Waikato Regional Council
Central Waikato Catchment Committee Agenda

Date: Friday, 10 May, 2019
Time: 1:00 pm
Location: Council Chamber
Waikato Regional Council
401 Grey Street, Hamilton East

Members: M Moana-Tuwhangai - Chair (Local Community Representative)
B Hicks - Deputy Chair (Local Community Representative)
Cr B Quayle (Waikato Regional Council)
Cr S O’Regan (Waipa District Council)
Cr P Southgate (Hamilton City Council)
E Wright (Hamilton City Council)
Cr R McGuire (Waikato District Council)
D Arbury (Mercury Energy)
S Edmunds (Local Community Representative)
W Puke (Nga Mana Toopu o Kirikiriroa)
R Kaukau (Ngati Haua)
P Davies (Ngati Koroki Kahukura)
Cr S Kneebone - Joint Chair Integrated Catchment Management Committee South (Waikato Regional Council)
Cr A Livingston - Ex Officio (Waikato Regional Council)
N Smith - Chair Waikato Central Drainage Advisory Subcommittee (Waikato Regional Council)

Alternates: B Morgan - Alternate (Hamilton City Council)
Cr T Mahuta - Alternate to Cr A Livingston - Ex Officio (Waikato Regional Council)
R Mourits - Alternate to N Smith - Deputy Chair Waikato Central Drainage Advisory Subcommittee (Waikato Regional Council)

Notice of Meeting:
I hereby give notice that an ordinary Meeting of the Central Waikato Catchment Committee will be held as detailed above.

VRJ Payne
Chief Executive Officer
1. **Terms of Reference**

2. **Apologies**

3. **Confirmation of Agenda**

4. **Disclosures of Interest**
   Any disclosures of interest relating to the business at this meeting.

5. **Confirmation of Minutes**

   5.1 **Central Waikato Catchment Committee Minutes**
   
   The minutes from the meeting of the Central Waikato Catchment Committee dated 27 March 2019 to be received and taken as a true and accurate record.

   Extract of Integrated Catchment Management Committee 10 April 2019 as it relates to the Committee.

6. **Issues and Actions from the Previous Meeting**
   Report to update the Committee on any issues and actions from the previous meeting.

7. **Central Waikato Chairperson Report – Verbal Update**
   
   This item provides the Committee with a verbal update from the Central Waikato Catchment Committee Chair including any updates on matters of particular significance or relevance to the Zone.

8. **Central Waikato Zone Status Report**
   Report by the Zone Manager to update the Committee on Central Waikato catchment financials, activities and work programmes since the last Committee meeting.

9. **Drainage Schemes within Waikato Central Catchment Zone**
   Report for the Central Waikato Catchment Committee in response to a request regarding a general overview of Council’s administered drainage districts within the Central Zone boundary.

10. **Te Awa O Katapaki Stream Erosion Remediation**
    Report to provide the Central Waikato Catchment Committee with an overview of the erosion remediation project on Te Awa O Katapaki Stream and funding options.

11. **Hamilton Halo Project Phase 2**
    Report to update the Committee on one of Landcare’s proposed options and some of their recommendations being incorporated into Halo within the existing budget.
Central Waikato Catchment Committee

OPEN MINUTES

Date: Wednesday, 27 March, 2019, 10:00 am
Location: Council Chamber
Waikato Regional Council
401 Grey Street
Hamilton East

Members Present: M Moana-Tuwhangai (Chair)
B Hicks (Deputy Chair)
Cr B Quayle (Waikato Regional Council)
Cr P Southgate (Hamilton City Council)
E Wright (Hamilton City Council General Manager Infrastructure Operations)
Cr R McGuire (Waikato District Council)
D Arbury (Mercury Energy)
S Edmonds (Local Community Representative)
P Davies (Ngati Koroki Kahukura)
Cr S Kneebone (Joint-Chair Integrated Catchment Management Committee South)
J Fransen (Waikato Central Drainage Advisory Subcommittee)

Staff Present: B Toohey (Manager, Lower Waikato/Waipa/West Coast)
J Francis (Zone Manager, West Coast and Central Waikato)
L Van Veen (Democracy Advisor)

In Attendance: Mayor A King (Hamilton City Council)
SECTION A: UNDER DELEGATION AND FOR THE INFORMATION OF COUNCIL

1. Apologies

The apologies from Cr S O'Regan (Waipa District Council), Wiremu Puke (Nga Mana Toopu o Kirikiriōa), Cr A Livingston (ex officio), Noel Smith (Chair - Waikato Central Drainage Advisory Subcommittee) and Robert Mourits (Deputy Chair - Waikato Central Drainage Advisory Subcommittee) were accepted. Apologies for lateness from Cr Paula Southgate were also accepted.

CWCC19/01

Moved By: Cr B Quayle
Seconded By: P Davies

RESOLVED

The apologies from Cr S O'Regan (Waipa District Council), Wiremu Puke (Nga Mana Toopu o Kirikiriōa), Cr A Livingston (ex officio), Noel Smith (Chair - Waikato Central Drainage Advisory Subcommittee) and Robert Mourits (Deputy Chair - Waikato Central Drainage Advisory Subcommittee) were accepted. Apologies for lateness from Cr Paula Southgate were also accepted.

The motion was put and carried

2. Disclosures of Interest

There were no disclosures of interest.

3. Confirmation of Agenda

CWCC19/02

Moved By: P Davies
Seconded By: S Edmunds

RESOLVED

THAT the agenda of the Central Waikato Catchment Committee of 27 March 2019 be confirmed as the business for the meeting.

The motion was put and carried

4. Confirmation of Minutes

4.1 Central Waikato Catchment Committee Minutes

The minutes of the previous meeting of the Central Waikato Catchment Committee dated 14 November 2018 were received and accepted as a true and accurate record.

CWCC19/03

Moved By: D Arbury
Seconded By: B Hicks
RESOLVED
THAT the Minutes of the 14 November 2018 Central Waikato Catchment Committee Meeting be approved as a true and correct record.

The motion was put and carried

4.2 Waikato Central Drainage Advisory Subcommittee

The minutes of the Waikato Central Drainage Advisory Subcommittee meeting of 1 March 2019 were provided to the Committee for information.

During questions, answers and related discussion Committee members raised or noted the following matters:
- Members highlighted the importance of landowners being advised of appropriate plantings around drains to allow for easy access of spraying and clearance.
- Also noted challenge of enforcing clearance of cut vegetation in drains by landowners due to limited legislation requirements. Appropriate planting and clearance along scheme drainage systems could be a potential item for a future zone newsletter, in addition to the Central Waikato Drainage Scheme newsletter.

CWCC19/04

Moved By: R McGuire
Seconded By: J Fransen

RESOLVED
THAT the Minutes of the 1 March 2019 Waikato Central Drainage Advisory Subcommittee meeting be received.

The motion was put and carried

4.3 Extract of Integrated Catchment Management Committee Minutes

CWCC19/04

Moved By: M Moana-Tuwhangai
Seconded By: B Hicks

RESOLVED
THAT the extract of the minutes of the Integrated Catchment Management Committee meeting of 5 December 2019 be received.

The motion was put and carried

5. Issues and Actions from the Previous Meeting

Presented by Zone Manager, West Coast and Central Waikato Catchments (J Francis) to report back on actions and issues discussed at previous meetings.

During questions, answers and related discussion Committee members raised or noted the following matters:
- Work is being undertaken to progress the Waikato River Stability Management Strategy.
- Overall, positive feedback was received from Committee members regarding the West Coast Zone newsletter circulated as an example of how the Central Zone could communicate important information to ratepayers. Work will be undertaken to develop
a draft zone newsletter in upcoming months. This will be provided to the members for feedback prior to distributing to the community.

- Work to develop an overarching communications plan for all zones is currently being progressed by the Waikato Regional Council Communications Team. Updates on this work will be provided to the Committee in future.

**CWCC19/05**

**Moved By:** D Arbury  
**Seconded By:** P Davies

**RESOLVED**  
**THAT** the report **Issues and Actions from previous meetings (Central Waikato Catchment Committee Meeting 27 March 2019)** be received.  

The motion was put and carried.

6. **Chairperson’s Report**

Presented by the Chair (M Moana-Tuwhangai), a verbal update was provided for the information of the Committee on matters of particular relevance to the Zone.

The following discussion points were raised:

- With respect to the One Billion Trees Programme being led by Te Uru Rakau (Forestry NZ), Weo Magg Chairman of the West Coast Zone advised the ICMC meeting that landowners were able to work together to combine their adjacent land and qualify for funding under the programme, provided the total collective land area encompassed a minimum of 200ha.
- Liaison with Waipa District Council to resolve the need to clear drainage networks within the Lake Ngaroto area continues. This is to resolve concerns raised by adjacent landowners of the impact that the reserve land has on their drains.

**CWCC19/06**

**Moved By:** Cr S Kneebone  
**Seconded By:** Cr B Quayle

**RESOLVED**  
**THAT** the report **Central Waikato Chairperson report – verbal update (Central Waikato Catchment Committee 27 March 2019)** be received.  

The motion was put and carried.

7. **Central Waikato Zone Status Report**

Presented by Zone Manager, West Coast and Central Waikato Catchments (J Francis), the report outlined the status of the Central Waikato zone activities and work programme, covering the period to 28 February 2019.

During questions, answers and related discussion Committee members raised or noted the following matters:

- Noted budget expenditure year to date is tracking below forecast due to delays in the processing of contract costs relating to river management works under the Hamilton City Council project watershed programme.
A member queried the budget spend of 35% year to date and asked for assurance that this would reach target by year end. Staff assured members that this was typical for this time of the year and that the majority of work under our agreements is carried out in favourable conditions over the summer period. Staff are also currently working with HCC on utilising the River Improvement budget allocated for implementation actions for the River stability project. An update before the next meeting was requested and will be provided in April to the committee.

Staff highlighted the growth in planned works within the Karapiro and Mangaonui catchments as a result of increased funding with contributions from the Hill Country Erosion Fund and One Billion Tree funding. This has been a major gain for the zone due to these catchments being major sediment contributors to the Waikato catchment. Increased funding has meant that council have been able to offer up to 70% funding opportunities to landowners within these areas for this first time. This has hugely progressed work within these catchments.

Members raised concern that drainage throughout the region was unable to be sufficiently managed due to drainage schemes being managed within defined scheme boundaries, instead of being all encompassing. Staff undertook to provide a report to the next Committee meeting, to provide oversight of how drainage is managed throughout the region and the issues arising as a result of the areas which are not currently managed.

SECTION B: FOR RECOMMENDATION TO COUNCIL

CWCC19/07

Moved By: Cr B Quayle
Seconded By: Cr R McGuire

RECOMMENDED

THAT staff prepare a report for the next Central Waikato Catchment Committee to provide oversight of how drainage is managed throughout the region and the issues arising as a result of the areas which are not currently managed by Council.

The motion was put and carried
SECTION A: UNDER DELEGATION AND FOR THE INFORMATION OF COUNCIL

CWCC19/08

Moved By: E Wright
Seconded By: D Arbury

RESOLVED
THAT the report Central Waikato – Zone Status Report to 28 February 2019 (Central Waikato Catchment Committee 27 March 2019) be received.

The motion was put and carried

8. Update on Hill Country Erosion Fund and One Billion Tree Funding

Presented by Zone Manager, West Coast and Central Waikato Catchments (J Francis), the report provided the Committee with an overview on recent discussions, decisions and announcements concerning the 'Hill Country Erosion Fund' and 'One Billion Tree' funding opportunities.

During questions, answers and related discussion Committee members raised or noted the following matters:

- Staff advised that the One Billion Tree Funding regional sector bid was submitted to Te Uru Rakau (Forestry New Zealand) in January. At the time of bidding, regional council was of the understanding that staff resourcing would be covered by central government. Staff have since been advised that this is not the case.
- Staff highlighted that negotiations are progressing regarding how to apply the reduced rate of funding awarded under the Hill Country Erosion Funding programme across the zones. An update on the outcome of these negotiations and the impact on the zone for this financial year will be provided at the May Committee meeting.
- Members discussed the recently released Parliamentary Commissioner for the Environment, Simon Upton report on climate change and its recommended approaches to managing greenhouse gas emissions, particularly in relation to the ability of certain trees to offset these emissions. It was noted that the recommendations of the report might impact the type of trees council chooses to plant in future.

CWCC19/09

Moved By: S Edmunds
Seconded By: B Hicks

RESOLVED
THAT the report Update on Hill Country Erosion Fund and One Billion Tree Funding (Central Waikato Catchment Committee 27 March 2019) be received.

The motion was put and carried

9. Flood Campaign Update

Presented by Zone Manager, West Coast and Central Waikato Catchments (J Francis), the report provided the Committee with an update on the proposed communications campaign in relation to Council's flood protection and land drainage schemes.
Moved By: P Davies  
Seconded By: Cr B Quayle  

RESOLVED  
THAT the report Flood Campaign Update (Central Waikato Catchment Committee 27 March 2019) be received.  

The motion was put and carried

10. Dam Safety Management System - Update on Progress

Presented by Zone Manager, West Coast and Central Waikato Catchments (J Francis) and Team Leader Asset Management (Lisa Drysdale), the report provided the Committee with an update on progress of the Dam Safety Management System Programme of works and next steps occurring in 2019.

During questions, answers and related discussion Committee members raised or noted the following matters:

- Staff highlighted that the Central Waikato zone has two detention dams. Recent assessment of these dams showed that corrective actions to raise these dams to standard are needed. These actions will be covered within existing zone budgets – costs equate to $8.5k for the Central Waikato zone. Additional funding may be sought through annual planning processes, in the case of unexpected corrective actions being identified later in the project during the detailed investigation and planning stage.
- Members asked for detail regarding the extent of the corrective actions within the zone. Staff advised that actions included raising the dam heights, clearing of gorse and trees and removal of rubble within and around the detention dams.
- Members queried if there was a need for a risk management programme, until corrective actions had been undertaken. Staff assured that there was no imminent risk and that provided planned corrective actions were undertaken, a risk management plan was not needed.
- A member requested detail of the landowners of the affected sites and the provisions in place to ensure easy access for planned works. Staff advised that the land was owned by local farmers and that no easements were in place to ensure easy access. Staff undertook to provide further detail to the committee regarding ownership and legal arrangements for accessing the dams for future maintenance purposes.
- A member expressed interest in the ease of fish passage through the dams at present. Staff advised that the design of the dams (being detention dams) in conjunction with culverts situated at the foot of the dams, ensured easy travel of fish.
- A member highlighted the risk of increased seismic activity and queried if this had been taken into account during assessment of the dams. Staff confirmed that this had been included as part of the assessment criteria.
- A member raised the need to prioritise the programme of works based on high versus low risk matrices. Staff advised that prioritisation of works had been applied based on the assessment findings and that as a result it had been identified that two dams (one within the Lower Waikato and one within the Waihou Piako zone) required works to be undertaken within two years to safeguard against future issues.
- A member queried whether any trees were found to be growing on the dam walls. Staff advised that none were found on the two dams within the Central Waikato zone.
A member raised concern that costs could escalate should further works be identified as needed during the detailed investigation and planning stage of the project. Staff assured that identified corrective action costings had been based on “worst case” scenario to safeguard against potential cost escalation.

CWCC19/11

Moved By: Cr B Quayle
Seconded By: S Edmunds

RESOLVED

THAT the report Dam Safety Management System – Update on Progress (Central Waikato Catchment Committee 27 March 2019) be received.

The motion was put and carried

11. **Central Waikato Catchment - Te Awa Lakes development Alligator Weed biosecurity restriction**

Team Leader, Biosecurity Pest Plants (D Embling), presented a verbal presentation to the Committee regarding Alligator Weed biosecurity issues. The presentation (refer doc# 14023321) highlighted the following points:

- Alligator weed is a growing concern across the region, with 200 affected sites identified, 50 of which are located within the Hamilton area.
- The weed is particularly evasive, readily spreading through growth of dispersed fragments as opposed to seedlings. Herbicides are used to control the weed, however control is difficult across land, particularly along the banks of waterways.
- The weed readily competes with pasture growth and is toxic when eaten by animals, resulting in eczema and blinding. It also spreads within drains, creating blockage issues. Studies show that horticulture properties in Northland infected by the weed have had a 40% reduction in profit as a result. The exact impact on agriculture profits is yet to be determined.
- The Perry Sand Quarry site contains the largest infestation of Alligator weed within the Waikato. The main control on site is via herbicide gun and spray, boat and ground control team work. A Biosecurity Restricted Place Notice has been in place on the site since July 2004. This provides mechanism to control activity on and off site to protect against further spread.
- Noted water management of the weed is restricted to specific conditions, dictating when spraying can occur, involving early 5am boat control spraying and weekend work if necessary. This can be highly disruptive to affected landowners.
- Biosecurity Restricted place notices are issued under Rule 5.3.1 of the Waikato Regional Pest Management Plan and s130 of the Biosecurity Act. Consequences of breaching these notices involve up to $100k of fines or up to five years imprisonment for individuals and up to $200k of fines for companies. Landowners affected by Restricted Place Notices are required to advise prospective buyers of the implications of having these attached to the property prior to selling.
- The Te Awa Lakes development infestation will result in 1000 residential and commercial properties needing close monitoring and ground control going forward. The infestation found through works at the State Highway 1 bypass site involves 1000 affected properties. This will require significant funding of which is yet to be secured. Options for funding
include targeted rates, direct billing of work to landowners and/or securing a bond through development contributions.

- Work to include adequate funding mechanisms under the Regional Pest Management Plan provisions is currently being undertaken by staff.

During questions, answers and related discussion Committee members raised or noted the following matters:

- A member queried the type of communications being undertaken by Waikato Regional Council staff to raise awareness of the risk of Alligator weed across the region. Staff advised they have undertaken a vast range of communications including workshops, flyer drops, direct contact with landowners and the “See You Later Alligator Campaign”. Staff also highlighted that placement of a large coloured newspaper advertisement was the mechanism which triggered discovery of the Rototuna Alligator weed infestation of which a wide range of ground cover monitoring and works is now undertaken to ensure control of this area.

- A member highlighted the need to ensure affected sites are identified within Territorial Authority LIM reports. Staff advised that information of affected sites is currently held by WRC and not provided to Territorial Authorities.

- A member noted concern that Alligator weed was more than just a regional issue and should be advocated though central government as a national issue requiring dedicated funding at this level. Staff advised that central government has not prioritised funding for Alligator weed prevention and control and that the cost of control currently falls on rate payers. Staff have arranged for an economic assessment to be undertaken through the New Zealand Institute of Economic Research.

SECTION B: FOR RECOMMENDATION TO COUNCIL

CWCC19/12

Moved By: Cr P Southgate
Seconded By: S Edmunds

RECOMMENDED

a) THAT when the economic impact assessment determining the costs of Alligator weed is received from the New Zealand Institute of Innovation Research by staff, council then use this as a leverage tool and advocate to central government for support to manage Alligator weed at a national, regional and local level; and

b) THAT staff present the Alligator Weed presentation presented at the 27 March 2019 Central Waikato Catchment Committee to the upcoming Waikato Central Drainage Advisory Subcommittee Meeting; and

c) THAT staff present the Alligator Weed presentation presented at the 27 March 2019 Central Waikato Catchment Committee to the upcoming Mayoral Forum

The motion was put and carried

- A member questioned whether staff were targeting farmers as part of their work to educate members of the community of the risk of Alligator weed. Staff advised limited work with farmers had been undertaken to date, however they noted that this is to be a focus in future.
• Mayor A King noted the need to implement a rate across the whole region to fund works to safeguard future generations against Alligator weed spread and its implications.

CWCC19/13
Moved By: M Moana-Tuwhangai
Seconded By: B Hicks

RECOMMENDED
THAT staff investigate options for implementing Mayor King’s recommendation to implement a region wide rate to fund works to safeguard future generations against Alligator weed spread and its implications.

The motion was put and carried

SECTION A: UNDER DELEGATION AND FOR THE INFORMATION OF COUNCIL
CWCC19/14
Moved By: D Arbury
Seconded By: Cr R McGuire

RESOLVED
THAT the report Central Waikato Catchment - Te Awa Lakes development Alligator Weed biosecurity restriction (Central Waikato Catchment Committee 27 March 2019) be received.

The motion was put and carried

12. Hamilton City Council presentations

Stormwater Master Plan, ICMPs
Andrea Phillips (Hamilton City Council), presented a verbal presentation to the Committee regarding the Stormwater Master Plan and Integrated Catchment Management Plans (ICMPs). The presentation (refer doc# 14040465) highlighted the following points:
• Integrated Catchment Management Plans are being developed per catchment by Hamilton City Council in response to drivers from central and local government for improved management of stormwater.
• They provide for better high level understanding of the nature of stormwater (quantity and quality) within the Hamilton City catchments taking into account the effects of urban growth and recognising effects on culturally significant sites and receiving environments. Information to inform on these matters is illustrated through use of GIS data and the development and inclusion of associated maps.
• This also helps to identify issues and opportunities for better management of stormwater throughout the city. This mapping work also provides better oversight of existing and planned stormwater management devices which are critical to the success in better managing stormwater through the city.
During questions, answers and related discussion Committee members raised or noted the following matters:
• A member queried regarding the use of a master plan to predict effects of additional impervious surfaces as a result of future growth and the likelihood of increased infilled development. Staff confirmed this is a focus of the master plan.
Members raised the need for both Hamilton City Council and Waikato Regional Council to work closely together to ensure mitigation measures are adequate to ensure stormwater volumes are not adversely affecting adjacent and outlying rural areas. Staff advised that they recognise the effects of urban development and stormwater flows on rural drainage and in response to this regularly liaise with the Waikato Regional Council drainage manager to ensure interests are aligned and accounted for.

A member highlighted the increased need for urban development to include water efficiency measures. Staff advised of the Hamilton City Council District Plan rule which requires all new residential developments to install water efficiency measures.

CWCC19/15

Moved By: B Hicks
Seconded By: Cr S Kneebone

RESOLVED

THAT the verbal presentation from Hamilton City Council, Stormwater Master Plan, ICMPs (Central Waikato Catchment Committee 27 March 2019) be received.

The motion was put and carried

LIBS Strategy

Matthew Vare (Waikato Regional Council), presented a verbal presentation to the Committee regarding the LIBS Strategy. The presentation (refer doc# 13991277) highlighted the following points:

- Two pilot projects have been undertaken (one with a rural and one with an urban focus) to develop a framework and toolbox to give effect to the aspirations of Waikato Regional Policy Statement of better integrating biodiversity across the region in future.
- The urban pilot project focussed on increasing ecologically significant land across Hamilton, with the aim of lifting the current area of ecologically significant land across the city from 1.5% to a minimum target of 10%.
- The project has resulted in the development of a collective impact framework, comprising five key success factors including: a common agenda, shared measurements, mutually reinforcing activities, continuous communication and backbone support.
- Achievement of the success factors relies on utilising a range of tools. Potential tools have been identified and are being developed, including: a phone app to assist with community contributions to habitat restoration, a prioritisation guide developed in collaboration with Hamilton City hapu which takes into account community and cultural values, an online ecosystem mapping tool expanding on the existing Hamilton City valley guide to inform landowners regarding potential plantings on their property that will best attract native biodiversity on their land, targeted branding centred around restoring and reconnecting communities, development of a monitoring framework which could be utilised to monitor progress of biodiversity across the city, an online map and communication tool, a funding toolkit and a carbon forestry assessment which highlighted 270ha of land across the city as exhibiting capability to offset plantings with carbon credits. Work has also been undertaken to find ways of integrating biodiversity into Hamilton City Council business.
- A structure was also developed under the pilot project to guide how governance would be best structured to ensure all contributing parties are working effectively together to achieve the shared biodiversity outcome targets.
- The next steps in order to implement the findings from the pilot project involve HCC developing its own biodiversity strategy. A workshop is being scheduled to initiate
community engagement to develop the strategy. Hamilton City Council have committed to bringing this strategy to their members for endorsement by the end of September this year.

During questions, answers and related discussion Committee members raised or noted the following matters:

- A member highlighted that a strategic approach to engage well informed hapu as part of development of the prioritisation guide should be employed. Staff advised that they have engaged with hapu to ensure the prioritisation guide encompasses all cultural values. Ngati Haua have been engaged as the key initiators of this who in turn will roll this out to other hapu.
- A member queried regarding whether the committee is considered a key party of the biodiversity governance structure. Staff advised that the committee would fall within the middle tier of the governance structure and that the committee would need to firstly clearly identify its roles and responsibilities in order to effectively operate within the collective impact framework and achieve its desired biodiversity outcomes.
- A member raised the importance of developing well defined monitoring outcomes in order to track whether initiatives undertaken in response to the urban pilot project are achieving the target of 10% ecologically valuable land across the city.

CWCC19/16

Moved By: Cr S Kneebone
Seconded By: P Davies

RESOLVED

THAT the verbal presentation from Hamilton City Council, LIBS Strategy (Central Waikato Catchment Committee 27 March 2019) be received.

The motion was put and carried

Project Watershed Q2

Adam Donaldson (Hamilton City Council), presented a verbal presentation to the Committee regarding Project Watershed Q2. The presentation (refer doc# 13885181) highlighted the following points:

- Visual inspection and physical works continue to be carried out by Hamilton City Council staff as per contractual arrangements with Waikato Regional Council.
- The dry summer has allowed for a wide range of visual inspection and associated clearance work to be carried out.
- Highlighted the effects of recent willow and poplar clearance at the Kirikiriroa outlet to the Waikato River. Clearance resulted in alterations to the stream flow path which impacted on erosion control works further downstream, causing controls to become null and void.

During questions, answers and related discussion Committee members raised or noted the following matters:

- Staff raised concerns with regards to the situation regarding access to carry out erosion remediation works on the Te Awa o Katapaki Stream. Negotiations have been ongoing for the past year and has been raised at previous committee meetings. There has been no resolution to date.
- Staff noted that a particular tenant had been reluctant to allow Hamilton City Council staff adequate access to their land on the northern side of the stream, in order to undertake the required erosion control works. Staff highlighted that reluctance was due to the specific
nature of part of the works requiring an access track to be constructed on a tenant’s property for work to be carried out safely. This would result in the tenant losing a small area of land, however this land is already slipping and suffering significant erosion. There had been ongoing dialogue around the implications of this including a request for compensation

- Hamilton City Council staff noted that compensation by their Council for loss of assets could be difficult to obtain due to the land not being within their jurisdiction.
- The prevention of access to undertake the required works has caused concern of ongoing health and safety risk to those occupying land. Staff noted that a significant rain event could result in further land collapse at the locality.
- Staff highlighted that the window for being able to undertake the required works in favourable conditions was nearing an end.
- Legal advice had been sought by Waikato Regional Council with regards to gaining access to the site, however staff preferred to gain access via agreement with Waikato District Council and their tenant with the interest of retaining good working relationships.
- Cr R McGuire undertook to discuss the need to resolve the land access issue with Waikato District Council staff this week.

CWCC19/17

Moved By: S Edmonds  
Seconded By: Cr P Southgate

RESOLVED

THAT the presentation on Project Watershed Q2 be received for information.

The motion was put and carried

Prior to closing the meeting the Chair advised the committee members that the May committee meeting would be J Francis’ final meeting as Zone Manager, West Coast and Central Waikato Catchments. The Chair acknowledged J Francis’ contribution to the committee.

Meeting closed at 12.55pm
Central Waikato Catchment Committee 27 March 2019

Minutes of Central Waikato Catchment Committee of 27 March 2019.

M Moana-Tuwhangai spoke to the minutes.

During questions, answers and related discussion the following was noted:

- The issue of drainage clearance at Lake Ngaroto and impacts on adjacent landowners was highlighted.
- A member advised that Cr P Southgate was seeking to strengthen the relationship between Hamilton City Council and Waikato Regional Council by attending the committee.

ICM19/41
Moved by: M Moana-Tuwhangai
Seconded by: Cr S Kneebone

RESOLVED (SECTION A):

1. THAT The minutes of the Central Waikato Catchment Committee meeting held on 27 March 2019 be received; and
2. THAT the decisions in Section A of the report be noted.

The motion was put and carried

ICM19/42
Moved by: M Moana-Tuwhangai
Seconded by: Cr S Kneebone

RECOMMENDED (SECTION B)

THAT the recommendations contained in Section B of the report be endorsed - being:

Item 7: Central Waikato Zone Status Report

THAT staff prepare a report for the next Central Waikato Catchment Committee to provide oversight of how drainage is managed throughout the region and the issues arising as a result of the areas which are not currently managed by Council.

Item 11: Central Waikato Catchment - Te Awa Lakes development Alligator Weed biosecurity restriction

1. THAT when the economic impact assessment determining the costs of Alligator weed is received from the New Zealand Institute of Innovation Research by staff, council then use this as a leverage tool and advocate to central government for support to manage Alligator weed at a national, regional and local level; and
2. THAT staff present the Alligator Weed presentation presented at the 27 March 2019 Central Waikato Catchment Committee to the upcoming Waikato Central Drainage Advisory Subcommittee Meeting; and

3. THAT staff present the Alligator Weed presentation presented at the 27 March 2019 Central Waikato Catchment Committee to the upcoming Mayoral Forum

4. THAT staff investigate options for implementing Mayor King’s recommendation to implement a region wide rate to fund works to safeguard future generations against Alligator weed spread and its implications.

   The motion was put and carried
Report to Central Waikato Catchment Committee

Date: 18 April 2019

Author: Jolene Francis, Zone Manager West Coast and Central Waikato Catchments

Authoriser: Clare Crickett, Director, Integrated Catchment Management

Subject: Issue/Actions Report May 2019

Section: A (Committee has delegated authority to make decision)

Purpose
1. To report back on actions and issues discussed at the Central Waikato Catchment Committee meeting held on 27 March 2019 and previous meetings.

Executive Summary
2. An update on Central Waikato Zone actions will be given at the meeting.

Staff Recommendation:
That the report Issues/Actions Report May 2019 (Central Waikato Catchment Committee Meeting 10 May 2019) be received.

Issues and Actions
3. Table 1 lists resolutions and matters arising and issues raised from previous meetings that are tracked over time.
Table 1: Summary of matters raised at the 27 March 2019 meeting and earlier meetings, and the actions that have followed.

<table>
<thead>
<tr>
<th>Date</th>
<th>Matters Arising</th>
<th>Actions</th>
<th>Status update</th>
<th>Responsible</th>
</tr>
</thead>
<tbody>
<tr>
<td>29/11/17</td>
<td><strong>Waikato River Stability Management Strategy (SMS)</strong></td>
<td>Place Group Environmental Ltd have recently been engaged to facilitate the progression of this strategy. As a first step, a stakeholder workshop is to be held in May 2019 to discuss/confirm a draft management framework for the stability strategy and potential management/governance arrangements for actions.</td>
<td>In progress</td>
<td>Zone Manager</td>
</tr>
<tr>
<td></td>
<td>• Explore the potential to include the Waikato River Authority in its membership.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21/03/2018</td>
<td><strong>Zone communications</strong></td>
<td>Positive feedback was received from committee members on the West Coast newsletter circulated by the Zone Manager. A draft newsletter is to be developed and brought to the May committee meeting for feedback.</td>
<td>On Hold</td>
<td>Zone Manager</td>
</tr>
<tr>
<td></td>
<td>• Questions were raised as to whether zone information in the form of a newsletter or similar, could be produced to assist committee members to inform their parent organisations etc.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• A report back on the Zone Communications Plan would be timely.</td>
<td>The Zone Communications plan is on hold pending the outcome of a review of the plan template by the Section Manager.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>05/03/2018</td>
<td><strong>Items for Meetings in 2018/2019</strong></td>
<td>Potential items for report back:</td>
<td>Completed</td>
<td>Zone Manager</td>
</tr>
<tr>
<td></td>
<td>• Rotokauri – Waikato Regional Council/Hamilton City Council (HCC) catchment management in this area.</td>
<td>• An overview of the HCC Stormwater Master Plan and guidelines – to be reported on at the March 2019 by HCC.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Update on Integrated Catchment Management Plans in preparation (HCC).</td>
<td>• An update on Integrated Catchment Management Plans (HCC) to be reported by HCC at the March 2019 meeting.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Stormwater Guideline development.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Update on Healthy Rivers.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27/03/2019</td>
<td><strong>Central Waikato Zone Status Report</strong></td>
<td>• Emailed to the committee on 18 April 2019.</td>
<td>Complete</td>
<td>Zone Manager</td>
</tr>
<tr>
<td></td>
<td>Noted budget expenditure year to date is tracking below forecast due to delays in the processing of contract costs relating to river management works under the HCC project watershed programme.</td>
<td>An update before the next meeting was requested and will be provided in April to the committee.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>An update before the next meeting was requested and will be provided in April to the committee.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27/03/2019</td>
<td><strong>Central Waikato Zone Status Report</strong></td>
<td>• To be presented at the committee meeting on 10 May 2019.</td>
<td>In Progress</td>
<td>Section Manager</td>
</tr>
<tr>
<td></td>
<td>Members requested to be provided with oversight of how drainage is managed throughout the region and the issues arising as a result of the areas which are not currently managed by Council.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>Description</td>
<td>Status</td>
<td>Responsible Party</td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>------------------------------------------------------------------------------</td>
<td>-------------------</td>
<td>---------------------------------</td>
<td></td>
</tr>
<tr>
<td>27/03/2019</td>
<td><strong>Dam Safety Management System - Update on Progress</strong>&lt;br&gt;A member requested detail of the landowners of the affected sites and the provisions in place to ensure easy access for planned works. Staff advised that the land was owned by local farmers and that no easements were in place to ensure easy access. Staff undertook to provide further detail to the committee regarding ownership and legal arrangements for accessing the dams for future maintenance purposes.</td>
<td>In progress</td>
<td>Asset Management Team Leader</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Currently being followed up with the Asset Management Team Leader. To be presented back to the committee at future meeting.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27/03/2019</td>
<td><strong>Central Waikato Catchment - Te Awa Lakes development Alligator Weed biosecurity restriction</strong>&lt;br&gt;THAT staff investigate options for implementing Mayor King’s recommendation to implement a region wide rate to fund works to safeguard future generations against Alligator weed spread and its implications.</td>
<td>In Progress</td>
<td>Biosecurity</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Currently being followed up with the Biosecurity team. To be presented back to the committee at future meeting.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Key:**
- Complete
- On plan / work in progress
- Issues being addressed
- Not completed / on hold / at risk
Report to Central Waikato Catchment Committee

Date: 16 April 2019
Author: Jolene Francis, Zone Manager West Coast and Central Waikato Catchments
Authoriser: Clare Crickett, Director, Integrated Catchment Management
Subject: Central Waikato Chairperson Report – Verbal Update
Section: A (Committee has delegated authority to make decision)

Purpose
1. The Chairperson of the Central Waikato Catchment Committee, Maxine Moana-Tuwhangai, will provide a verbal update to the catchment committee on various items of interest.
2. Members are asked to pre-read the minutes from the previous Integrated Catchment Management Committee meetings, and raise questions as required during the Chairperson’s Report.
3. Minutes and Agendas can be found on Waikato Regional Council’s website at Agendas and minutes.

Staff Recommendation:
That the report Central Waikato Chairperson Report – Verbal Update (Central Waikato Catchment Committee 10 May 2019) be received.
Report to Central Waikato Catchment Committee

Date: 18 April 2019

Author: Jolene Francis, Zone Manager – West Coast and Central Waikato Catchments

Authoriser: Clare Crickett, Director, Integrated Catchment Management

Subject: Central Waikato Zone Status Report – May 2019

Section: A (Committee has delegated authority to make decision)

Purpose
1. To provide the Catchment Committee with an update on financial performance and status of zone activities to 31 March 2019, including the activities undertaken by Hamilton City Council for the Central Waikato zone.

Executive Summary
2. Financials to end of April 2019 were not available in time for this meeting. As at 31 March 2019, Budget expenditure year to date is on track.

Staff Recommendation:
That the report Central Waikato Zone Status Report May 2019 (Central Waikato Catchment Committee 10 May 2019) be received.

Financial Commentary
3. Budget expenditure year to date is back on track.

![Central Waikato - Zone Operating](chart.png)
Table 1: Central Waikato Zone Financial Summary through to 31 March 2019 - by activity

**Central Waikato Catchment**  
Mar-19 NZD

<table>
<thead>
<tr>
<th></th>
<th>YTD Actual</th>
<th>YTD Budget (Revised)</th>
<th>Variance</th>
<th>FY Budget (Revised)</th>
<th>FY Budget Ann Plan</th>
<th>% Spent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MAINTENANCE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Catchment Oversight</td>
<td>122,098</td>
<td>167,947</td>
<td>45,849</td>
<td>264,657</td>
<td>277,657</td>
<td>46%</td>
</tr>
<tr>
<td>Information and Advice</td>
<td>23,817</td>
<td>49,972</td>
<td>26,155</td>
<td>69,318</td>
<td>77,318</td>
<td>34%</td>
</tr>
<tr>
<td>Catchment Maintenance</td>
<td>4,710</td>
<td>17,994</td>
<td>13,284</td>
<td>29,090</td>
<td>36,090</td>
<td>16%</td>
</tr>
<tr>
<td>Catchment New Works</td>
<td>107,129</td>
<td>73,877</td>
<td>(33,252)</td>
<td>176,615</td>
<td>171,615</td>
<td>61%</td>
</tr>
<tr>
<td>River Management</td>
<td>63,339</td>
<td>52,731</td>
<td>(10,608)</td>
<td>115,554</td>
<td>115,554</td>
<td>55%</td>
</tr>
<tr>
<td>River Management HCC</td>
<td>325,364</td>
<td>306,481</td>
<td>(18,883)</td>
<td>525,149</td>
<td>525,149</td>
<td>62%</td>
</tr>
<tr>
<td>River Improvement</td>
<td>48,536</td>
<td>68,937</td>
<td>20,401</td>
<td>192,923</td>
<td>201,923</td>
<td>25%</td>
</tr>
<tr>
<td></td>
<td>694,993</td>
<td>737,939</td>
<td>42,946</td>
<td>1,373,316</td>
<td>1,495,316</td>
<td>51%</td>
</tr>
<tr>
<td>Interest on reserve expense</td>
<td>(41,668)</td>
<td>(40,257)</td>
<td>1,411</td>
<td>(53,675)</td>
<td>(53,675)</td>
<td>78%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL OPERATING EXP (OPEX)</strong></td>
<td>653,325</td>
<td>697,682</td>
<td>44,357</td>
<td>1,319,641</td>
<td>1,351,641</td>
<td>50%</td>
</tr>
</tbody>
</table>

**Funded by**

<table>
<thead>
<tr>
<th></th>
<th>YTD Actual</th>
<th>YTD Budget (Revised)</th>
<th>Variance</th>
<th>FY Budget (Revised)</th>
<th>FY Budget Ann Plan</th>
<th>% Spent</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Rate</td>
<td>185,166</td>
<td>185,166</td>
<td>0</td>
<td>246,887</td>
<td>246,887</td>
<td>(75)%</td>
</tr>
<tr>
<td>Targeted Rates</td>
<td>551,737</td>
<td>547,335</td>
<td>4,402</td>
<td>729,794</td>
<td>729,794</td>
<td>(76)%</td>
</tr>
<tr>
<td>Direct Charges</td>
<td>21,943</td>
<td>0</td>
<td>21,943</td>
<td>0</td>
<td>0</td>
<td>n/m</td>
</tr>
<tr>
<td>Other Income</td>
<td>35,149</td>
<td>0</td>
<td>35,149</td>
<td>0</td>
<td>0</td>
<td>n/m</td>
</tr>
<tr>
<td></td>
<td>793,995</td>
<td>732,501</td>
<td>61,494</td>
<td>976,671</td>
<td>976,671</td>
<td>(81)%</td>
</tr>
</tbody>
</table>
4. The status of activities and report against 2018-2028 key performance indicators through 31 March 2019 are presented in Table 2.

Table 2. 2018 – 2028 Long Term Plan Key Performance Indicators

<table>
<thead>
<tr>
<th>Activity</th>
<th>Level of service</th>
<th>Performance measure</th>
<th>Target</th>
<th>Commentary (as at 31 March 2019)</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flood Protection</td>
<td>To provide the standard of flood protection agreed with communities (as set out in zone plans and associated documents).¹</td>
<td>Major flood control works are maintained, repaired and renewed to the key standards defined.</td>
<td>Achieved</td>
<td>Flood protection provided within the Central Waikato zone is within the agreed service levels of the Lower Waikato Waipa Flood Control Scheme. These measures have been met year to date.</td>
<td>Good</td>
</tr>
<tr>
<td>River management</td>
<td>To achieve a balance between maintaining channel capacity, channel stability and environmental values in the management of priority rivers and streams in each management zone.</td>
<td>Percentage of river instability enquiries responded to within three days, and appropriate actions taken on a prioritisation basis.</td>
<td>95%</td>
<td>There have been no river instability enquiries recorded for Central Waikato Zone for the year to date.</td>
<td>Good</td>
</tr>
</tbody>
</table>

¹ The plans set out time frames under which flood response actions are to be completed.
<table>
<thead>
<tr>
<th>Activity</th>
<th>Level of service</th>
<th>Performance measure</th>
<th>Target</th>
<th>Commentary (as at 31 March 2019)</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land drainage</td>
<td>To provide reliable water table management on land within drainage schemes for the purpose of maintaining pastoral production.</td>
<td>Number of reported incidences where it takes more than three days to remove surface water after events with up to a 10% annual exceedance probability.</td>
<td>Less than 5% RTC</td>
<td>No incidents have been reported year to date to have occurred within Waikato Regional Council drainage schemes where surface rainwater took more than 3 days to drain.</td>
<td></td>
</tr>
<tr>
<td><strong>Integrated Catchment Management - Biosecurity</strong></td>
<td>To control plant and animal pests within the Waikato region to maintain and enhance biodiversity and protect agricultural productivity and community health.</td>
<td>Average number of possums caught for every 100 traps set for possum operations.</td>
<td>Less than 5% Residual Trap Catch (RTC) for ground control Less than 3% RTC aerial control.</td>
<td>An annual update on work within the zone was given at the November 2018 meeting.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reducing trend in the number of known sites for each species of eradication pest plant (plant pests with limited distribution or density).</td>
<td>Achieved</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biodiversity</td>
<td>Work with partners, stakeholders and community to maintain and enhance indigenous biodiversity.</td>
<td>Improving trend in the habitat condition score of sites under active management.</td>
<td>Achieved</td>
<td><strong>Hamilton Halo:</strong> All of the control works that were carried out in 2018 were successful, with the numbers of tracking tunnels showing signs of rats at the conclusion of control operations being lower than required. A Request for Tender is about to be sent to approved contractors for rat and possum control in Hope Bush and Johnstone’s Block in Old Mountain Rd for a third year, in Te Miro and Pukemako for a second year and in an additional area at Tirohanga Rd. <strong>Project Echo:</strong> Waikato Regional Council made a significant contribution to the latest survey of native long-tailed bats in Hamilton City. As with previous surveys, automatic bat monitors were deployed at potential habitats across the city, but bats were found to be confined almost entirely to the southern gully systems. Potential habitats to the north, including Seeley</td>
<td></td>
</tr>
<tr>
<td>Activity</td>
<td>Level of service</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Catchment planning and management</strong></td>
<td>Work with partners, stakeholders and community to improve soil conservation and water quality.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Environmental farming systems</strong></td>
<td>Work with partners, stakeholders and community to promote land management practices to improve environmental and agricultural sustainability.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Performance measure</th>
<th>Target</th>
<th>Commentary (as at 31 March 2019)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Projects funded through the Environmental Initiatives Fund (EIF) achieve milestones as per the funding agreement.</td>
<td>100%</td>
<td>The Small Scale Community Initiatives Fund (SSCIF) provides funding grants up to $5,000 to support volunteer community groups and individuals undertaking ecological restoration through animal and plant pest control. This funding round opens on 11 March 2019 (this round is for community groups only). The Environmental Initiatives Fund (EIF) has one round per financial year and for 2018/19 this was held in July 2018. 18 applications were received and 14 were approved – one of these had relevance to the Central Waikato Zone and this was a small grant of $3,935 to the Twin Rivers Community Art Centre in Ngaruawahia to run a kauri dieback community education programme.</td>
</tr>
<tr>
<td>Percentage of people (as surveyed) who participate in extension programmes organised by Waikato Regional Council who make a change in agricultural practice within 12 months of attendance.</td>
<td>30%</td>
<td>The survey is due to be undertaken early in 2019.</td>
</tr>
<tr>
<td>Identify priority sub catchments and sites for soil conservation and remediation.</td>
<td>Achieved</td>
<td>Refer to Focus Area 1 below.</td>
</tr>
</tbody>
</table>

Gully, Claudelands Bush, Forest Lake or Horseshoe Lake had no bats recorded during the survey. **Mangaonua Stream**: A landowner living at Butcher Rd, Tamahere had repeatedly seen bats in the bush area on their property. They requested assistance with predator control to safeguard the bats that might be roosting at the site. Pest control supplies have been provided.
Zone Plan Goals and Focus Areas

5. The goals for the Central Waikato zone are:

   - **Goal 1:** Contribute to improving water quality within priority catchments in the zone.
   - **Goal 2:** Maintain and enhance the indigenous biodiversity associated with the Waikato River, its tributaries and wetlands and lakes across the zone.
   - **Goal 3:** Manage the instream impacts of urban development and land use intensification in association with territorial authorities and other partners.
   - **Goal 4:** Work collaboratively with iwi, territorial authorities and communities to align and integrate projects and priorities within the zone.

6. These Goals are to be achieved through actions within the 11 Focus Areas (refer to Section 5 of the Central Waikato Zone Plan). The relationship of the Focus Areas and Goals is presented in Attachment 1. Reporting against these Focus Areas is as follows (Table 3).

### Table 3. Progress against the 11 Zone Plan Focus Areas and activities

<table>
<thead>
<tr>
<th>Focus Area</th>
<th>Actions/Targets 2018/2019</th>
<th>Commentary</th>
<th>Status</th>
</tr>
</thead>
</table>
| 1. Catchment new works in priority catchments | • Raise awareness of assistance available for erosion control and soil conservation in priority catchments.  
• Inspections, advice, prepare Environmental Farm Plans, promote best practice, prepare funding applications and achieve legal security over assets.  
• Progress toward 80% works undertaken in priority catchments by 2019.  
• Development of a targeted monitoring programme. | • Regular visits are being made to farms and lifestyle blocks giving advice and information on erosion control, riparian planting and sustainable land management.  
• Lake Maratoto Waikato River Authority (WRA) project – work continued controlling weeds in preparation of additional native planting along the western buffer.  
• Mangaonua catchment project – see Iwi Engagement section below.  
• Lake flocculation WRA project – NIWA carried out sediment sampling from the 7 lakes (a gradient of lakes from peat to riverine). These were tested to see how effective the flocculants, alum and allophane, were at clearing the water of these lakes and ‘locking’ phosphorus into the lake sediments. The results were inconclusive. Contributions from WRC to this study have suspended for now. |        |
<table>
<thead>
<tr>
<th>Focus Area</th>
<th>Actions/Targets 2018/2019</th>
<th>Commentary</th>
<th>Status</th>
</tr>
</thead>
</table>
| **2. Catchment maintenance works** | • Maintain accurate up to date database.  
• Inspect assets at least 3 yearly.  
• Confirm annual maintenance programmes in consultation with landowner.  
• Ensure landowners are aware and meet obligations under agreements.  
• Support development of regional maintenance policy.  
• Work with other agencies to develop processes for sharing information. | Follow-up work relates specifically to weed control and some small in-fill planting. |  |
| **3. Preparing for change** | • Assist landowners to adapt to new expectations and rules of Plan Change 1.  
• Develop and implement a sustainable agriculture extension programme.  
• Build capacity within agriculture industry to support farmers in adapting to funding within limits.  
• Ensure various initiatives are aligned across Waikato Regional Council, industry and community. | • The Council is currently developing and updating fact sheets, brochures and booklets to help inform land owners of the plan change rules.  
• Staff are currently involved with Farm Environment Plan (FEP) workshops in conjunction with Beef and Lamb designed to help farm owners through the plan change process.  
• A series of field days were held during 2018 encompassing the following topics:  
  ➢ Poplar Pole planting  
  ➢ Water quality  
  ➢ Soil conservation/erosion control  
  ➢ Better understanding of nutrient and Overseer modelling  
  ➢ Afforestation  
  ➢ Identification of critical source areas  
• Work is being done to assist with critical source identification with the aim to categorise areas of high importance and planning to help with budgeting  
• Waikato Regional Council (WRC) has conducted three soil conservation workshops for rural professionals as part of the qualifications that will be needed to be a certified farm environment planner.  
• Waikato Regional Council has initiated and facilitated sector group meetings with  
  • Dairy  
  • Dry stock  
  • Horticulture  
  • Arable |  |
<table>
<thead>
<tr>
<th>Focus Area</th>
<th>Actions/Targets 2018/2019</th>
<th>Commentary</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. River management</td>
<td>• Promote river management best practice.</td>
<td>Best practice continues to be promoted in discussions with landowners as issues arise. All enquiries have been responded to and implementation plans have been put in place to undertake works where required. Recent work sites have had inspections and maintenance actions developed/undertaken where required.</td>
<td></td>
</tr>
<tr>
<td>5. Landowner, stakeholder and community engagement</td>
<td>• Improve understanding and education of catchment management activities.</td>
<td>Potential opportunities in this space need to be explored.</td>
<td></td>
</tr>
<tr>
<td>6. Collaborate with stakeholders to achieve the greatest value - communication and partnership</td>
<td>• Develop relationships internally, across directorates and with other organisations.</td>
<td>Relationships across directorates continues to be progressed. In particular, discussions are ongoing with Science and Strategy in relation to the zone based monitoring programmes and with Resource Use in regard to stormwater management guidelines. These matters will be reported to a future Catchment Committee meeting.</td>
<td></td>
</tr>
<tr>
<td>7. Working in partnership with Hamilton City Council (HCC)</td>
<td>• Collaborate with HCC the Project Watershed Service Level Agreement and related works programme and agreed outcomes.</td>
<td>Regular liaison between the two councils occurs on a range of matters. HCC presented on their Stormwater Master Plan, LIBS strategy, ICMPs and Project Watershed at the 27 March 2019 meeting.</td>
<td></td>
</tr>
<tr>
<td>Focus Area</td>
<td>Actions/Targets 2018/2019</td>
<td>Commentary</td>
<td>Status</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td><strong>8. Iwi engagement</strong></td>
<td>• Progress understanding and actions in relation to the impacts of urban growth on tributary streams.</td>
<td>Strong relationships exist with Ngati Haua in the Mangaonua and Mangaone catchment. The Ngati Haua Mahi Trust has gained funding from the WRA for a three year project to plant the main stems and tributaries in these catchments. Waikato Regional Council is supporting the project through its catchment new works and river management budgets and staff. At a recent meeting led by Ngati Haua, objectives for the project were identified, these included the use of Matarauunga Maori methodology when assessing the state of the waterways. Ngati Haua received funding for planting of the Karapiro Gully and in liaison with Waikato Regional Council, a maintenance programme and planting plan were developed. Ngati Haua Mahi Iwi and Ngati Koroki Kahukura gave their support to the central zone WRA application which was successful.</td>
<td></td>
</tr>
</tbody>
</table>
| **9. Community resilience to floods and high rainfall** | • Build trust and credibility by strengthening relationships with mana whenua.  
• Understand mana whenua objectives and priorities and incorporate into new works projects.  
• Be responsive and adaptable to Treaty settlement outcomes.                                                                                                                                                                                                                                                  | These matters are to be progressed in a more focused manner in the latter portion of the year.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |        |
| **10. Biosecurity operations**                 | • Support the review of the Regional Pest Management Plan (RPMP).  
• Support collaborative opportunities through Predator Free 2050.  
• Support collaborative opportunities.                                                                                                                                                                                                                                                  | The RPMP Review will commence later in the year.  
• Waikato Regional Council biosecurity staff and Hamilton City Council Parks staff work collaboratively on a day to day basis in regard to pest plant control.                                                                                                                                                                                                                                                                                                                                                       |        |
| **11. Biodiversity and natural heritage operations** | • Develop a Willis Report implementation plan for the Central Waikato zone.  
• Incorporate outcomes of the Local Indigenous Biodiversity Strategy (Pilot Project)  
• Work with Enviroschools coordinators to promote biodiversity                                                                                                                                                                                                                                                                  | Willis Report implementation plan  
Plans are in the early stages. Consideration is being given to the range of information to be included and the possible sources for that information.  
Enviroschools  
Enviroschools have not identified anything specific for us to contribute. However, we have been working with schools at various events. We took the Halo game to an A&P Show Learning Event for Primary |        |
Focus Area | Actions/Targets 2018/2019 | Commentary | Status
---|---|---|---
• Review Best Management Practices for restoration planning. | and Intermediate students and to a Conservation Week event for schools out at Waiwhakareke in the latter months of last year. |  | 
• Monitor the success of biodiversity projects and programmes. |  |  | 
• Develop and implement restoration/enhancement plans for priority areas |  |  | 
• Incorporate biodiversity objectives into flood protection and river management work programmes. |  |  | 

7. HCC undertakes a number of projects and activities under the Central Waikato work programme under the agreement with WRC. The first quarter of the work programme is complete and will be presented at this meeting.

**Waikato Stormwater Management Guidelines**

8. Two draft guidelines were prepared: “Waikato Stormwater Management Guideline” and “Waikato Stormwater Runoff Modelling Guideline”. The target audience for these guidelines comprises developers, consultants, Territorial Authorities (TA’s) and council staff. The guidelines will help inform the design of stormwater management systems for existing developed areas and for proposed new growth areas to avoid, remedy and mitigate potential downstream effects. They reflect the local land and conditions in the Waikato (e.g. local soils). The Waikato Stormwater Management Guideline also includes a chapter on managing the effects of urban stormwater discharges to WRC managed drainage areas.

9. The guidelines were released in June 2018 and are available on the regional council website.

10. Three stormwater workshops are being held across the region with the Territorial Authorities. The Taupo workshop was held in March 2019, and the Hamilton one is scheduled for 14 May 2019. The TA’s attending will be Waitomo, Hamilton City and Waipa. These workshops offer an opportunity for TA’s to raise and discuss any issues, feedback and improvements on the Waikato Stormwater Guidelines with an update of the guidelines to be released in July 2019. The final workshop is scheduled for 21 May 2019 in Paeroa.

11. HCC presented on the HCC Stormwater Master Plan at the March 2019 meeting.
# FOCUS AREAS AND GOALS

Relationship between each focus area and the zone goals.

<table>
<thead>
<tr>
<th>Focus area</th>
<th>Goal 1: Water quality</th>
<th>Goal 2: Biodiversity enhancement</th>
<th>Goal 3: Urban development</th>
<th>Goal 4: Relationships/collaboration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Catchment new works in priority catchments</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Catchment maintenance works</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Preparing for change</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. River management</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Landowner, stakeholder and community engagement</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Collaborate with stakeholders to achieve the greatest value - communication and partnership</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Working in partnership with Hamilton City Council</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Iwi engagement</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Community resilience to floods and high rainfall</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Biosecurity operations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Biodiversity and natural heritage operations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Reference: Central Waikato Zone Plan (2017).

# Attachment 2

HCC Q3 report
To: River and Catchment Services, Waikato Regional Council
From: Hamilton City Council
Subject: Project Watershed Works Quarter 3 Report 2018/19

1. Purpose of the Report
1.1. The purpose of this report is to:
   a. Provide Waikato Regional Council and relevant Committee(s) with highlights of the 2018/19 works programme carried out under the Project Watershed service level agreement.
   b. Report on the HCC’s project watershed financial year to date operating performance.

2. 2018/19 Year Work Programme Update

   Waters – Stream Maintenance

2.1. Removal of obstructions identified during previous quarterly visual inspections has occurred within the Mangaonua and Kirikiriroa catchments during this period. For areas Works consisted of spraying, drain cleaning (mechanical and by hand), removal of any fallen trees, inlet/outlet maintenance, and control of weed and pest species.

2.2. The Te Awa o Kati Paki stream area from the River Road culvert and the Waikato River confluence remains a high-risk item through elevated hydraulic loading on the system (Waikato River levels and catchment rainfall). This has resulted in areas of erosion which have led to landowner complaints.

   WRC and HCC have engaged a consultant through the LASS professional services panel to provide support on the final design solution. Anticipated to be completed prior to 2018-2019 summer construction season.

   Access has been granted by the Horsham Downs Golf Club to allow works on Reach 1 to be completed this financial year. Design work for the remaining 2 areas (Reach 2&Reach 3) will be progressed during the winter season with the hope to complete works during the 2019/2020 summer period.
Figure 1. Mangaonua stream – pre clearing

Figure 2. Mangaonua stream - post clearing
2.3. Focus next Quarter

2.3.1 Progress access and construction for Te Awa o Katipaki for area closest to River Rd culvert (Reach 1).

2.3.2 Mangaonua Stream remaining blockages near Cambridge Rd clearing ongoing

2.3.3 Continued visual inspections of all catchments to identify any obstructions for removal and or further maintenance.

2.3.4 Waitawhirihirihiri stream erosion control works and clearing of silt and obstructions.

3. Parks and Reserves

The quarter has been dry though the summer months. The groups are now bust preparing planting areas and releasing plants for the upcoming planting season. This season will have more of a focus on infill planting existing areas to help reduce weed growth.

- Plant releasing is a key task post planting to ensure the plants survival.
- The Mangaonua Group have been busy spreading mulching and releasing the plants in the gully area.

3.1 Reserve Funded Areas - Mangaiti Reserve Restoration

Plant site preparation is under way, making room for the 36,890 plants were planted, in 20 days through the 3 defined areas.
3.2 Mangaonua Restoration

This quarter was the last for the NHMT project lead Cliff Kelly who has gone back to university for further study, we welcomed Michael Paviour into the role and have had several meetings to get him up to speed on the project.

The Mangaonua has an official community group (the friends of the Silverdale branch of the Mangaonua gully system) that go along every Thursday undertaking weeding along the path within a 10m width, remove rubbish and maintain seedlings.

Planting is about to start again with 8,000 plants planned for infill planting.

3.3 Focus for the next quarter

To undertake releasing of the new plants and also start planning the next steps for the project with NHM trust and community groups which includes extending the existing track at Mangaonua Gully
4. Financial Update

4.1 The financial progress year to date is deemed to be ‘on-track’. For specific operational expenditure summary please refer to the table below.

Report Date: Apr-19
Project Manager: Adam Donaldson
Period: Quarter 3

<table>
<thead>
<tr>
<th>Projects</th>
<th>QTR Actuals ($)</th>
<th>YTD Actuals ($)</th>
<th>Annual Budget ($)</th>
<th>Variance ($)</th>
<th>Variance</th>
<th>Status</th>
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</thead>
<tbody>
<tr>
<td>Project Watershed Stream Maintenance</td>
<td>46,364</td>
<td>131,401</td>
<td>153,700</td>
<td>22,299</td>
<td>15%</td>
<td>Green</td>
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<tr>
<td>Reactive Erosion Management</td>
<td>0</td>
<td>0</td>
<td>20,000</td>
<td>20,000</td>
<td>100%</td>
<td>Green</td>
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<td>Project Watershed Management</td>
<td>6,500</td>
<td>19,500</td>
<td>26,000</td>
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<td>25%</td>
<td>Green</td>
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<td>Stream Bank Stabilisation</td>
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<td>65,000</td>
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<td>Green</td>
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<tr>
<td>River Bank Stabilisation</td>
<td>0</td>
<td>0</td>
<td>50,000</td>
<td>50,000</td>
<td>100%</td>
<td>Green</td>
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<tr>
<td>Community Tree Planting</td>
<td>0</td>
<td>0</td>
<td>34,589</td>
<td>34,589</td>
<td>100%</td>
<td>Green</td>
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<tr>
<td>Maintenance of works and gully's</td>
<td>39,841</td>
<td>124,102</td>
<td>179,234</td>
<td>55,132</td>
<td>31%</td>
<td>Green</td>
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<tr>
<td>Unspecified Projects (WRC Reserve Funded)</td>
<td>0</td>
<td>29,348</td>
<td>0</td>
<td>137432</td>
<td>0%</td>
<td>Green</td>
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<tr>
<td>TOTAL</td>
<td>92,705</td>
<td>304,351</td>
<td>528,523</td>
<td>224,172</td>
<td>42%</td>
<td>Green</td>
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</tbody>
</table>

Commentary:
- The Kirikiriroa and Mangaonua Stream Rehabilitation expenditure is held in an HCC Reserve fund and is not included within this report.
Report to Central Waikato Catchment Committee

Date: 26 April 2019

Author: Russell Powell, Land Drainage Manager, Lower Waikato West Coast Catchments, ICM

Authoriser: Clare Crickett, Director, Integrated Catchment Management

Subject: Drainage Schemes within Waikato Central Catchment Zone

Section: A (Committee has delegated authority to make decision)

Purpose
1. A request was received at the last Central Waikato Zone Catchment Committee meeting seeking a general overview of Council’s administered drainage districts within the central zone boundary. This paper for members information, gives an overview of rural drainage throughout our drainage areas including the issues arising.

Executive Summary
2. The land drainage service is a layer of service provided by the Waikato Regional Council ("the Council") to specific geographical areas called drainage areas. The community within these drainage districts pay a specific targeted drainage rate in addition to other rates, for a Level of Service (LOS) specified in the Long Term Plan. The Central Zone has 11 drainage subdivisions, each with their own respective funding systems and administered by Waikato Central Drainage Advisory Sub-Committee as part their 28 subdivisions in their district.

Staff Recommendation:
That the report Drainage Schemes within Waikato Central Catchment Zone (Central Waikato Catchment Committee 10 May 2019) be received.

Background
3. The sub-committee members consist of drainage rate payers from the respective areas who apply to represent each of the subdivisions. One person is selected by Council to serve the three year term.

The name of the 11 drainage subdivisions administered by Council are:
- Eureka drainage area, Mangaonua subdivision
- Fencourt drainage area
- Hautapu drainage area
- Pukeroro drainage area
- Matangi drainage area
- Part of Rotomanuka drainage area (Mystery Creek catchment)
- Te Rapa drainage area, part of Ngaruawahia subdivision
- Kirikiriroa Komakorau drainage area
- Kirikiriroa Horsham Downs drainage area
- Puketaha drainage area
- Greenhill drainage area
Issues
4. The issues being experienced in the drainage areas are as follows:

**Maintenance of Levels of Service (LOS)**
The maintenance of the network of Council drains is undertaken to allow landowners to manage their own water tables to support pastoral farming. The work includes maintaining the Council drainage channels to a depth and size that allows gravity drainage and the removal of ponded water from rainfall events up to a 10 year return period (10 % AEP) within three days, with the intent of avoiding pasture damage.

**Urban encroachment and impacts on Drainage Areas**
Spreading urbanisation and the potential for additional volumes of water run-off discharging into rural designed drainage channels, can compromise how the private lateral drainage networks operate.

- The level of contaminants being discharged from urban stormwater discharge into the rural network
- Increased bank erosion due to additional volumes
- Named waterways (e.g. parts of the Manganoua Stream) being managed as a drainage asset instead of as a river/stream management asset under the zone catchment budget.

**Peat soil and land consolidation**
Many of the drainage areas within the Waikato Region are associated with peat soils and have been fully developed into farmland, except for some small isolated areas. The drainage networks are currently being managed to prevent the over drainage of peat through the Council’s maintenance practices while still allowing for pastoral use. The Council has other options to manage water levels within the main drainage arterial networks to regulate peat drainage but currently there are no such controls in place.

Conclusion
5. That the report be received for members information which provides a general background of Council managed drainage subdivisions within the Waikato Central Catchment Zone.
Report to Central Waikato Catchment Committee

Date: 1 May 2019

Author: Jolene Francis - Zone Manager West Coast & Central Waikato Catchments

Authoriser: Clare Crickett, Director, Integrated Catchment Management

Subject: Te Awa O Katapaki Stream Erosion Remediation

Section: A (Committee has delegated authority to make decision)

Purpose
1. The purpose of this report is to provide the Central Waikato Catchment Committee with an overview of the erosion remediation project on Te Awa O Katapaki Stream and funding options.

Executive Summary
2. The Te Awa O Katapaki Stream has experienced ongoing erosion issues over the last ten years, in the section from the River Road culvert to the confluence with the Waikato River. This erosion is affecting six landowners; five private within Hamilton City Council (HCC) jurisdiction, and the Horsham Downs Golf Course (HDGC) (the land owned by Waikato District Council). Erosion remediation measures were identified for three separate reaches of the stream by Tonkin & Taylor (December 2018), costing $1.95M with HCC contributing $1.3M and WRC $618,524.

3. Negotiations for access to the work site through the golf course have been ongoing due to lack of engagement from Waikato District Council, and the request of compensation from the Golf Club.

4. Works were due to commence in mid-April 2019 in Reach 1 (close to the River Road culvert), with remaining work to be completed in the 2019/20 summer period.

Staff Recommendation:
That the report Te Awa O Katapaki Stream Erosion Remediation (Central Waikato Catchment Committee 10 May 2019) be received.

Background
5. Waikato Regional Council (WRC) is responsible for the overall management and coordination of river and catchment management activities, consistent with its legislative responsibilities (Soil Conservation and Rivers Control Act 1941). In the Waikato River catchment, WRC established Project Watershed (as set out in the Project Watershed Funding Policy document 2002) to provide an integrated river and catchment programme across the entire Waikato River Catchment. The programme provides for the coordination, assistance and direct provision of flood protection, river management and catchment works and services.

6. WRC and HCC are required to give effect to the purpose of local government as prescribed by section 10 of the Local Government Act 2002. That purpose includes meeting the current and future needs of communities for good quality local infrastructure, local public services, and the performance of regulatory functions that is most cost effective for households and businesses. Good quality means infrastructure, services and performance that are efficient and effective, and appropriate to present and anticipated future circumstances.

7. WRC currently have a Service Level Agreement (SLA) (2016) with HCC to carry out river management of flood protection, river and catchment works, and stormwater within their jurisdiction on our behalf as
required under Project Watershed. Te Awa O Katapaki is one of the priority stream catchments identified within the SLA. WRC provide HCC with funding ($516,000 this financial year) and technical advice/support each year as a contribution to these works. There is provision within the SLA for HCC to apply for additional funding for Unspecified Work not identified in the annual plan. This project falls into that category.

8. The Te Awa O Katapaki stream has a catchment size of approximately 700 hectares, within an urban development area at the northern end Hamilton. The existing catchment is a mix of residential and pastoral land use. Figure 1 provides a catchment overview.

9. There have been ongoing severe erosion issues of the 300 m section of the Te Awa o Katapaki Stream between the existing River Road box culvert and the confluence with the Waikato River. It is understood that this issue was first raised around 15 years ago. Erosion has affected the adjacent 5 landowners (land within Hamilton City) and the HDGC (land within Waikato District and owned by Waikato District Council) to varying degrees over time. The property boundary is effectively the historic stream centreline and there is no public land access to the stream over the subject reach.

10. In 2013, the existing 2.7m diameter pipe culvert under River Road was replaced with a 3.5m wide by 4m high concrete box culvert. The land area inside the 700ha catchment of the Te Awa O Katapaki Stream has been developed from farmland into residential suburbs at a fast rate and has mostly occurred from 2006 onwards. The peak flows are assumed to be managed through development detention ponds but the runoff volume into the Te Awa O Katapaki Stream will naturally increase for any given rainfall depth.

11. Degradation of the Waikato River bed over time will also contribute to bank instability. Te Awa O Katapaki Stream is responding to a new runoff regime likely also affected by lower river bed levels, by widening and deepening its bed and banks through erosive processes.

Issues

12. A number of WRC/HCC-funded (and private) remediation initiatives have been carried out over the last 15 years along the 300 m stretch of the Te Awa O Katapaki stream, however all of these measures have suffered some extent of deterioration.

13. Short term erosion remediation was carried out in the summer of 2017/18 by HCC resulting from discussions with HCC, WRC and Waikato DC – however, all parties were in agreement that longer term solutions are required. At this time a (separate) budget was also available to clear debris/fallen trees at the Te Awa O Katapaki Stream outlet to the River, however access was required from the HDGC, due to the steep eroding face(s) down to the stream (with no barge available for use to access from Waikato River). This would result in loss of part of the 4th green at the golf club in order to build the access track. Discussions with the golf club were not successful and works did not progress.

14. The golf club have a very large bank under the 4th green that has progressively worked its way back from the stream over at least 15 years. Other instances of bank erosion threaten the 4th fairway and green. Due to the risk of the bank collapsing, in order to carry out the work safely, an access track needs to be constructed at Reach 3 which will require benching into the 4th green (already eroding).

15. Negotiations to access the work site for all reaches has been unsuccessful to date, and the Golf Club have requested compensation for perceived grievances including historical and future loss of land, loss of revenue etc. The course has made this a prerequisite of settlement to granting access, and has delayed resolution of the erosion issues.
16. Waikato District Council, as the landowner, sought legal advice regarding the compensation request from the golf club (their leasee). As a result of this advice, they have now left negotiations to HCC, WRC and the golf club.

17. Degradation of the Waikato River bed over time will also contribute to bank instability. Te Awa O Katapaki Stream is responding to a new runoff regime likely also affected by lower river bed levels, by widening and deepening its bed and banks through erosive processes.

18. There has also been no financial contribution for these works proffered by Waikato District Council, as normally required from landowners for this type of work.

**Funding of Works.**

19. In 2017 MWH was contracted to design hard structure solutions for the entire length of the stream. This was costed at $2.7M with HCC agreeing to cover $2M and WRC agreeing (currently unconfirmed as to the timing/process of this) to contribute the remaining cost ($800k) from the Central Zone reserves.

20. In August 2018 Tonkin and Taylor were contracted to redesign the erosion remediation focusing on remediating identified hot spots with soft solutions rather than hard engineering as per the earlier report. This reduced the cost of the works from $2.7M to $1.7M. (See detailed costs in Table 1 below).

21. Based on existing in-stream structures and reach scale geomorphic processes, three management reaches were identified:
Reach 1 – from the River Road culvert to approximately in line with the boundary of 19 and 17B Riverlinks Lane
Reach 2 – from the boundary of 19 and 17B Riverlinks Lane to the boundary of 17 and 15 Riverlinks Land.
Reach 3 – from the boundary of 17 and 15 Riverlinks Lane to the Waikato River confluence.
(See Figure 2 for map showing the identified reaches)

Figure 2: Aerial view of Te Awa o Katapaki Stream showing properties and reaches. Reach 1 in red, Reach 2 in green and Reach 3 in blue.
The estimated costs associated with each Reach over the term of the project are shown in Table 1 below.

Table 1. Te Awa O Katapaki Erosion Remediation cost estimates – Reaches 1-3

<table>
<thead>
<tr>
<th>TAOK River Road Erosion Remediation Budget estimate 2018/19</th>
<th>Estimate $</th>
<th>WRC share</th>
<th>HCC share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investigation &amp; design costs 2018/19</td>
<td></td>
<td></td>
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<tr>
<td>TAOK Stream erosion - Initial Review (completed)</td>
<td>26,400</td>
<td>26,400</td>
<td>-</td>
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<tr>
<td>TAOK Stream Erosion, River Road Reach. Detailed Design - Reach No. 1 (based on Initial Review - completed)</td>
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<td>20,500</td>
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<tr>
<td>Detail design Reaches 2 and 3 (based on initial Review)</td>
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<tr>
<td>SUBTOTAL Investigation and Design</td>
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<table>
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<tr>
<th>Estimated costs not yet committed 2018/19</th>
<th>Estimate $</th>
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<th>HCC share</th>
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<tr>
<td>Construction Reach 1 - Maree Stewart</td>
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<tr>
<td>Resource consent applications Reaches 2, 3</td>
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<td>Project mgmt - Reach 1 construction</td>
<td>14,500</td>
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<td>Technical oversight during construction Reach 1</td>
<td>10,000</td>
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<tr>
<td>SUBTOTAL construction</td>
<td>199,500</td>
<td>199,500</td>
<td></td>
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</tbody>
</table>

| Project contingency (rounded)              | 40,000     |           |           |

| TOTAL estimate 2018/19                     | $ 385,400  | $ 99,500  | $ 285,900 |

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<thead>
<tr>
<th>TAOK River Road Erosion Remediation Budget estimate 2019/20</th>
<th>Estimate $</th>
<th>WRC share</th>
<th>HCC share</th>
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<td>Follow-up planting Reach 1</td>
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<td>Construction Reach 2</td>
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<td>Compensation - disruption to golf course during construction (Provisional)</td>
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<tr>
<td>SUBTOTAL construction</td>
<td>1,310,800</td>
<td>432,564</td>
<td>878,236</td>
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</table>

| Project contingency (rounded)                            | 262,000    | 86,460    | 175,540   |

| TOTAL estimate 2019/20                                    | $ 1,572,800 | $ 519,024 | $ 1,053,776 |
| Project TOTAL over 2 years                                | $ 1,959,200 | $ 618,524 | $ 1,340,676 |

22. The Central Zone Reserve balance is currently $1.7M (as at 30 June 2018). This was to be reduced over the term of the 2018-2028 LTP with support given to HCC to remEDIATE the erosion issues in Te Awa O Katapaki Stream up to $800,000. A further $375,000 would also be used to smooth rate increases for the across the term of the LTP. This would leave the zone reserve balance at $525,000. (See Figure 3).

23. Work to remediate Reach 1 should be completed this financial year. Reaches 2 and 3 (still requiring final design) is due to commence in the 2019/20 summer.
Next Steps
24. Reach 1 is to be completed this financial year with WRC contributing $99,500 for design only, and HCC covering the remaining cost for design and construction of $286,900.

25. Work on reaches 2 and 3 will commence in the 19/20 summer period. This cost is estimated at $1.34M, subject to the design for Reach 3 being finalised. WRC contribution to this cost would be approximately $432,564 from the Central Zone Reserve.

26. The Committee supports the two year Te Awa O Katapaki erosion remediation work programme with funding from the Central Zone Reserve totalling $618,524.

Conclusion
27. WRC and HCC have committed funding to remediate ongoing erosion issues in the Te Awa O Katapaki Stream, a priority catchment identified in the SLA and project watershed, however progress has been slow due to prolonged negotiations with the golf club for site access.

28. Reach 1 of the works is due to be completed this financial year, with Reach 2 and 3 to be completed over the 2019/20 summer period (with access approval).

29. WRC have supported the design component of Reach 1 of the proposed works, and will continue to provide funding and technical support for design and construction of Reaches 2 and 3, pending Catchment Committee support.

Attachments
N/A

References
N/A
Report to Central Waikato Catchment Committee

Date: 10 May 2019

Author: Andrea Julian, Senior Biodiversity Officer, Natural Heritage

Authoriser: Clare Crickett, Director, Integrated Catchment Management

Subject: Hamilton Halo Project Phase 2

Section: A (Committee has delegated authority to make decision)

Purpose
1. Advice was sought from Manaaki Whenua Landcare Research (Landcare) about possible changes to the successful Hamilton Halo Project (Halo). One of Landcare’s proposed options and some of their recommendations are being incorporated into Halo within the existing budget. This report is for the information of the committee.

Executive Summary
2. The Hamilton Halo project has successfully increased the number of tūī visiting Hamilton City. WRC has sought advice from Landcare about possible future objectives and strategies for Halo to further advance the recovery of native birds in and around Hamilton. Landcare proposed two broad possible futures for Halo and the Halo project team has opted for consolidating the current approach and, within the existing budget, enhancing control for forest bird species, particularly bellbird and kererū. To this end, the recommendation that control at more distant Halo blocks be dropped in favour of annual control at closer blocks is being implemented. An initial focus on blocks which are thought to have more numerous bellbird is planned. Consideration is also being given to forest blocks close to sanctuaries and major pest control projects. Research proposals that align with the selected option and the implemented recommendations will be supported if resources permit.

Staff Recommendation:
That the report Hamilton Halo Project Phase 2 (Central Waikato Catchment Committee dated 10 May 2019) be received.

Background
3. The Hamilton Halo project (Halo) is a pest control programme started in 2007 by the Waikato Regional Council (WRC) to increase the abundance of tūī in Hamilton City and surrounds. The Halo model was originally developed from known movements of tūī between Hamilton and native forests up to 20 km away (Innes, Fitzgerald, Watts, et al. 2005). Predator control of possums and rats is carried out just before tūī breeding season in bush areas within this 20km ‘halo’. With the programme now 10 years old, and tūī abundant and breeding in the city, WRC sought advice from Manaaki Whenua Landcare Research (Landcare) on possible future objectives and strategies for Halo to further advance the recovery of native birds in and around Hamilton.
Issue

4. The Halo project team in the Natural Heritage (Biodiversity) team (Integrated Catchment Services) have considered the recommendations and options outlined in the Landcare report and are in the process of starting to implement some of these in the ongoing Halo operations within the existing budget.

Options and Recommendations

5. The Landcare report outlined two broad possible futures for Project Halo and made a series of recommendations. These options and recommendations and their implementation to date are as follows:

- The two broad possible futures for Project Halo are: (1) maintain, or preferably enhance, existing pest control for current forest birds (tūī, bellbird, kererū), or (2) select new focus bird species that would demand new management actions. The Halo project team feel it is premature to substantially change the approach. Kererū and bellbirds are both species that Hamilton residents would very much like to see regularly in their city. It had been hoped that these two species would respond as tūī have to the pest control, but the increases have been only very gradual. This may be because their populations were much smaller than those of tūī at the beginning of the Halo project, but there may be other issues. The intention is to enhance existing pest control for current forest birds with the objective of increasing bellbird and kererū numbers in Hamilton and maintaining the increases in tūī numbers.

- Landcare recommended dropping pest control at distant Halo blocks (Maungakawa and Bridal Veil Falls) in favour of sites closer to Hamilton (e.g. Kaniwhaniwa Conservation Area, Karakariki and Te Puroa Scenic Reserves and Whewells Bush Scientific Reserve), or in favour of more frequent (e.g. annual, indefinitely) control at other Halo pest control blocks. For budgetary reasons, pest control is currently carried out for only three years out of five at each of the bush areas. This appears to have worked for tūī, but it is possible that it is insufficient for bellbird. Adult bellbird are small enough to be killed by ship rats and it is possible that disproportionate numbers of females are being killed when rats raid nests. The Halo project team are following the recommendation to drop Maungakawa and Bridal Veil Falls in favour of increasing frequency of control at Pukemako with the intention of increasing bellbird numbers. Discussions about the possibility of expanding the Tirohanga control site and including the Kaniwhaniwa Conservation Area in Halo are beginning. A community conservation group, the Pirongia Te Aroaro o Kahu Restoration Society, have reintroduced kokako to Pirongia and are very interested in creating a buffer in the surrounding landscape. One of the pairs of kokako from Pirongia have been attempting to breed at Kaniwhaniwa.

- Landcare recommends increasing planting (and post-planting releasing) and pest control in Hamilton City gullies to greatly increase the area of habitat suitable for rarer native birds such as kererū, bellbirds and miromiro (tomtits). While this is not currently being actively pursued by WRC’s Biodiversity team, the Policy Implementation team is working with Hamilton City Council on the development of a Biodiversity Strategy for the city. This will include consideration of Hamilton gully management.

- Another Landcare recommendation is to investigate current and potential vegetation composition along the Waikato and Waipā river banks, and then methodically transform these riparian ecosystems by large-scale planting to establish two new substantial forest areas and corridors in the central Waikato. This is not currently being actively addressed by WRC’s Biodiversity team.

- Landcare recommends encouraging further planting of trees that best deliver fruit and nectar at nesting times and nesting sites for kererū, and tūī and bellbirds, respectively. The Landcare report includes a literature review about plant species that contribute substantially to the diet of these birds. This is important guidance that WRC’s Biodiversity team will be disseminating as widely as possible.

- Landcare suggests WRC supports research on kererū display dives, bellbird nesting, deer impacts on bird habitat, bird (including ruru/morepork) movement, use of artificial nest sites by various species, and factors limiting freshwater birds, which in aggregate would assist conservation management and
iwi wellbeing in diverse, non-forested landscapes. Out of the six research projects proposed, the Halo project team is most interested in two, resources permitting:

- Determine times and places of kererū display dives using public report and structured observations at key locations. Display dives are tight indicators of nesting, and knowing more about where and when they happen will directly steer where and when to apply pest control to protect the resultant attempts.
- Follow bellbirds to nest sites, and follow outcomes of nesting attempts using small radio transmitters. It is possible that bellbirds face much greater risks than tūī when nesting because they are much smaller, and so sitting females in particular may be vulnerable to ship rats. This may clarify that bellbirds need lower residual abundances of ship rats than tūī for successful nesting.

**Conclusion**

6. The Halo project team has considered the options and recommendations from Landcare Research, and are focussing on increasing the numbers of kererū and bellbird visiting the city while maintaining the gains made in tūī numbers. This has involved dropping two sites and increasing the frequency of pest control at bush blocks closer to Hamilton City. Consideration is being given to introducing additional sites that are closer to Hamilton City. Proposed research projects that will help accomplish increases in kererū and bellbird numbers will be supported if resources are available.

**Attachments**
Halo Review Report

**References**
Hamilton Halo Strategic Review: future options for Halo goals and implementation

Prepared for: Waikato Regional Council

October 2018
Hamilton Halo Strategic Review: future options for Halo goals and implementation

Contract Report: LC3348

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Disclaimer

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Summary

Project and client

- The Hamilton Halo project (henceforth Halo) is a pest control programme started in 2007 by the Waikato Regional Council (WRC) to increase the abundance of tūi in Hamilton City and surrounds. With the programme now 10 years old, and tūi abundant and breeding in the city, WRC has sought advice on possible future objectives and strategies for Halo to further advance the recovery of native birds in and around Hamilton.

Objectives

To review potential strategies to increase native birdlife in and around Hamilton, including:

- modifications to the current Halo regime (pest control timing, sites and methods) while maintaining current biodiversity gains
- strategies to increase kererū / New Zealand pigeon and bellbird/korimako
- strategies to increase native bird breeding in Hamilton (e.g. predator control, planting)
- identifying other focal or iconic species that could be re-established or increased
- identifying priority research needs.

Methods

- We first clarify the restoration context of the Halo project by establishing the policy framework in which it sits, then review the historical and present occurrence of major ecosystems (forests and wetlands) and bird species.
- We then review candidate forest and wetland bird species that could be included in the Halo future.
- We also review the literature to collate lists of major food plants for tūi, bellbird and kererū.
- We use published reproductive and survival rates to project bellbird populations under different predation scenarios.
- Finally, we discuss interactions between available sites and pest control tools, and other non-Halo restoration actions already underway, to derive recommendations for future directions for Halo, and future research to assist Halo management.

Results

- The recent objective of Project Halo to restore tūi populations is one of many possible goals for biodiversity restoration in the central Waikato.
- Literature on historical ecosystems (forests and wetlands) and the birds that inhabited them provides a clear restoration context for Project Halo.
• Of 37 forest and wetland birds, we describe the importance, threats, Halo opportunities, associated risks, and possible research for 15 selected focus taxa and present an ambitious 10-year objective for each.

• We recommend five native trees and shrubs that are valuable food sources for tūī, bellbird, and kererū but are under-represented in current planting guides. We also identify 25 native species, two introduced species, and six introduced genera that are important for bellbirds alone, and suggest 25 native trees and shrubs that are key food sources for kererū.

Conclusions

• We see two broad possible futures for Project Halo: (1) maintain, or preferably enhance, existing pest control for current forest birds (tūī, bellbird, kererū), or (2) select new focus bird species that would demand new management actions.

• Possible new focus species, and new management actions for them, include:
  • weka and/or brown kiwi (control mustelids, feral cats and possums, and manage domestic dogs and cats in rural landscapes)
  • shags, dabchicks and fernbirds (experimentally supply artificial nest sites, and sustain predator control at wetlands)
  • kākā and kākāriki (partner with an agency that may be interested in captive rearing for release)
  • falcons (hack young falcons onto building nest sites in Hamilton City).

• The riparian banks of the Waikato and Waipā Rivers are together the best current option for restoration by planting to restore large-scale connectivity for forest birds requiring continuous forest across the Halo area.

• Nesting success, and hence abundance of kererū, and of tūī and bellbirds, are likely to be increased by planting particular tree species that supply fruit and nectar, respectively, at key nesting times and places.

Recommendations

We recommend that WRC and other agencies interested in avian restoration in and around Hamilton City:

• consider which of the two broad Halo futures (‘tūī, bellbirds, kererū’ or ‘new focus species’) interests them most and apply the relevant management opportunities described for each

• consider dropping pest control at distant Halo blocks (Maungakawa and Bridal Veil Falls) in favour of sites closer to Hamilton (e.g. Kaniwhaniwha Conservation Area, Karakariki and Te Puroa Scenic Reserves and Whewells Bush Scientific Reserve), or in favour of more frequent (e.g. annual, indefinitely) control at other Halo pest control blocks

• increase planting (and post-planting releasing) and pest control in Hamilton City gullies to greatly increase the area of habitat suitable for rarer native birds such as kererū, bellbirds and miromiro (tomtits)
investigate current and potential vegetation composition along the Waikato and Waipā river banks, and then methodically transform these riparian ecosystems by large-scale planting to establish two new substantial forest areas and corridors in the central Waikato.

- encourage further planting of trees that best deliver fruit and nectar at nesting times and nesting sites for kererū, and tūī and bellbirds, respectively.
- support research on kererū display dives, bellbird nesting, deer impacts on bird habitat, bird (including ruru/morepork) movement, use of artificial nest sites by various species, and factors limiting freshwater birds, which in aggregate would assist conservation management and iwi wellbeing in diverse, non-forested landscapes.
1 Introduction

Regional councils have clear responsibilities to maintain and enhance indigenous biological diversity (biodiversity) by controlling the adverse effects of activities (Resource Management Act 1991), and by many other possible mechanisms. The Waikato Regional Policy Statement (RPS; Waikato Regional Council 2016) sets the policies and methods to manage biodiversity through regional and district plans, and this is reviewed each 10 years. In the Waikato RPS indigenous biodiversity decline is recognised as an issue, and it is an agreed objective that ‘The full range of ecosystem types, their extent and the indigenous biodiversity that those ecosystems can support exist in a healthy and functional state’.

Policies for maintaining or enhancing indigenous biodiversity (RPS section 11) include ‘the re-creation and restoration of habitats and connectivity between habitats’ and ‘working collaboratively with landowners, resource managers, tangata whenua and other stakeholders’. Other contextual matters – such as complex legislation and the roles of different agencies, growing the participation of iwi and community groups, Predator Free NZ 2050, and a recent restart of the process to have a National Policy Statement for indigenous biodiversity – are noted by the regional council think piece on the future of biodiversity management in New Zealand (Willis 2017).

Vulnerable, endemic forest bird species have declined on the mainland for centuries, and these declines continue today (Innes et al 2010; Walker et al. 2017). While predation by introduced pest mammals is the primary problem in the remaining large forests, predation as a mechanism interacts with food competition, habitat area, genetics, disease, and other factors (Innes et al. 2010; Parliamentary Commissioner for the Environment 2017). In particular, while 20% of the Waikato Region remains under indigenous forest (Landcare Research 2015), large areas are in pastoral farming, with abundant small forest fragments (Burns et al. 2011). Increasing forest area and connectivity between fragments is likely to assist forest bird populations (Ruffell & Didham 2017; Walker et al. 2017). There are, therefore, many possible management tools that can be applied to alleviate each of these problems, although some are much easier to apply than others.

Pest control options are very diverse in terms of target pests, pest control tools (e.g. traps and poisons), target abundance (eradication or control), strategies (e.g. pulsed or sustained), and sites (urban, rural, large native forest tracts). Pest control scale also varies hugely, from individual properties or communities (Peters et al. 2015) to large, council-led programmes such as Cape to City in Hawke’s Bay. A new national long-term vision is to eradicate rats (Rattus spp.), stoats (Mustela erminea) and possums (Trichosurus vulpecula) from the entire New Zealand mainland by 2050 (Russell et al. 2015).

Mammal pests can be controlled at unfenced mainland island sites where reinvasion is constant, or in pest-fenced sanctuaries such as Maungatautari, where reinvasion is

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1 https://capetocity.co.nz/
substantially prevented and pest populations can be – at least temporarily – eradicated (Saunders & Norton 2001; Burns et al. 2012; Pech & Maitland 2016). Bird species whose sensitivity to predators is matched to a site can then be translocated back into such sanctuaries (Miskelly & Powlesland 2013; Smuts-Kennedy & Parker 2013).

Habitat restoration is a complementary strategy to pest control. Restoring native forest by planting into pastoral grassland is rare, although riparian planting to improve water quality in streams is widespread (McKergow et al. 2016; Daigneault et al. 2017). However, concerted planting to increase habitat area outside the riparian setting is possible. There is a 60 ha restoration project in Hamilton City at Waiwhakareke/Horseshoe Lake, where, over time, pasture is being replaced by shrub-hardwoods and eventually by native forest (Clarkson & Kirby 2016). Non-native forest planting would also improve fragments isolated in pasture for birds by improving microclimates and connectivity (Denyer et al. 2006).

This report reviews current objectives and actions of the Hamilton Halo project, which has successfully increased tūī abundance in Hamilton by implementing pest control against ship rats (*Rattus rattus*) and possums in key, forested tūī-nesting sites within 20 km of the city. It discusses what modifications might be possible to enhance the current project while maintaining the tūī increase. Such modifications could include new focal bird species, new management tools or sites, and new underpinning research.

### 2 Background

Initial bird counts in Hamilton City in 2004 showed that Hamilton had a diverse (23 species) bird fauna, but that this comprised mostly introduced birds and common and widespread natives. Key iconic native species, such as tūī (*Prosthemadera novaeseelandiae*), kererū (*Hemiphaga novaeseelandiae*) and bellbird/korimako (*Anthornis melanura*), which have important roles as pollinators and seed dispersers and are most welcomed by residents, were rare or absent. ‘Green areas’ (parks and gullies) were a stronghold for city birds, with 50% more species overall, 100% more natives, and a greater abundance of most species than in residential areas (Innes, Fitzgerald, Thornburrow, et al. 2005). Research on tūī showed that the few birds visiting Hamilton in the winter returned to surrounding native forests to nest in the spring, although their nest success was poor due to predation by ship rats and possums (Innes, Fitzgerald, Watts, et al. 2005).

In 2007 WRC began a pest control programme using contractors to target ship rats and possums at seven Halo forest blocks in central Waikato (Figure 1). Blocks generally received a pulsed, 3-years-on, 2-years-off, regime (Figure 2), which aimed to have both pest species at low levels by the onset of each tūī nesting season (October to January). Pest control contractors were required to achieve target residual pest abundances, assessed by standard indexing techniques at <5% tracking rate (Gillies & Williams 2001) for ship rats and <5% residual trap catch (NPCA 2011) for possums. Old Mountain Road East / Johnstone (pest control area 195 ha) and Old Mountain Road West / Hope (175 ha) blocks were first targeted in spring 2007, Te Miro Scenic Reserve (684 ha), Maungakawa Scenic Reserve (now Pukemako, 78 ha) and Tirohanga Road block (135 ha) in 2008,
Pukemokemoke Bush Reserve (39 ha) in 2009, and Te Tapui Scenic Reserve (now Maungakawa, 997 ha) in 2010.

Control techniques varied from site to site and year to year, although most blocks had poison bait stations on a 75 m grid with brodifacoum, diphacinone, pindone, cholecalciferol, or pre-fed 1080 in cereal pellets to target both species. Sometimes possums were targeted separately with leg-hold traps or cyanide. Pre-fed aerial 1080 (0.08%, Wanganui No. 7 baits) was used only at the Old Mountain Road West block during 2007–2009.

Pest control was highly effective, reducing ship rats to a mean 2.7% tracking rate and brushtail possums to a mean 1.2% residual trap catch in subsequent tūi nesting seasons (D. Byers, WRC, pers. comm. 2013). Biennial urban bird counts since 2004 and public reports documented that tūi abundance and distribution increased significantly in

Figure 1. Hamilton City, Halo pest control sites, and other community-led pest-control projects. The green line depicts a 20 km zone around Hamilton, on which the current Halo model is based.
Hamilton City after 2008, initially in ‘green’ areas (parks and gullies) in winter. Then, in the 2012/13 summer, tūī also increased significantly in green areas in November, indicating nesting in Hamilton rather than returning to natal sites; some were also counted in residential areas in November for the first time. The mean number of tūī in 5-minute bird counts in Hamilton green areas (0.75) in August 2016 was 19 times higher than in 2004 (Fitzgerald et al. 2017).

![Figure 2. Periods of pest control achieving residual pest abundance targets, at each of the eight Hamilton Halo forest blocks, from 2007 to 2017.](https://www.karioimaunga.co.nz/)

Outside the Halo programme, other central Waikato sites receiving pest control (Figure 1) are the 3,400 ha, pest-fenced Maungatautari Ecological Island, from which all introduced mammals except house mice (*Mus musculus*) have been eradicated (Smuts-Kennedy & Parker 2013), and Mt Pironia, where 1,000 ha of ship rat control is embedded in a 13,000 ha possum control area. Missing forest bird species such as North Island robin (*Petroica longipes*) and North Island kōkako (*Callaeas wilsoni*) have been returned to both sites by translocation (Miskelly & Powlesland 2013; Smuts-Kennedy & Parker 2013).

On Mt Karioi, the Karioi Maunga ki te Moana project has predator control on over 2,000 ha of forest and surrounding land to protect ōi / grey-faced petrel (*Pterodroma macroptera gouldi*) and forest birds.² In the Lake Serpentine (Rotopiko) Sanctuary south of Ohaupo, a 9 ha area has been pest-fenced and was cleared of pest mammals in 2013. The National Wetland Trust that co-manages the site with Waipā District Council, the

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Department of Conservation (DOC) and NZ Landcare Trust is considering whether a translocation of pāteke (*Anas chlorotis*) to this site would succeed.

Annual control of ship rats and possums with bait stations and traps is undertaken by a community group on Mt Kakepuku near Te Awamutu (Chris Monk, WRC, pers. comm. 2018), by others in a 104 ha block on the south-eastern corner of the Hakarimata Range near Ngāruawāhia, and by Andrew Styche and others during August–April annually in Whewell’s Bush, a scientific reserve on the outskirts of Hamilton (A. Styche, DOC, pers. comm. 2018). Therefore, most native forests around Hamilton except for the Karakariki Ranges between Raglan and Ngāruawāhia are receiving some kind of predator control already. Finally, there is increasing interest in pest control in Hamilton City itself, with a Predator Free Hamilton Trust established in 2017.

3 Objectives

To review potential strategies to increase native birdlife in and around Hamilton, including:

- modifications to the current Halo regime (pest control timing, sites and methods) while maintaining current biodiversity gains
- strategies to increase kītikiti and bellbird
- strategies to increase native birds breeding in Hamilton (e.g. predator control, planting)
- identifying other focal or iconic species that could be re-established or increased
- identifying priority research needs.

4 Methods

We first consider the restoration context of the Halo project by establishing the policy framework in which it sits, then review the historical and present occurrence of major ecosystems (forests and wetlands) and bird species, based on available literature. We then consider a best planning period and area for Halo, and list potential flagship bird species (including tūī, the recent focus) that Halo could restore in this time and place.

We then review candidate bird species in the following categories:

- New Zealand status and threat ranking
- importance
- threats
- Halo opportunities and risks
- potential research.

We then use this review to suggest an ‘ambitious 10-year objective’ for each species.
We also review the literature to collate food plant lists for tūī, bellbirds and kererū, to help Halo planning to improve food supply for these taxa. Criteria for inclusion of species in diet lists were as follows.

- Plant-use data were taken from unpublished data sets, personal observations and original published studies and theses, rather than from existing collations.
- We included records from the North and South Islands, so these are national lists and may include species that are not locally appropriate.
- We included food items where they comprised at least 5% of diet observations in a single study (as a proportion of feeding observations, or proportion of individual birds observed), or where they were identified as a diet item in at least two separate studies.
- Availability of plant foods represents known phenology for each plant species throughout New Zealand, so local availability will be over shorter periods for some plant species.

We used matrix population models to project potential bellbird population growth under various predation scenarios using the popbio package in the R statistical computing environment (Stubben & Milligan 2007; R Core Team 2018). We used estimated vital rates for bellbird reproduction rate and life expectancy from published accounts (Higgins et al. 2001; Sagar 2013), and estimates of juvenile survival and nest predation from studies of other New Zealand forest birds (e.g. Innes, Fitzgerald, Watts et al. 2005).

Finally, we discuss interactions between available sites and pest control tools, and other non-Halo restoration actions already underway, to derive recommendations for future directions that Halo could take, and future research to assist Halo management.

5 Restoration context of Halo goals

The 2007/18 Halo objective of recovering tūī populations in Hamilton and environs is one of many possible goals of biodiversity restoration in this area. Enhancing biodiversity is firmly embedded in long-term plans of the WRC (Waikato Regional Council 2016). Policy 11.1 in the Waikato Regional Policy Statement (‘Maintain or enhance indigenous biodiversity’) contributes to 12 of the 26 objectives in the Regional Policy Statement, and Policy 11.2 (‘Protect significant indigenous vegetation and significant habitats of indigenous fauna’) contributes to two. In particular, both policies support Objective 3.19: ‘The full range of ecosystem types, their extent and the indigenous biodiversity that those ecosystems can support, exist in a healthy and functional state’.

Halo sites are all Significant Natural Areas (A. Julian, WRC, pers. comm. 2018), and the episodic control of the arboreal and omnivorous ship rats and possums in them is a proven, practicable way of increasing the abundance of diverse leaves, flowers, fruits, invertebrates and vertebrates (lizards and birds) at all height levels in these forests, if done effectively (Innes 2005; Byrom et al. 2016).

Internationally, ecological restoration has been defined as ‘the process of assisting the recovery of an ecosystem that has been degraded, damaged or destroyed’, and an
ecological restoration activity is ‘any activity whose aim it is to ultimately achieve ecosystem recovery, insofar as possible and relative to an appropriate local native model (termed here a ’reference ecosystem’), regardless of the period of time required to achieve the recovery outcome’ (McDonald et al. 2016).

Typically, details of reference ecosystems are derived from information about past and present biota and conditions (McDonald et al. 2016; Sinclair et al. 2018). It is inevitable that in urban and pastoral landscapes, such as those around Hamilton, biodiversity recovery can at best be partial across most of the developed matrix (houses, streets and pasture) that exists between the few remaining natural vegetated fragments. Biodiversity conservation (e.g. restoring tūī) and restoration ecology can be integrated seamlessly (Society for Ecological Restoration International 2008).

We recommend following DOC acceptance of ‘ecological integrity’ (Lee et al. 2005) as the main framework for guiding Halo restoration and monitoring. Key elements are:

- **indigenous dominance** – key ecological processes such as herbivory, predation and decomposition are shaped primarily by indigenous species
- **species occupancy** – species that naturally occurred at a site are present at a relevant spatial scale (for rare or missing taxa, this may require active management, including translocation)
- **environmental representation** – an indigenous biota occurs across regional environmental gradients derived from climate, soils and geology (abiotic aspects of ecosystems).

The ecological integrity framework is entirely consistent with the guidelines referred to above, published by the International Society for Ecological Restoration International Science & Policy Working Group (2004), and McDonald et al. (2016).

Adequate accounts of recent historical Waikato ecosystems and bird distributions are available to derive reference ecosystems that broadly frame future restoration in the Halo project.

### 5.1 Historical and present occurrence of ecosystems

The history of vegetation in the Waikato basin for the past 20,000 years is described by Nicholls (2002). He describes pollen and other evidence dating Māori arrival to around 1300 AD. Māori lit extensive fires to clear forests, so that when Europeans arrived from the 1840s on there were large areas of secondary vegetation as well as intact native forests and wetlands. Today, after extensive land clearance, native forest covers 20% of the Waikato region, but it has been fragmented into over 8,100 individual patches. Although 95% of Waikato’s native forest area remains within blocks larger than 25 ha, 92% of the
individual patches are fragments smaller than this. There are over 7,500 such fragments in the Waikato region, separated by pasture, plantation forestry, orchards or urban areas.³

The vast majority of fragments are too small to sustain viable populations of birds, and perhaps some plants, invertebrates and lizards. Remaining large native forests are particularly important as the last opportunities to conserve large forest bird populations and their behaviours and genetics. Native bird species that are widespread on the New Zealand mainland today, such as grey warbler (Gerygone igata), fantail (Rhipidura fuliginosa), tūi, kererū, and ruru/morepork (Ninox novaeseelandiae), are either highly mobile (able to move between food and habitat patches) or can survive and breed successfully in matrix (between-fragment) habitats such as gardens, hedgerows, plantation forests, and riparian vegetation. The Halo project has so far focused on tūi – one of these successful taxa – but in this report we also consider whether other more vulnerable species such as North Island weka (Gallirallus australis greyi) and North Island brown kiwi (Apteryx mantelli) could in time move freely between fragments if the matrix environments were highly managed.

Predation by pest mammals is the primary factor limiting endemic forest birds nationally, because such species decline despite very large forests remaining in some places. In substantially deforested local parts of New Zealand, such as the central Waikato, however, forest habitat shortage is clearly the main limiting factor (Innes et al. 2010). In a recent study around Auckland, the abundance and species richness of native forest birds declined rapidly below c. 5−10% forest cover (Ruffell & Didham 2017). This means that in the Waikato, habitat restoration could potentially add much to predator control to restore some bird species, but predator control is currently much easier and cheaper than native forest restoration on bird-relevant scales (100+ ha) on land that is currently pasture.

Due to extensive drainage and conversion to pasture, only 7.9% of historical wetlands remain in the Waikato region (Ausseil et al. 2008). However, in the Halo footprint, only 719 ha (0.7%) of 96,204 ha of original wetland remains (Ausseil et al. 2008, Figure 3). There are numerous small lakes in the Halo project area, including in Hamilton City, and the Waikato River and associated wetlands are also habitat for waterfowl, crakes (Porzana spp.), bitterns (Botaurus poiciloptilus), fernbirds (Bowdleria punctata), herons, and three freshwater shag species (Phalacrocorax spp.). Far fewer projects have focused on restoring or showcasing wetland birds than forest birds in New Zealand (O’Donnell et al. 2015), but we suggest that this is an interesting and valuable possibility for Halo in the future.

Figure 3. Historical (pre-human) and current wetlands in the Halo area.

5.2 Historical occurrence of bird species

Atkinson and Milliner (1991) used data from subfossil birds, and current and past vegetation, to reconstruct four lowland and coastal forest-bird systems of pre-human New Zealand, including ‘warm-temperate humid conifer/hardwood forest on karst terrain’ at Waitomo, and ‘cool-temperate dry conifer/hardwood forest on loess-covered hills and valleys’ in North Canterbury. Guilds of birds were very similar or identical across these sites, with differences due to island (North, South) endemics (hihi and whiteheads are absent from the South Island), and New Zealand eagle (Aquila moorei) being absent from the north. Atkinson and Milliner’s guild lists comprise birds they considered to occupy the areas from c. 6,000 to 1,000 years BP. The Checklist of the Birds of New Zealand (Gill et al. 2010) provides authoritative accounts of historical and recent bird distributions, so it is a straightforward matter to place Halo bird restoration objectives into a robust historical ‘reference forest’ framework.
Of the 67 forest bird species listed by Atkinson and Milliner (1991), c. 40% are now extinct and so unavailable for restoration unless surrogate species are used. However, Halo will not in the foreseeable future be able to introduce sensitive birds such as tieke/saddleback (Philesturnus rufusater), which require zero pest mammals, unless it is to parts of the Halo forest estate that are pest-fenced, such as Maungatautari. However, such species will inevitably spill out from pest-fenced sanctuaries and present both challenges to and opportunities for neighbouring landowners.

5.3 Halo planning period and area

Over the timeframe of decades it is likely that the scale and effectiveness of control of key pests will increase as research and experimental management associated with Predator Free New Zealand\(^4\) yield new insights (Russell et al. 2015). Predator control or provision of nest sites is likely to show demonstrable change in bird populations faster (say, within 5 years) than habitat restoration or repair, because vegetation requires many years to grow and provide nectar and fruit. After a decade of Hamilton Halo, we consider options for the next phase of the programme that could be achieved over the next 10 years.

The Halo model was originally developed from known movements of tūī between Hamilton and native forests up to 20 km away (Innes, Fitzgerald, Watts, et al. 2005). Seasonal and dispersal movement of other species that could be restored to Hamilton are generally less well known. Therefore, we consider management options both within the existing 20 km ‘Halo area’ and beyond this where relevant.

6 Potential flagship species

While Halo has so far focused on tūī, there are many more iconic New Zealand birds that could be encouraged to increase in Hamilton and surrounding landscapes. Table 1 considers extant native forest birds that could be considered, and documents whether they occur already in the Halo area or in nearby pest-free Maungatautari. Table 2 presents freshwater or wetland birds that could also be considered.

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\(^4\) [https://predatorfreenz.org/about-us/pf-2050/](https://predatorfreenz.org/about-us/pf-2050/) accessed 23 May 2018
Table 1. Extant indigenous forest birds that could be considered for restoration in the Hamilton Halo project. Current Maungatautari records are from Fitzgerald & Innes 2014 and Smuts-Kennedy & Parker 2013. Species names and order are from Gill et al. 2010

<table>
<thead>
<tr>
<th>Common name</th>
<th>Scientific name</th>
<th>Present in Halo?</th>
<th>Present at Maungatautari?</th>
</tr>
</thead>
<tbody>
<tr>
<td>NI brown kiwi</td>
<td>Apteryx mantelli</td>
<td>No</td>
<td>Breeding, translocated 2005</td>
</tr>
<tr>
<td>Little spot. kiwi</td>
<td>Apteryx owenii</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Swamp harrier</td>
<td>Circus approximans</td>
<td>Breeding</td>
<td>Breeding</td>
</tr>
<tr>
<td>NZ falcon</td>
<td>Falco novaeseelandiae</td>
<td>Breeding</td>
<td>Breeding</td>
</tr>
<tr>
<td>NI weka</td>
<td>Gallirallus australis greyi</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Kererū/NZ pigeon</td>
<td>Hemiphaga novaeseelandiae</td>
<td>Breeding</td>
<td>Breeding</td>
</tr>
<tr>
<td>NI kākā</td>
<td>Nestor meridionalis septentrionalis</td>
<td>Vagrant</td>
<td>Breeding, translocated 2007</td>
</tr>
<tr>
<td>Yellow-crowned kākāriki</td>
<td>Cyanoramphus auriceps</td>
<td>No</td>
<td>No, translocated 2010 failed??</td>
</tr>
<tr>
<td>Red-crowned kākāriki</td>
<td>Cyanoramphus novaезнelandiae</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Shining cuckoo</td>
<td>Chrysococcyx lucidus</td>
<td>Breeding</td>
<td>Breeding</td>
</tr>
<tr>
<td>Long-tailed cuckoo</td>
<td>Eudynamys taitensis</td>
<td>Vagrant</td>
<td>Vagrant</td>
</tr>
<tr>
<td>Ruru/morepork</td>
<td>Ninox novaeseelandiae</td>
<td>Breeding</td>
<td>Breeding</td>
</tr>
<tr>
<td>NZ kingfisher</td>
<td>Todiramphus sanctus</td>
<td>Breeding</td>
<td>Breeding</td>
</tr>
<tr>
<td>Rifleman</td>
<td>Acanthisitta chloris</td>
<td>Yes, Pirongia</td>
<td>No</td>
</tr>
<tr>
<td>Silvereye</td>
<td>Zosterops lateralis</td>
<td>Breeding</td>
<td>Breeding</td>
</tr>
<tr>
<td>Grey warbler</td>
<td>Gerygone igata</td>
<td>Breeding</td>
<td>Breeding</td>
</tr>
<tr>
<td>NI kōkako</td>
<td>Callaeas wilsoni</td>
<td>Yes, Pirongia, translocated</td>
<td>Breeding, translocated 2015</td>
</tr>
<tr>
<td>NI saddleback</td>
<td>Philesturnus rufusater</td>
<td>No</td>
<td>Breeding, translocated 2013</td>
</tr>
<tr>
<td>Tūī</td>
<td>Prosthemadera novaeseelandiae</td>
<td>Breeding</td>
<td>Breeding</td>
</tr>
<tr>
<td>Stitchbird/hihi</td>
<td>Notiomystis cincta</td>
<td>No</td>
<td>Breeding, translocated 2009</td>
</tr>
<tr>
<td>Bellbird/korimako</td>
<td>Anthornis melanura</td>
<td>Breeding</td>
<td>Breeding</td>
</tr>
<tr>
<td>Whitehead</td>
<td>Mohoua albicilla</td>
<td>Yes, Pirongia</td>
<td>Breeding, translocated 2009</td>
</tr>
<tr>
<td>NZ fantail</td>
<td>Rhipidura fuliginosa</td>
<td>Breeding</td>
<td>Breeding</td>
</tr>
<tr>
<td>NI tomtit/miromiro</td>
<td>Petroica macrocephala</td>
<td>Breeding</td>
<td>Breeding</td>
</tr>
<tr>
<td>NI robin</td>
<td>Petroica longipes</td>
<td>Yes, Pirongia, translocated</td>
<td>Breeding, translocated 2011</td>
</tr>
</tbody>
</table>
Table 2. Extant freshwater or wetland birds that could be considered for restoration in the Hamilton Halo project. Halo area distribution records are from Robertson et al. 2007 and from personal observations by the authors (or others). Species names and order are from Gill et al. 2010

<table>
<thead>
<tr>
<th>Common name</th>
<th>Scientific name</th>
<th>Present in Halo area?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown teal</td>
<td>Anas chlorotis</td>
<td>No</td>
</tr>
<tr>
<td>NZ scaup</td>
<td>Aythya novaeseelandiae</td>
<td>Yes</td>
</tr>
<tr>
<td>Dabchick</td>
<td>Poliocephalus rufpectus</td>
<td>Breeding</td>
</tr>
<tr>
<td>Black shag</td>
<td>Phalacrocorax carbo</td>
<td>Yes</td>
</tr>
<tr>
<td>Pied shag</td>
<td>Phalacrocorax varius</td>
<td>Yes</td>
</tr>
<tr>
<td>Little black shag</td>
<td>Phalacrocorax sulcirostris</td>
<td>Yes</td>
</tr>
<tr>
<td>Little shag</td>
<td>Phalacrocorax melanoleucos</td>
<td>Breeding</td>
</tr>
<tr>
<td>Australasian bittern</td>
<td>Botaurus poiciloptilus</td>
<td>Yes</td>
</tr>
<tr>
<td>Banded rail</td>
<td>Gallirallus philippensis</td>
<td>No</td>
</tr>
<tr>
<td>Spotless crake</td>
<td>Porzana tabuensis</td>
<td>Breeding</td>
</tr>
<tr>
<td>Marsh crake</td>
<td>Porzana pusilla</td>
<td>Breeding</td>
</tr>
<tr>
<td>Fernbird</td>
<td>Bowdleria punctata</td>
<td>Breeding</td>
</tr>
</tbody>
</table>

Below we discuss potential focal species for Halo from Tables 1 and 2. Primarily, this subset comprises birds that present practicable restoration options in the next 10 years. We include birds that are: (a) already present in Hamilton or surrounding forests and waterways, (b) birds that occur in nearby large native forest tracts but may reach Hamilton, and (c) birds that would need to be translocated to the Halo area. Within sections the order of species is not significant.

The ‘opportunities’ presented here are new options for WRC to consider. Unless otherwise stated, we assume that the status quo, such as pest control in Halo blocks for tūi, will be maintained.

6.1 Birds already present in Halo forests and wetlands that could be encouraged

**Tūi**

**New Zealand status and threat ranking:** Endemic, Not Threatened

**Importance:** Tūi is an iconic species that feeds on a wide variety of fruit, nectar and invertebrates. They are strong fliers, able to move between fragmented native vegetation, and are considered a keystone species for their role in preserving ecological integrity through pollination and seed dispersal of many native plants (Anderson et al. 2006). (See Appendix 1 for plant foods frequently consumed by tūi, and their phenology.)
**Threats:** In the absence of effective control of ship rats and possums, nesting success is poor (Innes, Fitzgerald, Watts et al. 2005). Tūī need adequate nectar in the nesting season (September to January) and invertebrates to raise young, and prefer taller trees with dense cover for nesting.

**Halo opportunities:** Increase (more years) control of ship rats and possums in the current Halo blocks, or other native forests within the Halo zone, to increase spillover into Hamilton and other urban areas. Adding stoat (*Mustela erminea*) control to Halo blocks may increase tūī numbers, but we have no direct evidence for this. With Hamilton City Council, DOC and Predator-free Hamilton, bolster predator control in Hamilton to enhance nesting success there. Encourage more planting of appropriate plants (Appendix 1) to provide food sources for tūī at crucial times in rural and urban areas to reduce habitat limitation and support the growing population.

**Ambitious 10-year objectives:** Tūī are heard by every Halo resident in every month of 2028. At least 200 ha of new tūī habitat have been planted by 2028.

**Risks:** Nest productivity and survival of fledgling tūī in urban environments are not well known and there is uncertainty around habitat quality and effective area in the city. Recent fledglings are weak fliers and have been observed killed by domestic cats (*Felis catus*; K. Fitzgerald, pers. comm. 2015) and harassed by dogs (W. Hansen, pers. comm. 2008). These uncertainties mean the number of birds visiting Hamilton could decline if pest control is not maintained in Halo forests.

**Bellbird/korimako**

See Appendix 2 for names and phenology of plant foods frequently consumed by bellbirds.

**New Zealand status and threat ranking:** Endemic, Not Threatened.

**Importance:** Like tūī, the bellbird is an iconic New Zealand species with a welcome song, although it is much less recognised by residents. With tūī and silvereye it is one of only three remaining widespread effective bird pollinators, and it is also an important disperser of smaller native forest fruits (Kelly et al. 2010). Although common in the South Island, bellbirds are absent from most of the Northland, central Waikato, south Taranaki and southern Hawke’s Bay. An unsuccessful attempt to translocate them into Hamilton City was made in 2010. Since then, efforts have focused on enhancing their natural dispersal from Halo pest control blocks (Fitzgerald et al. 2018).

**Threats:** Bellbirds are more vulnerable to predation than tūī while nesting because they are much smaller (24–36 g cf. 90–120 g). Females may be at the top end of the size range that a ship rat can kill on the nest or even while roosting; ship rat spread appears to have been responsible for the extinction of bellbirds in Northland after 1880 (Innes et al. 2010).

Figure 4 shows the potential change in a bellbird population under four predation scenarios. This modelling suggests that if 27% of bellbird nests are successful without predator control, as with tūī (Innes, Fitzgerald, Watts et al. 2005), and females are killed during 20% of nest predations, the population will decline to extinction (growth rate = 0.9 per year). However, if females are not killed during those nest predations, the population...
may persist, with a growth rate of 1.1 per year. Sensitivity analysis of these models suggests that adult survival and recruitment of juveniles into the adult population have the greatest effect on population growth.

Like tūi, bellbirds need nectar and invertebrates to nest successfully in the breeding season (September to January). Sixty-four percent of preferred introduced bellbird plant species and 74% of preferred native bellbird plant species are also preferred by tūi (Appendices 1 and 2).

**Halo opportunities:** Increase (more years) control of ship rats and possums in the current Halo blocks, or other native forests within the Halo zone, to increase spillover into Hamilton and other urban areas. Adding stoat control to Halo blocks may increase bellbird numbers, but we have no direct evidence for this. When bellbirds start nesting in Hamilton, these significant first attempts must be protected by local control of ship rats and possums. Continue to plant species that feed tūi and bellbirds, as well as plants preferred by bellbirds rather than tūi, to limit competition between the two taxa.

**Ambitious 10-year objective:** Bellbirds are widespread and breeding in Hamilton City. As many bellbirds as tūi appear at residents' bird feeders.

**Risks:** It is unknown why bellbirds are so much slower than tūi to respond to pest control, but it may be because there were simply many fewer of them to start with (Fitzgerald et al. 2018). Demographic vital rates for mainland bellbirds are not well known, and there has been no published research on this in the Waikato. This means that estimates of potential population growth under different predation scenarios require several estimates and assumptions.

**Research:** Research to explore the diet, movements and breeding success of bellbirds would sharpen management action.

![Figure 4. Modelled bellbird population change under four predation scenarios: nests and females vulnerable to predation; nests only vulnerable to predation; no predation; and a pulsed regime with no predation for 3 out of 5 years and nest and female predation 2 out of 5 years.](image)
Kererū / New Zealand pigeon

See Appendix 3 for plant foods frequently consumed by New Zealand pigeons, and their phenology.

**New Zealand status and threat ranking:** Endemic, Not Threatened.

**Importance:** The oft-cited statement that kererū are ‘virtually the sole dispersers’ (Clout & Hay 1989) of forest tree fruits >10 mm has now been qualified, because birds like tūī, kōkako and saddlebacks, with smaller gapes, have been shown to disperse smaller individual fruits of the large-fruiting species (Kelly et al. 2010). Nevertheless, kererū are important fruit dispersers – especially for the largest fruits such as taraire (*Beilschmiedia taraire*) and karaka (*Corynocarpus laevigatus*; Wotton & McAlpine 2015) – and disperser loss is likely to limit tree recruitment (Wotton & Kelly 2011). Further, kererū are iconic and welcomed by all New Zealanders, and have special significance as a once-harvested species for Māori (Lyver et al. 2008).

**Threats:** Food supply is a more vital trigger for nesting for New Zealand frugivores such as kererū than for honeyeaters and insectivores (Innes et al. 2010). Kererū and parea / Chatham Island pigeon (*Hemiphaga moaeseelandiae chathamensis*) nest when fruit is abundant and otherwise may not attempt nesting at all (Clout et al. 1995; Powlesland et al. 1997; Powlesland et al. 2003). Poor food supply (just foliage rather than fruit) combined with poor winter weather is believed to have caused the deaths of kererū at Mohi Bush, Hawke’s Bay, while stoats, feral cats, ship rats and possums are all known predators (Clout et al. 1995; Powlesland et al. 2003; Innes et al. 2004). It is therefore more likely that food supply limits kererū populations more than those of other taxa in this report.

**Halo opportunities:** Ongoing control of ship rats and possums will continue to increase fruit and leaf availability and protect kererū nesting attempts from these omnivores. Published evidence suggests that adding stoat and cat control will assist kererū populations, especially since stoats and cats are likely to kill adults rather than eggs or chicks (Clout et al. 1995; Powlesland et al. 2003).

Plant suitable fruit-bearing trees that will enhance kererū breeding throughout the Halo area. Eighty percent of introduced plants and 39% of native plants preferred by kererū are not preferred by tūī and bellbirds (Appendix 3). Therefore, plant species that supply food to all three taxa (tūī, bellbirds, kererū) *as well as* others that feed kererū alone.

**Ambitious 10-year objective:** In 2028 kererū are widespread and breeding in Hamilton City, and all Halo residents see kererū every month.

**Research:** Kererū display dives should be mapped over time to see the extent to which current Halo predator control operations match the locations and timing of kererū breeding attempts. Kererū display flights are closely associated with the timing and location of nesting, so they can be used to inform predator control (Mander et al. 1998). Manaaki Whenua – Landcare Research has been collating public observations of display flights since January 2015 using the iNaturalist.nz platform. To date, 491 observations have been recorded from the Waikato, where birds were recorded as either displaying or seen but not displaying (Figure 5). These data are sparse for most of the year, but display dive
observations in January, March, May, July, and August to November (inclusive) indicate that birds may attempt to breed throughout the year. The large number of observations in September is due to publicity associated with the Great Kererū Count citizen science project.

More data are needed to allow more detailed analyses of NZ pigeon breeding phenology in the Halo area. Display dive data could be obtained opportunistically by promoting the NZ Pigeon Display Flights project on iNaturalistNZ for public observations, and through systematic surveys by skilled individuals and groups (e.g. Birds New Zealand).

Figure 5. New Zealand pigeon display flights in the Waikato Region recorded on the iNaturalist.nz website. The number of observations where a display was seen (orange triangle), where birds were seen but not displaying (tan circle), and displays as a proportion of all observations (green area) are aggregated by month.

New Zealand falcon / kārearea

New Zealand status and threat ranking: Endemic, At Risk – Recovering

Importance: The New Zealand falcon (*Falco novaeseelandiae*) is the only endemic bird of prey remaining in NZ. It is an apex predator, feeding mainly on small to medium-sized birds. Home range is large but varies by habitat, with estimates varying from around 4 to 200 km² (Holland & McCutcheon 2007; Kross, Tylianakis et al. 2013; Seaton & Hyde 2013b). New Zealand falcons are widespread but rare, especially north of Hamilton (Bell 2017), and are absent as breeders from most urban areas (Seaton & Hyde 2013b).

Threats: New Zealand falcons typically nest on the ground and their eggs and chicks are vulnerable to predation by introduced mammals, particularly mustelids, hedgehogs (*Erinaceus europaeus*) and cats, as well as pigs (*Sus scrofa*) and possums (Kross, McDonald et al. 2013; Seaton & Hyde 2013a). The conversion of native vegetation to intensive land uses has reduced breeding habitat availability. They are also shot illegally and are at risk of electrocution from powerlines (Seaton & Hyde 2013b).
**Halo opportunities:** New Zealand falcons are periodically seen in Hamilton and surrounding areas, including Te Miro and Hakarimata Scenic Reserves, and are known to breed in large blocks of native forest in the Halo area at Pirongia, and beyond at Maungatautari (NF, pers. obs.) and Tirohanga (C. Smuts-Kennedy, pers. comm. 2017). New Zealand falcons do not usually nest in urban environments, but the first known instance of this occurred in 2012, within the Halo area, when a pair nested in Cambridge (Barea 2013).

Nesting on tall city buildings would provide protection from key nest predation and disturbance from people, but unlike other *Falco* species, NZ falcons have not naturally exploited such sites. New Zealand falcons have been ‘hacked’ on the roof of a building in Rotorua by Wingspan Birds of Prey Trust, but these birds did not subsequently nest on buildings. Hacking is a soft-release technique used for raptors, where chicks are housed in boxes at release sites and released at ages coinciding with their ability to fledge and sustain flight (Dzialak et al. 2006). Hacking of peregrine falcons (*Falco peregrinus*) in Europe shows a degree of imprinting and subsequent use of nest sites similar to the release site, enabling the recovery of a previously extirpated tree-nesting ecotype (Sielicki & Sielicki 2009). Using this approach with wild-caught NZ falcons chicks could be the genesis for urban populations nesting on buildings (L. Barea, pers. comm. 2017).

Encouraging falcons to breed on buildings in Hamilton would be a novel way to expand the potential habitat for this species and contribute directly to its conservation. NZ falcons preferentially take introduced and more abundant species (Kross,Tylianakis et al. 2013; Kross et al. 2018), and most of the prey brought to the nest of the falcons breeding in Cambridge in 2012 were feral pigeons (*Columba livia*; Barea 2013; NF, pers. obs.). The introduction of NZ falcons to vineyards in Marlborough resulted in significant reductions in the abundance of some introduced birds and the damage they do to grape crops (Kross et al. 2011). Increasing falcon numbers in Hamilton could therefore help to reduce the abundance of nuisance bird species such as feral pigeons. Restoration of falcons in the urban and peri-urban environment, along with education, could help to raise social acceptance of this iconic species and the importance of endemic predators.

**Ambitious 10-year objective:** Falcons are nesting on buildings in Hamilton City by 2028.

**Risks:** Conflicts may arise when falcons kill prey that some members of the public value. Falcons will also aggressively defend nests against threats, including attacking people and dogs that approach too close. Some owners and occupiers might not appreciate falcons nesting on their buildings, and discarded prey remains may be offensive to some people. Public education should help mitigate these risks.

Hacking falcons at novel sites in the city would, by its very nature, be experimental. Although NZ falcons have routinely been released by hacking, little information is available on post-release dispersal and survival. The experimental release of falcons in the city could contribute to understanding these important questions through post-release monitoring by satellite tracking.
Ruru/morepork

New Zealand status and threat ranking: Native, Not Threatened.

Importance: Ruru are fascinating native birds that occur in forest, peri-urban and urban landscapes, but curiously are better known by one of their calls (‘more-pork’) than by their appearance. Our last remaining native owl (i.e. excluding the recently arrived barn owl, *Tyto alba*) since the laughing owl/whēkau (*Scologlaux albifacies*) became extinct, ruru are one of a very small suite of remaining avian predators. They also have special cultural significance for Māori (Mahuta et al. 2017).

Threats: They are vulnerable to predators (cats, possums, ship rats, stoats) when nesting, and also to secondary poisoning from anticoagulant poisons, especially brodifacoum (Seaton & Hyde 2013a). However, despite being hole-nesters – normally a trait associated with extreme vulnerability in New Zealand forest birds – they remain reasonably widespread and common. The best nesting trees are large and old because such trees are most likely to have suitable nesting crevices. However, these trees are frequently exotic and may be felled because they impede development or are not native.

Halo opportunities: There should be advocacy for the retention of large, old trees that are used by ruru for roosting, feeding and nesting. There is also an opportunity for WRC, through Halo, to promote ruru nest boxes that would provide safe nesting sites for the species, where there are few old trees or banks that would otherwise be used. Ruru are known to use nest boxes, and young raised in them may be more likely to use a box themselves. Designs are available from Wingspan Birds of Prey Trust.\(^5\)

Communities may be more likely to undertake pest control if ‘their’ ruru are known to be nesting at a site. Ruru are a special opportunity for agencies to work with local iwi to help them restore a culturally significant relationship between tangata whenua and ruru.

Ambitious 10-year objectives: Ruru call-rates have doubled in Hamilton City between 2011 (baseline established by Morgan & Styche 2012) and 2028. By 2028 ruru can be heard at every marae in the Halo zone.

Risks: Ruru are natural predators of long-tailed bats (*Chalinolobus tuberculatus*, O’Donnell 2000), which are also present in Hamilton. Long-tailed bats are classified as Nationally Critical (O’Donnell et al. 2017). Increased ruru abundance may present an additional threat (or the perception of a threat) to the precarious existence of bats in Hamilton, although the main causes of bat decline are probably predation by pest mammals and ongoing clearance of large old roost trees.

Research: Little is known about ruru habitat use, movement and nesting success in fragmented, settled landscapes. In particular, what pasture gaps will they cross freely? Nest box usage in diverse habitats and situations could be explored by a student and could become a national morepork conservation tool.

\(^5\) [https://www.wingspan.co.nz/PDF/how-to-build-morepork_nest_boxes.pdf](https://www.wingspan.co.nz/PDF/how-to-build-morepork_nest_boxes.pdf)
Little shag, black shag, and little black shag

New Zealand status and threat ranking: Native, Not Threatened (little shag). Native, Naturally Uncommon (little black shag and black shag)

Importance: Freshwater birds in New Zealand are greatly under-researched compared with forest birds, probably because they are more common. However, they are no less familiar, or even iconic. These three shag species use the Waikato River and also lakes and wetlands throughout the Halo area, but almost no-one can tell the species apart. Shags (kawau) are significant for iwi, appear in numerous whakatau, were used as food, and are considered taonga species by some iwi (Rolleston-Gabel & Innes 2017).

Threats: All three shags may become entangled in fishing nets or snagged on lost fishing lines. Little shags may be vulnerable to depletion of their aquatic prey due to pollution or habitat loss (Taylor 2013).

Halo opportunities: Shags nest in colonies in trees or on cliffs adjacent to water, and also frequently nest on artificial structures such as maimais. There is therefore the opportunity to build conspicuous artificial nesting structures (Meier 1981; Hobson & Wilson 1985; Suzuki et al. 2015) in or adjacent to Halo wetlands and the Waikato River that shags would use (Figure 6). Unlike natural trees, which are sometimes killed by droppings from the nesting shags and then rot, artificial structures could be permanent and are likely to be used year after year. They could become wildlife highlights of walking and cycling trails around the river and lakes, and could be strategically placed to be visible to people but unapproachable, and therefore safe from disturbance. The nearest nesting colonies to Hamilton we know of are at Lake Milicich near Rukuhia (believed to be little shags), and in trees at Port Waikato and at Whangamarino (in both cases ‘species unknown’).

Ambitious 10-year objectives: All three shag species are using artificial nest trees in Halo wetlands, including the river, by 2028, and shags are celebrated and welcomed by Pākehā and Māori alike.

Research: Seeing whether these three shag species would use artificial nesting structures would be a major contribution to shag management and conservation in New Zealand.
Figure 6. Artificial structures used by pelicans (left) and shags (right) for nesting. Built structures for shag nesting in the Halo project could be public art that has significant conservation value.

**Fernbird/mātātā**

**New Zealand status and threat ranking:** Endemic, At Risk – Declining

**Importance:** This is a fascinating, little-known species that allows close contact with humans in dense wetland and dry shrubland vegetation, where they are more often seen than heard. They appear to be poor fliers, and banded fernbirds have not been recorded moving more than 800 m. However, they are occasionally found tens of kilometres from known populations, often in relatively small patches of suitable habitat (Miskelly 2013; NF, pers. obs.).

**Threats:** The drainage of wetlands and clearance of scrub for agriculture have greatly reduced the area of suitable habitat for fernbirds. They are also vulnerable to predation by introduced mammals, including ship rats, which caused the local extinction of fernbirds on some islands (Miskelly 2013).

**Halo opportunities:** The nearest known breeding site to Hamilton is Moanatuatua Scientific Reserve, a 112 ha remnant, restiad bog wetland 10 km southwest of Hamilton. The reserve is dominated by wire rush (*Empodisma robustum*) and the At Risk bamboo rush (*Sporadanthus ferrugineus*; Clarkson 2002). Fernbirds have also been recorded at Lakes Maratoto and Ngaroto (Sheppard & Allard 2018), and at Rotopiko (R. Cannings, pers. com. 2018).
Fernbird capability to move between patches suggests that a viable population could be established in the mosaic of wetlands and gullies in and around Hamilton, if limiting factors (primarily vegetation structure and predators) are addressed.

Fernbirds inhabit a wide range of vegetation types, but common characteristics of quality habitat are very dense understorey vegetation with emergent shrubs and trees, which are used for calling and marking territory boundaries. New habitat could be created in Hamilton by re-establishing suitable species, such as raupō (Typha orientalis), in gully wetlands. For a viable population to be established, sufficient habitat for 10–20 pairs and additional populations within dispersal distance are required, ideally having an eventual population of hundreds of birds (K. Parker, pers. comm. 2018).

Lake Rotokauri, on the northwest boundary of Hamilton, may offer a good opportunity to establish fernbirds at a new site near the city in the near future. Waikato District Council currently undertakes pest control targeting rats, hedgehogs, mustelids and possums around the entire margin of Rotokauri, but does no residual abundance monitoring (Ben Wolf, pers. comm.).

If fernbirds do not disperse naturally to Hamilton in time, a translocation programme would ensure sufficient founders for healthy population growth and long-term survival. With the nearest population of fernbirds to Hamilton, Moanatuatua may be a suitable source population for future translocations, although no effective predator control is currently undertaken there (A. Styche, pers. comm. 2018). Establishing predator control at Moanatuatua would contribute to the survival of fernbirds in situ, increase spillover to other wetlands in the area (such as Rotopiko and Ngaroto), and potentially allow birds to be harvested for translocation to other suitable sites. This could be seen as an extension of the Hamilton Halo model, from one of increasing natural dispersal to one including assisted dispersal (i.e. translocation).

**Ambitious 10-year objectives:** Fernbirds are common at Moanatuatua due to predator control, and are breeding in the margins of all central Waikato peat lakes by 2028, which together make a sustainable metapopulation.

**Risks:** Fernbirds can be cryptic and inconspicuous to inexperienced observers, so they lack some of the appeal of more well-known species. However, this can be overcome with appropriate education and publicity.

**Dabchick/weweia**

**New Zealand status and threat ranking:** Endemic, Recovering.

**Importance:** An endemic grebe, dabchicks (Poliocephalus rufpectus) until recently were found only in the North Island. Although small and inconspicuous, dabchicks are unusual and very engaging, carrying their young on their backs when they are small (first 3 weeks).

**Threats:** Probably predation by introduced mammals, along with declining water quality, and loss of wetlands and water-side vegetation (Szabo 2013).
**Halo opportunities:** Part of the reason for dabchick rarity in the central Waikato may be the absence of suitable nest sites on stable water (in aquatic vegetation or in small caves or man-made structures accessible by diving; Szabo 2013). This could be remedied by placing small floating islands on lakes that are not disturbed by motor boats, to see if they attracted dabchicks to nest on them. The related Australasian crested grebe (*Podiceps cristatus*) readily uses artificial nest platforms at the Wanaka marina (Figure 7). The design of these could be based on structures that are used for nesting on Rotorua lakes (there are many; e.g. Figure 8).

**Ambitious 10-year objective:** Dabchicks have bred successfully in a Hamilton lake.

**Risks:** Like the fernbird, this is a small, inconspicuous bird that would need advocacy and signage to draw people’s attention to it, so it possibly would not be appreciated by many people.

**Research:** Finding the best design for a nesting platform would be a good student project, and like nesting structures for shags would have national value and interest for dabchick conservation. Considering their rarity, little is known about the basic life history of dabchicks: their diving, diet and movements, or what limits their current distribution in the Waikato.

*Figure 7. Australasian crested grebe on a nest on an artificial floating platform at the Wanaka marina.*
6.2 Birds present in large, nearby forest tracts that may reach Halo by natural dispersal

**Kākā and red-crowned kākāriki**

**New Zealand status and threat ranking:** Endemic, Recovering (kākā) and Endemic, Relict (red-crowned kākāriki).

**Importance:** These parrots are charismatic and ancient elements of the New Zealand forest avifauna. Kākā already visit Hamilton and other Halo urban places every winter but are not known to nest, and it is unknown where they come from and return to.

**Threats:** Mammalian predators (stoats and possums for nesting kākā, and stoats and ship rats for nesting kākāriki) are the key factor limiting current populations; cats are opportunistic predators of kākā chicks in the first week after fledging, and of kākāriki young and adults because they frequently feed on the ground. Both species require quality food to attempt nesting.

**Halo opportunities:** Both species could be encouraged by captive rearing for release (perhaps from Hamilton Zoo) in Hamilton; by translocations to Pirongia or Maungatautari...
that would in time disperse into Halo habitats; and by placing nest boxes at sites they visit to encourage them to breed. Both species can be highly mobile (Burge et al. 2017).

**Ambitious 10-year objective:** Both kākā and kākāriki have fledged a chick in the wild in the Halo footprint.

**Risks:** Kākā have a natural behaviour of damaging trees by removing bark to feed on sap and invertebrates; in Wellington these were mainly eucalypts and conifers. They may also damage fruit crops and buildings (Charles 2012; Recio et al. 2016). Residents with specimen trees damaged by kākā may face expensive arborist bills to manage the damage.

**Research:** Accumulating records of kākā in the Halo area will assist smart planning for their eventual establishment there.

**Miromiro (Tomtit)**

**New Zealand status and threat ranking:** Endemic, Not Threatened

**Importance:** Although a widespread species in native and exotic forests, tomtits (*Petroica macrocephala*) are rarely seen in highly modified habitats, such as farmland and suburbia (Powlesland 2013). They are small but charismatic, the male being boldly coloured black and white. This is therefore a challenging but achievable new native forest bird species that could (with adequate predator control) live in riparian, treed vegetation of the Waikato River and Hamilton gullies.

**Threats:** Mammalian predators, especially ship rats, threaten eggs, chicks and sitting females. Tomtits have proven to be difficult to translocate, with only two of seven sites being successful (Powlesland 2013).

**Halo opportunities:** Tomtits will cross at least 3 km sea gaps (Anderson 2003) and apparently disperse widely, since the tomtit that reached Rangitoto Island was probably from the Hunua or Waitakere Ranges. In the central Waikato, tomtits have already been seen at some Halo forests (Te Miro, Pukemako, Tirohanga Road Bush, and Maungakawa), and near the end of Roberts Rd (Maungatautari), and also, more surprisingly, near Rukuhia (B. Righter, pers. comm. 2018). Ongoing pest control at Pirongia and Maungatautari and elsewhere should send increasing numbers of tomtit dispersers into Halo forests. Translocation seems unlikely to be successful.

**Ambitious 10-year objective:** A tomtit has been sighted in Hamilton City.

**Research:** Accumulating sightings of tomtits in forest fragments and other properties around the Halo project will yield insights into their dispersal capabilities, and in due course into learning what habitats they find acceptable for breeding.
6.3 Birds that would need to be translocated to Hamilton or environs

**Weka**

**New Zealand status and threat ranking:** Endemic, At Risk – Recovering (North Island subspecies)

**Importance:** Weka are a large, flightless, iconic New Zealand bird. Their diurnal habit and their attraction to human activity mean they present an exciting opportunity for rewarding wildlife encounters.

Weka inhabit a wide range of vegetation types, including wetlands, rough pasture, shrubland, and native and plantation forests. They are often found at the margins of different vegetation types. The mixed and fragmented native and exotic vegetation of the Waikato is likely to provide a large area of potential habitat.

Weka are scavengers and predators, taking a wide variety of fruit and invertebrates, as well as eggs, lizards, small mammals and birds, and carrion. They kill mice (Ogilvie 2010) and have been recorded killing animals as large as stoats (300 g) and Norway rats (500 g; Beauchamp & Miskelly 2013). Avian predators were an important component of New Zealand’s pre-human avifauna, but most are now extinct. Therefore weka could play an important role in restoring indigenous dominance by restoring some avian predation.

Weka predation of some introduced mammalian predators may also help to increase natural ecosystem resilience to these pests, especially where complete eradication of these pests is not yet feasible. Furthermore, weka are important seed dispersers for some tree species, such as hinau (*Elaeocarpus dentatus*, Carpenter et al. 2018), and those with large fruit (Clout & Hay 1989). Avian dispersers of forest trees with large seeds are an important, but now depauperate, component of New Zealand’s native fauna.

**Threats:** The main recognised threats to weka are starvation during droughts and predation by mustelids, especially ferrets (*Mustela putorius furo*) and uncontrolled dogs.

**Halo opportunities:** North Island weka could inhabit the fragmented remnants of native vegetation and pastoral matrix that make up a large proportion of the Hamilton Halo area.

**Ambitious 10-year objective:** Weka are common in parts of the Halo area in 2028.

**Risks:** Large-scale predator control would be required, such as that being trialled already in the Hawke’s Bay Cape to City project. Like kiwi, weka are likely to require some management of dogs, which would undoubtedly be difficult with some residents. However, this issue will need to be faced sooner or later if there is any future for widespread restoration of these two large, flightless taxa in rural and urban areas on the New Zealand mainland.

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**Research:** Trial whether weka predation could control mouse numbers in the Garland's QE II block at Maungatautari, as a study site with relevance to all New Zealand fenced sanctuaries that have house mice as the only pest mammal species present.

**North Island brown kiwi**

**New Zealand status and threat ranking:** Endemic, Declining.

**Importance:** Although NI brown kiwi were on Mt Pirongia in the 1980s, the nearest relic wild populations today are in Tongariro Forest, Coromandel, and the Bay of Plenty (Robertson 2013). However, they have been translocated back to pest-free Maungatautari, where a ‘kōhanga’ or kiwi farm is planned for western brown kiwi. Kiwi are the ultimate iconic NZ bird species, and their reappearance in lived parts of the Halo would signify a truly new era in human–wildlife relationships on the mainland.

**Threats:** The main risks to kiwi are predation of chicks by stoats and cats, and of adults by dogs and ferrets. They are also vulnerable to accidents, such falling down holes or cattlestops and being hit by cars.

**Halo opportunities:** Re-establishing kiwi in the Halo area would require both large-scale predator control (stoats, ferrets and feral cats) and dog management. The former would be expensive but achievable; the latter would be controversial, as is already the case in Northland, where kiwi and people co-exist. Kiwi is one species for which existing habitat (pasture and forest fragments) would probably be acceptable, but a translocated kiwi population would not grow unless dogs were managed by kiwi-aversion training, changes in community dog owner behaviour, and other means.

**Ambitious 10-year objective:** In 2028 a brown kiwi hatched by its parents has successfully reached ‘safe weight’ (1 kg, about 12 months old), entirely in the predator-protected wilds of project Halo.

**Risks:** WRC will inevitably find opposition from residents to any limitations on domestic animal ownership and management that occurs in the future, but such limitations would have to be a compulsory part of kiwi re-establishment.

**Research:** Establishing kiwi would be a bold move that would require forward planning and community cooperation. The very process of achieving kiwi establishment would be a research programme in itself.

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6.4 Discussion

6.4.1 Halo goals

We see two broad possible futures for Project Halo in the next 10 years.

Tūī, bellbirds, kererū

The first possible future is to largely continue status quo goals, sites and management, although we suggest some intensification. This would primarily aim to sustain the ongoing recovery of tūī, bellbirds and kererū, and in the long term, miromiro (tomtits). Sustained control of omnivorous, arboreal ship rats and possums will continue to be important, but outcomes could be strengthened and hastened by:

- undertaking control in all years rather than pulsing effort
- adding annual stoat control
- dropping Maungakawa and Bridal Veil Falls, sites that are distant from Hamilton, and replacing them with Kaniwhaniwha Reserve and Karakariki Scenic Reserve, which are nearer to Hamilton (Figure 9)
- greatly increasing the emphasis on planting particular food trees that will sustain kererū, especially with fruit during nesting (Appendix 3).

If future research on kererū display dives indicates that kererū nest outside the November–January period, then pest control should also be extended to protect those attempts at those times and places.

Tūī, bellbirds and kererū are all mobile outside the nesting season, and so suitable food plants for this part of their annual cycle, particularly during the leaner winter months, could be encouraged anywhere, including gardens in Hamilton City. However, there may be substantial benefit in sharpening planting objectives to include species such as flax (*Phormium* spp.) and rewarewa (*Knightia excelsa*), which provide nectar for nesting tūī and bellbirds, and others such as podocarps, nikau (*Rhopalostylis sapida*), poroporo (*Solanum* spp.), and swamp maire (*Syzygium maire*) that would yield fruit for nesting kererū.
Figure 9. Current forest and wetland cover, protected areas, and pest control sites in the Halo footprint.

**New focus species**

A second possible future for Halo is to focus on new bird species other than tūi, bellbirds and kererū. The potential target birds and suggested initiatives are diverse, and could be implemented separately or together, with or without sustaining *status quo* Halo pest management. However, if *status quo* pest control ceases, tūi, bellbirds and kererū will all decline. Following are possible new birds to focus on.

- **Weka and/or North Island brown kiwi**: These large, flightless birds would need the same pest control regime – sustained control of stoats, ferrets and feral cats – and would require restrictions (aversion training, no freedom to roam) on dog owners and dogs, which would be predictably controversial. The dog issue is being explored in relation to kiwi in Northland, and so Waikato would not be the first agency to face this. These are probably two species for which the ‘matrix’ farmland environment is suitable habitat, but they would do better where ground cover such as hedgerows and forest fragments was more abundant. Therefore, more suitable habitat for this initiative is west of Hamilton (between Pirongia and Karakariki) than east.

- **Shags, dabchicks, fernbirds**: These water or wetland birds are not currently as iconic for the public as forest birds, just as wetlands themselves are also not seen by most people as places to spend much time. However, this is probably changing, and there is considerable scope to experimentally enhance these birds by the provision of nesting sites, predator control, and revegetation (O’Donnell et al. 2015). There are many public walkways around Halo lakes and the Waikato River, and wetland and
forest birds could both be enhanced at these sites. Riparian predator control to assist shags, dabchicks and fernbirds would also assist bitterns, marsh (Porzana pusilla) and spotless (P. tabuensis) crakes, as well as tūi and bellbirds, which could easily choose to nest near wetlands or visit them in winter. Such control would also increase mallard (Anas platyrhynchos) nesting success, to the benefit of local duck hunters.

- **Moreporks/ruru, kākā, red-crowned kākāriki, miromiro (tomtits):** These forest birds could be encouraged in Halo in diverse, species-specific ways, as outlined above. Ruru may respond to widespread provision of nest boxes, which would engage the public and would not require habitat change, but may encourage it. Kākā and kākāriki are typically abundant only where numbers of key pests (stoats, cats, rats) are low. Whether kākā and kākāriki can survive in urban Wellington after leaving the predator-free Zealandia sanctuary is being explored (Miskelly et al. 2005; Recio et al. 2016).

Recovering these taxa could involve a partnership with Hamilton Zoo, which could captive-raise them for release. The location of the zoo by Waiwhakareke, which is destined to be pest-fenced, is fortunate, although these species are mobile and may move elsewhere. Miromiro (tomtit) is the one forest bird that seems to be already dispersing out from Maungatautari, and perhaps Pirongia. This could be encouraged by highly targeted planting of fast-growing species (perhaps exotics that would have shade or have other values for farmers) to facilitate corridor movement between forest fragments, and other planting to enlarge the size of fragments or riparian forests in which miromiro may nest.

- **Falcons:** Falcons occur already in Hamilton but are sparse and do not nest here. A hacking programme onto buildings in the city (as Wingspan Trust did in Rotorua) may break the cycle of young falcons returning to forests to nest, and introduce some dramatic wilderness to urban Hamilton.

### 6.4.2 Pest control regimes

The regime currently used in project Halo targets ship rats and possums seasonally. It was initially developed to recover North Island kōkako (Innes et al. 1999) in central North Island forests, thus targeting the same predators that threaten tūi. There are two other more intensive regimes (Byrom et al. 2016) commonly applied on mainland New Zealand: unfenced ‘mainland islands’, which would add at least stoats and perhaps other pest species as targets (Saunders & Norton 2001), and pest-fenced sanctuaries such as Maungatautari and Rotopiko, which reduce 10–14 mammal pest species to zero density and keep them there (Burns et al. 2012; Byrom et al. 2016).

In this regime framework, most community-level pest control programmes also target rats (both ship rats and Norway rats; Rattus norvegicus) and possums. There may be an emerging regime on farmland targeting mustelids, feral cats, and perhaps hedgehogs on pastoral land such as at Cape to City, Hawke’s Bay, but it is not yet clear if this incipient regime will yield sufficient biodiversity benefits to have wide application.

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We suggest above that adding stoat control to the Halo regime is likely to be beneficial, and that there are species such as kiwi for which stoat control is vital.

Pest-fencing a forest area and preventing reinvasion with a pest-proof fence is the only current tactic that will enable very pest-sensitive species such as tieke to breed on the mainland. The Zealandia sanctuary in Wellington has demonstrated that species like tieke will spill over the fence and attempt to nest in adjacent forest if they can reach it. Maungatautari (3,400 ha) is by far the largest pest-fenced sanctuary in New Zealand, and will be a source of rare forest birds for decades to come if connectivity between it and other possible breeding sites can be established. In contrast, Rotopiko (9 ha) is one of the smallest fenced sanctuaries and its value for biodiversity restoration is still unknown; it may valuably allow some safe crake and fernbird breeding if they attempt nesting there. Waiwhakareke Natural Heritage Park (60 ha, Figure 9) in urban Hamilton was established in 2004 and is still destined to be pest-fenced (C. Kirby, Waikato University, pers. comm. 2018). It is unclear what new bird species should be translocated to such a small reserve, but the site will undoubtedly be a centrepiece for ecological restoration in Hamilton in the future.

Not all pest fences have the full 1.8 m height of the Xcluder fences at Rotopiko and Maungatautari; Xcluder also make a ‘low fence’, which would keep out ship and Norway rats, stoats, ferrets and weasels, rabbits (*Oryctolagus cuniculus*) and hares (*Lepus europaeus*), possums and hedgehogs, plus domestic stock (Figure 10). Cats can jump over fences of this lower height but can be targeted with traps. Currently such fences are being built only around food-processing factories, but they would have strong application around forest fragments in farmed environments. One excellent candidate for such a fence is Whewell’s Bush Scientific Reserve at Matangi.

6.4.3 Sites

Current forest and wetland cover, protected areas, and pest control sites in the Halo footprint are shown in Figure 9. Broadly, there are four potential pest-control site types: forests, wetlands, urban areas, and the largely pastoral matrix between.
Figure 9 clarifies how close Kaniwhaniwha Conservation Area, Karakariki and Te Puroa Scenic Reserves and Whewells Bush Scientific Reserve are to Hamilton, which is why we recommend them for consideration as pest control sites from which dispersing tūī, bellbirds and kererū can readily reach Hamilton. Pest control is also suggested in the future for the Hakarimata Range (A. Styche, DOC, pers. comm. 2018). Conversely, Maungakawa and Bridal Veil Falls are outside the 20 km Halo zone (Figure 1), and are large and with difficult terrain, respectively, and are therefore expensive as pest control sites. We recommend dropping distant sites in favour of others closer to Hamilton, and perhaps more frequent control at other ongoing Halo blocks.

The figure also clarifies that there are several protected lakes (Hotoananga, Pikopiko, Areare, C, B, Rotokauri, Koromatua, and Ngāroto; Figure 9) in addition to Rotopiko. As discussed previously, water and wetland birds such as fernbirds, crakes, dabchicks and bitterns are probably good dispersers, and so populations of these birds may establish and be sustainable if good pest control is undertaken at all ‘candidate metapopulation’ lakes. While existing shore vegetation is probably suitable for these species, the addition of artificial or (planted) tree nesting sites for shags and floating nesting platforms for dabchicks may enhance occupancy for those species.

Pest control is slowly increasing in Hamilton urban areas. Hamilton City Council undertakes cyclical pest control at parks and open spaces throughout the city, with greater emphasis on Significant Natural Areas, although the previously strong gully restoration movement has now lost strong City Council support. Community groups also work at Hammond and Mangaiti Parks. There is now a Predator-free Hamilton Trust, whose aim is to facilitate pest control action by community groups in the city. However, there is not yet strong leadership of city-wide pest control from any agency, group or individual.

Although pest control in the farmed matrix is undertaken on a large scale in the Cape to City project in Hawke’s Bay, it is too soon to know what, if any, biodiversity benefits might accrue. A key limiting factor is the absence of forest and shrublands on most of the land area; land cover is 83% exotic grassland and 7% exotic forest, while indigenous forest is 1.4% (Burge et al. 2017). Control of feral cats, mustelids, hedgehogs, ship rats and Norway rats across large areas of farm landscape could enable kiwi and weka to establish and breed, but only if dogs were also managed. This would require enormous community support, otherwise the few dissenting landowners’ dogs could gradually kill most birds in the population. We suggest that the dog issue will inevitably arise at some stage in the future if residents want kiwi in their backyards; the issue is when WRC or another agency wishes to begin this particular engagement. Farm-based control of diverse predators undertaken in a ‘buffer zone’ around lakes and wetlands would also be enormously helpful to limit reinvasion to vegetated wetlands, including lake edges.

6.4.4 Connectivity

Birds vary enormously in their capability, and perhaps willingness, to leave a habitat site and search for other places to live. Such movements include:

- natal dispersal, by which sub-adult birds move from where they were born to where they will themselves breed
• breeding dispersal, by which adult birds change their breeding site from year to year
• migration – an annual repeated cycle of movement between widely separated breeding and non-breeding locations
• home range and territory – the typical movements of a bird as it finds seasonal food (e.g. large tūi movements in winter) and breeds, throughout a year
• post-translocation dispersal – the movement of individual birds after translocation to a new site (Richardson et al. 2015).

There have been very few detailed studies of most of these movements for most bird species, simply because the research is difficult and time-consuming, and therefore expensive. There are few tools (banding, radio transmitters, genetics), and the work needs substantial effort and time. There is a preliminary synthesis of relevant known data about pasture or sea gap-crossing, natal dispersal, and common seasonal movements for 21 forest bird species in the Cape to City landscape setting in Burge et al. 2017 (reproduced here in Appendix 4). That synthesis suggests that the distance of ‘pasture-gap’ that birds will willingly cross varies greatly between species, with some birds, such as hihi/stitchbird (Notiomystis cincta), North Island robin, North Island tieke, and whitehead (Mohoua albicilla), that won’t cross 300 m gaps between trees; others, such as bellbird, harrier, kākā, kererū, falcon, kākāriki, and tūi, that will cross 20+ km gaps; and a few species, such as brown kiwi, rifleman (Acanthisitta chloris), and miromiro (tomtit), that are in between.

In a Halo setting these behaviours suggest a clear provisional framework for the kinds of vegetation ‘corridors’ required by different species to cross landscapes, from continuous trees or shrubs for robins and whiteheads, to virtual irrelevancy for tūi, bellbirds, kererū and falcons. Miromiro (tomtit) seems to be one endemic forest bird species that is in between: it will cross sparsely treed landscapes, including exotic forests. Many insectivorous birds such as, miromiro and some frugivorous species (including North Island kōkako) travel and/or breed in exotic forests in New Zealand (Peterson & Hayman 2018). Exotic forests are therefore a fast-growing and possibly financially remunerative option for restoring connectivity for birds in production landscapes.

In general, restoring native forest by planting is labour-intensive and expensive, even on quite small areas. Larger planted areas include 120 ha on Tiritiri Matangi Island, Auckland; the planned 60 ha at Waiwhakareke in urban Hamilton (26 ha so far achieved); and 45 ha at the outlet of Lake Rotoiti near Rotorua (P. de Monchy, Bay of Plenty Regional Council, pers. comm.). The only other nationally large-scale initiative is riparian planting to improve stream quality by excluding stock, limiting nutrient entry, and providing shade and allochthonous detritus (McKergow et al. 2016). However, most New Zealand riparian buffers in pastoral land are <5 m wide (McKergow et al. 2016). At 385 Waikato sites, most (62%) stream sites had <5 m wide buffers and >80% had non-woody vegetation (Jones et al. 2016), which would not be habitat for most biodiversity, and certainly not forest birds.

If establishing bird movement corridors for reluctant gap-crossers such as whiteheads, robins and tieke is of further interest to WRC, there would be value in a more detailed GIS-based analysis of current vegetation and the need for new planting to achieve the required connectivity for these species, at selected key sites. The recently announced
Billion Trees programme\(^9\) may offer possible support for larger-scale planting than has previously been the case.

Pending that connectivity analysis, we see two other large planting initiatives that would clearly help birds.

- The first is to plant or encourage widespread planting of food plants for tūī, bellbirds and kererū (Appendices 1–3; see section 6.4.5) anywhere in the Halo area, but particularly of species that produce nectar and fruit \textit{at the times required for nesting}, when the demand for food by breeding females is greatest. These species are mobile and in time should find most food trees.
- The second is to utilise the banks of the Waikato and Waipā Rivers (Figure 9) as planting restoration sites that on average are much wider than for most riparian planting. The river banks potentially link forests near Maungatautari and Cambridge with Hamilton downstream, via the Waikato, and forests near Pirongia and Whatawhata with the Hakarimata Range, via the Waipā. There is then a short link from the Hakarimata Range upstream via the Waikato to Hamilton, where the Waikato binds the 750 ha ‘ribs’ of Hamilton gullies (Clarkson et al. 2007; Clarkson & Kirby 2016) to the ‘spine’ of the main river. Substantial further investigation would be merited to look closer at the current vegetation composition along the river banks, and to decide what additional plants should be established there, and why.

While planting could deliver some nectar, fruit and connectivity to birds inside 10 years, gains would inevitably accrue long after this, for decades and even centuries.

Many Halo residents, groups like Tui 2000, tangata whenua, farmers, other landowners, and agencies such as Waikato Regional Council and Hamilton City Council will undoubtedly continue to do much planting of native trees, and presumably these initiatives may be helped by the Billion Trees initiative.

\subsection{6.4.5 Targeted planting for visiting tūī, bellbirds and kererū}

Tūī, bellbirds and kererū use a wide variety of native and exotic plants for food (Appendices 1–3), and many of these are often used in restoration and amenity plantings. We compared plants known to be frequently eaten by tūī, bellbirds and kererū with four published planting guides that include parts of the Halo area (Table 3), and the 2018 order form for purchasing plants through the Waikato Regional Council Plant Supply scheme.

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Table 3. Planting guides compared against known food sources frequently used by tūī, bellbirds and kererū

<table>
<thead>
<tr>
<th>Guide</th>
<th>URL</th>
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<tbody>
<tr>
<td>Getting riparian planting right in the Waikato</td>
<td><a href="https://www.dairynz.co.nz/media/660477/waikato_riparian_management.pdf">https://www.dairynz.co.nz/media/660477/waikato_riparian_management.pdf</a></td>
</tr>
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We identified plants that provide important food types (nectar for tūī, nectar and fruit for bellbirds, and fruit for kererū), before and during main breeding times (June–December for tūī and bellbirds, and throughout the year for kererū), but that are under-represented in planting (i.e. listed in fewer than half of the five documents). We excluded exotic plants that are considered weeds and native species that are not endemic to the Halo area.

Promoting additional planting of these species, where appropriate, may help to alleviate food constraints and attract more of these iconic birds to visit and breed in rural and urban environments in the Halo area. Note that some of these plants may be difficult to cultivate, or may have specific habitat requirements that are outside the scope of this analysis.

**Species to plant for tūī, bellbirds and kererū**

We identified five key plants (all native) that are important food sources for tūī, bellbirds, and kererū. Planting these species will benefit all three bird species: *Dysoxylum spectabile* (kohekohe), *Elaeocarpus dentatus* (hīnau), *Fuchsia excorticata* (kōtukutuku, tree fuchsia), *Pseudopanax arboreus* (fivefinger), and *Vitex lucens* (pūriri).

**Species to plant for bellbirds**

We identified 25 native species that are suitable for targeted planting for bellbird food: *Alseuosmia macrophylla*, *Coprosma grandifolia*, *Coprosma lucida*, *Coriaria arborea*, *Dysoxylum spectabile*, *Elaeocarpus dentatus*, *Fuchsia excorticata*, *Geniostoma ligustrifolium*, *Illeostylus micranthus*, *Knightia excelsa*, *Leucopogon fasciculatus*, *Lophomyrtus bullata*, *Metrosideros fulgens*, *Metrosideros robusta*, *Muehlenbeckia australis*, *Parsonia heterophylla*, *Peraxilla colensoi*, *Peraxilla tetrapetala*, *Phormium cookianum*, *Pseudopanax arboreus*, *Rhabdothamnus solandri*, *Solanum laciniatum*, *Tupeia antarctica*, *Vitex lucens*, and *Weinmannia racemosa*. In addition, the genus *Veronica* was identified as a valuable food source, so the local species (*Veronica stricta*) may be worth promoting. Although not identified in our analysis, *Alseuosmia quercifolia* is likely to be
another suitable species, as it occurs in the Halo area and has in the past been included in the closely related *A. macrophylla*.

Recognising that introduced plants may be preferred by landowners in some situations, we identified two introduced species that could make a valuable contribution to bellbird food supply. These are *Camellia reticulata* and *Chamaecytisus palmensis*. In addition, six genera contain many species that are typically valuable nectar sources: *Banksia, Eucalyptus, Corymbia, Grevillea, Kniphofia,* and *Ribes*.

*Species to plant for kererū*

We identified 25 native species that would be particularly valuable for New Zealand pigeon: *Alectryon excelsus, Beilschmiedia tawa, Coprosma grandifolia, Coprosma lucida, Coprosma rhamnoides, Dacrydium cupressinum, Dysoxylum spectabile, Elaeocarpus dentatus, Fuchsia excorticata, Hedycarya arborea, Illeostylus micranthus, Litsea calicaris, Lophomyrtus obcordata, Piper excelsum, Nestegis cunninghamii, Nestegis lanceolata, Prumnopitys ferruginea, Pseudopanax arbores, Pseudopanax crassifolius, Pseudowintera axillaris, Rhopalostylis sapida, Ripogonum scandens, Solanum aviculare, Solanum lacinatum,* and *Vitex lucens.*

Most introduced species used by kererū (Appendix 3) are either weedy or provide mainly foliage, which is considered a low-quality subsistence food. Consequently, no introduced plants were identified as suitable for planting for kererū.

**6.4.6 Synthesis**

We do not see any easy ‘low-hanging fruit’ for Halo after its āti success. It is important to remember that āti increases occurred after years of targeted research about limiting factors, plus decades of planting by residents, agencies and community groups such as Tui 2000. We think that ongoing and, if possible, increased pest control will continue to slowly increase bellbird and kererū numbers, although this could be hastened by research.

Restoration in non-forest environments challenges how habitat shortage and mammalian predation interact as factors limiting forest bird abundance (Innes et al. 2010). It is possible that food supply and habitat shortage are larger and more immediate limiting factors *in local and regional deforested landscapes* than people have acknowledged (Ruffell & Didham 2017). Increasing habitat *area* is conceptually simple (plant trees) but in practice expensive and long term for the required scale, and may be politically difficult when nearly all of the land in the landscape matrix is privately owned.

Nesting success and hence abundance of kererū and of āti and bellbirds, is likely to be increased by planting particular trees that supply fruit and nectar, respectively, at key nesting times and places. Because these bird species are mobile, there is probably value in anybody planting these trees anywhere. Planting for avian *connectivity* or kererū/honeyeater *food* is easier than planting to increase habitat *area*, because a much smaller number of trees may be adequate, and they could be fast-growing exotics. If connectivity is the aim, there first has to be new habitat available before there is any point in giving birds access to it.
We think the riparian banks of the Waikato and Waipā Rivers together provide the best current option for restoration by planting to restore large-scale habitat area and connectivity for forest birds in the Halo area (see section 6.3.4). We recommend that there be substantial investigation of current and potential vegetation composition along the river banks, and that planting then proceed methodically to transform these riparian ecosystems and establish these two large new forest corridors in the Waikato. As always with native plant restoration, it is vitally important that there is repeated releasing of seedlings after they are planted, to prevent smothering by weeds.

Similarly, translocations can dramatically transform local avifauna, as has occurred with Zealandia in Wellington, but there has to be suitable habitat free of predators around such a sanctuary for population establishment to be successful in the long term (Seddon et al. 2012).

It is interesting to ponder whether Hamilton has a ‘Zealandia-equivalent’ site, but there are no obvious candidates. Waiwhakareke is destined to be pest-fenced, but it is only 50–60 ha, a quarter of the size of Zealandia and probably less than the smallest area that would sustain a population of tieke, for example, with genetic safety, although it would be a perfectly adequate site for a kiwi crèche, or a sanctuary for lizards or rare invertebrates. Maungatapouri is by far the largest pest-free site in New Zealand, an extraordinary, large project that is in a sense on our doorstep, and yet is outside the current Halo envelope and is poorly connected to other habitat.

Rare and iconic forest birds such as tieke require zero abundance of key mammal pests (ship and Norway rats, feral cats, all three mustelids, and possums), plus management of domestic cats and dogs in urban and rural environments. Currently, and for the foreseeable future, multi-mammal eradication inside a pest-proof fence is the only available tool and strategy to have tieke in human-lived environments. Such a project and fence could be imagined at Pirongia, at Karakariki, in the Hakarimata Range, or in the clustered forests between Te Miro and Pukemako (Figure 1) but it would be expensive and would come with substantial opportunity cost.

Freshwater birds are in many ways a new venture. They have the advantage of being mobile and so can perhaps form naturally dispersive populations in the scattered remaining Halo wetlands. They could greatly help celebrate Waikato wetlands, bringing them to life for citizens who are not yet enamoured of wetland landscapes. They have the disadvantage of extremely little background research that can inform us about which factors limit their abundance. This is both a challenge and an opportunity, because simple initiatives such as trialling artificial breeding sites for shags and dabchicks, and expanding best practice pest control (including, perhaps, pest low-fences) around wetlands, may be rapidly effective at increasing bird numbers.

6.4.7 Research

In 2018, conservation management has vastly outstripped reliable knowledge about how habitat area and quality and predation interact as limiting factors for birds and other wildlife. That is, there is far too little research being undertaken to support the greatly increasing scale of pest control and habitat restoration for wildlife. In this situation,
management projects themselves can be powerful learning case studies if they are carefully targeted, conceived and monitored.

The following potential research projects (in no particular order) have arisen during this review, and we think that implementing any of them would help support practicable progress in aspects of Project Halo.

- Determine times and places of kererū display dives using public report and structured observations at key locations. Display dives are tight indicators of nesting, and knowing more about where and when they happen will directly steer where and when to apply pest control to protect the resultant attempts.

- Follow bellbirds to nest sites, and follow outcomes of nesting attempts using small radio transmitters. It is possible that bellbirds face much greater risks than tūī when nesting because they are much smaller, and so sitting females in particular may be vulnerable to ship rats. This may clarify that bellbirds need lower residual abundances of ship rats than tūī for successful nesting.

- Commence local study of deer (especially fallow) impacts on vegetation, and/or support national calls for such research. It is likely that habitat quality (food supply) is an increasingly important success factor for bird populations, once predation is substantially managed, and that deer control at key sites will increase bird populations.

- Commence local study and/or support national research on forest bird movement in fragmented landscapes, especially for ruru and bellbirds. Better understanding of natal dispersal would help explain if sub-adult birds fledged at a site actually recruit there as adults or move elsewhere, while better understanding of gap-crossing behaviour in birds would help explain natal dispersal and in turn help design movement corridors for birds. The full or natural expression of natal dispersal may obviously be limited by available habitat size and connectedness, and so understanding both natal dispersal and gap-crossing is required.

- Commence local study and/or support national research about factors that limit freshwater bird numbers in New Zealand. This could include study of how water clarity, depth, macrophyte and alga presence, shore vegetation, food sources and human disturbance influence the presence of diving birds such as shags and dabchicks.

- Experimentally study the use of artificial nest sites by selected species (little, black, and little black shags, ruru, dabchicks, and falcons; perhaps kākā and kākāriki later) as experimental tests of whether the species would use the sites and whether these are simple, effective conservation measures.

7 Conclusions

- We see two broad possible futures for Project Halo:
  - maintain, or preferably enhance, existing pest control for current forest birds (tūī, bellbirds, kererū)
  - select new focus bird species that would demand new management actions.
Possible new focus species, and new management actions for them, include:

- weka and/or brown kiwi (control mustelids, feral cats and possums, and manage domestic dogs and cats in rural landscapes)
- shags, dabchicks and fernbirds (experimentally supply artificial nest sites, and sustain predator control at wetlands)
- kākā and kākāriki (partner with an agency that may be interested in captive rearing for release)
- falcons (hack young falcons onto building nest sites in Hamilton City).

The riparian banks of the Waikato and Waipā Rivers are together the best current option for restoration by planting to restore large-scale connectivity for forest birds requiring continuous forest across the Halo area.

Nesting success, and hence the abundance of kererū and of tūī and bellbirds, is likely to be increased by planting particular tree species that supply fruit and nectar, respectively, at key nesting times and places.

8 Recommendations

We recommend that Waikato Regional Council and other agencies interested in avian restoration in and around Hamilton City:

- consider which components of the two broad Halo futures ('tūī, bellbirds, kererū' or 'new focus species') are of most interest them and apply the relevant management opportunities that we describe for each
- consider dropping pest control at distant Halo blocks (Maungakawa and Bridal Veil Falls) in favour of sites closer to Hamilton (e.g. Kaniwhaniwha Conservation Area, Karakariki and Te Puroa Scenic Reserves, and Whewells Bush Scientific Reserve) or in favour of more frequent (e.g. annual, indefinitely) control at other Halo pest control blocks
- increase planting (including more methodical post-planting releasing) and pest control in Hamilton City gullies to greatly increase the area of habitat suitable for rarer native birds such as kererū, bellbirds and miromiro (tomtits)
- investigate current and potential vegetation composition along the Waikato and Waipā river banks, and then methodically transform these riparian ecosystems by large-scale planting to establish two large new forest areas and corridors in the central Waikato
- encourage further planting of trees that best deliver fruit and nectar at nesting times and nesting sites for kererū, and for tūī/bellbirds, respectively
- support research on kererū display dives, bellbird nesting, deer impacts on bird habitat, bird (including ruru) movement, use of artificial nest sites by various species, and factors limiting freshwater birds, which, in aggregate, would assist conservation management and iwi wellbeing in diverse, non-forested landscapes.
9 Acknowledgements

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10 References


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Appendix 1 – Plant foods used by tūī


1 Known or likely weed species (M. Smale, pers. comm. 2018).

1 Species not native to Halo area (M. Smale, pers. comm. 2018).

2 Some species in this genus are not native to the Halo area.
Figure A2, con’t.
Appendix 2 – Plant foods used by bellbirds

Figure A3. Seasonal availability of introduced plant fruit (red), and flowers (orange) frequently eaten by bellbirds. Plant use from Rasch & Craig 1988; Williams & Karl 1996; Robertson et al. 1999; Higgins et al. 2001; Medway 2006; Anderson et al. 2011; Pattemore & Anderson 2013. Plant phenology from New Zealand Plant Conservation Network (www.nzpcn.org.nz) and iNaturalistNZ (www.inaturalist.nz).

1 Known or likely weed species (M.C. Smale, pers. comm. 2018).
Figure A4 (continued next page). Seasonal availability of native plant fruit (red), and flowers (orange) frequently eaten by bellbirds. Plant use from Rasch & Craig 1988; Williams & Karl 1996; Robertson et al. 1999; Higgins et al. 2001; Medway 2006; Anderson et al. 2011; Pattemore & Anderson 2013. Plant phenology from New Zealand Plant Conservation Network (www.nzpcn.org.nz) and iNaturalistNZ (www.inaturalist.nz).

1 Species not native to Halo area (M.C. Smale, pers. comm. 2018).
2 Some species in this genus are not native to the Halo area.
Figure A4, con’t
Appendix 3 – Plant foods used by New Zealand pigeon


1 Known or likely weed species (M.C. Smale, pers. comm. 2018).

1 Species not native to Halo area (M.C. Smale, pers. comm. 2018).
Figure A6, con’t.
Appendix 4 – Native forest bird movements: a preliminary assessment

Table A1. A preliminary assessment of movement distances for native bird species currently present, or having a realistic possibility of being present in the future, in the Cape to City area, Hawke’s Bay. As species attributes, the data are also relevant to the Halo project. Dispersal distances are mostly means or representative figures from available data, and generally do not include outlying records. Scientific names follow Gill et al. 2010. Reproduced with permission from Burge et al. 2017. See Burge et al. 2017 for sources.

<table>
<thead>
<tr>
<th>Species</th>
<th>Scientific name</th>
<th>Pasture* or sea* gap-crossing (km)</th>
<th>Natal dispersal (km)</th>
<th>Other seasonal movements (km)</th>
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<tr>
<td>Bellbird/korimako</td>
<td>Anthornis melanura</td>
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<td>Brown kiwi</td>
<td>Apteryx australis</td>
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<td>10</td>
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<td>Red-crowned kākāriki</td>
<td>Cyanoramphus novaeseelandiae</td>
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<td>1.7</td>
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