest control (including mice) within the Lizard Restoration Sites (Section 6.6.4).	Yes	-	-	-

Deliverable / Task No.	Deliverable / Task	Project-wide - EMMP Implementation Plan	Project Package		
			Pre-construction	Construction	Post-construction
56	Monitor the lizard population at the Lizard Restoration Sites. Year 3, 6 and 9 post restoration. Consider further options should interventions prove ineffective at providing lizard habitat (Section 7.0).	Yes HCC (part funded by Transport Agency	-	-	-
Birds (avifauna)					
57	Time vegetation removal to avoid peak nesting period (September – February). Note: Seasonal limitations relating to potential bat roosts should be considered (Section 6.7.3).	Yes	✓	✓	-
58	Monitor changes in bird abundance and species as a consequence of the Project. The monitoring will be undertaken in accordance with the baseline survey methodology (locations and period). The monitoring will be undertaken every two years to co-inside with the Hamilton bi-annual bird surveys. The surveys will be undertaken for the duration of the construction phase and 5 years post construction (Section 7.0).	Yes	-	-	-

1.0 Introduction

Hamilton City Council as the Requiring Authority (HCC (RA)) and the NZ Transport Agency (Transport Agency) commissioned AECOM New Zealand Limited (AECOM) to produce an Ecological Management and Monitoring Plan (EMMP) for the Southern Links Project (the 'Project').

This EMMP has been developed in consultation with the Tangata Whenua Working Group (TWWG) and representatives from Waikato Regional Council (WRC), the Territorial Authorities (HCC, Waipa District Council (Waipa DC) and Waikato District Council (Waikato DC)), the Waikato River Authority[2], the Director-General of Conservation, the Mangakotukutuku Stream Care Group Incorporated (MSCG) and the Riverlea Environment Society Inc. (RESI)[3].

The Project and consequently the designation cross the boundaries of three Territorial Authorities (TA's); HCC, Waipa DC and Waikato DC. The HCC designation conditions relate to the section of the Project under the jurisdiction of HCC (RA) (refer Figure 1 and Section 2.0). The Waipa DC and Waikato DC designations conditions relate to the section of the Project to be delivered by the Transport Agency (refer Figure 1 and Section 2.0). All references to mitigation and / or offset activities outside of HCCs jurisdiction referencing the Transport Agency are not being delivered by HCC (RA) and are not part of its designation requirements. Therefore, these activities should be viewed as recommendations to the Transport Agency and will be considered by the Transport Agency when they produce their EMMP to meet their designation conditions.

The scope of this EMMP has been determined by the HCC designation conditions for the Project and is summarised in Section 1.4. The full conditions are presented in Section 2.0 of this EMMP. A separate EMMP will be produced to meet the Transport Agency Waikato DC and Waipa DC designation conditions.

1.1 Project description

The Project is a joint initiative between HCC and the Transport Agency. It comprises approximately 21 km of state highway, two new river crossings, one bridge upgrade and 11 km of urban arterial roads as shown in Figure 1. In addition, a new wastewater network will be installed along parts of the designation corridor in advance of road construction.

[2] Waikato River Authority declined to be involved in the consultation process for Southern Links in 2017 (per com. with Grant Eccles)
[3] The designation conditions issued by Waipa District Council and Waikato District Council require consultation only with TWWG, Waikato Regional Council, the Director-General of Conservation and the Territorial Authority.

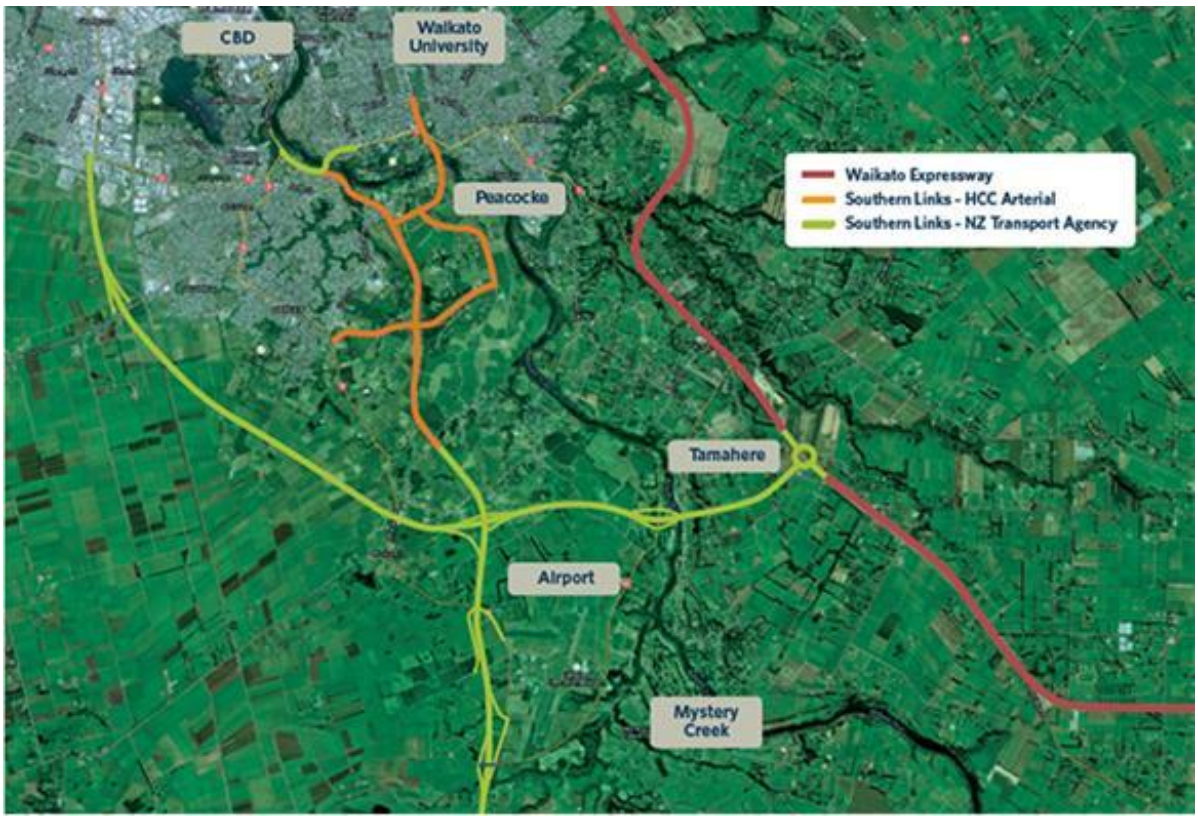


Figure 1 Southern Links Project Area.

When constructed the Project will:

- Link State Highway 1 (SH1) from Kahikatea Drive in Hamilton City to Tamahere and the Waikato Expressway in the south;
- Link State Highway 3 (SH3) from Hamilton Airport to central and east Hamilton;
- Establish a key transport network within the Peacocke Growth Cell; and
- Provide the building blocks for further urban development in the region.

The majority of the designation passes through agricultural land, although the Project will require the construction of new bridge crossings over the Waikato River and the Mangakotukutuku Stream gully.

1.2 Project delivery

HCC (RA) has secured funding for delivery of part of the Project within their jurisdiction (refer to Figure 2) during the next 10 years. The section of the Project to be delivered by the Transport Agency is currently entirely unfunded for consultation.

This EMMP has been prepared to meet the HCC designation conditions but includes recommendations to the Transport Agency to provide context for how the ecological effects of the whole Project (HCC (RA) and the Transport Agency) can be managed. This approach is taken because some of the species present within the local area e.g. long-tailed bats (*Chalinolobus tuberculatus*) have large home ranges which covers large sections of the Project area as such the management approach taken will be the same for all areas of the Project, albeit that the location and scale of the mitigation will vary.

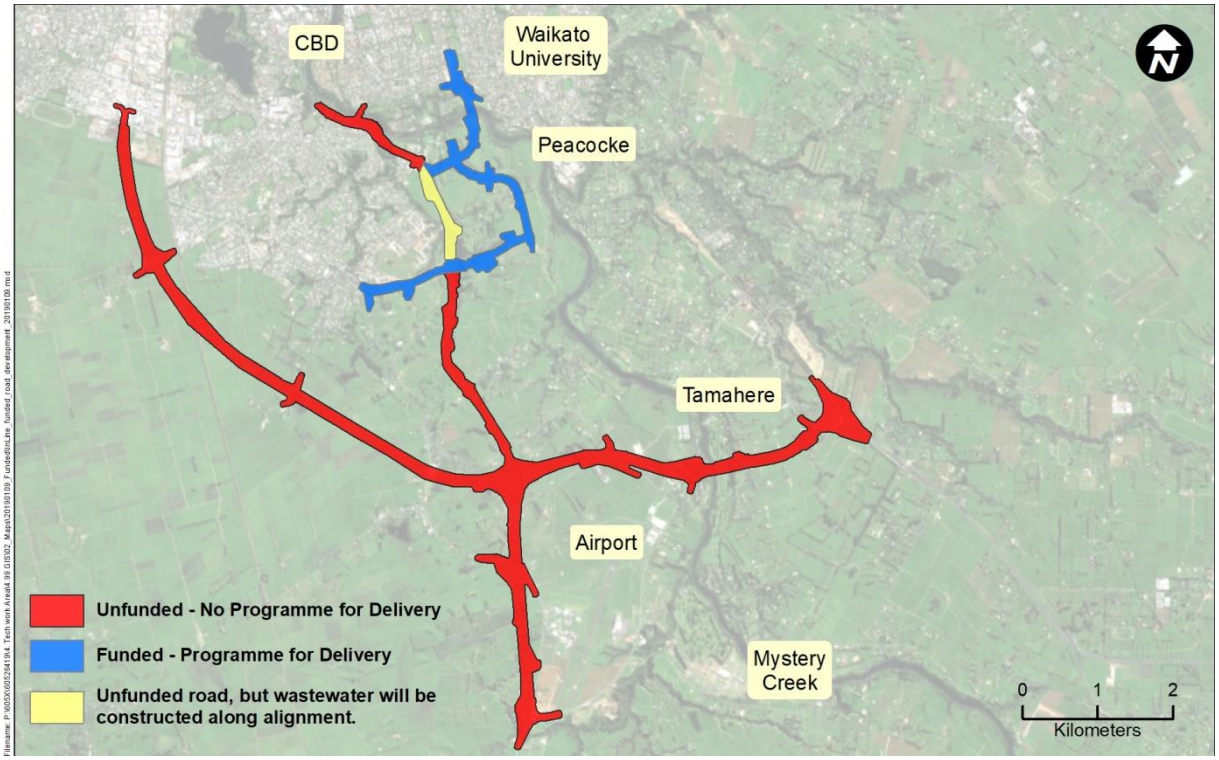


Figure 2 Illustration of the areas of the Project which are currently funded and unfunded.

1.3 Peacocke Growth Cell

The Peacocke Structure Plan provides a framework for future development and infrastructure provision for the City's southern growth cell Peacocke. The new urban growth area is to provide for a new community of approximately 20,000 people (refer to Figure 3).

The Project aims to provide the arterial transport infrastructure network incorporating three waters infrastructure that will facilitate the urbanisation of the construction of growth cell. For context this EMMP considers the development of land surrounding the road network and how this might integrate with the on mitigation proposed. However, the EMMP will not mitigate for the effects of urbanisation. Ecological mitigation for the urbanisation effects of the growth cell are expected to be delivered by developers as they move forward with each of their projects.

The survey and monitoring data collected by the Project will be shared with developers as will the approach to mitigation. It is expected that each developer will be encouraged by the regulating authority to expand upon the restoration works completed by the Project and establish habitat linkages that are beyond the influence and scope of the Project. This is the responsibility of the TA's to manage and is not a commitment that can be made by HCC (as RA).

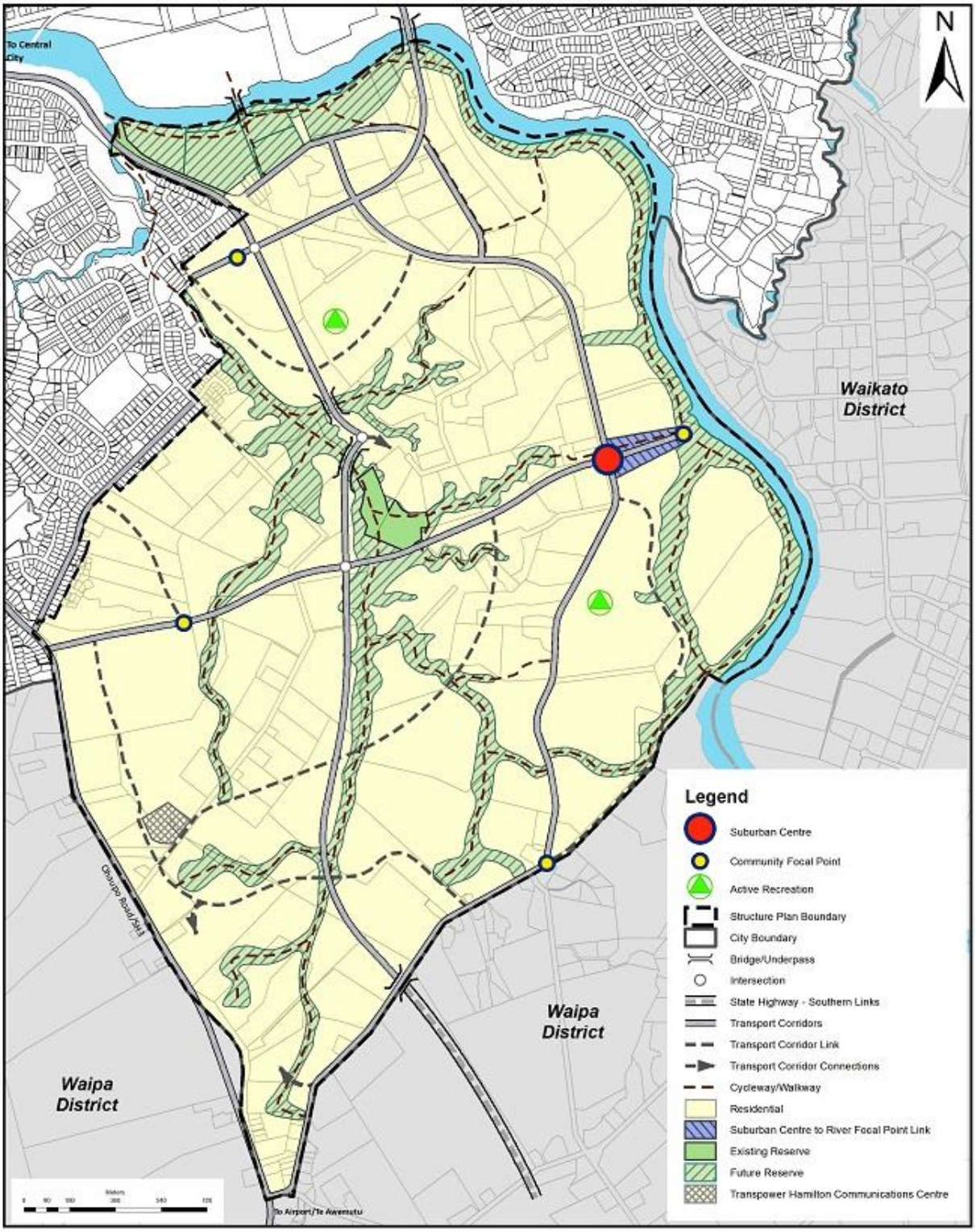


Figure 3 Peacocke Structure Plan (Hamilton District Figure 2-2, Appendix 2, Volume 2).

1.4 EMMP scope

The HCC designation conditions determine the scope of this EMMP. The over-arching objective of the EMMP is to demonstrate how HCC (as Requiring Authority) intends to achieve no net loss of terrestrial, wetland and stream biodiversity values. That over-arching objective will be achieved

through the implementation of the following scope, which in turn is informed by the requirements of conditions 15.2-15.6 of the HCC designation conditions:

- Definition of the existing ecological baseline within the designation corridor and its zone of influence, specifically in relation to long-tailed bats (bats), lizards, birds along with terrestrial, wetland and stream habitats. This baseline information has been collected in accordance with methods defined in current best practice guidance using specialists in their field including; Wildlands Consultants Ltd., AECOM and Davidson-Watts Ecology Pacific (bats), EcoGecko Consultancy Limited (lizards), AECOM (birds) and Tonkin & Taylor Ltd (T&T) (stream habitats and species);
- Detailing measures that will be implemented to mitigate for potential significant adverse ecological effects of the construction and operation activities identified within the Assessment of Environmental Effects (AEE) (Opus, 2014a), supporting material (Opus, 2014b & c) and following the collection of detailed baseline information (Wildlands 2017a, 2017b, Tonkin and Taylor Ltd. 2018, Wildlands 2018a, 2018b and Davidson-Watts Ecology Pacific 2018);
- Identification of where terrestrial and gully restoration habitat will be provided (minimum of 11.46 ha – Hamilton, 4.89 ha – Waipa and 2.19 ha – Waikato), and indicates when these restoration projects will commence. The EMMP will define the format of the Site Restoration Plans that will be produced for each restoration site;
- Inclusion of a long-term monitoring programme to allow the effects associated with the Project and at the restoration sites in relation to bats, reptiles, birds and aquatic (streams and wetlands) habitats to be monitored. Performance measures are set from the ecological baseline data which establishes trigger levels; and
- Identification of the sites where the 20-year pest control programme will be implemented around significant bat roosting sites.

It is considered that the implementation of the above scope will constitute achieving no-net-loss of terrestrial, wetland and stream biodiversity values and therefore compliance with the HCC designation conditions.

1.5 EMMP structure

The EMMP is structured as below;

- Roles and responsibilities (Section 1.6);
- Designation conditions (Section 2.0);
- Consultation response (Section 3.0);
- Baseline survey and long-term monitoring methodology (Section 4.0);
- Baseline ecological information (Section 5.0);
- Mitigation and long-term management (Section 6.0);
- Long-term monitoring (Section 7.0); and
- Performance measures, trigger levels and actions (Section 8.0).

The HCC designation conditions state that '*the EMMP shall be prepared by an appropriately qualified and experienced ecologist*/s'.

A list of the personnel who have been involved in the development of the EMMP and for supporting technical reports are presented in Appendix C. Their role in the development of the EMMP is also detailed.

1.6 Roles and responsibilities

There are a number of organisational job specific roles and associated responsibilities that are covered by this EMMP. These are detailed below.

- **HCC and the Transport Agency as requiring authority** - responsible for providing the EMMP and supporting documentation to their contractors. They are responsible for ensuring that their consultants and contractors understand the content of the documentation and what their role will be in delivering ecological mitigation measures. Ultimately it is HCC (and the Transport Agency's) responsibility if one of their consultants and contractors undertakes works in accordance with directions that has a negative effect on native ecology. Share ecological survey information and proposed mitigation with developers associated with the Peacocke Growth Cell;
- **HCC Project Manager** – responsible for co-ordinating interactions between the RA and the main contractor. Responsible for ensuring that the main contractor has access to all documentation or data required to meet the requirements of the EMMP. Responsible for ensuring that the Project Ecologist is being involved in all aspects of the Project as required by the EMMP. Responsible for ensuring that all ecological mitigation works considered to be part of the EMMP Implementation Plan are delivered.
- **Main Contractor (including their subcontractors)** - responsible for ensuring that they fully understand the requirements for delivering this EMMP, and it's supporting documentation. They will be responsible for ensuring that all of their staff are aware of the requirements of the EMMP. The competent contractor will work closely with the Project Ecologist to ensure that an ecologist is present to provide supervision as required, in accordance with the EMMP;
- **Main Contractor Project Manager** – responsible for co-ordinating interactions between the main contractor and their subcontractors with the RA. Responsible for ensuring that all contracting personnel are aware of their obligations in relation to the EMMP. Responsible for ensuring that the Project Ecologist is involved in all aspects of the Project as required by the EMMP. Responsible for ensuring that all ecological mitigation works considered to be part of the Project Packages are delivered.
- **Project Ecologist** - responsible for working with the Contractors, Project Engineers, Project Landscape Architect and Council compliance staff to ensure compliance with the requirements of the EMMP, Regional Consents and Permits (DOC and Ministry of Primary Industries (MPI)). The Project Ecologist will need to have the competencies to undertake the works specified within the EMMP. It is anticipated that the Project Ecologist role may be filled by a number of individuals with certain species specific skill sets;
- **Design Consultant (Project Engineers)** - responsible for developing an understanding of the ecological requirements and for seeking solutions that meet the requirements of the EMMP while remaining within budget of the Project;
- **Project Landscape Architect -** responsible for taking into consideration the requirements of the EMMP and for seeking ways in which this can be complemented by the wider landscape plantings;
- **Project Arboriculturalist** – responsible for working with the Contractor and the Project Ecologist during the removal of vegetation to ensure compliance with the requirements of the EMMP, while undertaking works in accordance with Health and Safety requirements;
- **Pest Control Contractor** – responsible for the delivery of pest control within all of the Designation Restoration Sites, Lizard Restoration Sites and significant roosting sites located on land within HCCs ownership. The contractor is responsible for monitoring pest levels to identify if they are below target level. If this is not the case it is their responsibility to indicate to HCC (or the Transport Agency) how the pest control should be adjusted to achieve target levels; and
- **Council's Regulatory Staff** - responsible for reviewing the implementation of the EMMP and providing guidance if it is determined that there may be a need for a change in approach.

1.7 Programme for EMMP delivery

At the current time funding is not available for delivery of the full Project. Figure 2 illustrates the packages of the Project that are currently provided for within the Hamilton City Council 10-Year Plan 2018-28.

The construction of NZ Transport Agency components of Southern Links is not provided for in the current Regional or National Land Transport Plans.

The four distinct Project Packages related to road construction over the next 10 years are summarised in Table 2.

Table 2 Delivery of Project over the next 10 years broken down by Project Package.

Southern Links Transportation Project Package	Expected Commencement FY	Expected Completion FY
SH3 Intersection, East-West Arterial Road Stage 1	end of 2019	mid 2021
Wastewater infrastructure along the north-south major arterial	end of 2019	mid 2024
Wairere Drive Extension and Waikato River Bridge	end of 2020	mid 2023
Peacocke Road urban upgrade	end of 2021	mid 2023
East-West Arterial Road Stage 2	end of 2022	mid 2024

Construction of the North-South major arterial component of Project is not provided for within the current 10-Year Plan period.

This EMMP will be implemented by each of the Project Packages, which will deliver all sections of the Project within HCC jurisdiction as specified by the designation (not all sections are listed in Table 2). Implementation has already commenced with 1.74ha of gully restoration work at 104 Hall Road undertaken in 2017 which was jointly funded by Waikato Regional Council (WRC) and the Project in support of the Mangakotukutuku Stream Care Group (MSCG) and landowner. The Project in due course will acquire this land and assume management, monitoring, pest and Pest control of the site.

Further implementation of the EMMP will commence following its certification. HCC (as RA) will prepare a detailed programme for implementing the EMMP as part of a separate operational document - EMMP Implementation Plan. This will be made available to the TA's once complete and kept up-to-date to reflect that. A delivery and operation document will be regularly updated.

This EMMP includes various interventions or approaches to mitigation of Project effects. Some can be directly linked to pre-implementation, construction and operational phases for each package. Others are project-wide interventions that will not align solely to any particular package. These will instead follow their own independent programme. For example, detailed site-specific restoration plans, procurement and delivery of the Designation, Lizard and Stream Restoration Sites will only occur once the EMMP has been certified to provide HCC (as RA) certainty with respect to its ecological investments. The ability to deliver is fundamentally linked to the availability of the restoration sites. Some of these sites are in private ownership but are subject to acquisition processes under the Public Works Act. Land that HCC currently has ownership over is set out in Figure 4.

This will ensure ecological mitigation is happening in advance of the significant packages of the Project construction activities.

For completeness, the Wairere Drive / Cobham Drive interchange project currently underway is part of the Project designation however an alteration to condition 15.2 (amended 2 March 2018) ring-fenced that project from the EMMP requirements by providing for its own separate response to ecological effects.

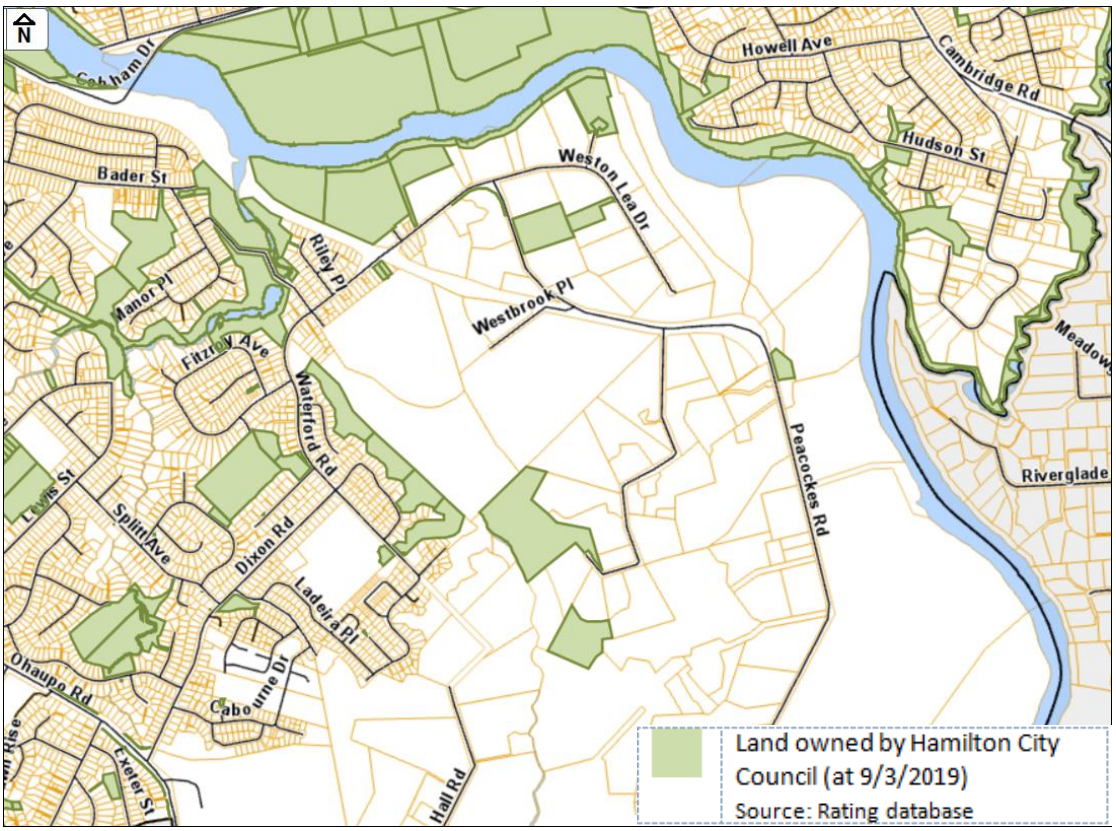


Figure 4 Current HCC landownership.

Note: Figure 4 includes all reserves, land held for road, Water Treatment Plant, Hamilton Gardens, but not formed public roads.

2.0 Designation Conditions

2.1 Introduction

The Project crosses the boundaries of three TA's; HCC, Waipa DC and Waikato DC. Therefore, designation conditions for each Territorial Authority were prepared in relation to the Project.

The conditions relating to the EMMP are similar in content, but the condition numbering differs between designations:

- HCC - designation conditions 15.1 – 15.7 *(relevant to this EMMP)*;
- Waikato DC – designation condition 17.1 – 17.7; and
- Waipa DC – designation condition 21.1 – 21.7.

2.2 Designation conditions

Table 3 presents the designation conditions in relation to the EMMP. For completeness and because the EMMP conditions are similar for each TA, the table shows which TA the condition relates to and which EMMP section is applicable to meet that condition.

Table 3 Designation conditions for the Project.

Item	Designation Condition Summary	HCC	Waipa DC	Waikato DC	Response within EMMP
1	The Requiring Authority shall, after consultation with the TWWG, Waikato Regional Council, the Territorial Authority and the Director-General of Conservation, develop an Ecological Management and Monitoring Plan (EMMP).	✓ 15.1	✓ 21.1	✓ 17.1	Section 3.0 and Table 36
2	HCC has a requirement to consult with the Waikato River Authority, the Mangakotukutuku Stream Care Group Incorporated and the Riverlea Environment Society, during the development of the EMMP.	✓ 15.1	✗	✗	Section 3.0 and Table 3
3	The EMMP shall be prepared by an appropriately qualified and experienced ecologist/s.	✓ 15.1	✓ 21.1	✓ 17.1	Appendix C
4	The EMMP shall be submitted to the Territorial Authority's Chief Executive or nominee, for certification. The EMMP must be submitted for certification within **three (3) years** after the date on which the designation is included in the Operative or Proposed District Plan or at least forty (40) working days prior to the commencement of Construction Works, whichever event occurs earlier in time.	✓ 15.2	✗	✗	2019 for HCC
5	The EMMP shall be submitted to the Territorial Authority's Chief Executive or nominee, for certification. The EMMP must be submitted for certification within **ten (10) years** after	✗	✓ 21.2	✓ 17.2	2026 for Transport Agency

Item	Designation Condition Summary	HCC	Waipa DC	Waikato DC	Response within EMMP
	the date on which the designation is included in the Operative or Proposed District Plan or at least forty (40) working days prior to the commencement of Construction Works, whichever event occurs earlier in time.				
6	The EMMP shall include performance measures, actions, methods, trigger levels and monitoring programmes designed to achieve the objectives specified below.	✓ 15.2	✓ 21.2	✓ 17.2	Methods - Section 4.0 Monitoring – Section 7.0 Performance measures, actions and triggers levels – Section 8.0
7	The objectives of the EMMP shall be to demonstrate how the Requiring Authority (HCC or Transport Agency) intends to achieve no-net-loss of terrestrial, wetland and stream biodiversity values.	✓ 15.2	✓ 21.2	✓ 17.2	Section 2.3
8	It (EMMP) shall provide details on how monitoring, management and mitigation of the significant adverse effects of construction activities and Project operation is to be undertaken, including but not limited to effects on: a. Long-Tailed Bats, with the aim of enhancing long-tailed bat habitat; b. Avifauna, with the aim of enhancing the extent and quality of habitat for native species; c. Lizards, with the aim of enhancing the extent and quality of habitat for native species; and d. Indigenous vegetation, aquatic and wetland values, with the aim of restoring indigenous vegetation to the gullies and margins of the Waikato River in accordance with the objectives and policies of the Hamilton Gully Reserves Management Plan: 2007 (or its successor) as these relate to biodiversity, with the species and composition of vegetation restored reflecting as far as possible the natural ecosystems that were likely	✓ 15.2	✓ 21.2	✓ 17.2	Section 6.0 and 7.0

Item	Designation Condition Summary	HCC	Waipa DC	Waikato DC	Response within EMMP
	to be originally representative of gully systems and riparian margins of the Waikato River as defined in Clarkson & Clarkson (1997).				
9	The EMMP shall set out the methodologies and processes that will be used to achieve these objectives and shall include, but will not be limited to: a. Ecological management i. vegetation and habitat management; ii. management of effects on long-tailed bats, avifauna and lizards. a. Ecological monitoring b. Habitat restoration/offset mitigation on the following basis: i. A minimum 1:1 restoration ratio for areas of gully, bat habitat and river margin affected by the designation (including habitat dominated by exotic vegetation). ii. A minimum 3:1 restoration ratio for significant indigenous habitats (including indigenous forests, wetlands, seeps and springs) affected by the designation.	✓ 15.3	✓ 21.3	✓ 17.3	Section 6.0
10	The total area to be restored based on the ratio in (i) and (ii) above shall be a minimum of - 11.46 hectares Hamilton, 2.19ha Waikato and 4.98ha Waipa.	✓ 15.3 (c ii)	✓ 21.3 (c ii)	✓ 17.3 (c ii)	Section 6.0
11	Gully habitat restoration proposed by the EMMP shall generally align with Wall, K and B.D. Clarkson 2006: Gully restoration guide: a guide to assist in the ecological restoration of Hamilton's gully system. Third Revised Edition. Hamilton City Council (or an updated version).	✓ 15.3 (c iii)	✓ 21.3 (c iii)	✓ 17.3 (c iii)	Appendix J
12	Options for habitat restoration shall include consideration of Sites 8, 10 and 11 identified in Annexure 2 of Mr John Turner's evidence in chief.	✗	✓	✗	Section 6.0
13	Animal Pest Control, undertaken for a period of twenty (20) years, at known significant roost sites (significant roost sites being maternity roost sites or	✓ 15.3 (c iv)	✓ 21.3 (c iv)	✓ 17.3 (c iv)	Section 6.5.7 and 6.5.8

Item	Designation Condition Summary	HCC	Waipa DC	Waikato DC	Response within EMMP
	other roost sites used by multiple bats on a regular basis). Any measures implemented must be determined by an Animal Pest Control specialist as having a reasonable prospect of being effective. The duration or nature of Animal Pest Control in accordance with this condition can be altered should monitoring of the Animal Pest Control demonstrate that it is ineffective, or to allow alternative Animal Pest Control approaches to be trialled. Any alteration to the duration or nature of Animal Pest Control shall necessitate a review of the EMMP in accordance with condition 15.7 Hamilton, 17.7 Waikato and 21.7 Waipa.				
14	The EMMP shall include the identification of areas and timeframes for establishment of advance restoration / mitigation planting, as far as practicable ahead of construction activities taking into account land ownership, accessibility and the timing of available funding;	✓ 15.4 (a)	✓ 21.4 (a)	✓ 17.4 (a)	Section 1.7 and 6.0
15	The EMMP shall include consideration of opportunities to integrate existing restoration planting on public or private land with the restoration/mitigation planting to be undertaken as part of this designation in order to enhance ecological benefit;	✓ 15.4 (b)	✓ 21.4 (b)	✓ 17.4 (b)	Section 6.3.1.2
16	This (*in relation to Item 15*) shall include but not be limited to the restoration planting undertaken to date adjacent to the Mangakotukutuku Stream and on the following private properties: • Lot 2 DPS 83799 (M & M Shaw). • Lot 2 DP 313598 (G James).	✓ 15.4 (b)	✗	✗	Section 6.3.1.2
17	Or, this (*in relation to Item 15*) shall include but not be limited to the restoration planting undertaken to date on the following private properties: • Lot 1 DP 368405 (P and B Bevan). • Lot 1 DP 445431 (T and K Keyte).	✗	✗	✓ 17.4 (b)	Section 6.3.1.2
18	The EMMP shall include identification of areas and timeframes for establishment of incremental restoration / mitigation planting to be	✓ 15.4 (c)	✓ 21.4 (c)	✓ 17.4 (c)	Section 1.7 and 6.0

Item	Designation Condition Summary	HCC	Waipa DC	Waikato DC	Response within EMMP
	undertaken as property is acquired by or vested in the Territorial Authority through the Public Works Act or the Resource Management Act;				
19	The EMMP shall include provision for the coordination of construction works and environmental protection and restoration programmes;	✓ 15.4 (d)	✓ 21.4 (d)	✓ 17.4 (d)	Section 1.7
20	The EMMP shall include provision for the engagement of suitably qualified and experienced ecologists to develop appropriate procedures to manage effects on long-tailed bats, avifauna, and lizards, where habitats are affected;	✓ 15.4 (e)	✓ 21.4 (e)	✓ 17.4 (e)	Section 1.6 and Appendix C
21	The EMMP shall include the nature of any weed and / or pest control considered appropriate (timing, extent and location) in restoration / mitigation planting areas;	✓ 15.4 (f)	✓ 21.4 (f)	✓ 17.4 (f)	Section 6.3.2.1
22	The EMMP shall include the nature and extent of stock proof fencing (if required) that is to be established around the boundaries of restoration / mitigation planting areas;	✓ 15.4 (g)	✓ 21.4 (g)	✓ 17.4 (g)	Appendix J
23	The EMMP shall include provisions, where practicable, for the salvage of elements of indigenous flora and fauna that is being destroyed as a result of the construction of the Project and its translocation to appropriate restoration areas; and	✓ 15.4 (h)	✓ 21.4 (h)	✓ 17.4 (h)	Section 6.3.1.2, 6.5.4.1 and 6.5.5
24	The EMMP shall include provisions to ensure all restored areas are legally protected in perpetuity, where practicable.	✓ 15.4 (i)	✓ 21.4 (i)	✓ 17.4 (i)	Section 6.3.2.2
25	The EMMP provisions for Long-tailed Bat Management shall include, but not be limited to, the following: a) Details of measures to avoid, minimise and monitor roost removal and habitat loss (including specific minimum standards determined by a recognised bat ecologist for roost tree identification and monitoring of roost trees before their removal, recognising the limitations for determining roost tree occupancy in some situations), as well as habitat replacement and enhancement;	✓ 15.5 (a)	✓ 21.5 (a)	✓ 17.5 (a)	Section 6.5
26	b) Details of the provision of alternative roosting sites (including	✓ 15.5	✓ 21.5	✓ 17.5	Section 6.5

Item	Designation Condition Summary	HCC	Waipa DC	Waikato DC	Response within EMMP
	suitable indigenous or exotic trees for roost habitat, their ongoing management to enhance their roosting potential (for example, encouraging cavity formation or providing artificial bat houses), with artificial roosts installed as far in advance of construction as possible;	(b)	(b)	(b)	
27	c) Details of measures to minimise habitat fragmentation and alteration to bat movement (e.g. creating possible bat crossing points such as a bridge/ tunnels/ culverts; reducing the effect of road lighting by creating 'dark zones' at key bat habitats, aligning streetlights in certain ways or installing baffles on lighting columns to reduce the 'spill' of light away from the road);	✓ 15.5 (c)	✓ 21.5 (c)	✓ 17.5 (c)	Section 6.5
28	d) The establishment of buffer zones and hop overs along the Project route in advance of construction (where feasible), during and after construction to encourage bat avoidance of the road and maintaining important bat flyway navigational references, if deemed appropriate by a recognised bat ecologist;	✓ 15.5 (d)	✓ 21.5 (d)	✓ 17.5 (d)	Hop-overs - Section 6.5.1 Buffer zones - 6.5.6 Buffer habitat - Section 6.5.4.3
29	e) Details of measures to minimise disturbance from construction activities within the vicinity of any active roosts that are discovered until such roosts are confirmed to be vacant of bats, as determined by a recognised bat ecologist using current best practice;	✓ 15.5 (e)	✓ 21.5 (e)	✓ 17.5 (e)	Section 6.5.6
30	f) Details of ongoing monitoring and reporting of bat activity, including the establishment of adequate baseline survey and post construction monitoring to identify and assess changes in bat activity and behavioural patterns that may occur as a result of construction and operation of the Project network at all locations where bats are detected. The specific priority objectives of monitoring shall include: i) Determining the effects of lighting and roads on the movement of bats and what other key potential barriers (e.g. bridges, embankments) are to movement;	✓ 15.5 (f)	✓ 21.5 (f)	✓ 17.5 (f)	Section 5.0 and Section 7.0.

Item	Designation Condition Summary	HCC	Waipa DC	Waikato DC	Response within EMMP
	ii) Monitoring to gauge the effectiveness of the Animal Pest Control; and iii) Identification, protection and ongoing monitoring of key habitats (e.g. maternal roosting sites and foraging sites).				
31	g) Specific minimum standards as determined by a suitably qualified bat ecologist for minimising disturbance associated with construction activities around active roosts within the footprint of the Project or its vicinity that do not require removal. This includes the preparation of a pre-tree felling protocol following consultation with the Department of Conservation. The purpose of the pre-tree felling protocol shall be to avoid the injury or mortality of roosting long-tailed bats; and	✓ 15.5 (g)	✓ 21.5 (g)	✓ 17.5 (g)	Vegetation removal protocol - 6.5.5 Section 6.5.6
32	h) Monitoring shall be carried out over the long-tailed bat breeding season and peak activity period (beginning of November to the end of April), first commencing two (2) years prior to Construction Works starting, and continuing during construction and five (5) years post construction for the first stage of the Project, and shall ensure adequate site coverage incorporating all potential roosting and foraging habitats as well as suitable control sites. The timeframes for the monitoring in accordance with this condition shall only be triggered with respect to the first stage of Construction Works for any part of the Project. The pre-construction monitoring can be carried out without a certified EMMP being in place.	✓ 15.5 (h)	✓ 21.5 (h)	✓ 17.5 (h)	Section 4.0 and 7.0.
33	The EMMP shall outline the aquatic surveys to be undertaken by a suitably qualified and experienced ecologist/s prior to lodgement of resource consent applications with the Regional Council. These shall include, but will not be limited to: a) Fish surveys of waterways (including drains and wetlands) using a recognised protocol prior to stream crossing design to determine the fish community and therefore likely fish passage and fish recovery requirements where culverts are to be	✓ 15.6 (a)	✓ 21.6 (a)	✓ 17.6 (a)	Section 4.0

Item	Designation Condition Summary	HCC	Waipa DC	Waikato DC	Response within EMMP
	installed; and times when instream works are to be avoided so as not to adversely impact on peak periods of fish migration and spawning; and				
34	b) Surveys to determine aquatic quality and character of habitats impacted by stream crossings where instream habitats will be impacted (e.g. culverts) so that an appropriate methodology can be used to mitigate loss of ecological value that has not already been accounted for by advanced mitigation restoration (e.g. presence of mudfish.	✓ 15.6 (b)	✓ 21.6 (b)	✓ 17.6 (b)	Section 4.1.2 and 4.2
35	The Requiring Authority may review the EMMP at any time to make provision for the future grant of resource consents required to authorise components of the Project, and any staging of construction of the Project network, within Hamilton City. The Requiring Authority shall consult with the TWWG, Waikato Regional Council, the Territorial Authority, the Waikato River Authority, the Director-General of Conservation, the Mangakotukutuku Stream Care Group Incorporated, the Riverlea Environment Society and the NZ Transport Agency in preparing any review to the EMMP. The Requiring Authority shall submit any review of the EMMP to the Territorial Authority's Chief Executive for certification.	✓ 15.7	✗	✗	Section 3.0
36	**Or** the NZ Transport Agency may review the EMMP at any time to make provision for the future grant of resource consents required to authorise components of the Project, and any staging of construction of the Project network, within Waikato District. The Requiring Authority shall consult with the TWWG, Waikato Regional Council, Hamilton City Council, the Director-General of Conservation and the Territorial Authority in preparing any review to the EMMP. The NZ Transport Agency shall submit any review of the EMMP to the Territorial Authority's Chief Executive for certification.	✗	✗	✓ 17.7	Section 3.0
37	**Or** the NZ Transport Agency may review the EMMP at any time to make provision for the future grant of resource consents required to	✗	✓ 21.7	✗	Section 3.0

Item	Designation Condition Summary	HCC	Waipa DC	Waikato DC	Response within EMMP
	authorise components of the Project, and any staging of construction of the Project network, within Waipa District. The Requiring Authority shall consult with the TWWG, Waikato Regional Council, Hamilton City Council, the Director-General of Conservation and the Territorial Authority in preparing any review to the EMMP. The NZ Transport Agency shall submit any review of the EMMP to the Territorial Authority's Chief Executive for certification.				

2.3 Interpretation of no-net-loss

As indicated above in Section 2.2 (Item 7 and 8), the designation conditions state the objectives of the EMMP shall be to demonstrate how the Requiring Authority (Hamilton City Council or NZ Transport Agency) intends to achieve '**no-net-loss'** of terrestrial, wetland and stream biodiversity values.

The EMMP is required to provide details on how monitoring, management and mitigation of the significant adverse effects of construction activities and Project operation is to be undertaken, including but not limited to effects on:

a. *Long-Tailed Bats, with the aim of enhancing long-tailed bat habitat;*

b. *Avifauna, with the aim of enhancing the extent and quality of habitat for native species;*

c. *Lizards, with the aim of enhancing the extent and quality of habitat for native species; and*

d. *Indigenous vegetation, aquatic and wetland values, with the aim of restoring indigenous vegetation to the gullies and margins of the Waikato River in accordance with the objectives and policies of the Hamilton Gully Reserves Management Plan: 2007 (or its successor) as these relate to biodiversity, with the species and composition of vegetation restored reflecting as far as possible the natural ecosystems that were likely to be originally representative of gully systems and riparian margins of the Waikato River as defined in Clarkson & Clarkson (1997).*

To provide clarity in relation to the interpretation of '**no-net-loss'**, the following documents were consulted:

- Department of Conservation. (2014). Guidance on Good Practice Biodiversity Offsetting in New Zealand; and
- Biodiversity Working Group. (2018). Biodiversity Offsetting under the Resource Management Act: A Guidance Document.

In 2014 '**no-net-loss'** was defined by DOC as – *the point at which biodiversity gains from targeted biodiversity management activities match the losses of biodiversity due to the impacts of a specific development project, so that there is not net reduction in the type, amount (quality) of biodiversity.*

In 2018 '**no-net-loss'** was defined by the Biodiversity Working Group as – *offsets aims to return biodiversity values to the point they would be without development impacts or the offset. A successful no-net-loss biodiversity offset does not halt the decline of biodiversity as it only provides biodiversity gains which are equivalent to losses, and only for the elements of biodiversity targeted in the exchange.*

The offsetting guidelines 2014 and 2018 go on to define '**net gain**' in contrast to '**no-net-loss'**. '**Net gain'** is described as an offset that would generate biodiversity values that are greater than the existing situation. The designation conditions indicate that habitat for bats, avifauna and lizards should be enhanced and that the extent and quality of habitat for avifauna and lizards should be increased.

Section 6.0 of this report presents the mitigation measures that will be implemented to meet the objectives and aims of the designation conditions and represents how '**no-net-loss',** including the enhancement of habitat for bats, avifauna and lizards, will be achieved.

3.0 Consultation

3.1 Introduction

The designation conditions require that consultation is undertaken with the organisations listed during the development of the EMMP.

HCC, Waipa DC and Waikato DC designation conditions;

- TWWG;
- WRC;
- TA's - HCC, Waipa DC and Waikato DC; and
- Director-General of Conservation.

HCC designation conditions only;

- MSCG;
- RESI; and
- Waikato River Authority.

Two rounds of consultation have been undertaken during the development of this EMMP. The purpose of the consultation was;

- to provide the consultees with the results collected from detailed species surveys;
- to obtain information that the consultees may hold in relation to habitats and species within the study area;
- to obtain feedback in relation to concerns or ideas that they have in relation to the Project; and
- to present options for mitigation as they are being developed and obtain feedback.

A summary of the comments obtained are provided within Appendix D. Detailed minutes are provided in Appendix E.

4.0 Survey Methodology

The designation conditions require the Project to establish a means of assessing whether 'no-net-loss' in biodiversity has been achieved. To complete this assessment, it is necessary to establish the existing baseline for native habitats and species within the zone of influence of the Project. It is against this baseline that changes in extent / distribution and abundance of species can be compared over time and consequently whether the Project has attained its objective of 'no-net-loss'.

The survey methodologies presented below were designed to establish a baseline and also to provide a method by which long term monitoring would be delivered. These have been designed in line with current best practice and in order to enable the detection of any variation from the baseline that would then require consideration of potential remedial actions where changes are a consequence of effects of the Project.

4.1 Habitats

4.1.1 Terrestrial and wetland habitats

A terrestrial and wetland habitat survey was completed by Opus in 2014 (Opus, 2014a). The objective of the survey was to identify sites of ecological value within the designation corridor. The survey followed the methodology described by Cornes *et al* (2012), which included;

- A description of vegetation and habitat including a list of dominant plant species;
- An assessment of ecological value against the Criteria in Table 11-1 of the Proposed Regional Policy Statement (PRPS) as drafted in 2014;
- The diameter at breast height (dbh) of significant trees at each site was recorded;
- A record of birds heard or observed during the site visit;
- An assessment of habitat potential for lizards; and
- Photographs and maps for each location.

The survey covered all areas of mature vegetation including riparian habitat along the Waikato River, gullies (including wetlands) and scattered patches of forest, within the designation corridor of the Project.

All vegetation types at the survey sites were mapped to show location and extent. This allowed for spatial extent and quantity of habitat loss as a result of the Project to be calculated.

In 2017 AECOM undertook a walkover to assess whether the condition of the habitats described by Opus in 2014 had changed significantly.

Refer to Opus, 2014 for the detailed survey methodology.

In 2017 Morphum undertook surveys within the Mangakotukutuku Gully to guide the development of the Integrated Catchment Management Plan (ICMP) for this catchment. As part of these survey works Morphum mapped and described the wetland habitat present within the catchment, which built on the information collected by Opus. The location of wetland habitat was presented in Tonkin & Taylor Ltd (T+T) 2017 Aquatic Assessment Report (T+T, 2017). A description of the habitat is presented in Appendix A of this EMMP.

4.1.2 Stream habitats

Stream ecological assessments were undertaken by T+T in 2017 (T+T, 2017). Assessment sites were located along the proposed Southern Links alignment where the preliminary design indicated that stream habitats would be impacted by crossings, filling and/or stormwater ponds (refer to Figure 5).

The assessments included the collection of habitat data using the Stream Ecological Valuation (SEV) methodology (Story *et al.* 2011) and WRC Wadeable Stream Habitat Assessment Methodology (WRC, 2005a). Water quality and sediment samples were also taken in accordance with the methodology specified by Stark *et al*. 2001 & WRC 2005a.

The WRC habitat assessment method produces a total score between 9 (low quality) and 180 (high quality), while the SEV method produces a total score between 0 (low quality) and 1 (high quality).

T+T also undertook macro-invertebrate and fish surveys, which are described further in Section 4.2 of this EMMP.

Refer to T+T, 2017 for the detailed survey methodology (refer to Section 4.1.1 for survey methodology of wetlands).

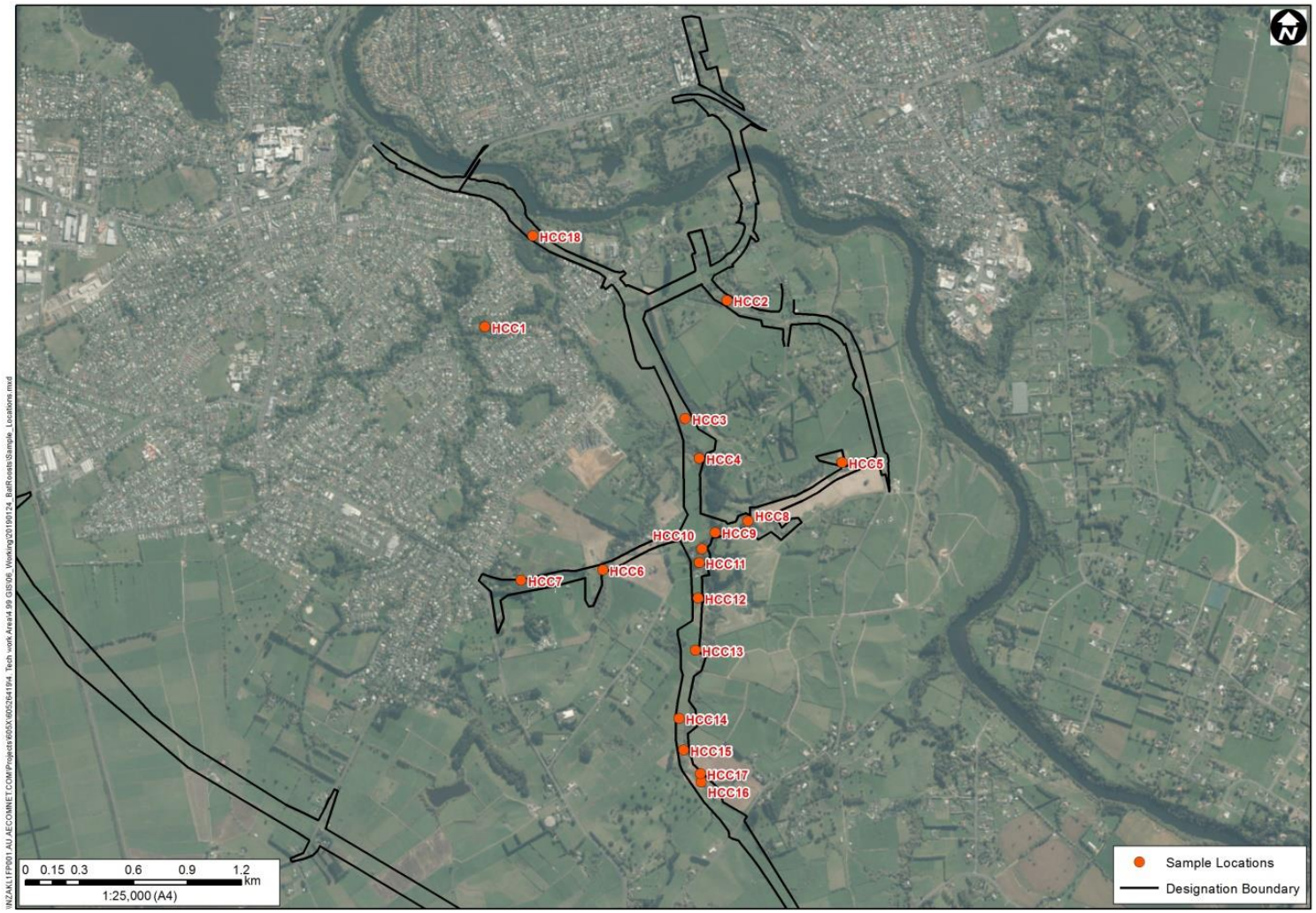


Figure 5 Location of streams monitored

4.2 Freshwater fauna

The stream ecological surveys undertaken by T+T in 2017 included macro-invertebrate and fish surveys (T+T, 2017).

Macro-invertebrate sampling was undertaken in accordance with protocols C1 (hard bottomed) or C2 (Soft bottomed) described in Stark *et al.* (2001) and WRC (2005a). All samples were processed by Stark Environmental Ltd., Nelson.

Freshwater fish surveys were completed in accordance with the New Zealand freshwater fish sampling protocols for wadeable rivers and streams Joy *et al.* (2013). Fish surveys were undertaken by electric fishing or the netting/trapping methodology. All electric fishing surveys involved a single pass along a 150 m reach at each survey site. Sites where netting was used were surveyed using a total of six baited fyke nets and 12 un-baited Gee-Minnow traps. Nets/traps were set overnight and cleared the next morning.

At the scoping stage of the surveys T+T reviewed the potential for black mudfish (*Neochanna diversus*) to be present within the study area, as specified within the designation conditions. It was concluded that the habitat within the study area, was of low suitability for this species. The fish survey (using Gee-Minnow traps) undertaken in the catchment did include areas considered to have low potential for black mudfish by T+T (including HCC 16 and 17) (Figure 6). Mudfish were not identified to be present during these surveys. However, there are other areas within the catchment with low potential that were not surveyed.

To remove the risk that an isolated population of mudfish could be present further survey is proposed, which will be completed to support Resource Consent applications. This EMMP presents the survey methodology as required by Designation Condition 15.3. The survey will be completed in accordance with Ling et al. (2013), Figure 6 presents the areas that will be surveyed as they were identified by T+T to have the potential to support mudfish, based on previous survey work, and that these habitats could be or will be directly impacted by the Project. If mudfish are identified, then appropriate mitigation would need to be developed. This would be provided as an addendum to the EMMP.

Refer to T+T, 2017 for the detailed survey methodology.

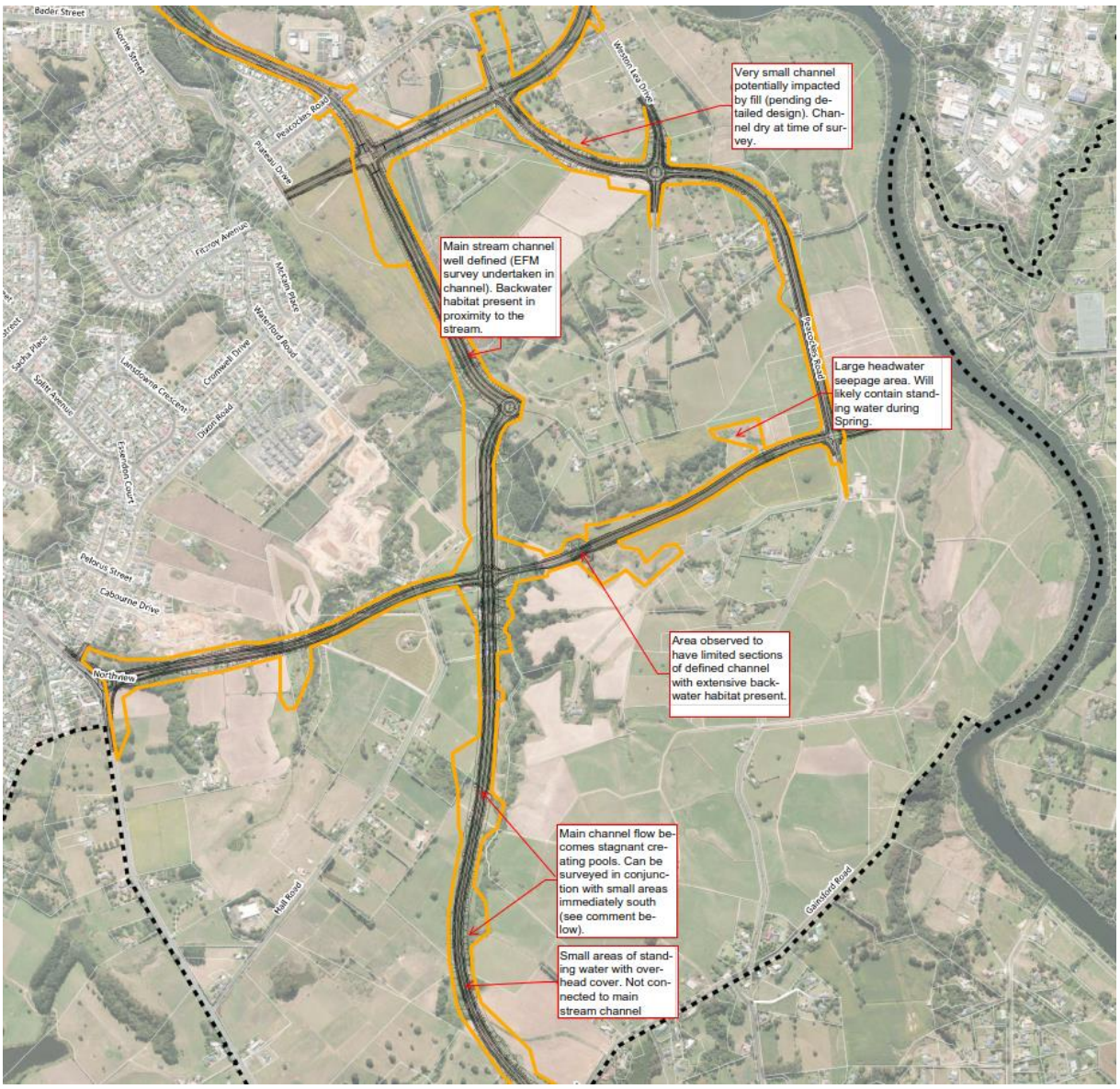


Figure 6 Location of potential mudfish habitat within the designation boundary.

4.3 Bats

4.3.1 Acoustic monitoring

Acoustic monitoring of bats was undertaken by Wildlands Consultants Ltd in 2017a and 2018a. An acoustic survey is currently underway for 2019 (Wildlands, 2017a & 2018a)[4].

Acoustic monitoring involved the detection of bat echolocation calls using ultrasound detectors known as Automated Bat Monitoring units (ABMs). Monitoring site selection and monitoring setup was undertaken to assess changes in activity in relation to the Project and to monitor at bat roost locations identified prior to 2017.

Along the alignment of the proposed transport corridor, paired sites (e.g. 'road sites' 7a & b) were established with one ABM close (e.g. site 7a) to the proposed transport corridor and the second located 200m away (e.g. site 7b) (refer to Figure 7). This allows for long term impacts of the Project on bats to be assessed before, during and after construction.

[4] The results of this survey are not required in order to process the certification of the EMMP.

At confirmed or possible long-tailed bat roosts, identified prior to 2017, within the zone of influence of the Project, ABMs were placed along forest edges within the vicinity of the roosts.

The ABMs were placed on site from January – March each year (2017, 2018) with the objective of capturing data for a minimum of 21 nights.

At each ABM site noise (sound) and light levels were measured once during the survey period to assess if a change in noise or light levels could impact bat activity.

Refer to Wildlands 2017a and 2018a for the detailed survey methodology

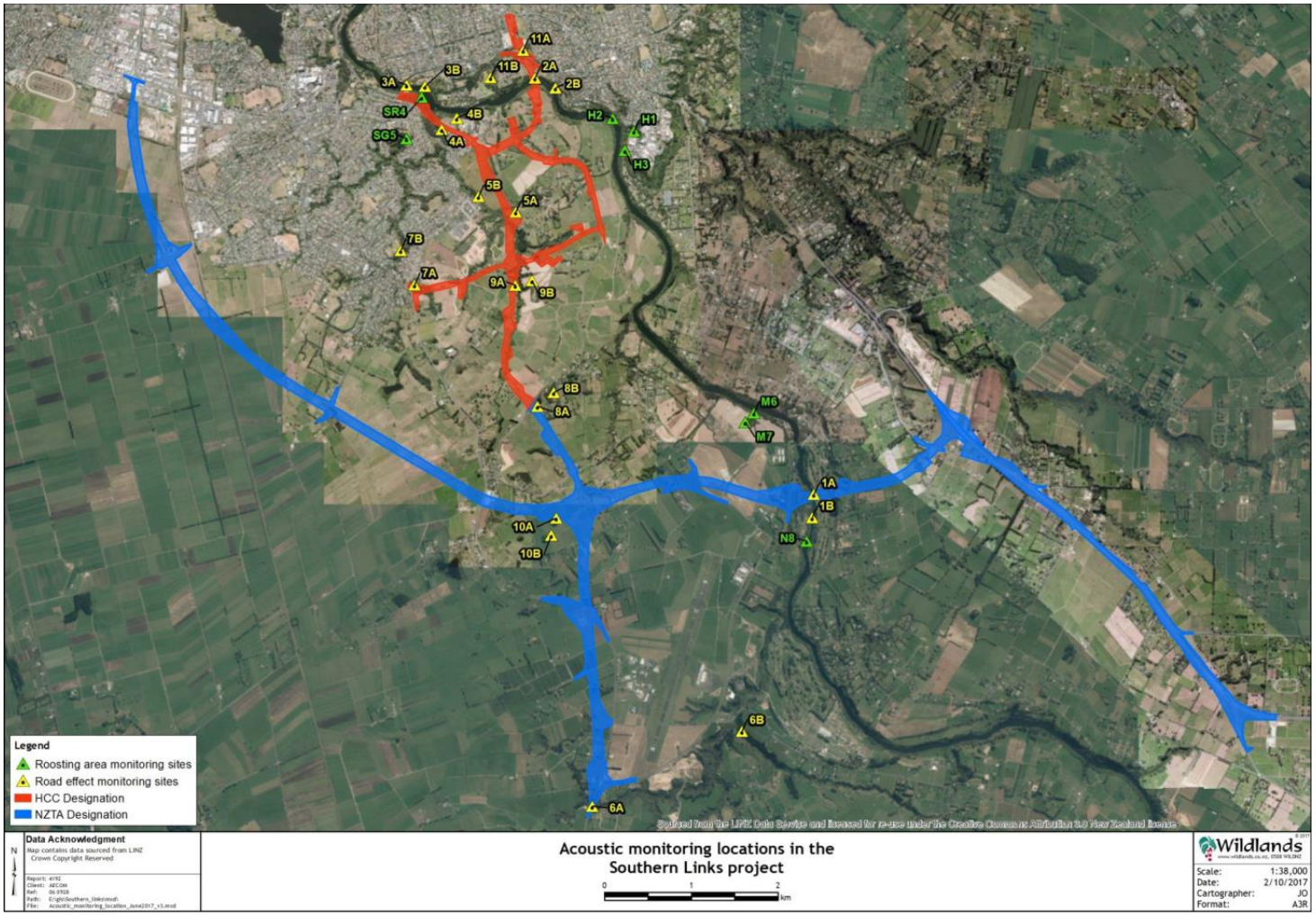


Figure 7 Location of ABMs.

4.3.2 Thermal imaging

Thermal imaging surveys of bats in the vicinity of proposed new bridges and bridges identified for modification were undertaken by Wildlands Consultants Ltd in 2017b and 2018b (refer to Figure 8) (Wildlands, 2017b & 2018b).

Thermal imaging surveys were designed to collect data on bat behaviour and frequency of bat flights at existing and proposed bridge sites within the Project. The aim of the surveys was to assess if there is any change in bat behaviour before, during and after construction of the bridges.

A FLIR T1020 28 thermal imaging camera with a standard lens (28˚) was used to record imagery at the existing and proposed bridge sites along the Waikato River. A wide lens (45°) was used at three of the four proposed bridge sites (28° lens used at the fourth site) along the Mangakotukutuku Gully.

In 2017 and 2018 thermal imagery was recorded at two proposed bridges along the Waikato River and the existing Cobham Bridge that will be upgraded as part of the Project. Three control sites (river edge habitat) were established 200 metres or more away from the proposed or existing bridge locations. In 2018, three additional proposed bridge sites along the Mangakotukutuku gully were surveyed with one control site.

At each of the site's imagery was collected for a total of three nights. During each night of monitoring imagery was collected for a period of three hours post sunset. This time period was chosen to ensure that recording took place during the peak activity period for bats in the Hamilton Area (Le Roux *et al*. 2013). The imagery was collected in 2017 and 2018, between February and April[5].

Metrics were developed to describe behaviours at sites including:

- Flight types (commuting, foraging or unclear);
- Changes in direction and height of bat crossing in relation to the current bridge or bank height;
- The height at which bats would travel in relation to the proposed bridge structures; and
- Hypothetical road centreline crossing for new the bridges.

In 2017 and 2018 thermal imagery (one night for three hours) was collected at an existing bridge site on Cambridge Road (Mangaonua Stream). In 2018, thermal imagery (one night for three hours) was also collected from Narrows Bridge (Waikato River) and from Ohaupo Road (Mystery Creek) (refer to Figure 9).

Refer to Wildlands 2017b and 2018b for the detailed methodology.

[5] Not all of the imagery was analysed in 2018 due to the volume of images with a potential bat. Therefore a sample was taken. Further details are presented in the report produced by Wildlands (2018b).

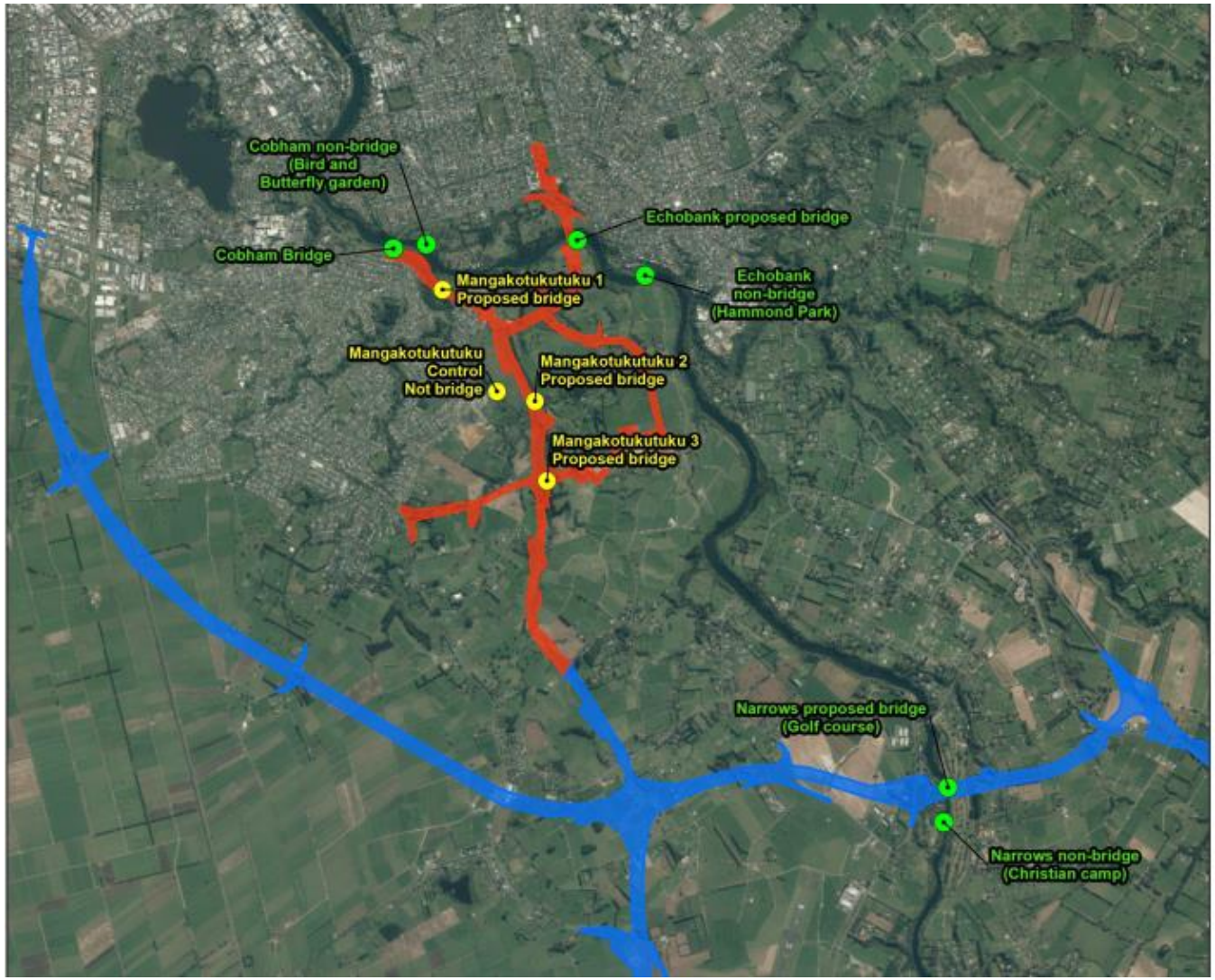


Figure 8 Location of thermal imaging sites at proposed bridges, Cobham Bridge and the control sites.

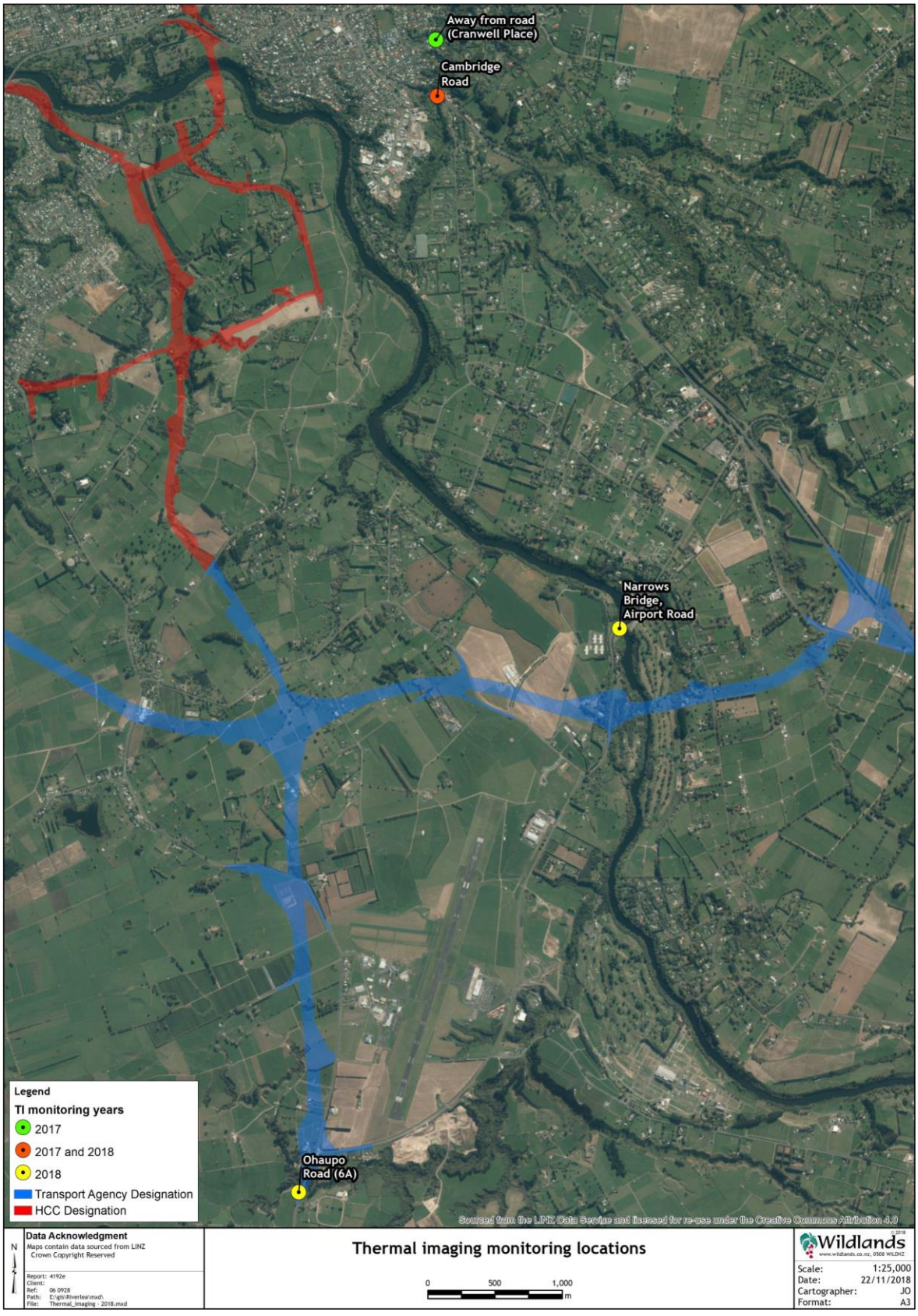


Figure 9 Location of thermal imaging sites on existing road bridges.

4.3.3 Radio tracking

Bat trapping and radio tracking was undertaken by Davidson-Watts Ecology (Pacific), AECOM and Wildlands Consultants Ltd during three trapping sessions in 2018 and one in 2019 (refer to Table 4) (Davidson-watts Ecology Pacific, 2018), over two bat activity periods. The surveys were timed so that one session was completed during the bat maternity period and one post maternity when bats are mating and are particularly mobile, therefore, maximising the potential of roost finding and obtaining information in relation to key foraging and commuting habitat. The surveys were extended over two bat activity periods as ABM surveys indicated the presence of bats in areas that the bats with transmitters in the first bat activity period did not visit. Therefore, the surveys sought to trap bats within the areas where bats had not visited in the first activity period including Hammond Park.

Table 4 Number of nights of trapping and tracking during each session.

Session Number and Period	Trapping Nights	Tracking Nights
1 – 14th Jan – 29th Jan 2018	5	15
2 – 19th Mar – 29th Mar 2018	5	10
3 – 2nd Dec – 14th Dec 2018	4 (1 short night due to rain)	13
4 – 17th Feb – 27th Feb 2019[6]	5	9[7]

The trapping and radio tracking were undertaken in accordance with methodology described by Collins, 2016 and field methods described in DOC guidance Sedgley *et al* (2012).

Bats were trapped using up to six 4m^2 harp traps and/or 6-12m mist nets, placed in forest/parkland habitats within the study area. Up to six acoustic lures (Sussex Autobats) were used to improve catch efficiency in forest/tree dominated habitats (Hill and Greenaway, 2005).

In accordance with the Wildlife Authorisation Permit (63753 – FAU) and Project objectives, trapped bats had a radio-transmitter and / or aluminium rings attached. The bats with transmitters were simultaneously or subsequently followed by radio tracking teams during the survey sessions.

In the first 3-4 nights post capture bats were followed from dusk until dawn, or until bats appeared to have returned to their day roosting site. Positions of tagged bats were pinpointed at regular intervals throughout the night. Tracking aimed to record positional fixes that enabled determination of home ranges and core areas of activity. Bats were tracked using the ‘‘homing-in’’ method (White and Garrott, 1990) on foot or by vehicle, and/or through the triangulation method (Kenwood, 2000).

Where access was possible to roost sites, emergence counts were undertaken at identified roosts to determine the status/function of the roost.

Refer to Davidson-Watts Ecology (Pacific) Ltd, 2018 for the detailed survey methodology.

4.4 Avifauna (birds)

Native forest birds were surveyed by AECOM in 2017/18 and 2018/19 following the five-minute bird count methodology (AECOM, 2018a).

The counts were undertaken in accordance with the five-minute bird count methodology employed by DOC for monitoring of forest bird species (Hartley & Greene, 2012). This method is based on protocols developed by Dawson and Bull (1975) and required the observer to record the species and number of all birds seen or heard during each five-minute sample period.

This method does not determine absolute density of birds, but provides repeatable indices of abundance, provided that counts are made by experienced observers at the same time of year in conditions of little or no wind or rain (Hartley & Green, 2012).

The survey design included the use of paired sites within suitable habitat and is aligned with the ABM survey methodology for bats. Each pair was made up of an ‘impact’ site and a ‘control’ site. Impact

[6] DOC continued to roost find, intermittently, up until 5th March 2019. Survey data collected in December 2018 and February 2019 is currently being processed. This information is not needed for certification of the EMMP.
[7] Nine nights of tracking rather than ten because bats were not caught on the first night.

sites were located in suitable habitat within 50m of the designation and paired with a control site located approximately 350m away from the designation (refer to Figure 10). Past research suggests that this distance is beyond the influence of disturbance factors caused by roads (Summer *et al*, 2011). This approach to monitoring has been designed to focus on local changes in the population.

In order to obtain two years of baseline survey data prior to the start of construction in 2020, the bird survey 'seasons' were undertaken over two calendar years. The surveys were completed between November - August 2017/18 and 2018/19 and included four separate replicated bird count surveys as follows:

- Three separate counts were undertaken in spring/summer at each monitoring site (including one between 10–30 November in accordance with the Hamilton City biennial bird count monitoring period). This recorded breeding birds; and
- A single count was completed in winter between 9–29 August (in accordance with the Hamilton City two biennial bird count monitoring period). This recorded winter visitors.

Refer to AECOM, 2018 for the detailed survey methodology.

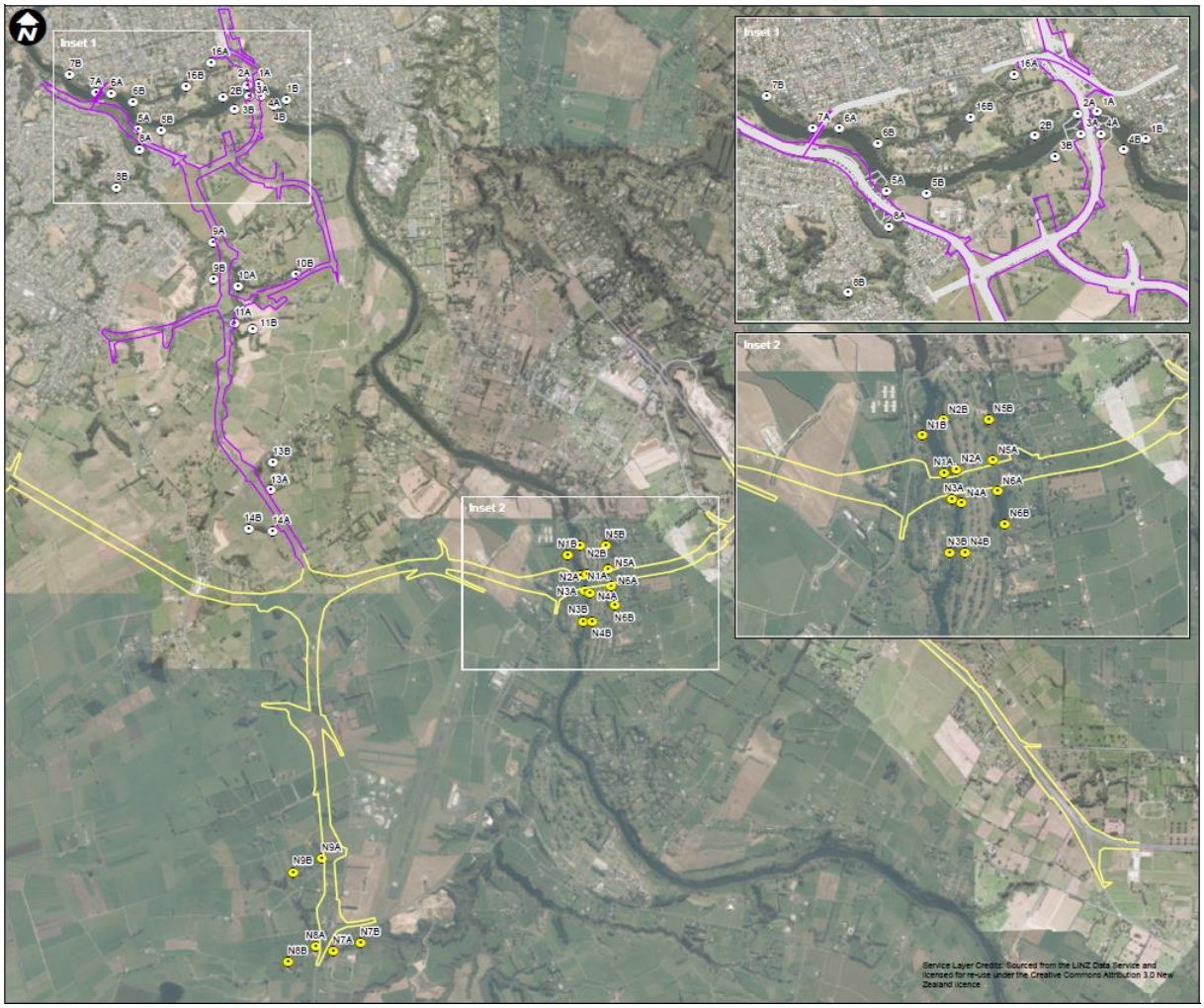


Figure 10 Location of bird monitoring sites.

4.5 Herpetofauna (lizards)

Lizard surveys were undertaken by EcoGecko and AECOM in 2018 (AECOM and EcoGecko, 2018).

The surveys were designed to detect Lizards (skinks and geckos) that may be present within suitable habitat that would be directly impacted by the Project. The survey included four methods;

- Artificial refugia;
- Day searching of natural and artificial refugia;
- G-minnow traps; and
- Spotlighting.

In October 2017, 350 Double-layer Onduline artificial cover objects (ACOs) were set up across 15 sites. Onduline ACOs were checked in accordance with methodology described in Lettink (2012) (refer to Figure 11). If a lizard was present, the individual was caught and the species was confirmed and if native, the sex, life stage (neonate, juvenile, sub-adult, adult), snout to vent length (SVL) and tail length were recorded. Lizard/s were then released back under the same ACO.

Additionally, day searching of natural and artificial refugia was undertaken. This involved searching leaf litter, under fallen woody debris, under rocks and below artificial objects such as corrugated iron or concrete.

Night spotlighting for lizards was undertaken for a total of 25 hours across 11 of the 15 sites. Spotlighting did not occur at four of the sites because they were not considered suitable for geckos. The time spent at each site depended on the size of the site and the suitability of the vegetation to support geckos. Surveyors used LED Lenser H7 or H14 headlamps and searched in close proximity to the trees, and from further away using binoculars. Surveyors looked for lizard bodies and/or eye-shine whilst searching.

Refer to EcoGecko and AECOM, 2018 for the detailed methodology.

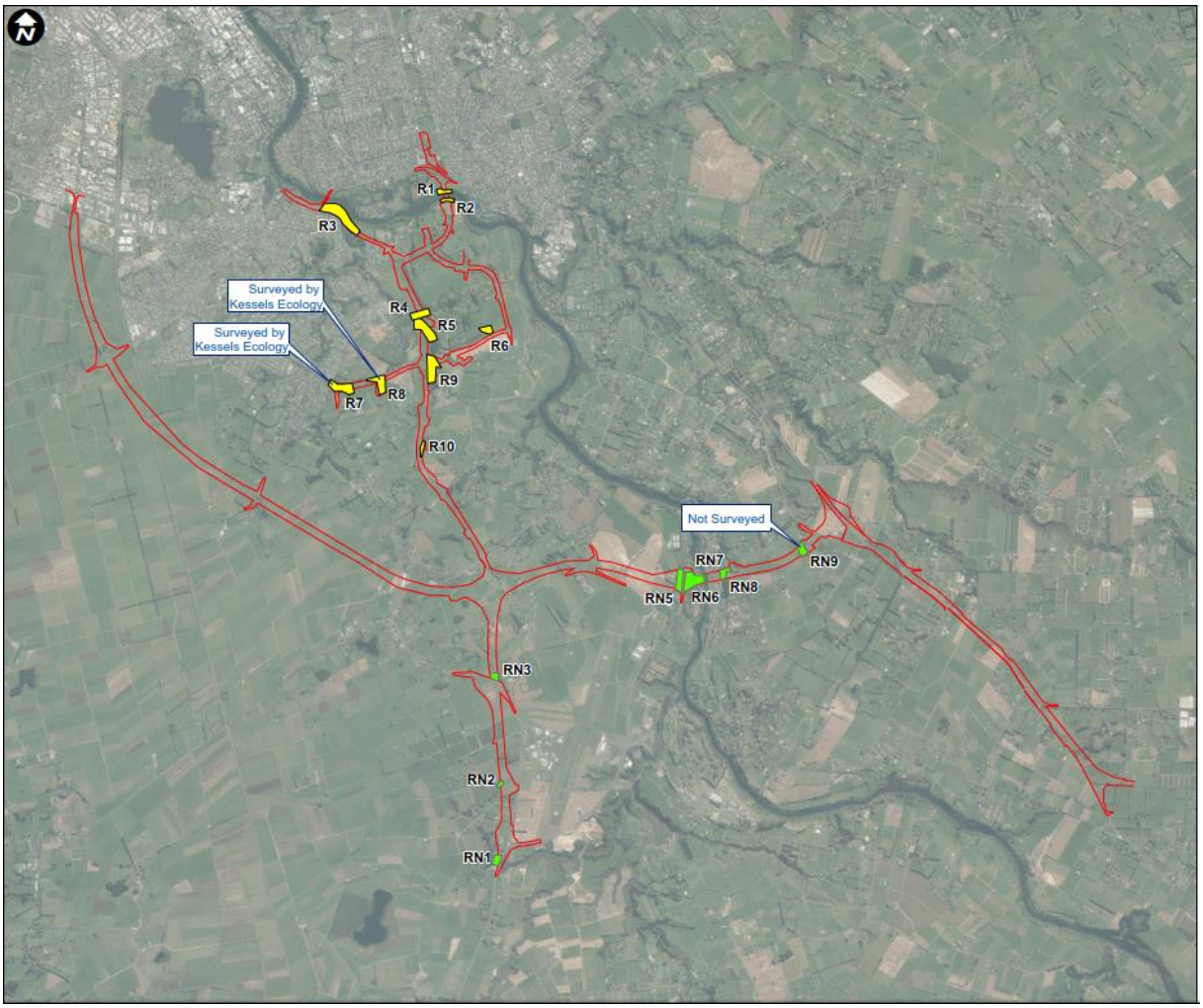


Figure 11 Location of lizard survey areas.

5.0 Ecological Baseline

The ecological baseline data presented below is focused on the data that will be used to monitor change, during and after construction. Full survey results can be found in the habitat and species reports referenced within the text below.

5.1 Habitat

5.1.1 Terrestrial and wetland habitat

The terrestrial and wetland vegetation within the Project designation corridor was described within the following documents:

- Opus (2013) Ecological Assessment, Appendix L Southern Links Notice of Requirements (NOR); and
- Opus (2014) Supplementary Vegetation and Habitat Survey Report.

Habitats located within the designation corridor were grouped as detailed in Table 5. The table presents the total area of each habitat to be impacted by the Project.

Table 5 Terrestrial habitat located within the designation corridor identified by Opus (2014).

Broad habitat classification	Area (ha) to be affected by HCC Section of the Project	Area (ha) to be affected by Transport Agency Section of the Project
Pasture	1.1	0.09
Weed community	2.7	0.56
Exotic forest	5.5	3.7
Restoration planting	2.4	1.0
Native regeneration	0.08	0.2
Native forest	0.25	N/A

Table 6 Wetland habitats located within the designation corridor identified by Opus (2014).

Broad habitat classification	Area (ha) to be affected by HCC Section of the Project	Area (ha) to be affected by Transport Agency Section of the Project
Gully and ephemeral wetland	0.73	0.70

In 2017 Morphum updated the extent of wetland within the Mangakotukutuku Catchment (excludes Waipa and Waikato). At this time Morphum gained access to properties at the top of the catchment which Opus were not able to access in 2014, leading to the identification of additional wetland habitat. Table 7 has been produced to illustrate the area of wetland habitat that will be impacted by the proposed road based on the survey information collected by Opus and Morphum. Further detail is provided in Appendix A relating to the location of wetland habitat and the description of this habitat.

Table 7 Wetland habitat identified by Morphum and Opus surveys.

Broad habitat classification	Area (ha) to be affected by HCC Section of the Project
Gully and ephemeral wetland	1.60

5.1.2 Stream habitat and freshwater fauna

Stream surveys were undertaken along the Mangakotukutuku Gully and its tributaries by T+T in 2017 (refer to Figure 5). A summary of key ecological indicators is presented within Table 8. It was concluded that the condition of the watercourses is typical for streams where the surrounding land use is dominated by agriculture.

Surveys of the Mangaone Stream and Mystery Creek have not been completed to date. The principles of mitigation for these two watercourses will be the same as that developed for the Mangakotukutuku Gully.

Table 8 Summary of key stream survey results (refer to Figure 5 for the location of monitoring sites).

Monitoring site/Easting and Northing	WRC habitat assessment score – Range 9 (poor quality) – 180 (high quality)	SEV overall mean score – Range 0 (poor quality) – 1 (high quality)	Fish	Macro Invertebrates MCI score QMCI score
HCC1 E1802108 N5812404	99	0.497	Shortfin eel	76 3.24
HCC 2 E1803453 N5812551	-	-	-	-
HCC 3 E1803221 N5811894	117	0.840	Longfin eel Shortfin eel Banded kokopu Giant kokopu	94 4.20
HCC 4 E1803300 N5811673	111	0.755	Longfin eel Giant kokopu	106 4.30
HCC 5 E1804092 N5811650	-	-	-	-
HCC 6 E1802763 N5811054	-	-	Shortfin eel	-
HCC 7 E1802309 N5810996	-	-	-	-
HCC 8 E1803570 N5811325	84	0.616	Shortfin eel	80 2.90
HCC 9 E1803387 N5811262	106	0.806	Longfin eel Banded kokopu Giant kokopu Redfin bully	103 3.10
HCC 10 E1803313 N5811171	94	0.688	No data	112 3.07
HCC11 E1803298 N5811094	86	0.637	No data	79 3.90
HCC 12	-	-	-	-

Monitoring site/Easting and Northing	WRC habitat assessment score – Range 9 (poor quality) – 180 (high quality)	SEV overall mean score – Range 0 (poor quality) – 1 (high quality)	Fish	Macro Invertebrates MCI score QMCI score
E1803293 N5810897				
HCC 13 E1803278 N5810607	-	-	-	-
HCC 14 E1803187 N5810228	-	-	-	-
HCC 15 E1803213 N5810053	62	No data	No data	80 2.32
HCC 16 E1803310 N5809875	69	0.261	Longfin eel Shortfin eel Gambusia (exotic)	90 3.5
HCC 17 E1803306 N5809921	52	0.300	No data	83.5 2.34
HCC 18 E1802375 N5812909	110	No data	No data	102 5.6

5.2 Bats

The baseline for bat activity with the zone of influence of Project is taken from the following documents:

- Wildlands. 2017a. Acoustic Monitoring of Long-Tailed Bats for the Southern Links Roading Project, Hamilton: Summer 2016-2017.
- Wildlands. 2017b. Thermal Imaging of Long-Tailed Bats for the Southern Links Roading Project, Hamilton: Summer 2016-2017.
- Wildlands. 2018a. Acoustic Monitoring of Long-Tailed Bats for the Southern Links Roading Project, Hamilton: Summer 2017-2018.
- Wildlands. 2018b. Thermal Imaging of Long-Tailed Bats for the Southern Links Roading Project, Hamilton: Summer 2017-2018.
- Davidson-Watts Ecology (Pacific). 2018. Long-tailed Bat Trapping and Radio Tracking Baseline Report - Southern Links, Hamilton.
- AECOM (2018) Bat Roost Potential Survey of Trees – Southern Links, Hamilton.

Please refer to the reports listed above for the detailed results.

5.2.1 Acoustic monitoring

ABMs were placed at 11 paired sites (‘road sites’ – A site adjacent to the road, B site located >200m from the road) within the vicinity of the Project and eight roosting sites identified prior to 2017. Table 9 presents the mean number of bat passes in 2017 and 2018 at each monitoring site. The location of the monitoring sites is illustrated in Figure 7.

In summary, bats were recorded at all monitoring sites. The number of bat passes recorded at each of the sites was highly variable between 2017 and 2018.

Sites with a high number of passes in 2017 and 2018 included sites 10A (kahikatea stand), 10B (kahikatea stand), 7B (urban park) and 8B (exotic tree plantation).

In the long-term the ABM data will be used to determine if bats are still using the same habitats and if levels of activity at each site has changed beyond annual variation.

Modelling undertaken by Wildlands suggested that at the sites where a local road (unlit, single carriageway) is currently present there appears to be a trend towards activity being higher at the B sites, which are located more than 200 m away from the Project. The modelling suggests that this trend was not observed at the sites where a road is not currently present. It is unknown what environmental factors are leading to this outcome e.g. habitat loss, scale of retained habitat, species composition of retained habitat.

Light and noise monitoring was undertaken at the acoustic monitoring sites in 2017 and 2018. The results from the light monitoring were inconclusive potentially caused by methodology and equipment suitability. The mitigation proposed within this EMMP has therefore taken a pre-cautionary approach to lighting. No relationship was observed in relation to noise and bat activity e.g. bat activity was not seen to decrease at higher noise levels.

Table 9 Mean number of bat passes in 2017 and 2018 at the ABM Monitoring sites.

Site	Site description	Surrounding habitats	Mean number of bat passes per night in 2017	Mean number of bat passes per night in 2018
Paired road sites				
1A	Narrows Golf Course.	River. Parkland.	0.62	14.48
1B	Narrows Park.	River. Parkland.	69.03	8.24
2A	Waikato River bank adjacent to proposed Waikato River Bridge.	River. Parkland.	5.70	5.24
2B	Waikato River bank 250m south east of the proposed Waikato River Bridge.	River. Parkland. Residential.	11.66	11.07
3A	Adjacent to Cobham Bridge and the Waikato River.	Road. River. Parkland.	0.24	0.91
3B	200m east Cobham Bridge in the Bird and Butterfly Garden adjacent to the Waikato River.	River. Parkland.	0.56	1.81
4A	Sandford Park adjacent to the Mangakotukutuku Stream.	Forest. Stream. Residential. Pasture.	18.49	13.16
4B	Waikato River bank adjacent to Hamilton Water Treatment Station.	River. Light industrial. Pasture.	0.66	0.59
5A	Mangakotukutuku Gully adjacent to proposed road.	Stream gully. Pasture.	9.96	6.10

Site	Site description	Surrounding habitats	Mean number of bat passes per night in 2017	Mean number of bat passes per night in 2018
5B	Mangakotukutuku Gully east of Edgeview Crescent.	Stream gully. Pasture. Residential.	35.15	23.56
6A	Mystery Creek adjacent to SH3.	Road. Stream gully. Pasture.	18.57	9.03
6B	Mystery Creek south of Mystery Creek Road.	Stream gully. Pasture. Road.	2.75	23.66
7A	Parkland adjacent to the proposed Dixon / Ohaupo junction.	Parkland. Road. Residential.	0.55	1.95
7B	Te Anau Park.	Parkland. Residential.	28.09	80.72
8A	Peacockes Road	Road. Forest. Farmland.	15.00	9.55
8B	Peacockes Road	Road. Forest. Farmland.	259.00	105.02
9A	Mangakotukutuku gully east Hall Road.	Stream gully. Pasture.	9.11	6.66
9B	Mangakotukutuku gully at the end of Texas Road.	Stream gully. Pasture	8.43	20.53
10A	Kahikatea located south of Raynes Road	Forest. Pasture.	61.93	177.87
10B	Kahikatea located south of Raynes Road	Forest. Pasture.	36.67	94.59
11A	Parkland adjacent to SH1 (Wairere Cobham Interchange).	Parkland. Road.	2.20	1.30
11B	Adjacent to Hamilton East Cemetery, within the grounds of Hamilton Gardens.	Parkland.	24.70	7.80
Roosting sites identified prior to 2017				
H1	Hammond Park.	Forest. Parkland.	131.23	165.05
H2	Hammond Park adjacent to Waikato River.	Forest. Parkland.	41.00	22.83
H3	Hammond Park adjacent to Waikato River.	Forest. Parkland.	14.60	19.32
M6	Meridian Oaks adjacent to the Waikato River.	Forest. River. Arable.	30.26	31.19

Site	Site description	Surrounding habitats	Mean number of bat passes per night in 2017	Mean number of bat passes per night in 2018
M7	Meridian Oaks.	Forest. Arable.	35.13	31.76
N8	Narrows Christian Park.	River. Parkland.	68.56	36.54
SG5	Sandford Park surrounding the Mangakotukutuku Gully.	Forest. Parkland. Residential.	11.89	134.66
SR4	Sandford Park adjacent to the Waikato River.	Forest. River.	4.40	3.78

5.2.2 Thermal imaging

Thermal imagery was collected to provide information about long-tailed bat behaviour at current and proposed bridge crossings along the Waikato River, Mangakotukutuku Gully and at non-treatment (control) sites, including flight type, flight direction, and the height of flights.

Analyses of the thermal imagery found that bats were typically commuting and foraging at the top of the tree canopy (Wildlands, 2019). Therefore, if the top of the canopy were to be located within 0-5m of the deck there is the potential for bats to fly at the same height that the vehicles would be crossing the bridge. This would create the potential for bats to be struck by moving vehicles if they were not to adjust their flight heights in response.

To understand where there is a risk of bat strike and to enable appropriate mitigation to be developed, Figure 12 - Figure 17 were produced. These images include information in relation to existing bank height, location of bridge deck (proposed or existing), approximate height of vegetation and number of bats observed in relation to the bank height and subsequently the bridge. Due to land profiles in the wider landscape the proposed bridge deck may not be level with the current bank height. Therefore, the bridge is not always in the same zone. Table 10 presents the number of bats that appeared to be at risk of strike during monitoring in 2017 and 2018 because they flew in the zone where they could collide with vehicles and were seen to cross the centre line of the bridge (existing or proposed).

In the long term, the thermal imaging will monitor whether bat behaviour is significantly modified by the presence of the bridge e.g. are bats seen to travel at a different height, are bats observed approaching the bridge but not crossing it etc.

Thermal imagery was collected from three existing road bridges to the south of Hamilton to see how bats behave in relation to existing roads and bridges. It was observed that bats did cross the road and did so at canopy height. However, it should be noted that baseline monitoring was not undertaken at these sites, so it is unknown as to whether there has been a reduction in the number of bats travelling along the gully since the bridges were constructed.

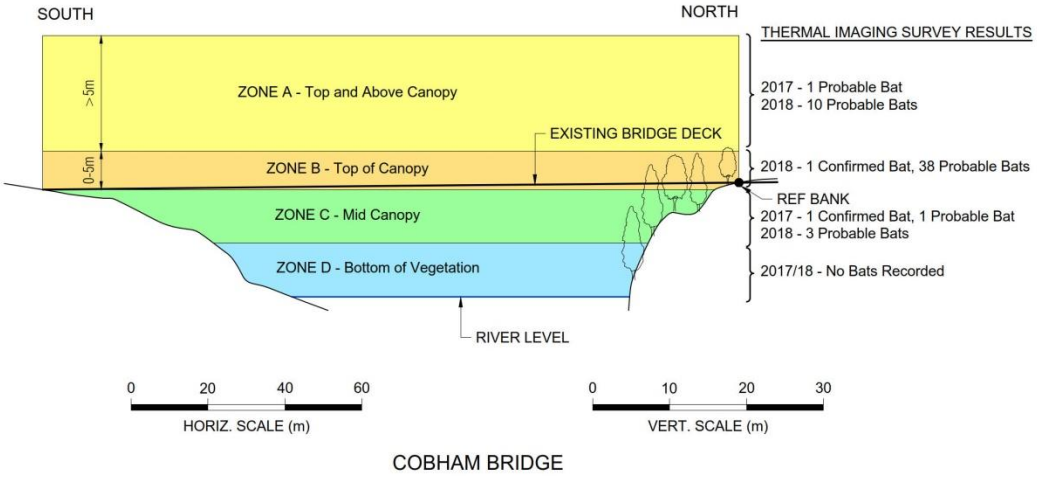


Figure 12 Bat flight height in relation to the existing bank top, bridge and tree canopy at Cobham Bridge.

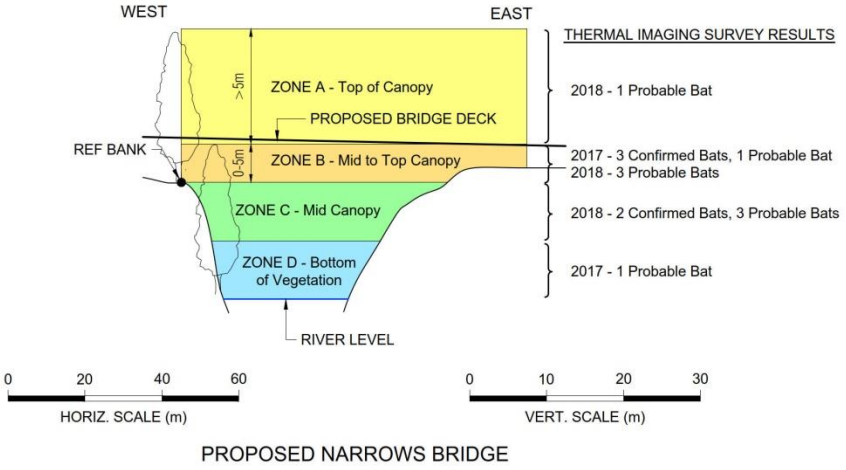


Figure 13 Bat flight height in relation to the existing bank top and tree canopy and the proposed Narrows Bridge.

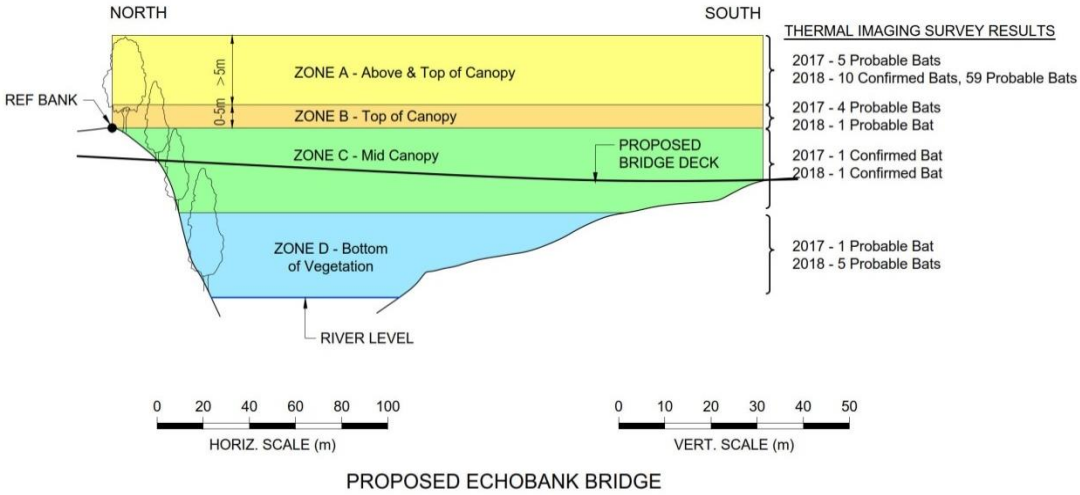


Figure 14 Bat flight height in relation to the existing bank top and tree canopy and the proposed Echobank Bridge.

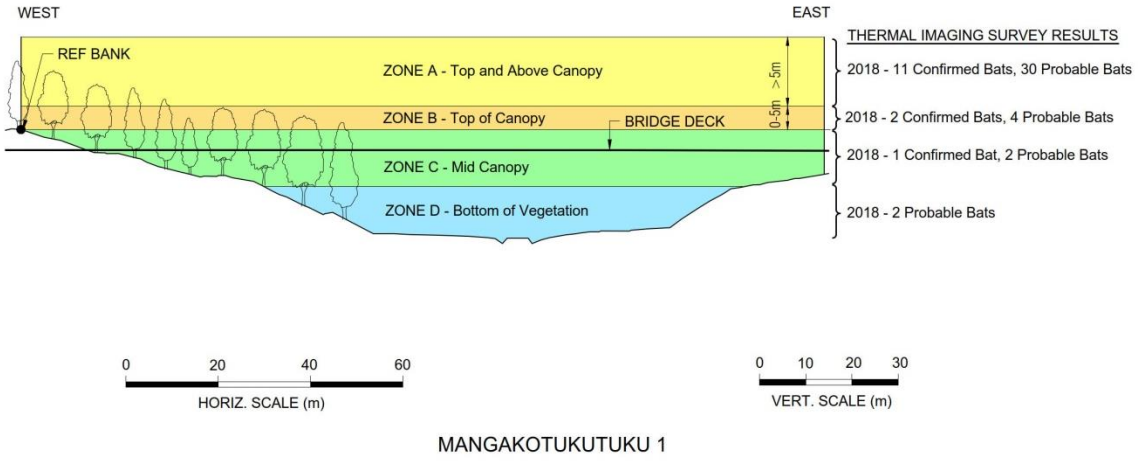


Figure 15 Bat flight height in relation to the existing bank top and tree canopy and the Mangakotukutuku 1.

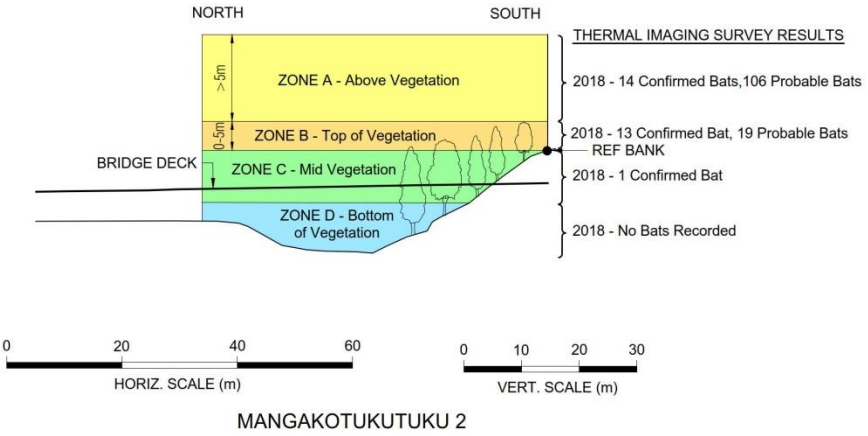


Figure 16 Bat flight height in relation to the existing bank top and tree canopy and the Mangakotukutuku 2.

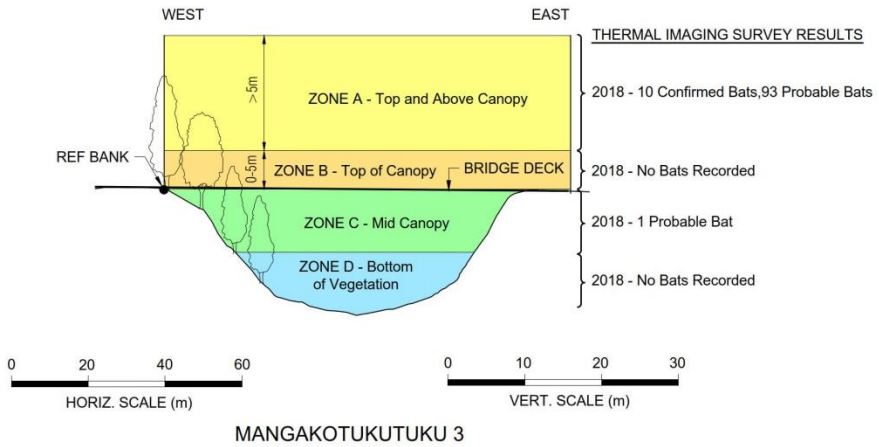


Figure 17 Bat flight height in relation to the existing bank top and tree canopy and the Mangakotukutuku 3.

Table 10 Total number of bats recorded within the potential collision zone and how many were recorded crossing a superimposed line representing the middle of the bridge.

Site name	Year	Total number of confirmed and probable bats within all four zones (refer to Figure 12 - Figure 17	Zone that bridge is / proposed to be located	Number of confirmed and potential bats recorded in the potential collision zone (0-5m above bridge deck)	New metric in 2018 – No. bats that cross the bridge within the collision zone (centre line)
Cobham bridge – existing	2017	3	Zone B	0 – confirmed 0 – probable	No data as metric developed in 2018
	2018	52		1 – confirmed 38 - probable	1 – confirmed 0 - probable
Echobank bridge	2017	11	Zone C	1 – confirmed 0- probable	No data as metric developed in 2018
	2018	76		1 – confirmed 0 - probable	1 – confirmed 0 - probable
Narrows bridge	2017	5	Zone A	0 – confirmed 0 – probable	No data as metric developed in 2018
	2018	9		0 – confirmed 1 - probable	0 – confirmed 0 – probable
Mangakotukutuku 1	2018	52	Zone C	1 – confirmed 2 - probable	0 – confirmed 1 – probable
Mangakotukutuku 2	2018	153	Zone C	1 – confirmed 0 - probable	0 – confirmed 0 – probable
Mangakotukutuku 3	2018	69	Zone B	0 – confirmed 0 - probable	0 – confirmed 0 - probable

5.2.3 Bat radio tracking

In January and March 2018, a transmitter (tag) was placed on 11 bats. The transmitters remained on the bats for 2-14+ nights, before they were groomed off. The mean home range of the bats tracked covered an area of 704 ha with a mean span of 76.4 km. Core areas, which are the areas where bats spent most of their time, covered a mean area of 76.4 ha.

Key roosting and foraging areas for female bats included the Mangakotukutuku Gully, Nukuhau Gully, Mystery Creek Gully, Waikato River, remnant kahikatea stands and stands of exotic trees. It was also seen that the bats visited areas of open water and parkland to the west of Hamilton to forage and bats were recorded roosting in three bat boxes within Sandford Park. The exact movements of the bats cannot be mapped with radio tracking, but it was observed that bats were travelling over open pasture and roads (State Highway and arterial roads) to access their core habitat areas (100% Minimum Convex Polygons (MCP).

In December 2018 a total of six bats were tracked. Male bats were trapped and tracked from Sandford Park and Hammond Park. The bats were observed foraging within vegetation along the banks of the Waikato River and a branch of the Mangaharakeke Stream, which extends up to Whewells Bush,

Tamahere. The breeding females that were trapped at site 10a and Nukuhau Gully were observed to cover a similar area to that described in January and March 2018.

In February 2019 a total of seven bats were tracked including adult male and female bats and juvenile bats. The foraging, commuting and roosting habitats were similar to that previously recorded. However, bats were observed moving from the Narrows Park east to a side branch of the Mangaharakeke Stream (Tamahere Drive) and then on to Whewells Bush, Tamahere.

The four radio tracking survey sessions lead to the identification of 55 bat roosting sites (day and night) (refer to Figure 18), of which 45 were located in exotic trees including;

- crack willow (*Salix fragilis*),
- Tasmanian blackwood (*Acacia melanoxylon*),
- Ironwood (*Casuarina* sp.),
- *Eucalyptus* spp.,
- macrocarpa (*Cupressus macrocarpa*),
- London Plane (*Platanus* × *acerifolia*),
- sessile oak (*Quercus petraea*),
- false acacia/black locust (*Robinia pseudoacacia*); and
- radiata pine (*Pinus radiata*).

Eight of the roosts were located in kahikatea trees or presumed kahikatea trees (as they were located in inaccessible kahikatea stands) and the remaining two roosts where in inaccessible areas. Roost sites were distributed from Sandford Park within the urban fringe of Hamilton to Te Awa Road in the south, Tamahere to the east and the Transpower substation on Hall Road to the west.

Thirty-six maternity bat roosts[8] were identified within kahikatea stands north of Raynes Road, Narrows Park and adjacent properties, Nukuhau Gully, Mangakotukutuku Gully including Sandford Park bat boxes and shelterbelt trees near Te Awa Road.

A maternity roost is located within the designation corridor adjacent to Narrows Park (roost 30 - Figure 18). Two-night roosts are located within the designation corridor in Sandford Park (roost 19 and 26 - Figure 18).

Where access was possible emergence surveys were undertaken at the day roosts (*n*=16). The surveys completed in January and March 2018 confirmed that roosts contained between 1 – 39 bats[9]. In January roost counts were higher than March. However, 12 bats were recorded emerging from bat box 2 in Sandford Park during the March surveys.

[8] This includes roosting sites where bats that were lactating / post lactating roosted in January 2018 and December 2018, but an emergence count was not undertaken to confirm the number of bats roosting, therefore, classified as a potential maternity roost.
[9] Results of the surveys in December 2018 and February 2019 are currently being processed. This information is not required for the EMMP to be certified.

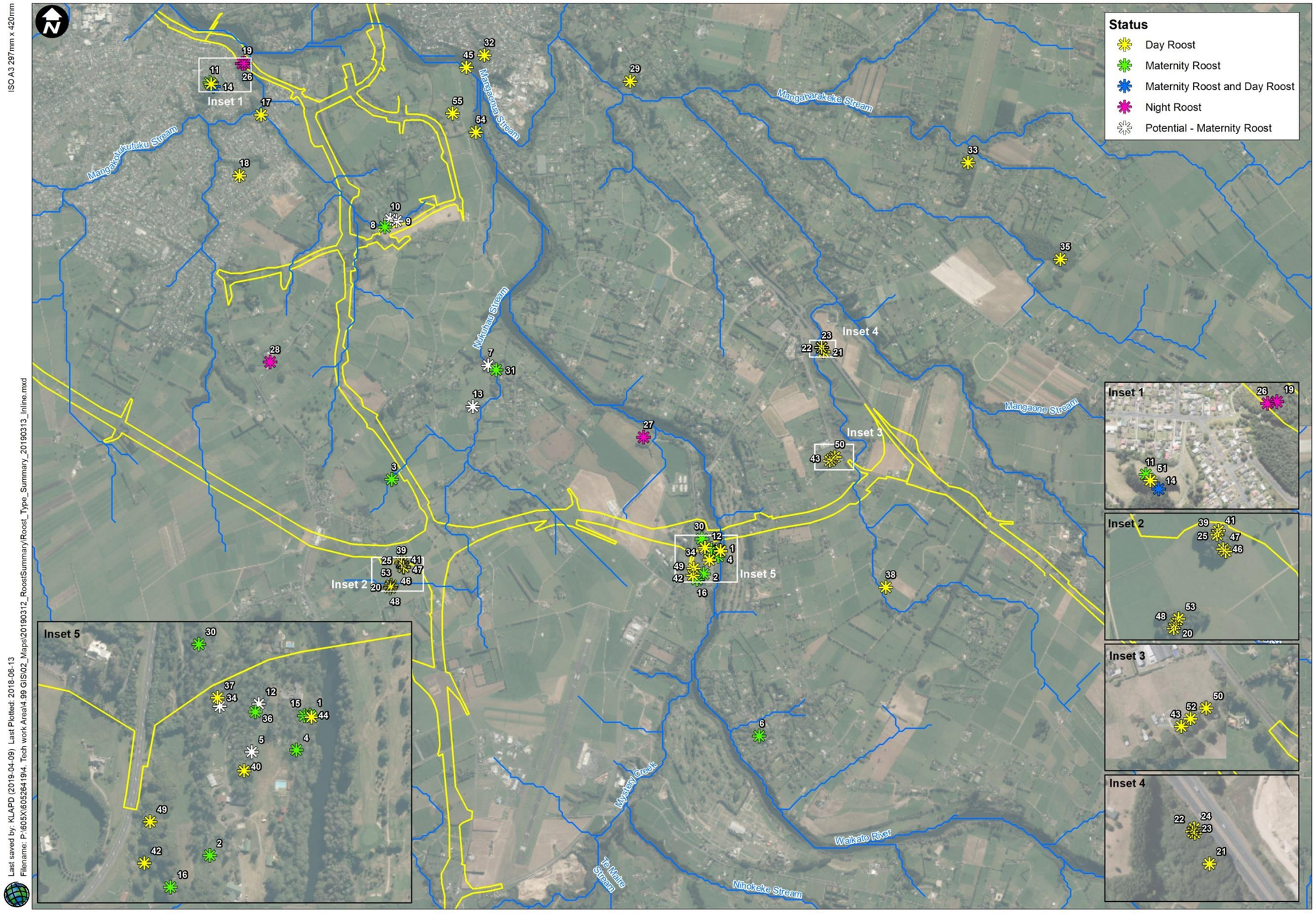


Figure 18 Location of known bat roosting sites.

5.3 Avifauna (birds)

The 5-minute bird count was carried out by AECOM in 2017/18 across 23 paired sites (AECOM, 2018a) (refer Figure 10). These surveys identified 35 species (native and exotic) at the monitoring sites. The bird community was observed to be comprised predominately of exotic species, both in terms of species richness and relative abundance. Overall, 60% of the species observed across the Project area were exotic, while 67% of individuals observed were exotic.

A total of 14 native bird species were observed; the most commonly observed being silvereye *Zosterops lateralis* and fantail *Rhipidura fuliginosa*. Twenty-one exotic bird species were observed, with goldfinch *Carduelis carduelis* and chaffinch *Fringilla coelebs* being the most commonly observed, making up 17% and 15% of the observed exotic population respectively.

The bird assemblages observed at the monitoring sites were typical of those present in modified landscapes and consisted only of urban-adapted exotic and native species.

At 18 of the 23 paired sites there was no significant difference in the abundance of birds at the A (50m from proposed road) and the B (approx. 350m from the proposed road) sites. However, at six sites (5 A/B, 6 A/B, 13 A/B, 14 A/B and N6 A/B) it was found that the abundance of birds was currently significantly different between the A and the B sites.

On review of the sites there is no clear reason for this difference that is relevant to all sites. However, it is likely to be due to the quality of the habitat even though during survey design similar habitats at sites A and B were sought. The significant difference does not appear to relate to existing infrastructure e.g. site 13 B has higher bird abundance than 13 A, and 13B is next to an existing local road.

The mean number of birds (species richness and abundance) recorded during the three summer visits are presented in Table 11.

Table 11 Mean number of birds at each site.

Pair	Site ID	Mean species richness	Variance (±)	Mean abundance	Variance (±)
HCC section					
1	1A 1B	9.3 9.7	0.4	11.3 11.7	0.4
2	2A 2B	10.7 10.7	0.0	13.0 12.7	0.3
3	3A 3B	10.3 12.0	1.7	14.3 15.7	1.4
4	4A 4B	9.7 9.3	0.4	12.7 10.7	2.0
5	5A 5B	10.3 9.7	0.6	15.3 11.7	3.6**
6	8A 8B	10.7 8.7	2	18.7 11.3	7.4**
7	9A 9B	9.3 11.7	2.4	13.7 21.0	7.3
8	10A 10B	11.7 12.0	0.3	16.3 15.3	1.0
9	11A 11B	10.3 10.0	0.3	14.3 12.7	1.6
10	16A 16B	8.7 8.7	0.0	12.3 12.0	0.3
Transport Agency section					
11	6A 6B	8.7 10.0	1.3	10.3 11.0	0.7

Pair	Site ID	Mean species richness	Variance (±)	Mean abundance	Variance (±)
HCC section					
12	7A 7B	5.3 7.3	2.0	7.0 10.7	3.4
13	13A 13B	8.3 12.7	4.4**	12.3 20.3	8.0**
14	14A 14B	12.7 10.3	2.4	19.7 16.7	3.0**
15	N1A N1B	10.3 10.7	0.4	16.0 18.7	1.7
16	N2A N2B	9.7 11.7	2.0	17.7 24.3	6.6
17	N3A N3B	11.0 10.0	1.0	15.3 21.3	6.0
18	N4A N4B	9.7 7.7	2.0	14.3 13.0	1.3
19	N5A N5B	8.3 9.7	1.4	16.3 16.3	0.0
20	N6A N6B	8.7 10.0	1.3	17.0 19.7	2.7**
21	N7A N7B	7.3 9.7	2.4	12.3 19.0	6.7
22	N8A N8B	9.7 9.3	0.4	16.3 17.3	1.0
23	N9A N9B	9.0 9.0	0.0	15.0 13.7	1.6

**Difference between control and impact sites is significant (paired *t*-test $P < 0.05$).

5.4 Herpetofauna (lizards)

AECOM and EcoGecko carried out lizard surveys during March 2018 at 15 sites across the Project area (AECOM and EcoGecko, 2018). A total of 51 native copper skink (*Oligosoma aeneum*; Not Threatened (Hitchmough et al 2016)) and 62 invasive plague skink (*Lampropholis delicata*; Introduced and Naturalised (Hitchmough et al 2016)) observations were made during the survey[10].

Copper skinks were found to be present at 80% of the sites (12 of 15) surveyed (refer to Figure 19). They were found at all of the sites surveyed along the Mangakotukutuku Gully and along the Waikato River, excluding Site RN7 and 8, which was located adjacent to the Narrows Golf Course. The preferred habitat of copper skink was observed to be areas of long grassland along forest margins or *Tradescantia* located beneath exotic or native forest. The management at the golf course means that the closely mown fairways and greens abuts the forest; therefore, removing the grassy margin favoured by copper skinks.

Copper skinks were recorded within the gully head of Mystery Creek, albeit at only 1 of the 2 sites surveyed (RN1 present and RN2 not detected). An individual skink was recorded within marginal vegetation surrounding an isolated stand of sweet chestnut *Castanea sativa* (RN3), but it was considered that a population was not likely to be present.

The survey confirmed that the populations within the Mangakotukutuku Gully, Mystery Creek Gully and the Waikato River appear to be functional populations, since juveniles and sub-adults were recorded, as well as adult skinks.

[10] Some of these sightings may have been repeat observations of the same individual lizard.

No geckos or other skinks were recorded during the survey and on conclusion of the survey works it was considered that they are not likely to be present.

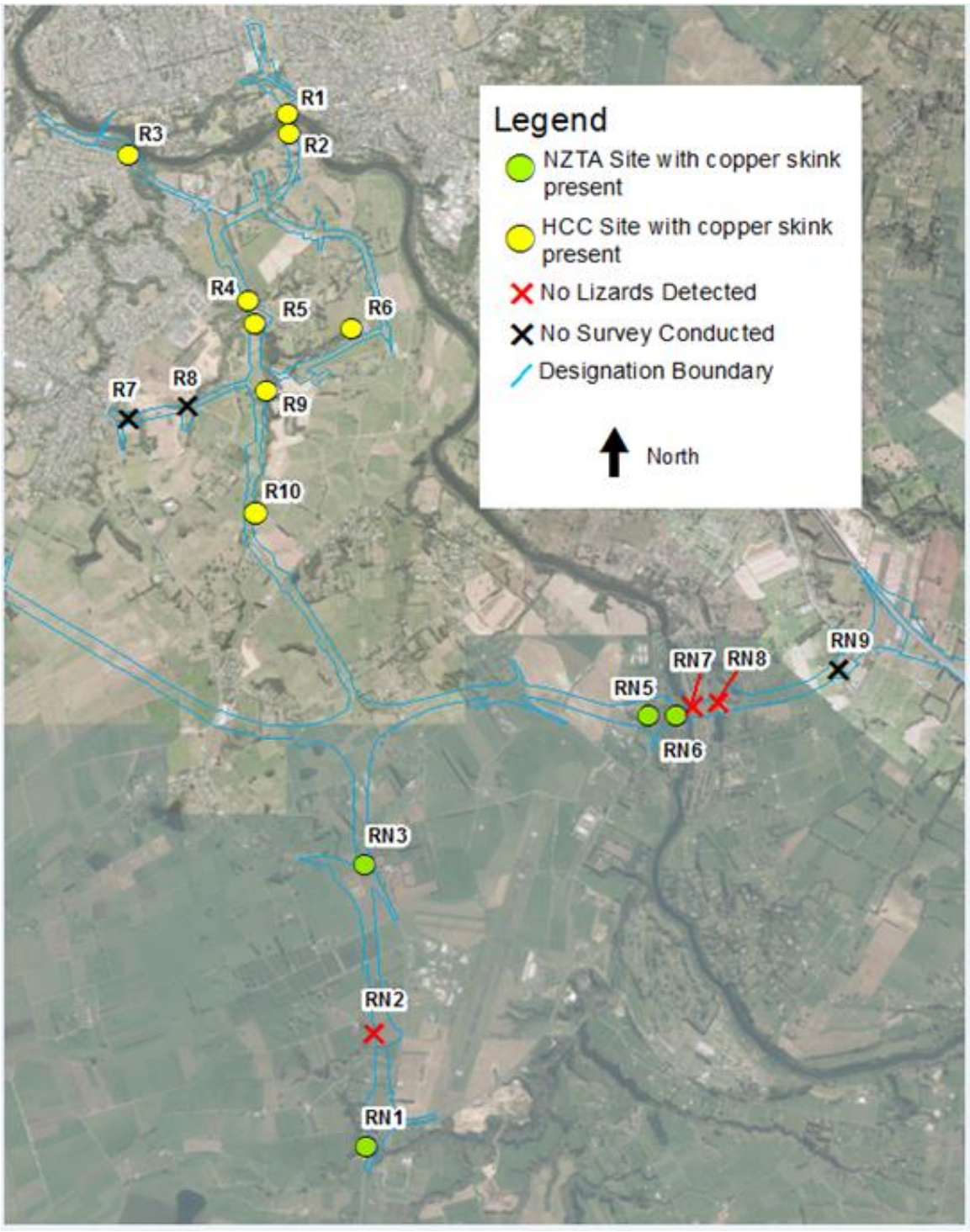


Figure 19 Distribution of copper skink across the Project area. No survey was completed at R7 and R8 as these were surveyed by Kessels Ecology, 2017.

6.0 Mitigation and Management

6.1 Introduction

This section of the EMMP presents the ecological mitigation and management measures that will be implemented. The potential effects of the Project have been defined based on the available habitat and species information and the preliminary design for the Project which was submitted as part of the Notice of Requirements (NOR) in 2014. The mitigation has been developed in accordance with the mitigation hierarchy presented in Figure 20.

The mitigation has also been prepared to meet the objectives of the designation conditions relating to no-net-loss of biodiversity and for the enhancement of bat, avifauna and herpetofauna habitat and also to increase the extent of avifauna and herpetofauna habitat. The manner in which this will be achieved is presented in the Section 6.3 - 6.7 for each of the target species or groups of species.

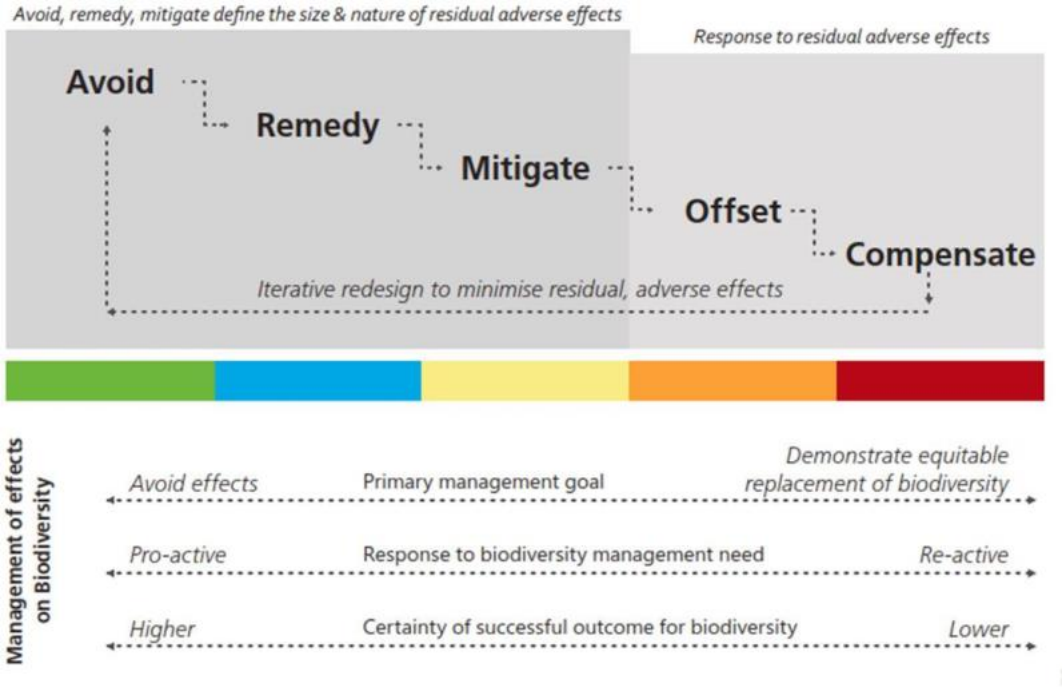


Figure 20 Mitigation hierarchy which shows that biodiversity offsetting and compensation should only be used for residual effects (Biodiversity Working Group, 2019).

6.2 Strategic approach

During consultation, the consultees voiced a desire to protect native fauna during the development of the Project and the Peacocke Growth Cell and that a strategic approach to mitigation was sought. This is relevant because species such as long-tailed bats and native birds will have territories/ranges that extend between and beyond the boundaries of the Project and the Peacocke Growth Cell.

The strategic vision for the urban expansion to the south of Hamilton is provided by the Peacocke Structure Plan. HCC are in the process of updating the Structure Plan via a plan change to the Hamilton District Plan. It is understood that the amendment will remove the current requirement for each developer in the Peacocke Growth Cell to produce a Masterplan which is considered ultra vires as a consequence of a court ruling on similar provisions. The HCC review will also reflect on how to respond to the results of ecological survey work that has been undertaken since the Structure Plan was produced and in response to changing advice in relation to biodiversity offsetting.

For effective mitigation to be delivered in the south of Hamilton for native fauna, each developer will need to incorporate mitigation that provides habitat that can support the species present and provide habitat connectivity. A strategic vision is critical to achieving effective mitigation. It will ensure that irrespective of any financial pressures/constraints that may arise during development, those habitats

that have been demonstrated to be of value to native fauna are retained, reinstated, mitigated and enhanced, in line with species requirements. Survey results presented within this EMMP illustrate the type of habitats that native species require and provide a snapshot of activity relevant to the Project.

The mitigation and management of effects described in this EMMP are focused on the effects of the Project. However, all ecological survey information collected and any proposed mitigation as part of this EMMP has been provided to those organisations which are currently looking to develop within the Peacocke Growth Cell. HCC and the Transport Agency will continue to share information with developers as they look to take forward parcels of land for resource consent within the Peacocke Growth Cell.

The need to avoid, mitigate and / or offset adverse effects of development on native flora and fauna to the south of Hamilton extends beyond the designation boundary and the Peacocke Growth Cell. This is illustrated by Figure 21.

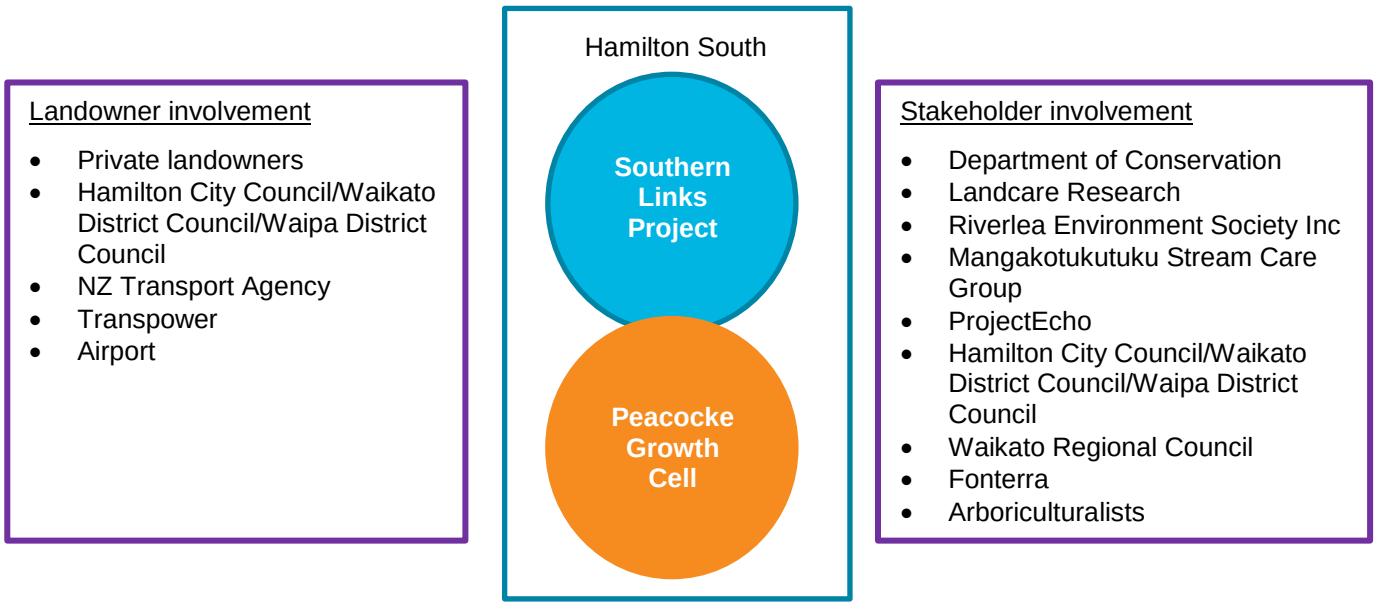


Figure 21 Parties who have a responsibility and scope for the protection of native species to the south of Hamilton.

6.3 Terrestrial and wetland habitat

The designation conditions include an objective relating to the development of mitigation for terrestrial, wetland and gully habitat including;

- No-net loss in biodiversity.

The designation conditions also define an aim to;

- Restore indigenous vegetation to the gullies and margins of the Waikato River, including wetlands.

The designation conditions for all three TA's state a minimum amount of habitat restoration/creation that is required to offset for unavoidable loss of habitat identified to be of value botanically and to native fauna (refer to Table 12). The extent of offset habitat was determined during the hearing of the Notice of Requirement based on a ratio of 3:1 for significant vegetation (including wetlands) and 1:1 for other vegetation (Opus, 2014d). The offset vegetation is broken down according to where habitat loss will occur, the relevant TA and RA, and it assumes that no vegetation of ecological value within the designation area is retained i.e. worst-case scenario.

Table 12 Habitat restoration/creation required by the three TA's designation conditions.

Territorial authority	Delivered by	Minimum area of habitat to be provided.
Hamilton City Council	HCC	11.46 ha
Waipa District Council	Transport Agency	4.98 ha
Waikato District Council	Transport Agency	2.19 ha

Table 13 presents the potential effects of the Project on terrestrial, wetland and gully habitats without mitigation and the mitigation that is proposed to achieve no-net-loss in biodiversity as a result of the Project. Section 6.6 details the specific lizard mitigation and management approach that will be implemented for each phase of the Project – Pre-implementation, Construction and Operation.

Table 13 Potential effect of the Project on terrestrial and gully habitat and subsequent mitigation.

Effect of the Project, without mitigation	Approach to mitigation	No-net-loss	Enhancement
Loss of habitat of ecological value due to vegetation removal (including wetlands)	Avoid / minimise	Safeguard zones to be identified in order to avoid unnecessary vegetation removal.	n/a
	Mitigation	At the conclusion of substantive construction works those areas adjacent to the road that have been disturbed will be replanted in accordance with the detailed Landscape Management Plan which will include ecological restoration as appropriate to the location.	n/a
	Offset – mitigation specified by the designation conditions.	Habitat restoration / offset; HCC – 11.46 ha Waipa DC – 4.98 ha Waikato DC – 2.19 ha A review of wetlands within HCCs designation boundary identified the need for an additional 1.9 ha of offset[11]. Total of 13.38 ha for HCC.	Actual restoration of gullies will be undertaken so that areas of existing native vegetation and valuable exotics are retained. Therefore, the total area of Designation Restoration Sites will be larger than required by the designation conditions: HCC – 15.25 ha (including 3.5 ha of wetland) Waipa DC – 6.2 ha Waikato DC – 3 ha
Habitat fragmentation along the Mangakotukutuku Gully / increase in edge effect	Mitigation / offset	The retained areas of gully habitat will be increased in area with additional plantings as part of the Designation Restoration Sites.	Plantings will be undertaken to encourage linkages in addition to those which area currently present.

[11] This additional area of wetland was identified on land that Opus had not gained entry at the time of the designation and / or Opus defined habitat at exotic weed community, which was later defined by Morphum as wetland, therefore, requiring additional offset (3:1 rather than 1:1).

Effect of the Project, without mitigation	Approach to mitigation	No-net-loss	Enhancement
		Additional areas of planting as part of the Designation Restoration Sites will be undertaken to maintain existing linkages along the Mangakotukutuku Gully, including plantings on both sides of the north-south link.	

In addition to the terrestrial and gully habitat restoration defined above, it has been identified that for the delivery of the HCC Section of the Project that **1,570 m** of stream habitat offset is required. This will mitigate for the loss of stream length due to the construction of culverts and the realignment of a section of the headwaters of the Mangakotukutuku Gully. Refer to Section 6.4 for further information on stream restoration.

6.3.1 Designation Restoration Site planning – [offset habitat loss]

To identify where Designation Restoration Sites should be located a series of workshops were held to draw on specialist knowledge. In Appendix F the nature of the workshops and the list of attendees are presented.

To identify possible restoration sites the following factors were initially considered;

- Current and future landownership;
- Habitat type provided – gully/river margin, seep/wetland, aquatic or terrestrial;
- Condition of the site;
- Existing value of habitat to species;
- Connectivity – reptiles, birds and bats;
- Erosion management; and
- Use as a stream compensation site (refer Section 6.4).

It became clear during this process that it would not be ecologically beneficial to remove all exotic vegetation within the restoration sites as the exotic vegetation is providing valuable habitat for native species. The sudden loss of this vegetation could sever habitat connectivity and also remove important foraging and refuge habitat. Therefore, the areas identified for restoration are greater in total area than required by the designation conditions (refer to Table 14) in order to take account of the areas of likely retained habitat. Appendix B presents the location of the Designation Restoration Sites.

Table 14 Required and actual area (ha) of Designation Restoration Sites to be delivered by the Project.

Territorial Authority	Minimum restoration area required by the designation conditions	Actual area subject to restoration
Hamilton City Council	13.38 ha	15.25 ha
Waipa District Council	4.98 ha	6.2 ha
Waikato District Council	2.19 ha	3 ha

6.3.1.1 Advanced restoration

The designation conditions require that early/advanced restoration takes place. The first restoration works were completed on 104 Hall Road in 2017. These works have delivered 1.74 ha of restoration

as part of the Designation Restoration Sites. Implementation was jointly funded by WRC and the Project in support of the MSCG and landowner. In due course, the Project will acquire this land and assume management, monitoring, pest and Pest control of the site.

Early restoration works, ahead of construction will be undertaken as land comes into the ownership of HCC (refer to Figure 22). A key area for early restoration is around the north-south link to be delivered by HCC (refer Figure 22). This restoration will occur as this land comes into HCC ownership. Care will be taken to ensure that any early plantings are positioned so that they will not be disturbed by future construction and included within safeguard zones.

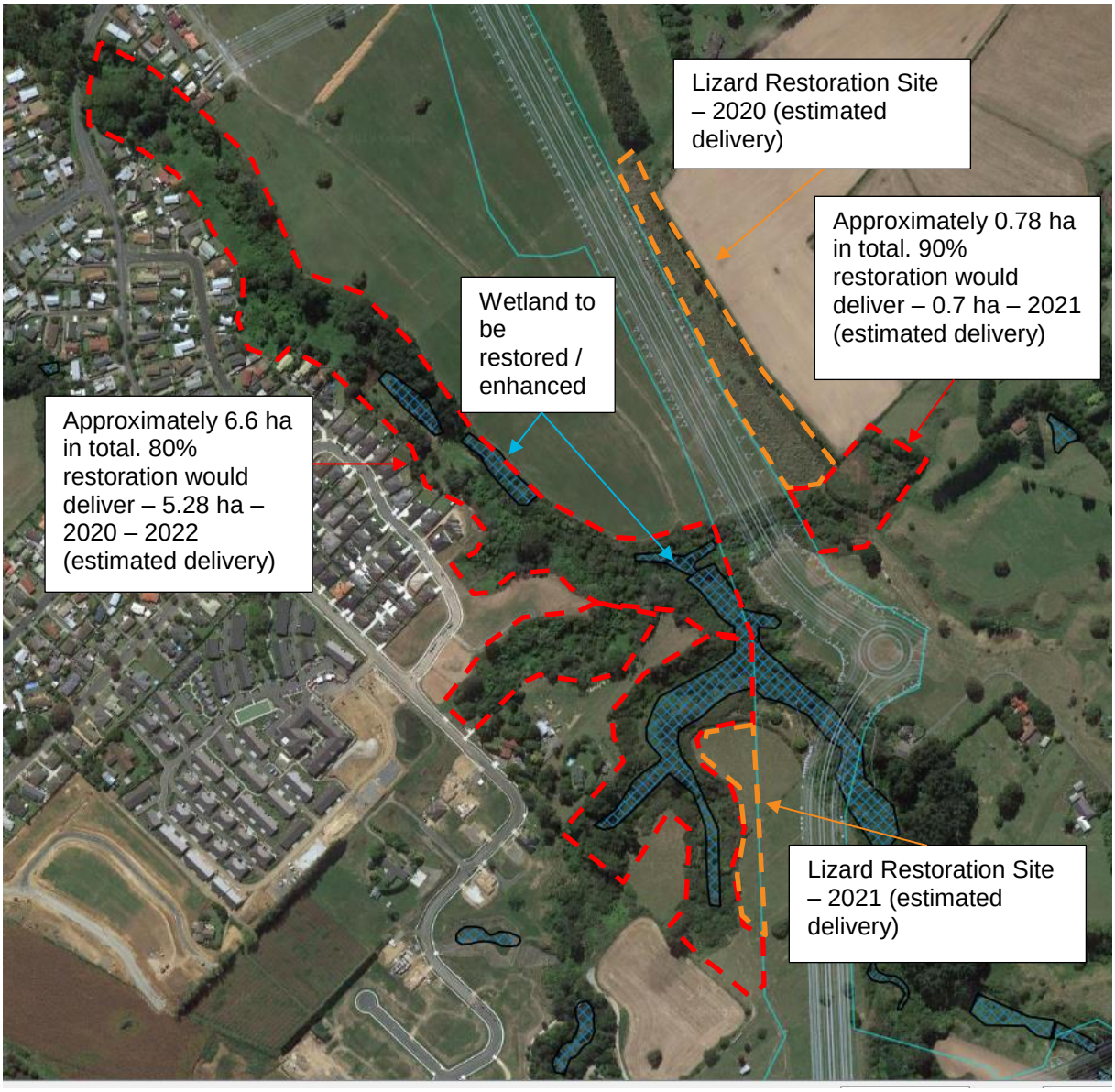


Figure 22 Early restoration to deliver a link across the north-south link.

6.3.1.2 Restoration opportunities that would be additional to the requirements of the designation conditions

In addition to the habitat provided by the Designation Restoration Sites, the Project will also construct treatment wetlands (to manage road runoff) and there will be some areas of landscape plantings which will also provide additional habitat for native fauna. These areas are additional to the total area of habitat restoration required by the designation conditions.

HCC will also be working with Tangata Whenua to understand their aspirations for the Whatukoruru Pa Site that is located where the east-west link meets the north-south link (refer to Figure 22). The

Whatukoruru Pa is located where baseline studies have identified important linkages for native fauna. As such, the manner in which this site is restored has the potential to significantly enhance an important habitat linkage. This site is subject to an agreement to transfer ownership to Waikato Tainui.

The designation conditions require that opportunities should be sought to integrate with existing restoration plantings on public and private land in order to enhance ecological benefits. The conditions specify known restoration areas on private land including:

HCC Designation Conditions

- Lot 2 DPS 83799 (M &M Shaw); and
- Lot 2 DP 313 598 (G James).

Waikato DC Designation Conditions

- Lot 1 DP 368405 (P and B Bevan); and
- Lot 1 DP 445431 (T and K Keyte).

Site visits were undertaken to the properties listed in the HCC designation conditions to gain an understanding of the existing ecological values of these sites and how the location of the Designation Restoration Sites could complement these. On conclusion of the site visits the following recommendations were made (AECOM, 2017) and will be implemented;

- Establish Safeguard Zones (refer to Section 6.3.3) to ensure that native habitat loss within the designation, particularly in relation to the Shaw and Jame's property is kept to a minimum where practicable.
- Restoration sites within the Mangakotukutuku should be positioned to reflect the aspiration established by the Jame's to restore the ecological values of the Mangakotukutuku (e.g. 104 Hall Road – condition 15.4(b)) (refer to Appendix B).
- Consideration should be given to the translocation of tree ferns from the James gully into areas that are to be restored (*Cyanthea* sp. to be dug up and replanted, *Dicksonia* sp. can be cut and replanted/laid on the ground). This will only be applicable where there is existing tree canopy.

Two Community Liaison Group Meetings have been held by HCC and the Transport Agency since the designation was confirmed. The purpose of these meetings included providing opportunities for adjoining landowners to identify ecological restoration works on their property that could be considered for integration within the EMMP. The owner of 3153 SH3, Hamilton highlighted restoration works on their property. The area of restoration is located at the southern end of the north-south major arterial to the west of the Project. Restoration to be delivered by the Project at this location will be to the east of the Project. Therefore, an opportunity to link these two restoration areas does not exist.

6.3.2 Site Restoration Plans prepared and implemented – [avoid and offset habitat loss]

At each of the Designation Restoration Sites a detailed Site Restoration Plan will be produced that will guide weed control, planting and long-term management. The planting design of these habitats will be undertaken in accordance with HCC's Gully Restoration Guide (Wall & Clarkson, 2006). Appendix J presents further detail in relation to the content of the Restoration Plan.

To ensure that the Project delivers a minimum of 13.38 ha each Restoration Plan will clearly indicate within a table and on a map the area and nature of restoration completed (Refer to Table 15 for example).

Table 15 Example of the habitat restoration table to be included in each of the Restoration Plans to track progress.

Approach to habitat restoration	100 % (1:1)	50 % (1:0.5)*	Total Restoration to meet designation conditions
Full habitat restoration (all existing vegetation removed)	2 ha		2 ha

Approach to habitat restoration	100 % (1:1)	50 % (1:0.5)*	Total Restoration to meet designation conditions
Partial restoration (under canopy)		2 ha	1 ha
Weed removal from native habitat		2 ha	1 ha
Total habitat restoration			4 ha

*Restoration of this nature will provide partial restoration only, therefore, the associated offset area delivered is reduced by half to reflect this.

Each subsequent plan will present the total restoration area delivered, in relation to the minimum 13.38 ha to be delivered. It will also reflect on the area of land remaining to determine the practicality of delivering the restoration required.

Once the EMMP has been certified Site Restoration Plans will be prepared and implemented in areas indicated in Appendix B on land available to the Project. Further Site Restoration Plans will be produced and implemented as restoration site land becomes available to the Project.

At the top of the catchment a section of the Mangakotukutuku Stream headwaters will be realigned (HCC 16 and 17). At this location a Stream Reconstruction Plan will be produced. This is described further in Section 6.4.8. The Plan will be submitted as part of the resource consent application.

6.3.2.1 Maintenance

Following the completion of restoration planting, the Designation Restoration Sites will be inspected annually in order to identify if the maintenance regime needs to be amended (i.e. control of re-infestations, re-mulching, erosion controls).

To reduce maintenance and avoid accidental death of plants due to herbicide, it is recommended that each tree is surrounded by a small area of weed mat. However, it may still be necessary to manually or chemically release the new plants from competition of competitive grass species and will be determined within the Site Restoration Plans. It is recommended that this occurs three times a year for a minimum of two years following restoration planting. The effort required will be dependent on-site conditions and plant growth.

Plants should also be monitored for a minimum of three years following planting to identify and replace any plant losses in accordance with the trigger levels detailed in Section 8.0. If possible, the cause of the losses should be recorded and remedied as required. For example, if rabbit herbivory is the cause for numerous losses, pest control strategies should be modified to manage the problem. In the event that losses do occur, blanking (like-for-like species replacement of failed seedlings) is required at the end of the first planting season. Further replacement planting may also be required during the second year of implementation. The maintenance schedule will be detailed in the Site Restoration Plans.

6.3.2.2 Protection in perpetuity

The means by which each of the Designation Restoration Areas will be protected in perpetuity will vary. Typically, restoration sites delivered by HCC will be either owned and controlled by HCC or they will remain in private ownership with an easement placed over the restoration area.

The Transport Agency will look to place QEII covenants or easements on the restoration areas to protect them in perpetuity. The land may then return into private ownership or ownership of Waipa and / Waikato District Council Parks and OpenSpaces Team.

The manner in which each site will be protected in perpetuity will be presented in the Site Restoration Plans.

6.3.3 Safeguard zones for Designation Restoration Sites – [avoid habitat loss]

Advanced restoration is being undertaken as part of the mitigation package. Therefore, these plantings will be in place before construction begins. To protect these plantings, safeguard zones will be established. These areas will be fenced or marked, adjacent to where contractors intend to work, prior to the contractor commencing any enabling or construction works on site to ensure that there is no

accidental encroachment into the Designation Restoration Sites by contractors e.g. vehicle damage, materials stored inappropriately etc.

The contractor will be responsible for ensuring that the fencing or marking remains in a suitable condition to prevent the accidental encroachment by their personnel.

6.3.4 Additional tree planting – [mitigate and offset habitat loss]

The Project includes the establishment of significant areas of restoration planting, hop-overs, underpasses, buffer planting etc., but it will not be possible to plant up to the edge of the road until construction has been completed. Therefore, at the end of the construction phase there will be a period where final plantings are completed to ensure that the links are fully established.

These plantings will be undertaken in accordance with recommendations outlined within the Site Restoration Plans (refer Appendix J) and Landscape Management Plan as appropriate to the location.

6.4 Stream habitat and fauna

The designation conditions overarching objective relevant to the development of mitigation for stream and habitat are;

- No-net loss in biodiversity.

The designation conditions also define an aim to;

- Restore indigenous vegetation to the gullies and margins of the Waikato River to restore stream values.

The designation conditions also established a requirement for the EMMP to outline the stream surveys to be undertaken by a suitably qualified and experienced ecologist/s prior to lodgement of resource consent applications with the WRC.

T+T were engaged to undertake the survey works specified by the designation conditions within the section of the Project to be delivered by HCC in 2017. The survey methodology followed by T+T in 2017 is presented in their report, and summarised in Section 4.1.2 and 4.2 of this EMMP. The same survey methodology specified by T+T (2017) will be implemented on watercourses impacted by Transport Agency section of the Project once the detailed design phase commences.

Table 16 presents the potential effects of the Project on stream habitats without mitigation and the mitigation that is proposed to achieve no-net-loss in biodiversity as a result of the Project.

Table 16 Potential effect of the Project on stream habitat and subsequent mitigation.

Effect of the Project, without mitigation	Approach to mitigation	No-net-loss	Enhancement
Habitat loss due to the construction of culverts and stream realignment– 985 m.	Avoid / Minimise	Stormwater devices designed to be offline. Where practicable install bridges without piers to reduce modification to the stream bed.	n/a
	Offset.	1,570 m of stream will be restored to compensate for stream loss. A priority is avoiding loss of stream length, but it cannot be totally avoided. At the top of the catchment 450 m of stream (of the total 985 m to be impacted), will be realigned and therefore, it will not be lost.	n/a

Effect of the Project, without mitigation	Approach to mitigation	No-net-loss	Enhancement
Degradation of habitat	Avoid / Minimise.	Implement appropriate sediment control during construction to avoid degradation of the stream.	n/a
		Stormwater devices will be designed in accordance with current best practice guidelines, Mangakotukutuku ICMP and the Comprehensive Stormwater Discharge Consent.	N/A
Alteration of hydrology within the streams and associated Significant Natural Areas (SNA).	Avoid.	Design culverts so that they do not alter instream hydrology (e.g. velocity and volume).	N/A
		Stormwater devices have been taken offline so that they do not alter hydrology within the gully habitat. These devices should also be designed to ensure that the stream system experiences peak flows as this allows natural flushing of materials.	N/A
Restriction of fish migration through the installation of culverts.	Avoid.	Install bridges where practicable to ensure that all species of fish can migrate unrestricted.	Existing obstructions to fish passage will be removed during the upgrade of existing culverts.
	Mitigate.	Install measures to encourage fish migration if culverts are installed and provide access to areas that are known to or could provide valuable habitat.	n/a
	Offset.	Maximise the ecological value of re-aligned sections of stream for native fish by varying the channel and undertaking riparian planting.	n/a
Killing or injuring fish during instream works.	Avoid.	Culvert and stream diversion - in stream works timed to occur from January – April avoiding the main migration period for native fish species.	n/a
	Mitigate.	Fish salvage to be undertaken in areas where instream work occurs.	n/a

6.4.1 Stream compensation planning as part of Site Restoration Plan– [avoid and offset habitat loss]

Structures at the bottom of the main branch of the Mangakotukutuku Gully have been designed as bridges (rather than culverts) to reduce impacts on streams. In addition, all stormwater devices are expected to be off line from streams as per current best practice.

It has been identified that **985 m** of stream would be impacted[12] by culverting or realignment due to the Project. The length of compensation habitat was calculated based on the following loss-to-gain ratio[13]:

- For impact sites where the overall level of effect has been determined as **'Very High'** a loss-to-gain ratio of 1:3 was applied;
- For impact sites where the overall level of effect has been determined as **'High'** a loss-to-gain ratio of 1:2 was applied; and
- For impact sites where the overall level of effect has been determined as **'Low',** but the magnitude of effect is "High" a loss-to-gain ratio of 1:1 was applied.
- For impact sites where the overall level of effect has been determined as 'Very Low' a loss-to-gain ration of 1:0 was applied, as the loss of this habitat is not considered significant.

In total **1,570 m** of stream offset would be required (refer to Table 17). At these offset sites 10m of gully vegetation will be restored on each side of the stream.

Table 17 Stream offset quantities.

Crossing location (refer to Figure 5)	Crossing type	Level of effect	Loss-to-gain ration	Length of stream habitat impacts (m)	Indicative length of stream habitat compensation (m)
HCC 1 – Not directly impacted	N/A	N/A	N/A	N/A	N/A
HCC 2 – Artificial watercourse	Culvert	N/A	N/A	N/A	N/A
HCC 3	Bridge	N/A	1:0	0	0
HCC 4	Bridge	N/A	1:0	0	0
HCC 5 – Overland flow path	Culvert	N/A	N/A	N/A	N/A
HCC 6	Culvert	Very Low	1:0	50	0
HCC 7 – Ephemeral stream	Culvert	N/A	N/A	N/A	N/A
HCC 8	Culvert	High	1:2	95	190
HCC 9	Bridge	N/A	1:0	0	0
HCC 10	Culvert	High	1:2	90	180
HCC 11	Culvert	High	1:2	90	180
HCC 12 – Seepage	Culvert	N/A	N/A	N/A	N/A

[12] Including directly affected area and upstream of any culvert.
[13] Previously agreed with WRC - meeting between WRC (Jorge Rodriguez, Bruno David , Michael Pingram), and Southern Links Project staff, meeting minutes confirmed by Bruno David (email to Dean Miller dated 31 July 2017).

Crossing location (refer to Figure 5)	Crossing type	Level of effect	Loss-to-gain ration	Length of stream habitat impacts (m)	Indicative length of stream habitat compensation (m)
HCC 13	Culvert	Low	1:1	90	90
HCC 14	Culvert	Very Low	1:0	60	0
HCC 15	Culvert	Very Low	1:0	60	0
HCC 16	Culvert and reclamation / diversion	Very High	1:3	240	720
HCC 17	Reclamation / diversion	Low	1:1	210	210
HCC 18	Bridge	N/A	1:0	0	0
Total				**985 m**	**1,570 m**

The stream compensation to be delivered by HCC has been targeted at the headwaters of the Mangakotukutuku Gully (refer to Appendix B- Figure 48 - Figure 50). The length of and location of stream compensation habitat to be delivered by the Transport Agency will be determined in accordance with the principles detailed above. The exact quantities and locations will be determined at the detailed design phase of the Project.

6.4.2 Hydrology [avoid alternation to the natural hydrology of the streams and associated SNAs]

There is the potential that the construction of culverts and stormwater devices could alter instream hydrology and consequently the hydrology of adjacent wetlands. These changes can include alteration to the velocity, volume and peak flows. In particular, the engineers undertaking the design of the culvert at HCC 8 (east-west link (Table 2)) will look to ensure that design does not significantly alter the hydrology of the stream and consequently the wetland that surrounds the stream (e.g. SNA 56). In addition, stormwater devices that feed into the streams along the full alignment will be designed so that they do not prevent periodic peak flows that would replicate the natural situation.

6.4.3 Fish passage – [avoid and mitigate inhibition of fish migration]

The Project includes two new bridges over the Waikato River, four bridges, 12 culverts and two sections of stream alignment along the Mangakotukutuku Gully (based on current design). One of the Waikato River bridges will be delivered by the Transport Agency and additional culverts will be required during the delivery of their section of the Project. The location and nature of these structures will be confirmed at the detailed design stage.

Fish passage improvement work has been undertaken on the main stem of the Mangakotukutuku Stream at the Peacockes Road culvert (lead by MSCG) and further work is programmed to occur at the downstream side of Waterford Road culvert, on the Peacocke Tributary (an HCC lead project). Therefore, connectivity for native fish migration to the downstream catchment has been improved.

The Project includes bridges at four road crossing sites; HCC 18, HCC 3, HCC 4 and HCC 9. A bridge allows the natural stream to remain, fish passage to be unimpeded and is considered the best outcome for a stream crossing. The potential for HCC6, 8 and 13 to be bridged or spanned by an arch culvert will be considered as part of the detailed design. If this is not possible then fish passage measures will be installed where there is habitat upstream of a culvert that could support native fish.

Based on the results of the fish survey works (refer Table 8) undertaken for this Project and other available data, the key species for consideration in fish passage design for upper catchment sites will be shortfin and longfin eels, banded kokopu and giant kokopu. However, the target species for each culvert design will be site specific dependent on the species known to be present as well as the amount and nature of upstream habitat. A site-specific summary of fish passage issues and design requirements for each of the crossing sites considered is presented in Table 18.

Where fish passage is required at culvert crossings the design will follow the New Zealand Fish Passage Guidelines (NIWA, 2018).

Table 18 Fish passage requirements for the Project.

Crossing location	Crossing type as per conceptual	Habitat description	Target species	Fish passage requirement
HCC 1	Not impacted by the Project.	N/A	N/A	N/A
HCC 2	Culvert.	Artificial watercourse, seasonally dry.	Intermittent habitat for eels only.	Bury culvert inverts.
HCC 3	Bridge. Preferred crossing type – defined by NZ Fish Passage Guidelines.	Stream.	Eels, banded kokopu and giant kokopu.	No additional mitigation required.
HCC 4	Bridge. Preferred crossing type – defined by NZ Fish Passage Guidelines.	Stream / wetland.	Eels, banded kokopu, inanga and giant kokopu.	No additional mitigation required.
HCC 5	Culvert.	Overland flow path.	N/A	N/A
HCC 6	Culvert.	Stream has been modified to form ponds.	Unconfirmed.	Solution to be determined at resource consent stage.
HCC 7	Culvert.	Overland flow path.	N/A	N/A
HCC 8	Culvert.	Headwater stream with wetland.	Eels.	Review if stream can be bridged or spanned by an arch culvert. If this is not practical culverts will include hydraulic design targeting climbers (NIWA, 2018).
HCC 9	Bridge. Preferred crossing type – defined by NZ Fish Passage Guidelines.	Stream.	Eels, banded kokopu, giant kokopu and redfin bully.	No additional mitigation required.
HCC 10	Culvert.	Headwater stream with no permanent stream habitat present upstream of the crossing.	N/A	N/A

Crossing location	Crossing type as per conceptual	Habitat description	Target species	Fish passage requirement
HCC11	Culvert.	Headwater stream with no permanent stream habitat present upstream of the crossing.	N/A	N/A
HCC12	Culvert.	Overland flow path with no permanent stream habitat present upstream of the crossing.	N/A	N/A
HCC13	Culvert.	Some headwater stream habitat upstream of the crossing. Also, an existing piped section that may be a barrier.	Eels.	Review if stream can be bridged or spanned by an arch culvert. If this is not practical culverts will include hydraulic design targeting climbers (NIWA, 2018).
HCC14	Culvert.	Headwater stream with no permanent stream habitat present upstream of the crossing.	N/A	N/A
HCC 15	Culvert.	Headwater stream with no permanent stream habitat present upstream of the crossing.	N/A	N/A
HCC 16	Culvert and reclamation / diversion.	Main stem site linking to major tributaries, including areas proposed for restoration as mitigation.	Eels, banded kokopu and giant kokopu.	Stream simulation design.
HCC 17	Reclamation / diversion.	Main stem site linking to major tributaries, including areas proposed for restoration as mitigation.	Eels, banded kokopu and giant kokopu.	Stream simulation design.
HCC 18	Bridge. Preferred crossing type – defined by NZ Fish Passage Guidelines.	Stream.	Eels, banded kokopu, giant kokopu, inanga and redfin bully.	No additional mitigation required.

6.4.4 Instream works timing – [avoid or minimise disruption of migration]

In-stream works have the potential to disrupt migration and spawning for native fish species. This disruption can be avoided and/or minimised by timing the works appropriately. The species diversity was observed to be higher towards the bottom of the Mangakotukutuku Gully catchment in comparison with the upper catchment.

The preliminary design excludes the placement of piles / piers within the main channel of the Mangakotukutuku Gully and the Waikato River where bridge crossings are proposed. Therefore, provided robust erosion and sediment controls are in place, no particular timing restrictions are necessary for bridge crossing works to avoid impacts on migrating fish.

At the upper catchment culverts and diversion sites the key species of concern would be eels, banded kokopu and giant kokopu. Unless otherwise determined by Regional Consent, avoidance of any in-stream works in the period of August to December inclusive will minimise any impacts on the upstream migration period for those species. Avoiding in-stream works between May and August inclusive would also avoid the peak spawning period for giant kokopu and banded kokopu. Overall, instream works will occur between January and April inclusive. This seasonal restriction for undertaking works is necessary at stream crossing sites that are linked to favourable upstream habitat, specifically sites HCC 8, HCC 13, HCC 16 and HCC 17.

6.4.5 Fish recovery – [avoid or minimise killing and injuring fish]

Fish recovery will be required in areas where there are in-stream works and where water is present. Based on the survey work undertaken for this project and the nature of the impacted stream sites a mix of electric fishing and netting methods will be necessary. The method implemented will be determined by the Project Ecologist at the time of the fish salvage works. The broad methodology for fish rescue is contained in Appendix K and is subject to change to reflect any Regional Consents.

6.4.6 Sediment control – [avoid degradation of the stream bed]

An Erosion and Sediment Control Plan (ESCP) will be produced for the Regional Consents for each part of the Project. This will detail the measures that will be put in place to avoid the release of sediment into watercourses during all earthworks.

The Site Restoration Plans will also detail the manner in which the restoration works are undertaken to prevent the release of sediment into surrounding watercourses (refer to Appendix J). The key method is the spot clearance of grasses at planting sites, rather than widespread removal of vegetation. In areas where the habitat is dominated by exotic shrubs which are to be removed and will leave areas of bare ground, sediment fencing will be installed prior to vegetation clearance. The sediment fences will be maintained until it is considered that the plantings have stabilised the ground. Depending on the nature and the scale of restoration work, separate Resource Consents may be required.

6.4.7 Stormwater devices [avoid degradation of stream bed and pollution events]

Stormwater devices will be designed by the Project Packages (Table 2) in accordance with the Comprehensive Stormwater Discharge Consent, Regional Infrastructure Technical Specifications (RITS) (Waikato LASS), Waikato Stormwater Management Guidelines and the Mangakotukutuku Integrated Catchment Management Plan (ICMP) (on completion). The objective of these guidelines, plans and consent is to ensure that the discharge from new stormwater devices do not degrade the quality of streams. Therefore, they will be designed to attain what is considered to be current best practice.

6.4.8 Stream realignment – [offset habitat loss]

Minor stream diversions / realignments may be required for the installation of culverts. A longer diversion will be required where stream reclamation is proposed (Figure 23 and Figure 24).

Figure 23 Existing stream to be realigned (HCC 16 and 17).

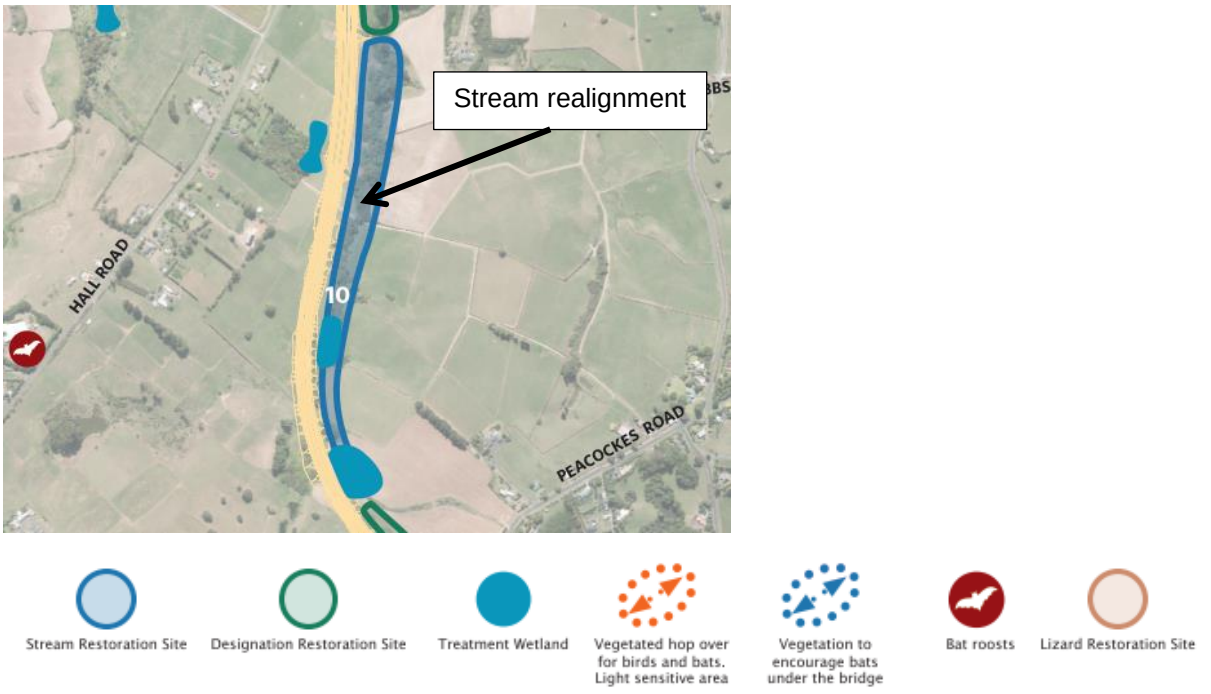


Figure 24 Proposed location of stream re-alignment for HCC 16 and 17.

The design for stream diversion channels will be focused on enhancing this habitat from its current modified state. The stream realignment will take into consideration that the stream channels are surrounded by areas of wetland and will incorporate this into the Stream Reconstruction Plan (need to compensate for loss of stream length and width of existing wetland habitat). The ecologist and engineer working on this Plan will need to take into consideration the cross section and longitudinal shape of the waterway and the materials used within the channel and on the banks. Christchurch City Council (CCC) Waterways, Wetlands and Drainage Guide (2003) Chapter 9 includes guidelines on the restoration of waterway form. This Plan will consider the following aspects:

- Hydraulic capacity – a meandering waterway slows the flow of water, which can impact on surrounding land users. The design will take this into consideration by maintaining connectivity with adjacent land identified as wetland so that natural function is retained / restored. The objective on conclusion of the realignment is to have greater stream length.

- Longitudinal channel profile – the design of the stream will include natural meanders along the stream's length, the inclusion of riffles, run and pool habitats and consider the potential for islands within large pools to increase habitat diversity.
- Channel cross-section – create variable widths and depths within the channel. Create areas of narrow channel of low flow is an issue. The stream banks will be varied to provide steeper and more gentle slopes. The gentle slopes should be located to provide connectivity to adjacent wetland habitat.
- Stream bank materials – use rocks and logs in combination with vegetation to provide habitat variability.
- Streambed substrate – the watercourse effected are mud bottom streams, but the character of these stream will have been affected by surrounding agriculture. It is recommended that coarse substrates are used to provide habitat variability within the stream.
- Bank vegetation – the plantings along the realigned stream will include riparian vegetation that grades into wetland vegetation in some locations.
- Aquatic vegetation – it is important that the bank side vegetation will develop and provide instream shade. Due to high nutrient inputs and sedimentation macrophytes can become a problem when these is an absence of shade.
- Stormwater outfalls – if there are any stormwater outfalls these need to be engineered into the design to ensure that they do not cause erosion.
- Approach to construction - the new stream alignment will be built off-line to minimise water quality effects during construction.
- Resident fish from the reach of stream to be decommissioned will be relocated prior to water flow being diverted into the new watercourse.

  Details will be confirmed as part of future Regional Consent for that part of the Project once detailed design is available.

6.4.9 Stream compensation – [offset habitat loss]

Stream compensation will be undertaken to offset the loss of stream riparian habitat caused by the installation of culverts and stream re-alignment. The location of the stream compensation works are illustrated in Appendix B - Figure 48 - Figure 50.

The approach to the restoration of these areas will be the same as for the Designation Restoration Sites described in Appendix J, in that gully restoration will be completed (instream, wetland and forest habitat restoration). A Site Restoration Plan will be prepared for each of the sites. The maintenance of these habitats will be undertaken in accordance with the methodology described in Section 6.3.2.1 and the monitoring of these habitats will be undertaken in accordance with the methodology described in Section 7.0.

6.5 Bats

The designation conditions overarching objective relevant to the development of mitigation for long-tailed bats ('bats') is;

- No-net loss in biodiversity.

The designation conditions also define an aim to;

- Enhancement of bat habitat.

The designation conditions also specify that the following mitigation measures need to be included within the EMMP;

- Pest control for 20 years at significant roosts;
- Measures to avoid, minimise and monitor roost removal and habitat loss;

- Provision of alternative roosting sites (e.g. bat boxes);
- Measures to minimise habitat fragmentation;
- Establishment of buffer zones and hop-overs in advance of construction where feasible;
- Measures to minimise disturbance during construction within the vicinity of roosts; and
- Long-term monitoring of bat activity with respect to the Project.

Table 19 presents the potential effects of the Project on bats without mitigation and the mitigation that is proposed to achieve no-net-loss in biodiversity as a result of the Project. Sections 6.5.1- 6.5.9 detail the specific bat mitigation and management approach that will be implemented.

Table 19 Potential effect of the Project on bats and subsequent mitigation.

Effect of the Project, without mitigation	Approach to mitigation	No-net-loss	Enhancement
Loss of habitat connectivity due to habitat removal or installation of structures.	Avoid / minimise.	Safeguard zones – retain existing native vegetation as close as possible to bridge structures and road edges to encourage continued movement of bats.	N/A
	Mitigate.	Additional tree plantings – at the conclusion of substantive construction works those areas adjacent to the road that have been disturbed will be replanted in accordance with the detailed Landscape Management Plan which will look to include ecological restoration as appropriate to the location.	N/A
	Mitigate.	Hop-overs and underpasses installed where the Project crosses known bat foraging and commuting routes.	N/A
	Mitigate.	Restoration and buffer plantings will be undertaken to increase the total area of habitat that are of value to bats.	N/A
Loss of roosting sites.	Avoid / minimise.	Where practicable, retain trees of moderate to high bat roost potential that are located at the edge of the designation corridor. Review the potential to retain known bat roosts within the designation corridor (three known	N/A

Effect of the Project, without mitigation	Approach to mitigation	No-net-loss	Enhancement
		roosts), if the roosting site would still be of value to the bats.	
	Mitigate.	Provide roost features in the short, medium and long term; • Short – bat boxes • Medium – fast growing exotic trees that typically form cavities early. • Long – native restoration plantings including species known to be used for roosting.	N/A
	Offset.	Relocation of the cavity of bat roost 30 (maternity roost in alignment) to be clear of the designation corridor.	N/A
Killing or injuring bats during vegetation removal.	Avoid.	A Vegetation Removal Protocol will be implemented to avoid bats being injured or killed (refer Appendix I). Timing of roost relocation for when bats are less likely to be present (avoid November - February).	Installation of predator bands on trees with known significant roosts, where practical, given site constraints, Health and Safety and with landowner/manager approval. Funding to support private landowners to install predator bands and provide advice in relation to other approaches to pest control. Implementation of pest control for 20 years at all Stream Offset Sites and Designation Restoration Sites.
Disturbance of foraging and roosting bats during construction and operation.	Avoid / minimise.	Sensitive lighting design will be implemented (e.g. warm white LED lights, shades to focus light and reduced height poles at crossing points) (refer to Section 6.5.2).	N/A

Effect of the Project, without mitigation	Approach to mitigation	No-net-loss	Enhancement
		Buffer planting will be used to minimise light spill into existing habitat.	
	Mitigate.	Good site practice measures (refer to Section 6.5.6) will be adopted including buffer zones around known roosting sites.	N/A
Reduction in foraging habitat due to severance of habitat linkages.	Mitigate.	Maintenance of connectivity between habitats of value to bats as part of the Designation Restoration Sites.	N/A
	Offset.	Restoration of habitats that are currently of value to bats as part of the Designation Restoration Sites.	N/A

6.5.1 Bat hop-overs and underpasses design – [mitigate for effects on habitat connectivity]

Bat hop-overs or underpasses will be created across the Project where there is the potential for the road to sever known habitat linkages used by bats. These features will be constructed where the Project crosses the main branch of the Mangakotukutuku Gully at four locations and the Waikato River at three locations (one of which is the existing Cobham Bridge). In addition, terrestrial crossing points will be installed in areas where bats have been observed during radio tracking surveys to commute to isolated habitats e.g. kahikatea stands or open water. Refer to Appendix B Figure 48 - Figure 50 for the location of the proposed bat hop-overs and underpasses.

The nature of these hop-overs and underpasses will be tailored to the ground conditions and profiles at each site. Sketches illustrating conceptual options for the delivery of hop-overs are provided Appendix G. These will be further developed and confirmed as part of the detailed design phase.

If these mitigation features are to be effective it is important that their structure/form is created in advance of road construction. This means that where practical, the trees at the hop-overs and underpasses are planted in advance of the construction works so that the trees at the hop-overs reach a height where the canopy will enable bats to travel over the road at a safe height (>5 m). At the underpasses tree species will be selected to ensure that at maturity the top of the canopy is below the bridge deck so that bats will travel beneath the bridge rather than over it. Where it is not possible to plant in advance of the Project, large grade specimen trees will need to be planted as early as practicable during or following construction of the relevant section of the Project.

In areas where bat hop-overs are developed adjacent to the existing and proposed Waikato River bridges the bridge designers will also consider if there are opportunities to protect bats from vehicle strike through the installation of design features to the bridge. In their simplest form these features could be described as the placement of sides or barrier on the bridge structure, particularly adjacent to the river banks where bats are most likely to be travelling. The appearance of these structures is not important from the bat's perspective; their role is to lift the height at which bats are travelling. If these measures were to be implemented, they need to be implemented in connection with the vegetated hop-over.

6.5.2 Lighting and noise control design – [minimising disturbance]

The acoustic bat surveys undertaken for the Project (refer Section 4.3.1) investigated how artificial light levels could affect bat activity. Previous studies in New Zealand suggest that the presence of artificial light correlated to reduced levels of bat activity (Le Roux & Le Roux, 2012). The study undertaken for the Project has been inconclusive; however, a precautionary approach will be adopted by the Project.

HCC has implemented a policy for installing warm white LED lights when refurbishing existing street lighting and when constructing new roads. Therefore, the lighting along the Project will be warm white LED lighting. Lighting guidance within the UK has identified that this type of lighting is likely to have less impact on bats than sodium lighting (ILP & BCT, 2018). This is because the LEDs do not attract insects from the adjacent habitat used by bats, and consequently do not attract bats to forage on insects around the light, which would be a modification of their natural foraging behaviour.

The lighting design for the Project will include the installation of lenses/reflectors into each light (refer to Figure 25). The lenses/reflectors focus the light onto the road, away from adjacent habitat used by bats. The objective is to ensure that the Mangakotukutuku Gully and other key bat habitat features are protected from light spill and remain dark, even though the road will run adjacent to it. Light will also be managed along the Mangakotukutuku Gully by widening the vegetation that surrounds the stream.

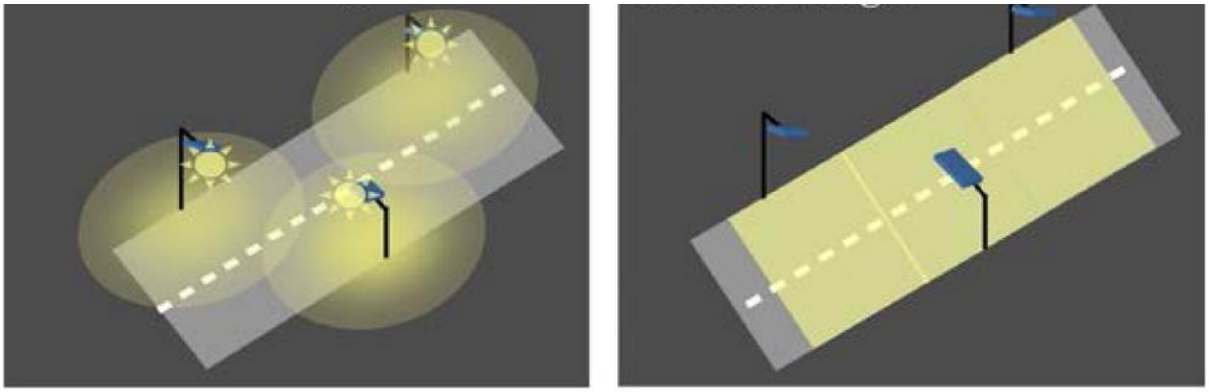


Figure 25 Figures indicatively illustrates+ that through effective lighting design light is focused on the road away from adjacent habitats.

At hop-over locations, road lighting will be shorter poles than the standard height. This will ensure that the head of the light is below existing mature canopy height and / or decreases the period for new plantings to reach and exceed the height of the light column. An example of this configuration for safety purposes is shown for Airport Road at the end of the Hamilton Airport runway (Figure 26). For the Project the purpose of this is to encourage bats to continue to travel at the top of the canopy uninhibited by light, while ensuring that health and safety requirements for lighting are met.

Figure 26 Example of reduced height street lighting on Airport Road, Hamilton.

The use of warm LEDs, lenses/reflectors, widening gully vegetation and lamps of reduced height are considered to be the main methods of controlling light spill from the Project. However, during the design of the three Waikato River Bridges (two new bridges and one modification to an existing bridge) the Project Engineers will consider whether aesthetic structures on the bridge could also reduce light spillage.

There is an aspiration for Waikato River Bridge to be a 'landmark structure'. It is understood that during consultation it was suggested that the structure could have lighting on its sides or beneath it for aesthetic reasons. It is understood why this has been suggested, however, it is considered that lighting of this nature could inhibit the movement of bats along the Waikato River. Therefore, as a precautionary approach none of the bridge structures will have lighting for aesthetic reasons.

The Peacocke Structure Plan indicates that a footpath and cycleway would be located at the base of the Mangakotukutuku Gully. In response to concerns about disturbance and construction feasibility the Project will not promote the construction of public pedestrian and cycle paths within the gully network. This will avoid disturbance from public access and lighting. Foot access will be limited to DOC style maintenance tracks in consultation with HCC Parks and Open Spaces.

The monitoring undertaken as part of the Project did not identify any relationship between bat activity and elevated noise levels. However, the Project will look to manage noise levels through the construction and operation of the Project. The preliminary design specifies the use of open graded porous asphalt (OGPA) on all major arterial roads and asphalt on all other roads to reduce noise levels caused by vehicle friction. HCC designation conditions 2.3.4 (b) requires low noise road surfaces to be used.

6.5.3 Safeguard zones for existing vegetation and tree retention – [avoid habitat loss]

In Section 6.3.3 this EMMP discusses the implementation of safeguard zones to protect newly created habitats within the Designation Restoration Sites. Safeguard zones will also be used to protect existing vegetation that is of ecological value.

To limit the effect of habitat loss on connectivity at known connective linkages for bats, the Project Ecologist will work with the Project Engineers and Contractors to seek methods of construction that limit vegetation loss without making the Project cost prohibitive. Fencing and markers will be erected to define the maximum working area and develop safeguard zones within which no work will occur. If the contractor needs to extend their site working area into a safeguard zone, the contractor will be obtained approval from HCC (RA) or Transport Agency who will consult with the Project Ecologist.

Safeguard zones will also be established around areas of restoration planting (refer to Section 6.3.3). To ensure the establishment of connective linkages (hop-overs and underpasses) for bats, early restoration planting will occur. In particular this will occur around the north-south link (refer to Figure 27), where the Project is aiming to provide a new area of foraging habitat and new connective linkage

in advance of construction (estimated >10 years). Care will be taken to ensure that planting does not occur in areas that will be required during construction. Fencing or markers will be installed adjacent to the working area to ensure that accidental or intentional incursion does not occur by the contractor.

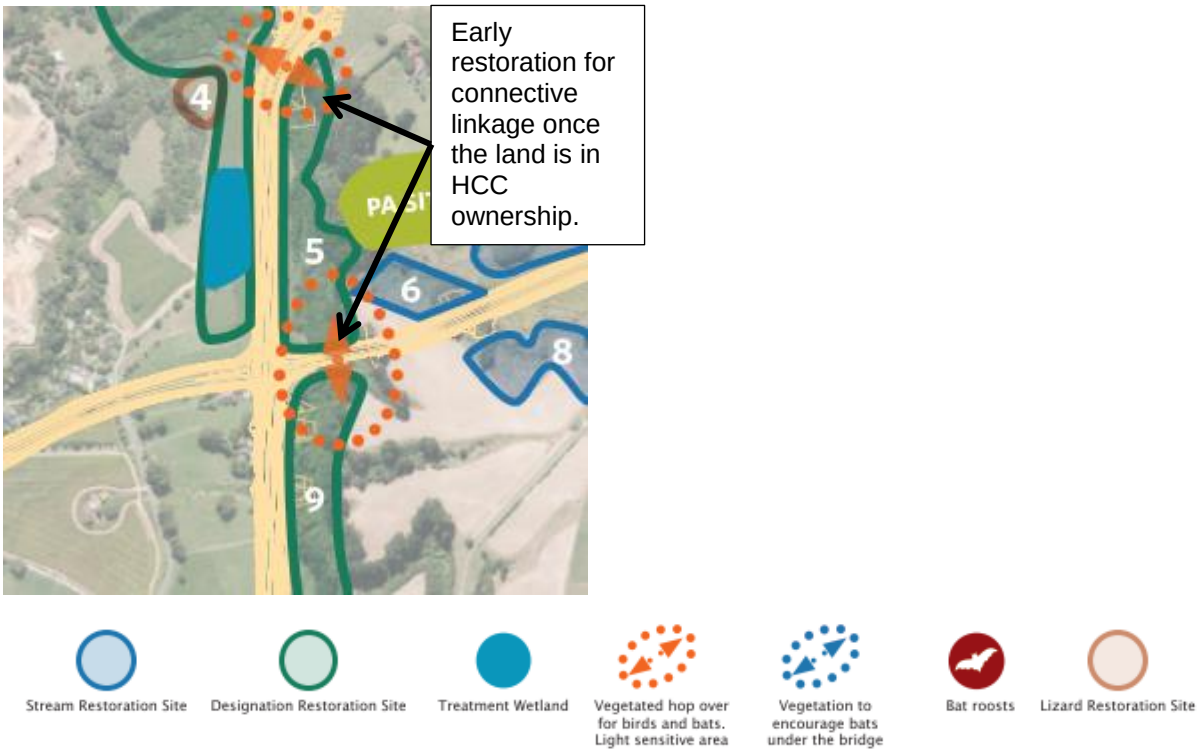


Figure 27 Location of an area of early restoration to establish a hop-over.

A Bat Roost Potential Survey of Trees (AECOM, 2018) was undertaken within the section of the Project to be delivered by HCC. Further surveys will occur in the section of the Project to be delivered by the Transport Agency once the design phase of the Project commences.

The survey identified mature trees with features that could provide bats with suitable roosting sites within the designation corridor. The Project Ecologist will work with the design team to identify opportunities to retain trees with moderate or high bat roost potential, when they are located beyond the footprint of the road and its associated earth works and construction area.

Trees identified for retention will be fenced and / or marked so that it will be immediately clear to all contractors that care should be taken in the vicinity of the tree. Fencing will be located at the edge of canopy of the tree to minimise disturbance to the tree's roots. If this is not possible then advice will be sought from the Project Arboriculturalist on the measures to adopt to ensure that the integrity of the tree is not compromised by works e.g. matting to spread the weight of vehicles etc.

6.5.4 Artificial roost replacement – [offset loss of potential bat roost trees]

The Project will compensate for the loss of potential or future bat roosting trees in three ways;

- Short term - Bat boxes;
- Medium term - Exotic tree planting; and
- Long term - Native tree planting (restoration and buffer areas).

6.5.4.1 Bat boxes – manufactured and natural

The Project bat radio tracking surveys (Davidson-Watts Ecology, 2018) confirmed that existing artificial roosts (bat boxes) were used by bats during the late maternity and post maternity period (post lactating females were recorded roosting in January and March 2018). A maximum of 150 bat boxes will be erected within the Project area (refer to Figure 28) to provide immediate mitigation for the loss of potential bat roost trees. HCC will erect up to 100 of the bat boxes, while up to 50 will be erected by

the Transport Agency. Where beneficial / practical, bat boxes should be located within existing trees in close proximity to restoration areas that will include exotic trees. This is because as the bat boxes fail (i.e. disintegrate over time), the bats may be able to access newly formed roosting sites in the adjacent exotic trees. HCC and the Transport Agency will install bat boxes as part of the EMMP implementation works. In areas of HCC owned land early installation will be possible, in Designation Restoration Sites the boxes will be installed as part of the restoration works. These boxes will provide bats with alternative roosting sites in the short term[14].

Figure 28 illustrates locations where trees have been identified that are suitable for the installation of bat boxes, albeit that some are located on third party land and would require their permission (i.e. suitable size tree, no existing cavities in which bats could roost). The potential to use these locations for bat boxes will need to be discussed and agreed with the appropriate landowners/land managers. The Project Ecologist may identify additional locations that would be suitable for the installation of the bat boxes as part of the EMMP implementation works. The exact placement of the bat boxes will be determined by the Project Ecologist, working with the Projects Arboriculturalist. Guidance on the positioning of bat boxes is presented in Appendix H.

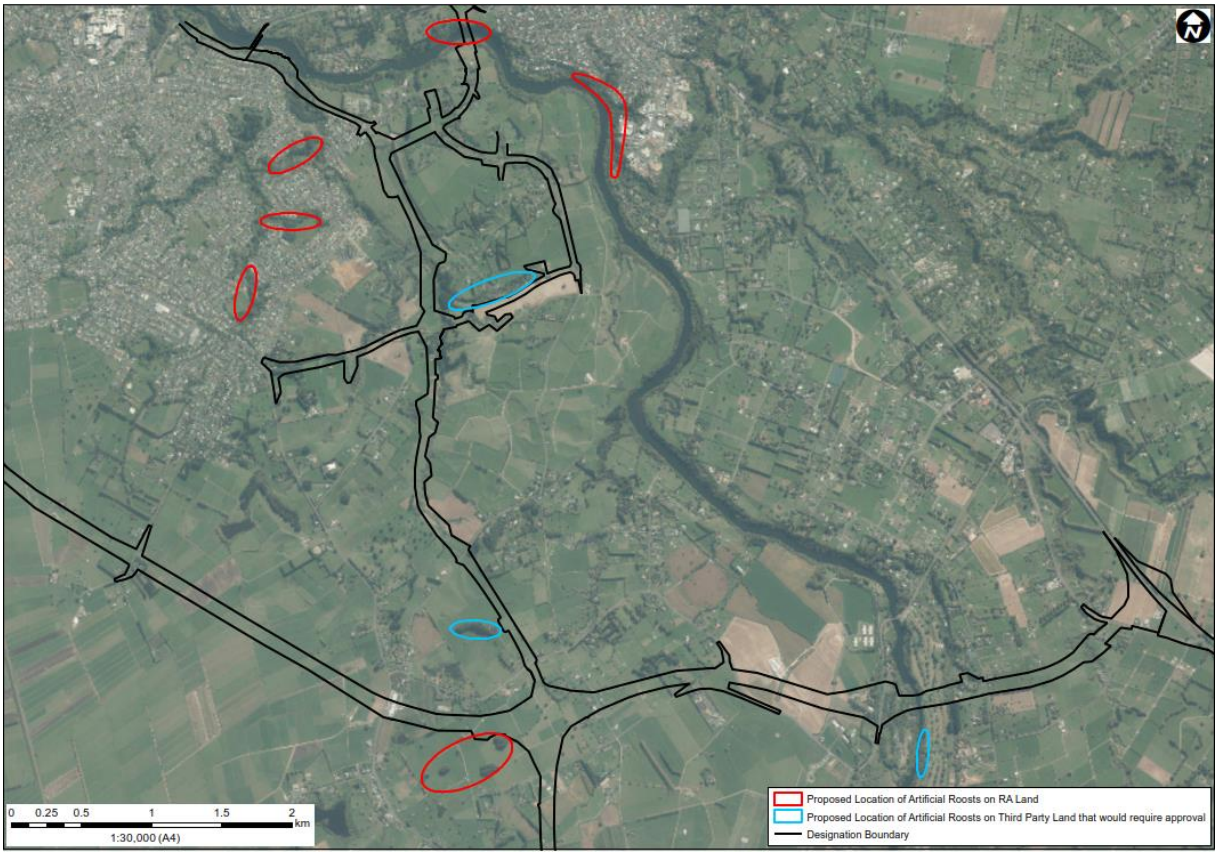


Figure 28 Potential areas for the installation of bat boxes (Note: Some locations would require approvals from 3rd parties (landowners / managers for access)).

The bat boxes will be Kent bat boxes or similar (2F Schwegler with double front panel) (refer to Figure 29 & Figure 30). The type and location of bat box selected will reflect the knowledge gained from the Projects bat radio tracking and bat box trials in Canterbury completed by DOC (email DOC, 2018). The type of box erected maybe amended by the Project Ecologist to reflect current knowledge of the success of bat boxes in New Zealand.

[14] Bat boxes will be installed as short term mitigation. However, the boxes will be designed to remain in place for as long as practicable.

Figure 29 Kent bat box.

Figure 30 2F Schwegler bat box with double front panel.

The Project will also look for opportunities to install features called ‘natural bat boxes’, refer to Figure 31.

During the implementation of the Vegetation Removal Protocol (refer to Section 6.5.5) the Project Ecologist will look for features within the trees being removed that could provide suitable bat roosting sites e.g. a limb contains a suitable roost cavity. If these are identified, then the Project Arboriculturalist will cut these so that they are in a form that could be erected into a living tree that is to be retained in the long term or on an artificial structure such as a wooden telephone pole. The viability of this approach will depend on the scale and nature of the trees being removed. However, the Project Ecologist will be appointed to ensure opportunities are sought. The positioning of these features would follow the guidelines in Appendix H manufactured bat roosts.

Figure 31 Example of a natural bat box.

6.5.4.2 Exotic trees

A small number of exotic trees are to be planted within the Designation Restoration Sites because they are known to grow faster than native tree species and are more likely to form features within which bats could roost sooner than native trees. Exotic trees will provide roosting sites for bats in the medium term to mitigate roost loss from the Project.

Eucalyptus trees (100 trees) have been planted within the first area of restoration planting 104 Hall Road delivered by the Project with the support of MSCG, WRC and the landowner. These have been planted in an accessible location in clusters of 3-5 trees and set back from the designation corridor so that they can be readily manage (e.g. poisoned or partially felled) without compromising native plantings.

Each of the Designation Restoration Sites will include exotic trees (the number will vary due to the scale of the restoration area) (refer to Appendix B Figure 48 - Figure 50). They will form a small percentage of the overall restoration planting.

The positioning of exotic tree planting is important, and the following factors need to be considered;

- Ease of access for management (including removal if required);
- Ease of access for additional habitat enrichment features if considered of value e.g. bat box installed after 10 years;
- Distance from the proposed road; and
- Positioned to increase the potential for bats to encounter the roost and the value to them e.g. connected, suitable foraging, not too exposed etc.

Table 20 presents a list of exotic tree species that could be planted as they have been observed to provide bats with roosting sites in the area south of Hamilton (Davidson-Watts Ecology, 2018).

Table 20 Exotic tree species

Common name	Latin name
Giant gum	*Eucalyptus regnans*
Brown barrel	*Eucalyptus fastigata*
Messmate	*Eucalyptus obliqua*
Tasmanian blackwood	*Acacia melanoxylon*
Radiata pine	*Pinus radiata*
London plane	*Platanus x acerifolia*
Sessile oak	*Quercus petraea*

6.5.4.3 Designation Restoration Sites and buffering vegetation – [offset habitat loss and minimise disturbance]

The Designation Restoration Sites described in Section 6.3 have all been selected so that once completed they will provide bats with suitable foraging and roosting habitat in the long term and ensure that existing connective linkages are maintained.

The restoration plantings to be delivered by HCC will be delivered as land parcels are transferred into their ownership (refer to Section 1.7). Restoration works will be delivered in the pre-implementation phase of each stage of the Project with the aim of maintaining or developing linkages and / or to provide a buffer between the road and important foraging habitat and roosting.

A key area for early restoration planting is the area that wraps around the north-south link of the Project (refer to Figure 27). The bat radio tracking surveys have illustrated that the Mangakotukutuku Gully is currently an important connective linkage and is used for foraging with side branches being used for roosting. The objective of the planting is to establish vegetation around both sides of the proposed road in combination with hop-overs to encourage bats to continue to cross the new road when it's operating.

A detailed Site Restoration Plan will be produced for each of the restoration sites. The Site Restoration Plans and subsequently the planting lists will take into consideration the requirements of bats and other native species. Table 21 contains a list of trees and shrubs that are likely to encourage bats to forage and roost.

Table 21 Plant schedule for Designation Restoration Sites to encourage bats

Common name	Latin name	Value to bats
Makomako	*Aristotelia serrata*	Foraging on associated insects
Mingimingi	*Coprosma propinqua*	Foraging on associated insects
Karamu	*Coprosma robusta*	Foraging on associated insects
Ti kouka	*Cordyline australis*	Foraging on associated insects and roosting
Kahikatea	*Dacrycarpus dacrydioides*	Foraging on associated insects and roosting
Rimu	*Dacrydium cypressinum*	Foraging on associated insects and roosting
Pokaka	*Elaeocarpus hookerianus*	Foraging on associated insects
Kanuka	*Kunzea robusta*	Foraging on associated insects
Manuka	*Leptospermum scoparium*	Foraging on associated insects
Mahoe	*Melicytus ramiflorus*	Foraging on associated insects
Harakeke	*Phormium tenax*	Foraging on associated insects

Common name	Latin name	Value to bats
Manatu	*Plagianthus regius*	Foraging on associated insects
Totara	*Podocarpus totara*	Foraging on associated insects and roosting
Matai	*Prumnopitys taxifolia*	Foraging on associated insects

Three Designation Restoration Sites are associated with the section of the Project to be delivered by the Transport Agency to meet the requirements of the designation conditions (Waipa DC and Waikato DC). Funding is not currently available for this section of the Project. The Transport Agency will look to undertake early restoration plantings once the detailed design phase commences.

A priority for the Designation Restoration Sites delivered by the Transport Agency will be to enhance two areas that are known to be of high value to the local population of bats for roosting and foraging;

- **61 Narrows Road** - used as a roosting and foraging site (Figure 32)

  At this site three existing stands of kahikatea will be linked by additional plantings. These plantings will be native, include a range of species that will increase invertebrate diversity and in the long term will provide bat roosting sites.

- **512 Airport Road** - adjacent to the maternity roost at Narrows Park (Figure 33). The mechanism for landownership in the long term is yet to be determined.

  At this site marginal vegetation along the Waikato River will be widened to provide additional habitat for the bats roosting at the Narrows Park. The focus will be on increasing the diversity of native botanical species and the inclusion of species that will provide roosting sites in the long term.

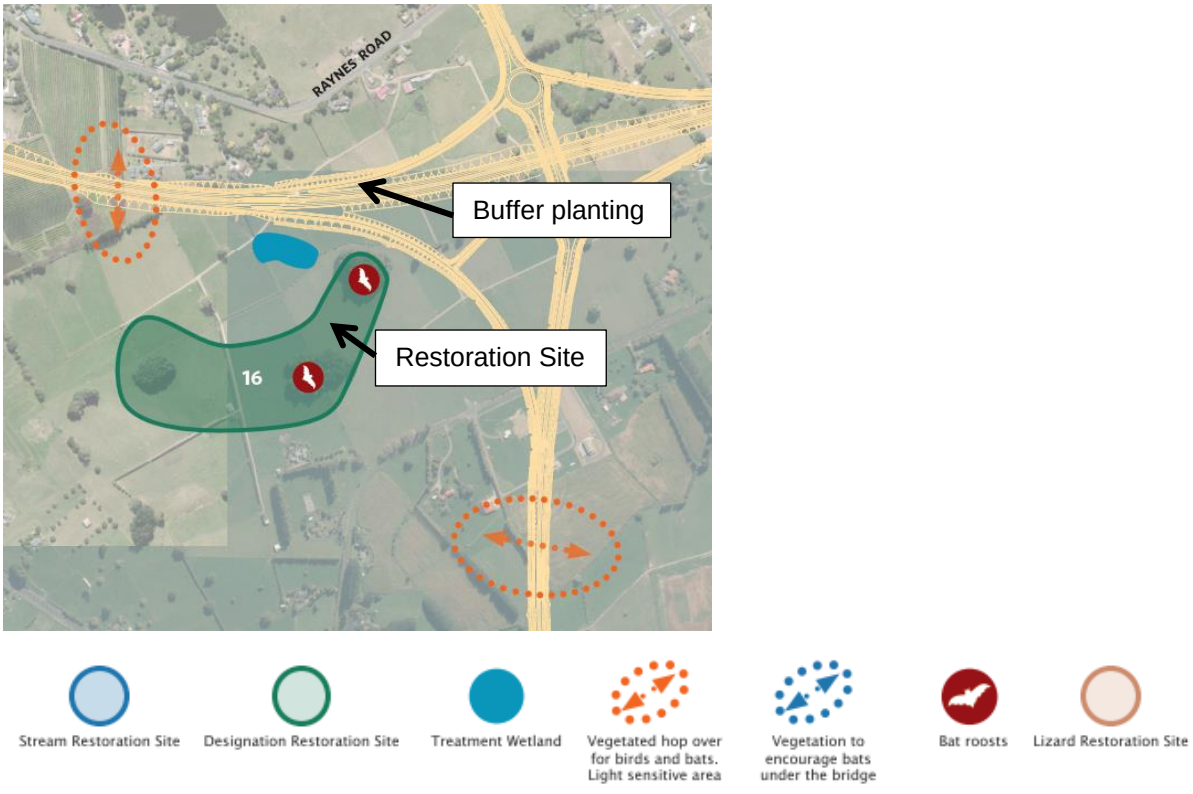


Figure 32 Designation Restoration Sites and buffer planting associated with 61 Narrows Road.

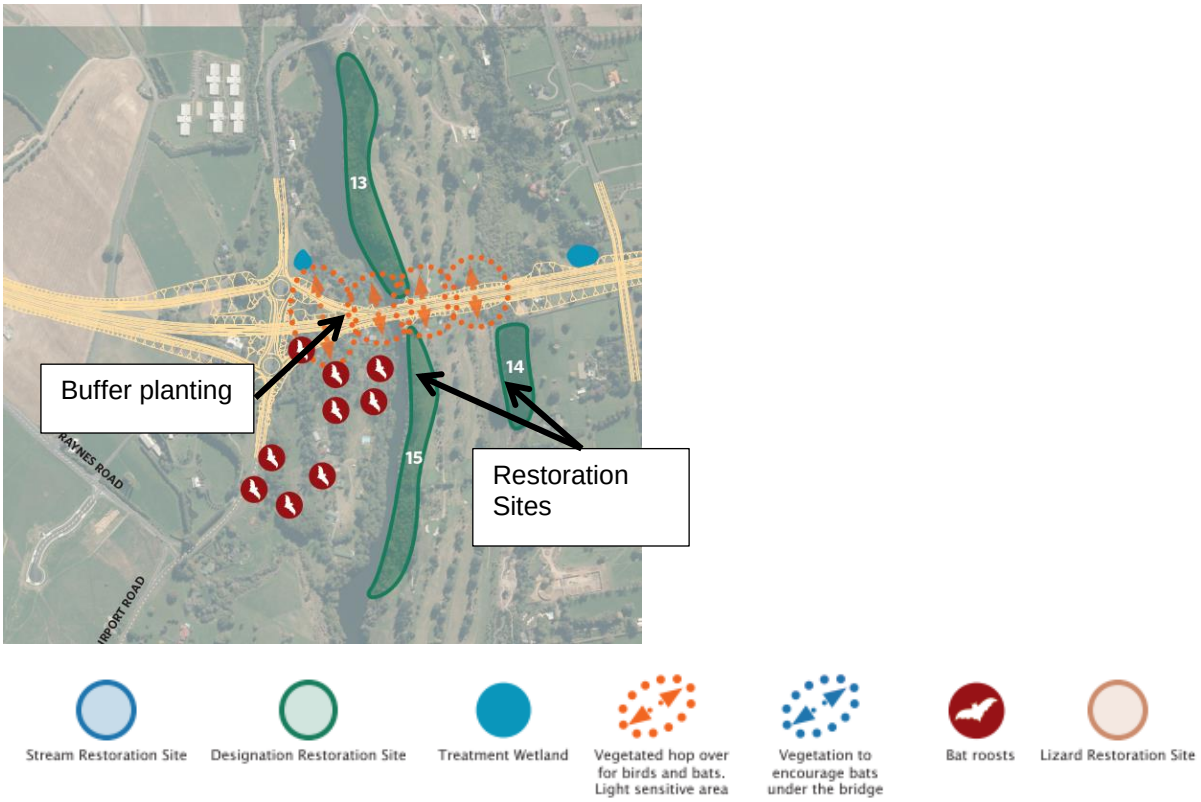


Figure 33 Designation Restoration Sites (512 Airport Road and golf course) and buffer planting at the Narrows Park (442 Airport Road).

In addition to the Designation Restoration Sites the Transport Agency will also deliver buffer planting, at key roosting sites:

- The kahikatea stands located at 61 Narrows Road to the south of Raynes Road (Figure 32);
- The oak and false acacia trees located at 442 Airport Road and the local vicinity (Narrows Park) (Figure 33); and
- The kahikatea stand located at 99 Raynes Road[15] (Figure 34).

[15] Any works within the vicinity of 99 Raynes Road will take into consideration Designation Condition 13.1 *During the preparation of the detailed stormwater design plans for the Project, the NZ Transport Agency shall pay particular attention to the design of stormwater devices and methods on 99 Raynes Road2 to ensure that existing drainage issues on the property are not made worse by the Project, and that the health of the covenanted kahikatea stand on the property is not adversely affected. In consultation with the owners of 99 Raynes Road, the detailed drainage design shall, where practicable, incorporate or complement existing field drainage works on the property.*

Figure 34 Buffer planting associated with 99 Raynes Road.

The buffer plantings will be incorporated within the Project's Landscape Management Plan as part of the Project landscape plantings and the planting surrounding wetlands. The buffer plantings will be additional to the Designation Restoration Sites, as they cannot be clearly separated from the landscaping plantings. These plantings are critical in managing potential impacts on key bat roosting locations.

The Project will construct multiple stormwater management wetlands. This habitat is not credited as part of the Projects delivery of restoration habitat for the Designation (i.e. is in addition to the areas in Table 14). However, it is important to recognise the additional habitat they provide. The wetland construction toolbox prepared for the Integrated Catchment Management Planning (ICMP) will be used to guide design of planting for a range of outcomes including to encourage bats to use wetlands for foraging.

6.5.5 Vegetation Removal Protocol – [avoid killing and injuring of bats]

A Bat Roost Potential Survey of Trees (AECOM, 2018) within the section of the Project to be delivered by HCC was completed and identified approximately 680 trees with moderate or high bat roost potential required further survey to confirm the presence or likely absence of bats, prior to their removal. This excludes 760 trees at Sandford Park, which are not expected to be felled in the next 10 years and the five sites where access could not be obtained during the Bat Roost Potential Survey of Trees (AECOM, 2018b).

These future tree surveys will be undertaken as part of the Vegetation Removal Protocol, presented in Appendix I.

The vegetation removal protocol describes the following;

- When the Vegetation Removal Protocol should be applied.

- Trees that are marked with a metal tag and have previously been identified by the Bat Roost Potential Survey of Trees to have moderate or high bat roost potential and need to follow the vegetation removal protocol (AECOM, 2018); or
- If a tree has been assessed to have negligible or low potential during the Bat Roost Potential Survey of Trees it can be removed with no further action. Therefore, it does not continue to follow the vegetation removal protocol

- Timings of vegetation removal works that are following the vegetation removal protocol (1st October and 30th April);
  - The removal of trees with moderate or high bat roost potential in the vicinity of the Narrows Bridge has additional seasonal constraints. In this area (refer Figure 35) a significant number of trees have been confirmed to be in use by bats during the maternity period. Therefore, tree felling works will be programmed to occur during October or March to April which is during the bat active period (October to April), but outside of the bat maternity period (November -February).
- The nature of further survey works required to determine the presence or likely absence of bats; and
- The actions to take if bats are found to be roosting or not roosting within a tree.

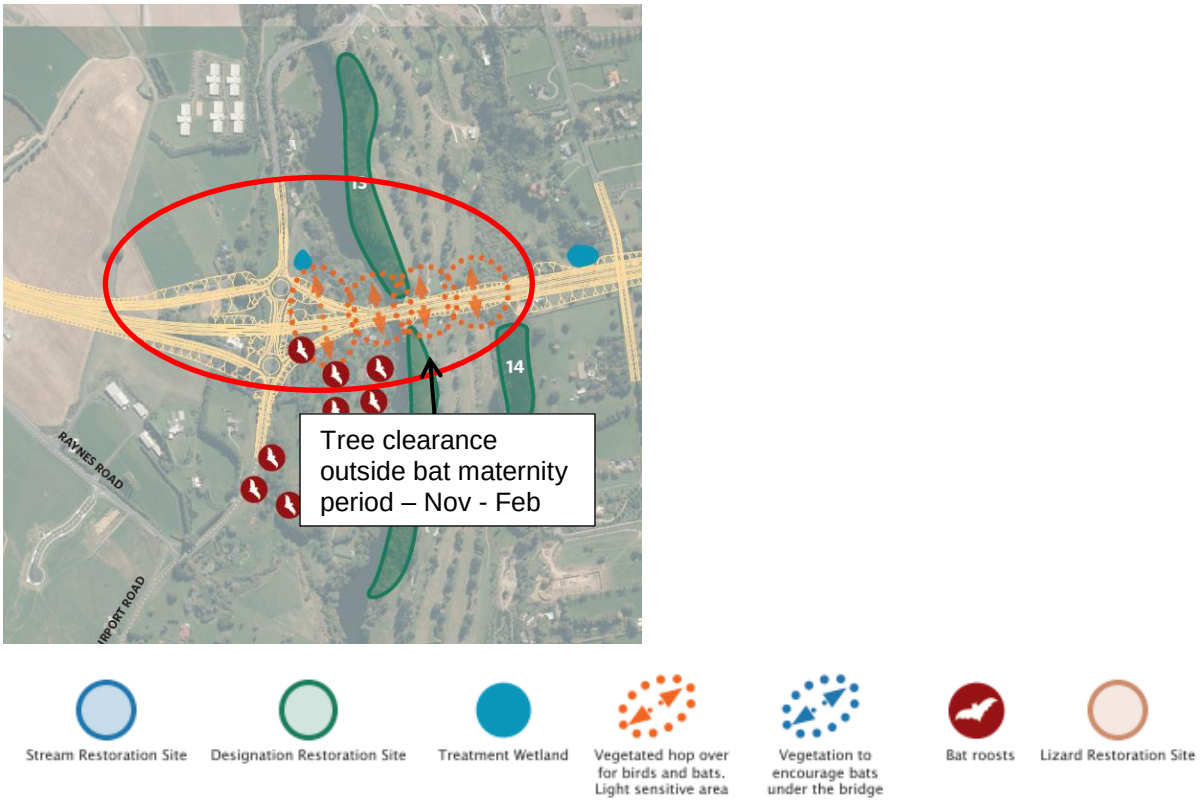


Figure 35 Vegetation removal to occur outside of the bat maternity period (Nov – Feb).

DOC has indicated that they do not have the authority to issue a permit for works that would be considered an offence under the Wildlife Act 1953. Therefore, works will proceed in accordance with the Vegetation Removal Protocol with a view that works are undertaken in a manner that will ensure that they would not be considered an offence under the Wildlife Act 1953. If a bat roost is identified consultation should be undertaken with DOC in relation to a way forward in relation to Wildlife Authorisation Permits.

6.5.5.1 Roost removal – [avoid killing and injuring of bats and mitigate for habitat loss]

Bat radio tracking survey works completed in 2018 and 2019 have identified 55 bat roosting sites (refer to Figure 18), within the Project area. Three of these are located within the designation corridor:

- Sandford Park (HCC Section) – Roost 19 and 26 (refer Figure 18); and
- Narrows Bridge/456 Airport Road (Transport Agency Section) —– Roost 30 (refer Figure 18 and Figure 36).

These three roosts are located within sections of the Project that do not have funding for construction within the next 10 years.

DOC is currently undertaking a review of how the Wildlife Act 1953 is implemented and its associated Permitting process. At the time of writing DOC had concluded that they could not provide Permits for the removal of known roosting sites (an offence under s63), as the Act (s53) does not delegate authority to DOC to do this.

Therefore, the recommendations below have been prepared based on current best practice in New Zealand and internationally when a development encounters a known bat roosting site. The focus of the mitigation is to provide equivalent habitat for the species in an area that is likely to be used e.g. known foraging and roosting area, avoiding having a significant effect on the conservation status of the species.

This EMMP assumes a worst-case scenario where these roosts will not be retained in their current location and mitigation has been developed to mitigate for their loss. During detailed design the Project Ecologist shall work with the Project Engineers to look for options for the roost trees to be retained in situ.

The known maternity roosting site (Roost 30 – refer to Figure 36 and Figure 37) located at the Narrows Bridge (refer Figure 36) will be relocated from its current position onto a parcel of adjacent land. An example of this method is shown in Figure 31. It could also be placed on a telegraph pole. Care will be taken to ensure that the roosting location remains at the same height, orientation and has a similar position in relation to surrounding trees, as this can affect the micro-climate within the roost.

It is possible that the whole dead tree could be relocated as a single piece of standing dead timber and re-erected beyond the designation boundary. However, the longevity of this approach is uncertain, as rot from the base could make the roost fall sooner than if positioned on a living tree. This option will be reviewed by the Project Ecologist and the Project Engineers at the detailed design stage.

Roost 30 is a known maternity roost so translocation works will be programmed to occur during the bat active period (October – April), avoiding the maternity period. As per the Vegetation Removal Protocol (refer to Appendix I), a survey will be undertaken to determine if bats are present or absent. If bats are present the translocation works will not commence until the bats have relocated themselves or they have been displaced using a method agreed with DOC e.g. one-way exclusion device.

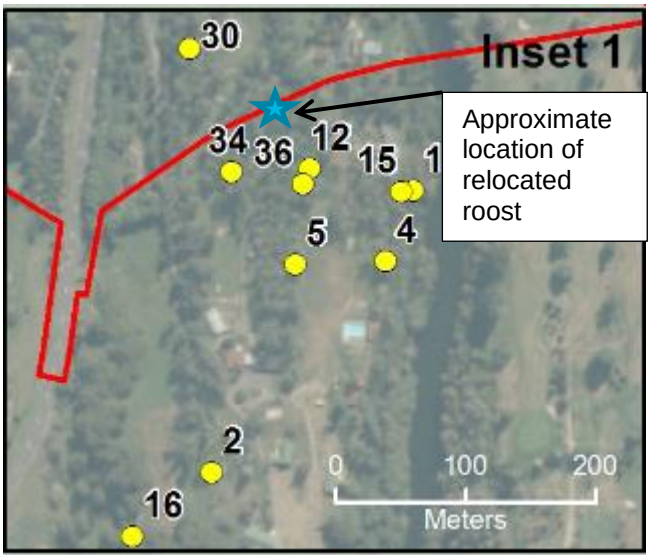


Figure 36 Roost 30 (Narrows Bridge) would be relocated from within the designation boundary to a parcel of adjacent land owned by the Transport Agency. Red line shows the designation boundary.

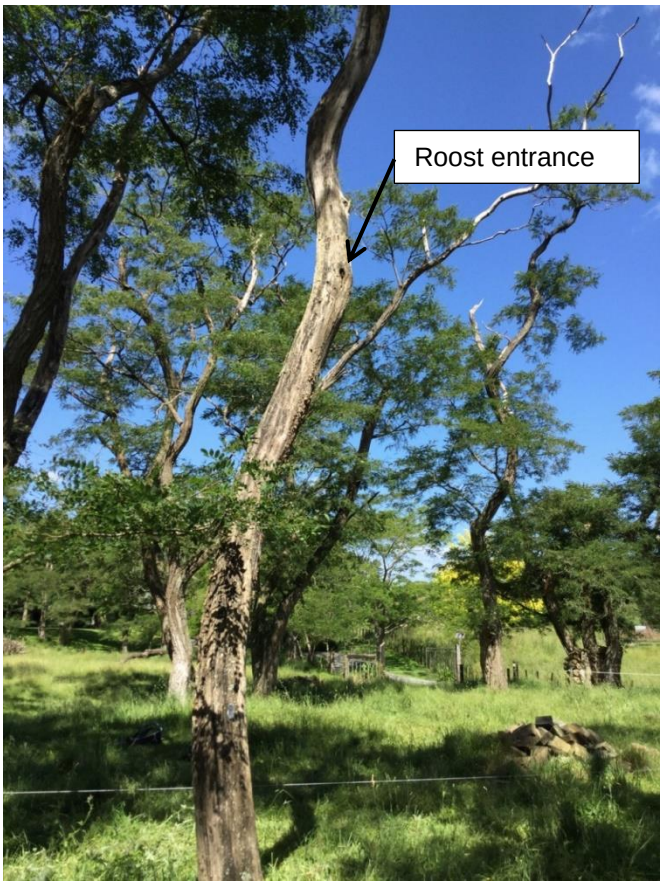


Figure 37 Bat maternity roost located within the designation alignment – 456 Airport Road, Narrows Bridge (roost 30 – refer to Figure 18).

At Sandford Park the two roosting sites within the designation boundary were night roosts (Roosts 19 and 26). These are important to the local bat population as often bats use night roosts when weather conditions are poor or when roosting between foraging. These roosting sites do not provide the thermal properties that would be present at a maternity roosting site and can be temporary in nature. Roost 26 was beneath a small area of lifted bark on a Tasmanian blackwood, only slightly bigger than the bat that roosted beneath it. Only one bat was observed to use this roost.

During the detailed design stage, the Project Ecologist will work with the Project Engineers to see if the known roost trees can be retained in situ. However, this is considered unlikely due to the extensive earthworks that would be required at this location. Therefore, it is proposed that these roosting sites are replaced with bat boxes with predator bands on appropriately selected trees or positioned poles, away from the area being affected by works.

In accordance with the Vegetation Removal Protocol (refer Appendix I) the removal of the roost tree will occur between October – April. It will be determined whether bats are currently present or absent (prior to tree removal works taking place). If bats are present, then the roost will be retained until it has been confirmed that bats are no longer present or they have been displaced using a method agreed with DOC e.g. one-way exclusion device.

6.5.6 Good site practice – [minimise disturbance]

A Construction Management Plan (CMP) will be produced for each Project which will detail how the Project Package and will manage wider environmental impacts e.g. sediment runoff, management of hydrocarbons etc.

It is anticipated that the CMP will include measures to ensure that during normal operations there are no negative impacts on adjacent fauna through unnecessary disturbance. Below is a summary of the measures that should be incorporated into the CMP to ensure that there is no significant disturbance on bats that could be roosting in area adjacent to the works.

- **Buffer zones around known roosts** – Section 6.5.5 indicates the mitigation measures that are required where bat roosts are located within the designation alignment. To manage noise and vibration disturbance, works should remain at least 50 m or two tree lengths from the known roosting sites, where practicable.

  If works need to occur closer to a roost trees (e.g. Narrows Bridge) they should be scheduled to occur over as short a period as possible.

  Timing of works should take into account when roosts are in use. Works adjacent to roosts at the Narrows Bridge should be programmed to occur outside of the bat maternity period (November-February), where practical.

- **Night working** – night work typically needs to be lit for Health and Safety reasons and should be avoided within the vicinity of the known bat roosting sites, where practicable. If night works are required or storage areas/work compounds need to be lit, then the lighting selected should use warm white LEDs and these should have lenses/reflectors fitted to ensure that lighting is focused on to the working area only. Storage areas/work compounds should be located away from areas that are known to be of high value to bats for foraging and roosting. The Project Ecologist will provide guidance on positioning of compounds during each stage of the Project.

- **Tree felling** – Project Arboriculturalists undertaking felling works must work with the Project Ecologist to implement the Vegetation Removal Protocol (Appendix I). Trees with a diameter at breast height (dbh) that is >15cm should not be removed unless it is indicated in the Bat Roost Potential Survey Report (AECOM, 2018), or subsequent surveys, that it has negligible or low bat roost potential.

  If tree removal works need to occur in areas where the trees are >15cm dbh and they have not been surveyed as part of the Bat Roost Potential Survey (AECOM, 2018 – absence of metal tags on tree) then the Project Ecologist will assess the potential for the trees to support bats and determine if further survey works are required in line with the Vegetation Removal Protocol (Appendix I).

- **Maintenance of safeguard zone fencing** – The Contractors are responsible for the duration of the Project to ensure that all safeguard zone fencing or marking remains in a suitable condition to ensure that accidental encroachment does not occur. If fencing or marking needs to be realigned, approval will be required from the Project Management Team with advice from the Project Ecologist. The process and outcomes will be documented.

6.5.7 Predator bands at known bat roosting sites – [avoid predation]

Bat Radio Tracking Survey works have identified 55 roosts (refer Figure 18), of which 28 were tracked to a specific tree. The Project Ecologist will review each of the bat roosting sites from information presented within the radio tracking reports and by ground truthing the roosts to identify where it would be suitable for predator bands to be installed and working with HCC determine if it is safe for the bands to be installed e.g. the tree is not located at the top of a steep embankment (refer to Table 23).

Three of the bat roosts are in bat boxes on trees that currently have predator bands. It is likely that others will not be suitable for the installation of the predator bands e.g. roost was beneath a piece of loose bark and there are a large number of sites similar on the tree that could provide a roosting site, therefore, banding is not a viable option. In addition, the roosting sites are on a mix of private and public land. On private land landowner/manager permission will be required to have the predator bands installed.

If it is appropriate to install the predator bands and the landowner/manager is in agreement, the bands should be installed outside of the bat maternity period (November-February) to avoid unnecessary disturbance to pregnant and/or lactating females when the tree has been confirmed to be a maternity roost (refer to Figure 18).

6.5.8 Pest Management Strategy – [avoid or minimise predation]

The designation conditions require that animal pest control is implemented at known significant bat roosting sites for 20 years. The conditions qualify that a significant bat roost is a maternity roost site or other roost used by multiple bats on a regular basis.

The Bat Radio Tracking Surveys have identified bat roosting sites on public and private land. Therefore, the influence that the Project has in regard to pest control at each roosting site will vary.

As indicated in Section 6.5.7, where access is available and a predator band would exclude the target predators, they will be installed at known significant roost trees. In addition, predator bands will be installed on all bat boxes installed as mitigation (refer Section 6.5.4.1).

The Project has committed to the implementation of pest control within all of the Designation Restoration Sites that will be gradually be implemented based on landownership and site restoration(refer to Appendix I Figure 48 - Figure 50). Therefore, HCC will deliver pest control over an area of approximately 18.25ha (15.25 ha of restoration habitat and 3 ha of stream restoration) and the Transport Agency will implement pest control over an area of approximately 9.2 ha.

The Project Ecologist will liaise with the Hamilton Parks and Openspaces Team, when delivering pest control on land owned/managed by HCC to ensure that the pest control implemented complements the measures that are already in place

In the areas where the Project will implement pest control, poison bait stations are proposed to be spaced 50 x 50 m apart The Project will use purpose-built bait stations (e.g. Philproof) to keep the bait dry and to protect non-target animals. DOC200 traps will be installed at approximately one per hectare (refer to Table 22).

Poison bait stations will target rats (*Rattus* spp.) and possums (*Trichosurus vulpecula*) and will follow current best practice. Diphacinone, pindone and cholecalciferol products are all available in pellet form for controlling rats and possums in bait stations. Bait type should be varied to avoid bait shyness, and label instructions must be followed to achieve optimum efficacy. Sustained use of brodifacoum should be avoided.

The DOC200 traps will target stoats (*Mustela erminea*) and weasels (*M. nivalis*), and at the suggested trap density should provide a high level of suppression of these species.

Servicing of traps and bait stations will initially be monthly, but this may be reduced to quarterly depending upon the results of pest abundance outcome monitoring. Bait and trapping will be undertaken in pulses as this has shown to be most effective. The timing of the related operations shall be set so that predator numbers are reduced during winter, when bats are most likely in torpor, and during spring-summer when they may be heavily pregnant and non-flying young may be present.

Table 22 Estimated number of bait stations and DOC 200 traps.

Organisation to deliver pest control	Number of traps and bait stations
HCC = approx. 15.25 ha of restoration and 3 ha of stream restoration. Total of 18.25 ha.	Bait stations = 135 DOC 200 traps = 19
NZ Transport Agency = approx. 9.2 ha	Bait stations = 69 DOC 200 traps = 10
Totals	**Bait stations = 204** **DOC 200 traps = 29**

Pest control will commence within the HCC Designation, Lizard and Stream Restoration Sites once restoration is complete and will continue for 20 years after completion.

Figure 38 Designation and stream restoration areas within which pest control will be delivered by HCC from 2020.

HCC will approach landowners with significant roosting sites adjacent to the alignment which is being delivered by HCC and offer to install predator exclusion bands were practical. At the current time the Transport Agency does not have funding to implement any mitigation, therefore, the Transport Agency will consult with Waipa DC and Waikato DC to assess if alternative funding could be available to deliver pest control in the wider landscape where significant bat roosts have been identified. Once the Project has funding for the delivery of the Transport Agency section the delivery of pest control at significant bat roosting sites will be reviewed. Table 23 and Table 24 present a summary of the pest control that will be offered at each of the known significant bat roosting sites within the area to be delivered by HCC.

Table 23 Significant bat roosts identified within the area to be delivered by HCC (as defined by HCC Condition 15.3(iv).

Roost number (refer to Figure 18)	Property / landowner / land manager	Roost status[16]	Significant roost according to designation conditions – (Yes or No)	Pest control to be offered by the Project	Estimated date at which pest control would commence	Ownership for options investigations
28	Transpower.	Night roost Single bat.	No.	N/A	N/A	N/A
8, 9 and 10	89 Peacockes Lane	Maternity Roosts.	Yes.	Restoration site – banding	To be confirmed.	HCC
18	Fitzroy Park.	Day roost – single bat recorded roosting on multiple nights	Yes.	Banding not appropriate as roost is beneath loose bark. Pest control currently undertake by HCC. This should be reviewed with the Parks Team to see if this needs to be modified to protect bats.	Pest control currently undertake by HCC.	HCC
11, 14, 17, 19, 26 and 51.	Sandford Park.	Maternity, day and night roosts.	Yes.	Roosts 11, 14 and 17 are bat boxes and have predator bands installed. Roost 19 and 26 are night roosts beneath bark so predator bands are not appropriate. Pest control is currently	Pest control delivered in Sandford Park by HCC.	HCC

[16] Night roost – bat recorded spending a period of time roosting between sunset and sunrise (excluding emergence and return). Day roost – single bats known to be roosting. A day roost could also be multiple bats outside of the bat maternity period. There is the potential that a day roost could be used as a maternity roost, just it was not in use as such during the emergence survey. Maternity roost – multiple bats recorded emerging or returning to a roosting site, including adult females that are either pregnant, lactating or post lactating, but with young still present in a collective roost.

Roost number (refer to Figure 18)	Property / landowner / land manager	Roost status[16]	Significant roost according to designation conditions – (Yes or No)	Pest control to be offered by the Project	Estimated date at which pest control would commence	Ownership for options investigations
				delivered in Sandford Park. Possums and rats were observed in the Park; therefore, current pest control will be improved.		
32	Hammond Park.	Day roost single bat.	No.	N/A	Pest control delivered in Hammond Park by HCC.	HCC
45, 54 and 55.	Weston Lea Limited	Day roost Single bat	No	N/A	N/A	N/A

Table 24 Significant bat roosts identified within the area to be delivered by the Transport Agency (as defined by Waipa DC Condition 21.3(iv) and Waikato DC Condition 17.3(iv)).

Roost number (refer to Figure 18)	Property / landowner / land manager	Roost status[16]	Significant roost according to designation conditions – (Yes or No)	Pest control to be offered by the Project	Estimated date at which pest control would commence	Ownership for options investigations
1, 2, 4, 5, 12, 15, 16, 34, 36, 37, 40, 42, 44 and 49	Narrows Park.	Maternity roosts.	Yes.	To be confirmed once funding is secured.	Owner currently implements control for rats.	Transport Agency
6	Blue Heron Place.	Maternity roost.	Yes.	To be confirmed once funding is secured.	To be confirmed once funding is secured.	Transport Agency
20, 25, 39, 41, 46, 47, 48 and 53.	NZ Transport Agency.	Day roost – single bats recorded on	Yes.	To be confirmed once funding is secured.	To be confirmed once funding is secured.	Transport Agency

Roost number (refer to Figure 18)	Property / landowner / land manager	Roost status[16]	Significant roost according to designation conditions – (Yes or No)	Pest control to be offered by the Project	Estimated date at which pest control would commence	Ownership for options investigations
		multiple locations in multiple trees.				
3	99 Raynes Road.	Maternity roost.	Yes.	To be confirmed once funding is secured.	Landowner provided with bait stations for rats by Waikato Regional Council (WRC).	Transport Agency
7, 13, 31	Nukuhau Stream Multiple landowners.	Maternity roosts.	Yes.	To be confirmed once funding is secured.	To be confirmed once funding is secured.	Transport Agency
27	Meridian 37.	Night roost Single bat.	No.	N/A	N/A	N/A
21, 22, 23 and 24	Crown land (adjacent to 25 Tamahere Drive).	Day roosts single bat.	No.	N/A	N/A	N/A
29	32A Cedar Park Road.	Day roost single bat.	No.	N/A	N/A	N/A
33	40C Cranmere Drive.	Day roost single bat.	No.	N/A	N/A	N/A
35	Whewells Bush – Department of Conservation.	Day roost two bats.	Yes.	Currently delivered by DOC to a high standard. Predator bands could be fitted to the tree.	Pest control delivered by DOC.	Transport Agency
38	290 Tamahere Drive	Maternity roost 20+	Yes	To be confirmed	To be confirmed once	Transport Agency

Roost number (refer to Figure 18)	Property / landowner / land manager	Roost status[16]	Significant roost according to designation conditions – (Yes or No)	Pest control to be offered by the Project	Estimated date at which pest control would commence	Ownership for options investigations
		bats emerged		once funding is secured.	funding is secured.	
43, 50 and 52	134 E & F Tamahere Drive	Day roosts – single bats and maternity roost 7 bats emerged (R52)	Yes	To be confirmed once funding is secured.	To be confirmed once funding is secured.	Transport Agency
45, 54 and 55.	Weston Lea Limited	Day roost Single bat	No	N/A	N/A	N/A

6.5.9 Maintenance

Requirements for maintenance of restoration sites are detailed in Section 6.3.2.1.

The condition of the bat boxes and their predator bands will be monitored periodically (including bat box surveys) for the duration of the construction stages of the Project (≥ 20 years). If they are in need of repair, then the Project will implement remedial measures.

6.6 Herpetofauna (lizards)

The designation conditions overarching objective relevant to the development of mitigation for native lizards are;

- No-net loss in biodiversity.

The designation conditions also define an aim to;

- Enhancement of the extent and quality of lizard habitat.

Table 25 presents the potential effects of the Project on native lizards without mitigation and the mitigation that is proposed to achieve no-net-loss in biodiversity as a result of the Project. Sections 6.6.1 - 6.6.7 detail the specific lizard mitigation and management approach.

In consultation with DOC it was concluded that the salvage of copper skink would not be undertaken as part of this Project. The effort that would have been put into the salvage process will instead be put into habitat restoration at specific Lizard Restoration Sites to ensure that on conclusion of the Project that the quality and extent of lizard habitat will have enhanced. This will meet the aims of the designation conditions.

The importance of lizards to TWWG was highlighted during consultation. Although salvage of lizards will not be undertaken, measures will be put in place to reduce the potential of individual lizards being injured or killed. Further details of the measures that will be implemented are presented in Section 6.6.6.

Table 25 Potential effect of the Project on native lizards and subsequent mitigation.

Effect of the Project, without mitigation	Approach to mitigation	No-net loss	Enhancement
Killing and injuring of individuals during vegetation removal (approx. 1 ha).	Avoid / minimise	To reduce the potential that individuals would be killed or injured, vegetation removal will be phased. This includes gradual height reduction (24 hours apart) of vegetation and clearance from the centre of the parcel of land to the exterior. In addition, the adjacent habitat will be enhanced through the provision of additional refugia. This will only occur in areas that will not require access by vehicles/machinery during long term maintenance. As agreed with DOC and WRC a detailed salvage programme will not be undertaken where vegetation clearance occurs.	n/a
Loss of habitat connectivity	Avoid / minimise	Bridges will be used in favour of culverts along the main branch of the Mangakotukutuku Gully and the Waikato River where copper skink are known to be present. The location of bridges will be confirmed at detailed design.	n/a
Increased risk of predation through the provision of new corridors along which predators may travel.	Mitigate	20 years of Pest control will be implemented within the two Lizard Restoration Sites.	n/a
Loss of habitat (approx. 1 ha)	Offset	2 ha of habitat will be enhanced to provide copper skink with additional habitat (Lizard Restoration Sites). This Site is linked to the Mangakotukutuku Gully.	The Lizard Restoration Site will be a greater extent (>1 ha) and quality to that currently present. Pest control will be delivered within the Lizard Restoration Sites.

The mitigation presented within the EMMP will be described in further detail within the Project Lizard Management Plan (LMP) which will be produced in 2019.

6.6.1 Lizard Restoration Sites for copper skink – [offset habitat loss and injuries / deaths]

To determine the location of the Lizard Restoration Sites for habitat enhancement for copper skink, sites were reviewed in accordance with the criteria listed below (developed in consultation with DOC);

- **Additive** – needs to increase the extent and quality of habitat available to lizards;
- **Connected** – to allow natural colonisation the site needs to be linked to habitat features that will allow natural colonisation;
- **Area** –sufficient to compensate for the habitat lost as a result of the Project.
- **Early delivery** – to provide suitable mitigation and time to enhance, the site needs to be available prior to construction commencing.
- **Long term security** – a site that will not be impacted in the future by the Project or surrounding urban development;
- **Pest control** – effective long-term control that is connected to the wider pest control strategy (refer to Section 6.5.8). Vegetation design will focus on complexity (and food resource) to increase the potential for predator avoidance;
- **Suitable habitat** – habitat complexity, food resource and easy management will be the focus of the habitat design; and
- **Conflicting requirements** – ensure that there are not conflicting requirements for the site e.g. bat habitat, aspirations for Pa site, designated for other purposes.

A review of six available sites led to the identification of two sites (Figure 39 - Figure 42) that met the criteria detailed above. Table 44 in Appendix L details the sites that were considered, how they meet the criteria and ultimately why they were adopted or discounted.

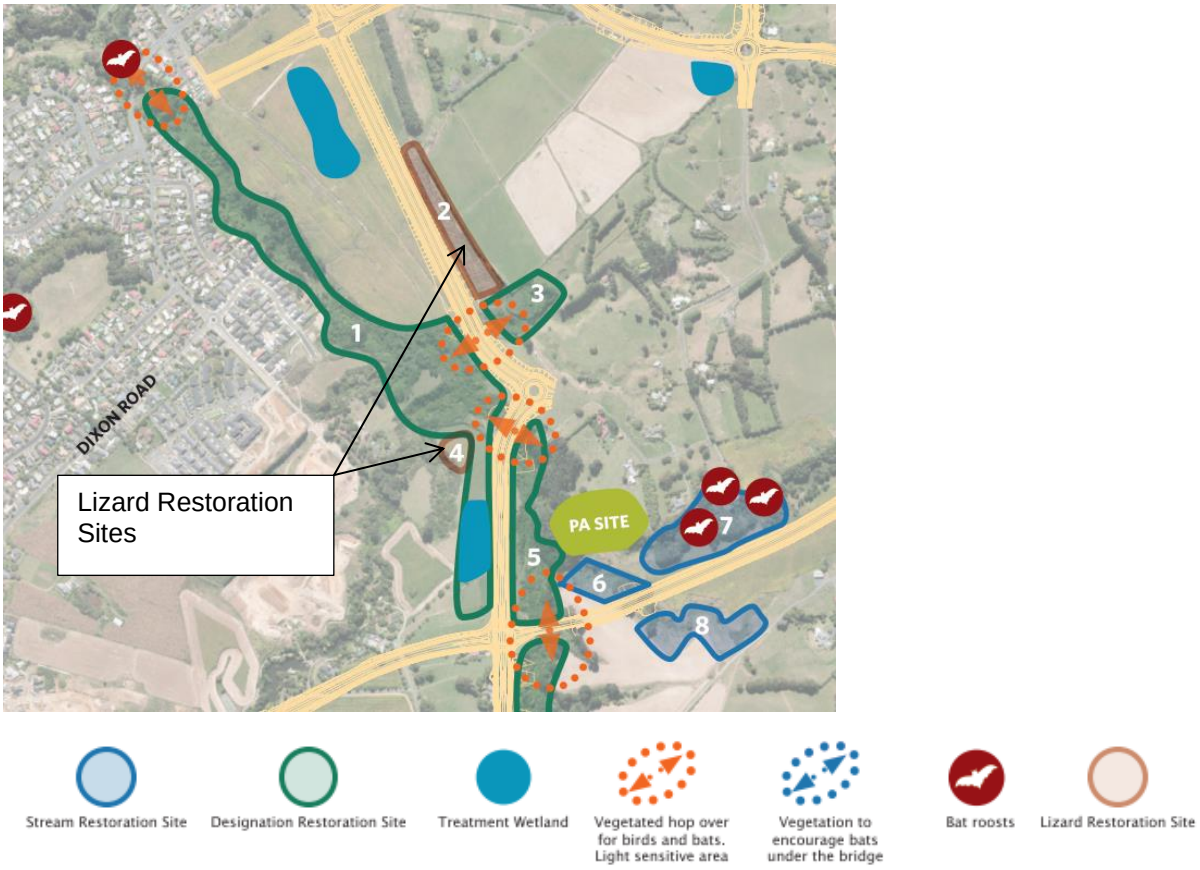


Figure 39 Location of proposed Lizard Restoration Sites.

Figure 40 Overview of the main Lizard Restoration Site.

Figure 41 Image of the main Lizard Restoration Site illustrating the current vegetation.

Figure 42 Aerial image of the two Lizard Restoration Areas to illustrate habitat connectivity.

6.6.2 Lizard Restoration Sites – [offset for habitat loss]

A Lizard Restoration Site Plan will be produced for both restoration areas. This will detail measures in relation to weed control (e.g. gorse), preparation of planting sites, fencing, refugia, pest control etc.

A key aspect for the main lizard restoration area will be the preparation of the planting plots. In preference to using herbicide to manage competitive grasses (which can be harmful to lizards) the sod of the planting hole will be turned over at the time of planting and matting used to suppress weeds within the immediate area of the planting. This process will ensure that the existing long grass at the sites currently providing habitat for copper skink is retained until the new plantings provide greater habitat variability.

The plantings within the Lizard Restoration Sites will include native botanical species that will provide food (e.g. berries and invertebrates) and habitat complexity. Dense ground cover will maintain moisture and help lizards avoid predation. The planting will be designed to provide suitable habitat for copper skink, as this is the only species thought to be present within the local area. Therefore, the traditional forest planting mix used elsewhere for birds and bats will not to be used in the Lizard Restoration Sites, and while copper skink is currently found in long grassland margins, dry habitat will be avoided to try and discourage plague skink, which are a basking species.

Table 26 Recommended plant species within the Lizard Restoration Sites.

Common name	Latin name
Toe toe	*Austroderia richardii*
Toe toe	*Austroderia fulvida*
Pohuehue	*Muehlenbeckia complexa*

Common name	Latin name
New Zealand flax	*Phormium tenax*
Whahariki	*P. cookianum* spp. *hookeri*
Mingimingi	*Coprosma propinqua*
Rengarenga	*Arthropodium bifurcatum*
Shrubby tororaro	*Muehlenbeckia astonii*
Puawhananga	*Clematis paniculata*
Thick leaved coprosma	*Coprosma crassifolia*
Kanuka,	*Kunzea robusta*
Karamu	*Coprosma spp*
Mahoe	*Melicytus ramiflorus*
Manuka	*Leptospermum sp*
Mapou	*Myrsine australis*
Karaka	*Corynocarpus laevigatus*
Kohekohe	*Dysoxylum spectabile*

During development of the Lizard Restoration Site Plans, the Project Ecologist will determine whether the existing pine trees at the top of the embankment meets the Lizard Restoration Site objectives. This review will take into consideration the advantages to the lizards but also the potential loss of habitat to other species e.g. bats (trees located outside of the designation boundary and consequently the Bat Roost Potential Survey of Trees did not cover this shelterbelt) and birds. If on balance, the Project Ecologist considers the trees should be removed then this will be discussed with the landowner and approval sought. If approval from the landowner is not provided, then no further action will be taken.

6.6.3 Refugia – [avoidance of predation]

Timber and rock will be placed in piles to create additional habitat complexity to the plantings within the Lizard Restoration Sites and also in habitat within the designation that is adjacent to areas directly affected by vegetation clearance and is inaccessible by maintenance machinery. The timber in the piles will be stacked in two ways. Some of the piles will comprise logs, while others will be constructed out of wooden discs. The wooden discs are favoured as it is believed that when these are piled/stacked that the interstitial spaces will be small enough to prevent mice from accessing the refugia and predating on the lizards. The Project Ecologist will guide the contractors in the installation of these features.

The timber used in the log piles will be salvaged from the vegetation removal works that will be undertaken for the Project (if material is available). For each log pile a small shallow hole/pit (10cm) will be created within the soil into which the logs/discs are placed. Excavated soil can then be backfilled gently against the log pile at its base. Dense plantings will be put in place surrounding the log piles. These features should blend in when the planted vegetation is semi-mature. These steps will help maintain moisture within the wood piles, which is favoured by copper skink.

Figure 43 Traditional log pile for lizards.

Figure 44 Wooden disc pile, not in a natural situation.

6.6.4 Pest control – [avoid or minimise predation of lizards]

Pest control will be implemented at the Lizard Restoration Sites. As indicated in Section 6.5.8 pest control will comprise the use of poison bait stations and DOC 200 traps.

Bait stations will be spaced at 25 m x 25 m grid within the Lizard Restoration Sites (2 ha), subject to site constraints such as topography. The density of bait stations differs to the pest control delivered in the Designation Restoration Sites to reduce the number of mice present. Mice are considered a significant predator of lizards (Newman, 1994 and Lettink & Cree, 2007). Bait will be delivered in four pulses throughout the year (January, April, August and November).

A non-toxic pre-feed will be used at the beginning of each pulse for a period for two weeks to encourage animals into the traps before toxic baits are swapped into place. Once the use of toxic bait begins, they will be filled in accordance with the following regime; fill on day one, three, five and 14. If less than half the bait from the previous fill is present on day 14 fill, then fill again on day 17. Remove bait at the end of week four.

DOC 200 traps will be used to kill stoats, ferrets, weasels, rats and hedgehogs within Lizard Restoration Sites. The traps will be set approximately 50 m apart on trap lines that are 100 m apart. During the first week after the traps have been placed on site, they will be baited but not set to encourage animals to enter the trap. The traps will then be set and checked every 1-2 days, once catch rates drops (between 5-10 checks); traps will be checked once a month. If catch rate numbers increase, the frequency of trap checking should also increase.

6.6.5 Bridges – [avoid loss of habitat connectivity]

Most road crossings across the Mangakotukutuku Gully are planned to be bridges. The two crossings over the Waikato River for the Project are also bridges. This form of crossing has the potential to achieve habitat connectivity to enable copper skink to continue to migrate along the Mangakotukutuku Gully if the area under the bridges is vegetated. However, due to ground conditions in the Peacocke area, appropriate ground improvement and erosion protection measures may need to be installed under each bridge. If such measures are necessary, they will need to be implemented as a priority to ensure the long-term structural performance of each bridge. Where such measures have the potential to preclude habitat connectivity under the bridges the Project design team in conjunction with the Project Ecologist will consider a range of habitat connectivity mitigation measures and select a preferred measure for implementation. All measures set out below should thus be regarded as potential measures subject to viability assessment following detailed bridge design at each location.

The habitat beneath these bridges will be shady and dry due to the rain shadow caused by the new bridge. Therefore, where practicable following the installation of any necessary ground improvement and erosion protection measures, it is proposed that a mix of native ferns could be planted beneath these structures, which are adapted to shady conditions. In addition, refugia (woody debris) could be used to provide cover and to help retain water (refer to Section 6.6.3). Any refugia installed would need to be fixed in place using staking to avoid this material being displaced during high flow events. Table 27 presents a list of species that could be selected to plant adjacent and under the bridge.

To encourage vegetation growth underneath a bridge (where the installation of vegetation is achievable following the installation of any necessary ground improvement and erosion protection measures) the Project design team will review the viability of constructing irrigation swales, or an alternative, underneath the bridge close to each bridge abutment on both sides of the stream. Figure 45– Figure 47 present an example of an irrigation swale that is currently being developed for the Matakana Link Road. Clean water runoff from adjacent road batters and subsoil water from the bridge abutments could be intercepted and directed to the irrigation swales via conveyance channels. The irrigation swale is in effect a long level spreader that allows water to pond to a shallow depth so that it can discharge as sheet flow across the entire length of the swale. This would provide a source of water for vegetation located underneath the bridge structure.

Table 27 List of fern species that could be planted beneath / adjacent to bridges.

Common name	Latin name	Habitat preference
Kowaowao	*Microsorum pustulatum*	Abundant throughout New Zealand and may be found creeping over the ground, on rocks, epiphytic on trees, scrub and open areas. Usually occurs in slightly drier places.
Huarau	*Hypolepis millefolium*	Grows in a range of habitats including open, rocky places, tussock grassland, scrub and open forests.
Hen and chicken ferns	*Asplenium bulbiferum*	Common in moist lowland forest particularly gullies and along streams.
Black shield fern	*Polystichum richardii*	Throughout the North Island usually in drier forests and scrub, on rocky banks, forest margins and coastal rocks.
Prickly shield fern	*Polystichum vestitum*	Lowland forest throughout the North Island. It will also grow along forest margins and in tussock grassland.

Common name	Latin name	Habitat preference
Crown fern	*Blechnum dicolor*	Abundant in coastal to montane forest including open forest. Often grows to the exclusion of all other vegetation.

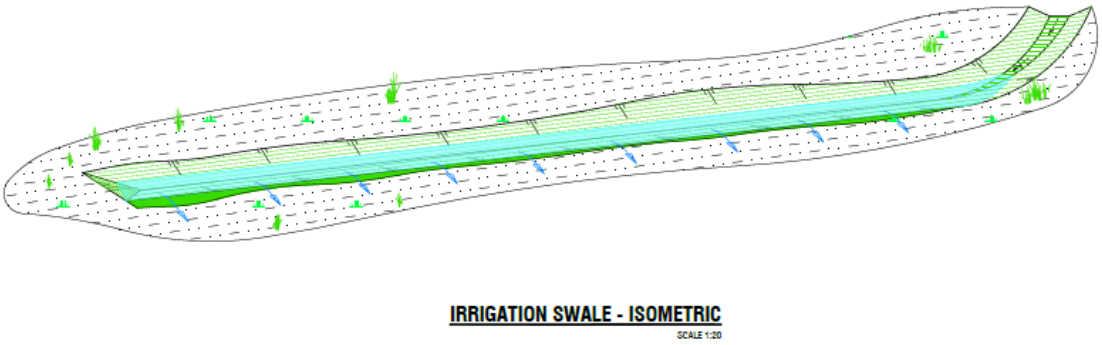


Figure 45 Example of irrigation swale (this image should not be used for construction). Each of the Project Packages will review whether the construction of an irrigation swale or similar is practical for the bridges being constructed.

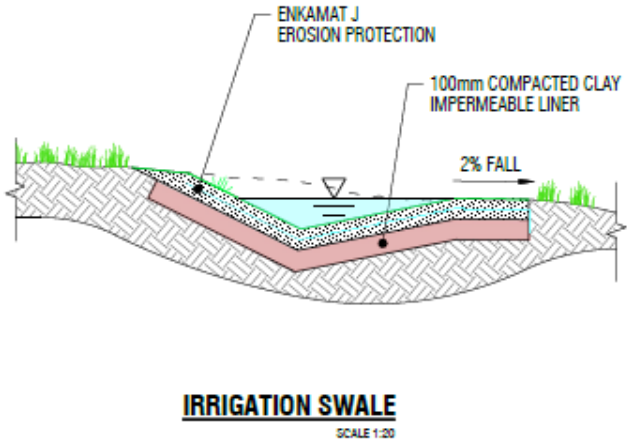


Figure 46 Example cross section of swale (this image should not be used for construction). Each of the Project Packages will review whether the construction of an irrigation swale or similar is practical for the bridges being constructed.

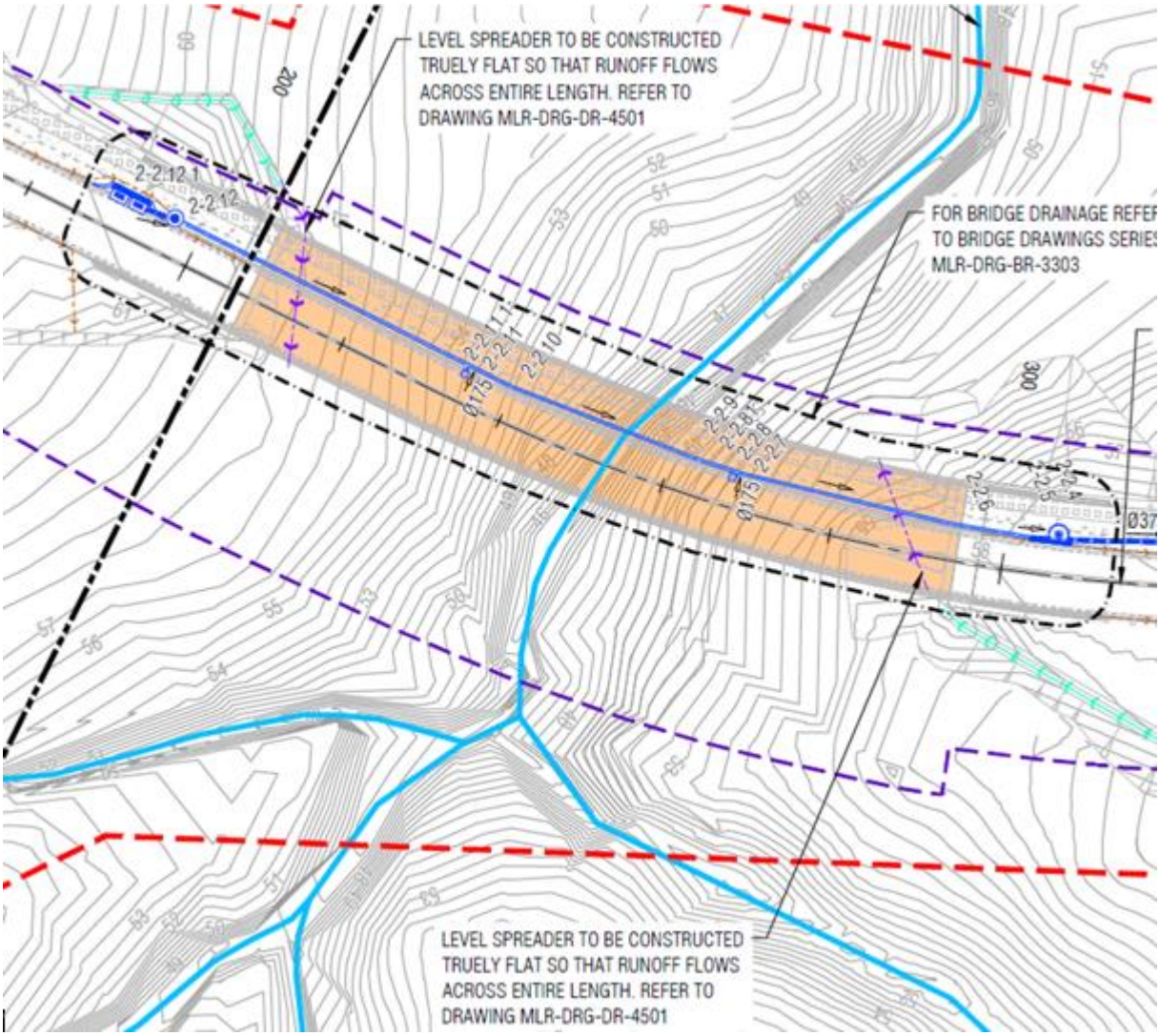


Figure 47 Figure illustrating the location of two swales (level spreader) beneath a proposed bridge being designed for Matakana Link Road (this image should not be used for construction). Each of the Project Packages will review whether the construction of an irrigation swale or similar is practical for the bridges being constructed.

6.6.6 Vegetation manipulation – [avoid or minimise killing and injuring lizards]

The removal of vegetation (and opportunistic salvage of lizards) within the designation corridor favoured by copper skink (long grassland, log piles and *Tradescantia* beneath forest); will be undertaken between September – May, when temperatures are high enough for lizards to be active. The high temperatures will increase the potential that animals are active and able to relocate themselves during the vegetation clearance works.

Copper skink are found within areas of tall grass (> 200 mm in height) located along the margins of forest / shrub vegetation. To displace lizards from the working area a herpetologist will walk through the area of grassland to be cut, removing any potential refugia material (e.g. logs) and searching any features that could provide lizards with cover. The grassland will then be immediately cut to a level of 50 – 100 mm above the ground using hand-held line trimmers or flail mowers. Cutting the grass to this level and avoiding disturbance to the soil, will lower the risk of direct injury or mortality in lizards utilising the dense lower layer in the grass. This also allows the soil/ substrate to either dry-out in the sun or become saturated during heavy rain, with the aim of lizards vacating the affected area.

The grass cuttings should be removed from the site for disposal and the area left for a period of approximately 48 hours prior to any further vegetation clearance works. Again, a herpetologist will walk through the area prior to the last cut. The log/disc piles detailed in Section 6.6.3 will be

constructed, beyond the zone of influence of the works but in adjacent habitat, prior to the vegetation removal to ensure that habitat variability has been increased in the local area prior to the vegetation clearance. In addition, if lizards are identified they will be transferred to this habitat.

If there are any areas of gorse, bramble or root balls, the herpetologist will work with the contractor to pull this material apart gently and inspect for the presence of lizards. Any lizards identified will be caught and transferred to the adjacent habitat.

The Project Ecologist will brief the contractors in the event a lizard is identified and caught during any construction works. The contractors will be informed on how to store the individuals appropriately (sealed container with cover and air holes and kept in the shade) and to contact the Project Ecologist immediately. The Project Ecologist will supervise the transfer and subsequent release of the lizard to one of the Lizard Restoration Sites.

6.6.7 Maintenance

The two Lizard Restoration Sites will be established in advance of construction. During the construction and subsequently in the operational phase these areas will need to be maintained. This will involve the management of weed species, monitoring pest damage, replacement of lost plants and undertaking watering if there are extended dry periods following planting.

The maintenance of these habitats will be undertaken by an experienced contractor for at least the first 10 years of establishment and it is considered that the habitat will self-regulate itself refer to Section 6.3.2.1 for further information in relation to maintenance (e.g. frequency, approach etc.).

6.7 Avifauna

The designation conditions overarching objective relevant to the development of mitigation for native avifauna (birds) are;

- No-net loss in biodiversity.

The designation conditions also define an aim to;

- Enhance the extent and quality of bird habitat.

Table 28 presents the potential effects of the Project on native birds without mitigation and the mitigation that is proposed to achieve no-net-loss in biodiversity as a result of the Project. Sections 6.7.1–6.7.4 the specific avifauna mitigation and management approach.

Table 28 Potential effect of the Project on birds and subsequent mitigation.

Effect of the Project, without mitigation	Approach to mitigation	No-net-loss	Enhancement
Loss of habitat connectivity due to vegetation removal and structures.	Avoid / Minimise.	Safeguard zones – to retain mature vegetation adjacent to bridges to encourage birds to cross.	N/A
	Mitigate.	Additional plantings – at the conclusion of substantive construction works those areas adjacent to the road that have been disturbed will be replanted in accordance with the detailed Landscape Management Plan which will look to include	N/A

Effect of the Project, without mitigation	Approach to mitigation	No-net-loss	Enhancement
		ecological restoration as appropriate to the location.	
	Mitigate.	Hop-overs and underpasses - Maintain high vegetation along road margins where it is likely that forest birds would commute e.g. Mangakotukutuku Gully. The intention is that if vegetation is kept high within the immediate vicinity of the road then birds would travel above the height of vehicle traffic.	N/A
Killing or injuring of birds or their young during vegetation clearance.	Avoid / minimise.	Timing of vegetation clearance works to avoid peak nesting period (September - February).	N/A
Disturbance due to increased levels of noise / light / vibration.	Avoid.	Develop sensitive lighting design that avoids light spill into habitats of value to native birds.	N/A
	Mitigate	The restoration plantings will widen the vegetation surrounding the Mangakotukutuku Gully and other key habitat.	N/A
Loss of foraging and nesting habitat as a result of vegetation removal.	Offset	Designation Restoration Sites will provide offset habitat for the loss of habitat caused as a result of habitat loss.	Expansion of the Designation Restoration Sites beyond designation condition requirements. Therefore, additional native habitat will provide improved foraging and nesting habitat for birds. Implementation of pest control for 20 years in all Designation and Stream Restoration Sites
Increased risk of bird strike	Mitigate	Plantings adjacent to the road should be high to encourage birds to cross the road above vehicle height.	

The potential effects of the Project on native birds are similar to bats and consequently the means of mitigating them are also similar. The following mitigation measures will be implemented for native birds;

- Safeguard zones – to minimise habitat loss (refer to Section 6.5.3);
- Buffer vegetation – to avoid and minimise disturbance (refer to Section 6.5.4.3);
- Hop-over and underpass vegetation – to mitigate for the effect on habitat connectivity (refer to Section 6.5.1);
- Lighting and noise control – to avoid and minimise disturbance (refer to Section 6.5.2);
- Designation Restoration sites – to offset habitat loss (refer to Section 6.5.4.3);
- Timing of vegetation removal – to avoid killing and injuring (refer to Section 6.7.3);
- Pest control – to avoid or minimise killing and injuring (refer to Section 6.5.8); and
- Additional tree planting – to mitigate for habitat loss (refer to Section 6.3.4).

If the manner in which mitigation is delivered is the same for bats and native birds' further information will not be presented. Further information is only presented if it is considered that there are additional aspects to consider specific to native birds.

6.7.1 Hop-over and underpass vegetation – [mitigate for the effect on habitat connectivity]

The structure of these will not differ to that previously described for bats. The intention for these plantings is to push birds above vehicles on the road. Care needs to be taken in relation to the selection of plantings along the road to ensure that there are no low growing species that would be providing food for birds as this could increase the risk of vehicle strike.

6.7.2 Restoration sites – [offset habitat loss]

Preparation of the Site Restoration Plans will ensure that the species mix includes a wide range of native species that provide fruit and nectar. The Plans will also take into consideration the seasonality of fruit and nectar provision to make sure that food will be available for native birds year-round.

6.7.3 Timing of vegetation removal – [avoid or minimise killing and injuring]

Native birds will typically nest from September – February. To avoid / minimise the risk of encountering nests of native birds it is recommended that vegetation is cleared from March – August when nests are less likely to be present. It is however noted that there are a number of areas where there is the potential for bats to be roosting within trees which will affect the timing of when vegetation can be cleared.

If vegetation needs to be removed between September – February, which is assessed by the Project Ecologist to have potential for birds to nest, a pre-clearance check for nesting birds will be completed. The Project Ecologist, a maximum of five days prior to the vegetation clearance being undertaken, will complete a visual survey to identify if there are any native birds nesting. The 5-minute bird counts have confirmed that there are only common native bird species present; therefore, it is not proposed that any acoustic monitoring is undertaken.

In areas where the vegetation is dense, it may not be possible for the Project Ecologist to determine the presence or absence of a nest. In this situation, it may be necessary to leave the vegetation in place until the end of the peak bird breeding season (September – February).

In the unlikely event that a native bird was found injured or killed by works the procedure detailed in Appendix M would be followed.

6.7.4 Maintenance

Details of how habitat maintenance will be implemented are presented in Section 6.3.2.1.

6.8 Summary of quantifiable no-net-loss deliverables

Table 29 presents the quantifiable mitigation measures that will be delivered by the Project to meet the objective of no-net-loss as defined within this EMMP. Table 11, 13, 16, 22 and 24 present the quantifiable and non-quantifiable mitigation measures that will be delivered to meet the objective of no-net-loss and where relevant enhancement.

Table 29 Summary table presenting how no-net-loss of habitats will be delivered.

Ecological feature	Habitat lost	No-net-loss	Supporting information (refer to Section 6.3 – 6.7 for further detail)
Terrestrial and wetland habitat loss	Hamilton City Council Designation Conditions; Habitat loss calculated by Opus, 2014 without mitigation; • Significant vegetation and habitats (including SNAs) = 1.14 ha • Other vegetation = 8.04 ha Total loss = 9.48 ha Offset ratio determined by Opus, 2014 • 3:1 for significant vegetation; and • 1:1 for other vegetation. Minimum total offset required = 11.46 ha. Wetland surveys undertaken by Morphum identified additional wetland loss. This led to the requirement for an additional 1.9 ha of habitat restoration[17]. Total offset required = 13.38 ha	13.38 ha including pest control throughout this area.	The restoration of gullies will be undertaken so that areas of existing native vegetation and valuable exotics are retained. Therefore, the total area of Designation Restoration Sites will be larger than required by the designation conditions: • 15.25 ha Refer to Appendix B for the location of the Designation Restoration Areas.
	Waipa District Council Designation Conditions; Habitat loss calculated by Opus, 2014 without mitigation; • Significant vegetation and habitats (including SNAs) = 0.73	4.98 ha including pest control throughout this area.	The restoration of gullies will be undertaken so that areas of existing native vegetation and valuable exotics are retained.

[17] In combination Opus and Morphum identified 1.6 ha of wetland loss through the construction of Southern Link. At the time of the hearing Opus identified 0.73 ha of wetland. In addition, they had identified 0.685 ha as exotic weed community. In the calculations for offset both habitats types were included, but the ratio of offset differed (wetland 3:1 and exotic weed community 1:1). Therefore, Opus calculated 0.73*3 = 2.19 ha and 0.68*1=0.68 ha. Total of 2.87. Combined Morphum and Opus calculates to 1.6*3=4.79 ha. Therefore, a difference in offset of 1.9 ha.

Ecological feature	Habitat lost	No-net-loss	Supporting information (refer to Section 6.3 – 6.7 for further detail)
	Offset ratio determined by Opus, 2014 • 3:1 for significant vegetation. Total offset required = 4.98 ha		Therefore, the total area of Designation Restoration Sites will be larger than required by the designation conditions: • 6.2 ha Refer to Appendix B for the location of the Designation Restoration Areas.
	Waikato District Council Designation Conditions; Habitat loss calculated by Opus, 2014 without mitigation; • Other vegetation = 2.19 ha Offset ratio determined by Opus, 2014 • 1:1 for significant vegetation. Total offset required = 2.19 ha	2.19 ha including pest control throughout this area.	The restoration of gullies will be undertaken so that areas of existing native vegetation and valuable exotics are retained. Therefore, the total area of Designation Restoration Sites will be larger than required by the designation conditions: • 3 ha Refer to Appendix B for the location of the Designation Restoration Areas.
Stream loss	Culvert construction and realignment of streams will lead to the loss of stream length without mitigation on delivery of HCC section of the Project. T+T, 2018, calculated that this loss would be; • 985 m The ratio of offset, in relation to the level of effect, as determined by T+T, 2018; • Very high – 1:3 • High – 1:2 • Low – 1:1 • Very low – 1:0	HCC section only; 1,570 m of stream will be restored to compensate for stream loss. Pest control will also be undertaken throughout this area. A priority is avoiding loss of stream length. At the top of the catchment 450 m (of the total 985 m), will be realigned and therefore, will not be lost.	The Project will impact on 13 watercourses. To reduce impacts the Project has included bridges within the lower reaches of the Mangakotukutuku Stream (refer to Section 6.4). Table 17 of the EMMP presents how offset has been calculated for each of the watercourses. Appendix B presents the location of stream restoration.

Ecological feature	Habitat lost	No-net-loss	Supporting information (refer to Section 6.3 – 6.7 for further detail)
Fish migration	HCC will impact on 18 sections of watercourse (17 along the Mangakotukutuku Stream) and one crossing over the Waikato River during the delivery of their section of the Project. The Project sought to avoid restrictions on fish passage through the construction of bridges. This left five potential locations where culverts could be constructed, and fish passage was required (e.g. fish habitat upstream of culvert). Each Project Packages will undertake an additional review to determine whether there are options to replace these five culverts with bridges or arch culverts.	HCC section only; Five bridges will be constructed. Five culverts will be designed to facilitate fish passage.	Table 18 provides detail in relation to where fish passage will and will not be provided.
Fish salvage	Fish salvage will be undertaken at any location where instream works are required, and water is present.	HCC section only; Five culvert locations. One pond (HCC6). Seven overland flow paths or headwaters that need to be checked for water when instream works occur.	Section 6.4.5 indicates that if in stream works are required and water is present then fish salvage will be undertaken.
Bat habitat connectivity	The Project has used thermal imagery, acoustic monitoring and bat radio tracking to gain an understanding of how bats are moving through the landscape and potentially where the Project could impact on connectivity.	Construct; Two underpasses; and 15 overpasses. Maintain; Two overpasses.	Refer to Section 6.5.1 and Appendix B for further detail. Refer to Section 7.0 for details as to how monitoring will be delivered to assess the success of this mitigation and Section 8.0 for performance measures and triggers.
Bat roost	The Project has undertaken a tree roost potential survey within the designation boundary of the area to be delivered by HCC. The approach to providing bats with roosting sites in the long term will be delivered in three ways – bat boxes, exotic trees and native trees.	Short term; Maximum of 150 artificial bat boxes.	Refer to Section 6.5 for further details in relation to the delivery.

Ecological feature	Habitat lost	No-net-loss	Supporting information (refer to Section 6.3 – 6.7 for further detail)
		Installation of natural bat boxes as opportunities arise. Medium term; Small percentage of exotic trees will be planted in the Designation Restoration and Stream Restoration Areas. Long term; Habitat restoration as detailed above.	
Reptile habitat loss	The lizard surveys (AECOM & EcoGecko, 2019) confirmed that copper skink was present within rank grass that borders the edges of the Mangakotukutuku Gully and the Waikato River and beneath Tradescantia. They were not found within the gully vegetation. Therefore, the estimated loss of lizard habitat prior to mitigation would be; • 1 ha The ratio for offset was determined to be 1:2.	2 ha including pest control throughout this area. Refugia will be constructed in the restoration areas and within habitat adjacent to each area to be impacted.	The EMMP sought to follow a set of criteria in the identification of the offset sites, which are presented in Section 6.6.1. The review of possible sites is presented within Appendix L.
Reptile habitat connectivity	To ensure that the lizard population is resilient habitat connectivity will be maintained beneath bridge structures.	HCC section only; Connectivity to be maintained beneath four bridge structures.	Refer to Section 6.6.5 for further details as to how connectivity will be maintained.
Bird habitat connectivity	Refer to bat habitat connectivity.		

6.9 Summary of seasonal constraints

In some locations within the designation corridor multiple species will need to be taken into consideration during construction activities. A summary of these constraints are provided below.

Red – Period when works should not be undertaken if there is a risk bats could be present. If the need to remove a tree during this period is identified, then the Project Ecologist will determine if an inspection could be undertaken without disturbing bats in torpor.

Green – Period when works can be completed but additional survey works may be required, if indicated by text.

Amber – Indicates when native birds are likely to be nesting but work will likely be required in some areas due to seasonal constraints for bats, which are of higher conservation status and more difficult to detect, therefore works can proceed with nesting bird checks.

Table 30 Seasonal constraints for each species.

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Vegetation removal												
Negligible or low **bat** roost potential trees (or trees / shrubs with a dbh <15cm) – no seasonal constraint.	Consider nesting birds								Consider nesting birds			
Moderate or high **bat** roost potential trees – remove according to vegetation removal protocol.	Consider nesting birds and implement tree removal protocol for bats		Implement tree removal protocol for bats							Consider nesting birds and implement tree removal protocol for bats		
Moderate or high **bat** roost potential trees adjacent to **Narrows only** – remove according to vegetation removal protocol.			Implement tree removal protocol for bats							Tree removal protocol for bats		
Nest bird period – in areas there will be a conflict between birds and bats. In these areas trees should be checked for nesting birds at the same time as bat inspections.	Consider the presence of bats		Consider the presence of bats						Consider the presence of bats			
Instream works (e.g. dewatering) – timings may be modified during the resource consent process.												
Stream containing water will require fish to be removed prior to / during dewatering works.												

7.0 Monitoring

To determine whether no-net loss of biodiversity has been achieved a long-term monitoring programme has been established.

The designation conditions specify in relation to bats, that continual monitoring is required during construction and 5 years post construction. In relation to birds and lizards the duration of monitoring is not specified, but the conditions do indicate that monitoring needs to determine that no-net-loss has been achieved.

Table 31 presents the monitoring that will be undertaken and the frequency of that monitoring. A summary of the relevant methodology is presented in Section 4.0 and further detail can be obtained by making reference to the detailed species reports.

The delivery programme for the Project is staged; therefore, HCC will be undertaking construction in advance of the Transport Agency. Each RA will be responsible for delivering monitoring and reporting for their sections of the Project, excluding where the monitoring needs to be delivered at a wider landscape scale e.g. lizard monitoring, bat acoustic monitoring and 5-minute bird counts. In this situation the surveys and reporting may be jointly commissioned by the two organisations. In some situations, cost savings could be found by delivering mitigation together and therefore enabling the alignment of monitoring e.g. bat boxes.

The EMMP Implementation Team will be working with the Project Package Teams to ensure that each team understands and complies with the requirements and intent of the EMMP. In addition, a biannual audit will be undertaken of the Project Packages to document their compliance with the EMMP. If it is identified that works could have additional ecological effects (e.g. extension of the working area) and mitigation is required, then the Project Packages will provide a report to HCC Project Manager providing an impact assessment (this may only be a couple of pages) including proposals for mitigation to reduce impacts to less than minor. The approach proposed within the impact assessment must be provided and agreed with HCC prior to any works taking place. This assessment should indicate how this change will affect the outcomes of the EMMP e.g. increase in overall delivery of habitat offset.

Table 31 Long-term monitoring.

Habitat or species / species group	Effect being monitoring	Monitoring	Frequency of monitoring	Reporting / Documentation
Terrestrial, gully, stream and wetland habitat loss and fragmentation.	Success of habitat creation.	Log the extent of habitat restoration that will be delivered on the ground using GIS within each of the restoration areas.	The mapping of habitat will occur when the Restoration Plan is prepared for each of the restoration areas.	The area of restoration will be mapped on GIS and the expected and actual area of restoration will be logged on a register, held and managed by HCC[18], to aid comparison. The Project Ecologist will review on completion of all restoration areas whether the extent of habitat delivery is as expected or whether it is likely that additional land will be required to meet the designation conditions. A report will be produced to document this review and will be provided to the TA on request.
		Monitor plant losses in accordance with trigger levels (minimum of first three years) (refer to Table 32).	Annual inspection by the Project Ecologist or Landscape Architect of success of plantings for a minimum period of three years. If trigger levels are exceeded replacement planting to occur in the next	A summary report will be prepared annually by the Project Ecologist or Landscape Architect and shared with the maintenance team within an annual meeting to review if changes to the current regime are recommended by the Project Ecologist or Landscape

[18] HCC or their nominated Ecological Consultants.

Habitat or species / species group	Effect being monitoring	Monitoring	Frequency of monitoring	Reporting / Documentation
			planting season following inspection.	Architect. This documentation will not be provided to the TA (unless requested) as it is solely to guide maintenance rather than to meet compliance requirements.
		HCC to monitor the implementation of general maintenance e.g. removal of competitive grasses.	Annual inspection by HCC until the 10-year audit is completed. Removal of competitive grasses should occur (October – April) occur 2 to 3 times a year until it is determined by the Project Landscape Architect, during the annual monitoring visit it is no longer required (will not exceed 10 years). This may not be required if weed matting is installed.	A summary report will be prepared annually by the Project Ecologist or Landscape Architect and shared with the maintenance team within an annual meeting to review if changes to the current regime are recommended by the Project Ecologist or Landscape Architect. This documentation will not be provided to the TA (unless requested) as it is solely to guide maintenance rather than to meet compliance requirements.
		Monitor rainfall (i.e. drought) in first year of planting.	Monitor during the first year of planting during the summer period (October – April). If there are prolonged periods without rainfall (>2 weeks) implement supplementary watering.	
		Monitor grazing by possums and rabbits or use tree guards.	HCC to annually monitor damage during the inspection of success until	

Habitat or species / species group	Effect being monitoring	Monitoring	Frequency of monitoring	Reporting / Documentation
			plantings are self-sustaining (after 10 years). If damage is seen, then modify pest control to address this negative effect.	
		Monitor weed infestation annually to guide maintenance.	HCC to annually monitor weed levels during the inspection of success (period of 10 years). If it is identified that a species is present that could compromise the success of the planting, then immediate action should be implemented through the general maintenance regime (e.g. hand removal or careful application of herbicide).	
		Stream Ecological Valuation (SEV) (Story *et al*. 2011) will be undertaken along the sections of stream to be restored to assess the success of instream and riparian restoration.	Five years post restoration (one survey visit).	Project Ecologist will prepare a report presenting the score that the habitat achieved post restoration.
		Monitor wetland condition in accordance with the Handbook for Monitoring Wetland Condition (Clarkson *et al*. 2003)	Prior to habitat restoration and 5 years post restoration (two survey visits).	Project Ecologist will prepare a report presenting the condition score that the habitat achieved prior to and post restoration.
		Undertake audit 10 years post planting to confirm that Designation Restoration Sites and	10 years post planting inspection by HCC to determine if the approach to	Project Ecologist or Landscape Architect will produce a report presenting

Habitat or species / species group	Effect being monitoring	Monitoring	Frequency of monitoring	Reporting / Documentation
		planting design have been achieved and there is canopy closure and therefore self-sustaining (e.g. maintenance can be reduced).	maintenance can be reduced and monitoring of success can end. It is likely that on-going monitoring for weeds will be required.	the results of the audit. A meeting will be held with the maintenance team to discuss the long-term maintenance regime. This audit report will also confirm if the habitats are self-sustaining. The audit report will be provided to the TA.
	Degradation of stream habitat through sedimentation and other pollutants.	Monitoring of all sediment control measures.	The frequency will be dependent on the nature of works being undertaken and will be specified within the Erosion and Sediment Control Plan and the Regional Consents.	Reporting to the Regional Council will be in accordance with the requirements of the Resource Consent.
		Monitoring of discharge from stormwater devices.	The frequency of monitoring will be determined by the resource consent which will be based on meeting the requirements of the Comprehensive Stormwater Discharge Consent.	Reporting to the Regional Council will be in accordance with the requirement of the Resource Consent.
Fish (excluding mudfish)	Fragmentation of fish habitat due to the construction of culverts and stream realignment at HCC 8, 13, 16 and 17.	Monitoring of fish to determine if the diversity of fish species present above a culvert or in the stream realignment is consistent or greater than identified prior to the construction of culverts. These surveys may be conducted by a third party e.g. NIWA or for the	Monitor upstream of culverts in Year 2 and 5 post construction.	Project Ecologist will prepare a report presenting the results of the survey.

Habitat or species / species group	Effect being monitoring	Monitoring	Frequency of monitoring	Reporting / Documentation
		Comprehensive Stormwater Discharge Consent rather than directly by the Project.		
Bats.	Usage of bat boxes and relocated roosts.	Visual monitoring (internal inspection of the bat box or an emergence survey using infra-red camera) for the use of relocated roosts.	Monitoring of bat boxes will to be undertaken in February – March in Year 2 and 5 post installation. Monitoring of relocated roosts to be undertaken in February – March in year 1, 3 and 5 post relocation.	Summary report to be produced by Project Ecologist after each year of monitoring and provide to the TA.
	Monitoring changes in bat activity within the zone of influence of the Project.	Acoustic monitoring at all of the paired road sites and roost sites, as per the baseline surveys (refer to Section 4.3.1), where access is available.	Once every two years, between Jan-March for a minimum of 21 nights for the duration of the construction period (all stages) and for 5 years post construction.	Summary report to be produced by Project Ecologist on completion of each monitoring season which looks at trends. Report to be provided to TA.
	Monitoring changes in habitat connectivity for bats.	Thermal imagery at bridge sites along the Mangakotukutuku Gully and Waikato River, to be completed in accordance with the baseline survey method (refer to Section 4.3.2).	This survey will be completed once following vegetation clearance during the next bat active season (three visits/nights to each bridge in Feb – March for three hours) and once when the road is operational during the next bat active season (three visits/nights to each bridge in Feb – March for three hours)	Summary report to be produced on conclusion of a monitoring event, which looks at trends in behaviour. Report to be provided to TA.

Habitat or species / species group	Effect being monitoring	Monitoring	Frequency of monitoring	Reporting / Documentation
		Acoustic monitoring – as specified above.	As specified above.	As above
		Emergence surveys at bat boxes located in Sandford Park.	To be completed February - March, post vegetation clearance in the Mangakotukutuku Gully and in Year 1, 3 and 5 post operation of a bridge along the Mangakotukutuku Gully.	Results to be presented within the thermal imaging report after each monitoring event, as this monitoring is designed to complement the thermal imaging. Report to be provided to TA.
Lizard.	Monitoring of lizards to demonstrate recruitment and use of restoration sites (Appendix L and Appendix N).	Monitoring to capture as many lizards as possible as part of an ongoing mark and recapture programme to; • Determine population trends; and • Determine whether habitat restoration and pest control has benefited copper skinks.	Monitoring to be completed prior to restoration and in Year 3, 6 and 9 post restoration during Nov – March (set up of monitoring sheets can occur in advance of this period as they should be left in place for a period of three months to increase the potential that reptiles have found the artificial cover objects, if being used).	Report to be produced by the Project Ecologist after each survey, looking at changes in the population. Report to be provided to the TA.
Birds (Avifauna).	Monitoring the abundance and species composition of native birds in response to the construction and operation of the road.	5-minute bird counts at the established monitoring sites in accordance with the methodology established during the baseline surveys (refer to Section 4.4).	Surveys to be completed every two years for the duration of construction and for 5 years post construction. Survey will include 3 survey visits in November – December and 1 visit in August. These will be timed to occur at the same time as the Hamilton Biennial Survey	Summary report to be produced by Project Ecologist on completion of a monitoring season (summer and winter) which looks at trends. Report to be provided to TA

Habitat or species / species group	Effect being monitoring	Monitoring	Frequency of monitoring	Reporting / Documentation
			to allow comparisons of trends.	
Pest control monitoring – rats, mice, possums, hedgehogs and mustelids.	Pest control will aim to achieve the target of 2% Rat Tracking Indices, with levels to be maintained under 5%. The effectiveness of pest control will be monitored by using tracking tunnels and wax tags (refer to National Pest Control Agencies, 2015)	Tracking tunnels and wax tags will be used to monitor the presence of pest species. Tracking tunnels shall be used to monitor relative rat and mustelid abundance and shall therefore be set up for one night with peanut butter bait for rodent monitoring and then three nights with meat baits for mustelid monitoring following Gillies and Williams (2013). Spacing shall follow Gillies and Williams (2013) wherever possible, i.e. each tunnel line consists of 10 tunnels set 50 metres spacing for rodent monitoring. WaxTag monitoring shall take place over three nights following National Pest Control Agencies (2015) protocol. Waxtags will be placed 20 metres apart for 200 metres.	Monitoring shall take place prior to and following pulsed Pest control operations that take place during winter and spring - summer. Monitoring shall take place during the same months each year.	Report to be produced by the Pest Control Contractor. Results to be reviewed by the Project Ecologist or Landscape Architect and the Contractor. The report will be provided to the TA.

8.0 Performance measures and trigger levels

The designation conditions state that the EMMP will include performance measures, triggers and actions. These have been defined as follows;

- **A performance measure** – a quantifiable indicator used to assess how the Project is achieving its objectives as defined by the designation conditions;
- **A trigger level** – a quantifiable point / level at which corrective action must be implemented to ensure that the Project meets the objectives defined by the designation conditions. This measure will be taken from the long-term monitoring data that will be collected for the Project and is summarised in Table 31; and
- **An action** – a defined action that will be implemented if it is identified that the Project is not meeting its performance measures and has exceeded or has not met the trigger level.

The objective defined by the designation conditions is for;

- No net loss in biodiversity.

The designation conditions also define the following aims;

- Enhancement of long-tailed bat habitat;
- Enhancement of the extent and quality of native bird habitat;
- Enhancement of the extent and quality of native lizard habitat; and
- Restoration of indigenous vegetation, stream and wetland values in the gullies and margins of the Waikato River.

Table 32 presents the performance measures, triggers and actions that the Project will use

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Table 32 Performance measures, triggers and actions.

Habitat, species or species group	Performance measure to ensure Project meets designation conditions – no-net-loss and enhancement of habitat	Trigger	Action	Reporting / documentation
Terrestrial, gully, stream and wetland habitat.	Designation Restoration Sites - deliver minimum of: HCC – 13.38 ha. Waipa DC – 4.98 ha. Waikato DC – 2.19 ha. Plus, delivery of 1,570m of stream restoration. Realigned stream (HCC 16 & 17) retains 450m of stream length.	Overall, 10% maximum plant loss being acceptable for grades smaller than 15lt/PB 28 at the completion of the defect's liability and maintenance period, provided that the losses are spread evenly throughout the planting and there are not noticeable bare patches. All larger plants grades 15lt/PB 28 with no loss being acceptable at the completion of the defect's liability and maintenance period (by contract completion). Planting shall achieve an 80% canopy coverage of the ground by contract completion	If the triggers are met then remedial action should be taken in the following planting season, in accordance with the Restoration Site Plan. Review maintenance processes. Implement localised pest control focused on target species e.g. possums/rabbits, if losses have occurred due to pests.	A summary report will be prepared annually by the Project Ecologist or Landscape Architect and shared with the maintenance team at an annual meeting to review if changes to the current regime are required (same memo as detailed for monitoring). This will not be provided to the TA as it is a tool to manage maintenance.
		Minimal weed species present in replanted areas that are listed on the Waikato Regional Pest Management Strategy or that are considered could be detrimental to the	Implement additional localised weed control of problem species at a level considered appropriate for control.	A summary report will be prepared annually by the Project Ecologist or Landscape Architect and shared with the maintenance team at an annual meeting to review if changes to the current

Habitat, species or species group	Performance measure to ensure Project meets designation conditions – no-net-loss and enhancement of habitat	Trigger	Action	Reporting / documentation
		plantings, in the first three years.		regime are required (same memo as detailed for monitoring). This will not be provided to the TA as it is a tool to manage maintenance.
		SEV score attained is lower than 0.65 after 5 years.	Review each of the functions in the SEV survey and determine why the target score has not be achieved and take action to rectify this.	Project Ecologist to prepare a report which clearly indicates the score attained for each function and the measures that can be implemented to ensure that the stream achieves its target restoration value.
		An improvement in wetland condition score achieved in each wetland restoration area compared to that calculated prior to survey.	If no improvement is identified review each of the condition indicators to determine why no improvement has been attained in wetland condition.	Project Ecologist to prepare a report which clearly indicates the score attained for each indicator and the measures that can be implemented to ensure that the condition of each wetland improves.
		No net loss of habitat is not achieved when all areas of restoration planting have been delivered by HCC or the Transport Agency.	Additional land will be identified and secured for plantings / stream restoration to meet the objective of no net loss, as quantified within the EMMP.	Project Ecologist or Landscape Architect will review the extent of habitat restoration indicated on the register. The results of this audit will be presented in a report. A meeting will be held with the maintenance team to discuss what the

Habitat, species or species group	Performance measure to ensure Project meets designation conditions – no-net-loss and enhancement of habitat	Trigger	Action	Reporting / documentation
				long-term maintenance regime should be. This audit report will also confirm if the habitats are self-sustaining. The audit report will be provided to the TA.
		An exceedance of water quality limits set during Resource Consent application (construction and operation).	Review why the pollution incident occurred and take corrective action in accordance the Resource Consent conditions.	Reporting will be in accordance with the requirements of the Resource Consent.
	No pollution incidents in exceedance of the condition of the Resource Consents (sediment).	Multiple bats no longer using the bat boxes e.g. <5+ bats recorded emerging from the bat boxes in Sandford Park through the bat active period (Bat box 1, 2 and 3).	HCC (RA) and the Project Ecologist to review whether the change in behaviour is in response to the Project. Review what the potential reasons for the change in behaviour are and implement remedial action to eliminate or minimise the effect, if change is attributed to the road and if feasible e.g. additional planting, use of artificial structures, alterations to lighting etc. If a problem is identified, then thermal monitoring will be repeated on implementation of	The Project Ecologist will review the results of the surveys every 2 – 5 years to see if there are changes that could be attributed to the Project and present this review in a report. If change is documented reasons for this will be explored and recommendations presented in the report, if the changes is due to the Project. The Project Ecologist and HCC and / or Transport Agency will hold a meeting to review options for remedial action if required. This will be documented. The meeting minutes and the analysis of

Habitat, species or species group	Performance measure to ensure Project meets designation conditions – no-net-loss and enhancement of habitat	Trigger	Action	Reporting / documentation
			corrective action to monitor if the mitigation has been effective.	results will be provided to the TA.
Fish (excluding mudfish)	Connectivity is maintained along HCC 8, 13, 16 and 17.	Eels are no longer present upstream of the culvert on HCC 8 and 13. Eel, banded kokopu and giant kokopu are not present within the stream realignment at HCC16 and 17.	Review the condition of the culvert and stream realignment for obvious problems e.g. culvert has become perched, water velocity, insufficient habitat variability etc. Implement measures to remove obstruction to fish passage or to improve instream habitat.	The Project Ecologist will review the results of the survey and make recommendations for modifications to culverts if required. The report will be provided to HCC to action.
Bats.	Connectivity is maintained at all of the installed hop-overs and underpasses (Appendix B) recorded at same frequency on either side of the road during and post construction.	Acoustic monitors indicate that there is a statistically significant decrease in bat passes, beyond natural fluctuations recorded during baseline data collection. Thermal imagery captures bats approaching bridges but are then demonstrating avoidance behaviour e.g. turning away at a level that is statistically significant in comparison with the base line information or bats are observed crossing the bridge within the vehicle	HCC (RA) and the Project Ecologist to review whether the change in behaviour is in response to the Project. Review what the potential reasons for the change in behaviour are and implement remedial action to eliminate or minimise the effect, if change is attributed to the road and if feasible e.g. additional planting, use of artificial structures, alterations to lighting etc.	The Project Ecologist will review the results of the surveys every 2 – 5 years to see if there are changes that could be attributed to the Project and present this review in a report. If change is documented reasons for this will be explored and recommendations presented in the report, if the changes is due to the Project. The Project Ecologist and HCC and / or Transport Agency will hold a meeting to review options

Habitat, species or species group	Performance measure to ensure Project meets designation conditions – no-net-loss and enhancement of habitat	Trigger	Action	Reporting / documentation
		strike zone (0-5m above bridge deck).	If a problem is identified, then thermal monitoring will be repeated on implementation of corrective action to monitor if the mitigation has been effective. Alter method of contacting individuals.	for remedial action if required. This will be documented. The meeting minutes and the analysis of results will be provided to the TA. In 2020 or before a summary report prepared by HCC / Transport Agency (RA) will be provided to TA indicating that they have met this designation condition.
		Acoustic monitors indicate that there is a statistically significant decrease in bat passes, beyond natural fluctuations recorded during baseline data collection.		
	Existing foraging habitat is maintained and where possible enhanced for bats – number of bats passes remains the same or increases.	100% of private landowners with significant bat roosts have been approached by either HCC (RA) (only those within HCC boundary) by 2020 to discuss the installation of predator bands. The Transport Agency to consult with Waipa and Waikato DC prior to funding being available.		
	Significant bat roosting sites (refer to Table 23) have been contacted by HCC (RA) in relation to the possibility to install a predator band.	No evidence that the population is stable or has increased from the baseline, established during the pre-restoration surveys.	Review success of restoration planting and take corrective action if habitat complexity is not considered optimal for lizards with additional planting or refugia.	Report to be produced by the Project Ecologist after the year 5 and 9 of monitoring looking at changes in the population. This will include a review of whether corrective action is required. The Project Ecologist and HCC (RA) (within HCC boundary only) and / or Transport Agency will hold a meeting to

Habitat, species or species group	Performance measure to ensure Project meets designation conditions – no-net-loss and enhancement of habitat	Trigger	Action	Reporting / documentation
				review options for remedial action if required. This will be documented. The meeting minutes and the analysis of results will be provided to the TA.
Lizards.	Functional population of copper skink present in the two Lizard Restoration Sites.	Statistically significant decrease in bird abundance or species at the monitoring sites.	HCC (RA) and the Project Ecologist to review whether the change in behaviour is in response to the Project. Review what the potential reasons for the change in behaviour are and implement remedial action to eliminate or minimise the effect, if change is attributed to the road and if feasible e.g. additional planting.	Report to be produced by the Project Ecologist after year 5 of monitoring looking at changes in the population. This will include a review of whether corrective action is required. The Project Ecologist and HCC and / or Transport Agency (RA) will hold a meeting to review options for remedial action if required. This will be documented. The meeting minutes and the analysis of results will be provided to the TA.
Birds (Avifauna).	Connectivity is maintained along the Mangakotukutuku and other known habitat linkages – There is no statistically significant decrease in bird abundance, compared to baseline data.	No net loss of habitat is achieved within 5 years for each significant stage of the development i.e. habitat restoration is completed equivalent to the extent of construction works completed (delivery of road	Additional planting to achieve habitat restoration requirements.	Report to be produced by the Project Ecologist after year 5 of monitoring looking at changes in the population. This will include a review of whether corrective action is required. The Project

Habitat, species or species group	Performance measure to ensure Project meets designation conditions – no-net-loss and enhancement of habitat	Trigger	Action	Reporting / documentation
		will be in several significant stages).		Ecologist and HCC and / or Transport Agency (RA) will hold a meeting to review options for remedial action if required. This will be documented. The meeting minutes and the analysis of results will be provided to the TA. Report to be produced by the Pest Control Contractor. Results to be reviewed by the Project Ecologist or Landscape Architect and the Contractor. The report will be provided to the TA.
	Habitat available to native birds is enhanced in extent and quality.	Statistically significant decrease in bird abundance or species at the monitoring sites.	HCC (RA) and the Project Ecologist to review whether the change in behaviour is in response to the Project. Review what the potential reasons for the change in behaviour are and implement remedial action to eliminate or minimise the effect, if change is attributed to the road and if feasible e.g. additional planting.	
		Numbers exceed 5%.	Modify pest control to reduce predator numbers.	
Pest control	Predator numbers to remain less than 5% within the Designation and Lizard Restoration Sites.			

9.0 References

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Appendix A

Wetland Descriptions and Mapping – Morphum (2017)

Appendix A Wetland Descriptions and Mapping – Morphum (2017)

Table 33 Morphum (2017) wetland habitat descriptions cross referenced to T+T (2017) and Opus (2014).

Morphum (2017) reference	T+T (2017) reference	Opus (2014) reference	Wetland or pond?	Area (ha) – impacted habitat only	Habitat description
1	N/A	Not surveyed / classified	Wetland	0.0046	Wetland area but very dry with ephemeral reach downstream. Exotic grass predominates the vegetation.
2	HCC8	Site 5c Gully wetland	Wetland	0.0391	Wider and shallower wetland than identified downstream. Weed infestations and willows altering hydrology. Possible willow removal and restoration planting.
3	HCC8	Site 5c Gully wetland	Pond	N/A	Farm pond restricted by culvert. Unfenced. *Carex secta* and *C.virgata*.
4	HCC8	Site 5c Gully wetland	Wetland	0.0325	Continuous seepage wetland starting midway down steep upper banks. *Carex geminata* predominant vegetation with blackberry, *Tradescantia* and pasture grasses.
5	HCC11	Site 5c - exotic weed community	Wetland	0.0544	Continuous seepage wetland starting midway down steep upper banks. *Carex geminata* predominant vegetation with blackberry, *Tradescantia* and pasture grasses.
6	HCC8	Site 5c Gully wetland	Wetland	N/A	Unfenced with pugging damage and grazing impacts from stock. Good potential for restoration. *Carex secta* and *Juncus* species present.
7	HCC6	Site 6 Pond	Pond	N/A	3rd pond in chain throughout property. Bunded by 2 m high concrete dam with 10 m wide spillway. Outlet culvert 0.5 m discharges into downstream channel approximately 2 m drop to pond below. Manuka scrub on pond banks.
8	HCC6	Site 6 Pond	Pond	N/A	5th pond in chain throughout property. Bunded by 1.1 m high gravel dam with 6 m wide spillway. 500mm concrete culvert. Very poor water quality with red algal bloom. Stagnant. Several small netted waterfowl breeding enclosures drain into this pond.

Morphum (2017) reference	T+T (2017) reference	Opus (2014) reference	Wetland or pond?	Area (ha) – impacted habitat only	Habitat description
9	HCC6	Site 6 Pond	Pond	N/A	4th pond in chain throughout property. Bunded by 1.7 m high gabion basket concrete earth weir structure. High sediment deposits > 0.2 m. Manuka scrub on pond banks.
10	N/A	Not surveyed / classified	Wetland	0.142	Rushland. Spring fed wetland reach. Pools 0.1 m deep with >1m sediment created by stock wallowing. Stagnant standing water with poor water quality.
11	HCC16	Site 5H - Gully wetland and exotic weed community	Wetland	0.3667	Wide wetland floodplain with willows on true right bank, *Carex secta* and *C. geminata*. Modified, artificial channel, likely deepened by landowner along true left bank.
12	HCC13	Not surveyed / classified	Pond	N/A	Pond formed by culvert acting as dam and restricting flows, culvert observed to be partially blocked with roots & sediment but trickling flows. Grey willow with *Carex* species on banks.
13	HCC13	Site 5 D Exotic weed community	Wetland	0.0487	Seepage wetland part way up true left bank. Could be refuge habitat off the main stem of stream during floods.
14	HCC4	Site 5a and 5b Gully wetland x2 (Morphum missed one area)	Wetland	0.2631	Wide wetland floodplain with stream channels meandering through, often in many braids. Groundwater seeps frequent from adjacent banks.
15	N/A	5G Exotic Forest	Wetland	0.1345	*Carex*, willow. Wetland area with wide floodplain and two distinct channels. Western channel likely dug and out maintained in some places. Willows between channels. Areas of dense weeds.
16	HCC14	Not surveyed / classified	Wetland	0.0545	Seepage wetland with grasses and some Carex.
17	HCC15	Not surveyed / classified	Wetland	0.0845	Seepage wetland. No defined channel. Carex grasses through wetland area.
18	HCC17	Site 5H - Gully wetland and exotic	Wetland	0.2872	Wide wetland reach with groundwater inputs maintaining water levels during summer.

Morphum (2017) reference	T+T (2017) reference	Opus (2014) reference	Wetland or pond?	Area (ha) – impacted habitat only	Habitat description
		weed community			
		Site 5e Ephemeral wetland (not picked up by Morphum)	Wetland	0.0346	Opus (2014) description - Degraded stream runs through an area of native restoration plantings that appears to be ephemeral.
		Site 5f Gully wetland (Not picked up by Morphum)	Wetland	0.053	Opus (2014) description - Shallow finger of gully with no significant indigenous vegetation or habitat. Primarily pasture with some gorse, grey willow and soft rush.
			Total	1.6	

Table 34 Summary of calculation to determine if additional habitat offset is required in response to wetland review.

	Opus - wetland	Opus – exotic vegetation that Morphum later identify as wetland	Morphum - wetland
Total area	0.73 ha	0.6849 ha	1.5994 ha
Ratio	3:1	1:1	3:1
Offset area	2.19 ha	0.6849 ha	4.7982 ha
Total offset area	2.88		4.80
Difference between Opus and Morphum habitat offset	1.92		
Total habitat offset required	13.38		

ISO A3 297mm x 420mm

Wetland - Opus | Wetland Lost | Wetland (Morphum) | Manmade Pond | Designation Restoration Site | Stream Restoration Site

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PROJECT

Southern Links

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Hamilton City Council and
NZ Transport Agency

CONSULTANT

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SPATIAL REFERENCE

Scale: 1:5,000 (A3 size)

50 0 50 100 150 200 Meters

Map features depicted in terms of NZTM 2000 projection.

PROJECT MANAGEMENT

Approved	F. Davies	Date	16/08/2019
Checked	L. Smith	Date	16/08/2019
Designed	D. Klap	Date	12/08/2019
Drawn	M. Bryant	Date	14/08/2019

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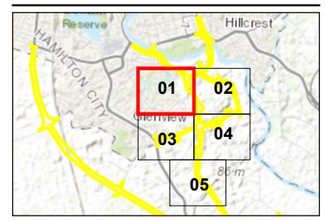
A	16.08.19	For Review

KEY PLAN



PROJECT NUMBER

60526419

SHEET TITLE

Wetland Mapping
Wetland Restoration Areas

MAP NUMBER

60526419_01_002_01

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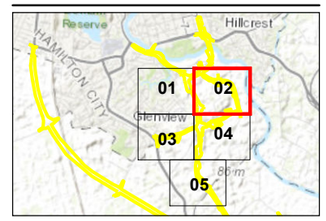

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SHEET TITLE

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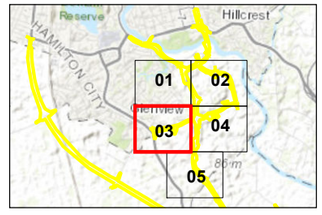

PROJECT NUMBER

60526419

SHEET TITLE

Wetland Mapping
Wetland Restoration Areas

MAP NUMBER

60526419_01_002_03

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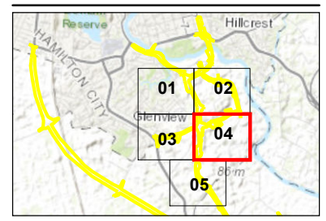

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SHEET TITLE

Wetland Mapping
Wetland Restoration Areas

MAP NUMBER

60526419_01_002_04

ISO A3 297mm x 420mm

Wetland - Opus | Wetland Lost | Wetland (Morphum) | Manmade Pond | Designation Restoration Site | Stream Restoration Site

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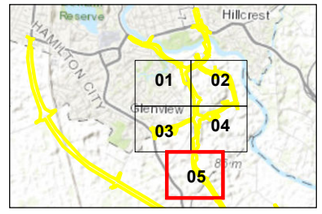

PROJECT NUMBER

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SHEET TITLE

Wetland Mapping
Wetland Restoration Areas

MAP NUMBER

60526419_01_002_05

Appendix B

Designation Mitigation Plans

Appendix B Designation Mitigation Plans

NZ TRANSPORT AGENCY WAKA KOTAHI / Hamilton City Council Te kaunihera o Kirikiriroa

SOUTHERN LINKS

DRAFT

Stream Restoration Site

Designation Restoration Site

Treatment Wetland

Vegetated hop over for birds and bats. Light sensitive area

Vegetation to encourage bats under the bridge

Bat roosts

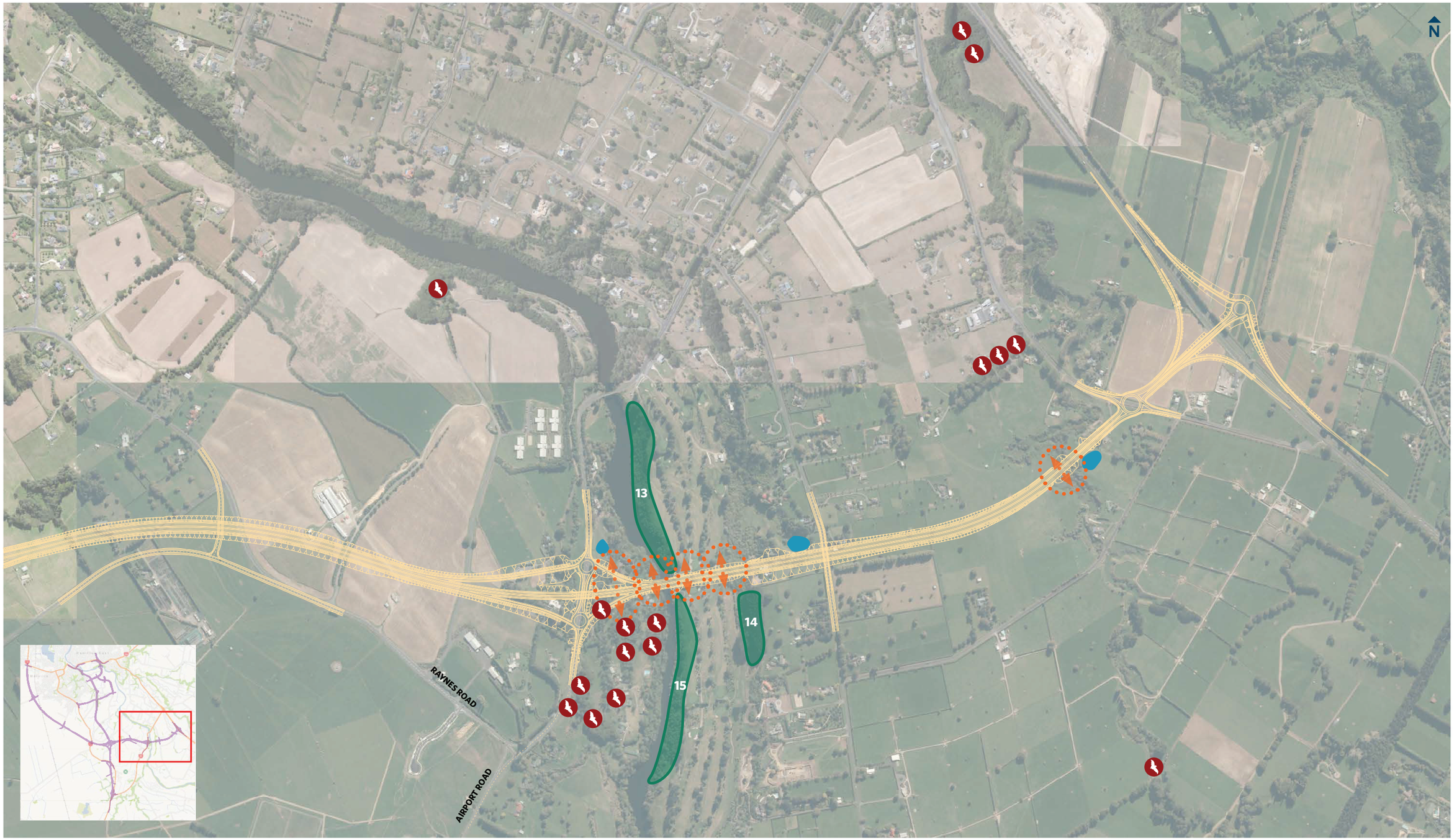
Lizard Restoration Site

0 125 250 500 750 1,000m

NZ TRANSPORT AGENCY WAKA KOTAHI / Hamilton City Council Te kaunihera o Kirikiriroa

SOUTHERN LINKS

DRAFT



Designation Restoration Site

Treatment Wetland

Vegetated hop over for birds and bats. Light sensitive area

Bat roosts

0 100 200 400 600 800m

NZ TRANSPORT AGENCY WAKA KOTAHI / Hamilton City Council Te kaunihera o Kirikiriroa

SOUTHERN LINKS

DRAFT

Appendix C

Personnel Involvement in the Development of the EMMP, their Role and Experience

Appendix C Personnel Involvement in the Development of the EMMP, their Role and Experience

A list of the personnel who have been involved in the development of the EMMP are presented in Table 35. Their role in the development of the EMMP is also detailed.

Table 35 Personnel involved in the development of the EMMP, their role and experience.

Personnel	Organisation	Role and Experience
Fiona Davies.	AECOM.	**EMMP Project Manager** Fiona has over 16 years' experience working as environmental manager on large scale projects in the UK and New Zealand (NZ). Specifically, in the project management of ecological issues and the development and implementation of Ecological and Environmental Management Plans while working on large infrastructure projects including the West Coast Route Modernisation rail project (UK) and the Waikato Expressway road project (NZ).
Lyndsey Smith.	AECOM.	**EMMP Author** Lyndsey has 16 years professional ecological experience that she has gained while working in NZ and the UK. Lyndsey has produced EMMPs for a range of projects including; regeneration of disused mineral extraction sites, regeneration of large areas of disused industrial land to create new towns, management and restoration of hydraulic fracturing projects, management of nature reserves, replacement and new rail projects etc. The EMMPs for these projects were complex due to their landscape scale and the range of habitats and species that were present in the local area.
Dr Kerry Borkin.	Wildlands Consultants Ltd.	**Specialist Advisor – bats** Dr Kerry Borkin has 18 years' experience in ecological management and research. She completed her PhD (Biological Sciences) in 2010, which investigated long-tailed bat ecology in Kinleith Plantation Forest, particularly the impact of clearfell harvest on bats.
Dr Kate Richardson.	Wildlands Consultants Ltd.	**Specialist Advisor – bats** Kate is an ecologist with extensive experience working with a range of bat, bird, and herpetofauna species. Kate has previously monitored long-tailed bats with the Department of Conservation, as a Biodiversity Ranger at Pureora Field Base.
Tim Martin.	Wildlands Consultants Ltd.	**Wildlands – Project Manager** Tim Martin has excellent skills in the survey and monitoring of indigenous fauna throughout the North Island mainland and on several off-shore islands. Tim has acted as lead ecological advisor for several major roading projects with potential effects on bat populations. For these projects, Tim worked collaboratively with the wider project team (including planners, engineers, landscape architects, and other ecological specialists) to develop appropriate mitigation for the effects on bats.
Dr Ian Davidson-Watts.	Davidson Watts Ecology (Pacific) Ltd.	**Specialist Advisor – bats** Ian Davidson-Watts has been researching and advising on bat related issues since 1993 and trapping bats and

Personnel	Organisation	Role and Experience
		training bat workers for permit/consent related activities since 1996. In the UK, Ian has led a range of research and development related projects involving advanced techniques for the capture of bats, resulting in the designation of two major protected areas for rare woodland bat species. Ian has pioneered the use of acoustic lures with NZ bats delivering commercial trapping and tracking projects.
Dean Miller.	Tonkin and Taylor Ltd.	**Specialist Advisor – aquatic ecology** Dean Miller is an aquatic ecologist with 16 years' professional experience in aquatic ecology and water resource evaluation and management. Dean has been involved in numerous ecological investigations covering river, stream, lake and wetland systems.
Angela Chaffe.	AECOM.	**Specialist Advisor – birds** Angela has 4 years of professional ecological experience and has specialised in terrestrial and freshwater ecology. She has a strong background in ecological survey application, including catchment and terrestrial habitat characterisation, vegetation and fauna surveys, freshwater and terrestrial ecological assessment and environmental baseline surveys.
Ian Southey.	Self-employed ornithologist.	**Specialist Advisor – birds** Ian Southey has extensive experience of undertaking a broad range of bird surveys voluntarily and commercially. Ian is the regional representative of Birds New Zealand.
Conor Reid.	AECOM.	**Specialist Advisor - birds** Conor has 6 years of professional ecological experience developed while working in the UK and New Zealand. Conor has developed skills in botanical and faunal surveys taking a particular interest in New Zealand birds.
Trent Bell.	EcoGecko Consultants Ltd.	**Specialist Advisor - lizards** Trent was formerly based at Landcare Research from 2004—2009, as a Research Technician/Herpetologist. Trent developed the NZ Lizards Database, is the editor of BioGecko journal, has published 13 lizard-related papers in peer-reviewed journals and produced over 40 technical reports to stakeholders. Trent has considerable experience in field work with lizards, having worked across the length and breadth of New Zealand and on several remote offshore islands.

Appendix D

Summary of Consultee Comments and Response by the Project

Appendix D Summary of Consultee Comments and Response by the Project

A summary of consultee comments with information summarising how the Project responded to these comments.

Table 36 Comments and questions obtained during consultation.

Organisation and attendees	Date	Information shared	Comments	Project response
Round 1 Consultation 2017				
WRC – Freshwater. Jorge Rodriguez. Bruno David. Michael Pingram.	31st July 2017.	Results of the freshwater surveys.	The Waterford/Peacockes branch of the Mangakotukutuku Stream is important from a city perspective (it has the highest stream habitat, invertebrate and fishery values of Hamilton's gully systems).	Noted
			WRC feel the Stream Ecological Valuation (SEV)/Ecological Compensation Ratio (ECR) approach seems quite rigid and tends to focus on riparian planting. WRC prefer a ratio approach that considers mitigation measures beyond planting, and with potentially more valuable habitat or biodiversity benefits such as fish passage, stream creation and in-stream habitat enhancement. WRC suggested the Huntly Section approach or similar would be appropriate.	Ratio approach adopted as requested by WRC. Section 6.4.1.
			WRC highlighted the following: - Principles of good practice offsetting should be followed (e.g. permanent protection of mitigation sites). - No double dipping. Stream mitigation / compensation should be clearly identified as over and above mitigation for other habitat restoration/ biodiversity elements. In terms of gully restoration, the near stream planting	Noted and Stream Restoration Sites are not included in the habitat restoration to be provided by the Project (Appendix B).

Organisation and attendees	Date	Information shared	Comments	Project response
			(20 m either side of the stream) could contribute to the stream mitigation. Key issues they would like to see addressed: - Effects on hydrology, and in particular where a culvert or diversion short circuits small seepage areas. Need to consider peak and base flows. - Loss of stream length. Riparian planting to address stream habitat loss doesn't replace the stream length. Stream length is also important from a hydrology effects perspective. WRC would like to see options included that maintain the overall stream length (e.g. replacing lost stream length through meandering diversion design).	The Project Engineers will take this into consideration when producing the detailed design. The stream alignment will be undertaken a manner that ensures that there is not loss of stream length (refer to Section 6.4.8).
DOC. Andrew Styche. Ray Scrimgeour.	11th Sept 2017.	Results of 2017 surveys (ABM and thermal bat surveys and stream surveys) and proposed survey methodology for birds and lizards.	DOC indicated that they have seen resources spent on lizard salvage that on reflection would have been better spent on habitat restoration / creation / protection.	Noted and this led to the concept of investing resources in the Lizard Restoration Sites rather than spending resources on detailed salvage of native lizards (refer 6.6.2).
			DOC expressed concern around the delivery of wildlife mitigation in areas that would be surrounded by high density residential development.	Noted
			DOC expressed concern in relation to the cumulative effect of the road and the surrounding residential development.	Noted
			DOC indicated that they would like to know more about how bats are moving and foraging across Hamilton, including social structure.	This led to the completion of four sessions of bat radio tracking and the extension of the thermal imaging surveys to the Mangakotukutuku.

Organisation and attendees	Date	Information shared	Comments	Project response
			DOC indicated that they thought from previous studies that long-tailed bats would be widespread through the study area, but present in low numbers. It was also indicated that it was thought that safe roosting sites were limited by the availability of trees. It was suggested that bats numbers may be boosted by bats travelling into the city from the wider area.	Noted
			DOC indicated that they were looking for well thought through expenditure of mitigation money. It may be better to invest mitigation money beyond the proposed Peacocke Growth Cell.	Noted. The Project will deliver areas of restoration habitat that are in the Peacocke Growth Cell and beyond it (refer to Appendix B)
			DOC reiterated that the designation conditions require no-net-loss of biodiversity.	Noted. Refer to 2.3.
			DOC highlighted that they were concerned in relation to how effective localised pest control would be as studies have shown that it needs to be delivered over a wider area.	Noted. The delivery of pest control is affected by landownership. The designation conditions specify pest control at significant roost sites. The Project will do this through the use of tree bands, where practical and the landowner is willing. The provision of resources and advice to landowners for the delivery of pest control on private land. The Project has taken an additional step by delivering pest control along the Mangakotukutuku which is used by bats for foraging, commuting and roosting (refer to Section 6.5.7.
			DOC indicated that vegetation canopy adjacent to the roads needed to be high to avoid bird strike.	Noted (refer to Section 6.7.1).
			DOC suggested that if lizards were found during works that the Project should consider existing reserves where pest control is being delivered rather than starting again.	Noted. The Project undertook further consultation with DOC who highlighted that it was preferable for Designation Restoration Sites to be additive, therefore, the Project moved away

Organisation and attendees	Date	Information shared	Comments	Project response
				from using existing reserves (refer to Appendix L).
			DOC indicated that in relation to the aquatic environment that WRC had a number of experts that could provide comment rather than DOC.	Noted. The Project has undertaken consultation with WRC.
			DOC indicated that it would be hard to find restoration sites that would provide suitable habitat for all the species the Project would be looking to mitigate for. Permeability of the wider environment would be important for bats. Thought there were large gaps in knowledge in relation to bats and the location of their maternity roosts.	Noted. Refer to Appendix B, which aims to improve areas of habitat that are known to be of value to native birds, bats and lizards and to maintain connectivity between these high value habitats.
WRC - Terrestrial Ecology and MSCG. Dave Byers (WRC). Moniqua Nelson-Tunley (WRC). Matthew Vare (WRC). Andrea Julian (WRC). Grant Blackie (WRC/ MSCG).	20th Sept 2017.	Results of 2017 surveys (ABM and thermal bat surveys and stream surveys) and proposed survey methodology for birds and lizards.	It was suggested that AECOM should liaise with Project Echo (Kessels) who are undertaking bat surveys.	Noted and undertaken.
			The cycleway through Hammond Park was discussed and concerns were raised about lighting.	Noted. This is beyond the scope of this Project.
			There was interest in the height at which bats were flying and indicated that there should be a focus on finding bat roosts.	Following consultation four sessions of bat radio tracking were completed to identify bat roosts. In addition, the thermal imaging surveys were extended to the Mangakotukutuku gully and existing roads sites. This looked at the height that bats were travelling.
			WRC expressed concern in relation to the number of bird surveys being undertaken at each site and questioned as to whether the level of survey would be able to show a change in activity.	The bird survey methodology includes three survey visits in summer. Taking into consideration the number of monitoring sites. It is considered that an assessment can be made as to whether changes in local abundance are significant (refer Section 5.3).

Organisation and attendees	Date	Information shared	Comments	Project response
			WRC are working with Landcare on a project that will look at reptiles in Hamilton.	Noted. Landcare Research were contacted to understand the extent of their works and see if there were opportunities to share data. It was noted that after one year of monitoring of lizards that the Landcare Research project confirmed also that the only native lizard present in the local area was copper skink.
			WRC suggested that AECOM liaise with the urban biodiversity project being run by HCC.	Noted. AECOM contacted the biodiversity team in 2017 to understand the location of on-going community habitat restoration projects and areas of high value habitat. The Project have shared with the HCC Biodiversity Team the results of survey works completed by the Project.
			WRC suggested that if lizards were found during surveys that they should be relocated immediately. Suggested relocation sites include Lake Rotopiko. Should be within 20km of capture.	Noted. Refer to Section 6.6.2 and Appendix L.
			WRC indicated that the stream compensation sites should be planned at the same time as the habitat restoration sites.	Noted. Refer to Appendix B.
			WRC indicated that they would like to see a co-ordinated set of actions in the EMMP.	Noted.
			WRC were interested to know if HCC and the Transport Agency would buy land to deliver restoration.	Noted. The Designation Restoration Sites will be delivered on land that comes into the ownership as a result of the designation. No significant additional land needs to be or would be purchased.
			WRC indicated that there could be opportunities to undertake compensation within HCC reserves in the Peacockes area.	Noted. The Designation Restoration Sites are not within current HCC reserves to ensure that they are additive.

Organisation and attendees	Date	Information shared	Comments	Project response
			WRC indicated that HCC needed to work more closely with the MSCG.	Noted. Beyond the scope of this Project.
TWWG and DOC. Raymond (Moko) Kumar – Waikato Tainui. Wayne Harris – Ngati Wairere. Maree Pene – Ngati Wairere. Poto Davis - Ngati Koroki Kahukura. Marina Hape – Ngati Mahanga. Andrew Styche DOC.	12th Oct 2017.	Results of 2017 surveys (ABM and thermal bat surveys and stream surveys) and proposed survey methodology for birds and lizards.	A number of questions were asked which are summarised here; - Is there lighting available that leads to less spill? - Is height of bridges being considered in relation to bat mitigation? - Are the mitigation measures being suggested by the Project in use elsewhere on other road projects? - How confident is the Project that mitigation will work and be successful? - Are bat boxes in use and are they effective?	Noted. Responses, where applicable are below; Yes, shields will be used (refer to Section 6.5.2). The height of structures are fixed but the height at which bats are travelling in relation to the bridges has been considered and this has influenced how hop-over and underpass vegetation is delivered (refer to Section 6.5.1). Yes, the suggested mitigation is in use in New Zealand and internationally. Mitigation has been designed to allow no-net-loss of diversity as a result of the Project (refer to Section 2.3). The bat radio tracking surveys have confirmed that the bat boxes in Sandford Park are used by bats regularly.
			Poto indicated that an urban bat population is important to Hamilton and is quite unique. Support is given to efforts that improve global knowledge of bats and refine mitigation. It was indicated that HCC should be incorporating this knowledge into the Structure Planning Process.	Noted. The Project has provided all of the species survey reports to the team within HCC who are reviewing the Peacocke Structure Plan.
			Wayne indicated the significance of mokomoko (lizards) in maori culture and that best practice options should be explored. Wayne indicated that he agreed with DOC that lower than anticipated success has been observed with capture and relocation e.g. Ruakura Site in Silverdale and indicated that he hoped that better approaches would be found.	Noted. Refer to Section 6.6.

Organisation and attendees	Date	Information shared	Comments	Project response
			Moko indicated that restoration site prioritisation should take into consideration future urban impacts when considering best bang for buck and that mitigation aligns with other developments.	Noted. Refer to Appendix B.
			Archaeological and heritage sites should also be considered when selecting restoration sites.	Noted. A Pa site is located in an area that is of value for habitat connectivity. Restoration of this area is currently in discussion with the TWWG.
RESI. Allen Pearson. John Badham.	09th Nov 2017.	Results of 2017 surveys (ABM and thermal bat surveys and stream surveys) and proposed survey methodology for birds and lizards.	RESI indicated that they were not in support of a cycleway within Hammond Park (beyond the scope of this Project).	Noted. This is beyond the scope of this Project.
			RESI have had some anecdotal reports of high bat activity below houses at Balfour Street entrance to Hammond Park.	Noted.
			RESI indicated that there could be an opportunity for the Project to collaborate with the Cacophony Project.	Noted. Consultation with the Cacophony Project did not lead to any joint working.
			RESI indicated in relation to restoration sites, that they would like to see a cross river park, including Hammond Park and much of the opposite river bank.	Noted. The parcel of land referred to for the cross river park is located on private land and the Project has no influence on how this area is developed. The Peacocke Structure Plan indicates that the width of riverbank vegetation at this location should be widened on development.
HCC (TA). Peter Kirk.	1st Feb 2018.	Results of 2017 surveys (ABM and thermal bat surveys and stream surveys) and proposed survey methodology	HCC indicated that the programme looked comprehensive but that technical ecological components would need to be reviewed by the Council's ecological peer reviewer once they were appointed.	Noted.

Organisation and attendees	Date	Information shared	Comments	Project response
		birds and lizards.		
Round 2 Consultation 2018				
DOC. Andrew Styche. Moira Pryde.	25th Oct 2018.	Consultation in relation to 2018/2019 bat radio tracking surveys.	Moira indicated that the long-tailed bats have a large home range and that the bat radio tracking works will be focused within only part of their larger range. This will affect our understanding of their ecology but indicated that it was understood that the radiotracking survey design had been developed for the Project.	Noted. Radio tracking was focused on the identification of bat roosts within the zone of influence of the Project as the designation conditions require the delivery of pest control at significant bat roosting sites. The radio tracking also looked to identify key foraging habitat and connective linkages.
			Moira indicated that a key concern was the loss of trees due to the development of the road and housing. The loss of trees would likely lead to the loss of bats. If DOC is to protect bats as indicated in the Wildlife Act, then they should not be permitting the removal of trees.	Noted. Trees will need to be removed as part of the development. Therefore, mitigation has been developed to avoid bats being injured and killed during these works and to compensate for the loss of potential and actual roosts (refer to Section 6.5.
			Andrew indicated that the bat radio tracking was positive as it is identifying bat roosts within the landscape and that the survey was providing information about the bats core areas.	Noted.
			Andrew indicated that DOC is concerned in relation to the monitoring being completed as it is felt that it will not be able to demonstrate whether 'no-net-loss' has or has not been achieved as specified in the designation conditions.	Noted. The monitoring has been established to monitor no-net-loss of the Project.
			Andrew indicated that he did not think that the bird survey was fit for purpose and indicated that the Project should refer to a paper that has been produced for the assessment of impacts on birds.	Noted. The Project undertook a review of the bird monitoring methods and concluded that they align with current best practice for identifying local changes in bird abundance.

Organisation and attendees	Date	Information shared	Comments	Project response
			Moira highlighted that in a modified landscape where bats are being subjected to variable conditions it was unlikely that acoustic monitoring could be used, in isolation, to monitor whether the population of bats to the south of Hamilton was declining.	Noted. Acoustic Monitoring has limitations. It will not indicate the number of bats present. It will indicate the distribution of bats in the landscape. In addition, thermal imaging will be undertaken to assess if bats are crossing areas which have been bridged by the road. Monitoring of the bat boxes in Sandford Park will be undertaken as a means of assessing if bats are continuing to migrate into the central city.
DOC.* Andrew Styche. Moira Pryde. Lynn Adams.	29th Nov 2018.	Document summarising survey results from 2018 (lizards, birds, bats - ABM, thermal and radio tracking) and proposed mitigation / habitat restoration sites was provided to DOC in advance of the meeting.	Moira Pryde was keen to see a landscape based plan for managing impacts on bats from Southern Links.	Noted. This is beyond the scope or responsibility of the Project. The request has been passed on to HCC senior management.
			Moira talked about her concerns with monitoring – not a Southern Links Project specific issue. The proposed monitoring will not address wider questions being asked. Needs a long-term plan. This links back to HCC's Structure Plan Project. DOC considers that the Southern Links Project needs to be more pro-active.	Noted. Landscape scale monitoring is beyond the scope of the Project. The Project has been pro-active in that it has engaged with the team undertaking the review of the Peacocke Structure Plan, HCC Biodiversity Team and have shared survey information with Waipa DC, Waikato DC and WRC so that they can review what this information means for their planning process.
			Moira and Andrew indicated that they were in support of one permit application for all of Southern Links rather than separate applications for each phase of the Project.	Noted.
			DOC indicated that the assessments of effects on bats could not purely be undertaken for Southern Links, they would need to take into consideration the wider urban development.	Noted. The EMMP is not an assessment of effects.
			DOC indicated that there should be a long-term monitoring programme for bats and that all involved parties should invest in this.	Noted. The monitoring to be delivered by the Project is focused on meeting the Projects designation conditions. Landscape scale

Organisation and attendees	Date	Information shared	Comments	Project response
				monitoring is beyond the responsibility of the Project.
			DOC expressed concern around the continual removal of trees as so many have already been removed.	Noted. Trees will need to be removed by the Project. Mitigation will be provided for this loss (refer to Section 6.5).
			DOC indicated that the validity of the lizard compensation site should be checked by an expert. They indicated that they are concerned about the success of these types of projects and indicated that would be interested in a research project that could determine changes in the population size. DOC indicated that the lizard mitigation appeared to be moving in the right direction. It was indicated that the Pest Management Plan should be submitted with the Lizard Management Plan.	Noted. EcoGecko have reviewed recommendations with the EMMP, will co-write the LMP and subsequent restoration plans. The Project will monitor to assess the success of the mitigation areas. Pest management will form part of the LMP.
			DOC indicated that for bats the Project need to consider landscape restoration.	Noted. The Designation Restoration Sites have been selected has in part they are known to provide bats with habitat within the zone of influence of the Project (refer to Appendix B).
***** DOC provided further comment after the meeting (29th November 2018) when the minutes were circulated. A summary of these comments is provided below;	N/A	N/A	DOC indicated they want to be part of the review of the Peacocke Structure Plan and the Biodiversity Framework.	Noted. DOC are part of the Peacocke Structure Plan Review, Biodiversity Framework and Biodiversity Offsetting. These processes are all separate from the Project.
			The Project needs to think on a landscape scale in relation to monitoring. There has been one colony identified and every development affecting bat habitat will affect the colony.	The Project will deliver monitoring in line with the designation conditions. These require the Project to monitor change during construction and post construction. This is not the landscape scale monitoring requested by DOC.
			DOC indicated that there needs to be a demonstration of no-net-loss.	The Project will undertake monitoring to identify if there is any change as a results of the Project.

Organisation and attendees	Date	Information shared	Comments	Project response
DOC. Moira Pryde. Laurence Barea.	14th Dec 2018.	Drive around Southern Links Project Area.	The purpose of the drive around was to show DOC where bats had been recorded and the landscape through which the road will pass.	N/A
TWWG.	7th Nov 2018.	Presentation on survey results from 2018 (lizards, birds, bats - ABM, thermal and radio tracking) and draft proposals for mitigation /habitat restoration sites.	Enquiries were made about what would happen to long-tailed bats if the mitigation was not successful.	Noted. The EMMP details monitoring that will be undertaken to assess if there are changes in the bat population as a result of the road. If changes are observed than the Project will review why the changes could be occurring and implement corrective action if appropriate.
			Indication that iwi was pleased to see that the development was taking into consideration ecology and would like to continue to be involved as restoration plans are developed further.	Noted. The Project will make regular updates to TWWG in relation to the delivery of restoration.
RESI and MSCG. Kevin Collier (MSCG), Grant Blackie (MSCG), Andrea Graves (RESI), John Badham (RESI), Alan Pearson (RESI).	27th Nov 2018.	Presentation on survey results from 2018 (lizards, birds, bats - ABM, thermal and radio tracking) and draft proposals for mitigation / habitat restoration sites.	RESI indicated that they were interested in the Southern Links Project because of its connection to the wider Peacockes development and the effect it may have on Hammond Bush.	Noted.
			MSCG discussed the idea that Cobham Bridge is an existing barrier to bat movements along the Waikato River due to lighting. Although the negative effects of lights on NZ bats is not yet proven, they thought a precautionary approach should be taken to the potential effects of lighting on bats.	Noted. Precautionary approach to lighting adopted (refer to Section 6.5.2).
			Concerns were raised about the effects of the new bridge height on the movement of bats along the river following the presentation of the thermal results.	Noted. Refer to Section 6.5.1.

Organisation and attendees	Date	Information shared	Comments	Project response
			The Southern Links development needs to be assessed in the context of what the wider area will be like in 20 years' time with extensive urbanisation. The river may be the only dark corridor remaining for bat movement, underscoring the importance of getting the new bridge design right to allow unimpeded bat movement along the river.	Noted. The Project is taking into consideration bats during the design of the Waikato River Bridges.
			A question was raised in relation to the effect of car lights as opposed to road lighting on bats.	Noted.
			It was stated that bat boxes are only bat boxes if they are colonised and that monitoring will be needed to confirm this. It was asked what would be done if bat boxes weren't occupied.	Noted. Bat boxes will be monitored. If they are not occupied after 5 years it will be reviewed as to whether their relocation would improve the potential of them being used.
			A question was raised as to what would be done if post construction monitoring showed that mitigation / compensation had not been successful.	Monitoring will be undertaken to assess if the road has had a negative impacted on native species. If there is evidence that this is the case the Project will reflect on how this can be rectified.
			It was queried as to how Southern Links was working with developers within the Peacocke Growth Cell.	Southern Links is providing all survey information that they have to developers within the Peacocke Growth Cell and indicating how the Project will mitigate for its impacts.
			The Structure Plan reserves shown on the Southern Links Draft Compensation Plans were discussed. It was identified to be very important that these reserves are developed properly (native plantings etc.) as the area is developed. The example of Amberfields was discussed by RESI who suggested that the 100m wide reserve shown on the Structure Plan adjacent to the Waikato River is to be reduced to 7m in the current resource consent application. There was	Noted.

Organisation and attendees	Date	Information shared	Comments	Project response
			a lot of concern from RESI in regard to this issue.	
			RESI and MSCG wanted HCC to think about how all the different developments were 'fitting together' and address thing from a city wide perspective.	Noted. HCC as TA is currently considering a review of the Peacocke Structure Plan and guidance on offsetting, with the objective of providing a framework for the different developments to fit together.
			MSCG thought that it would be a key management strategy of the catchment to manage stream crossings during the detailed design stage.	Noted. The Project is working with ICMP team in relation to culvert design.
			It was identified that the assessment of the effect of light on bat activity had been inconclusive due to issues with methodology and equipment. It was enquired as to whether an alternative approach to light assessment would be implemented.	The Project is reviewing alternative approaches to monitoring light and its effect on bats.
HCC, Waipa DC and Waikato DC. Peter Kirk (HCC, Planning Guidance Unit). Mark Roberts (HCC, Economic Growth and Planning Unit). Matt Lillis (HCC, Strategic Development – Mangakotukutuku ICMP project manager).	28 Nov 2018.	Presentation on survey results from 2018 (lizards, birds, bats - ABM, thermal and radio tracking) and draft proposals for mitigation / habitat restoration sites.	It was noted that over the course of the Project ecology surveys that there has been vegetation removal in Waipa around significant sites used by long-tailed bats. It is important that regulatory teams have an awareness of long-tail bat habitat and the protection they require. TA's noted that they have a greater awareness of bats now and find the information being developed by Southern Links project helpful.	N/A
			Enquiry as to how Southern Links have been connecting with the team developing the Amberfields Masterplan.	Southern Links is providing all survey information that they have to developers within the Peacocke Growth Cell and indicating how the Project will mitigate for its impacts.
			Paula Rolfe noted that HCC as TA was working on an off-set mitigation approach (New South Wales (NSW) approach) to roll out as part of	N/A

Organisation and attendees	Date	Information shared	Comments	Project response
Paula Rolfe (HCC, Team Leader Implementation & Monitoring, City Planning). Margaret Glassey (Waikato DC, Monitoring Officer). Wayne Allen (Waipa DC, Planning and Regulatory Manager). Jamie Sirl (HCC, Parks and Open Spaces). Zeke Fiske (HCC, Parks and Open Spaces).			Amberfield and Peacockes development to address biodiversity effects, including bats.	
			General comments were made that the work looked good. Wayne Allen noted there is a need for the TA's to talk about jointly engaging someone to do the certifying work.	N/A
WRC – Biodiversity Team Andy Thomas (WRC, Biodiversity Officer), Andrea Julian (WRC, Biodiversity Officer - Strategic),	7th February 2019.	Presentation on survey results from 2018 (lizards, birds, bats - ABM, thermal and radio tracking) and draft proposals for mitigation/	Enquired whether the Project was liaising with the Peacockes developers and whether the latest ABM survey data had been obtained.	Southern Links is providing all survey information that they have to developers within the Peacocke Growth Cell and indicating how the Project will mitigate for its impacts. The Project had not obtained ABM data collected by Amberfields in summer 2018/19. However, this information would be requested.
			WRC thought a key issue was bats moving over the roads.	Noted. Refer to Section 6.5.1.

Organisation and attendees	Date	Information shared	Comments	Project response
Moniqua Nelson-Tunley (WRC, Biodiversity Officer)		habitat restoration sites.	HCC to confirm with WRC whether there was a health and safety policy in place to remove tall trees beside roads.	Noted.
			WRC suggested that shorter light poles could be used at hopover locations.	Noted. This design suggestion has been incorporated into the proposals (refer to Section 6.5.2).
			WRC wanted the success of early hop-overs to be monitored in order to inform the design of future ones on the Project.	Noted. Thermal imagery will be collected at bridge crossing sites (refer to Section 7.0).
			WRC voiced concerns about the unknown impacts of lighting on bats.	Noted.
			WRC asked that if wetlands were put next to roads that the effects on birds were considered.	Noted.
			WRC liked the idea of HCC providing a funding 'pot' administered by an organisation like Project Echo that could help private land owners with pest control.	Noted. Refer to Section 6.5.7.
			Matthew Vare (WRC) was absent from the meeting and provided separate email feedback mainly relate to how WRC would incorporate the Project survey data in to their own processes.	Noted. Survey reports have been provided to Matthew Vare.
			WRC noted the importance of cross-boundary approach for ecological management i.e. Waipa DC.	Noted. Refer to Appendix B.
			Some suggestions were given in regard to habitat requirements for copper skinks.	Noted.

Appendix E

Minutes of Consultee Meetings

Appendix E Minutes of Consultee Meetings

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Minutes of Meeting

Southern Links - EMMP (60526419)

Subject	Department of Conservation (DoC) Ecological Management and Monitoring Plan (EMMP) workshop	Page	1
Venue	DoC office, Hamilton	Time	2-4pm
Participants	Fiona Davies (AECOM – EMMP) Lyndsey Smith (AECOM – EMMP) Grant Eccles (AECOM – Planning) Kerry Borkin (Wildlands – Bats) Nathanael Savage (Hamilton City Council) Tahl Lawrence (Hamilton City Council) Andrew Styche (Department of Conservation) Ray Scrimgeour (Department of Conservation)		
Apologies	None		
File/Ref No.		Date	11-Sep-2017
Distribution	As above		

No	Item	Action	Date
1	**Introductions** were provided by all. AS provided some background to his role at DoC and his involvement in the administration of the Wildlife Act permits.		
2	A **general discussion on Southern Links** was undertaken.		
	AS discussed learnings from other projects such as spending vast resources on lizard salvage which he thought had a bad/ineffective outcome. Doesn't want to see everything being invested into surveys and 'old ways' of doing mitigation.		
	AS questioned the point of doing restoration (bats? Lizards?) for Southern Links where the density of housing (i.e. Peacockes) was going to increase so much.		
	AS mentioned Nicola Nelson doing a PhD study on lizards.		
	AS said that DoC were not happy with the final outcome of the designation conditions (particularly in regards to the concept of 'no net loss') and felt that they would use the Wildlife Permit conditions to reach the outcomes they were after if they had to.		
	Concerns raised by AS around the future subdivision/residential development in the Peacockes area and the cumulative effects this might		

No	Item	Action	Date
	have on Southern links.		
	TL reiterated that any mitigation/restoration undertaken as part of the Wairere/Cobham intersection works would not be taken out of the 11.46ha minimum requirements for Southern Links.		
	FD reiterated that Wairere/Cobham intersection was being viewed as a separate project and was not viewed as a 'significant' site in the scheme of the EMMP.		
	AS was interested to find out more about how bats are moving and foraging across Hamilton, including social structures. Current understanding (from De Krout) was that males are pre-dominantly found in town.		
3	AECOM provided a briefing on the results of the **bat surveys** from Year 1. This included monitoring design and results from the ABM and thermal surveys.		
	ABM results were found to be variable across sites. 8b was the highest activity. Analysis found that there was enough consistency though between the control and impact sites to show differences after road was built.		
	AS thought that bats were wide spread across Hamilton but at low levels.		
	AS thought there may already be pest control being undertaken at sites 8A/8B.	Wildlands to confirm with HCC whether pest control at this location	
	AS thought 'safe roosting sites' in Hamilton were limited by the availability of vegetation. This may impact the numbers of bats in Hamilton.		
	The results from the Year 1 thermal surveys showed bats that were travelling along the river were travelling predominantly at canopy height. AECOM mentioned that further discussions were to be held in regards to mitigation for bridges and other aspects of the year survey findings like light. AS mentioned that he knew bats were also flying at the water height. KB said this was correct and that the thermal surveys found bats also flying at a low height.		
	AS was interested in how the impacts of bridges and roads and the subdivision were linked together for bats.		
	AS asked AECOM / Wildlands to start speaking to Colin O'Donnell directly (cc'ing AS in to correspondence) to get more specific feedback on bat surveys/results		
	FD asked if DoC had register of known roost sites in	DoC to inform	

No	Item	Action	Date
	Hamilton, which they didn't. They knew of some, which they could verbally tell us.	AECOM of any known roost sites.	
	AECOM was considering radio tracking surveys to further inform results, but a decision not made yet.		
	Hammond Park was discussed as being a site with a lot of bats. Could do with some further protecting to prevent light impacts.		
	AS thought that the bat population of Hamilton was being sustained by bats moving into the city from outside, rather than breeding in the city.		
	AS thought we may need to accept that bats inhabiting Hamilton may be pushed out due to Southern Links road and subdivision effects.		
	AS thought that bat tour guides were seeing less bats in Hammond Park over the last few years, even though the AECOM/Wildlands study highlighted it as a site with high activity.		
	AS mentioned that DoC weren't expecting more cost for bat mitigation, just more thought and improved cost/benefit. For example if bats are being pushed out of Hamilton city, this may need to be an accepted fact, and therefore invest money for bat mitigation elsewhere where it can work. Same with lizards?		
4	Bio-banking was discussed. DoC was interested in this idea.		
5	Peacockes structure plan was discussed and whether there were any ecological provisions. DoC wants the effects of the roads and sub-division not to be approached in isolation. DoC to speak to the right people at HCC about the sub-division and their concerns. Nathanael to help set this up. NS reinforces relationship between HCC as requiring authority (Southern Links delivery team) and HCC as territorial authority with regulatory functions.	Nathanael to set up meeting between relevant HCC units and DoC with AECOM ecologist in attendance.	tbc
6	AS indicated that DoC would take their understanding of no net loss from the Guidance on Good Practice Biodiversity Offsetting in New Zealand.		
7	**Bird monitoring** approach was presented by AECOM		
	AS didn't think HCC pest control in the city was being effective.		
	AS thought birds were more resilient to effects of roads and would be easier to achieve 'no net loss'. A lot of birds more mobile e.g. tui. Although species like Morepork less mobile =more effects.		
	No net loss could help to be achieved through better pest control. Also, the Peacockes subdivision will		

No	Item	Action	Date
	likely provide more habitat for birds.		
	Amount of pest control required to be effective was mentioned as 8-900ha by AS. This wasn't being done to this scale within designations conditions which only required key roost sites to be included.		
	DoC advised that in terms of AECOM EMMP survey/mitigation approach the risk needs to be weighted up e.g. birds vs. lizards/bats		
	AS indicated that although there were aspirations to release birds including bellbird in the city these should not influence the approach to mitigation for Southern Links		
	Mitigation for birds might be keeping canopy height up. AS mentioned conditions required this to go in early.		
9	**Reptile monitoring** approach was discussed.		
	AS said that for WEX – a high effort expended for not much benefit. Thought Councils had insisted on the lizard salvage. Wants a more practical approach. Just enough surveys only.	HCC to get external reviewers on board early to agree approach.	
	Iwi should be talked to about lizard management approach. AECOM will be having consultation meeting with the TWWG in October, so will discuss then. DoC also speaks to iwi, so perhaps need to have everyone talking in same room together (iwi, DoC, AECOM)	Workshop with DoC, iwi and AECOM to discuss lizards	Tbc
	AS said that copper skinks had been found on WEX mainly at house sites only, in wood piles.		
	AS advised that they agree with approach of not surveying certain areas, if a risk assessment had been done. Surveys should be enough just to inform quantity of loss of habitat.		
	On the Huntly section of WEX they looked for geckos in the Taupiri Reserve. Found 3 species. Was like a 'needle in a hay stack'.		
	AS said that Lynn Adams was the herpetologist at DoC that AECOM should be speaking directly with.		
	AS recommended that an approach for the lizard surveys might be that if animals are found in a survey (and are in road corridor area) that they are moved to a safe place like the Te Rapa reserve which was already set up as a lizard reserve. AECOM to consider.		
	AS suggested that a Wildlife Permit for lizards for the whole of the road corridor is obtained. Permit can last for up to 10 years.		
10	**Stream and fish assessments** were briefed by AECOM		

No	Item	Action	Date
	DoC mentioned that WRC had more experts in this area and are therefore better suited to ensuring appropriate approach. AECOM said they had already been speaking with WRC.		
11	**Restoration sites** were discussed.		
	Hard to find areas that addressed all the needs of biodiversity. Bats had complex habitat requirements, lizards need connectiveness, birds are more resilient.		
	Permeability of landscape is considered important for the survival of bats to DoC		
	Currently massive gaps in our knowledge around bats and maternity roosts.		
	Peacockes structure plan was discussed in regards to lighting for cycle/walk ways in the gullies. DoC indicated that they felt this conflicted with the gullies being used as bat mitigation.	AECOM to look at structure plan in regards to design of gullies for walkway/cycleways	
	Discussion around No net loss. DoC interpretation of this is that it means more than just the 11.46ha stipulated in the conditions.		
	DoC wanted the EMMP to 'get the best' out of the conditions and this might mean more than what is stipulated.		
	It was agreed that ongoing communication with DoC is key to the success of the EMMP – AS, Colin O'Donnell and Lynn Adams.	AECOM to set up ad hoc catch up with DoC if available. Wildlands/AECOM to contact Colin and Lynn directly.	

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Minutes of Meeting

Southern Links - EMMP (60526419)

Subject	Waikato Regional Council (WRC) and Maungakotukutuku Stream Care Group (MSCG) Ecological Management and Monitoring Plan (EMMP) workshop	Page	1
Venue	WRC office, Hamilton	Time	11-1pm
Participants	Fiona Davies (AECOM – EMMP) Nathanael Savage (Hamilton City Council) Dave Byers (Waikato Regional Council) Moniqua Nelson-Tunley (Waikato Regional Council) Matthew Vare (Waikato Regional Council) Andrea Julian (Waikato Regional Council) Grant Blackie (Waikato Regional Council/Mangakotukutuku Stream Care Group)		
Apologies	None		
File/Ref No.		Date	20-Sep-2017
Distribution	As above		

No	Item	Action	Date
1	An introduction to the Southern Links project was provided by Nathanael and then Fiona		
2	Fiona provided a briefing on the results of the **bat surveys** from Year 1. This included monitoring design and results from the ABM and thermal surveys.		
	Moniqua suggested that AECOM should touch base with Project Echo (Kessels) as they were undertaking bat surveys, including a habitat assessment.	AECOM aware of surveys, but will confirm they have all info from Kessels.	
	The Te Awa cycleway is planned to go through Hammond Park. This was discussed as this could cause light pollution and impact the bat population that uses that park.		
	Andrea was interested to know at what depth bats were seen flying at from the thermal surveys. Adjacent to the rivers edge or further into the middle of the river?	Fiona to find out and let WRC know.	
	Thought bat surveys should be focusing on finding any roost locations that were within the area of vegetation removal for Southern Links.		
3	**Bird monitoring** approach was presented by AECOM		

No	Item	Action	Date
	Andrea and Moniqua were concerned that the number of bird surveys was not large enough to show differences above natural variability. Were particularly worried that only 1x5minute bird count was been undertaken at each site per survey round.		
	Fiona explained that AECOM had undertaken a statistical analysis to ensure a large enough sample size. She would send this on for WRC review.	Fiona to send statistical information	
	Fiona confirmed that no morepork specific bird surveys were being undertaken.		
	Andrea mentioned that WRC is undertaking Bellbird surveys this coming summer. Should share data and site information.	WRC/AECOM to share bird survey information and sites	
4	**Reptile monitoring** approach was discussed.		
	A WRC reptile project is currently underway involving Landcare Research (John Innes). Project looking at wild reptiles, green spaces and pest control. Thought Maungakotuktuku might be part of it. Bird nesting success also included – locating and following fate of nests. Nicky Nelson doing PhD is involved also.	AECOM to contact John Innes to find out about project.	
	Urban biodiversity project being undertaken, suggested AECOM speak to Catherine Kirby at Waikato University.	AECOM to contact Catherine to find out about project.	
	Moniqua agreed with DoC's suggestion that lizards should be removed from area during lizard surveys, to an existing release site. Particularly important for threatened species, but not necessarily coppers. Potential release sites mentioned were Rotopiki, Ohaupo. Need to ensure that a release site couldn't be more than 20km away as per a Lizards permit.	AECOM to discuss this approach with Lynn Adams at DoC.	
5	**Stream and fish assessments** were briefed by AECOM		
	WRC thought that stream compensation sites needed to be planned for the same time as choosing restoration sites for the EMMP.		
6	**Restoration sites** were discussed.		
	Thought Peacockes Master Plan should be a consideration of the EMMP.		
	Was mentioned that Swamp maire at Hammond Park was threatened by myrtle rust. A treatment programme was underway that could do with more support. Could something like this form part of the EMMP compensation package?		
	WRC would prefer to see a coordinated set of actions presented within the EMMP.		
	WRC discussed a joint project being undertaken with Hamilton City. A biodiversity pilot project being led by Paula Rolfe at Hamilton City Council. Will be	AECOM to contact Paula Rolfe to find out about project.	

No	Item	Action	Date
	wrapping up in December 2017. Project looking to identify key sites in Hamilton where can restore certain habitat types.		
	WRC was interested to understand if HCC were prepared to buy private land for restoration sites.		
	WRC thought there may be opportunities to undertake compensation within existing HCC reserves in the Peacockes area.		
	Grant mentioned that MSCG main focus was around instream water quality. He felt that their work within the Maungakotuktuku was being hampered by the designation and the fact that HCC seemed to be banking land (for EMMP compensation) that MSCG wasn't allowed to utilise themselves.		
	MSCG has a 3 year forward programme for restoration, whilst HCC's is a lot longer. MSCG feeling a bit frustrated.		
	WRC thought this was a lost opportunity and that needed more effort to work with MSCG. Ideas put forward around HCC doing the maintenance if MSCG did the work.	AECOM to discuss way forward with HCC and MSCG.	
	The Winn property was discussed. This is a potential future advance restoration site within the Mangakotuktuku gully for HCC. Grant said that this site was too much for a volunteer group to take on, so wouldn't be able to get involved.		
	WRC suggested that we should speak to Bruce Clarkson at the Waikato University.	AECOM to make contact.	
	WRC mentioned that the Parks and Open spaces department at HCC was underfunded and looking to get re-energised in regards to gully restoration. Potential opportunity here for the EMMP compensation.		

Minutes

Minutes of a meeting of the

Southern Links – TWWG – Narratives Workshop for CLMP

Time and date:	9:00am, 12 October 2017
Venue:	Chartwell Room, Hamilton Gardens
In Attendance:	Raymond (Moko) Kumar – Waikato Tainui Wayne Harris – Ngati Wairere Maree Pene – Ngati Wairere Poto Davis - Ngati Koroki Kahukura Marina Hape – Ngati Mahanga Tahl Lawrence – Hamilton City Council (as Requiring Authority) Nathanael Savage - Hamilton City Council (as RA) Tony Denton - Hamilton City Council (as RA) Barry Dowsett – NZTA Andrew Styche – Department of Conservation (DOC) Alastair Black - Gray Matter for NZTA and HCC (as RA) Lyndsey Smith – AECOM for HCC (as RA) James Fuller – AECOM for NZTA Erik van der Wel – Bloxam Burnett and Oliver for HCC (as RA) Adrian Morton – Adrian Morton Landscape Architects for HCC (as RA) Hannah Mueller – Kessels for HCC (as RA) Jennifer Price – Kessels for HCC (as RA)
Apology:	Sonny Karena - Ngāti Haua, Harry Wilson – Ngati Koroki Kahukura

1) Opening 9am

1.1 Wayne performed Karakia to open hui.

Round table introductions

Noted new agenda item - project Dixon/Ohaupo intersection brought to the TWWG

Noted Agenda structured to allow EMMP related items to be discussed first as DOC has attended for these.

1.2 Previous TWWG meeting minutes had not been circulated as part of agenda. They have been circulated with these minutes.

2) Southern Links

2.1 Nathanael briefly introduced Lyndsey Smith from AECOM. AECOM are working on the wider Southern Links EMMP with Wildlands, Tonkin and Taylor and Ecogecko. Lyndsey is attending to provide an update on the first season of site investigations and ecological studies.

2.2 EMMP – Bats

Lyndsey explained the approach and initial observations from year 1 of bat monitoring. Discussed methodologies used (Acoustic Bat Monitoring and Thermal imaging) and results recorded. Spoke

to the first seasons work being informative and useful in considering potential gaps so that any necessary study design changes can be identified. Noted foraging vs roost sites locations and observations. Noted findings appear to indicate that bats are sensitive to light but not really sensitive to noise. Bats were recorded at all monitoring sites but in varying quantities. Interesting and informing subsequent study plans.

Discussion on bats

- Hannah asked about monitoring timing of thermal camera, was it consecutive days/nights? LS – sometimes yes, sometimes no depending on weather forecast etc.
- Moko asked whether much thought has gone into mitigation yet at this stage? LS – yes this has been kept front of mind in terms of options, and specifically around bridge structures where some of the immediate issues are already becoming evident (light spill etc). Moko asked whether different lights were available with less spill? LS – Yes and also light spill can be managed through placement and structural design. Yet to confirm how it will be managed but numerous ways to approach. Moko also asked whether height of structures is being considered in mitigation? LS – Yes height is being measured in bat activity, with most bat travel at canopy height or within the gully which will help inform structural designs and associated mitigation packages.
- Wayne asked how are the type of mitigation recommendations being used on other similar jobs? LS – We are still learning and a range of options are being used on similar job such as Waikato Expressway. Ongoing monitoring of effectiveness will help lift overall understanding and better inform recommendations. Andrew Styche noted other large jobs have specific conditions to do some things which may or may not be that effective, but still the use of these will lift the global knowledge. Wayne asked how confident are we that the mitigations will work and be successful? LS – the mitigation will be based on our knowledge of bat behaviour within the study area and knowledge gained during the implementation of mitigation on other roading projects in New Zealand and Internationally. Getting the mix right of short term efforts vs long term solutions is a key focus and the transition between the two. Past road construction projects have shown that through the implementation of carefully placed mitigation bat activity can be sustained post road construction.
- Poto noted that an urban bat population is important to Hamilton and is quite unique. Support is given to efforts to continue to improve global knowledge of bats and refine mitigations. Also suggest Council incorporate learnings into wider structure planning processes. Poto noted that based on observations, where there are no trees, there are no bats. LY – yes, trees are important for roosting and foraging. Noted some of the higher bat activity has been recorded at isolated stands of trees with no significant vegetation corridor providing connectivity and so understanding bat movements between wooded areas will be assessed further in next round of monitoring.
- Maree asked how many species are we dealing with in Hamilton? AS – just long tailed here. Short tail are found elsewhere but not in Hamilton or surrounds.
- Moko noted NZTA are using Bat Boxes (artificial roost sites), and asked how effective they are? LS – Still learning about them. They are considered to be a short to medium term option until other tree growth. Some older installations are beginning to yield information on how well they work and this will be incorporated into consideration of use and location. AS – noted they shouldn't be relied on for full mitigation as the options used in NZ are not a fantastic design. Moko asked AS what is a good design? AS - Preference to transition to large diameter trees as soon as practicable. Large diameter trees better than small diameter trees.
- Andrew asked whether a study design was available for the coming round of investigations? LS – essentially the same study design with consideration of radio tracking if viable.

- Moko asked whether Council/NZTA will be receiving specific recommendations in relation to bat studies, next steps, etc? LS – Yes interim recommendations due within next week or so. Moko suggested these will be important for TWWG to consider/review.
- Nathanael offered for anyone interested in attending future bat investigations are welcome and to contact him to see if what arrangements can be made with AECOM/Wildlands.

2.3 EMMP – Birds

Lyndsey spoke about bird study and methodology planned to be undertaken this summer (2017/18).

Discussion on birds

- Maree asked about the Toy site noted on the plans for restoration. NS – Council was presented with an opportunity to undertake some restoration here early and so have done that.
- Andrew asked why 5min bird counts? LS – this is consistent with the ongoing city studies and so would make information useful in a wider context. Also, this makes it easy and repeatable. Andrew noted most species quite hardy in the study area already and the species still here now will probably be ok with any mitigation proposed, and no species that have already left the area are realistically expected to return. Andrew noted a kill zone is often built at roads where tree height gets lower as planting gets closer to the road and as the bird cross the road from one verge to the other, they are at car level. Noted by project team, and will be considered but will need to be balanced with required clear zones etc for human safety as well.

2.4 EMMP - Reptiles

Lyndsey spoke about the upcoming reptile study and methodology planned to be undertaken this summer (2017/18). One initial season of monitoring proposed for reptiles. Mixed views on whether recommendations will be to spend time and money on finding and relocating gecko/lizards prior to works (other projects this has been really expensive with surprisingly low rates (11 found for $250-$300K), or something else.

Discussion on reptiles

- Andrew noted current practices are expensive and perhaps not best use of money. Is not fixed on doing it this way in the future if better bang for buck options exists, such as not finding and relocating a small number, but instead just focusing on enhancing habitat elsewhere only. Money may go much further. Andrew put it to TWWG to consider.
- TL noted studies and/or searching for lizards to relocate is not being proposed at Wairere/Cobham. Instead habitat enhancement will be undertaken (log piling etc) through the landscaping plan.
- Wayne outlined the significance of mokomoko in maori culture, and that mokomoko remained very important. Best practicable options should be explored. Wayne also agreed with Andrew that lower than anticipated success has been observed with capture and relocation, noting the TGH Ruakura site in the Silverdale area. Hopefully better options are found.

2.5 EMMP – Aquatic

Lyndsey spoke about the aquatic studies and inputs into the EMMP have been undertaken by consultants Tonkin and Taylor as part of the Mangakotukutuku integrated catchment management plan (ICMP) which is concurrently being developed and has a detailed focus on potential instream effects.

Discussion on aquatic

- Wayne noted that if the tuna (eels) pictured were captured as part of those studies, then the population looks good. Lyndsey wasn't able to confirm they were the actual photos from that site, but would seek clarification.
- Tahl noted that a suite of Waikato Regional Council consents are being prepared specifically relating to instream works in relation to Wairere Drive, and aquatic studies and considerations are included

2.6 EMMP – Habitat restoration sites

Lyndsey and Nathanael outlined that a preliminary register of potential restoration sites has been put together to capture any site observations to date of potential sites. Once all of the ecological studies have been completed, the list will be reconsidered and prioritised. Indicatively based on whether enhancement would result in a good outcome. An example was noted along the southern Waikato River bank opposite Hamilton Gardens where on face value there is an opportunity to enhance with native species, the area contains exotic vegetation but the existing environment has high ecological value and so the site would not rank highly as a restoration site, as it would not be best bang for buck compared with some other sites.

Overall restoration sites need to be no less than 11.46Ha (for the HCC component) plus an additional 7.17 ha for the NZTA components.

Discussion

- Moko noted restoration prioritisation should also consider overlays of future urban impacts when considering best bang for buck and that mitigation is considered holistically in alignment with other development. Moko outlined the TWWG was involved in Southern Links, but not the structure plan development.
- Archaeological and heritage sites should also be considered when selecting restoration sites.
- NS noted the difference between HCC as requiring authority (the team delivering Southern Links and associated projects), and Council as the territorial authority who processes the consents and is also responsible for structure planning matters. HCC (as RA) has approached HCC (as TA) seeking their engagement with DoC on effects arising from urbanisation.
- NS noted that the structure plan identifies intent for the gully network to be part of a future reserve network. Under the current District Plan a master plan resource consent is required for development.
- Barry Dowsett noted the ICMP and EMMP comes together to inform HIF bid and also HCC 2018-28 10 Year Plan. A view on HIF and the 10 Year Plan should be seen before the end of the year as something will need to be adopted for the purpose of 10 Year Plan consultation early next year.
- Poto noted the effects from urban development seems relatively significant. Also noted it would be good to have a cultural overlay over mitigation sites.

3) Wairere Drive/Cobham Drive

3.1 EMMP

Tahl introduced the item noting an EMMP is now not specifically required as a designation condition, due to the site having been shown to be of low importance relative to the wider Southern Links (refer minutes from 11 July 2017, and subsequent letter TWWG to Grant Eccles 31 July supporting). However, one has been completed anyway as it was necessary to support an application to DOC for a Wildlife Permit.

Hannah spoke to the development of the EMMP for Wairere Drive/Cobham Drive site. The project site has been assessed numerous times before as part of Hamilton Ring Road project. The ecological value of the existing stream and gully network is very poor with significant existing stream erosion. Recommendations as a result are to not progress any further studies, and instead focus entirely on enhancement and restoration works from the outset as part of the project. An exception is long tailed bats, and long fin tuna, which had been found although in low density. Specific pre-construction and construction processes will be employed in respect to these species.

The TWWG had previously supported the notion that regardless of the low value of the existing stream some mitigation and enhancement is proposed. This is now proposed as planting suitable for bat foraging and roosting, landscaping features suitable for lizard habitat, enhanced fish habitat in the areas where fish can currently get to (some existing features already preclude fish passage for example)

- ACTION - TWWG to review the draft EMMP and provide any feedback. This feedback will be considered as part of submitting the final EMMP to DOC as part of the Wildlife Permit. Feedback to be provided following TWWG meeting on 20/10/17.
- Andrew Styche left after this agenda item.

3.2 Concept Landscape Management Plan (CLMP)

Adrian presented the final draft (90% complete subject to final review by TWWG, Hamilton Gardens, and Parks and Open Space teams).

Adrian noted this now fully reflects the work done in two previous TWWG hui (refer minutes 10 August and 27 September 2017 TWWG hui) to develop narratives and provide input and direction into cultural aspects of concept landscaping an urban design.

- ACTION - TWWG to review the 90% draft for alignment with previous inputs, and provide any feedback to support the CLMP being submitted to Council to satisfy designation condition 6
- TWWG note that the detailed Landscape Management Plan (LMP) will be prepared over the coming months, and there will be further opportunity to see how the concept further develops, and to provide input.

3.3 Archaeological

Tahl provided a brief update to the TWWG for information in respect to archaeological. Heritage authority is being sought based on the Archaeological assessments provided to the TWWG (refer minutes 11 July 2017).

Tahl outlined that the next step for TWWG in this work stream will be to review a draft Heritage Archaeological Site Management Plan (HASMP) for the Wairere/Cobham site. This is being developed currently by Warren and incorporating TWWG feedback already received.

Wayne said that often when Archaeological assessments are undertaken, that "nothing significant" is found. Wayne noted this is often because the archaeologist may only refer to previous written works, and not give due consideration to cultural history but not looking in the right places or talking to the right people. Tahl noted this was a good point, and this had also been said in the Wairere/Cobham instance. Erik noted the assessment for this site had resulted in a new historical site (S14/470), but point still noted.

Wayne/Moko talked to previous CIA work developed as part of Te Parapara and consider the linkages to this work.

Tahl offered to forward assessment report to Wayne for background info and minutes of the hui (11 July 2017)

3.4 Waikato Regional Council Consents

Erik outlined the four resource consents required from WRC for the job. Erik was hoping to have had the reports finished and circulated prior to the hui, but they are still being written and will be circulated next week (week of the 16th Oct). These include AEE reports supporting each consent.

Erik noted the extent of works are well described in the concept landscape management plan, and include realigning the upper section of the Hungerford Gully, and a new culvert under Cobham Drive. The consents are for fairly straight forward works and will result in an enhancement and restoration of existing gully which is intended to offset the culverting of around 130m of existing open stream.

- ACTION – Erik to circulate consent reports
- ACTION – TWWG to review the consents and reports and provide any feedback to support the application to WRC.
- ACTION – BBO to include linkages in any resource consent applications to the recommendations from the Tangata Whenua Assessment of Effects Report (TWEAR)

4) Dixon Road / Ohaupo Road Intersection

Alastair Black introduced the project. The project is another piece being delivered under the Southern Links designation earlier than previously expected, and is needed in order to support the balance of development in Stage 1 Peacocke.

Alastair gave power point presentation including concept layouts, underpasses, extent of works. No actions at this stage, as this is only to introduce the project.

The next TWWG hui will receive reports for review and feedback, aiming to submit resource consents prior to Christmas. Alastair Black to consider programme and inform next agenda.

4.2 Archaeology

Alastair provided archaeological assessment and draft HASMP for the Dixon Ohaupo intersection developed by Sian (not present). Both reports are draft and seeking any feedback from TWWG perspective.

Discussion

Wayne outlined the importance of cultural consideration in these assessments as they often only reference written information from other reports, and so don't go back far enough. Wayne talked bout this being historic area where flower milling would have taken place and traded.

Moko said Wiremu Puke has had involvement previously and provided a CIA that should be referenced.

- ACTION – Alastair to get Sian a copy of CIA.

4.3 Concept Landscape Management Plan (CLMP)

Adrian provided overview of the direction that the CMP development will take, presenting high level plans. TWWG strongly endorsed Adrian's work to date and were happy that this will flow through into this site too.

The principles and narratives developed from the Wairere/Cobham TWWG work will be used and built upon to fill any gaps.

Cultural mapping exercise planned which will help further document themes and narratives across the wider Southern Links.

A future site visit will be planned to further inform CLMP and other project inputs, and invitation extended to TWWG to attend. Wayne signalled interest in attending. Alastair Black to note and arrange.

5) Other

5.1 Meridian 37 Access

Barry Dowsett and James Fuller spoke to the need for a new access to a site owned by Meridian 37 (developers) as a consequence to the Southern Links severing their existing access.

NZTA responsible to provide new access and to progress a change to their concept development plan.

Poto/Moko questioned how stormwater gets from new access to the Waikato River, talking to direct discharge being unacceptable. James outlined that the stormwater will still travel along the same existing drainage swales it does now, but the water will be captured and treated in a new wetland first.

Moko noted that Rights of First Refusal issues need to be quantified and addressed by NZTA early.

- ACTION – James to send information on this item to TWWG
- ACTION – TWWG to review and provide feedback to support consenting

5.2 Programme

Nathanael provided update. Nothing much to tell that has not already been covered. Detailed business case for parts of Southern Links are being progressed under the HIF with MBIE, and will be closely tied to the 10 Year Plan process.

5.3 Southern Links Archaeological

Nathanael outlined that the main archaeological assessment works for the wider Southern Links network has not been commissioned, but will need to be soon. Nathanael asked TWWG whether there was any interest in identifying potential archaeologists to consider as part of the procurement process as the investigation area is significant.

TWWG thanked Nathanael for the opportunity to have input into this, and were very keen to do so.

Nathanael also spoke to the project presenting opportunity for TWWG to be present in numerous aspects of the actual investigations, and again, welcomed expressions of interest in this respect.

Moko noted there will likely be interest.

6) Hui Closed

Wayne performed Karakia to close hui. Lunch from 1pm at Hamilton Gardens Cafe

The meeting was declared closed at 1pm.

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Minutes of Meeting

Southern Links - EMMP (60526419)

Subject	Riverlea Environment Society Inc (RESI) - Ecological Management and Monitoring Plan (EMMP) workshop	Page	1
Venue	AECOM office, Hamilton	Time	10.30am - 12pm
Participants	Fiona Davies (AECOM – EMMP) Grant Eccles (AECOM – Planning) Nathanael Savage (Hamilton City Council) Tahl Lawrence (Hamilton City Council) Allan Pearson (RESI) John Badham (RESI)		
Apologies	None		
File/Ref No.		Date	09-Nov-2017
Distribution	As above		

No	Item	Action	Date
1	**Introductions** were provided by all – HCC, AECOM and RESI.		
2	A **general discussion on Southern Links** was undertaken.		
3	AECOM provided a briefing on the results of the **bat surveys** from Year 1. This included monitoring design and results from the ABM and thermal surveys.		
4	ABM results were found to be variable across sites. 8b was the highest activity. Analysis found that there was enough consistency though between the control and impact sites to show differences after road was built.		
5	The results from the Year 1 thermal surveys showed bats that were travelling along the river were travelling predominantly at canopy height. AECOM mentioned that further discussions were to be held in regards to mitigation for bridges and other aspects of the year survey findings like light.		
6	AECOM was planning radio tracking surveys this summer (2018) to further inform results.		
7	**Bird monitoring** approach was presented by AECOM		
8	**Reptile monitoring** approach was discussed.		
9	**Stream and fish assessments** were briefed by AECOM		

No	Item	Action	Date
10	**Restoration sites** were discussed.		
11	**Further items** discussed in the workshop are provided below:		
12	Cycleway through Hammond Bush (Te Awa) was discussed. RESI don't want to see the boardwalk widened or realigned for the cycleway, especially through the old-growth forest.		
13	Dixon/Ohaupo roundabout was discussed and how it is being fast tracked and treated as separate project outside of Southern Links. HCC advised that RESI might need to be consulted with and asked for comment.	HCC to contact RESI to discuss.	
14	RESI has seen glow worms in Hammond Bush near Hudson Street, Hudson Gully stream footbridge.		
15	RESI has some colloquial reports of high bat activity below houses at the Balfour Street entrance to Hammond Park.		
16	The Cacophony project was discussed. The project is developing a way of listening to birds using old phones. Tim Hunt (12 Silva Crescent, Riverlea) is involved. Opportunity to calibrate with Southern Links bird surveys.	AECOM to investigate Cacophony project.	
17	Pest control around Hammond Park was discussed. Had been done for 4-5years by RESI. RESI thought they had noticed more birds in recent years as a result.		
18	Dr. Andrea Graves and other RESI members have been involved in pest control for RESI. A trap has been set up in every 5th house. Of the predator grid planned, 50% is being done.	Confirm this with John and Andrea	
19	RES thought that looking for reptiles was like looking for a needle in a haystack. Suggested talking to Landcare.	AECOM to talk to Landcare	Complete
20	The insect photographer Bryce McQuillan was mentioned by RESI. He was often in Hammond Bush taking photos at night. Did he have any insight into ecology?	AECOM to consider contacting Bryce McQuillan.	
21	RESI thought streams were an important part of the 'big picture' and important to RESI.		
22	RESI had noticed that water quality of streams (e.g. Mangaonua and Hudson St) in their areas was not good at times. Thought this may be due to upstream dairy farming and septic tanks.		
23	They thought the cycleway would open up the Mangaonua stream for focus on water quality.		
24	RESI were asked if they had any aspirations in terms of restoration sites. They would like to see a cross river park, including Hammond Park and the site opposite the river to be restored to match.		

No	Item	Action	Date
25	RESI requested a copy of the Southern links presentation. They said they were interested to hear the results of the further monitoring being undertaken this summer.	AECOM to send RESI copy of presentation.	Complete

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Minutes of Meeting

Southern Links

Subject	Consultation wtih Hamilton City Council - Resource Consent Planning Team	Page	1
Venue	Hamilton City Council Offices	Time	10.30-11.30
Participants	Peter Kirk (HCC as Territorial Authority – Planning Guidance Unit) Nathanael Savage (HCC as Requiring Authority – City Development) Lyndsey Smith (AECOM – Ecologist)		
Apologies	Fiona Davies (AECOM) Tony Denton (HCC as RA) Mark Roberts (HCC as TA)		
File/Ref No.	60526419	Date	01-Feb-2018
Distribution	As above		

No	Item	Action	Date
1	Introductions		
2	AECOM presented a summary of the ecological monitoring works that are currently being undertaken to meet the Southern Links designation conditions.		
3	Peter indicated that the programme looked comprehensive but that technical ecological components were beyond his expertise to review.		
4	AECOM indicated that the project had reached a stage where it would be useful to liaise with the ecologist who will undertake the specialist review of the Ecological Management and Monitoring Plan (EMMP). Nathanael indicated that on review of available specialists, that Boffa Miskell had to date not been involved with the Southern Links project and therefore, could be potentially be suitable in this role.	Nathanael to provide Peter with the contact details at Boffa Miskell. Peter to indicate to AECOM/HCC(RA) when the Southern Links project team can undertake consultation with the selected HCC(TA) technical specialist.	Complete To be confirmed
5	Peter requested a copy of the presentation. Nathanael provided file reference D-2582570.		

Minutes

Meeting name
Southern Links EMMP - DOC Consultation

Meeting date
29/11/18

Location
AECOM, Hamilton

Project number
60526419

Subject
DOC Consultation

Time
11.30am – 1.30pm

Project name
Southern Links

Prepared by
Fiona Davies

Attendees
Fiona Davies (AECOM), Lyndsey Smith (AECOM), Andrew Styche (DOC), Nathanael Savage (HCC), Alastair Black (Gray Matters), Virginia Comer (NZTA), Moira Pryde (DOC), Lynn Adams (DOC), Steve Bigwood (BBO)

Ref	Action	Responsible	Due by
01	Moira Pryde was keen to see a landscape based plan for managing bat impacts from Southern Links. DOC not currently engaged with HCC Structure Plan process being run by Paula Rolfe from HCC. Need to make a link with Paula, who is doing biodiversity framework with Matthew Vare (WRC). Gerry Kessels (Tonkin and Taylor) is developing offsetting guidelines as part of this. DOC feels it is essential to be involved in this process There is a wider conversation to be had around biodiversity and the Peacockes area, but today's consultation is just about the Southern Links transport network.		
02	Andrew Styche asked how it was possible to know from the current monitoring how proposed mitigation and monitoring for Southern Links wont be impacted by other development. How will we know the non-treatment sites from AECOM monitoring are true? [**Post meeting notes provided by Moira Pryde (01/02/19):** We won't that is why we need to be thinking at the landscape scale. There has been one colony identified and every development affecting bat habitat will affect the colony.]		
03	No net loss was discussed. Lyndsey Smith stated the designation conditions that had been developed to address 'no net loss' and with some specific details on individual species. Moira talked about her concerns with monitoring – not a Southern Links project specific issue. The proposed monitoring will not address wider questions being asked. Needs a long term plan. This links back to HCC's structure plan project. DOC considers that the Southern Links Project needs to be more collaborative with other development. **[Post meeting notes provided by Moira Pryde (01/02/19):** I would like to see how there can be no net loss.]		
04	The EMMP with Management Plans are due to be submitted to HCC (as Territorial Authority) for certification in March 2019. Global/Project wide wildlife permit for lizards, bats and birds for Southern Links will be sought from DOC at the same time (not separate permits for each project stage). Moira, Lynn Adams and Andrew supported this approach. There is a general preference by DOC that the wildlife permits would cover the entire project for the time required to complete the project and each stage of the project will not need to seek their own individual wildlife permits. **[Post meeting notes provided by Moira Pryde (01/02/19):** No more wildlife act permits can be given for bats in that further loss of habitat is highly likely to cause the extinction of Hamilton bats.]		
05	Survey results from 2017/18 were discussed, and comment sought.		

Ref	Action	Responsible	Due by
	[**Post meeting notes provided by Moira Pryde (01/02/19)**: The radiotracking study forms an excellent base of data to use so that we can collectively build up a bat friendly city.]		
06	DOC felt it was difficult to assess bats in isolation for just the Southern Links project. They feel every bush remnant in Hamilton south is important for the population. DOC felt that tree removal protocols could not be solely relied upon to protect population as they simply allow tree removal (rather than avoiding removal). [**Post meeting notes provided by Moira Pryde (01/02/19):** The radiotracking study has proved how important the whole landscape is for bats in Hamilton. This is an excellent opportunity for Hamilton to ensure that a population of bats survives in Hamilton.]		
07	Lyndsey queried what else DOC thought could be done in terms of monitoring? [**Post meeting notes provided by Moira Pryde (01/02/19)**: I don't think the question should be primarily about monitoring. There has not been enough consideration given to avoidance, maintenance and enhancement of bat habitat. The bats are not just using the gully systems but the whole landscape and this has been shown by the radiotracking study. The results of this study should now be considered by the group to decide how the development can be done with minimum disturbance to bats. The Structure plan should be being developed now or at least modified to incorporate the recent results. Monitoring can then be considered once it has been agreed on how the development is going to minimise the effect on bats. This needs to be statistically designed with a big enough sample size to provide meaningful data.] DOC/Moira wanted a long-term plan for bats/biodiversity that would include HCC, WRC etc and covered 25-50 years. Thought that everyone in Peacockes should be contributing towards it. ABM surveys could be done as a grid covering all of Peacockes, rather than the current approach of selected sites. ABMs indicate bat activity but not population number. Felt that thermal imaging surveys gave interesting but limited information, radiotracking gave useful information but tag/recapture is better. Costs to DOC of previous tag/recapture surveys in Southland was discussed: - $60,000 per year - 4-6 people (includes volunteers) - 6 weeks work - Don't track all night. Bats were tracked to the roost and tagged at emergence [**Post meeting notes provided by Moira Pryde (01/02/19)**: This estimate may be misleading - it must be taken in context. This is an estimate for a project where all the bat trapping gear has already been purchased, a vehicle is already available and staff are provided from another project. Starting up a bat project will be a lot more expensive as the harp traps and radiotracking gear will be required and specific staff will be required. If this is required then it should be costed out appropriately.]		
08	3 years surveys give extent of foraging range. Track back to roosts in regard to tag/recapture.		
09	DOC was asked what their ideal monitoring was? They thought maybe ABM surveys costs should be redistributed to tag/recapture. Maybe students could get involved and contribute towards science. [**Post meeting notes provided by Moira Pryde (01/02/19):** To clarify – we need to know the aim of the monitoring. The monitoring then needs to be statistically designed so that it will answer the question. It may involve ABMs or mark/recapture but depends on the questions and the timeline. This needs discussed further.]		
10	DOC isn't keen for any of the trees to come down to protect the bat population. Too many have already been lost in the landscape from other projects. They wished that the Southern		

Ref	Action	Responsible	Due by
	Links project had considered more avoidance.		
11	The bat roost potential survey undertaken for the Southern Links project was discussed. All trees within the designation were rated using high/medium/low potential criteria. The aim would be to keep as many high potential trees where ever possible. [**Post meeting notes provided by Moira Pryde (01/02/19):** We need to be clear about the word possible. This is not just a few trees out of thousands – this is getting down to the last trees that the bats have to use.		
12	Lynn asked whether the lizard compensation areas identified were considered good for copper skinks. Need to monitor the success of any lizard compensation site. Need to check whether the existing population has increased in size, rather than other Copper skinks moving into the new area. Mitigation techniques for lizards, including salvage and habitat enhancement is untested. Projects therefore need to ensure that any mitigation tools measures success. DOC would consider a well-designed research project as compensation. ACO's not telling if population is increasing or moving.		
13	Lynn interested in research projects: - Effectiveness of habitat enhancement to increase/maintain populations - Survival of salvaged lizards and the influence of enhancing (or establishing populations. - AECOM could reflect on how to achieve this		
14	Lyndsey explained that the current lizard compensation site has some population, but is next to an existing population. It is connected to existing habitat. On one side it is next to road, and is likely to be away from cats. Other areas were available but there were away from the Mangakotukutuku Gully.		
15	It was acknowledge that the effectiveness of habitat creation was a wider question on multiple projects. DOC thought that NZTA needed to start addressing some of these big research questions around roads. DOC would like to see some compensation for habitat loss, but also research to inform future project. Monitoring preferred over a longer period of time.		
16	Plague skinks are a problem around Hamilton. Don't want habitat to be created for plague skink instead as part of the Project. Maybe Hamilton should not be used as an area for compensation		
17	DOC thought Project was moving in the right direction for lizard mitigation. Compensation hasn't been offered. Criteria that have been used is good. Devil in the detail of the habitat design. TO be confident that it will be successful need to draw on herpetologists Lynn needs to understand the details of pest management (e.g. species targeted, methods used, frequency, duration). Mice need to be considered – 20m to 25m spaced stations (trap or poison bait) over managed area in perpetuity. Consider how the community can pick up once the project team has 'left'. It is understood that other areas like Whangaparaoa have had issues when pest control stops. Pest control will need to address both lizards and bats.		

Ref	Action	Responsible	Due by
18	No net loss – need to prove through monitoring – Lynn and Moira [**Post meeting notes provided by Moira Pryde (01/02/19):** I don't see how there can be no net loss.]		
19	Southern Links project – all bat roosts on public land will have pest control – bands and bait lines. For private property there can be a funding pot available for residents if needed.		
20	Lynn can help get monitoring advice if needed for lizards, but will be away most of January.		
21	DOC was asked if they had looked at the proposed compensation sites? [**Post meeting notes provided by Moira Pryde (01/02/19):** If the compensation sites are part of the structure plan then yes I have looked at them and they are not adequate]		
22	Limitations – Healy, Christian Camp, NZTA kahikateas. These are areas of private land so access or support is not guaranteed. [Post meeting notes provided by Moira Pryde (01/02/19): This is a key area as it is where the majority of maternity roosts are.]		
23	Moira is not familiar with Hamilton area, so finding it harder to visualise compensation maps and provide detailed comment. [**Post meeting notes provided by Moira Pryde (01/02/19):** The structure plan is not adequate for the survival of bats in Hamilton.] Hopovers not proven to work (Moira). Sometimes work if on existing flightpaths.		
24	Gully habitat is important, but so is the rest of the Peacocke area. Need to look at landscape scale compensation/restoration. DOC thinks the compensation areas are small in wider context of structure plan. Connectivity is key. Want to see restoration with a long term plan and pest control. [**Post meeting notes provided by Moira Pryde (01/02/19):** Again we need a Hamilton wide bat restoration plan that involves all developments so that we have any chance of saving the bats of Hamilton. DOC have been making this point since the beginning of the NZTA project and there has still been no action on it.]		
25	Moira was keen to see structural plan overlays on the map (not on the maps issued). Moira thinks there more that can be done. **[Post meeting notes provided by Moira Pryde (01/02/19):** The structural plan is a start but it has a long way to go. The radiotracking study has shown how important the current landscape is for the survival of bats. Any changes to the landscape need to be seriously considered as to how they will affect the connectivity of the bat landscape. These bats are only just surviving with the current landscape and incremental changes will lead to extinctions. The structure plan was not developed with the current knowledge of the radiotracking study. There needs to be a lot more work done on it with DOC involved.] Moira is keen to get Ian Davidson-Watts involved with the AECOM team, see what he thinks.		
26	DOC comments on bat monitoring: Acoustic monitoring – no, Thermal – ok, Radiotracking – good, Batbox monitoring – good, Pest monitoring – ok		
27	Moira would like to be taken over the compensation maps in more detail with Lyndsey. This would include a drive around the area. They will look to set meeting in person with Lyndsey and Moira and also talk to the Structure Plan team (Paula/Gerry).	Moira/Lyndsey	14/12/18 (complete)

Ref	Action	Responsible	Due by
	Want to understand the detail of connecting a fragmented landscape. Already lost so many trees.		
28	Lyndsey explained how the full picture needed to be seen to understand everything being done. DOC mentioned that they would find it difficult to issue a Wildlife Permit given the amount of trees already lost in the landscape and the fact they don't understand the bigger picture of things being done outside of Southern Links. They said there was nothing stopping the project putting an application in and it would be assessed and they would consider it. Recommended an urgent meeting between HCC and WRC.		
29	The Wildlife Act was mentioned and that every animal is protected. Recent court cases were mentioned by DOC indicating a desire for greater scrutiny. DOC indicated a concern that District and Regional Councils were not giving full effect to rules within their Plans. DOC thought there was good ministerial / government support to push back on projects if needed.		
30	Moira talked about coming up during the second week of December for a site visit around Hamilton with Lyndsey.	Moira/Lyndsey	14/12/18 (complete)
31	HCC as Requiring Authority would be applying for and holding the Wildlife Permit.		
32	Karen Saunders from HCC was mentioned and that she would talk to the director at DOC (David). Would be set up as a priority task.	Nathanael	14/12/18 (complete)
33	Bird monitoring was mentioned. Andrew said that John Innes had done some research about what sort of planting would encourage bird species. Andrew to send paper reference through to AECOM.	Andrew S	14/12/18 (complete)

Minutes

Minutes of a meeting of the

Southern Links TWWG

Time and date:	10:00am, 7 November 2018
Venue:	Chartwell Room, Hamilton Gardens
In Attendance:	Ikimoke Tamaki-Takarei – Waikato Tainui Harry Wilson – Ngaati Koroki Kahukura Te Rongapai Heto - Ngaati Hauaa Nathanael Savage - Hamilton City Council (as Requiring Authority) Tahl Lawrence - Hamilton City Council (Peacocke HIF) Alastair Black - Gray Matter for NZTA and HCC (as RA) Adrian Morton – Adrian Morton Landscape Architects for HCC (as RA) Jeremy Gibbons – BBO – Project Manager Steve Bigwood – BBO – Communications, engagement, and planning Lyndsey Smith – AECOM, ecologist
Apology:	Marina Hape – Ngaati Mahanga Poto Davis - Ngaati Koroki Kahukura Sonny Karena - Ngaati Haua Piripi Matika - Ngaati Wairere Simon Anderson – Ngaati Koroki Kahukura Barry Dowsett – NZTA Erik van der Wel – (BBO – Project Engineer) Tony Denton - Hamilton City Council (as RA) John Olliver (BBO – Engagement and Consultation)

1) Karakia and Welcome, 10am

Roundtable introductions and morning tea (provided following Item 4).

2) Actions from Previous Minutes

Action from Previous Minutes	Response
TWWG to provide feedback on Peacocke CLMP including any additional features or locations to be identified on the maps	No additional feedback provided, refer Item 3 below
Adrian to continue development of CLMP targeting final draft in mid/late-November	Ongoing, refer Item 3 below
Alastair to provide letter explaining scope of work for Dixon/ Ohaupo stormwater consultation	The letter is still being developed
BBO to advise TWWG of walkover dates so that Kaitiaki can be included in the walkovers for geotech and archaeological investigations	Initial walkover of bridge site planned for Wed 21 Nov. Dates for geotech and archaeological investigations to be confirmed for early 2019.

Action from Previous Minutes	Response
Letters of support to review and sign: • Dixon/Ohaupo – Concept Landscape Mgmt Plan • East-West Arterial (inc Dixon/Ohaupo) – Archaeological Assessment • Wairere/Cobham – Landscape Mgmt. plan • Peacocke Strategic Transport – Archaeological Investigations • Peacocke Strategic Transport – Geotechnical Investigations	All letters now part signed – waiting on • Ngaati Wairere • Ngaati Mahanga

3) Peacocke Concept Landscape Management Plan

No additional TWWG feedback provided. TWWG commended Adrian for reflecting previous feedback. TWWG confirmed that they are satisfied with the theme and concepts presented to date, subject to ongoing involvement during the detailed design.

Key areas of TWWG interest/input will include naming opportunities, Pa sites and any other waahi tapu, planting particularly areas where native is appropriate, and involvement in narratives.

ACTION: Adrian to complete development of CLMP. HCC to present final CLMP for TWWG endorsement at December TWWG meeting.

4) Southern Links Ecological Monitoring and Management Plan – Ecology Update

Lyndsey Smith (AECOM) presented a high level overview of bat, bird and reptile survey results from 2018.

- More bat radio tracking is planned for this summer, targeting Hammond Park
- Once reviewed, survey results will be shared with other parties, e.g. DOC to enhance wider understanding of bats
- Pest control is part of the proposed mitigation. This could include support for private landowners, pest control within gully network and at bat roost sites. Details to be confirmed.
- Initial bird survey completed to set baseline for future observations.
- DOC prefer habitat creation to extensive pre-construction reptile salvage. Protocols will developed as part of the Lizard Management Plan to minimise the risk to lizards including gradual removal of vegetation during clearing works to allow lizards to move away from the construction site, accidental discovery and relocation protocols.
- Two sites have been identified as part of mitigation works and were shown on the posters.
- Southern Links has a focus on mitigation of effects from development of the transport network, not the wider urban development. This is being addressed through other parts of HCC.
- Lyndsey presented the proposed mitigation plans identifying location for mitigation relating to the various species for discussion.
- TWWG support approaches taken, and particularly supported early planting where it made sense. Also encourage opportunities for sharing the new findings and important info with the public – bats and lizards etc are not very obvious and so people do not know much about them.

ACTION: AECOM to present completed EMMP including bat and lizard management plans to the TWWG in early 2019.

5) Dixon Road/ Ohaupo Road Roundabout

AB confirmed the scope of works for the Dixon/Ohaupo stormwater culvert and outlet as:

- New culvert to be installed under Dixon Rd, discharging from the new stormwater treatment wetland into the existing gully
- Construct a new outlet wingwall structure which will be a combined outlet including the new culvert as well as existing outlets. Existing outlet is near end of life and so this work will include improvements to erosion protection and replanting as currently this area is not in great condition.
- A new stormwater discharge consent will be required from WRC and TWWG support will eventually be sought for that.
- Stormwater quality treatment is included within the proposed wetland and is being coordinated with adjacent developers to seek best practicable treatment solution found.

ACTION: Alastair to provide letter explaining scope of work for Dixon/ Ohaupo stormwater consultation

ACTION: TWWG to review and sign letters for Dixon/ Ohaupo CLMP and archaeological matters

6) Peacocke Strategic Transport Project

a. Geotech investigations and Archaeology Authority

BBO are preparing resource consent and archaeological authority applications for site investigations. These items are critical path and will be lodged as soon as possible. The actual investigations will likely occur in January/ February 2019.

This work will require Kaitiaki and presents opportunities for education and up-skilling of tribal members.

BBO provided draft letters for review and signatures, and are now partly signed. TWWG confirmed verbal support for geotech and archaeological investigations and the relevant consent and archaeological authorities.

ACTION: TWWG to review and sign letters for geotechnical and archaeological investigations

ACTION: BBO/HCC to provide times and dates for karakia and kaitiaki well ahead of time.

b. Overall Programme

Steve provided an overview of timing of key TWWG inputs, including:

- Letter of support for geotechnical investigations and archaeological authority
- Attendance at site walkover in November 2018
- Karakia and Kaitiaki for geotechnical investigation (Jan/Feb 2019)
- Invitation to attend open days in Feb 2019
- Involvement in optioneering and evaluation processes (more detail in following sections)

The detailed programme for the various project stages is attached to these minutes.

TWWG thought the programme was helpful and would enable discussion with the right people within the Tribe who might be interested in working with the project.

ACTION: TWWG to consider kaitiaki resources to align with the programme (at HCC cost)

c. Bridge over Waikato River – Option development and evaluation process

Jeremy provided an overview of the optioneering and evaluation process for the Waikato River bridge. A copy of the presentation is attached to these minutes.

TWWG input will be requested on scoring on Cultural value as part of Multi-Criteria Analysis (MCA). An initial “non-negotiables” type sieve is a first step and would include factors such as no piers in the river

as a direct "fail". Cultural aspects such as access to the River, stories and narrativefor inclusion in design theme, etc could all be points to consider as part of evaluation.

TWWG initially support a standalone TWWG session on the bridge option development, as well as participating in the wider stakeholder group too. The project team support this holistic approach.

ACTION: TWWG to confirm their preferred method for involvement. Options include as a separate stakeholder group, as part of a wider stakeholder group, combination of both?

d. Bridge over Waikato River – Key Design Constraints

Jeremy outlined that as design for the bridge begins, numerous design parameters need to be confirmed. Steve explained that the designation included consents for the bridges which provides an envelope for the bridge structure. Other consents relating to stormwater discharge, along with all of the earthworks needed to build the bridge etc. are still required.

During consenting for the bridge, HCC and NZTA committed to providing minimum height between bridge deck and flood level and no piers in the waterway.

Steve outlined that normally the 'waterway' is generally defined as the 'low winter flow' level. Some specific measurements will be needed to show this point on site, but is generally the point at which vegetation begins to grow on the river banks. In flood events the water could rise above this level but ordinarily it is dry. How the pier is constructed will need to consider a range of construction and maintenance access needs and will be further discussed with the TWWG.

BBO will set out some levels to look at during site visit so that discussion can be had and guidance given by the TWWG on location of piers relative to the waterway. This will be discussed further as part of a site walkover (refer Item 6e below).

ACTION: BBO to set out key points on site for discussion on 21st November.

e. Site Walkover

Site walk over proposed for Wednesday 21 November at 10am with TWWG and project team, including archaeologists. BBO will peg out water levels to illustrate potential pier locations for discussion.

BBO will provide more details (time, location, confirmation for PPE, etc.). BBO can provide PPE if required.

ACTION: BBO to advise TWWG of details for walkover on Wednesday 21 November.

ACTION: TWWG to consider any wider people who might be part of kaitiaki work and who might benefit from attending site visit.

7) Wairere Drive/ Cobham Drive Interchange

TWWG signatures (Ngati Wairere and Ngati Mahanga) still required on letter for Landscape Management Plan.

TWWG confirmed a karakia should be carried out with the new contractors at the Wairere/Cobham site, separate to any sod turning.

The contract has not yet been awarded, but physical works are expected to commence within a month and dates will be provided.

ACTION: Pune/ Erik to advise TWWG of contractor start date so that karakia (dawn) can be arranged and to invite TWWG members to sod turning.

8) Hui Closed

Next TWWG hui, 10am, 5 December 2018 at Hamilton Gardens (Huddleston Room).

The meeting was declared closed at 12.35pm.

Minutes

Meeting name Southern Links EMMP Consultation – Riverlea Environment Society Inc (RESI) and Mangakotukutuku Streamcare Group (MSCG)	**Subject** RESI and MSCG	**Attendees** Kevin Collier (MSCG), Grant Blackie (MSCG), Nathanael Savage (HCC as RA), Alastair Black (Gray Matter), Andrea Graves (RESI), John Badham (RESI), Alan Pearson (RESI)
Meeting date 27/11/18	**Time** 10.00	
Location AECOM, Hamilton	**Project name** Southern Links	
Project number 60526419	**Prepared by** Fiona Davies	

Ref	Action	Responsible	Due by
01	Nathanael gave an update on the Southern Links programme in light of Council's 1018-28 10-Year Plan and Housing Infrastructure Fund decisions. Development of Peacockes is being advanced. This includes the construction of the Waikato River bridge, extension of the Ring Road into Peacockes and the East-West Minor Arterial. The North to South major arterial is not being constructed within the 10 year period, some land purchase for the North/South is provided for.		
02	The consultation today only relates to the road and not other development within Peacockes (i.e. urbanisation). Waiere/Cobham project is excluded from the EMMP process and also not covered by consultation today.		
03	MSCG currently has 10 projects going on within the wider catchment.		
04	RESI said they were interested in Southern Links due to the effects of the wider Peacockes development on Hammond Bush along with ensuring protection of flora and fauna in and around Hamilton and 'the big picture' of things. They were also involved in Pest Free Riverlea. Nathanael reinforced that the Southern Links team works on behalf of HCC as the Requiring Authority, and needs to appropriately manage its interactions with other parts of Council responsible for other functions and processes (e.g. Amberfield consenting)		
05	The outcomes of today's consultation were discussed. Minutes would be taken and actions registered. Where appropriate these would be expressed in the EMMP. Those not included would be recorded, with reasons why they were not incorporated and would be submitted to the Territorial Authority with the EMMP.	Fiona	21/01/19
	Fiona to send maps, a memo summarising ecology survey results, along with today's powerpoint presentation, to consultees for further review after the meeting today. Noted that this would have been useful to send to consultees prior to the meeting.	Fiona	21/01/19
	Any further comments from the consultees would be sent to Fiona within 2 weeks of issuing minutes	RESI/MSCG	04/02/19
06	Fiona provided a briefing on the results of the ecological monitoring from the past 2 years that would inform the EMMP. This covered bats, birds and lizards. The proposed habitat compensation plans and other mitigation relating to light and pest control were also discussed		
07	Andrea asked how often do roosts move (this was in relation to the 28 roosts identified during the 2018 radiotracking surveys)? Thought these may change. Wondered whether we would be		

Ref	Action	Responsible	Due by
	monitoring their use this summer? Fiona mentioned that bats may use the same roosts year to year, but that different roosts would be used across the landscape during different times of the year. No further surveys of the identified roosts are planned at this stage. Once identified as roost trees they will remain 'roosts' for their life. Removal will require a permit from DoC under the Wildlife Act. Under the designation, pest control will be undertaken at all of the identified roost sites (that we have access to).		
08	Lighting was discussed. Kevin said that Cobham Bride (due to lighting) was thought to be a barrier to bat movement along with Waikato River. Although the negative effects of lights on NZ bats is not yet proven, he thought a precautionary approach should be taken to the potential effects of lighting on bats from the project. The issue of car (head) lights was raised. All sensitive ecological areas (e.g. Narrows and other known roost sites) will be shielded from road and car light through physical and/or natural barriers. Fiona noted that the science gathered as part of Southern Links monitoring was not definitive with respect to lighting. Nathanael noted that the EMMP recommendations with respect to lighting were taking a precautionary approach (i.e. directed / shielded warm LED lights, avoiding aesthetic lighting).		
09	The question was asked as to what would be done if post construction monitoring showed that mitigation/compensation had not been successful. The designation conditions require trigger levels to be set and associated management strategies. This will be detailed within the EMMP. These trigger levels will be tied to bat monitoring results. What, if any, feasible options in response to an effect cannot be determined. Also complicated by other non-Southern Links related potential effects (e.g. urbanisation)		
10	The erection of bat boxes as part of project mitigation was discussed. Proposed that additional bat boxes will be used as part of the short-medium term mitigation package. Bat boxes will be monitored for use (1, 3 and 5 years post construction). If boxes are not being used then consideration will be given to relocating them.		
11	MSCG requested a copy of the freshwater report produced by T&T. Nathanael will check if it is finalised and then send through.	NS	Complete
12	Grant mentioned that regional consents would have ecological requirements, particularly in regards to stream works. This is not part of the EMMP and would follow with the relevant SW regional consents. All the aquatic data being gathered to date has been designed to be suitable for consenting purposes.		
13	It was queried how the project would deal with others doing work in the Peacockes area like Amberfield. Southern Links project is sharing information with Amberfields (and any other developments) and vice versa. A briefing with Amberfields ecologists is set up for 29/11/18. The intention is to provide them opportunity to complement what Southern Links is doing.		
14	The Structure Plan reserves shown on the Southern Links Draft Compensation Plans were discussed. Andrea thought it was very important that these reserves are developed properly (native plantings etc) as the area is developed. The example of Amberfields was discussed and the fact that the 100m wide reserve shown on the Structure Plan adjacent to the Waikato River is applying to be reduced to 7m width. There was a lot of concern from RESI in regards to this issue. The fact that Amberfields is being delayed due to ecology and caucusing of experts was mentioned. RESI has been involved with this.		
15	RESI and MSCG wanted HCC to think about how all the different developments were 'fitting together' and address thing from a city wide perspective.		

Ref	Action	Responsible	Due by
	Kevin commented that the Southern Links development needs to be assessed in the context of what the wider area will be like in 20 or so years time with extensive urbanisation. The river may be the only dark corridor remaining for bat movement, underscoring the importance of getting the new bridge design right to allow unimpeded bat movement along the river. Nathanael explained the role of the Southern Links team (Representing Requiring Authority) and HCC as the regulatory authority - The City Growth Group (Planning Guidance and City Planning) manage the consenting and District Plan related matters.		
16	The issues with the Shaw property were discussed (unconsented ponds etc). Grant wondered whether these should be sorted out as part of the project. Nathanael acknowledged the issue but that it was not within the direct mandate of the Southern Links work to resolve.		
17	Kevin asked about how many culverts were being installed. Some large box culverts and then the rest bridges. Kevin thought that it would be a key management strategy of the catchment to manage stream crossings during the detailed design stage.		
18	There will be a trade-off between a precautionary approach and being pragmatic in order to deliver the project. Especially where science is not yet giving answers.		
19	Grant queried whether the EMMP would be peer reviewed. HCC as Territorial Authority will be using consultant ecologists to certify the EMMP. Who this is, is not confirmed yet.		
20	RESI is currently using Rebecca Sturnham as their consultant ecologist.		
21	Concerns were raised in regards to bridge height on the movement of bats along the river. Thermal imaging surveys have shown that the majority of bats are travelling at canopy height where new bridges will be located. The new bridges and associated landscaping/hopovers will be designed to ensure bats pushed up and over bridges at canopy height or under the bridge so that the potential for vehicle strike is mitigated. Thermal imaging surveys will be undertaken post construction to confirm this has occurred.		

Minutes

Meeting name Southern Links EMMP – Waikato Regional Council (WRC) Consultation	**Project name** Southern Links	**Attendees** Fiona Davies (AECOM), Lyndsey Smith (AECOM), Nathanael Savage (HCC), Alastair Black (Gray Matters), Virginia Comer (NZTA), Andy Thomas (WRC), Andrea Julian (WRC), Moniqua Nelson-Tunley (WRC)	**Circulation list** Same as attendees list.	**Apologies** Matthew Vare (WRC)
Subject EMMP Consultation	**Project number**			
Meeting date 7th February 2019	**AECOM project number** 60526419			
Time 10am – 1pm	**Additional information**			
Venue AECOM, Hamilton	**Prepared by** Fiona Davies			

Ref	Action	Responsible	Due by	Initial
01	Nathanael Savage gave an update on the status of the Southern Links Project - programme, when lodging EMMP, surveys completed, Amberfields development etc			
02	Lyndsey Smith presented ecological survey data from 2018. This covered radiotracking, thermal imaging and ABM bat surveys.			
03	Hammond Park was discussed in regards females/maternity roosts. The surveys had not found any.			
04	High activity site in Waipa DC was mentioned that was private property being developed.			
05	Moniqua asked if the Project had been liaising with Peacockes developers. They had collected ABM data over the summer. AECOM to check that we had received this information.	Lyndsey Smith	8 March 2019	
06	Bird surveys were discussed. AECOM confirmed that a statistical analysis had confirmed that the number of sites would provide statistically viable results. It was not a geographical study, but confirming presence of species within the locality of the Project.			
07	Bat mitigation was discussed. WRC thought a key issue was how bats would move over the new roads.			
08	WRC had heard that the convention centre at Narrows was found to have a bat roost. Lyndsey confirmed that this was not in fact a bat roost.			
09	Lighting was discussed and that the results from the surveys were inconclusive. A precautionary approach to lighting impacts from the Project was therefore being taken.			
10	Bat crossing points were discussed. Heights of vegetation were important to push bats up and over. Fast growing species or artificial structures could be used. WRC asked	Nathanael Savage	8 March 2019	

Ref	Action	Responsible	Due by	Initial
	whether HCC was implementing a policy of removing taller trees along road sides to reduce health and safety risks. Nathanael will confirm with the Parks and Spaces team at HCC.			
11	WRC wondered whether lower street light poles could be used to lower the focus of lights at hopovers. Were their international design examples ? Lyndsey to investigate this idea.	Lyndsey Smith	Complete – Low street light poles have been included in EMMP.	
12	WRC asked about land bridges and whether these had been considered. It was concluded that were too expensive for the benefit provided and that the landform didn't lend itself.			
13	WRC recommended that the success of hopovers should be monitored once these were installed first for the east to west link. This is included in the EMMP.			
14	Lighting was discussed further. The Project would be implementing warm LEDs, shielding, reduced lighting pole heights (to be considered), no aesthetic lighting.			
15	New bridges would be monitored. The thermal data was discussed and the difficulty of interpreting it. Was Cobham Bridge a barrier? No one knows the answer yet. WRC was concerned about the unknown around lighting.			
16	WRC mentioned that wetlands near roads (to benefit bats) should also think about how lighting might effect birds.			
17	Three bats boxes would be used on the Project. These were discussed in terms of their characteristics and what maternity roost requirements would be. WRC asked if a trial was being done? Monitoring of use would be done as part of long term monitoring.			
18	Pest control was discussed. Some roosts were on private land so out of Project control, but efforts would be made to provide funding to these people.			
19	Pest control would be focussed around maternity roosts.			
20	Funding to private land owners could may be be administered by Project Echo or maybe owned by HCC urbanisation department e.g Paula Rolfe. Thought this was low hanging fruit but still a lot of time and effort. Longevity of this was important.			
21	Matthew Vares feedback was provided as a printed email. This related to how the results of the Projects ecological surveys would be incorporated into WRC processes such as explicit fauna mapping. A tree register in the district plan? Need to tie in with Shona Meyers work (AECOM is booked to meet Shona in March 2019)			
22	The need for a cross boundary approach with Waipa DC was discussed.			
23	The "dots" from the radiotracking survey data was			

Ref	Action	Responsible	Due by	Initial
	discussed. Can these be used for futher data analysis?			
24	Lizards were discussed. Copper skink thought to be a forest species. Would be good to add rotting logs to existing forested areas. Needed habitat complexity and humidity as they are humidity loving species. Native toi toi works well for them. Also other low growing and complex vegetation. Need to choose areas without plague skinks and not overlap with moist areas.			
25	Nathanael to send Shona Meyers the lizards and bird survey data.	Nathanael Savage	8 March 2019	

Appendix F

Restoration and Mitigation Workshops

Appendix F Restoration and Mitigation Workshops

To identify where Designation Restoration Sites should be located a series of workshops were held to draw on specialist knowledge. Table 37 lists the nature of the workshops and the list of attendees.

Table 37 Restoration and mitigation workshops.

Date of workshop	Purpose	Attendees - specialism
01 June 2017.	First review of potential sites, including the development of a framework that would identify priority areas.	Fiona Davies (AECOM) – EMMP Project Manager Grant Eccles (AECOM) – Planner Ange Chaffe (AECOM) – Botanical surveyor Tim Martin & Kerry Borkin (Wildlands) – Bat Ecologist Dean Miller (T&T) – Aquatic Ecologist Emily Reeves & Damian Young (Morphum) - hydrologists Nathanael Savage (HCC) – Southern Links Communication, Consultation and Property Liaison Manager Tony Denton (HCC) - Infrastructure Planning Team Leader Matthew Lillis (HCC) – Project Manager Mangakotukutuku Integrated Catchment Management Plan (ICMP) Barry Dowsett (Transport Agency) – Principal Advisor
16 October 2017.	EMMP mitigation workshop.	Fiona Davies (AECOM) – EMMP Project Manager Lyndsey Smith (AECOM) – EMMP Author Nathanael Savage (HCC) – Southern Links Communication, Consultation and Property Liaison Manager Tony Denton (HCC) - Infrastructure Planning Team Leader Barry Dowsett (Transport Agency) – Principal Advisor Alastair Black (Gray Matter) – Project Manager Kerry Borkin (Wildlands) – Bat Ecologist
22 December 2017.	Freshwater workshop.	Lyndsey Smith (AECOM) – EMMP Author Dean Miller (T&T) – Aquatic Ecologists Nathanael Savage (HCC) – Southern Links Communication, Consultation and Property Liaison Manager Tony Denton (HCC) – Infrastructure Planning Team Leader Alastair Black (Gray Matter) – Project Manager Chris Hardy (AECOM) – Associate Director – Civil Infrastructure
07 May 2018.	Bat mitigation workshop.	Fiona Davies (AECOM) – EMMP Project Manager Lyndsey Smith (AECOM) – EMMP Author Kerry Borkin (Wildlands) – Bat Ecologist Tim Martin (Wildlands) - Ecologist Des Smith (Wildlands) – Ecologist and Pest Control
17 May 2018.	Bat mitigation workshop.	Fiona Davies (AECOM) – EMMP Project Manager Lyndsey Smith (AECOM) – EMMP Author Nathanael Savage (HCC) – Southern Links Communication, Consultation and Property Liaison Manager Tony Denton (HCC) - Transport Barry Dowsett (Transport Agency) – Principal Advisor Alastair Black (Gray Matter) – Project Manager
18 September 2018.	Mitigation workshop.	Fiona Davies (AECOM) – EMMP Project Manager Lyndsey Smith (AECOM) – EMMP Author Nathanael Savage (HCC) – Southern Links Communication, Consultation and Property Liaison Manager Tony Denton (HCC) - Infrastructure Planning Team Leader Barry Dowsett (Transport Agency) – Principal Advisor Alastair Black (Gray Matter) – Project Manager Adrian Morton (Adrian Morton Landscape) – Project Landscape Architect

Appendix G

Hop-over and Underpass Design

Appendix G Hop-over and Underpass Design

Key points for hop-over and underpass design:

- They will typically be located[19] on an existing bat flight path identified during the bat radio tracking to increase the likelihood of use e.g. Mangakotukutuku Gully.
- They will be well connected to the surrounding landscape by existing vegetation and any planned restoration and / or landscape vegetation.
- The vegetation height will encourage bats to travel beneath bridges or at a height greater than vehicles travelling along the road, depending on whether the Project is developing a hop-over or underpass.
- The planting and at these locations will be made as wide as practical to ensure that the flight line is captured by the hop-over.
- At the detailed design stage of each phase of the Project the Project Ecologist will work with the Project Engineers and the Project Landscape Architect to further develop the design to support canopy closure over bridges where a hop-over is being created. Considerations will include;
  - construction that retains mature trees immediately adjacent to the bridge within the gully;
  - if there are two bridges with a gap between, trees should be allowed to grow between the bridges;
  - plantings (i.e. trees) on the bridge or vegetated structures shielding the edge of the bridge.
  - The viability of these options will be explored at the detailed design phase.
- Road median plantings at hop-overs will be considered at crossing points where the road is four lanes or more. The median plantings will encourage canopy closure that would not be possible by planting on either side of the road (refer to Figure 52). The tree species used within the median will be selected by the Project Landscape Architect from Hamilton City Councils Approved Street Tree Species List (HCC, 2013), taking into consideration Health and Safety. The trees will be selected so that they are fast growing, can tolerate disturbance by vehicles, can be 'limbed up' and require limited maintenance. In addition, the specimens that will be planted will be large (45 L, approx. 2 m high) to encourage quick establishment. To ensure that these trees thrive they will be provided with sufficient room for their roots, so that trees will reach maturity. The purpose of these trees is not to provide roosting opportunities but rather to encourage road crossings at height.
- Where practical planting of the hop-overs should occur in advance of road construction.
- Lighting columns at hop-overs will be reduced in height so that they are below mature tree canopy height and therefore bats are crossing above the columns (refer to Section 6.5.2).
- The development of a bat hop-over or underpass will depend on the current or future tree canopy height in relation to bridges and/or the road. For example, the northern end of Waikato River Bridge deck to be delivered by HCC will be below the existing tree canopy height as the bridge is located within a cutting. Therefore, through additional tree plantings bats will be encouraged to travel over the bridge (hop-over). The bridge deck at the southern end of Waikato River Bridge will be above the existing canopy height so through additional tree plantings bats will be encouraged to travel under the bridge. It is considered that the manipulation of vegetation in this manner in conjunction with adjacent high-quality bat foraging habitat will have the best results when influencing the movement of bats.
- In areas where bat hop-overs are developed adjacent to the existing and proposed Waikato River bridges the bridge designers shall also consider if there are opportunities to protect bats from vehicle strike through the installation of design features to the bridge. In their simplest form these features could be described as the placement of sides or barriers on the bridge structure,

[19] An exception will be where the Project is looking to create additional crossing points to complement the known linkages.

particularly adjacent to the river banks where bats are most likely to be travelling. The appearance of these structures is not important from the bat's perspective, their role is to lift the height at which bats are travelling. If these measures were to be implemented, they need to be implemented in connection with the vegetated hop-over.

At the detailed design stage the Project Ecologist will work with the designers to identify the best solution for each hop-over. It is known that bats are crossing roads that comprise two lanes around Hamilton when the canopy vegetation is permitted to close over the road. However, as these structures become wider then additional mitigation will be required to connect the tree canopy e.g. planting in central median. The road layout presented below may change in response to Project requirements at the detailed design stage and the mitigation proposed also needs to respond to these changes.

Figure 51 Maintenance of existing vegetation to abut bridge, with plantings to the side of the bridge between the cycle lanes and road to reduce the distance between the tree canopy (e.g. east – west link Mangakotukutuku Gully bridge).

Figure 52 Tree planting on the bridge in co-ordination with the retention of existing vegetation to reduce the distance between the tree canopy (e.g. east – west link Mangakotukutuku Gully bridge).

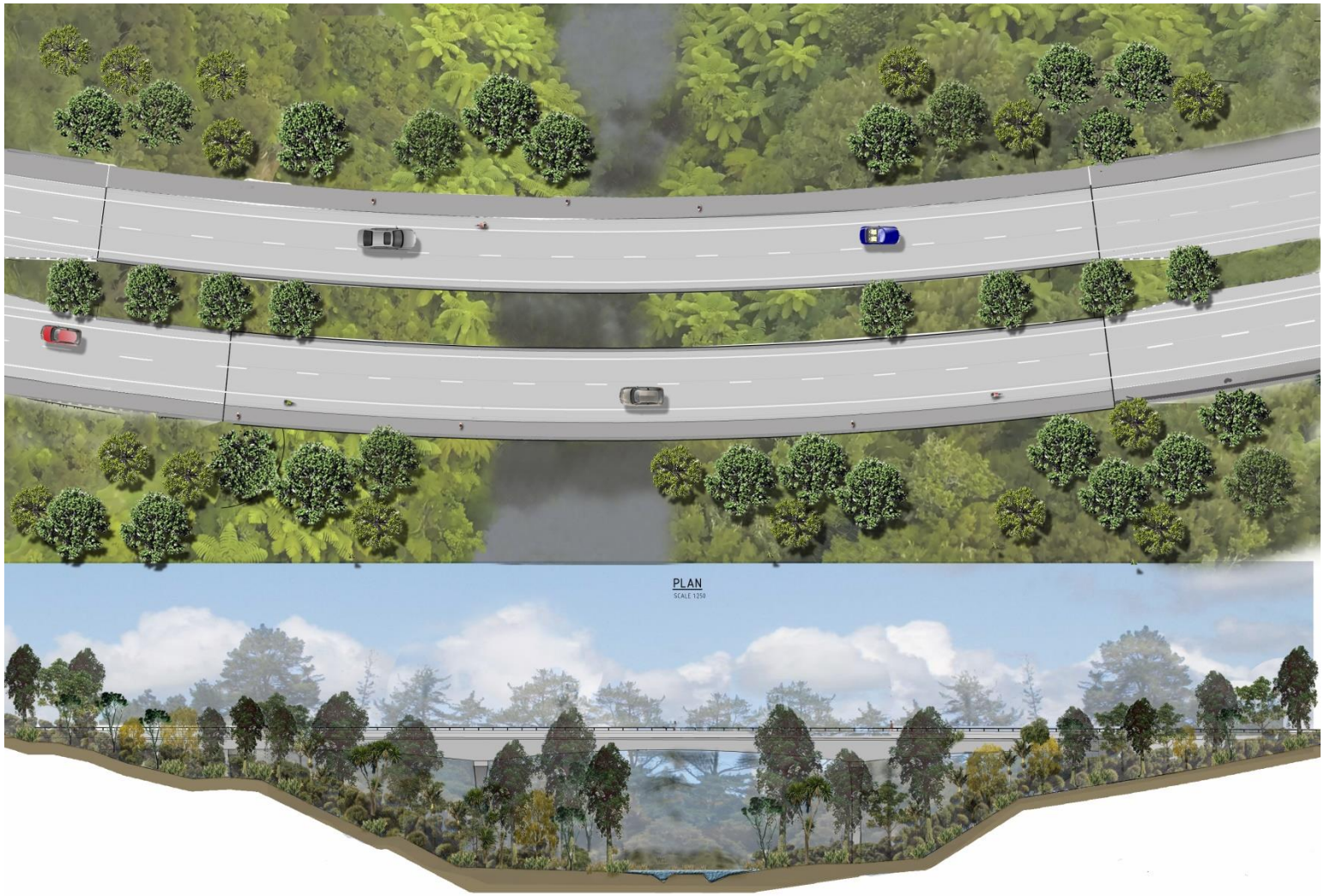


Figure 53 Tree planting between two bridges separate road bridges in co-ordination with the retention of existing vegetation to reduce the distance between the tree canopy (e.g. bridge at the confluence of the Mangakotukutuku and the Waikato River).

Appendix H

Guidance on Bat Box Positioning

Appendix H Guidance on Bat Box Positioning

The bat boxes will be positioned to provide a range of environmental conditions within the bat boxes. Guidelines in relation to the siting of the boxes are provided below.

- Boxes to be erected on living trees or poles singularly or in groups of two.
- The boxes will be orientated so that the entrance is facing north-east to north-west. This will provide a range of thermal conditions during the bat active period when bats are looking for warm stable temperatures for breeding.
- The boxes will be orientated so that there are no branches directly beneath the opening of the box to ensure that there are clear flight lines in and out of the box.
- The boxes should be at least 5 m above the ground. The Projects bat boxes will be installed so that they can be monitored by an ecologist. If an internal inspection is required to determine occupancy due to the box design, then bat boxes will be installed so that they can be reached on a standard surveyors ladder e.g. at 5 m.
- The boxes should be positioned so that they are either on a marginal feature e.g. footpath, forest edge or located in an area where that bats have space to fly within the vicinity of the bat roost.
- The bat boxes will be installed with a predator band above and below the box. The box will need to be positioned to ensure that there are no branches between the two bands that would allow predators access from a neighbouring tree.
- The bat boxes should be constructed from timber that has not been treated with stain or preservative or the boxes should be comprised of woodcrete. If painted, it is essential that the paint is not toxic to the bat.
- Where beneficial / practical, locate bat boxes within existing trees were exotic trees are being planted as part of the restoration works so that as the bat boxes fail the bats have alternative roost sites coming available.
- The bat boxes will be numbered to aid referencing in the long term.

Appendix I

Vegetation Removal Protocol

Appendix I Vegetation Removal Protocol

The Vegetation Removal Protocol (the 'Protocol') must be implemented by ecologists who are competent in accordance with the Bat Competency Classes (Smith *et al.* 2017). A flowchart of the Protocol is presented in Figure 55.

Identification of potential bat roosts

The Tree Roost Potential Survey of Trees (AECOM, 2018) (the 'Tree Roost Survey') classified trees (>15 dbh) within the HCC Section of the Project as **high risk** (includes high and moderate bat roost potential trees) or **low risk** (includes low and negligible bat roost potential trees) in terms of providing potential bat roost habitat. Trees were marked with silver numbered tree tags to enable contractors to identify the status of each tree. This Survey will be extended to trees within the section of the road to be delivered by the Transport Agency once funding has been approved for detailed design.

Pre-felling procedures

The pre-felling procedure detailed within this section will be used for vegetation where the bat radio tracking surveys have not confirmed the presence of roosting bats. Reference to trees within the procedure covers all tree species including tree ferns and cabbage trees.

a. Prior to starting works the status of trees from the Tree Roost Survey will be checked (using the report of the GIS layer held by HCC). If the trees were classified, then proceed to the following step. If trees have not been classified because they were inaccessible, they will need to be surveyed to determine their bat roost potential (AECOM, 2018b)

b. The Project Arboriculturalist, Site Manager and Ecologist will identify high risk trees (high and moderate bat roost potential) within the working area prior to any works commencing on site by cross referencing the metal tags on trees to Bat Roost Potential Survey of Trees or the associated GIS layer held by HCC.

c. High risk trees will only be removed between 1st October and 30th April (excluding known bat maternity roosts or areas – refer to Section 6.5.5 and Figure 54). If a tree needs to be removed unexpectedly outside of this period the Project Ecologist will determine whether an inspection for the presence of bats could be undertaken, due to the nature of potential roosting sites e.g. clear cavities, and without disturbing bats in torpor (if bats were to be found, refer to procedure below).

d. All low risk trees can be felled at any time. However, the Project Ecologist must be consulted to confirm that the felling of low risk trees would not disturb bats if they were roosting in adjacent high-risk trees.

e. The Project Ecologist will be on site for the removal of all high-risk trees or until features have been removed within which bats could roost. The ecologist is not required to be present for the removal of low risk trees but will be available if their presence becomes necessary due to the discovery of bats.

f. To confirm the presence or likely absence of bats the following survey methodologies can be implemented; ABM survey, endoscope inspection or emergence survey. ABMs can be advantageous in areas where bat activity is low e.g. no bats recorded during the monitoring period the trees can be removed. However, in areas where bat activity is known to be frequent the use of ABMs can have limited value. In areas of high bats activity, it is likely that high risk trees will need to be inspected with an endoscope if it is possible to complete an inspection by climbing or a lift. Alternatively, an emergence / dawn survey. The following text will explain each of the survey options.

   ABMs will be placed on site at **least** two nights prior to works commencing at high risk trees to gain further understanding as to whether bats could be present in potential roosting sites within the trees. During this monitoring period overnight weather conditions must meet the following criteria;

   i. Air temperature does not drop below ten degrees Celsius from sunset until four hours after sunset;
   ii. Mean overnight wind speed does not exceed 20km/h;

iii. Maximum overnight wind gust does not exceed 60km/h; and
iv. Rainfall of no more than 2.5mm in the first two hours after dusk.

g. No monitoring shall take place during a full moon, or one night either side of full moon.

h. Where a night of monitoring is lost to adverse weather or presence of a full moon, further monitoring will take place until two consecutive nights of monitoring is achieved.

i. If bats are not recorded on the ABMs at any time during the monitoring period, immediately prior to tree felling works, then the Project Ecologist will indicate to the arboriculturalists that high risk trees can be removed by sectional felling without any further inspection works.

j. If high risk trees cannot be removed prior to dusk the same day, then monitoring for bats using ABMs will continue and the arboriculturalists cannot commence works the following day until the Project Ecologist has indicated that they can do so, due to the continued absence of bats.

k. If bats are detected on the ABMs, then each high-risk tree will be inspected by the arboriculturalists under the supervision of the Project Ecologist, and all suitable features will be viewed with an endoscope to confirm the presence or absence of bats, prior to the tree's removal. Utmost care will be taken not to disturb any roosting bats. Photographs will be taken of any roosts or roost evidence found. If the tree cannot be climbed or viewed from a lift an emergence and/or dawn survey will be undertaken over two consecutive valid nights (see above – ABM weather conditions), to observe if bats are leaving or entering a roost within the trees.

l. If the check or observations reveal no roost is present, the ecologist will inform the Arboriculturalist that the tree can be removed.

Alternative – Endoscope survey

f. It is concluded that bat activity levels are high and therefore the value of completing ABM surveys are limited and it is decided to go directly to endoscope surveys. then each high-risk tree will be inspected by the arboriculturalists under the supervision of the Project Ecologist, and all suitable features will be viewed with an endoscope to confirm the presence or absence of bats, prior to the tree's removal. Utmost care will be taken not to disturb any roosting bats. Photographs will be taken of any roosts or roost evidence found.

g) If the check or observations reveal no roost is present, the ecologist will inform the Arboriculturalist that the tree can be removed.

Alternative – Emergence / dawn survey

f. If the tree cannot be climbed or viewed from a lift an emergence and/or dawn survey will be undertaken over two consecutive valid nights (see above – ABM weather conditions), to observe if bats are leaving or entering a roost within the trees.

g. If the check or observations reveal no roost is present, the ecologist will inform the Arboriculturalist that the tree can be removed.

Confirmed bat roost

a. Bat roosts within the designation alignment will be primarily identified by the following methods:

i. Bat Radio Tracking Surveys completed in 2018 and 2019 (IDW, 2018). To date one maternity bat roost (Roost 30) has been identified within the designation corridor (Transport Agency Section), which is illustrated in Figure 54
ii. Implementing the pre-felling procedures, detailed above.

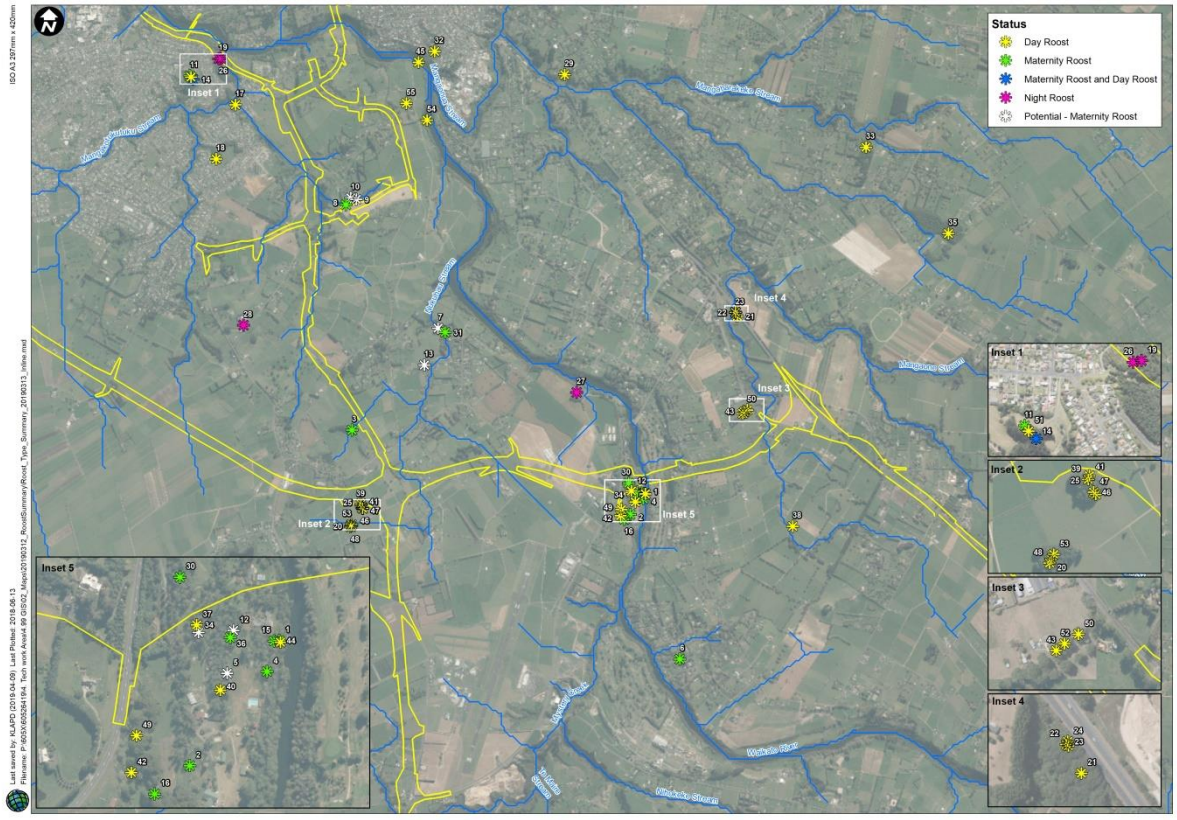


Figure 54 Known bat roosting sites.

b. This procedure applies to all roosts.

c. If bats are confirmed to be roosting within a tree, then options should be considered to retain the roost. This assessment needs to consider how other tree removal works could compromise use of the roost tree e.g. retention of a roost tree within the central reservation of a road is unlikely to be a good ecological outcome.

d. If it is identified that the tree containing the roost cannot be retained, then consultation is required with DOC. The Wildlife Act s 63 (1c) indicates it would be an offence without authorisation to rob, disturb, or destroy, or have in his or her possession the nest[20] of any absolutely protected or partially protected wildlife or of any game.

The following recommendations for tree removal of a known roost are based on current best practice and may not be applicable following the PauaMAC5 vs Director-General of Conservation High Court Decision.

Known or possible maternity roosts

1. At known or possible maternity roosts (refer to Figure 54) tree removal works should be scheduled to occur outside of the maternity period November to February inclusive.

Known day roosts (not maternity) and roosts identified during pre-felling surveys.

a. If bats are identified to be present in a roost during the pre-felling surveys, then the bat roost will not be disturbed / removed / relocated until further monitoring confirms that the bats have moved on from the roost and the roost is therefore empty of all bats (typically 2-5 days)[21]. Then the tree will be removed. In the interim the following actions will be taken;

[20] In relation to bats this refers to their roosting sites.
[21] If the roost is a maternity roost then felling should be delayed until after the maternity period November – February inclusive.

i. The Project Ecologist will review whether it is possible to relocate the roost into an area that would remain of value to bats e.g. could the hollow be kept and attached to another tree as a bat box? Could the tree be relocated as standing dead timber? Therefore, preventing the loss of the roost through careful repositioning.
ii. The immediate area will be cordoned off with safety fencing and signage erected in a 10m radius around the roost, alerting any person approaching the area that a bat roost is present and to stay clear.
iii. All arboricultural staff will be made aware of the presence of the roost. The Project Ecologist will determine whether all tree clearance works should be suspended or whether inspections and clearance can continue away from the roost.
iv. The roost will be clearly marked, and DOC will be made aware of the discovery of the bat roost. The roost will be monitored (acoustic or visual (emergence/return)) until the bat no longer occupies the roost.
v. If bats are still in the tree after seven nights, the Project Ecologist will contact DOC to decide an appropriate way forward. Appropriate measures may include the use of one-way exclusion features, followed by sectional felling.

2. Any high-risk trees felled will be inspected for bat roost signs by a Project Ecologist following felling. The Project Ecologist will assess as to whether there is an opportunity to use potential roost cavities as natural bat boxes, as recommended the Project EMMP.

Bat mortality - handling of dead and / or injured bats

a. In the event that the bat supervision, required in accordance with the Vegetation Removal Protocol, identifies that there has been mortality and /or injury of bats, then:

   i. Tree-felling shall be suspended until the Project Ecologist considers that works are unlikely to lead to the injury or death of other animals; and

   ii. DOC notified no longer than two hours after an injured or dead bat is found (DOC hotline if out of hours)

b. Any living bats found during felling will be taken to a vet immediately for assessment. Bats will be placed in a cool dark material lined box (e.g. tea towel) with a bottle lid containing water. Alternatively, the bat could be placed in a cotton bag by or under the direction of the Project Ecologist, to ensure the animal is handled appropriately.

c. Dr Andrew Gore at Hamilton Zoo will be an initial contact person; Hamilton Zoo, Brymer Road, Hamilton. Telephone Number: 07 838 6720 (If contact changes then this protocol will be updated without seeking TA certification).

d. If it is considered that the bat can recover from its injuries a location for its rehabilitation will be identified in co-ordination with the Hamilton Zoo. Once it is confirmed that the bat has sufficient weight and is able to fly it will be released on the site where it was found, an hour after sunset during suitable weather conditions, so that it can relocate itself.

e. Any bat that is found dead or injured and subsequently euthanised, it must be stored in a fridge at less than 4°C and be returned at the soonest available time to: DOC Waikato District Office, 5 Northway St. Te Rapa. The Wildlife Act requires that in the first instance the bat is returned to DOC.

Reporting and review of mortality and / or injury of bats

a. The Project Ecologist who was present on site when the injured or dead bat was identified will undertake an investigation and submit a Bat Mortality and / or Injury Investigation Report (the 'Report') within five working days of when DOC was notified.

b. DOC, on receipt of the Report, in consultation with the Project Ecologist will;

   i. Review and discuss the findings of the Report with the Project Ecologist; and
   ii. Consider under what conditions the Project works may re-commence operations, and whether there is a need for further or amended controls on this Protocol to address the cause of mortality and / or injury and prevent further such incidences.

c. The Project Ecologist shall submit the Report to DOC. The Project will then implement these additional controls.

Survey sites with difficult access

a. The Tree Roost Survey identified three sites where access for the bat roost potential surveyors was restricted. At these sites the Project ecologist will need to consult with the Arboriculturalist in relation to how tree felling works will be undertaken and to determine the best method available for determining the presence or absence of bats.

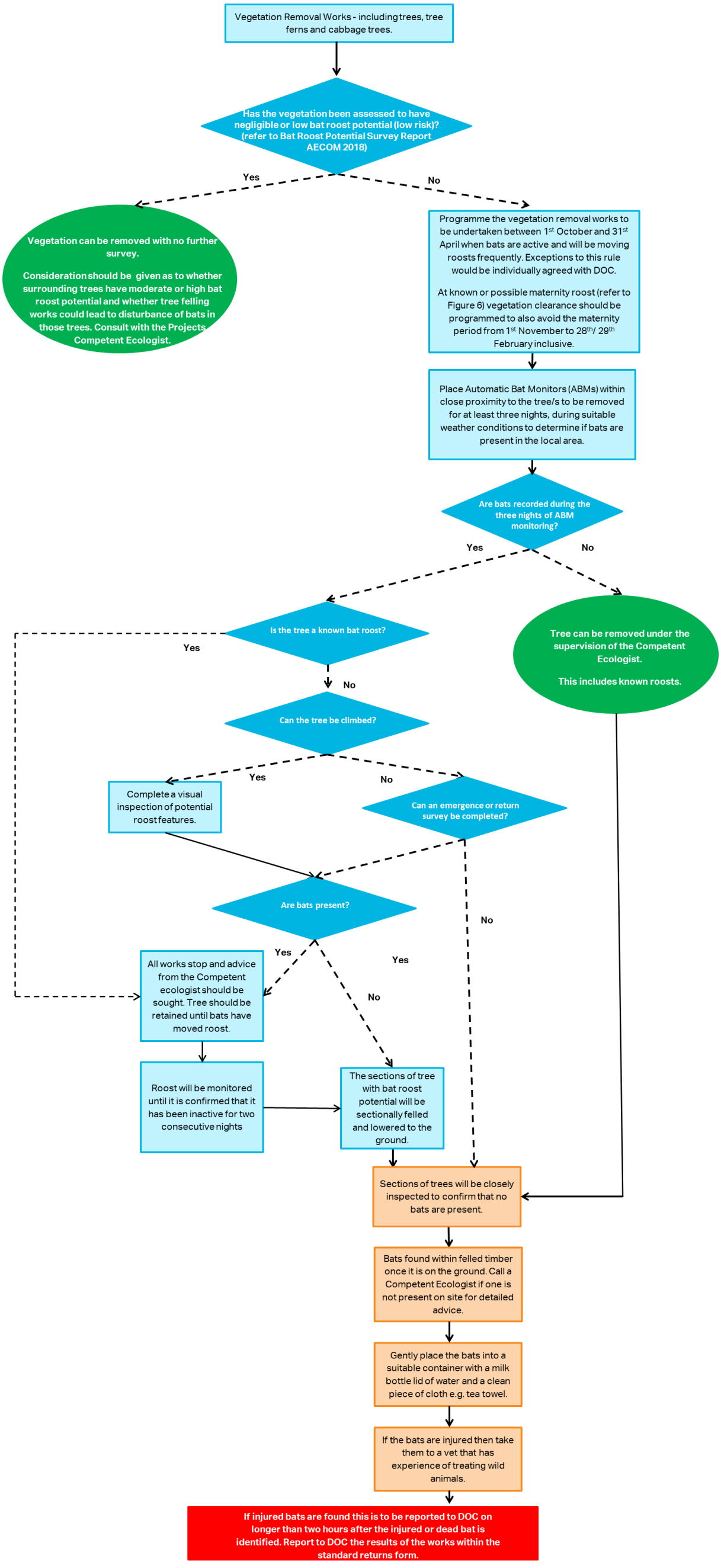
b. In relation to the trees located along the Waikato River (Tree Roost Survey - site 3.5.2), the river bank is extremely steep, and it may not be practical to use any of the currently available methods of survey to check for the presence or absence of bats e.g. ABM, emergence/return or endoscope. In this situation (as a minimum but only where safe to do so), the ecologist would inspect felled vegetation for the presence of bats.

c. At the two sites in the Mangakotukutuku Gully where access was restricted it may be possible for the Project Ecologist/Arboriculturalist to survey trees assessed to have high risk with an endoscope, once the Arboriculturalist has established a safe route of access. If this is not possible then the Project Ecologist may choose to use a mix of emergence/return surveys and ABMs to assess the presence or absence of bats and limit the risk that bats could be present. These surveys are seasonally constrained as they are reliant on bats being active between September to April when conditions are suitable. As a minimum (but only where safe to do so), the ecologist would inspect felled vegetation for the presence of bats.

Data management

Tree roost potential data has been collected using iForm and GIS Collector. In addition, each of the trees on site has been given an individual identification number, where practical, to allow cross referencing on site. It is recommended that as the detailed surveys are progressed that this information is updated to allow all contractors working on the Project to view this information. The Project Ecologist should update this layer as the ABM/endoscope surveys are completed. This information should be handed back to the client at Project completion and should be a contractual condition.

Figure 55 Flowchart illustrating the Vegetation Removal Protocol for Moderate and High Bat Roost Potential Trees



Bat competency classes

Table 38 Bat Competency Classes

Class	Key field activity	Competency	Individual experience / knowledge
A	ABMs	Setting up automatic bat detector monitoring systems (ABMs).	Recent previous experience in installing ABMs in at least 2 comprehensive surveys.
B	Analysing ABMs	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 long-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 (e.g. forearm band, temporary marks) • using wing biopsies for genetic sampling • attaching transmitters • inserting transponder tags • applying release techniques.
E	Trainer for class X	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. Survey data analysis and interpretation.	Competency in 3 or more of class A/B/C/D activities (field experience relating to competency classes A/B/C/D activities).

Class	Key field activity	Competency	Individual experience / knowledge
		Preparation of bat impact assessment reports. Can recommend impact management strategies (e.g. mitigation) for projects. Prepare, co-author, or certify the appropriateness of Bat Management and Monitoring Plans (BMMPs). Presentation of expert evidence for projects impacting bats.	Experience writing ecological assessments and/or species restoration or recovery plans. Thorough knowledge of available bat survey techniques and methodology, and their limitations. Thorough knowledge of the threat's 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 J

Restoration Plan Structure

Appendix J Restoration Plan Structure

A detailed Restoration Plan will be prepared for each of the Designation Restoration Sites. These will be tailored to each site. The headings below illustrate the type of information that will be included within each plan. Restoration plans will be produced to comply with intention of the EMMP and consequently the designation conditions.

Retention of existing native plants

At each of the Designation Restoration Sites a walkover will be undertaken by a Project Ecologist. The surveyors will map the vegetation on site, identifying areas of vegetation to be removed and retained.

Vegetation will be retained if it is considered;

- to provide long-tailed bats with known or potential roosting sites;
- provides critical bank stabilisation;
- provides important instream shade; or
- provides valuable variation in stream flow.

Vegetation will be likely removed if it is;

- Negatively effecting the flow within the stream;
- Listed as a pest plant species by WRC;
- A plant that spreads rapidly and would outcompete native planting; or
- Removed and this does not negatively affect native fauna but will allow native species to be planted.

The Restoration Plan will clearly indicate within a table and on a map the area and nature of restoration completed (Refer to Table 39 for example)

Table 39 Extent of habitat restoration.

Approach to habitat restoration	100 % (1:1)	50 % (1:0.5)[22]	Total Restoration to meet designation conditions
Full habitat restoration (all existing vegetation removed)	2 ha		2 ha
Partial restoration (under canopy)		2 ha	1 ha
Weed removal from native habitat		2 ha	1 ha
Total habitat restoration			4 ha

Each subsequent plan will present the total restoration area delivered, in relation to the 13.38 ha to be attained. The plan will also reflect on the area of total land remaining to determine the practicality of delivering the total restoration required.

Fencing

During the site walkover the ecologist will consider the need to install or upgrade fencing to ensure that stock is excluded from the new planting. If required, the fencing will be designed to exclude sheep and cattle from the new plantings. All fences are to be an 8-wire conventional fence with (3-5 battens),

[22] As the restoration in these areas will only be partial it is considered that its contribution to the total area of restoration will be allocated at 50 % of the total coverage.

or post and rail fencing to permanently exclude both sheep and cattle from the stream margins and new plantings.

Instream Habitat

During the site walkover, and if streams are present within the restoration area, the ecologist will consider ways in which instream habitat can be enhanced to restore natural substrate sorting, channel form and fish habitat. WRC have produced several documents relating to stream restoration, but these do not deal with instream improvements. However, Christchurch City Council (CCC) produced the Waterways, Wetlands and Drainage Guide (2003), which in Part B (9) includes detailed guidance on Restoring Waterway Form. https://ccc.govt.nz/environment/water/water-policy-and-strategy/waterways-wetlands-and-drainage-guide/. This documentation and the ecologists experience will be used to guide the instream restoration works.

At the headwaters of the Mangakotukutuku Stream (HCC 16 and 17) it will be necessary for stream realignment to occur. This will provide an opportunity to significantly improve stream form and function, therefore, a Stream Reconstruction Plan will be produced, this will incorporate the information required for a Restoration Plan and provide additional engineering detail relating to the realignment (refer to Section 6.4.8 of the EMMP). The Stream Reconstruction Plan will be used in the Projects application for resource consent.

Access Tracks

The Restoration Plans will indicate the location of access tracks that will be required for maintenance of the restoration area and also to structural features along the designation corridor. These will be positioned to have the least impact possible on the natural environments being created.

Blocking drains

One of the Designation Restoration Sites to be delivered by the Transport Agency includes three stands of mature kahikatea. These are each surrounded by a network of existing drains. Prior to the restoration plantings being undertaken around these stands of kahikatea the drains within its immediate vicinity should be infilled in to raise the water table within the stands of kahikatea. The objective would be to reinstate the wetland conditions that would naturally occur in this location. It is advisable to undertake these works at least one year before planting occurs to ensure that the proposed planting is appropriate to the ground conditions.

Plant species selection

The plant species will be selected based on the site-specific environmental conditions and topography and the Gully Restoration Guide (Wall & Clarkson, 2006). Plants will be sourced from local suppliers and will be grown from local seed. The Site Restoration Plan will be tailored to each site, but examples of species mixes are provided below. The plant species listed in Table 40 - Table 43 include species that provide fruit, nectar and seed throughout the year for native birds.

Streamside (Levee) and floodplain

The streamside section is generally a slightly raised area directly adjacent to the stream Plant species suitable for this habitat type are described in Table 40.

Table 40 Planting species list for levee areas.

Common name	Latin name	Spacing (m)
Swamp sedge	*Carex virgata*	0.75
Harakeke	*Phormium tenax*	1
Kowhai*	*Sophora microphylla*	1
Tī kōuka*	*Cordyline australis*	1.5
Mingimingi	*Coprosma tenuicaulis and/or C. propinqua*	1.5

*may also be planted on the footslope.

Backswamp / wetland

Wetland areas occur along the Mangakotukutuku Gully in areas where willows are slowing flow within the main stem of the stream and where landform (raised levee) traps water behind it after a period of flooding or because of a high-water table. Plant species suitable for this habitat type are described in Table 41.

Table 41 Plant species list for backswamp / wetland areas.

Common name	Latin name	Spacing (m)
Swamp sedge	*Carex virgata*	0.75
Swamp sedge	*Carex secta*	0.75
Baumea	*Baumea rubiginosa*	0.75
Harakeke	*Phormium tenax*	1
Whaririki	*Phormium cookianum*	1
Swamp coprosma	*Coprosma tenuicaulis*	1
Mingimingi	*Coprosma propinqua*	1
Tī kōuka*	*Cordyline australis*	1.5
Kahikatea**	*Dacrycarpus dacrydioides*	5
Swamp maire	*Syzygium maire*	5

Footslope

The footslope is the narrow area at the foot of the gully slope where organic material accumulates. It has good drainage where it meets the hillslope and poorer drainage closer to the streamside. Plant species suitable for this habitat type are described in Table 42.

Table 42 Planting list for footslope areas.

Common name	Latin name	Spacing (m)
Putaputaweta	*Carpodetus serratus*	5
Rimu	*Dacrydium cupressinum*	5
Kahikatea**	*Dacrycarpus dacrydioides*	5
Pukatea	*Laurelia novae-zelandiae*	5
Manatu	*Plagianthus regius*	5
Totara	*Podocarpus totara*	5

** may also be planted on the floodplain

Hillslope and crest

The hillslope and crest have very well-drained soils and can be prone to erosion. Plant species suitable for this habitat type are described in Table 43.

Table 43 Planting list for hillslope and crest areas.

Common name	Latin name	Spacing (m)
Makomako	*Aristotelia serrata*	1
Mikimiki*	*Coprosma rigida*	1.5
Karamu*	*Coprosma robusta*	1
Koromiko*	*Hebe stricta*	1
Houhere	*Hoheria sextylosa*	1

Common name	Latin name	Spacing (m)
Rewarewa	Knightia excelsa	5
Kanuka	*Kunzea robusta*	1
Tarata	*Pittosporum eugenioides*	1
Kohuhu	*Pittosporum tenuifolium*	1
Akeake	*Dodonaea viscosa*	1.5

* may also be planted on the footslope.

The planting mix suggested above is focused on delivering native habitat restoration. The Restoration Plans will also need to consider botanical species that are required for native bats, birds and lizards as specified by the EMMP.

Planting

To create a suitable planting area, competitive grass will be cleared within an area measuring approximately ½ m^2 for each plant. This will reduce competition when plants are establishing. Spot spraying to remove the competitive grasses will be undertaken four to six weeks prior to planting, being careful not to overspray the area. In areas that are known to be of value to native lizards the turf sod should be removed prior to planting and then turned upside down around the root to remove competitive grasses in the short term, provide mulch to the new plant and avoid toxic effects to lizards.

Planting will be completed from autumn to early Spring in May to August. A thick layer of mulch, straw or pre-cut squares of weed-mat would be placed around each plant; ensuring mulch is clear of the plant stem. This will help conserve moisture and suppress weed growth during the establishment period.

Hydrology – wetlands

It is known that within the Mangakotukutuku Gully there are existing areas of wetlands that are dominated by a mix of native and exotic vegetation. These wetlands are likely to be present due to one of the following reasons or a combination of these reasons;

- High water table;
- High levee adjacent to stream leading to water being retained following flood events; and / or
- Due to congestion in the bottom of the gully caused by willow leading to water being held back within wetlands areas.

The Restoration Plan will need to take into consideration changes in hydrology that could occur during restoration works and ensure that wetlands continue to receive the flow that they require.

Pest control

Pest control is to be implemented in accordance with the Pest Control Guidance within this EMMP.

Maintenance

Following the completion of restoration planting, the restoration site would be inspected in order to identify any potential maintenance (i.e. control of re-infestations, re-mulching, erosion controls) that may be required.

To reduce maintenance and avoid accidental death of plants due to herbicide, it is recommended that each tree is surrounded by a weed mat. However, it may still be necessary to manually or chemically release the new plants from competition of competitive grass species. Removal of competitive grasses should occur ideally monthly during the plant growing season (October – April) or at a minimum twice during this period during the first three years of establishment. The effort required will be dependent on-site conditions and plant growth.

Plants should also be monitored during the three years following planting to identify and replace any plant losses. If possible, the cause of the losses should be recorded and remedied as required. For example, if rabbit herbivory is the cause for numerous losses, pest control strategies should be modified to manage the problem. In the event that losses do occur, blanking (like-for-like species

replacement of failed seedlings) may be required at the end of the first planting season. Further replacement planting may also be required during the second year of implementation.

Monitoring

The monitoring of Designation Restoration Sites described above will initially be undertaken annually for a period of 5 years to enable corrective action to be taken rapidly if problems are identified with the planting. This will include;

- Monitoring of plant losses during the first three years of establishment.
- HCC implement general maintenance e.g. removal of competitive grasses.
- Monitor rainfall (i.e. drought) in first year of planting and implement additional watering if required.
- Monitor grazing by possums and rabbits and modify pest control if required.
- Monitor weed infestation annually to guide maintenance.
- Monitor canopy closure - after 10 years.
- Audit to confirm that Designation Restoration Sites and planting design have been achieved, after 10 years.

A summary of monitoring requirements in regard to terrestrial habitat are provided in Section 7.0.

Protection in perpetuity

The means by which each of the Designation Restoration Areas will be protected in perpetuity will vary. Typically, restoration sites delivered by HCC will be either owned and controlled by HCC or they will remain in private ownership with an easement placed over the restoration area.

The Transport Agency will look to place QEII covenants or easements on the restoration areas to protect them in perpetuity. The land may then return into private ownership or ownership of Waipa and / Waikato District Council Parks and OpenSpaces Team.

The manner in which each site will be protected in perpetuity will be presented in each Site Restoration Plan.

Erosion and Sediment Control Plan

The nature of the Erosion and Sediment Control Plan (ESCP) prepared for the delivery of habitat restoration will depend on the nature of the works. In some areas works will be limited to tree planting and therefore a detailed ESCP will not need to be prepared. However, during the construction of the North – South Link it will be necessary for stream realignment works to be undertaken. The Erosion and Sediment Guidelines for Soil Disturbing Activities (Waikato Regional Council, 2009) provides guidance on suitable measures that could be implemented, but practices continue to advance and therefore on writing the latest guidance should be followed.

If a full Erosion and Sediment Control Plan is required, the structure of this document is provided below;

- Project description, including construction timetable.
- Identification of specific site responsibilities.
- Estimate of soil loss.
- Principles to minimise sediment discharge from the site.
- Design of erosion and sediment control devices.
- Timetable and nature of stabilisation.
- Maintenance, monitoring and reporting.
- Rainfall response.
- Procedures to review and / or amend the ESCP.

- Appendix including figures illustrating areas of ground disturbance, timings and the location of devices to control sediment release.

Appendix K

Fish Recovery Methodology

Appendix K Fish Recovery Methodology

The fish recovery method implemented will be determined by the Project Ecologist at the time of the fish salvage works, however the broad methodology for fish rescue would be as follows.;

- A stop net will be deployed across the channel at the upstream and downstream ends of the works area at the commencement of the fish rescue operation. This is to prevent fish from re-colonising the works areas once fish recovery is completed and instream works are in progress. Stop nets will remain in place until instream works are completed. The stop nets will be checked and cleared of debris on a daily basis and after any high flow events.
- In wetland areas and non-wadeable streams baited fyke nets and gee minnow traps will be placed throughout the isolated section of water course. The fishing effort (number of nets) will vary according to the size of the area being fished. Nets will be left over night and checked/emptied the next morning. If a high number of fish are caught following the second night of trapping further trapping may be required. Subsequent nights of netting will be undertaken until the catch rate is below 80% of the previous pass or less than 10 individual fish captured, excluding eels from the total count. In relation to eels continue to fish until the catch rate is below 50% of the previous pass or less than 10 individual fish captured.
- In wadeable streams the entire length of stream will be electric fished by qualified technicians with repeat passes undertaken until the catch rate is below 80% of the previous pass or less than 10 individual fish captured, excluding eels from the total count. In relation to eels continue to fish until the catch rate is below 50% of the previous pass or less than 10 individual fish captured.
- A freshwater ecologist will be present on site at the time of dewatering of the stream or the wetland environments to ensure that any remaining fish are captured and relocated. This may involve searching the stream and substrate during dewatering, capturing any fish that are present. Spoil from any excavation will be spread out in a thin layer on the bank near the stream for inspection. The spoil will be briefly visually checked for any fish by the ecologist or appropriately trained members of the environmental team.
- All indigenous fish recovered will be transported and released at the designated relocation site (within the same watercourse or tributary network).
- Appropriate handling methods will be used to minimise stress to the fish. Fish will be held in covered bins that will be regularly refreshed with stream water and transferred and released within 1 hour of being caught. Bubblers will be used if necessary, to prevent asphyxiation.
- Exotic species captured through fish rescue exercises will not be transferred. Any exotic fish species captured will be euthanized humanely and disposed of appropriately.

The Project Ecologist will hold or will obtain a Permit from DOC to undertake electrofishing and will have or will obtain a Permit from the MPI to catch and release fish that are salvaged during instream dewatering works.

Appendix L

Lizard Restoration Site Review

Appendix L Lizard Restoration Site Review

Table 44 Review of potential reptile offset/restoration sites.

Site name	Additive	Connected	Area	Early delivery	Long term security	Pest control	Suitable habitat can be created	No conflicting requirements	Reason for dismissal or acceptance
Lake Rotopiko	No	No	40 ha	Yes - exists	Yes – predator fence	Yes – predator fence	Under development	None known	Not additive and isolated
Maungatautari	No	No – however it is large in scale	3400 ha	Yes - exists	Yes – predator fence	Yes – predator fence	Existing site dominated by native vegetation.	Management Plan in place, therefore, enhancement just for copper skink may not be appropriate.	Not additive, area currently well managed with limited potential to enhance for copper skink
61 Narrows Road	Yes	No	Area to be determined by project	Yes – NZ Transport Agency land	Yes – NZ Transport Agency land	Yes – 20 years	Potential	Area is of high value to bats. However, variable habitat is of value to this species.	Isolated
Part of property 632 Peacocke Road	Yes	Yes – link to the Mangakotukutuku	Approx. 1 ha	No – parcel of land may pass to HCC ownership	Uncertain – potentially HCC land	Yes – 20 years	Potential	Residential development surrounds	Unknown as to when this parcel of land would enter HCC ownership.
Proposed restoration areas Pt Lot 2 DP 35271 & 241 Dixon Road	Yes	Yes – link to the Mangakotukutuku	2 ha	Yes – will pass into HCC during designation acquisitions.	Yes – will pass into HCC during designation acquisitions.	Yes – 20 years	Potential – habitat complexity on the site can be developed	Main area surrounded by road and public facilities, not housing which is a key requirement.	Selected sites

Appendix M

Procedure if native birds were found injured or dead

Appendix M Procedure if native birds were found injured or dead

In the unlikely event that a native birds was found to have been injured or killed by works the following procedure would be followed.

If a bird is found dead and it is as nationally Threatened, At Risk or Data Deficient the following steps will be followed;

- Ensure that the body is to the Te Rapa office of DOC (chill or freeze if there is a delay in transferring the body to DOC);
- Undertake a review to determine why the death occurred and alter practice where possible to avoid further deaths; and
- Inform DOC of the death and discuss if it is necessary to halt works until full investigations of the death has occurred.

For injured birds, the steps below will be followed;

- Injured bird is to be transported to a veterinarian immediately;
- The veterinarian shall check the bird and direct whether it could be rehabilitated or released, or whether due to injuries it will be necessary to euthanise the animal; and
- Any birds that are euthanized will be returned to the Te Rapa office of DOC.
- Undertake a review to determine why the injury occurred and alter practice where possible to avoid further injuries; and
- Inform DOC of the injury and discuss if it is necessary to halt works until full investigations of how the injury has occurred.

No indigenous birds shall be euthanised without first:

- Consulting with the DOC Captive Management Co-ordinator and obtaining the prior consent from DOC; or
- Obtaining the recommendation of a veterinarian where euthanasia is undertaken on animal welfare grounds.

Appendix N

Lizard Monitoring Methodology

Appendix N Lizard Monitoring Methodology

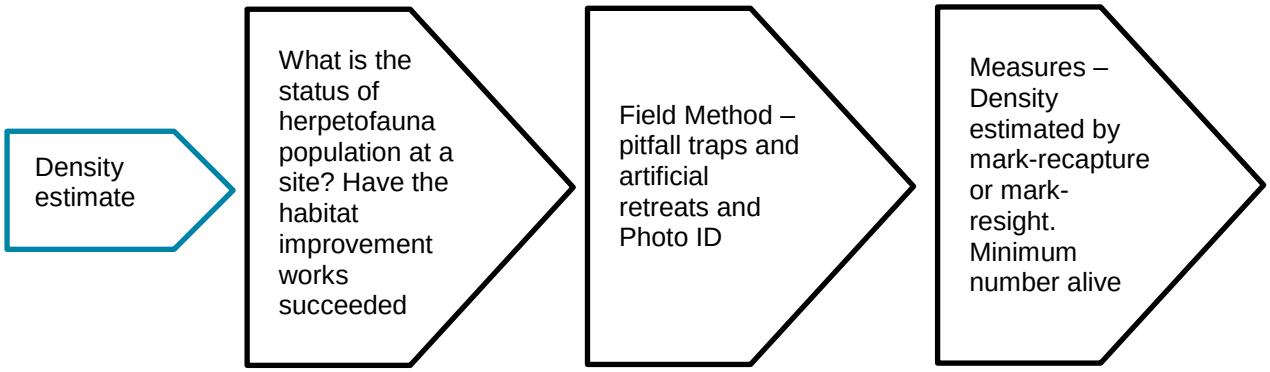
Decision tree

To determine the approach to long term monitoring the decision tree presented in the Department of Conservation's (DOC) guidance titled Introduction to herpetofauna monitoring (Lettink and Monks, 2012).

The objective of the long-term monitoring:

- To demonstrate recruitment and use of the restoration sites.
- To determine that habitat restoration has led to the occurrence or an increase in the population of copper skink present.

The pathway followed is presented below;



Long term monitoring - pitfall trapping

The following methodology is designed in accordance with the following guidelines;

- Hare (2012) Herpetofauna: pitfall trapping.
- Lettink (2012) Herpetofauna: photo-identification.

Location of Lizard Restoration Sites

Long term monitoring will be undertaken at two Lizard Restoration Sites constructed to compensate for the loss of copper skink habitat. These are illustrated in Figure 56, Figure 57 and Figure 58.

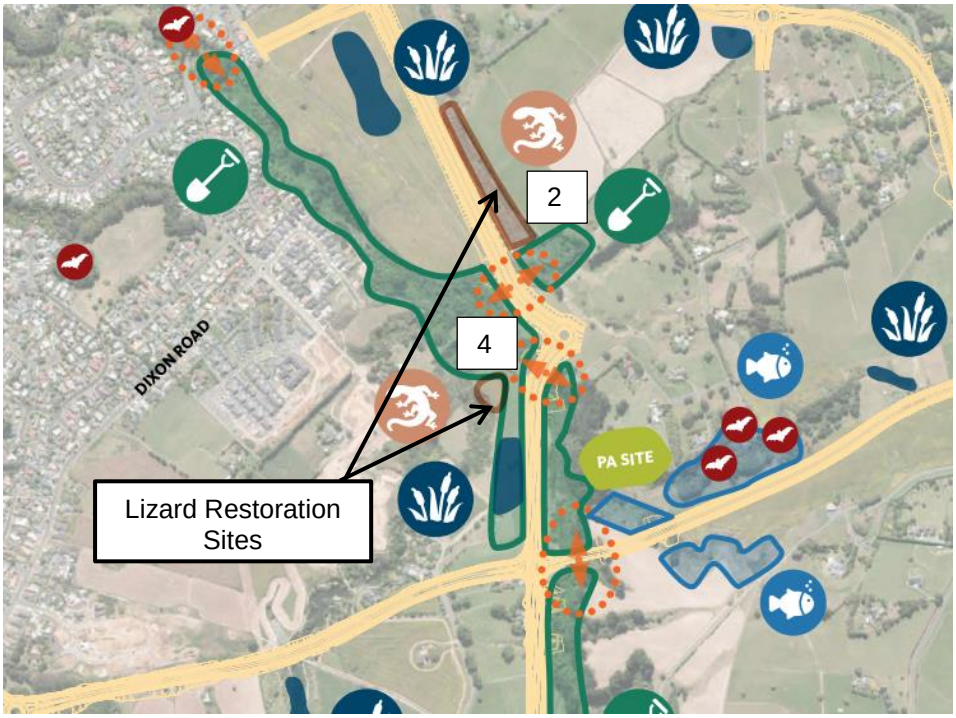


Figure 56 Location of proposed Lizard Restoration Sites.

Pitfall trapping methodology

Pitfall traps at the two Lizard Restoration Sites (Figure 56) will be placed along three transects (Figure 57 and Figure 58). The trap at the top of the bank will be set 3m from the boundary as there is a row of conifer trees at the top of the embankment that will affect environmental conditions.

Figure 57 Location of transects within Lizard Restoration Site 2[23]

[23] Number of sites is non

Figure 58 Location of transects within Lizard Restoration Site 4.

- It is proposed that pitfall traps are spaced 10m apart along each of the transects (approximately 105 pitfall traps in Site 2 and 30 pitfall traps in Site 4).
- Pitfall traps will comprise 4.5l square white plastic buckets or similar.
- They will have drill holes in the bottom to ensure that water drains out.
- Each pitfall trap will be set so that the top of the pitfall trap, including its lip, is flush with the ground (soil will be pack around the rim).
- Each trap will be numbered which will cross reference to a map of all of the pitfall traps and will also indicate which transect it is on (e.g. trap 1 on transect A – 1A).
- When open debris will be added to the bottom of the trap to provide refugia. A small piece of moistened sponge will also be placed at the bottom of the trap to avoid animals becoming desiccated. The surveyor will carry a bottle of water to remoisten the sponge during checks.
- The traps will be baited with tinned pear to attract lizards to the trap. The bait will be replaced every day. The bait will be placed on a piece of paper to allow rapid bait replacement.
- When open the trap will be covered by its own lid when open to protect lizard from predation and the sun. The lid will be set so there is a 1-2 cm gap that allow lizard entry, and the lid will be pinned in place.
- During trapping it will be determined if additional measures are required to exclude predators (e.g. mammals).
- If signs of mouse predation are observed in a trap, then the trap will be closed.
- If is found that a trap is prone to water collecting e.g. high-water table, it will be relocated.
- Ten nights of trapping will be completed at each of the sites. If the trapping period is split due to weather or the weekend the traps will be shut by placing a lid on the trap and placing rocks on top to ensure that the trap will not accidentally open. Sticks will be placed in each of the closed traps so that if a trap were to accidentally open animals would have a means of escape.

- The traps will each be marked by a tall stick so that traps can be found in the future by surveyor even when vegetation develops.
- The traps will be checked in the morning during the trapping period (no trap will be left open, unchecked, for more than 24 hours).
- Trapping will be undertaken in February each year to allow comparison of data between years.
- Monitoring should aim to be undertaken during similar weather conditions during each monitoring period to allow comparison of data between years.
- Weather conditions and temperature will be recorded during each trapping period.
- Monitoring (10-day period) will be undertaken prior to habitat restoration and in Year 3, 6 and 9 post restoration.
- The surveyor will have a map of the pitfall traps during each monitoring visit and they will record where a pitfall trap is empty or contains lizards on each visit.
- If lizards are present these will be removed one at a time for processing or alternatively placed in a soft, cloth bag, tied tightly with a cord.
- A high-resolution, standardised photographs of each individual will be taken;
    - Throat speckling and scarring pattern
    - both sides of the skin targeting the nose-to-foreleg (lateral view of head);
    - dorsal markings; and
    - Ventral markings and colouration
- It will be determined at the start of the trapping period which of these images are the best to enable comparison between individual of copper skink.
- All individuals encountered during a sampling session will be photographed and these will be compared to photographs taken on previous occasions to determine their identities.
- Each newly-encountered individual will be assigned a unique identification number.
- The photos of each individual will be archived in an electronic photo library.
- The surveyors will determine either by eye or by using pattern-recognition software if the individual caught on site is a new individual or has been previously recorded.
- In addition, to taking the photograph the surveyor will record species, sex, weight (g), snout-vent length (mm), vent-tail length (mm), any regeneration of tail or other damage, ectoparasites and development / reproductive status.

Analysis of data

A report will be completed on conclusion of each monitoring visit. This will look at the number of individuals present and their distribution within the habitat at the Lizard Restoration Sites.

If it is identified that lizard numbers are not increasing that the report will make suggestions as to changes that should be made to the habitat e.g. review connective linkages, modify vegetation.