



296-081 Te Karamū Enhancement
Review & Management Strategy 2016-25
Karamū Stream, Hawkes Bay

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Cover photo: Karamū Stream and Ruahāpia spring, looking upstream toward Ruahāpia Marae and Golflands (left) – 18 Dec 2014.

1 Executive Summary

The waterways of the Karamū catchment have evolved through a series of transformations over its history. The original meandering channels were regularly overwhelmed by the flow of the Ngaruroro, and infamous for the dense swamp vegetation that early settlers had to navigate. A programme to clear exotic willow that was choking the channel was undertaken in the early 1970's, and the grazing of sheep and cattle then became the accepted means of managing weed growth. The catchment currently functions to convey stormwater away from the Heretaunga Plains, including the expanding urban area of Hastings. The catchment is becoming increasingly valued as a source of irrigation; as habitat for wildlife; for views from public and private areas; and as a public recreational area.

Since the first coordinated planting at Havelock North in 1997, enhancement work has been initiated in parts of the Karamū catchment, from Whakatū (5kms upstream from Waitangi Estuary) to Bridge Pa (35kms upstream) and beyond. Significant support, engagement and awareness from marae on the banks of the waterway has been a driving factor for the project. Community support, engagement and awareness continues to grow with the maturing of the initial enhancement projects. A significant stage in the planning phase was the **'Te Karamū Catchment Review and Options for Enhancement'** (2004)¹ report. A strategy and work programme is now required to progress the enhancement work in the context of the changes that have occurred and the progress that has been made in implementing the recommendations to date.

Through the acknowledgment of an overarching objective (vision) to **'improve habitat and ecosystem health whilst providing flood and erosion protection'**, **24 management objectives** have been developed, and are grouped using the following four broad 'values and management objectives'²:

1. Drainage and Flood Control.
2. Ecological Value (Stream Habitat, both Terrestrial and Aquatic).
3. Amenity and Aesthetic.
4. Cultural, Social and Recreational.

It is recommended that the 'Te Karamū' Enhancement project continues through the application of the following strategy:

- Strategy 1a: Control Plant Pests and Prevent Re-Establishment.
- Strategy 1b: Control Animal Pests and Prevent Re-Establishment.
- Strategy 2: Protect and Preserve Existing Animals and Plants that are Desirable.
- Strategy 3: Re-establish an Indigenous Ecosystem (Framework).
- Strategy 4: Protect and Enhance Cultural, Social and Recreational Values.

This strategy provides a vision (or 'toolbox') to enable the Karamū Stream and its tributaries to be maintained as a highly valued asset to Hawke's Bay, providing a vision for a balancing of values where grazing, native vegetation, and recreational areas support a rich and abundant ecosystem that is accessible and easily managed. A vision for a network of clean healthy waterways, connecting and unifying the residents of the Heretaunga Plains. An asset and resource that supports the cultural, commercial, social and recreational needs of the community.

¹ **Te Karamū Catchment Review & Options for Enhancement** (15 June 2004). Asset management / Engineering Section, Environmental Management Group, Hawke's Bay Regional Council.

² **Te Karamū Catchment Review & Options for Enhancement** (15 June 2004). Asset management / Engineering Section, Environmental Management Group, Hawke's Bay Regional Council. Part 2.3, Pg 8.

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2 Introduction

“Consistent with the pattern of indigenous forest loss, the degree of change in the biological community is greater in rivers and streams in Hawke’s Bay that run from the foothills (of the main ranges) to the coast, than in those on the mountain ranges. The degradation of freshwater habitats from reduced flows and contamination, as well as the effects of introduced species and over-harvesting has severely restricted the distribution of many freshwater species (particularly birds and insects). Freshwater habitats are vulnerable to nutrient enrichment, sedimentation, algal blooms, changes in flow and proliferations of invasive plants...”³

A 2012 report on terrestrial ecology in the Karamū Catchment concluded that: *“With the almost complete change of land cover type from indigenous to exotic comes dramatic changes in ecological condition. The important focus for Resource Managers now needs to be on understanding the remaining terrestrial values and processes (including the role of both exotic and indigenous elements) and how they can best be secured, while meeting human objectives.”⁴*

The ‘**Te Karamū Catchment Review and Options for Enhancement**’ (2004)⁵ report provides thorough analysis and detailed recommendations for the management of the Karamū catchment. Part of the information formally approved in 2004 included a ‘Rough Order Cost Estimates’⁶ and it was recommended that staff would develop a further detailed proposed work programme. More detailed planning and assessment has occurred at various scales across the catchment since 2004, including a draft Karamū Revegetation Strategy and Concept⁷ report in 2007, and site specific earthworks and planting plans.

Community support, engagement and awareness has grown with the maturing of the initial enhancement projects, and this strategy assists to further progress and direct the management of this valuable asset by the **Hawke's Bay Regional Council** (HBRC) on behalf of residents of Hawkes Bay.

3 Preparation, Consultation & Ownership

The development and preparation of this strategy incorporates contributions from various staff members and groups of the HBRC, including Open Space Development, Engineering, Hydrology, Biosecurity, Environmental Science, and Land Management. Additional background information has been provided by kaitiaki and adjacent neighbours, including Jim Watt with regard to enhancement at ‘Park’s Reach’, Havelock North.

4 Scope

This strategy is primarily intended as a guide for the **open space development and management of public land within the Karamū catchment which is owned or managed by the Asset Management Group of the HBRC**. It can also be used as a resource guide or ‘toolbox’ to guide other land management decisions for other projects within HBRC, district and central government agencies, iwi, adjacent landowners, individuals, community groups and organizations, and other stakeholders wishing to coordinate enhancement projects in Hawkes Bay, or that have an interest in biodiversity, conservation and sustainable resource management in the area.

The strategy has been developed with the experience and knowledge of relevant experts; however it is intended to be an evolving document, subject to the changing needs of the local community and the statutory context.

³ Hawke’s Bay Regional Council (June 2015). **Hawke’s Bay Biodiversity Strategy: 2015-2050**. Pg 24.

⁴MWH (January 2012). **Karamū Catchment Terrestrial Ecology Characterisation**. Prepared for Hawke’s Bay Regional Council. HBRC Plan 4594. Part 6.1, page 50.

⁵ **Te Karamū Catchment Review & Options for Enhancement** (15 June 2004). Asset management / Engineering Section, Environmental Management Group, Hawke’s Bay Regional Council.

⁶ Meeting Agenda Item 5 - **Te Karamū Catchment Review & Options for Enhancement** (25 Feb 2004). Gary Clode, Mike Adye, Hawke’s Bay Regional Council – Asset Management and Biosecurity Committee. Table 11.2.

⁷ Hawke’s Bay Regional Council (McGlinchey, L.) and Huson Associates Ltd (Gerard, S.) (Feb 2007). **DRAFT Karamū Stream Enhancement – Revegetation Strategy and Concept**.

5 Vision and Purpose

The strategy shares the HBRC vision⁸ for a region with a vibrant community, a prosperous economy, a clean and healthy environment, now and for future generations, with an overarching vision (objective) to **improve habitat and ecosystem health whilst providing flood and erosion protection**.

This strategy provides a brief summary of the 'Te Karamū Catchment Review and Options for Enhancement' (15 June 2004), as well as updating the 2004 report to align with the implementation progress that has occurred since it was prepared. The strategy is consistent with the HBRC long term focus and statutory role in the following four core functions:

- Natural resource knowledge and management.
- Natural hazard assessment and management.
- Regional strategic planning.
- Regional scale infrastructure and services.

6 Location & Site Description

The **Karamū catchment** is located in Hawke's Bay, New Zealand, and consists of over 238 lineal kilometres of streams (shown on **Figure 1: 1-150,000 Topo Map and Attachment A: Karamū Catchment Map**), covering 51,462ha (514kms²) in area, and comprising 11 subcatchments (listed in **Table 1: Subcatchments of the Karamū**).

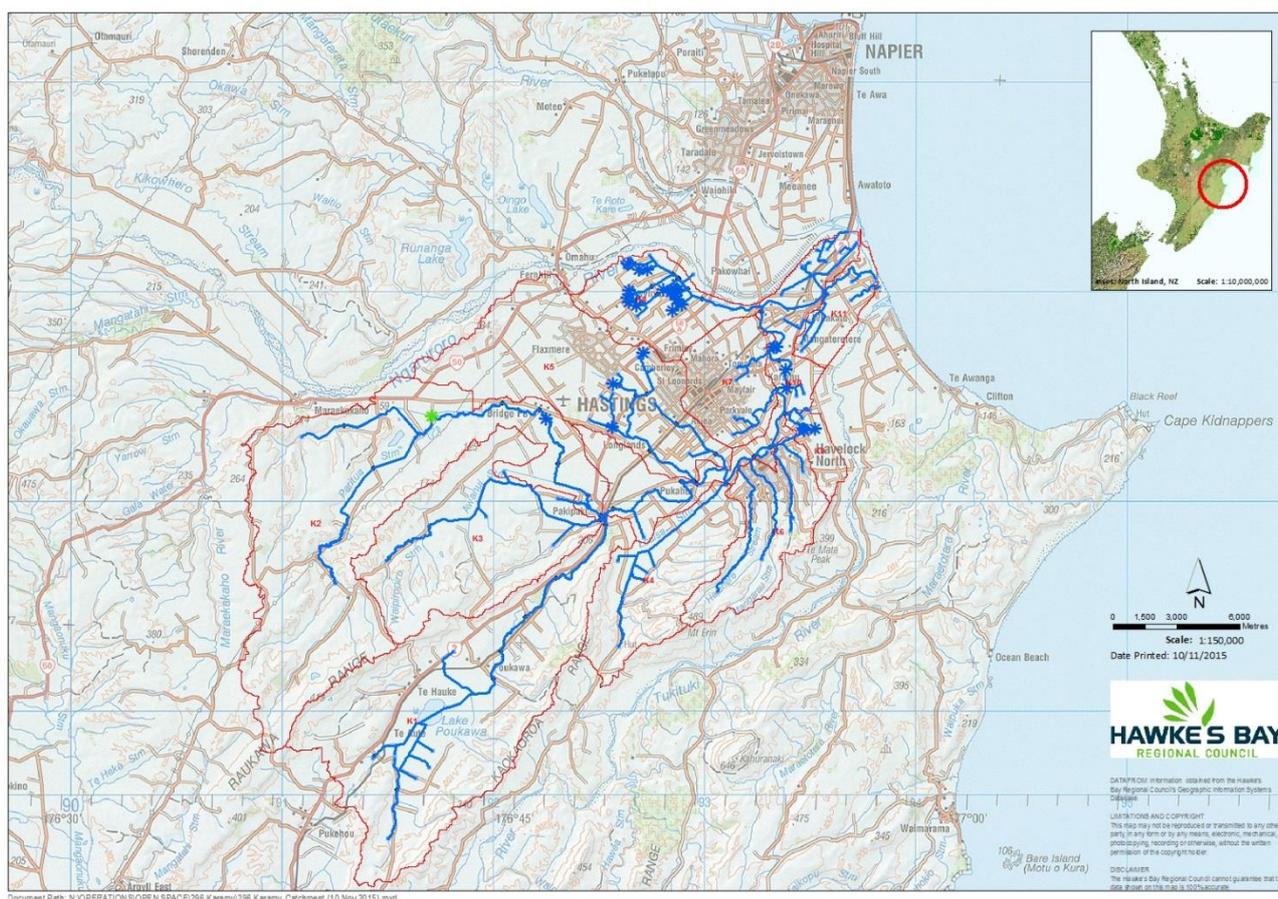


Figure 1: 1-150,000 Topo Map of Karamū Streams.

The **Karamū catchment** is bordered in the west by the Raukawa Ranges, and in the south by the Kaokaoroa Range where the highest point is Mt Erin (Kohinurakau) at 489masl. To the north it is defined by the stopbanks associated with the

⁸ HBRC – **Strategic Plan** (October 2011). ISBN 1-877405-58-2. HBRC Plan No. 4282. Page 5.

Ngaruroro River. The **catchment**, forms a significant part of the Heretaunga Plains, and flows to the tidal zone of the Waitangi Estuary where it meets Hawke Bay and the Pacific Ocean.

Land use across the catchment comprises a mix of grazing (predominantly sheep and beef), cropping, viticulture, orcharding, as well as urban residential, industrial, and commercial uses.

Table 1: Subcatchments of the Karamū

Code	Subcatchment	Hectares (Ha)	Median Flow (L/s)	Median Flow (L/s)
K1	Poukawa	11,044	180 ⁹	400 ¹⁰ (Awanui Flume)
K2	Paritua-Kārewarewa	12,005	185 ¹¹	
K3	Upper Awanui	6,165	107 ¹²	
K4	Louisa	3,483	86 ¹³	
K5	Irongate-Southland	6,213	333 ¹⁴	
K6	Havelock North Streams	2,742	N/A ¹⁵	
K7	Hastings Streams	2,106	N/A ¹⁶	
K8	Raupare	2,367	631 ¹⁷	
K9	Mangateretere	597	160 ¹⁸	
K10	Karamū-Clive Corridor	3,683	2,123¹⁹	
K11	Muddy Creek	1,058	N/A ²⁰	

The subcatchment '**K8 – Raupare**' forms part of the Karamū catchment, and is an important component of the strategy, however the Raupare Enhancement Society (RES) (with assistance from HBRC) are currently developing a separate and specific '**Raupare Enhancement Strategy**' in order to fulfil their requirements under the '**Agreement regarding Twyford Water Consents**' (24 Aug 2010).

This strategy is limited to the waterways which make up the **Karamū Catchment**, and excludes the 3 Regional Parks (Waitangi, Pākōwhai/Hawea, and Pekapeka) which form part of the catchment, and are important components of a potential framework, but are included in separate Management Plans.

For the purpose of this strategy, waterways have been divided into a series of zones, similar to the structure used for the '**Te Karamū Catchment Review and Options for Enhancement**' (2004)²¹, but which acknowledge the **Hawke's Bay Regional Park Network**²². These zones are listed in **Table 2: Karamū Enhancement Zones**.

⁹ Email From: Thomas Wilding, HBRC (Sent: Tuesday, 10 November 2015 5:12 p.m.). Re: Flow data for Karamū sub-catchments.

¹⁰ HBRC – Hawke's Bay Hydrological Data 2008-2014 (May 2015). **Table 3-35: Awanui Stream at Flume summary flow statistics, 1983-2014** (catchment area above the site is 302km²). Page 60.

¹¹ HBRC **Karamū Characterisation Report: Supporting Information for Water Allocation** (Nov 2013). **Table 4-1 Surface water statistics for the Paritua/Kārewarewa sub-catchment zone**. Page 62.

¹² HBRC **Karamū Characterisation Report: Supporting Information for Water Allocation** (Nov 2013). **Table 5-1 Surface water statistics for the Awanui sub-catchment zone**. Page 68.

¹³ HBRC **Karamū Characterisation Report: Supporting Information for Water Allocation** (Nov 2013). **Table 6-1 Surface water statistics for the Louisa sub-catchment zone**. Page 73.

¹⁴ HBRC – Hawke's Bay Hydrological Data 2008-2014 (May 2015). **Table 3-39: Poukawa Stream at Douglas Road summary flow statistics, 1976-2014** (catchment area above the site is 83.9km²). Page 64.

¹⁵ HBRC **Karamū Characterisation Report: Supporting Information for Water Allocation** (Nov 2013). **Table 8-1 Surface water statistics for the Havelock North Streams sub-catchment zone**. Page 87.

¹⁶ HBRC **Karamū Characterisation Report: Supporting Information for Water Allocation** (Nov 2013). **Table 9-1 Surface water statistics for the Hasting Streams sub-catchment zone**. Page 93.

¹⁷ HBRC **Karamū Characterisation Report: Supporting Information for Water Allocation** (Nov 2013). **Table 10-1 Surface water statistics for the Raupare sub-catchment zone**. Page 98.

¹⁸ HBRC **Karamū Characterisation Report: Supporting Information for Water Allocation** (Nov 2013). **Table 11-1 Surface water statistics for the Mangateretere sub-catchment zone**. Page 104.

¹⁹ HBRC **Karamū Characterisation Report: Supporting Information for Water Allocation** (Nov 2013). **Table 12-1 Surface water statistics for the Karamū-Clive-lower Awanui Corridor sub-catchment zone**. Page 110.

²⁰ HBRC **Karamū Characterisation Report: Supporting Information for Water Allocation** (Nov 2013). **Table 13-1 Surface water statistics for Muddy Creek**. Page 116.

²¹ **Te Karamū Catchment Review & Options for Enhancement** (15 June 2004). Asset management / Engineering Section, Environmental Management Group, Hawke's Bay Regional Council. Part 18.6, Pg 333.

²² **Hawke's Bay Regional Park Network Plan** (2014). ISBN: 1-877405-81-7. Hawke's Bay Regional Council (HBRC Plan 4552).

Table 2: Karamū Enhancement Zones

Zone Name	Water body	Zone Length	Description
Zone 1 - Whakatū	Karamū-Clive, Muddy Creek	5.87kms	Clive bridge to Karamū/Raupare confluence.
Zone 2 - Ruahāpia	Karamū, Ruahāpia	3.84kms	Floodgates to SH2 bridge
Zone 3 - Twyford	Raupare		U/s of Karamū/Raupare confluence
Zone 4 - Waipatu	Karamū, Awahou/Windsor/Riverslea, Mangateretere, Karitūwhenua	5.8 km	SH2 bridge to Crosses Rd bridge
Zone 5 - Havelock	Karamū, Herehere, Louisa	5.6kms	Crosses Rd bridge to Awanui/Irongate/Karamū Stream confluence
Zone 6 - Irongate	Irongate, Southland		K5 Irongate-Southland
Zone 7 - Awanui, Kārewarewa, Paritua	Awanui, Kārewarewa, Paritua, Poukawa		K3 Awanui, K2 Paritua-Kārewarewa, K1 Poukawa

7 Background & History of the Karamū

7.1 Context & Statutory Background

New Zealand has ratified the Convention on Biological Diversity, a multilateral treaty aimed at conserving biodiversity, ensuring sustainable and equitable resource use, with the vision: “By 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people”. In supporting the vision, New Zealand showed its support for international action to protect biodiversity and this strategy for Hawke’s Bay aligns with the national direction.²³ The New Zealand Biodiversity Strategy “...takes up the challenge to halt the decline of our indigenous biodiversity — our unique plants and animals and the places they live.”²⁴

At a local level, ngā take me ōna tikanga (issues and policies) listed in Mana Ake - An Expression of Kaitiakitanga with specific regard to Wai Māori include the following²⁵:

2.2.1 WATER QUALITY AND EXTRACTION

...

- Ensure the quality of water in all waterways is protected and maintained to support biodiversity in the awa, estuarine and coastal waters.
- Mitigate the use of upstream waters as a receiving environment for point source discharge of contaminants.
- That the quality of our waterways is maintained to that of a swimmable and recreational use standard.

...

2.2.3 WETLANDS

- There will be no further loss or degradation of Heretaunga wetlands; and restoration of existing wetlands of high importance will be a priority. This includes restoration of native vegetation and species.

7.2 Landform, Geology and Soil

The present channel of the Karamū Stream was left behind by the Ngaruroro River when it moved to its new channel in 1867. The Karamū catchment contains a large proportion of the Heretaunga Plains. The soils of the area are alluvial in origin, with the exception of relatively small areas of imperfectly drained soils of low fertility on strongly undulating hills.²⁶

²³ Hawke's Bay Regional Council (June 2015). **Hawke's Bay Biodiversity Strategy: 2015-2050**. Page 14.

²⁴ **The New Zealand Biodiversity Strategy** (February 2000). Page 2.

²⁵ Te Taiwhenua o Heretaunga (March 2015). **Mana Ake - An Expression of Kaitiakitanga**. Part 2.2, page 22.

²⁶ MWH (January 2012). **Karamū Catchment Terrestrial Ecology Characterisation**. Prepared for Hawke's Bay Regional Council. HBRC Plan 4594. Part 3.1.1, page 9.

7.3 Climate

Hawke's Bay has a generally dry, warm climate because it is sheltered on the west by the North Island's main mountain ranges. The region has between 2,100 and 2,200 hours of sunshine each year. In summer the maximum daytime temperature is usually 19–24°C. In winter, the daily maximum is 10–15°C. Rainfall is highly variable – summer can have droughts or heavy rains. The central plains receive between 800 and 1,200 millimetres²⁷.

7.4 Plant Biology

Before humans arrived Hawke's Bay was heavily forested. Beech trees and subalpine plants grew on the mountain ranges and foothills. Beech also grew on the southern coastal hills. Conifer–broadleaf forest and pockets of grassland covered the lower hills and plains.²⁸ Extensive wetlands would have been present, particularly towards the coast, characteristically featuring trunked sedges, toetoe, flax and raupo backed by kahikatea. Nearer the coast, low coastal forest and scrub communities would have included ngaio, kanuka, manuka, cabbage tree and tauhinu.²⁹

Pollen records indicate that when Hawke's Bay was first inhabited, the land was covered in a dense and diverse podocarp–hardwood forest dominated by matai (*Podocarpus spicatus*), totara (*Podocarpus totara*), kahikatea (*Dacrydium dacrydioides*), and included tree fern (*Cyathea dealbata* and *C. smithii*), titoki (*Alectryon excelsus*) and putaputaweta (*Carpodetus serratus*).³⁰

Indigenous cover is almost entirely gone from the Karamū Catchment. Those indigenous habitat patches which remain are typically small in area, and are embedded within an agricultural matrix. Isolation is an issue for many species of indigenous patches.³¹ In 2007, 71.6% of the land in Hawke's Bay was grassland, 14% exotic forest plantations, 6% mature or regenerating native bush and 2% horticultural land. Most of the very small amount of native forest in the region is found on the western mountain ranges and around Lake Waikaremoana. A number of exotic plants have become pests in Hawke's Bay.³²

7.5 Animal Biology

Native wildlife populations in Hawke's Bay are mainly confined to bush-covered mountain ranges, waterways and coastal habitats.³³ The Karamū catchment has the potential to be an important corridor between the Ranges and the coast. Native and endemic bird species currently present include: bellbird (korimako), welcome swallow, fantail (piwakawaka), tūi, kererū, grey warbler (riroriro) and kingfisher. The catchment could eventually become home to North Island kākā and New Zealand falcon (karearea), native skinks, geckos, bats and large land snails.

Bat sightings have occurred within the Karamū Catchment, and based on known distributions it is likely these bats would be the endemic long-tailed bat (pekapeka or *Chalinolobus tuberculatus*) which has been recorded widely across the North Island. They are thought to have a large total population but a high ongoing or predicted decline (ongoing decline of 50–70% in the total population over the next three generations is predicted). Long-tailed bats are known to be highly mobile (often undertaking 10–15km distance flights), therefore local forest remnants and favorable habitat within the catchment could well be important for maintenance of local populations of this threatened species.³⁴

The major animal pests of Hawke's Bay are rabbits, possums, rodents and cats.

²⁷ Te Ara – The Encyclopaedia of New Zealand. Manatū Taonga Ministry for Culture and Heritage. Web link [here](#).

²⁸ Te Ara – The Encyclopaedia of New Zealand. Manatū Taonga Ministry for Culture and Heritage. Web link [here](#).

²⁹MWH (January 2012). **Karamū Catchment Terrestrial Ecology Characterisation**. Prepared for Hawke's Bay Regional Council. HBRC Plan 4594. Part 6.1, page 50.

³⁰ O'Shaughnessy, H.J. (1988). **The Poukawa Catchment Water and Soil Resource Management Plan**. Hawke's Bay Regional Council.

³¹MWH (January 2012). **Karamū Catchment Terrestrial Ecology Characterisation**. Prepared for Hawke's Bay Regional Council. HBRC Plan 4594. Part 4.2, page 40.

³² Te Ara – The Encyclopaedia of New Zealand. Manatū Taonga Ministry for Culture and Heritage. Web link [here](#).

³³ Te Ara – The Encyclopaedia of New Zealand. Manatū Taonga Ministry for Culture and Heritage. Web link [here](#).

³⁴MWH (January 2012). **Karamū Catchment Terrestrial Ecology Characterisation**. Prepared for Hawke's Bay Regional Council. HBRC Plan 4594. Part 3.3.4.1, page 34.

7.6 Tangata Whenua and Te Karamū-Ngaruroro Awa

Māori first settled in Hawke's Bay around 1250–1300 AD. Ngāti Kahungunu people, who became the main iwi (tribe) in the region, arrived during the 1500's³⁵. Tangata whenua have an integral relationship with the natural environment of the Karamū-Ngaruroro Awa and, as kaitiaki, have a unique and important role in the protection, management and restoration of indigenous biodiversity. This strategy recognises:

- The unique and important role that Māori have in the management, restoration and sustainable use of indigenous biodiversity.
- The importance of effective working relationships between iwi, hapū and the community.
- That biodiversity management must reflect iwi and hapū priorities, alongside broader community priorities, to ensure benefits are shared, economic and social aspirations are met and kaitiaki responsibilities are fulfilled.
- The need for Mātauranga Māori to inform biodiversity management.



Figure 2: Tane-Nui-A Rangi Pa. A fortified village on the Ngaruroro River. From a drawing by Lieutenant H.S. Bates, 65th Regiment, 1858 (Turnball Library).

Current marae on the Karamū catchment include the following³⁶:

- Kohupātiki Marae (Whakatū)
- Matahiwi Marae
- Ruahāpia Marae
- Waipatu Marae
- Te Awa O Te Hauora Marae (HBDHB)
- Mihiroa Marae (Paki Paki)
- Taraia Marae (Paki Paki)
- Hougarea Marae (Paki Paki)
- Korongatā Marae (Bridge Pa)
- Mangaroa Marae (Bridge Pa)
- Te Aranga o Heretaunga Marae
- Kahurānaki (Te Haukē) Marae

Relevant Iwi/Hapu management plans include the following:

- Ngāti Hori Freshwater Resources Management Plan 2009-12, Operation Patiki Kohupātiki Marae³⁷.
- Mana Ake - An Expression of Kaitiakitanga, Te Taiwhenua o Heretaunga³⁸.
- Kahungunu ki Uta Kahungunu ki Tai Marine and Freshwater Strategic Plan, Ngāti Kahungunu Iwi Incorporated³⁹.

³⁵ Te Ara – The Encyclopaedia of New Zealand. Manatū Taonga Ministry for Culture and Heritage. Web link [here](#).

³⁶ Hawke's Bay Regional Council Online Maps (18/11/2015). **Pataka**. Link [here](#).

³⁷ Web link [here](#).

³⁸ Web link [here](#).

³⁹ Web link [here](#).

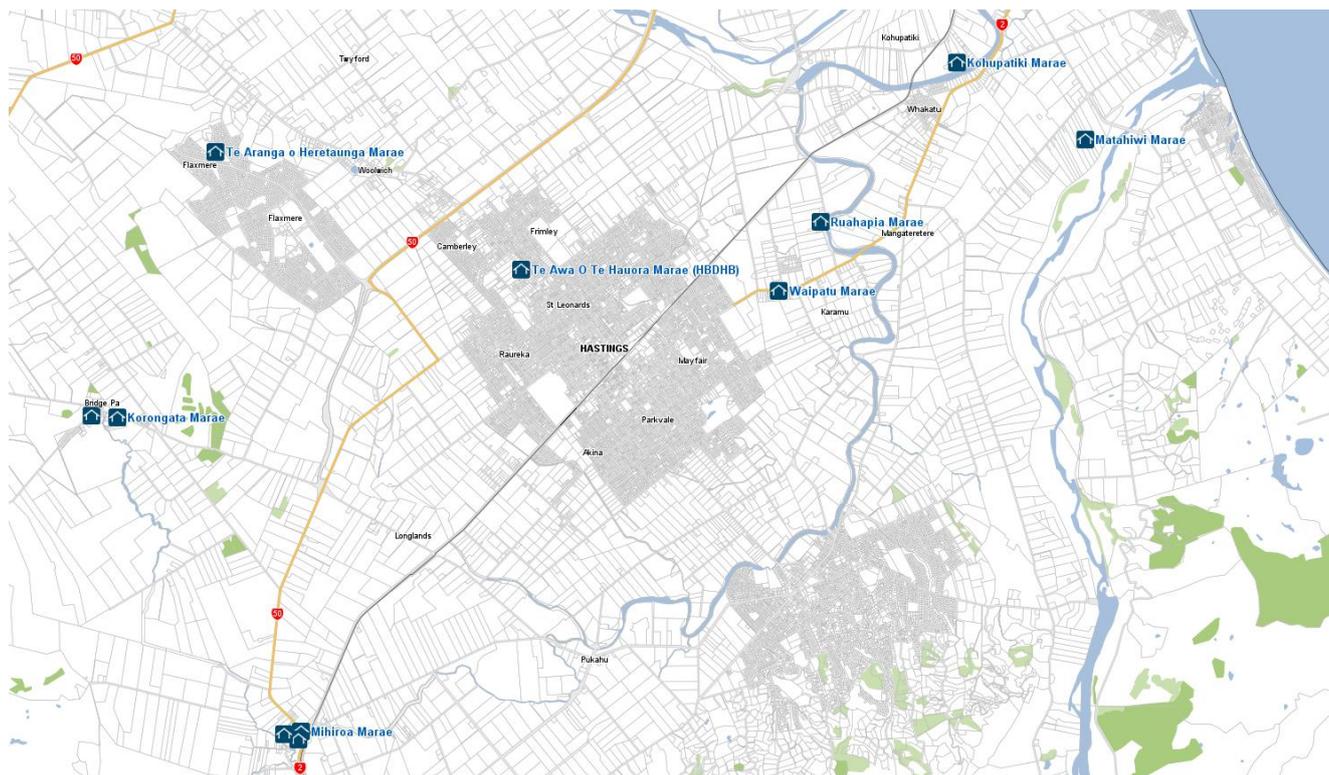


Figure 3: Marae on the Karamū Catchment (Kahurānaki Marae at Te Haukē is not shown).

7.7 Catchment Management in Hawkes Bay

Clearance of vegetation cover started with early Māori and continued with the arrival of Pākehā leaving a legacy of almost total modification of the natural ecosystems.⁴⁰ Upon his arrival, in 1769, Captain James Cook reported seeing “*several groves of straight tall trees...*”. One of those forest remnants sighted by Captain Cook at that time was no doubt the former forest remnant ‘Pakiaka Bush’, which was tall kahikatea dominated forest (120ha) near Whakatū.⁴¹ Over the last 150 years, 98% of freshwater wetlands in Hawke’s Bay have been lost, mostly through drainage or filling.⁴²

The following is a recent timeline of the Karamū implementation programme and related significant events:

Early 1970’s	Willow clearing.
1980’s	Land acquisition and coordination of grazing leases.
1997-2009	Enhancement planting initiated in Havelock North.
2004	Te Karamū Catchment Review & Options for Enhancement report.
2010-2013	Marae based enhancement planting starts.
2014	Consolidation (infill) enhancement planting.
2015	HBRC Biodiversity Strategy, Cape to City Project.

⁴⁰ Hawke's Bay Regional Council (June 2015). **Hawke's Bay Biodiversity Strategy: 2015-2050**. Pg 17.

⁴¹MWH (January 2012). **Karamū Catchment Terrestrial Ecology Characterisation**. Prepared for Hawke's Bay Regional Council. HBRC Plan 4594. Part 2.1, page 4.

⁴² Hawke's Bay Regional Council (June 2015). **Hawke's Bay Biodiversity Strategy: 2015-2050**. Wetlands. Pg 21.



Figure 4: Havelock North Bridge, Anderson Park and Lipscombe Crescent prior to clearing (c.1972-73).



Figure 5: Havelock North Bridge looking downstream, with Parkwood Country Lodge (April 1988).



Figure 6: Havelock North Bridge looking downstream (Sep 2015).

7.8 Enhancement Planting and Operation Karamū

Scattered groves of native trees as well as exotic fruit, nut, and shelter trees suggest that enhancement planting has occurred in limited locations, generally in close proximity to settlement, for many years. Examples include: the Havelock

North walnut trees (planted between 1915 and 1935⁴³); the miro and kahikatea native planting downstream of HN bridge (approx. 1960); and totara and kowhai planting (approx. 1km) downstream of Crosses Road bridge (approx. 1970).

In November 1984 the 'Plan for the Management of the Karamū Stream'⁴⁴ included an objective to coordinate the management and land use within the channel and floodway of the Karamū, with a focus on providing adequate flood capacity, land acquisition, vegetation control, grazing, access, recreation and water quality.

In the late 1990's a process of land acquisition was being completed, and the concept of a wider Karamū Enhancement project, which involved a corridor of planting from Paki to Clive, was being considered.⁴⁵

In 1997 a native revegetation programme (Operation Karamū) began at a section of the Karamū where it passes through Havelock North (see **Figure 7**: Plan of Operation Karamū (staged revegetation of the Karamū Stream, HNth), July 1997.), where previously there had been restricted public access due to crack willow growth. St Columba's Havelock North Environmental House Group (SCHNEHG) led by Hettie and Cyril Park initiated the 'Operation Karamū' ecological project over 3 years, from 1998 to 2000. Further information on the 'Karamū Stream Walkway (Heritage Trail)' is available online on page 20 to 21 of the Heritage Trail brochure⁴⁶.

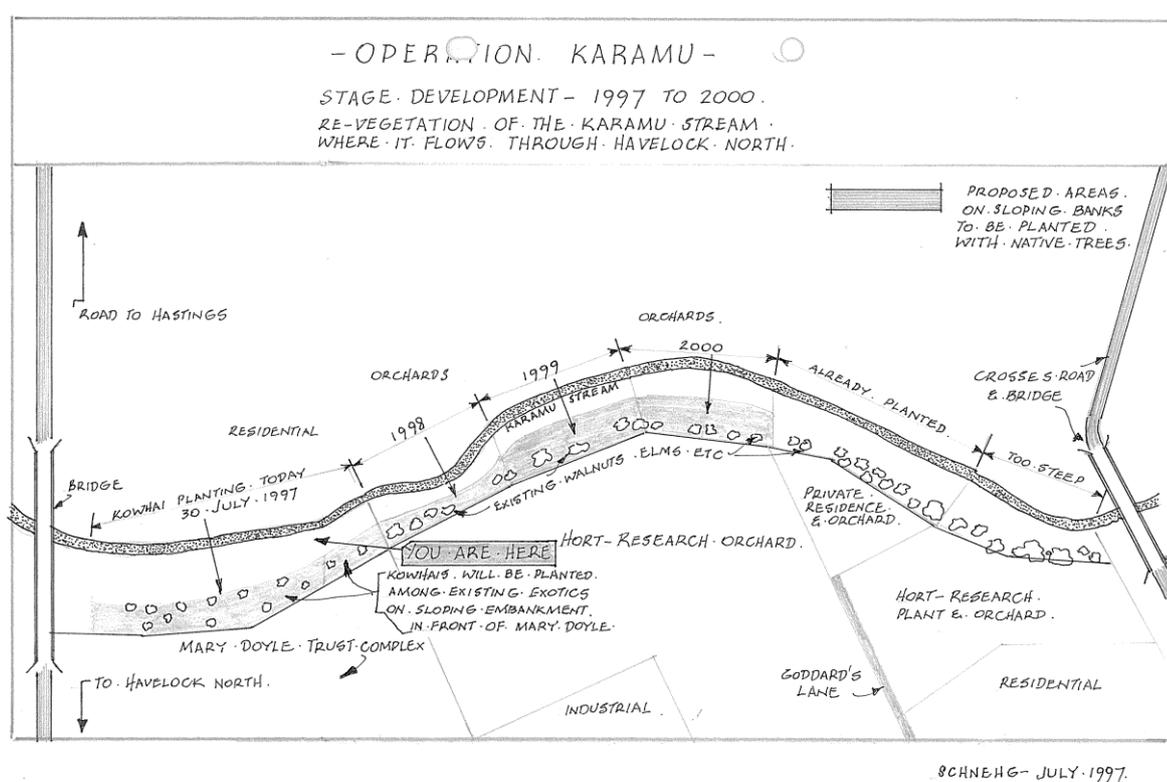


Figure 7: Plan of Operation Karamū (staged revegetation of the Karamū Stream, HNth), July 1997.

7.9 Te Karamū Catchment Review & Options for Enhancement (June 2004)

In 2004 the **Te Karamū Catchment Review & Options for Enhancement** report provided comprehensive information about the Karamū by summarising knowledge and understanding of the drainage, flooding and ecosystem relationships in the catchment area. The report includes recommendations on options to enhance the flood capacity of the Karamū system, as well as information on the ecosystem, indicating that the "habitat is in a poor state and water quality is less than ideal"⁴⁷.

⁴³ Pers comm Stephen Shaw, Arboricultural Consultant (Sep 2015).

⁴⁴ Olsen, N.F. (Nov 1984). **Plan for the Management of the Karamū Stream**. Hawke's Bay Catchment Board.

⁴⁵ Jim Watt (31 Aug 2015). 'Park's Reach' background information (Draft).

⁴⁶ Heritage Trail brochure (Nov 2003). Hastings District Heritage Trail Society Inc. Web link [here](#).

⁴⁷ **Te Karamū Catchment Review & Options for Enhancement** (15 June 2004). Asset management / Engineering Section, Environmental Management Group, Hawke's Bay Regional Council. Foreword.

The report included assessment methods (*Overall Habitat Class scores*⁴⁸ and *Summary of Stream Habitat Assessment Form*⁴⁹) which remain useful in defining objectives for this strategy.

The *Stream Habitat Assessment Form* is a modified version of the standard Hawke's Bay Regional Council Stream Habitat Assessment Form used regularly as part of the State of the Environment monitoring programme. This standard form was developed by the Regional Council in conjunction with a number of other lower North Island regional councils in 1999, to standardise the collection of information on aquatic and riparian habitat.⁵⁰

Overall Habitat Class scores⁵¹

Overall Habitat Class	Scoring range (Q 1 - 22 of Assessment)	Description
Class 1 - excellent	406 - 540	The habitat structure is quite diverse and offers an array of different habitats in the form of bends, pools, riffles and wooden in-stream debris. The riparian vegetation comprises predominantly indigenous species and shades most of the waterway. The stream/river bottom varies and channel and bank stability is high. Livestock generally have no access to the waterway.
Class 2 - good	271 - 405	The riparian vegetation is extensive, although not predominantly native, and gaps in the shading riparian vegetation occur. The benthic habitat diversity is still diverse in most of the stream/river sections. Some eroded areas are visible and stock is not always excluded from the watercourse.
Class 3 - fair	136 - 270	The riparian vegetation is insufficient in terms of shading and algae growth is visible. The benthic habitat diversity is low, as wooden debris, bends, pools and riffles are rare. The stability of the channel and banks is moderate, with unstable areas evident. Stock has access to certain sections of the watercourse and stock damage occurs.
Class 4 - poor	0 - 135	The streams are mostly void of trees. The benthic habitat structure is poor and most of the channel and the banks are unstable and actively eroding because of constant stock damage. There are also extensive algal growths that smother almost anything in the streams.

Summary of Stream Habitat Assessment Form⁵²

Question No.	STREAM HABITAT Characteristic	High Scoring Categories
1	Dominant land use pattern beyond the immediate streamside vegetative buffer zone	native forest, wetland; Tussock grassland
2	Width of stream and bankside vegetation on both sides that buffers the effect of deleterious land use patterns (average riparian zone)	>30 m wide; 5-30m
3	Structure of streamside vegetation	Trees with dense groundcover e.g. Tussock, toetoe, ferns, flax, rushes or natural wetlands
4	Type of streamside vegetation	Native trees like, Manuka, Kowhai, Hebe, Cabbage Tree etc., wetland
5	Age of the trees and the vegetation	High > 60
6	Streamside shading	50% or more
7	Completeness of bank and streamside vegetative buffer	Completely intact or Occasional breaks i.e. 1-10 gaps in reach
8-9	Periphyton and Macrophyte	not present
10-11	Bank and Channel Stability	stable, no evidence of erosion or bank failure

⁴⁸ Te Karamū Catchment Review & Options for Enhancement (15 June 2004). Asset management / Engineering Section, Environmental Management Group, Hawke's Bay Regional Council. Part 15.3, Pg 219.

⁴⁹ Te Karamū Catchment Review & Options for Enhancement (June 2004). Asset management / Engineering Section, Environmental Management Group, Hawke's Bay Regional Council. APPENDIX III, Pg 383.

⁵⁰ Te Karamū Catchment Review & Options for Enhancement (15 June 2004). Asset management / Engineering Section, Environmental Management Group, Hawke's Bay Regional Council. Part 15.3, Pg 218.

⁵¹ Te Karamū Catchment Review & Options for Enhancement (15 June 2004). Asset management / Engineering Section, Environmental Management Group, Hawke's Bay Regional Council. Part 15.3, Pg 219.

⁵² Te Karamū Catchment Review & Options for Enhancement (June 2004). Asset management / Engineering Section, Environmental Management Group, Hawke's Bay Regional Council. APPENDIX III, Pg 383.

12-13	Stock	No access or damage to the stream or banks
14-15	Potential for the input of sediments or contaminants	No
16-17	Artificial or natural drainage pathways	No
18	Stream/River bottom habitat diversity	Occurrence of riffle/ bends/pools. Diversity of habitat.
19-20	Stable bottom substrate	> 50% cobble, gravel, submerged logs, undercut banks, bedrock or other stable habitat (diverse and stable); Difficult to move.

The 2004 report included the following recommendations:

GENERAL ENHANCEMENT RECOMMENDATIONS – Stream Banks and Riparian Buffer Zones⁵³

It is recommended that the following be carried out throughout the catchment:

- Increase the proportion of tall riparian vegetation (trees) to increase shading effects on the waterways. This will in turn reduce periphyton and macrophyte growth (which will ultimately increase water and in-stream habitat quality), help stabilise banks, and introduce woody debris (where appropriate given other constraints) to increase benthic habitat diversity
- Where stream bank stabilisation is carried out in areas of severe erosion, it is important to ensure that taller trees do not completely shade the banks, thus excluding the grass species, rushes, sedges – especially *Carex secta* - and dense groundcovers that are the most effective at colonising and stabilising the banks
- Increase the proportion of native vegetation used in riparian margins
- Preserve and enhance areas already supporting native vegetation or valuable wetland flora. Fencing adjacent areas will encourage further natural regeneration
- Encourage landowners to repair existing fences and install new ones to prevent stock access to riparian areas
- Develop confluences as showcase wetland areas

RECREATIONAL USE⁵⁴:

There is excellent potential to develop a cycleway/track adjacent to the Clive/Karamū River. ... Opening up the riverside to public access will improve community buy-in to enhancements and promote public perceptions of the rivers in Hawke's Bay. A possible aim could be to link Pakipaki and Clive by track, providing a feature destination at the Pekapeka Wetland ... Such a track has the potential to become a national landscape feature...

... Clive River and river mouth area. Fishing, duck shooting, wildlife observation and boating (in particular rowing, waka, jet boating and water skiing) are popular, making this reach an important recreational area. One of the aims of this study is to look at ways of raising the profile of the Karamū as a natural asset, enhancing its recreational capacity and finding ways of encouraging greater recreational use.

CONSULTATION⁵⁵:

To enable a community inclusive process and enhance stakeholder ownership, consultation is important. Consultation empowers a community to participate fully in developing the aims and outcomes of an enhancement program, carrying it out and ensuring the improvements are long lasting.

7.10 Te Karamū Enhancement Project

Information presented to Council in 2004, included a 'Rough Order Cost Estimates'⁵⁶ for the Karamū enhancement options described in the **Te Karamū Catchment Review & Options for Enhancement** report, for each of the 6 zones, with a grand total of \$14,148,492 spanning a 20yr works programme. In March 2006 Council resolved that the following funding proposal should be included in the draft Long Term Council Community Plan (LTCCP) 2006/16 to:

1. Confirm their desire to progress work that will lead to the environmental enhancement of the Karamū Stream and its tributaries.



⁵³ **Te Karamū Catchment Review & Options for Enhancement** (June 2004). Asset management / Engineering Section, Environmental Management Group, Hawke's Bay Regional Council. Part 17.7.2, Pg 316.

⁵⁴ **Te Karamū Catchment Review & Options for Enhancement** (June 2004). Asset management / Engineering Section, Environmental Management Group, Hawke's Bay Regional Council. Part 18.3, Pg 331.

⁵⁵ **Te Karamū Catchment Review & Options for Enhancement** (June 2004). Asset management / Engineering Section, Environmental Management Group, Hawke's Bay Regional Council. Part 18.5, Pg 332.

⁵⁶ Meeting Agenda Item 5 - **Te Karamū Catchment Review & Options for Enhancement** (25 Feb 2004). Gary Clode, Mike Adye, Hawke's Bay Regional Council – Asset Management and Biosecurity Committee. Table 11.2.

2. Agree to include a provision for \$100,000 annually into the draft LTCCP 2006/16 for specific expenditure on enhancement works.
3. Agree that internal staff time will be in addition to this provision, with the primary staff input being provided for through the establishment of a new position under the asset management section of the Works Group.
4. Agree that an additional provision of \$10,000 in the 2007/08 financial year and increasing by \$10,000 per year in each subsequent year be included in the draft 2006/16 LTCCP to provide for the maintenance of completed enhancement works.
5. Agree to increase the rate proposed for the Havelock North community under agenda item Section D to provide funding for one third of the cost of the enhancement works.
6. Agree that the remaining two thirds of the costs be funded 50% from the Karamū Drainage Catchment Area and 50% from general funding.

Following the draft LTCCP consultation process this funding mechanism was adopted to fund the Karamū enhancement work⁵⁷.

In 2007 a draft Karamū Revegetation Strategy and Concept⁵⁸ report included a revegetation objective to “create a framework of native riparian vegetation to enhance indigenous biodiversity, habitat diversity and natural character, while retaining many existing exotic trees and plantings”.

A summary of the enhancement planting which has been implemented between 2006 and 2015, as part of the ‘296-081 Te Karamū Project’ and ‘296-008’ maintenance work is included in **Table 3: Karamū Enhancement Planting 2006-15**.

Table 3: Karamū Enhancement Planting 2006-15

Year (1 Jul to 30 Jun)	Zone - Area	Approx. number of plants	Dec-ExFin data summary	
			296-081 Te Karamū Project - Enhancement	296-008 Te Karamū Maintenance
2006-07	Zone 5 – Havelock (Herehere wetland)	41,727	\$ 95,356.94	No data
2007-08	Zone 4 – Waipatu (1km reach downstream of Crosses Rd Havelock North & Karitūwhenua entrance)	15,739	\$ 127,688.11	No data
2008-09	Zone 5 – Havelock (RB Carex edge planting between bridges 2000)	5,000	\$ 121,244.06	\$ 37,483.85
	Zone 1 – Kohupātiki (3000)			
	Zone 5 – Havelock (Infill 2000)			
2009-10	Zone 5 – Havelock RB upstream of Havelock Bridge to Herehere confluence (2000)	3,500	\$ 191,588.64	\$ 38,351.31
	Zone 1 – Kohupātiki (1500)			
2010-11	Zone 2 - Ruahāpia Stage 1 (LB)	12,000	\$ 183,101.93	\$ 42,250.02
	Zone 1 – Kohupātiki			
	Zone 1 – LB Clive (4000)			
2011-12	Zone 2 - Ruahāpia Stage 2 (10157)	12,457	\$ 180,730.45	\$ 60,244.28
	Zone 5 – Havelock adjacent neighbours (2000)			
	Zone 7 – Paki Paki (300)			
2012-13	Zone 2 - Ruahāpia Stage 3 (10000)	14,906	\$ 264,939.47*	\$ 111,639.49
	Zone 7 - Sissons Wetland (Longlands 2000)			
	Zone 5 – Havelock (LB Carex edge planting between bridges 2000)			

⁵⁷ Email **From:** Michael Adye, **Sent:** Sunday, 29 November 2015 2:49 p.m. RE: 296-081 Te Karamū – Management Strategy.

⁵⁸ Hawke’s Bay Regional Council (McGlinchey, L.) and Huson Associates Ltd (Gerard, S.) (Feb 2007). **DRAFT Karamū Stream Enhancement – Revegetation Strategy and Concept.**

	Zone 5 – Havelock Adjacent neighbours between bridges (906)			
	Zone 7 - Mangaroa Marae (1400)			
2013-14	Various small plantings and infilling along the Karamū Reach (Havelock, Ruahāpia, Whakatū and Kohupātiki)	5,699	\$ 219,071.02	\$ 131,874.96
	Zone 2 - Ruahāpia Stage 4 (D/s of SH2 bridge 4000)			
	Zone 7 - Bridge Pa (3000)			
2014-15	Zone 1 – Kohupātiki (4000)	12,500	\$ 230,027.63	\$ 116,072.68
	Zone 4 – Adjacent neighbours (1500)			
2015-16	Zone 1,2,4,5,6,7.	8,000*	\$ 60,000.00*	\$ 110,000.00*
	Total:	123,528	\$1,613,748.25	\$537,916.59

* Amount includes drainage concrete lining.

* Amount budgeted for 2015-16 financial year.

8 Conservation Targets, Opportunities and Threats

8.1 Values and Management Objectives

The 'Te Karamū - Catchment Review and Options for Enhancement' groups **values and management objectives** as⁵⁹:

5. Drainage and flood control.
6. Ecology and ecosystem.
7. Amenity.
8. Recreation.

These are consistent with the Hawke's Bay Regional Park Network values⁶⁰:

- Natural (ecology, biodiversity, open space).
- Cultural and Heritage.
- Recreation.
- Economic (which also acknowledges Education and Social values).

8.2 Enhancement Opportunities

Whilst acknowledging the primary management objective to **provide flood and erosion protection**, this strategy promotes the following opportunities to **improve habitat and ecosystem health** (based on the 'General Enhancement Recommendations – Stream Banks and Riparian Buffer Zones' in the 2004 report⁶¹):

1. Increase the proportion of **indigenous riparian vegetation** to:
 - Improve biodiversity and resilience of the natural ecosystems.
 - Increase shading effects on the waterways, which will ultimately improve water and in-stream habitat quality.
 - Reduce erosion and stabilise banks.
 - Introduce woody debris to improve habitat diversity.
2. Preserve and enhance areas already supporting **native vegetation, valuable wetland flora, or endangered species.**
3. Establish the **environmental infrastructure** (habitat, connectivity, reduced pollution, and food source such as vegetation and invertebrates) required for species to self-establish.
4. Create **wildlife corridors.**
5. Enhance **recreational, cultural and aesthetic qualities.**

⁵⁹ Te Karamū Catchment Review & Options for Enhancement (15 June 2004). Asset management / Engineering Section, Environmental Management Group, Hawke's Bay Regional Council. Part 2.3, Pg 8.

⁶⁰ Hawke's Bay Regional Park Network Plan (2014). ISBN: 1-877405-81-7. Hawke's Bay Regional Council (HBRC Plan 4552). Part 4.0, Pg 6.

⁶¹ Te Karamū Catchment Review & Options for Enhancement (June 2004). Asset management / Engineering Section, Environmental Management Group, Hawke's Bay Regional Council. Part 17.7.2, Pg 316.

6. Promote wetland plantings for managing **storm water run-off** and **filtering contaminants**.
7. Use the waterways, rivers and streams as distinctive **gateway** and **landscape features**.
8. Enable **education**; **research**; and **leadership**.

8.3 Threats and Pests

Threats to wildlife, conservation efforts, and productive land use opportunities across the wider Karamū catchment, include the following:

- Flooding, sedimentation and erosion.
- Existing plant and animal pests.
- Introduction of pests and diseases.
- Pollution and contaminants.
- Human disturbance of wildlife habitat.
- Climate (particularly drought).

9 Objectives

9.1 Reviewed and Updated Objectives of the Management Strategy 2016-25

The overarching objective (vision) to **improve habitat and ecosystem health whilst providing flood and erosion protection** can be further defined using the '2004 values and management objectives' structure.

9.1.1 Drainage and Flood Control

1. Provide flood capacity (including crack willow and aquatic weed control).
2. Reduce and prevent erosion.

9.1.2 Ecological Value (Stream Habitat)

3. Protect, enhance and restore **ecosystem** health.
4. Increase extent of existing **indigenous vegetation** (wildlife habitat, including wetland and prevent further degradation of wetlands).
5. Enhance indigenous **biodiversity**.
6. Improve **ecological resilience, connectivity** and **sustainability** (including increased plant biomass, nutrient and carbon store, and reduced maintenance through plant and animal pest control).
7. Reduce **plant and animal pests**.
8. Improve **stream habitat** ('Overall Habitat' ratings, as defined by 'Stream Habitat Assessment Form'⁶²) (no Class 1 or 2 habitat ratings were recorded in 2003):
 - Create areas (nodes) of Class 1 (Excellent) by 2036;
 - Create areas (sections) of Class 2 (Good) by 2026;
 - Eliminate areas of Class 4 (poor) by 2021.
9. Provide **fish passage** (remove barriers).

Terrestrial Ecosystem

10. Improve **terrestrial ecosystem health**, and associated habitat (including indigenous plants, invertebrates, birds and reptiles).

Aquatic Ecosystem

11. Improve **water quality** (stable dissolved oxygen and temperature levels, contaminant and nutrient capture and reduction), reduce nutrient and toxin levels (through run-off and spray drift).
12. Provide water quality **buffer**, ecosystem protection (resilience), stabilise banks and reduce erosion.

⁶² Te Karamū Catchment Review & Options for Enhancement (June 2004). Asset management / Engineering Section, Environmental Management Group, Hawke's Bay Regional Council. Part 15.3, Pg 218 and APPENDIX III, Pg 383.

13. Improve **aquatic ecosystem health**, and associated habitat, macroinvertebrate community, fish, and other instream values.
14. Reduce **periphyton, macrophyte and nuisance (weed) algae growth**, thereby improving dissolved oxygen levels and life supporting capacity for invertebrates and fish.

9.1.3 Amenity and Aesthetic Values

15. Improve **visual amenity and aesthetic values**, including the provision of views from public places, such as: bridges, roads, and tracks.
16. Display **natural and heritage features**, including visual access to waterways.
17. Enhance **naturalness, coherence and uniqueness**.
18. Use the waterways, rivers and streams as distinctive **gateway and landscape features**.

9.1.4 Cultural, Social and Recreational

19. Protect and enhance associated **cultural values**, particularly for tangata whenua.
20. Identify, protect and preserve important **cultural heritage sites** and **scenic landmarks**.
21. Provide for **public access and use** where compatible, including **interactive, mixed use areas** which encourage interaction with the water (such as fishing, whitebaiting, and non-powered water craft), and **rest and passive recreation areas**, including wildlife observation, walk and other opportunities for 'nature experience'.
22. Improve **community well-being**, sense of ownership, and social connection.
23. Promote **public awareness**.
24. Improve **economic, social, education, research, and leadership** values.

9.2 General Enhancement Objectives

In order to form a management strategy to achieve the complex set of objectives, it is helpful to group the objectives into the following:

Objective 1: Control and Manage Plant and Animal Pests

Identify plant and animal pests and programme their control on the site. Provide a management programme to prevent re-establishment of identified plant and animal pests.

Objective 2: Protect and Preserve Existing Animals and Plants that are Desirable

Identify, protect and preserve existing animals and plants that are present and desirable, particularly any endangered, rare, and uncommon species.

Objective 3: Re-establish Indigenous Vegetation Framework

Re-establish a framework of indigenous vegetation, based on that which may have occurred before humans arrived in Hawke's Bay.

Objective 4: Protect and Enhance Cultural, Social and Recreational Values

Identify, protect and preserve cultural sites and scenic landmarks, whilst providing cultural, social and recreational opportunities and public access and use.

10 Management Strategy and Recommendations

10.1 Strategy 1a: Control Plant Pests and Prevent Re-Establishment

10.1.1 Plant Pest (Weed) Control

Dumping of green (garden) waste on the banks of the Karamū is part of its history. Whilst this practice is becoming less common with increased awareness, education and surveillance, the effects continue in the form of 'garden escape' weeds and areas rich in organic matter and nutrients.

Where areas are disturbed through vegetation clearance, vigorous regrowth from weeds can be expected. This means that where enhancement planting occurs in disturbed areas, initial weed control requirements can be expected to be high, however, the requirement for plant pest control should reduce with the establishment to canopy closure of native plant species (slower growing natives which out-compete weed species). Plant species selection is important to ensure the combination of plants species used for enhancement are those which have adapted to the conditions and can create a stable ecosystem (similar to the ecosystem which originally occurred, prior to human habitation). The 'HB Plant Database' provides a tool for plant selection (refer Attachment B: Hawke's Bay Plant Database).

Planting density is also important in ensuring rapid canopy closure. To encourage canopy closure to occur within 5yrs of planting it is recommended that general revegetation planting occurs at 1m spacing. Whilst this may increase initial establishment costs (plant purchase and planting), it allows for some plant loss and natural selection, and reduces maintenance costs.

Maintenance requirements can further be reduced through an improved sustainable long term management approach which includes:

- Reducing the amount of nutrients, contaminants and rubbish through increased public awareness and ownership (as part of the enhancement programme).
- Reduced mowing and weed boat cutting (to reduce volume and biomass of soft vegetation release) and retain plants which filter nutrients.

10.1.2 Plant Pest Identification

HBRC identifies several plant pests in the Regional Plant Pest Management Strategy⁶³, and many of these pest plants are present on the Karamū. A schedule of pest plants specific to the Karamū catchment is shown in **Table 4**: Schedule of pest plants specific to the Karamū.

Table 4: Schedule of pest plants specific to the Karamū

Botanical name	Common name	HBRC Classification
<i>Clematis vitalba</i>	Old man's beard	Total Control (Nth of SH5)
<i>Cortaderia selloana</i>	Pampas	Not listed
<i>Foeniculum vulgare</i>	Fennel	Not listed
<i>Ipomoea indica</i>	Convolvulus	Not listed
<i>Iris pseudacorus</i>	Yellow flag iris	Not listed
<i>Ligustrum sinense and L. lucidum</i>	Privet	Total control
<i>Lonicera japonica</i>	Japanese Honeysuckle	Total control (Tutira)
<i>Rubus fruticosus agg.</i>	Blackberry	Boundary control
<i>Tradescantia fluminensis</i>	Tradescantia	Not listed
<i>Ulex europaeus</i>	Gorse	Boundary control
<i>Urtica urens</i>	Stinging nettle	Not listed
<i>Xanthium spinosum</i>	Bathurst bur	Boundary control

⁶³ Hawke's Bay Regional Council (Mar 2013). **Regional Pest Management Strategy 2013**. Biosecurity Section. Website [link](#).

It is recommended that the schedule is updated as required, and that control of pest plants included in the schedule is included in maintenance contracts and in grazing licence conditions to ensure a coordinated management approach to the identification, clearance and control of pest plants.

10.1.3 Control Method

A maintenance programme to prevent re-establishment of plant pests is to be incorporated into the annual maintenance contract, using the following techniques:

- Scrub bar.
- Herbicide spray.
- Mowing.
- Sheep grazing regime.

10.1.4 Crack Willow (*Salix fragilis*) Control

The control of crack willow in wetlands is a nationwide issue. A major programme to clear crack willow was carried out in the 1980's to improve flood capacity on the Karamū, and some of these areas have re-established, particularly within the Waipatu Zone, upstream from the SH2 Bridge to Flanders Road. Opportunities for using willow as a nurse crop are being developed, and therefore the staged removal incorporating enhancement planting is proposed to form part of this strategy and tree control in and funding for 'Tree clearing/weed control' is allocated for Whakatū and Waipatu Zones (refer Attachment E1: Cost estimate for Operational Expenditure (287/296) - 200K Target and Attachment E2: Cost estimate for Operational Expenditure (287/296) - 50% Target). The following provides further information on *Salix fragilis*⁶⁴:

Salix fragilis (crack willow or brittle willow, is a species of willow native to Europe and Western Asia). It is invasive, and grows rapidly to 10–20m (rarely to 29m) high with a trunk up to 1 m diameter, often multi-trunked, and an irregular, often leaning crown. The plant is commonly called crack willow or brittle willow because it is highly susceptible to wind, ice and snow damage. The name also derives from the twigs which break off very easily and cleanly at the base with an audible crack. Broken twigs and branches can take root readily, enabling the species to colonise new areas as broken twigs fall into waterways and can be carried some distance downstream. It is particularly adept at colonising new riverside sandbanks formed after floods. It also spreads by root suckers, expanding into pure 'groves'.

S. fragilis has escaped cultivation to become an invasive species in various parts of the world, including: New Zealand; the upper half of the United States; and South Africa. In New Zealand it is listed on the [National Pest Plant Accord](#), which means it cannot be sold or distributed. It can replace a habitat's native plant species diversity, by forming 'monoculture groves'. As only the male plant is present in New Zealand no fruit are formed unless hybridised. Species spread is facilitated by stem fragmentation (reproduction) which are carried via waterways. Control and management for habitat restoration projects often uses herbicides.

Crack willow can be replaced with native plant species or *Salix babylonica* (Babylon willow or weeping willow, which is native to dry areas of northern China). *S. babylonica* grows up to 20–25m tall, rapidly, but has a short lifespan (40 to 75 years).

10.2 Strategy 1b: Control Animal Pests and Prevent Re-Establishment

10.2.1 Animal pest control:

Identify and undertake animal pest control and eradication where possible. The following pest animals are present on the Karamū:

- Rabbits.
- Possums.
- Rodents (rats).
- Stoats.
- Cats.

Pest animal control would include the following objectives:

⁶⁴ Various from Wikipedia website: https://en.wikipedia.org/wiki/Salix_fragilis

- Increase biodiversity, esp. native bird species.
- Public perception management.

HBRC Biosecurity - Animal Pests can provide information and support. Pest management options include:

- Continue to observe the situation on the Karamū and take opportunity for community groups to assist with predator control.
- Taking an integrated approach involving the existing possum stations and some community run traps (recommended).

As the Karamū is in an existing HUB (Urban Possum control) area (refer **Figure 8**: Urban PCA Programme.) HBRC Biosecurity can provide support in the form of additional possum bait stations (bearing in mind that anticoagulant toxins used in these stations will kill rats).⁶⁵

Although the Cape to City project does not have any operational relevance/overlap in this area (at this stage), HBRC Biosecurity can provide a limited number of 'DOC200s' traps and subsidise additional materials for predator control. Feral cats are likely to be present along the Karamū, and care would be required in targeting cats, due to the proximity to residential areas and domestic cats, to ensure contractors or community group set traps in appropriate locations.⁶⁶

Care would also be required with a rat control programme (particularly with rat bait stations on the ground) in the same areas as dog walkers. For research purposes, it is recommended that baseline data is recorded (using chew cards to measure rat densities and bird counts to measure biodiversity benefit) prior to pest control measures.

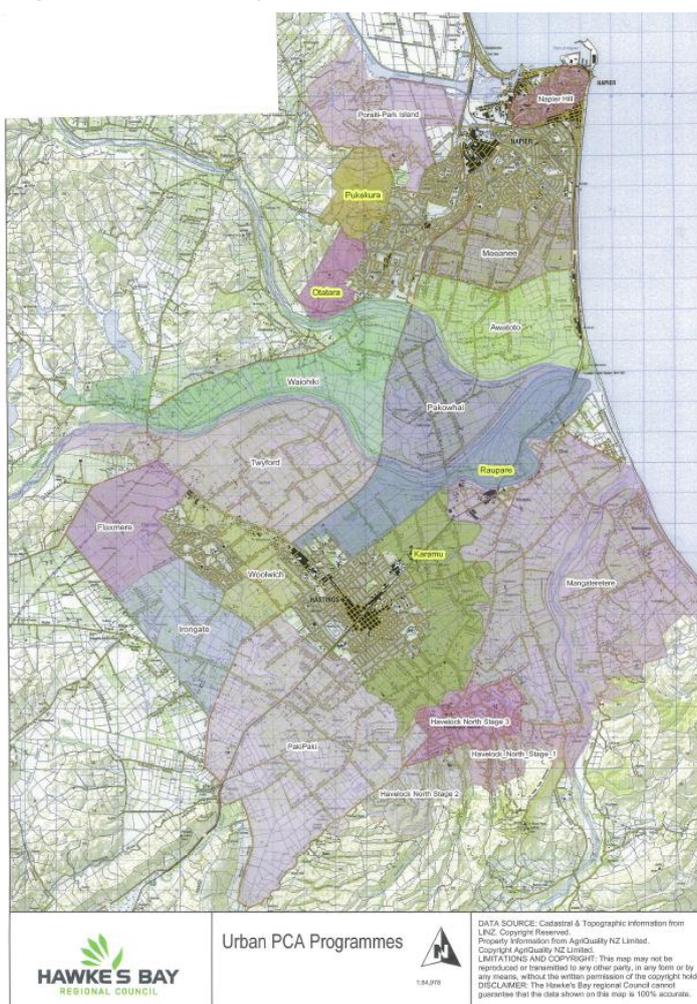
HBRC Biosecurity recommends engaging a contractor to initially set up a trap network and do any monitoring required. Be clear with tasks and expectations, and engage them as required in combination with volunteers to do the bulk of work to reduce labour expense. Annual funding for 'Biosecurity - animal pest control' is allocated for this purpose as a 'General Item' (refer Attachment E1: Cost estimate for Operational Expenditure (287/296) - 200K Target and Attachment E2: Cost estimate for Operational Expenditure (287/296) - 50% Target).

10.3 Strategy 2: Protect and Preserve Existing Animals and Plants that are Desirable

10.3.1 Existing Vegetation

Unless located on steep ground or cliff sites, many of the existing indigenous patches are currently grazed, and simply will further diminish over time as the current vegetation cover reaches senescence and dies. Protection and enhancement of existing indigenous habitats are critically important and securing their sustainability through active management is a key priority for maintenance of biodiversity values, at multiple scales.⁶⁷

Figure 8: Urban PCA Programme.



⁶⁵ Email from Rod Dickson (Sent: Wednesday, 3 December 2014 11:32 a.m.). Subject: Karamū predator control.

⁶⁶ Email from Rod Dickson (Sent: Wednesday, 3 December 2014 11:32 a.m.). Subject: Karamū predator control.

⁶⁷MWH (January 2012). Karamū Catchment Terrestrial Ecology Characterisation. Prepared for Hawke's Bay Regional Council. HBRC Plan 4594. Part 4.2, page 40.

Areas of enhancement planting on the Karamū have been surveyed and mapped (refer **Figure 9**: Existing planted areas on the Karamū or 16.1 Attachment A: Karamū Catchment Maps). Existing areas of native vegetation (shown in green) are generally limited to isolated patches near settlements and the enhancement planting started in 1997 (some of that planting is identified in **Table 3**: Karamū Enhancement Planting 2006-15). As these areas mature, ongoing monitoring of areas (and related ecosystem health) is recommended to identify and record animals and plants that are present and desirable, particularly any endangered, rare, and uncommon species. This strategy provides for ongoing protection and preservation of existing animals and plants that are desirable.

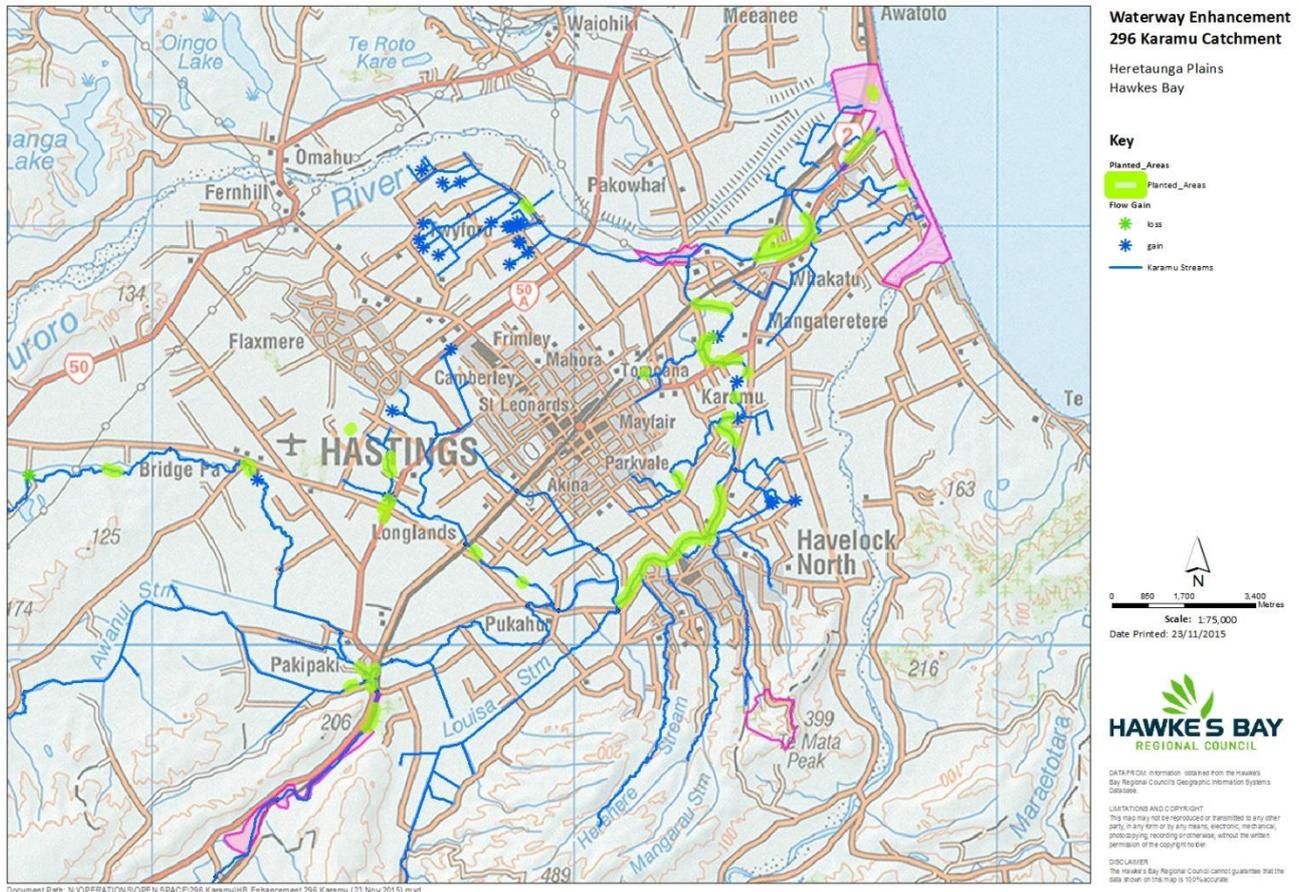


Figure 9: Existing planted areas on the Karamū

10.3.2 Indigenous Plant Database

The **'Hawke's Bay Plant Database'** has been developed, which currently lists 121 plant species (of the approx 2,418 vascular NZ indigenous plants) *"...considered to have potential for revegetation, with an objective to re-establish a framework of indigenous vegetation, based on that which may have occurred before humans arrived in Hawke's Bay"*.

The database focusses on coastal and lowland areas, excluding montane and alpine areas. It categorises plant species as 'Vegetation type' based on the definition used in 'Table D-3 (Pg77) of the HBRC - Biodiversity Inventory (Aug 2014, from Geoff Walls, 2013), and allows data to be sorted to create plant lists for specific environments. This provides a tool to enable the 're-creation' of more authentic and resilient plant communities, habitat, and ecosystems, with better diversity, more stability, that are easier to manage, and which enhance the unique identity of Hawke's Bay. The database includes 9 species (Ref 200-208) which do not naturally occur in HB, and it is recommended that alternatives to these are considered for planting.

10.3.3 Existing Animals

Native and endemic bird species currently present include: bellbird (korimako), welcome swallow, fantail (piwakawaka), tūī, kererū, grey warbler (riroriro) and kingfisher. Of particular importance in enabling ecosystems to become self-regenerating are the presence of the keystone seed dispersers/pollinators - bellbird, tui and kereru.⁶⁸

While the re-establishment of indigenous vegetation is important for animal habitat on the Karamū, areas of (non-native) production landscapes within the catchment that contain flowing or standing water, such as ponds, drainage waterways or damp pasture, also provide useful habitat for species such as pukeko, white-faced heron, paradise shelduck, mallard duck, feral goose, black swan, pied stilt, welcome swallow, kingfisher, and occasionally red-billed gull.⁶⁹

10.4 Strategy 3: Re-establish an Indigenous Ecosystem (Framework)

10.4.1 Native Habitat Re-Establishment

Assessment of bird and terrestrial invertebrate communities within indigenous revegetation sites along the Karamū Stream show that faunal communities are responding positively to habitat enhancement.⁷⁰ The 2012 report on terrestrial ecology in the Karamū Catchment recommends that any strategy should include revegetation of waterway, road and rail corridors to provide habitat 'stepping stones' and/or habitat corridors across the landscape.⁷¹

A model for the re-establishment of native habitat⁷² commonly used in New Zealand for modified landscapes where available land is limited, is structured on a range of minimum forest patch sizes. As native plants mature and contribute to the seed bank, plants disperse, and in time, areas of native vegetation become self-sustaining, regenerating, and start to connect, creating corridors of vegetation, increasing habitat and food source for native animals. The structure is illustrated in **Figure 10** below.

Reserve design theory has indicated that bigger, compact areas are preferable for preserving biodiversity⁷³. The 'idealised, nested forest patch' model uses reserve patch designs with 50m buffer zones which maximise core biological areas and can increase populations and sensitivities of plants and wildlife compared to linear patches with little or no core. Adjacent land use on the Karamū, including domestic landscaping, shelter planting, and horticulture may assist in providing buffering outside of planted areas. A patch size of around 6ha in urban or rural settings also meets local government targets for reserve contributions.⁷⁴

⁶⁸MWH (January 2012). **Karamū Catchment Terrestrial Ecology Characterisation**. Prepared for Hawke's Bay Regional Council. HBRC Plan 4594. Part 3.2.4.3, page 28.

⁶⁹MWH (January 2012). **Karamū Catchment Terrestrial Ecology Characterisation**. Prepared for Hawke's Bay Regional Council. HBRC Plan 4594. Part 3.1.4.2, page 13.

⁷⁰MWH (January 2012). **Karamū Catchment Terrestrial Ecology Characterisation**. Prepared for Hawke's Bay Regional Council. HBRC Plan 4594. Part 6.2, page 50.

⁷¹MWH (January 2012). **Karamū Catchment Terrestrial Ecology Characterisation**. Prepared for Hawke's Bay Regional Council. HBRC Plan 4594. Part 6.2, page 51.

⁷²Meurk and Hall (22 May 2006). **Options for enhancing forest biodiversity across New Zealand's managed landscapes based on ecosystem modelling and spatial design**. Landcare Research, NZ. Web link: <http://newzealandecology.org/nzie/2297.pdf>. Pg 141.

⁷³Meurk and Hall (22 May 2006). **Options for enhancing forest biodiversity across New Zealand's managed landscapes based on ecosystem modelling and spatial design**. Landcare Research, NZ. Web link: <http://newzealandecology.org/nzie/2297.pdf>. Pg 140.

⁷⁴Meurk and Hall (22 May 2006). **Options for enhancing forest biodiversity across New Zealand's managed landscapes based on ecosystem modelling and spatial design**. Landcare Research, NZ. Web link: <http://newzealandecology.org/nzie/2297.pdf>. Pg 141.

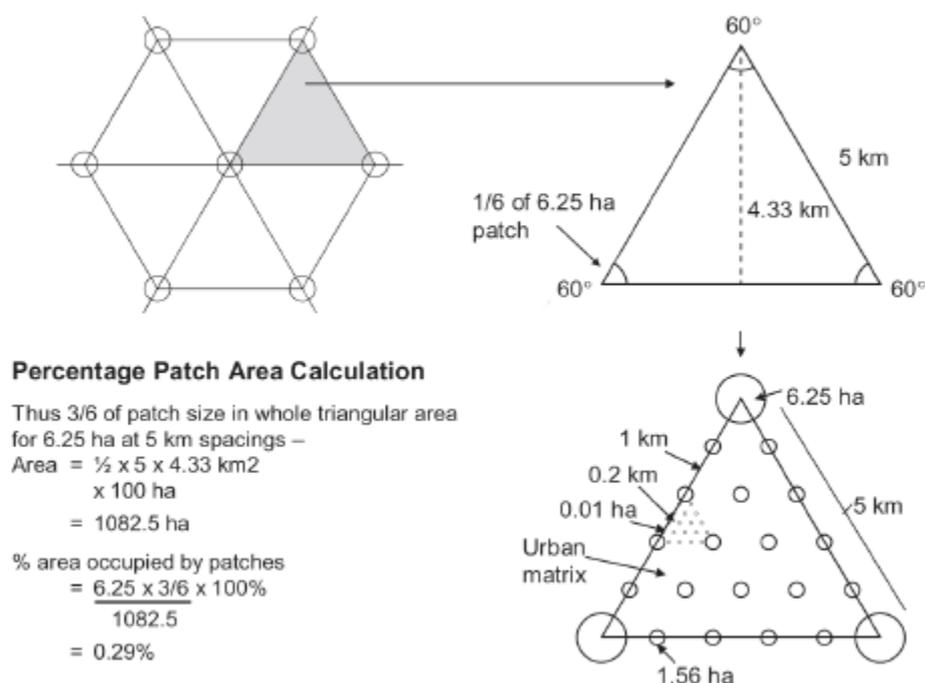


Figure 10: An idealised, nested forest patch configuration of three patch sizes; and method of calculation of percentage area occupied by patches, applied to the largest patch size of 6.25ha⁷⁵.

The 'idealised, nested forest patch configuration' creates a network of 'patches' to achieve spatial connectivity, as follows:

- Every 5km there should be a **core sanctuary** which is approx. **6.25ha** (250m x 250m).
- Every 1-2km there should be **habitat** which is approx. **1.56ha** (125m x 125m) to provide habitat for most plants, lizards, insectivorous birds and invertebrates and resource-rich 'stepping stones' for larger frugivorous or honey-eating birds.
- Every 200m there should be **groves** of natives which are **0.01ha** (10m x 10m) to provide groves of trees, finer-grained stepping stones, and feeding stations.

Existing examples of these 3 scales of 'patches' on the Karamū, are shown in the maps below.

Figure 11: Example of a **core sanctuary** at Ruahāpia (approx. 7.2667ha), original scale 1:3,000.

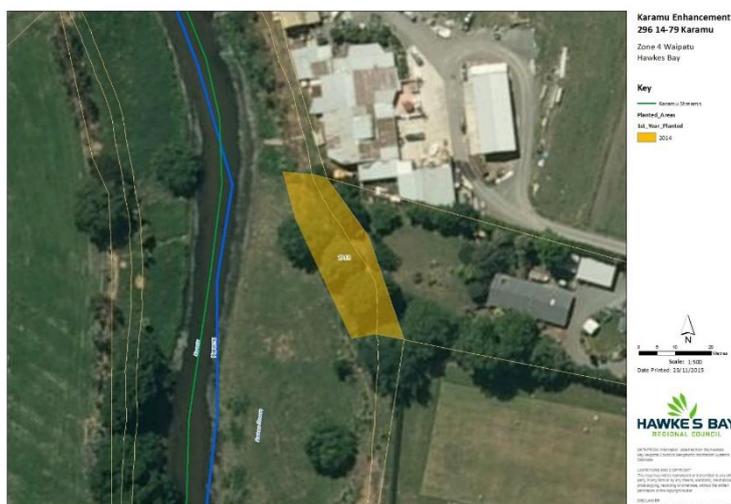


⁷⁵ Meurk and Hall (22 May 2006). **Options for enhancing forest biodiversity across New Zealand's managed landscapes based on ecosystem modelling and spatial design**. Landcare Research, NZ. Web link: <http://newzealandecology.org/nzie/2297.pdf>. Pg 141.

Figure 12: Example of potential **habitat** at Irongate Stream (approx. 1.5151ha) to provide habitat for most plants, lizards, insectivorous birds and invertebrates and resource-rich ‘stepping stones’ for larger frugivorous or honey-eating birds, original scale 1:1,000.



Figure 13: Example of **grove** at Karamū Stream (approx. 0.0717ha) to provide groves of New Zealand trees, finer-grained stepping stones, and feeding stations, original scale 1:500. This type of enhancement planting is typical of the adjacent neighbours programme.



The lineal nature of the Karamū waterways, and limited width, means that the model needs to be modified to suit. Existing areas of planting can be used as a basis for a framework (structure), and the current structure of Regional Parks and ‘nodes’ of enhancement (refer **Figure 14:** Conceptual layout of ‘patch’ network on the Karamū.) provides a good basis to develop the ‘idealised, nested forest patch configuration’ model.

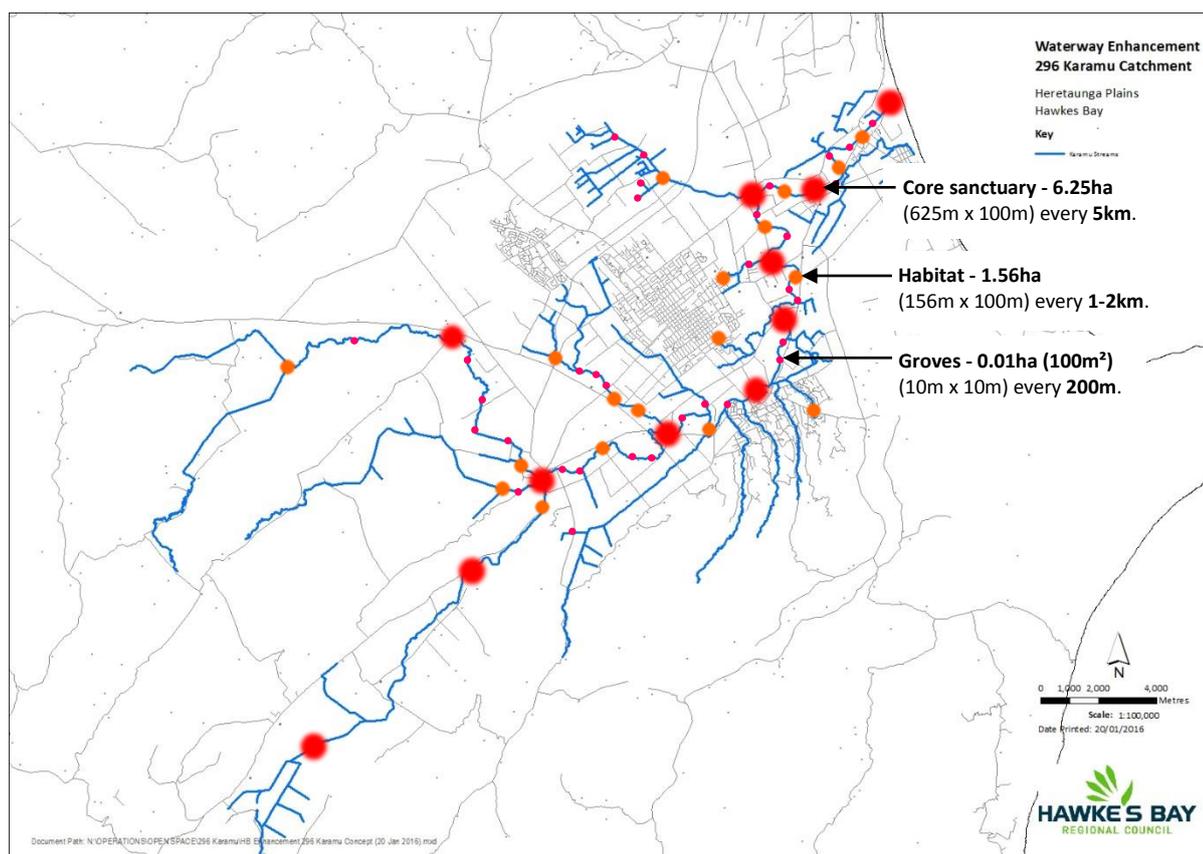


Figure 14: Conceptual layout of 'patch' network on the Karamū.

Comparison to the model confirms that existing enhancement planting at: *Kohupātiki-Whakatū*, *Ruahāpia*, *Havelock*, *Paki Paki*, and *Bridge Pa* is well placed, with some loss of connectivity occurring in sections between: *Ruahāpia* and *Havelock*; *Havelock* and *Paki Paki*; and the upper catchment (refer **Table 5**: Existing and potential 'Core Sanctuary' and 'Habitat' nodes).

Table 5: Existing and potential 'Core Sanctuary' and 'Habitat' nodes.

Zone	Node	Site ID*	Area (approx Ha)
	Waitangi Regional Park	01-00	308.9848
Zone 1 - Whakatū	Kohupātiki-Whakatū	05-00	5.0603
	Pākōwhai-Hawea Regional Park	07-00	33.0792
Zone 2 - Ruahāpia	Ruahāpia	10-00	7.2667
Zone 4 - Waipatu	Flanders Rd	14-00	0.5482
Zone 5 - Havelock	Havelock	18-00	8.5683
Zone 5 - Havelock	St Georges Rd bridge (potential)	22-00	8.8952
Zone 6 - Irongate	Irongate wetlands	23-00	1.5151
Zone 7 - Awanui, Kārewarewa, Paritua	Paki Paki	29-00	1.9613
	Pekapeka Regional Park	33-00	92.9869
Zone 7 - Awanui, Kārewarewa, Paritua	Bridge Pa	35-00	0.7007

Site ID* = approx. distance to Waitangi river mouth (kms).

It is therefore recommended that 'Core Sanctuary or Habitat' enhancement nodes are developed in the vicinity of Flanders Rd, St Georges Rd bridge and near on the Awanui Stream near Crystal Rd bridge, as well as several 'groves' of native trees, to provide finer-grained stepping stones, and feeding stations.

10.4.2 Implementation of Karamū Enhancement Planting

In order to continue the implementation of the Te Karamū Enhancement it is recommended the following planning programme is maintained:

- Create an open, transparent, inclusive, and ongoing **consultation** process to enhance community and stakeholder ownership.
- Monitoring and **mapping** (GIS data) of existing and proposed enhancement areas, including identification of the following:
 - Important ecological areas throughout the Karamū.
 - Areas of cultural significance.
 - Vegetation line.
 - Habitat quality.
 - Discharges.
 - Potential barriers to fish passage.
- **Identify plant species** and quantity of proposed indigenous riparian vegetation, based on the following:
 - Species considered to have potential for re-vegetation, with an objective to re-establish a framework of indigenous vegetation, based on that which may have occurred before humans arrived in Hawke's Bay (Refer: HB Plant Database).
 - Vegetation on proposed water margins which assist to stabilise soil and prevent erosion.
 - Vegetation which enhances indigenous wildlife habitat and biodiversity.
- **Stage planting** regimes to allow successive establishment, limit weed infestation, and improve resilience. The re-vegetation process involves the following steps:
 - Determine soil type (depth & texture), inferred microclimate (frostiness, moisture status) and shelter.
 - Match site conditions to vegetation types.
 - Determine the number of plants required.
 - Planting at the right time (generally autumn to winter to avoid summer drought stress on young plants) and employing correct techniques with carefully instructed and supervised labour.

10.4.3 Prioritisation Considerations (Criteria)

Consideration and evaluation of values (discussed in Conservation Targets, Opportunities and Threats) is a complex but important part of this strategy. When considering whether a site has potential for enhancement, or weighing whether one site should have priority over another it is recommended that the 'Prioritisation Considerations' (below) are used to evaluate a potential enhancement site (a score/evaluation system could potentially be useful while acknowledging that values are highly subjective). Considerations, criteria, and factors which could affect **prioritisation of projects and areas for enhancement** include the following:

Primary considerations

1. Drainage; flood control, and provision for channel flow capacity.

Natural and Ecological considerations

2. **Ecology** and ecosystem.
3. **Biodiversity** value.
4. **Open space** value.
5. Provides **habitat** restoration.
6. Incorporates **in-stream habitat**.
7. Enhances **connectivity**.
8. **Northern** bank (for water shading and weed reduction).
9. Enhances **water quality**.
10. Closest distance to **source of flow**.
11. Highest **flow rate**.
12. Supports **Focus/Priority/'Indicator' species**:
 - a. Threatened species.
 - b. Sensitive species.
 - c. Species representing habitat types.
 - d. Culturally important (or 'iconic') species.

Public considerations

13. Cultural Heritage.
14. **Amenity** (open, coherent and visually attractive).
15. **Recreation**.
16. **Visibility** and profile.
17. **Accessibility** for public use.
18. **Economic**.
19. **Education**.
20. **Social** values.
21. **Community** support (willingness).
22. Funding opportunities.

Practical considerations

23. Consistent with **strategy** (e.g. connectivity, node/corridor model for native habitat re-establishment).
24. **Accessibility** for implementation and maintenance.
25. Suitable **slope** (sufficient width to construct an adequate riparian interface, allow access and bank stability). Preferably a gradient ratio no greater than 1:2 (rise:run) with mid-slope benching.
26. Value for **alternative use** (such as grazing).
27. Enables **outcome monitoring**.

10.4.4 Staged Planting Programme - Priority Planting (2016-25)

The following table (**Table 6: Karamū Enhancement - Zone Summary**) provides an analysis of planting completed to date, within each zone, showing that approximately **14.76% (21.0235ha)** of the **142.4813ha** of land owned or managed by HBRC and potentially available for enhancement has been planted. This planting includes the 1997 'Operation Karamū' planting in Havelock North, other small areas of older planting (with an estimated age of up to 40 years), as well as the 'Te Karamū Enhancement' planting completed since 2006 (and detailed in **Table 3: Karamū Enhancement Planting 2006-15**).

Mapping of proposed priority enhancement areas (**8.68%** or **9.4464ha**) has been carried out using the 'Prioritisation Criteria' above, these areas are shown on Attachment C: Zone Maps. It is recommended that funding for the '**Identified planting 2016-25**' is allocated for planting in each Zone (refer Attachment E1: Cost estimate for Operational Expenditure (287/296) - 200K Target and Attachment E2: Cost estimate for Operational Expenditure (287/296) - 50% Target).

Table 6: Karamū Enhancement - Zone Summary

Zone	Total Area* (approx Ha)	Completed planted (approx Ha)	Completed planted (%)	Identified priority planting 2016-25 (Ha)	Identified priority planting 2016-25 (%)	Remaining area (Ha)	Remaining area (%)
Zone 1 - Whakatū	18.6559	3.5565	19.06%	1.3266	7.11%	13.7728	73.83%
Zone 2 - Ruahāpia	21.1462	3.1735	15.01%	4.9250	23.29%	13.0477	61.70%
Zone 4 - Waipatu	23.0398	3.4346	14.91%	1.1062	4.80%	18.4990	80.29%
Zone 5 - Havelock	39.0163	5.2873	13.55%	0.2480	1.10%	33.4810	85.81%
Zone 6 - Irongate	22.8742	3.2821	14.35%	0.6734	9.73%	18.9187	82.71%
Zone 7 - Awanui, Kārewarewa, Paritua	17.7489	2.2895	12.90%	1.1672	7.09%	14.2922	80.52%
Total	142.4813	21.0235	14.76%	9.4464	8.68%	112.0114	78.61%

Total Area* = mapped land owned or managed by HBRC and potentially available for enhancement.

This information is useful for assessing long term targets for the percentage of land 'enhanced' on land owned or managed by HBRC. The '**Remaining area**' listed above (**78.61%** or **112.0114ha**) generally comprises areas that are grazed, mown (Havelock North), or otherwise retired.

10.4.5 Staged Planting Programme - Contingency Planting (Zone Target of 50%)

In addition to the 'Priority Planting', it is recommended that supplementary planting occur to implement the 'idealised, nested forest patch configuration' framework model discussed above.

In zones which have wide river berms (such as the lower catchment) it is reasonable to expect 30% to 70% to be grazed while buffer planting occurs adjacent to waterways and in erosion prone areas. The small streams typical of the upper catchment have more opportunities for planting to improve water quality through shading and filtration, and it may be reasonable to expect 50% to 100% of land owned or managed by HBRC to be planted in the long term, noting that much of the upper catchment is privately owned (and therefore not part of this strategy). An example of mixed use of waterways, involving grazing, enhancement planting, and recreation is shown in **Figure 15: Typical Cross-section of Enhancement Planting incorporating Stock Grazing and Recreation.**

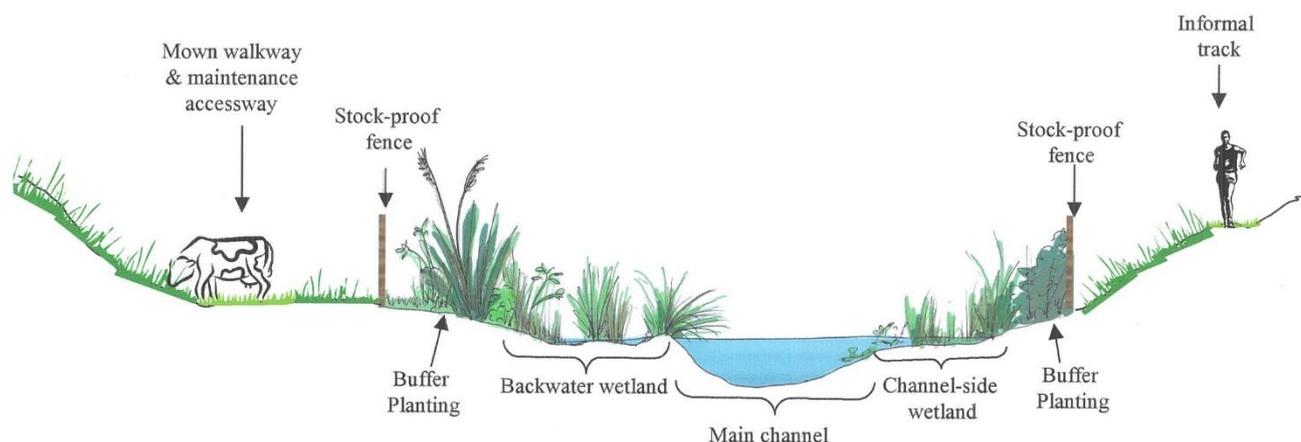


Figure 15: Typical Cross-section of Enhancement Planting incorporating Stock Grazing and Recreation.

All future enhancement areas will require site-specific assessment, using the 'Prioritisation Criteria' above; however, to enable broad scale planning and the long term benefits of the continued staged enhancement to be demonstrated, while managing any potential adverse effects it is recommended that a target of 50% of land owned or managed by HBRC and potentially available, is used for enhancement planting for each zone. A breakdown for each zone is shown in **Table 7: Karamū Enhancement - Zone Targets.**

Table 7: Karamū Enhancement - Zone Targets

Zone	Total Area* (approx Ha)	Completed planted (approx Ha)	Identified priority planting 2016-25 (approx Ha)	Zone target planted (%)	Target planting required (approx Ha)	Target planting required (%)
Zone 1 - Whakatū	18.6559	3.5565	1.3266	50%	4.4449	23.83%
Zone 2 - Ruahāpia	21.1462	3.1735	4.9250	50%	2.4746	11.70%
Zone 4 - Waipatu	23.0398	3.4346	1.1062	50%	6.9791	30.29%
Zone 5 - Havelock	39.0163	5.2873	0.2480	50%	13.9729	35.81%
Zone 6 - Irongate	22.8742	3.2821	0.6734	50%	7.4816	32.71%
Zone 7 - Awanui, Kārewarewa, Paritua	17.7489	2.2895	1.1672	50%	5.4178	30.52%
Total	142.4813	21.0235	9.4464	50%	40.7708	28.61%

Total Area* = mapped land owned or managed by HBRC and potentially available for enhancement.

10.5 Strategy 4: Protect and Enhance Cultural, Social and Recreational Values

10.5.1 Tangata Whenua

The history of Māori occupation on the Karamū catchment means that the Karamū-Ngaruroro is a network of important cultural sites and landmarks. Marae along the historic channel have been actively supporting the enhancement project, from their unique perspective and with a focus on that section, as well as acknowledging the connection the waterway creates between Marae of the Heretaunga Plains. The connection between Marae includes the effect that management of one section can have on another in terms of water quantity, quality, wildlife abundance, mauri, and mana.

HBRC have been actively collaborating with Nga Whenua Rahui (DoC) on enhancement projects adjacent to Marae, with many of these projects being given priority. Marae adjacent to the Karamū-Ngaruroro that have initiated enhancement planting include the following:

- Kohupātiki Marae (Whakatū) – planting started in 2009
- Ruahāpia Marae - planting started in 2011
- Hougareā Marae (Paki Paki) - planting started in 2014 (Marina Mohi in 2012)
- Mangaroa Marae (Bridge Pa) - planting started in 2014

Other Marae that are not immediately adjacent but have been actively supporting the enhancement in a range of locations, include:

- Waipatu Marae (planting Havelock North and Ruahāpia)
- Te Aranga o Heretaunga Marae (planting Havelock North, Ruahāpia, and Whakatū)
- Kahurānaki (Te Haukē) Marae (Poukawa radial gate fish passage)

This strategy proposes to continue the liaison and collaboration with Marae in the achievement of common goals for ecosystem health, including the appropriate acknowledgment being given to specific cultural sites and landmarks. It is recommended that annual funding for Marae/hapu is allocated for this purpose as a 'General Item' (refer Attachment E1: Cost estimate for Operational Expenditure (287/296) - 200K Target and Attachment E2: Cost estimate for Operational Expenditure (287/296) - 50% Target).

10.5.2 Stock Grazing and Mowing

While the grazing of sheep and cattle has been an integral part of the management of the Karamū Catchment, there is increasing awareness that regional councils should be setting an example of best practice in providing fencing and buffer strips to water bodies. It is recommended that efforts to exclude stock on the Karamū continues, and that opportunities for stock grazing and public recreation can be incorporated with enhancement planting (as shown in **Figure 15: Typical Cross-section of Enhancement Planting incorporating Stock Grazing and Recreation.**). Grazing and mowing can assist to maintain flood capacity, whilst enhancing a park-like or rural character.

10.5.3 Recreation and Public Use

Public use of the Karamū has increased significantly following the construction of the limestone pathways at Havelock North and Whakatū. The involvement of local schools in planting and clean up days has further increased awareness within the community, and there appears to be direct relationship between increased public awareness and increased public use (as well as a potential increase in expectations for access and maintenance). The involvement of children and community groups in the enhancement programme is expected to have long lasting positive benefits for public awareness and support of the project. It is therefore recommended that annual funding for Community Awareness, Consultation & Education is allocated as a 'General Item' (refer Attachment E1: Cost estimate for Operational Expenditure (287/296) - 200K Target and Attachment E2: Cost estimate for Operational Expenditure (287/296) - 50% Target).

10.5.4 Pathways

Opportunities to improve access for maintenance vehicles (including spraying, monitoring, and mowing) would also create informal walking and cycling tracks to link existing pathway routes and Regional Parks, with priority given to the link from Havelock North along the right bank to Ruahāpia (approx. 3kms), then continuing on to the Ruahāpia railway bridge

(2.8kms). It is recommended that funding for 'Maintenance access/pathway link' is allocated for each zone (refer Attachment E1: Cost estimate for Operational Expenditure (287/296) - 200K Target and Attachment E2: Cost estimate for Operational Expenditure (287/296) - 50% Target).

10.5.5 Pedestrian Bridges

Pedestrian link bridges were identified in the 2004 report, and further discussion has been progressed on a location and design for a pedestrian bridge near Havelock North. Funding for a pedestrian bridge has not been allocated as part of this strategy.

11 Recommendations to Implement Management Strategies

It is recommended that the following aspects are developed in order to ensure the efficient and effective implementation of the management strategies identified in this plan.

11.1.1 Staff Resourcing

Staff resourcing requirements are adequate to continue at the current rate of enhancement based on existing time allocations being retained with additional support as required provided through a contingency for external consultants. Should the rate of enhancement be increased to achieve strategy objectives in less than 10yrs or to increase percentage planting targets, additional staff resources (such as 50% FTE for contract management) will need to be considered.

11.1.2 Monitoring and Management

The most common forms of restoration employed by councils, community groups and regulatory agencies in New Zealand have been identified as: stock exclusion, riparian planting, bank stabilisation works, and fish passage enhancement⁷⁶. While significant financial contribution and voluntary efforts can be spent restoring streams and rivers, there are no agreed standards for what constitutes restoration. Ecological degradation typically motivates restoration projects, but post-project appearance and positive public opinion are the most commonly used metrics of success.⁷⁷ While people involved in restoration projects often describe a completed project as being a 'success' there is often no criteria to measure success.

Continued monitoring of the Karamū should be carried out to assess effects of enhancement completed and evolving threats and opportunities, and allow effective management decisions to be made. This could include trial planting, pest control techniques, and a comparison to the assessment methods used in the 2004 report (*Overall Habitat Class scores*⁷⁸ and *Summary of Stream Habitat Assessment Form*⁷⁹).

Management effectiveness should be assessed, including: habitat improvements in both, terrestrial and aquatic environment over time; and changes in plant and animal populations over time (native plants, insects, birds, reptiles, etc), as part of a regular, long-term programme (annual survey).

Table 8: Te Karamū Monitoring shows the association between the strategy objectives and the recommended monitoring as part of the overarching objective (vision) to **improve habitat and ecosystem health whilst providing flood and erosion protection.**

⁷⁶ Parkyn, S. et al (2010). **The Restoration Indicator Toolkit:** Indicators for monitoring the ecological success of stream restoration. National Institute of Water & Atmospheric Research Ltd, Hamilton, NZ. Web link [here](#). Pg 10.

⁷⁷ Parkyn, S. et al (2010). **The Restoration Indicator Toolkit:** Indicators for monitoring the ecological success of stream restoration. National Institute of Water & Atmospheric Research Ltd, Hamilton, NZ. Web link [here](#). Pg 11.

⁷⁸ **Te Karamū Catchment Review & Options for Enhancement** (15 June 2004). Asset management / Engineering Section, Environmental Management Group, Hawke's Bay Regional Council. Part 15.3, Pg 219.

⁷⁹ **Te Karamū Catchment Review & Options for Enhancement** (June 2004). Asset management / Engineering Section, Environmental Management Group, Hawke's Bay Regional Council. APPENDIX III, Pg 383.

Table 8: Te Karamū Monitoring

Objective	Outcomes (goals, considerations)	Actions	Monitoring (target or measure)	Monitoring (protocol)	Responsibility	
Provide flood capacity.	Adequate drainage capacity of waterway(s) is provided for 100yr event.	Appropriate design.	Cross-section modelling.	Hydraulic Modelling Software.	HBRC Engineering	
Reduce and prevent erosion.	Level of erosion is reduced.	Planting of suitable riparian species.	Bank erosion. Sedimentation.	Visual assessment.		
Protect, enhance and restore terrestrial ecosystem health.	Net increase in existing indigenous vegetation (wildlife habitat, including wetland).	a) Planting (native revegetation). b) Fencing. c) Plant pest control. d) Pest animal control. e) Implement strategy model to Re-establish an Indigenous Ecosystem (Framework).	Area (ha or %) of enhancement planting.	Mapping.	HBRC Open Space Development, GIS.	
	Indigenous biodiversity is enhanced.		Bird count.	5min bird count.	HBRC Open Space Development, HBRC Land Services, and Community.	
	Improve indigenous ecosystem resilience, health, connectivity and sustainability (including reduced plant and animal pests).		Plant survey. Growth and survival rates.	RECCE/plot. Seedling count. DBH (height).		
			Pest species record. Rat densities.	Trapping. Chew cards.		HBRC Biosecurity, and Community.
			Ecological success of stream restoration.	Restoration Indicator Toolkit.		HBRC Land Services, and Community.
Improve environmental resilience.	Plant biomass (carbon store).			HBRC Land Services and Community.		
Improve stream habitat ('Overall Habitat' ratings): • Create areas of Class 1 (Excellent) by 2036; • Create areas of Class 2 (Good) by 2026; • Eliminate areas of Class 4 (poor) by 2021.	Stream habitat.			Stream Habitat Assessment Form ⁸⁰ (10 yearly).		
Protect, enhance and restore aquatic ecosystem health.	Water quality is enhanced (stable dissolved oxygen and temperature levels, contaminant and nutrient reduction).	a) Planting riparian vegetation to provide shade and buffer (filtration and setback). b) Fencing.	Water quality.		HBRC Water Quality & Ecology.	
	Stable banks, reduced erosion.		Erosion scar measurement.			
	Increase in aquatic habitat, improve macroinvertebrate community and fish.		Habitat assessment.	Restoration Indicator Toolkit. Rapid HAP (annual). Detailed (5yr).		

⁸⁰ Te Karamū Catchment Review & Options for Enhancement (June 2004). Asset management / Engineering Section, Environmental Management Group, Hawke's Bay Regional Council. Part 15.3, Pg 218 and APPENDIX III, Pg 383.

				MCI, EPT, SHAP. SOE suite. VISPER. Mph.	
	Reduce periphyton, macrophyte and nuisance (weed) algae growth.		Aquatic plant survey.		
Improve visual amenity and aesthetic values.	Enhancing openness, park-like or rural character. Display natural and heritage features. Enhance naturalness, coherence and uniqueness.	Appropriate design.	Landscape character and visual assessment.	Landscape assessment report.	HBRC Open Space Development.
Protect and enhance cultural social and recreational values.	Protect and enhance associated cultural values. Identify, protect and preserve important cultural sites and scenic landmarks.	Public consultation and appropriate design. Continue liaison and collaboration with Marae.	Public opinion.	Public survey. State of the Takiwā.	HBRC Comms, Māori Policy Development.
	Improve community well-being, sense of ownership, and social connection.	Continue liaison and collaboration with Marae.	Cultural Health.	Cultural Health Index (CHI).	Community, Māori Policy Development.
		Involvement of local schools and community groups in planting and clean up days. Provide opportunities for community education, engagement and care for the environment.	Public opinion.	Public survey.	HBRC Comms, Māori Policy Development.
	Provide interactive, mixed use areas which encourage interaction with the water. Provide rest and passive recreation areas. Provide wildlife observation and other opportunities for 'nature experience'.	Appropriate design. Promote public awareness and provide for public use where compatible.	Public opinion. Amount of public use.	Public survey.	HBRC Comms.
Improve economic, education and social values.	Appropriate design.	Public opinion.	Public survey.	HBRC Comms.	

11.1.3 Marketing, Promotion, and Information Sharing

The Karamū Catchment has had a number of community groups contributing to its enhancement and HBRC will continue to support the contribution that groups make to stream enhancement in the area. Community involvement includes:

- Schools
- Marae
- Community groups (such as KEG)
- Adjacent Neighbour Programme

To ensure the ongoing success, it is important to continue to liaise, collaborate, and provide information updates to the trustees, government organisations (including HDC and HBRC), community groups, organisations that may be able to assist with funding and sponsorship, and other stakeholders.

11.1.4 Wildlife Management Training

It is recommended that community members are provided education, awareness, and training in the following areas:

- Wildlife and resource management.
- Revegetation.
- Ecological surveys, including: habitat assessment, plant identification, bird identification and surveys.

12 Cost Estimate

12.1 Enhancement Costs

A summary of the costs associated with implementing this strategy for two budget options is shown in **Table 9: Karamū Enhancement - Cost-Timeframe Analysis**, with a full 10 year summary shown in Attachment G: 10yr Cost Summary - 50% Target.

Table 9: Karamū Enhancement - Cost-Timeframe Analysis

10yr Target Budget	Staff resource and General Items	Zone enhancement	Area planted 2016-25 (approx Ha)	Total area of completed planted 2025* (approx Ha)	Total area of completed planted 2025* (%)
\$200,000 per yr	\$ 136,000.00	\$ 64,000.00	9.4464	30.4699	23%
\$400,000 per yr	\$ 157,500.00	\$ 242,500.00	50.2172	71.2407	50%

Total Area* = mapped land owned or managed by HBRC and potentially available for enhancement.

A schedule of cost estimates for each zone is provided in Attachment E1: Cost estimate for Operational Expenditure (287/296) - 200K Target and Attachment E2: Cost estimate for Operational Expenditure (287/296) - 50% Target. The Cost Estimate includes the following zone specific costs:

- Adjacent neighbour programme.
- Planting (based on Attachment C: Zone Maps and Attachment D - Enhancement Rates).
- Tree clearing/weed control, fencing, maintenance and informal pedestrian access.
- Whakatū Enhancement Plan implementation (Zone 1 - Whakatū).
- Earthworks (including pathway alignment) (Zone 1 - Whakatū).*
- Paki Paki design concept development (Zone 7 - Awanui, Kārewarewa, Paritua).*
- Options to improve flow quantity and quality: sediment seal, storage, augmentation, land acquisition (Zone 7 - Awanui, Kārewarewa, Paritua).*

The Cost Estimate includes the following general costs:

- Marae/hapu Liaison.
- Community education/training/monitoring (marae based wānanga/workshops on training to monitor outcomes for cultural values).*
- Consultancy - contingency.
- Staff time - Open Space Development (28 weeks/yr).
- Staff time - Engineering (2 weeks/yr).
- Staff time - Community Awareness, Consultation & Education (2 weeks/yr).
- Science monitoring.
- Biosecurity - animal pest control.

* Not included in '\$200K Target' costs estimate but included in '50% target (\$400K Target over 10yrs)' estimate.

The Cost Estimate does **not** include the following costs:

- Proposed Hawea Regional Park (Karamū/Raupare confluence) land acquisition (Zone 1 - Whakatū).

12.2 Maintenance Costs

In addition to the capital cost estimate to implement this strategy, a summary of the annual maintenance costs (for a 5 year period to establishment) associated with implementing the '50% target' enhancement planting (based on 2 x scrub bar (Aug/Feb) and 1 x spray (Sep)) is shown in a 10 year summary (refer Attachment G: 10yr Cost Summary - 50% Target). This includes the current maintenance budget of \$30,000 for Zone 1 – Whakatū (287-009) and \$80,000 for the remainder of the Karamū (296-008).

13 Review period

Whilst this strategy is intended to be a live document, subject to updates as knowledge and the environment evolves, it must also be sufficiently robust to allow time for long-term effects and benefits to occur. It is therefore recommended that the strategy be reviewed in 5yrs (2021) in conjunction with recommended monitoring.

14 Glossary and abbreviations

Biodiversity – a global concept that refers to the variety of the special or unique biota and habitats found naturally in an area (indigenous) or nowhere else in the world (endemic).

Resilience – the ability of a system to undergo, absorb and respond to change and disturbance, whilst maintaining its functions⁸¹.

15 References, Related Links and Further Information

Animal pest control:

- Online mapping/ recording of data for programme: <http://www.trap.org.nz/>
- More info on species and trapping work: <http://predatorfreenz.org/the-species/> or <http://predatorfreenz.org/useful-resources/>
- Materials: <http://www.connovation.co.nz/>
- Additional info / connectivity (bearing in mind that KEG is a nature space group): <http://www.naturespace.org.nz/resource-centre>

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⁸¹ Carpenter, et al (2001), from Green, A., Lokani, P., Sheppard, S., et al. (May 2007), Page 1.

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Robert H Watts, GreenVisioNZ, Christchurch

Simon R Swaffield, Lincoln University, Canterbury

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16 List of Attachments

16.1 Attachment A: Karamū Catchment Maps

296 Karamū Catchment - Overview (Scale: 1:150,000)

296 Karamū Catchment: Planted Areas pre-2015 (Scale: 1:75,000)

16.2 Attachment B: Hawke's Bay Plant Database

16.3 Attachment C: Zone Maps

Zone 1 – Whakatū: 287 01 to 07 Whakatū (Scale: 1:12,000)

Zone 2 - Ruahāpia: 296 07 to 12 Ruahāpia (Scale: 1:12,000)

Zone 4 - Waipatu: 296 12 to 16 Waipatu (Scale: 1:12,000)

Zone 5 - Havelock North: 296 17 to 23 HNth (Scale: 1:12,000)

Zone 6 - Irongate: 296 23 to 29 Irongate (Scale: 1:25,000)

Zone 7 - Upper Catchment: 296 23 to 40 Awanui (Scale: 1:50,000)

16.4 Attachment D - Enhancement Rates

16.5 Attachment E1: Cost estimate for Operational Expenditure (287/296) - 200K Target

16.6 Attachment E2: Cost estimate for Operational Expenditure (287/296) - 50% Target

16.7 Attachment F: Cost estimate for Maintenance Expenditure (287/296) - 50% Target

16.8 Attachment G: 10yr Cost Summary - 50% Target