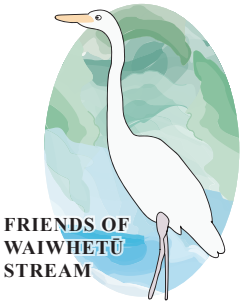


TE WAIWHETŪ
FRIENDS OF WAIWHETŪ STREAM

OUR STREAM – OUR TAONGA
A TEN-YEAR JOURNEY TOWARDS RESTORATION (2011-2021)

Produced by Friends of Waiwhetū Stream

With support from Greater Wellington Regional Council and Hutt City Council

ISBN number 978-0-473-64687-5

Title: Te Waiwhetū – Friends of Waiwhetū Stream: Our Stream – Our Taonga. A ten-year Journey towards Restoration (2011-2021)

Author: Friends of Waiwhetū Stream

Format: Softcover Publication

https://www.waiwhetu-stream.org.nz

Printed by Apex Print, Lower Hutt

CONTENTS

ACRONYMS

FWS	FRIENDS OF WAIWHETŪ STREAM
GWRC	GREATER WELLINGTON REGIONAL COUNCIL (also abbreviated as GW GREATER WELLINGTON)
HCC	HUTT CITY COUNCIL

KA PAI FRIENDS

Well done on the achievements of the first ten years of the Friends of Waiwhetū Stream (FWS).

You have made a significant contribution to the improvement of the Waiwhetū Stream environment and in helping keep the community safe from the effects of floods.

You should be proud of your efforts and the mahi you have put in. When the FWS was formed in 2010, a 4.5 kilometre-long section of stream was choked by Cape pondweed.

Thousands of hours of effort and hundreds of tonnes of removed weed and rubbish later, you have restored the mauri of this stream.

Many have tried to clear the weeds over the years and not succeeded; but you did.

The excellent results you have achieved demonstrate the power of people coming together to make a difference in their local community.

This project is also a great example of the power of partnership. Here at Greater Wellington, we have been proud to help support your efforts.

Congratulations to Dr Merilyn Merrett, and to all of the volunteers. Your vision, commitment and hard graft have truly paid off.

I wish you all the best for the next ten years and will continue to support you in your endeavours to improve the ecology of the stream and the community's resilience to flooding.

Graeme Campbell,
Manager - Flood Protection,
Greater Wellington
Regional Council

The Waiwhetū Stream has been part of my life for 15 years. When I first moved to Aotearoa I lived in a cabin by the stream. My career brought me to the stream two years later to help the Waiwhetū Project. Through that work I met people who became Friends of Waiwhetū. We figured out how community and council could work in support of the mauri of the stream, and worked on setting shared goals. Today, I am back in its story working on stream health. It has been a pleasure to be a part of the story of the Waiwhetū, and a privilege to work with Friends of Waiwhetū.

Alistair Allan

When the Friends of Waiwhetū Stream group was formed in 2011, as Mayor I recall thinking how great this was for our community to have such a dedicated and energetic group of people who took a bold step and said "we care about our stream, and we are going to do something about it". The group was impressive back then and, a decade on, they are just as impressive.

With regular clean-ups, a weed clearing and planting programme still regularly happening, the health of the Stream's ecosystem has improved immensely. The stream and surrounds look wonderful today, and that is down to the dedication and drive of the Friends - Kia Kaha Team.

Ray Wallace ONZM,
Hutt City Mayor 2010-2019

The Waiwhetū has played a major part in my life and that of my family and our community. We lived near it and played and walked next to it. We had a connection to it. It saddened us to see people disconnected from it, neglecting it, using it as a dumping site. So we took an active part in loving it. Planting trees along its banks, picking up rubbish that had blown or was dumped in it, fighting to protect and return it to its former glory. Watching the fish and birds return has given us pleasure; so happy that it is healthy again.

Lisa Bridson

I grew up in Waiwhetū so through the 1950s, as a water lover, the stream was an integral part of my life – swimming, fishing, and tinboating.

You could do all those things then. The stream flowed, the water was clear and drinkable (not too much!)

Over subsequent years, I saw the stream losing its mauri, being destroyed by unabated progress - less water, rainbow-coloured discharges, pollution, and eroding banks. It was a disgrace.

In my career as a Water and Soil Engineer, I developed a serious ethic about our waters and was contracted by Greater Wellington Regional Council (GWRC) in the mid-1900s to work on Floodplain Management Plans for Otaki, Waikanae, and Te Awa Kairangi. To involve the communities, I proposed and established Friends of the Rivers groups. These were remarkably successful and are still active.

When asked to help establish the Friends of Waiwhetū Stream, I was delighted. We set it up and it thrives as a notable community group. I have been tremendously proud to see the earnest efforts of the group to fulfil the vision established at the outset.

Congratulations!!

Derek Wilshere

It may take a village to raise a child but, as we have seen, it takes Friends to save a stream. That was my instinct when widening and deepening the Waiwhetū Stream was completed, and why I suggested that a Friends Group be established. And so it has been proved. It is due to the Friends' hard work over the years that today we have a cleaner stream and a richer fish habitat; a delight for its neighbours and popular with schools and people picnicking on its increasingly lovely banks. Thanks go to all the Friends for their ongoing work keeping the weeds in check and the planting of native trees and shrubs.

Prue Lamason JP
Councillor,
Greater Wellington
Regional Council

KAITIAKITANGA

Te Rira Puketapu inspecting a section of the stream in 2009. Image courtesy of Stuff Limited

Kaumātua Te Rira Puketapu (Teri) of Te Āti Awa grew up in Waiwhetū and has memories of fishing and catching eels in a beautiful clean stream. He has worked over the years to halt the stream's decline in health and began many restoration efforts, including clearing Cape pondweed, before the Friends group was established. His message to those that live by the stream is to treat it as a taonga and be mindful about what goes into the stream, especially through the stormwater system.

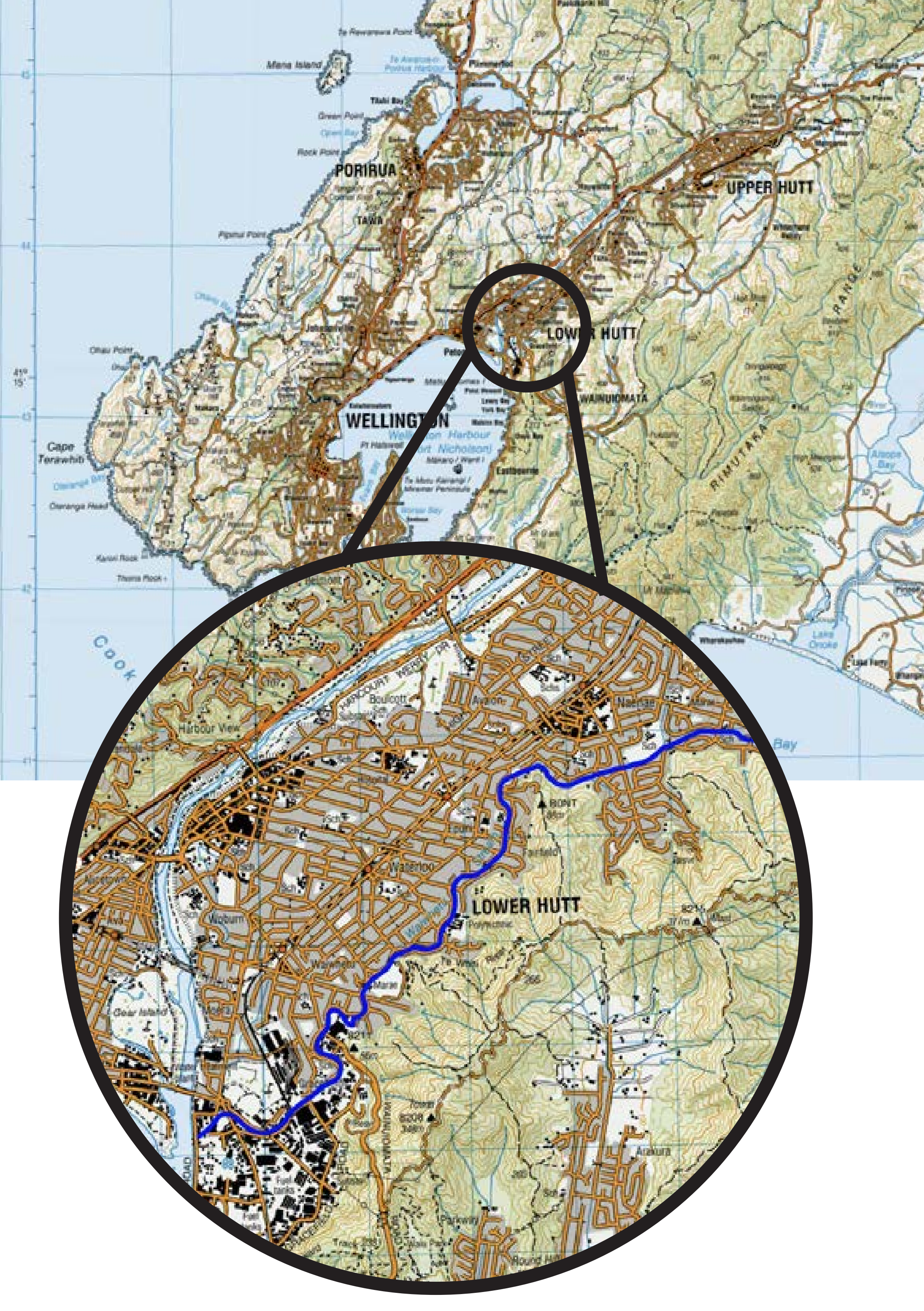
The Friends of Waiwhetū Stream (FWS) were inspired by Te Rira to concentrate on removing Cape pondweed. His early efforts and encouragement have been a part of the beginnings of the Friends of Waiwhetū.

"I spent a lot of time growing up at the Waiwhetū Stream, as my Nana lived just down the road. It's a special place for me. Since I became an MP in 2014, I've enjoyed helping out on the monthly stream cleans with our local team. I want to pay tribute to the amazing volunteers who have helped to revitalise this special taonga for the Hutt Valley and the wider region. Congrats to the first 10 years – here's to many more!"

Chris Bishop
National List MP, based in Hutt South

Friends of Waiwhetū Stream is the example that all New Zealand communities should follow: community action at its best. Step by step we have seen the regeneration of the Waiwhetū Stream – from a polluted waterway to a healthy and functioning ecosystem. My children still point out the shrubs they helped plant when they were much younger. I'd like to pay thanks to the many hands and hours applied over the past 10 years. I am grateful to be part of a community that cares.

Ginny Andersen
MP for Hutt South



Mana Island
PORIRUA
TAWA
UPPER HUTT
LOWER HUTT
WAINUIOMATA
WELLINGTON
Wellington Harbour
(Port Nicholson)
Cape
Terawhiti
Cook
RIMUTAKA
RANGE
Harbour View
Boulcott
Naenae
Waterloo
Epuni
Fairfield
Woburn
Waiwhetu
Gear Island
LOWER HUTT
Bay

CHAPTER ONE
INTRODUCTION

This booklet is the result of the combined efforts of the committee members of the Friends of Waiwhetū Stream (FWS), and represents a celebration of the first decade of their aspirational efforts to recapture some of the original sparkle of the "star reflecting water", as the stream's Māori name, Waiwhetū, denotes.

The Friends, as the group is sometimes informally referred to, is a group of local volunteers brought together by Greater Wellington Regional Council (GWRC) and Hutt City Council (HCC) in 2011 for the purpose of restoring the badly degraded Waiwhetū Stream in Lower Hutt.

As locals, we care deeply for this stream, and are passionate about this taonga.

This book details how a small community of like-minded people can work together with local government towards restoring our environment for future generations.

We hope you enjoy reading this book and can be inspired to take action in your own community.

Ma tini ma mano ka rapa te whai – Many hands make light work.

CHAPTER TWO

WAIWHETŪ STREAM – A BRIEF HISTORY & GEOGRAPHY

Waiwhetū means "star-reflecting water" (or, loosely translated, even "star reflecting in water" or "starry water").

"Waiwhetū has a rich Māori history dating back to before the 1820s, and the name 'Waiwhetū' was the name given to the Māori pa that once stood at the intersection of the Hutt River and the Waiwhetū Stream."[1] It must be acknowledged that a more in-depth account of the rich Māori history associated with this awa, the state of which has been of serious concern to local iwi for many years, is beyond the scope of this book.

The stream springs from the Eastern Hutt hills, above the Lower Hutt suburbs of Wingate and Naenae; its catchment has an area of approximately 18 km^2 with the main stream path about 9 km in length[2] flowing out to the mouth of Awakairangi, the Hutt River, where it meets the sea. The stream travels through many Lower Hutt suburbs, from Wingate, Naenae, Fairfield, Waterloo and Waiwhetū, then to the industrial zones of Seaview and Gracefield.

According to the historical accounts of many early European settlers to the Hutt Valley from as early as 1840, the valley seemed to be a mostly barren and inhospitable land with the valley and surrounding hills covered in dense forest[3]. Furthermore, it soon became clear that, while the landscape was indeed a valley, it was also a floodplain[3]. But not everyone viewed the valley with similar disappointment[3]. The young

[1]Cheong Y 2010. Reducing Wastewater Overflows – Lessons Learned in Hutt City. Proceedings of the 2010 WaterNZ Annual Conference.

[2]Watts L 2004. Flood Hydrology of the Waiwhetū Stream. Greater Wellington Regional Council Resource Investigations Report, p. 55.

[3]https://envirohistorynz.com/2010/11/13/the-valley-of-disappointment/

English-born New Zealand explorer, artist and surveyor, Major Charles Heaphy, reminisced and recorded in his Notes on Port Nicholson and the Natives in 1839 (Art.III), that the forests of the Hutt Valley in the 1800s were teeming with a myriad of species of birds such as: weka, tui, wren, riroriro, huia, pūkeko, pigeon, kākā, robin, bell-bird, to name but a few. Pre-European settlement, the valley was heavily forested with dense podocarp forest[4]. As Heaphy's ship sailed the Waiwhetū River, his Notes recount that its banks gave rise to lofty pine trees and "The various bends were very beautiful and secluded, and seemed to be the home of the grey duck and teal, and numerous other wild fowl. Here and there, on the bank, was a patch of cultivation, and the luxuriant growth of potatoes, taros, and kumeras, indicate the richness of the soil."[4]

Prior to the M 8.2 earthquake in 1855, along the West Wairarapa Fault, the vegetation of the Lower Hutt valley floor was a combination of flax *(Phormium)* in swampy areas and, in drier areas, dense podocarp forest comprising trees such as kahikatea *(Dacrycarpus dacrydioides)*, tōtara *(Podocarpus totara)*, rimu *(Dacrydium cupressinum)*, pukatea *(Laurelia novae-zelandiae)*, rātā *(Metrosideros robusta)* and tawa *(Beilschmiedia tawa)*. The original podocarp forest was felled and used for timber as well as clearing land for agriculture, market gardening and other activities associated with settlement. The clearance of native forest was so extensive that no native forest remains on the valley floor of Lower Hutt.

The 1855 earthquake raised the valley floor approximately 1.5 metres[5] and rendered a deep channel much shallower. Before the earthquake, waka and ships could be seen on the Waiwhetū River as far upstream as the area near Whites Line East.

In addition to the devastating natural disasters of earthquakes and floods that assailed the region, the post-war 1940s and 50s, accompanied

[4]Heaphy C 1879. Notes on Port Nicholson and the Natives in 1839. Transaction and Proceedings of the New Zealand Institute 12:32-39.

[5]Grapes R 2000. The Day the Earth Shifted. NZ Geographic 46. https://www.nzgeo.com/stories/the-day-the-earthshifted/#:~:text=The%20elevation%20reached%20its%20maximum,a%20metre%20to%20six%20metres.

by the plundering footsteps of urbanisation and industrialisation with their deleterious consequences, would shatter the ecologically rich valley lands and stream banks and muddy the beautiful “star-reflecting water”.

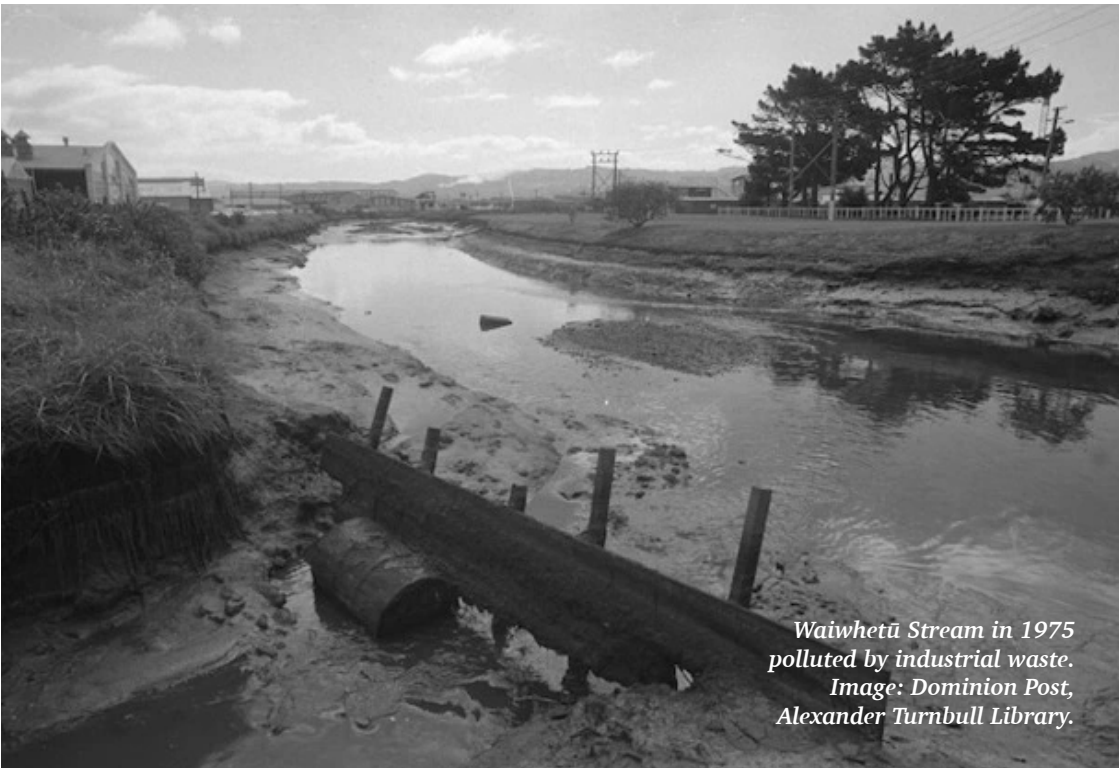
As the Hutt Valley was settled by flows of migrants, Waiwhetū Stream underwent a tumultuous transformation of its natural state: floodplain and bankside vegetation was cleared; its natural contours were disrupted in places where the stream was straightened with concrete channels; and pollutants and rubbish now entered the stream. And so was lost the enchanting natural beauty that first caught the artistic eye of the nature-loving Heaphy.

Vera Green-Bargiacchi

CHAPTER THREE
BEGINNINGS

In contrast to the beauty of its Māori name, “star reflecting water”, by the 1960s Waiwhetū Stream had degenerated into an open drain with untreated industrial waste discharged directly into it. The urban stormwater drainage system is connected to the stream and this does not seem to be understood by some of the local population when they dispose of paint brush washings or install illegal cross-connections with domestic wastewater pipes.

Heavily modified in the upper reaches in Naenae with housing developments in the 1940s and 50s, the stream had been neglected and diminished in quality by the late 1900s.



Waiwhetū Stream in 1975 polluted by industrial waste. Image: Dominion Post, Alexander Turnbull Library.

In addition, flooding has been an undesirable feature of life in Lower Hutt, with the Waiwhetū Stream flooding frequently as recorded in early historical accounts. The most recent flood was in February 2004 when extreme rainfall caused the Waiwhetū Stream to breach its banks driving 50 households from their homes[1].

Flooding in 2004, looking upstream towards Wyndrum Avenue

Although people could visually see the stream was in poor health, community awareness of the state of the stream was lacking.

In 2000, the Waiwhetū Stream Working Group (WSWG), initially led by Lorna Sandeman, was set up for the purpose of advocating for the restoration of the health of the stream. Les Roberts soon became chairman, leading the group until 2010. This vision for the Waiwhetū Stream corridor was supported by the group's Waiwhetū Stream Action Plan and, in 2008, was instrumental in advocating for the decontamination of the streambed from the effects of industrial discharges, and flood protection of the lower reaches of the stream.

[1]http://heart.huttcity.govt.nz/services/mapping-lower-hutts-flood-hazards/

In 2011, once the initial restoration work of the WSWG was completed, the focus changed. In tandem with the development of a Floodplain Management Plan by Greater Wellington Regional Council (GWRC), there began a drive by GWRC, Wellington Water and Hutt City Council (HCC) to engage the community in taking up a guardianship role of the stream. Instrumental in this were GWRC Regional Councillor, Prue Lamason, and Hutt City Councillor, Lisa Bridson.

GWRC Engineer, Alistair Allan, was tasked with the practical undertaking of meeting with residents living in close proximity to Waiwhetū Stream, for the dual purpose of (i) informing them of the various options on the table in terms of a floodplain management plan, and (ii) to invite them to take up a guardianship role for restoring the badly degraded stream.

How to clean up the Waiwhetū Stream?

This challenging task was to fall to a transitional committee that would eventually become the Friends of Waiwhetū Stream (FWS), a volunteer group of residents most of whom resided near the stream. They had been encouraged by Alistair Allan to take up the guardianship reins for restoring the stream.

Local ecologist, Dr Merilyn Merrett, had been deeply concerned for some time about the ecological condition of the middle reaches of the stream corridor. She was invited by GWRC and HCC to assist with efforts to restore the stream and tasked with establishing and leading a group of like-minded individuals in doing this.

The importance of consultation with local iwi on the project for restoring the Waiwhetū Stream was deemed a priority from the time of the group's inception. Te Āti Awa kaumātua at Waiwhetū Marae, Te Rira Puketapu, who had spent years battling to clean up the Waiwhetū Stream, attended the first meeting of the FWS 'steering group' on 30 June 2011 and a number of meetings thereafter. There have also been ongoing, albeit informal, consultations and exchanges between FWS and Te Rira Puketapu.

And so followed the process and formalities of formally setting up the group to be known as the Friends of Waiwhetū (FWS).

Development of the group's Terms of Reference (TOR), including a Vision and Principles, was a first step, which was accomplished with the valuable assistance and guidance provided by Derek Wilshere, a Civil Engineer and Natural Resources Consultant. With his background and expertise in setting up similar groups, he was commissioned by GWRC to chair the group's TOR meeting.

Once establishment formalities were completed, FWS held its inaugural meeting on Monday 28 November 2011.

Inspired by the temporary presence of a solitary kōtuku (white heron) along the stream, the group would go on to adopt it as its logo.

The Friends' Vision Statement was enshrined in the words:

"Waiwhetū Stream is a healthy functioning ecosystem treasured and enjoyed by our community".

The Friends adopted the following principles:

- To foster community guardianship.
- To enhance native biodiversity, cultural and amenity values and ensure a safe and healthy environment within the Waiwhetū Catchment.

The group's vision and principles, along with the remainder of the Friends' TOR, were endorsed unanimously at a public meeting in December 2011.

Dr Merilyn Merrett, who had chaired the transitional committee, was confirmed as chair of the now-established FWS.

And so began what was to become the group's now decade-long journey of restoring the stream.

Tasks that the group set itself for achieving its restoration mission included:

- Regular plantings, under the guidance of Dr Merrett, to enhance the stream corridor, stabilise the stream banks and provide bankside cover for fish.

- Monthly rubbish collections undertaken by area groups along the entire length of the stream.
- Special projects like the forest re-creation project at Rishworth Street.
- Control of aquatic weeds such as Cape pondweed.
- Channel naturalisation (in particular, the Naenae concrete channel).
- Citizen science: fish and wildlife surveys of the stream to monitor improvements in the stream's quality.
- Improvement of the aesthetics of the waterway with the commissioning of renowned artists to design and erect their artistic installations along the stream.
- Advocacy for the stream.

The group's commitment and efforts to restore this waterway have been rewarded with a number of environmental awards.

The first decade has, to some degree, reversed the decline in the stream's health as evidenced in the data collected from the monitoring and evaluation surveys that the Friends have been conducting on a regular basis. This data is set out in Chapter 11.

Dr Merrett's tenure as chair for the first nine years provided expert leadership until 2020 when she stepped down. Deputy Chair, Michael Ellis, then assumed the role of chair.

Ongoing efforts by the Friends to redeem the stream are expected to continue to improve the health and beauty of the stream in the future.

Vera Green-Bargiacchi

Flooding in 2021

CHAPTER FOUR

CAPE PONDWEED ERADICATION - MISSION IMPOSSIBLE?

In New Zealand's native forests, streams are clothed in trees, shrubs and a range of ground-covering plants which provide shade and food for aquatic organisms. With the advent of human habitation and development, forest cover was removed, streams were treated as storm water drains, especially in urban areas, and banks were altered to reduce the risk of flooding. Sometimes, exotic (introduced), flowering aquatic species were planted to 'beautify' a water body.

Fig 1. Cape Pondweed

In 2011 when the community group Friends of Waiwhetū Stream (FWS) was formed, Waiwhetū Stream presented as a highly modified waterway, almost entirely bordered by housing, industrial buildings and playing fields. Stream banks and berms were mown grasses and weeds, and the waterway itself was dominated by an aquatic plant with large, surface-floating leaves - Cape pondweed *(Aponogeton*

distachyos) (Fig. 1). Very few native trees, or other plants, were present. The stream also had an unpleasant, sewerage-like smell in places.

Fig. 2 Cape Pondweed perfumed flowers

Cape pondweed is from the Cape Region of South Africa where it occurs in ephemeral ponds; the type of habitat that would have controlled its spread. In the Waiwhetū Stream, however, because there is a constant supply of water and nutrients, it remains throughout the year; and has been present in the stream for probably more than 100 years. The species was apparently deliberately spread in New Zealand as duck food; although it may have been planted as an ornamental aquatic species.

Cape pondweed in Waiwhetū Stream was considered a nuisance weed by the Greater Wellington Regional Council's (GWRC) Flood Protection Group because its abundance impeded water flows which could pose a flood risk during heavy rainfall events. Prior to 2011, GWRC had used various methods to try to control it but without a permanent result.

Despite its somewhat attractive, perfumed flowers (Fig. 2), the local community considered it an environmental weed in that it reduced the aesthetics of the stream, caused extensive surface algal blooms in summer, collected floating wind-blown rubbish, captured sediment to enhance seedling establishment, and caused sediment to remain suspended in the water column, creating permanently muddy water.

Early in 2011, the author of this chapter, an ecology lecturer at the Open Polytechnic (OP), used her knowledge of plant reproductive biology to undertake in-situ research into Cape pondweed; this was supported by the OP, whose Waterloo campus borders Waiwhetū Stream.

Fig. 3 Pondweed volunteers

The research enabled an understanding of the growth, flowering, seed set, and root structure of Cape pondweed; knowledge that led to the development of an eradication strategy. Manual eradication of an aquatic weed had never been attempted previously in New Zealand, and the proposal to do so was initially met with considerable scepticism as to its success.

The plan was to begin removal at the upstream extent of the weed (Naenae) and work downstream. Because sediment was stirred up during the digging out process, thus reducing visibility, digging had to start several metres downstream at each session, working upstream until all visible plants were removed and then move downstream again.

Pondweed volunteers needed to be dressed in waders and long, water and chemical-resistant gloves for protection against cold and pollutants in the waterway. Their only tool was a long-handled garden fork. In general, there were four or five people in the stream and two on the stream banks (Fig. 3).

Between September 2011 and May 2014, 'pondweed' volunteers from both the OP and FWS dug the weed out of the stream bed. The OP group met at lunch time on Fridays and the FWS group dug fortnightly on Sunday afternoons. Volunteers soon learned there was a technique

for ensuring the plant tuber was removed. The fork tines needed to be positioned deeply near the tuber to loosen the stream bed while holding the stems gently; the stems which are composed of air cells for flotation are very fragile. Depending on the water depth, it is more difficult to remove the tubers if stems break off.

Once removed, the plant was thrown onto the stream bank and volunteers there placed the plants, as well as other rubbish, into piles for collection (Fig. 4). These volunteers needed to become quite skilled at dodging flying pondweeds!

Unaccustomed to seeing people in the stream channel, locals out walking were very curious about what was going on.

Volunteer effort was supported by both GWRC and HCC by providing waders and gloves and also for the removal of piles of pondweed and very large quantities of other rubbish from the stream bed; some items had clearly been deliberately dumped (Fig. 5, 6).

There have been significant improvements in the stream channel since the weed was removed (Fig. 7, 8) including improved water clarity, less algal blooms, longer riffles and the unpleasant smell has gone.

In total, volunteers contributed more than 1100 hours removing approximately 300,000 plants from 3.4 km of stream bed; a remarkable achievement (Fig. 9). Ongoing monitoring has been required to remove any missed tubers; some have been uncovered after sediment build-up has been washed away. Pondweed volunteer, Franz Hubmann, has regularly patrolled the stream since 2014 to ensure any remaining tubers are removed.

Controlling aquatic weeds is very difficult. The removal of Cape pondweed in Waiwhetū Stream was a unique project and shows what volunteers can achieve with a research-based eradication strategy.

Mission accomplished!

Volunteers who contributed to the project were: Merilyn Merrett, Alan White, Chrissie Burt, Andrew Campbell-Stokes, Barbara de Ste Croix, Michael Ellis, Franz Hubmann, Matthew Lear, Vivien Pohl, Nic Vipond, Dionne Ward, Grant Webby, Rosemary Webby (FWS), Mary Innes, Mike Burtenshaw and Karen Bingham (OP).

Merilyn Merrett

Fig. 4 A pile of Cape pondweed removed from the stream

Fig. 5 Some of the rubbish removed from the stream bed

Fig. 6 Stream bed rubbish for collection

Fig. 7 The stream in 1961 dominated by Cape pondweed

Fig. 8 The same stretch of stream after Cape pondweed was removed

THE Hutt News

www.huttnews.co.nz TUESDAY, MAY 6, 2014

Weed in retreat

Fig. 9 Article in the Hutt News, 7 May 2014

Barbara de Ste Croix with rubbish from the stream bed

CHAPTER FIVE

RIPARIAN RESTORATION PLANTING

Waiwhetū Stream has been heavily modified with the settlement of Lower Hutt, and all streamside vegetation and valley floor native forest has been cleared. The stream channel has been straightened, channelised (see Chapter 6) and re-aligned to make way for roads, housing, playing fields and commercial/industrial development. Stream flows are faster when flowing in straight lines and can contribute to erosion.

Stormwater from more than 60% of Lower Hutt city is discharged into the stream along its entire length through an extensive network of pipes. The consequences are that, during heavy rain events, the stream rises quickly and is prone to flooding. Stormwater also pollutes the water with a range of contaminants from roads, car parks, driveways, roofs and other impervious surfaces (Fig. 1). Cross-connected pipes and sewage pipe failures also result in raw sewage contaminating stormwater discharges.

Fig. 1 Paint pollution through a stormwater pipe from a residential property

A consequence of unplanted stream banks is that, when flows are high, the banks are prone to collapsing which also pollutes the

stream and has a negative impact on native aquatic species such as fish and invertebrates.

Planting stream banks has multiple positive benefits that include stabilising the banks to reduce erosion, providing habitat for native fish, shade to help keep the water cool, filtering to reduce contaminants entering the waterway, providing food resources for native birds, and improving the aesthetics of the stream corridor (Fig. 2).

Fig. 2 Bridge berms that were planted in 2012/13

There are guidelines for riparian plantings but these are more applicable for rural areas rather than an urban environment. In this case, it was not possible to plant the recommended bare minimum width of 10 metres because such widths are not present in many areas and numerous private property boundaries are well within this 10-metre width. In addition, the local community values the open, grassed areas. However, we have been able to plant three to four metre widths in some places, such as bridge berms and steeper sections of stream bank, with good results.

Waiwhetū Stream presented as a blank canvas in 2011 (Fig. 3); there was virtually no native stream-bank vegetation or trees. Initially, some GWRC Flood Protection staff were concerned that plantings would impede stream flows and contribute to flooding but, to date, this has not been the case.

In 2011, with support from Craig Cottrill (HCC Parks and Reserves Assets Manager) who supplied the plants, 400 *Carex secta* were planted after GWRC realigned a stream bank in lower Naenae.

Pre-planting site preparation is important and, depending on the weeds that are present, starts at least 6-8 weeks before planting. Weed-eating and then spraying, sometimes twice, was required. Restoration plantings grow better and have high survival rates without competition from weeds.

Fig. 3 There were no native plants along the stream banks before 2011

In a few areas with steep, high banks, Mike Jensen (GWRC) arranged terracing to allow access for planting. This proved very successful.

For the first five years, three planting events were held each winter; events that have been well supported by the wider community (Fig 4, 5). Over the years, a large number of community and corporate volunteer groups have helped with plantings and the Friends acknowledge their contribution.

The annual number of plantings increased up until 2016 when they started reducing (Fig. 5). By 2021 there had been more than 6kms of stream bank planted with more than 34,000 eco-sourced native plants comprising more than 100 species. A list of species is detailed in Appendix 1.

Most of the plants were supplied by HCC, but contributions have also been made by Wellington Forest & Bird nursery, Mainland Island Restoration Operation (MIRO) nursery, and GWRC.

It was important that a wide range of native species were planted to provide a food resource for native birds; but care was needed when planting some tall tree species. For example, a long-term view was required for kahikatea so these have been planted where there is

Fig. 4 Volunteers planting stream bank

no risk of shading private residences once they have grown to full height. The stream generally flows north to south and is exposed to full sun through the heat of summer. For this reason, trees needed to be planted quite close to the edge to be able to provide shade to help reduce the water temperature. Initially, trees were planted on the west (true right) bank for stream shade from afternoon summer sun.

Earlier plantings are starting to look quite well-established and are not only helping to stabilise stream banks but are also starting to provide shade. The plentiful kōwhai planted are attracting kererū and large numbers of tūī. Of interest is the natural regeneration occurring in some areas. For example, a wider planted area that was previously a sea of onion weed underneath three willows is now a diverse mix of natives, and seeds carried by kererū have germinated under the willows. These include cabbage tree, pigeonwood, nīkau, māpou, five finger, tōtara and māhoe.

The aesthetics of the Waiwhetū Stream corridor have been greatly improved with the native plantings. It was interesting to note that during the COVID-19 lockdown in March 2020, many more people than usual were out and about and walking along the stream corridor,

perhaps discovering their local neighbourhood for the first time. The foot traffic was such that a 'foot trail' was worn in the grass alongside the stream (Fig. 6); it is still present, perhaps indicating a greater appreciation of the Waiwhetū Stream environment.

A special thank you to all those volunteers who have dedicated their time and efforts over these ten years to our planting efforts.

Merilyn Merrett

Volunteers planting along stream edge, Riverside Drive South

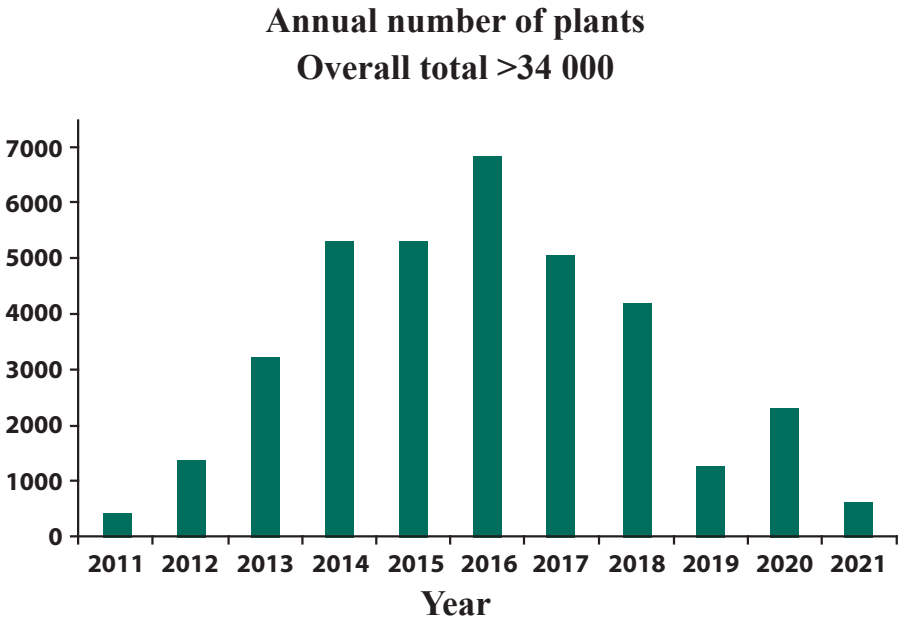


Fig. 5 The rise and fall of the number of plants planted each year 2011-21

Fig. 6 Part of the foot trail formed along the edge of the stream during lockdown in 2020 and maintained since

CHAPTER SIX

NATURALISING WAIWHETŪ STREAM CONCRETE CHANNEL, NAENAE

The channelisation of streams and rivers during the mid-20th century, usually by engineering methods, was primarily for the purposes of flood control, drainage, navigation, and prevention of erosion. This has been to the detriment of native freshwater flora and fauna, resulting in mostly ecologically sterile stream channels and is now a problem in many countries around the world.

Globally, solutions for naturalising channelised waterways include removing all or part of the structure. This is costly and the ecology of any natural waterway further downstream could be compromised by resultant sediment transport downstream.

In Naenae there is approximately 2.3 km of channelised Waiwhetū Stream as well as smaller side channels (Fig.1) from Rata Street to Waddington Drive ext. Hutt City Council (HCC) and Wellington Water (WW) are responsible for this section of the stream.

Fig. 1 Concrete channel confluence, Naenae Park

Fig. 2 Digger removing concrete berm

One of the problems with channelisation is the increased speed of water flows and concentrated volumes down straightened concrete channels compared with natural meandering waterways. In Naenae, this has a negative impact on the ability of native fish to migrate upstream. Observations during spring show the speed of water in the lower section of the channel prevented upstream migration of inanga *(Galaxias maculatus)*; they could not navigate the fast flow even with repeated attempts. Fish that can move overland, such as eels, can bypass water-speed barriers.

In 2015, in an effort to improve inanga upstream migration and naturalise the channel, Craig Cottrill (HCC) supported a FWS initiative that involved removing two separate sections of the 2 m wide concrete berms along the lower 50 m of the channel (Fig. 2). The trial included placing large and mixed rocks into the channel itself and FWS volunteers planting the areas that had been under concrete. The naturalisation potential of the initiative was supported by Diana Isaac and Iqbal Idris, Senior Engineers (WW), who wanted to contribute by removing another section of berm further upstream; the latter was achieved in 2016 with planting and 'rock rolling' (into the channel) done by WW volunteers.

The presence of large cobbles (or roughness) in the base of the concrete channel creates a form of riffle which slows the flow velocity down and creates a backwater effect upstream under normal flow conditions (Fig. 3) and velocity is reduced enough for inanga to be able to swim upstream (which has been observed).

Fig. 3 Planted area and showing riffle created after placing rocks in concrete channel, Naenae

It was noticed that a length of concrete berm was missing on one side of the channel, just upstream from Waddington Drive, so in 2016 a planting was arranged for a small group of students from Wā Ora Montessori School (Fig. 4) and the softening effect of draping native *Carex* is evident after three years growth.

This naturalisation initiative has largely been successful; the most obvious change has been the creation of the 'babbling brook' sound of water passing over and through rocks compared with the silence of water in a concrete channel. Some plants have suffered because during heavy rain events they have been impacted by fast flows coming down the channel from upstream as well as detritus and domestic rubbish.

Fig. 4 Wā Ora Montessori School students planting in 2016 and result

However, the main deterrent to extending this method is the cost of removing large slabs of concrete.

In 2017, FWS was contacted by Brendan Elks, a local resident and member of the Naenae Nature Trust community group, seeking input into how to improve the Rata Street (furthest upstream) section of the concrete channel and to see whether we were able to help with providing native plants to continue planting in the Rata Street area; a planting project that began a few years earlier but had stalled. The author met with two residents (Brendan Elks and Andy Mitchell) on 19 September 2017 where the issues were discussed.

Subsequently, a planting/naturalisation concept was formulated and a proposal for HCC to consider was produced. The concept included naturalising the concrete channel between Rata Street and a footbridge at the north end of Naenae Park (Fig. 5) with the use of rock mini-weirs across the channel to slow water flow and also create pooling behind the weirs. The proposal included planting a 1.5m width along the sides of the concrete berms and with *Carex* spp. closest to the edge of the concrete; these would drape over the edge and disguise the concrete. In addition, it was proposed that a walk/cycle path be

Fig. 5 Aerial map of naturalisation area, Naenae with the red lines

installed along the west side of the channel for access to Naenae Park and beyond.

At a site visit in October, Bruce Hodgins, Divisional Manager Parks and Gardens (HCC), supported the proposed project. Two WW engineers were also met on site to assess any flow risks; none were indicated and work started in 2018. HCC developed the path, WW provided the rocks, and Naenae Nature Trust has held community plantings in the area since 2018 (Fig. 6).

Naturally transported gravels have filled the channel itself, disguising the concrete and providing a natural substrate. One of the main issues has been that the rocks delivered for the mini-weirs were not large enough; some have been buried under gravels, and some removed illegally (B. Elks pers. comm.). However, there is a vast improvement in the aesthetics of this section of stream; from barren and ugly (Fig. 7) to vegetated and pleasing (Fig. 8, 9) and with access to Naenae Park from Rata Street.

This novel project offers a cost-effective solution/opportunity to naturalise the entire length of channelised Waiwhetū Stream down through Naenae Park and beyond. It has largely been successful; at this stage it has not progressed further downstream although HCC has recently constructed a connecting asphalt walking/cycling track around the channel side of Naenae Park from the footbridge southwards to Seddon Street, opening up more opportunities for restoration planting in conjunction with naturalisation.

Merilyn Merrett

Fig. 6 Planting event by Naenae Nature Trust volunteers, 2018

Fig. 7 Barren and ugly before planting and naturalisation

Fig. 8 Naturalisation progress 2022

Fig. 9 Carex secta draping over edge of concrete berm and taller plantings at the back

CHAPTER SEVEN

BEAUTIFICATION AND AMENITY IMPROVEMENTS

The Waiwhetū Stream corridor is naturally attractive with some wider areas having tall, introduced trees, such as willows and poplars and, in general, the stream corridor is valued by local residents.

With progress being made with Cape pondweed removal and riparian plantings, the Friends of Waiwhetū Stream (FWS) Committee deemed it time to further improve aesthetic and amenity values along the stream corridor, and so began considering ideas to present to HCC.

The first amenity project was completed in 2012 with a noticeboard positioned on the corner of Riverside Drive and Birdwood Road. The front side shows a map and the rear side shows volunteers planting the bridge berm there (Fig. 1).

Fig. 1 Noticeboard on the corner of Birdwood Road and Riverside Drive.

Fig. 2 Mosaic mural of native animals around picnic table at St Ronans weir.

The next proposal presented to HCC was to install a picnic table. The first site chosen for this was by the St Ronans weir where it was installed in 2014. Because the proposed site had a slope, it required raised concrete walls on three sides. Native trees and lower growing species were planted above the concrete walls to soften the industrial concrete appearance. At a later date, the committee proposed that a mosaic mural on the inner walls would enhance the table and this artwork, designed by Rachel Silver (silvermosaics.com), was installed in 2016 (Fig. 2).

This picnic table proved so popular, that Craig Cottrill (HCC) agreed to the group being allowed to install a picnic table each year. To date, six picnic tables have been installed from Riverside Drive South (below Wainui Road) (Fig. 3) to Riverside Drive North (opposite Heather Grove). It is hoped that more will be installed in future as these are a well-used amenity.

To further enhance the stream berms and provide shade for people, Craig suggested we plant groups of large native trees; this offer was gratefully accepted, and the group was allocated 20 large trees each year from 2015 until 2020 which were planted in groups of five (Fig.4). One of the

first plantings in 2015, five kahikatea near the St Ronans weir, have grown well and formed the basis of a planned kahikatea avenue with a path between them (Fig.5).

Fig. 3 Picnic table framed by a mature pōhutukawa

In 2017 FWS decided distance markers would be a useful addition, not only to give an indication of distances, but also to guide walkers when the route from Bell Road to Hamerton Street diverts away from the stream corridor. These markers were installed in 2019 (Fig. 6).

In 2016, beautiful stone sculptures made from pink granite (previously used to grind coconut at the Lower Hutt Griffins factory) and carved by Barry Te Whatu and Sonny Davis, were unveiled on the corner of Bell Road and Riverside Drive South (Fig. 7). FWS also learned that the proposed Waiwhetū Sculpture Walk, developed by the E Tu Awakairangi Hutt Public Art Trust, would not progress any further than Bell Road.

Fig. 4 A grouping of five tītoki trees

The FWS Committee was then motivated to continue the sculpture walk theme and commissioned Jason Dench (rawtiron.com) to create an iron sculpture. This was erected early in 2020 near the footbridge crossing the stream to Te Whiti Park (Fig.8). This was partly funded by

award money FWS received in 2014, and with HCC contributing the remainder.

It is hoped that the stream corridor will continue to be enhanced and enjoyed by all.

Merilyn Merrett

Fig. 5 Kahikatea avenue near St Ronans weir

Fig. 7 Beautiful stone sculptures on the corner of Riverside Drive South and Bell Road

Fig. 6 Distance markers for walkers

Fig. 8 Kōwhai leaf sculpture by footbridge entrance to Te Whiti Park

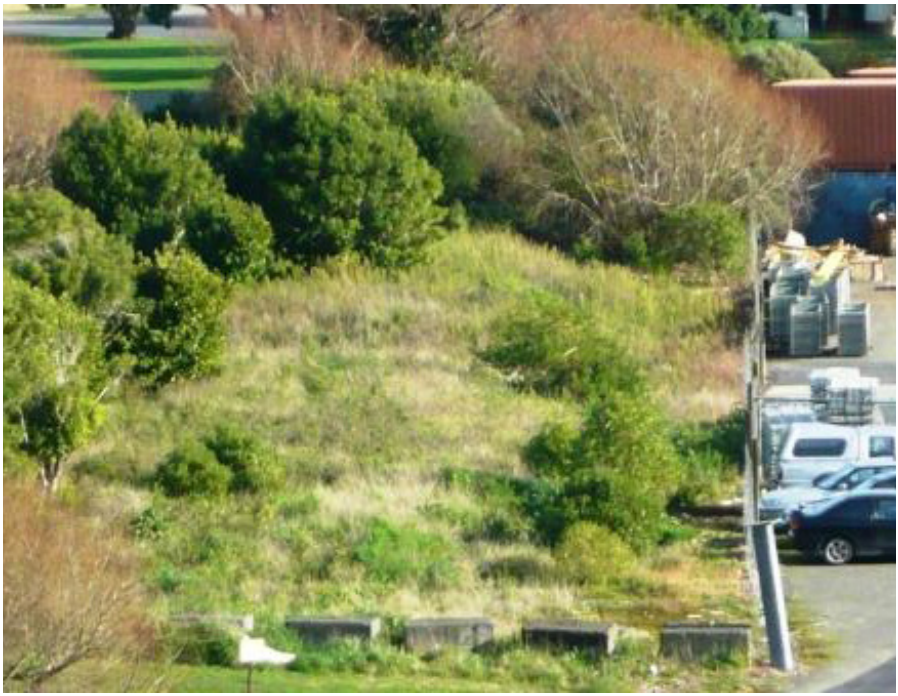


Fig. 1 Rishworth before 2010

CHAPTER EIGHT

RISHWORTH RESERVE

Rishworth Reserve was an undeveloped area of public land at the end of Rishworth Street, next to the Waiwhetū Stream, near the base of the Wainuiomata Hill. Less than a hectare in area, it is a narrow section stretching alongside the stream with the northern end prone to flooding. The site had been used for landfill with industrial rubble and was weedy and overgrown (Fig. 1). A vision for developing a patch of native forest in the Rishworth area was brought to the attention of the Friends of Waiwhetū Stream (FWS) Committee by committee member Henry Steele in 2011. Hutt City Council (HCC) had arranged planting days in both 2002 and 2003 but little had survived. There was concern expressed about the suitability of the site to support a native forest. Blackberry and noxious vines had successfully survived making access to the site very difficult.

In July 2012, FWS submitted a proposal to HCC to seek support for creating a podocarp-dominated native forest on the undeveloped public land. Merilyn Merrett, Chairperson of FWS at the time, led a vegetation survey. It was found that most of the area was dominated by introduced weedy plants with dense areas of blackberry and climbers.

Of the 74 vascular plant species recorded during the survey, most were non-native (exotic) weedy species. Four naturally-occurring native herbaceous species were located along the stream edge. Several of the previously planted native trees were located but were overwhelmed by rampant exotic weeds. Two of the naturally occurring herbaceous plants were found along the edge of Waiwhetū Stream during the plant survey.

Showing drain and a view never to be seen again. Taken 2 June 2013 volunteers unknown. View towards Rishworth Street.

Taken on February 2015. Volunteers from IAG Insurance ASB section

After approval from HCC, FWS started developing the area in September 2012 and, although it was quite late in the year for planting, some clearing was done for kahikatea, flax and a small number of other native species donated by the Mainland Island Restoration Organisation (MIRO) plant nursery. Vivien Pohl and Barbara de Ste Croix, persons with substantial experience with growing and planting native species,

became actively involved with the project. Over the years, at least 7,800 native plants have been supplied, the majority from Vivien Pohl, many from HCC, with other suppliers of plants, including Wellington Forest & Bird nursery, and individual contributors.

A great deal of early clearance effort was undertaken by Corrections Department teams with areas identified and prepared well ahead of annual winter planting. Before planting, hand weeding, spraying and mulching is undertaken. Much of the planting is carried out by members of the local community and by corporate groups. HCC contractors were responsible for removal of non-native trees, including willows, poplar, sycamore, elderberry and alder, along with rubbish from the site. Items removed included concrete, tiles, brickwork, metal, glass and plastic industrial bags, with a specialist required to remove asbestos. Some large items of brickwork, concrete and a car remain but are no longer visible among the plants.

Earlier plantings have become well-established, exceeding initial expectations with high survival rates among the 70 species planted. It does show the need for continuous maintenance for the plants to survive and grow successfully. Mulch has been especially beneficial, together with releasing from weed growth. Whilst forest growth encourages birds, they do drop non-native seed and berries, including ivy, flowering cherry, cotoneaster, sweet pea, climbing asparagus, blackberry and fennel. Other weed seeds are windblown or are stranded streamside on the outgoing tide.

Replanting dead flax area, taken on 19 August 2021

Initially, the major pest problem was rabbits but, with the help of pindone supplied by Greater Wellington Regional Council (GWRC), they were eradicated. Damage was substantial and large strong protectors are necessary. Emphasis

remains on reducing weed spread by preventing weeds from flowering and seeding. Each year a target species is chosen for removal. Recently, thistles, convolvulus, and onion weed have been targeted with earlier efforts concentrating on blackberry which is still presenting.

A setback occurred in summer 2018 when the large area of flax *(Phormium tenax)* suddenly collapsed from a dieback disease; efforts are now in progress to replant this area at the southern end with a diverse range of species.

As earlier plantings became well-established, a loop track was developed in 2017 through the area alongside the stream. At the Rishworth Street entrance a picnic table has been installed and signage provided.

Quarterly bird counts began in 2019 with many kererū and tūī now seen alongside resident fantails and grey warblers.

Pest monitoring with tracking tunnels (Fig. 2) is undertaken quarterly beginning in 2020 with trapping initiated the following year. Rats and mice were present but numbers are now controlled; but vigilance is

Henry Steele moving mulch, 2020

required as re-invasions can occur. Recently, rabbit damage was observed and the presence of rats after a prolonged absence. So now numbers can be kept sparse. However, hedgehogs are present with their footprints prevalent in tracking tunnels.

Today, the area is largely restored with native plants; and birdlife has noticeably improved. Planting, weeding/releasing and mulching is being undertaken by volunteers on Wednesday mornings and on other days when conditions are suitable.

Fig. 2 Henry Steele with tracking pad

This restoration project would not have been possible without the ongoing dedication of many volunteers.

Henry Steele

Entrance to Rishworth Reserve

Rishworth Reserve from Callaghan Innovation

Rishworth Reserve today

Volunteers from Eastern Hutt Rotary mulching with WorkZone in the background who are supportive in providing facilities. 14 October 2017

Volunteer Vivien Pohl with school children on a planting working bee at Rishworth Reserve.

Aerial photo of Rishworth Reserve showing boundaries (HCC aerial maps 2017)

CHAPTER NINE

WEED CONTROL

The Weed Warriors is a group of volunteers dedicated to ensuring that the Friends of Waiwhetū Stream's (FWS) plantings along the Waiwhetū Stream banks thrive. The Weed Warriors carried out their first weeding bee over the weekend of 15/16 March 2021 after its proposed inception date in 2020 was postponed due to the COVID-19 pandemic lockdown.

Prior to this, weeding was carried out by a small group of dedicated volunteers, the Weed Busters. This earlier group carried out its first weeding session on Sunday 21 September 2014. However, due to the dwindling number of volunteers, by February 2016, the group was no longer able to continue its weeding activities.

Weed control using weed mat and herbicide spraying are proven techniques used to suppress weeds before planting. Without some form of weed control plant losses are high.

In 2012 the Friends began laying polypropylene weed matting with new plantings. While being very effective at controlling weeds during the initial stages of plant establishment, Hutt City Council (HCC) was concerned that, as a form of plastic, after it breaks down it could become an added pollutant in the stream. Efforts to try a more environmental weed mat were difficult as the polypropylene weed mat was so effective, generally having a 90% plant survival rate as opposed to 50% without the mat.

In 2019, the Greater Wellington Regional Council (GWRC), HCC and the Friends worked with Chris Cosslett, consultant, to conduct a trial of various commercial weed suppressant mats to try and find an alternative. The weed mat trial was carried out on the true left of the stream at Hayward Terrace (Fig.1). The

four different types of matting included Ecojute (700 gsm) (Fig 2), Ecowool, Brown EcoWeedmat (Pillar Products) and Ecocoir coconut fibre mat (300gsm) (Fig 3). This trial concluded in 2021.

The brown eco-mat proved to be the most effective at suppressing weeds in the first two years of plant establishment after which it begins to break down. For the native plantings, this allows time for new plants to become established.

The benefits of a weed mat that breaks down ensures less of a persistent plastic problem within the planted areas. Polypropylene weed mat has become a hindrance to hand weeding. When the stream floods, silt and debris collect on top of the weed mat creating a soil base for further weed proliferation.

Fig. 1 Non-woven polypropylene as part of the trial. Image: Chris Cosslett

Fig. 2 Laying ecojute. Image: Chris Cosslett.

The role of the current Weed Warriors is to take care of plantings along the stream bank by hand weeding around the native trees, shrubs and grasses. Some of the more persistent common weeds that threaten to strangle our native species are *Tradescantia* sp., *Vinca major* (Periwinkle), *Hedera helix* (Ivy) along with exotic grasses and garden weeds that compete with native grasses.

The Weed Warriors carry out weed maintenance every third weekend of each month with weed piles (Fig.4) removed the following Monday by HCC contractors. With volunteers spread along the length of stream from Hamerton Street, Naenae, in the north, to Bell Road/Parkside Road in Gracefield, over 6 kilometres of stream is maintained.

These stream sections are notable for their well-maintained appearance. The group also organises weeding bees to target areas that need extra attention. These dedicated individuals and groups take responsibility and care for a section of stream in their neighbourhood and their efforts are greatly appreciated.

The Weed Warriors are always looking for new people to take an interest in helping to maintain the native plantings along the stream corridor. The stream is our taonga, and our ongoing commitment to maintaining an attractive urban green corridor for all the community to enjoy honours that.

Ros Wech and Chrissie Burt

Fig.3 Ecocoir coconut mat. Image: Chris Cosslett

Fig.4 Piles of weeds

CHAPTER TEN

STREAM CLEANING

Regular monthly clean-up of the Waiwhetū Stream corridor, the banks and the berm in particular, commenced in October 2011. Cleaning initially began from Naenae Park to Bell Road bridge and, three years later, was extended to include the section past Hutt Park to Seaview. Besides improving the appearance of the stream corridor, rubbish removal has reduced stream contamination and prevented substantial amounts of rubbish reaching the harbour. Volunteers do regular rubbish collections the first weekend of every month (except January).

There are eight teams each with a team leader and managed by a volunteer co-ordinator. After 10 years as co-ordinator, Henry Steele has handed over the reins to Phillip Zhou who ensures that teams are supplied with bags, pickers, bag holders and labels that are provided by Hutt City Council (HCC). The co-ordinator liaises with the contractors for collection of rubbish bags and any large items dumped in the stream.

Expectations were that, after initial monthly collections with removal of past rubbish, amounts collected would reduce and collections could be less frequent. This was not to be. Quantities of rubbish have not changed over the years of rubbish collection and so collections have continued monthly and similar amounts amassed each year. About 240 bags (50 litre in size) of rubbish are removed from the stream environs each year by 40 or so volunteers. It remains to be seen whether the change in recycling from open bins makes a difference, with less wind-blown material reaching the stream. Larger items are regularly removed from the stream bed. Noted in 2021 were traffic cones, a mattress, carpet, an armchair, a typist's swivel chair, a pig's head and a

cash register (Fig. 1). In April 2021, an in-stream cleanup was undertaken yielding 36 bags of rubbish and a variety of larger items.

More rubbish is found after wet weather events. In terms of items collected, plastic in the form of bottles and polystyrene makes up much of the rubbish together with coffee cups, plastic straws, fast food containers, aluminium beverage cans and glass liquor drink bottles. Since supermarkets may no longer use plastic shopping bags this major source of rubbish has significantly diminished only to be replaced by face masks. With the lower reaches being tidal, major infestations coincide with wet weather events and strong southerlies. Also, tidal flows can result in rubbish entering the Waiwhetū Stream from the Hutt River.

Special thanks are extended to the volunteers, most of whom have stayed with this project throughout these first ten years.

Henry Steele

Fig. 1 A cash register removed from the stream bed

Rachel Tallon removing rubbish from the stream banks

Franz Hubmann removing rubbish from the stream bed

CHAPTER ELEVEN
MONITORING AND EVALUATION

Inanga Spawning Trial

In autumn 2017, Friends of Waiwhetū Stream (FWS), with the support of Whitebait Connection (now Mountains to Sea Wellington) and HCC, took part in a Department of Conservation (DOC) trial[1] to investigate potential inanga spawning sites. Straw bales were installed at a site within the saline wedge zone of the stream and subsequent inspection revealed inanga eggs had been laid (Fig. 1).

Fig. 1: Inanga eggs

Citizen Science Activities

Background

Later, in 2017, staff from Greater Wellington Regional Council (GWRC) approached FWS and asked if the group would be interested in undertaking citizen science projects along the

[1] https://www.doc.govt.nz/globalassets/documents/conservation/land-andfreshwater/ freshwater/care-for-inanga-brochure.pdf

Waiwhetū Stream. Three FWS committee members met with council staff and planned the following projects:

(a) macroinvertebrate monitoring with three-monthly surveys and annual habitat surveys (to monitor the stream health);

(b) fish monitoring upstream and downstream of the St Ronans Avenue weir with surveys in November and February (to determine whether the weir is a barrier to fish passage); and

(c) an inanga habitat survey in the saline wedge zone between Bell Road and Whites Line East (to determine whether the vegetation is good for inanga spawning).

The first two were intended to be long-term projects while the third one was a one-off project.

Training and support, for the first two activities were provided by GWRC and Mountains to Sea Wellington. The necessary equipment was provided by GWRC. The inanga habitat survey was carried out by Dr Merilyn Merrett using her professional knowledge.

Inanga Habitat Survey

The results of the inanga habitat survey showed that most of the stream bank vegetation within the saline wedge zone of the stream was fairly good for inanga spawning. Since then, increased *Carex* sp. planting has been carried out to improve spawning chances.

Fish Surveys

Over the 2017-2018 summer, FWS assisted two university interns, employed by GWRC's Flood Protection Department, who were investigating options to improve inanga passage at the St Ronans Avenue weir. They suggested trialling a low-cost floating fish ramp and one was installed in February 2018 (see Fig. 2).

During 2018, FWS continued its observations of inanga attempts to climb the weir. Under suitable low flow conditions, some larger

fish are able to burst swim over the weir. This was confirmed by the fish survey carried out prior to the floating fish ramp being installed.

Fig. 2: St Ronans Avenue weir with floating fish ramp (note the use of the ramp by the local avian life)

The November and February fish surveys carried out since 2018 have definitively confirmed that the weir acts as a partial barrier to fish passage; although it is still not known whether the floating ramp is aiding fish passage (we suspect not). The survey objectives have expanded to monitoring fish population trends more generally over time.

The surveys involve setting three fyke nets at fixed locations over a 200 m distance downstream of the weir and another three nets over a similar distance upstream. The nets are set in the early evening (see Fig. 3) and then retrieved the following morning when the captured fish are identified and counted before being released.

Figures 4-6 show a series of graphs illustrating the results of the fish surveys over time.

Fig. 3: Fyke net set ready to capture fish overnight (fish swimming upstream or downstream meet the 'guide' part of the net spanning the width of the stream and are steered towards the mouth of the 'trapping' part of the net)

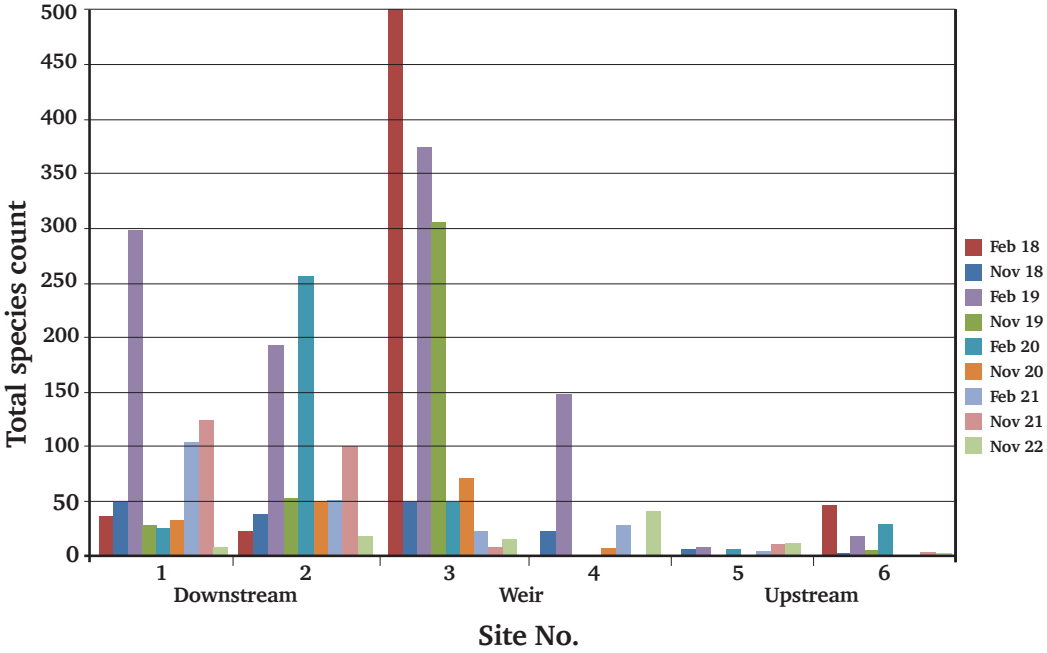


Fig. 4: Number of inanga captured downstream (Sites 1-3) and upstream (Sites 4-6) of St Ronans Weir over time - all surveys

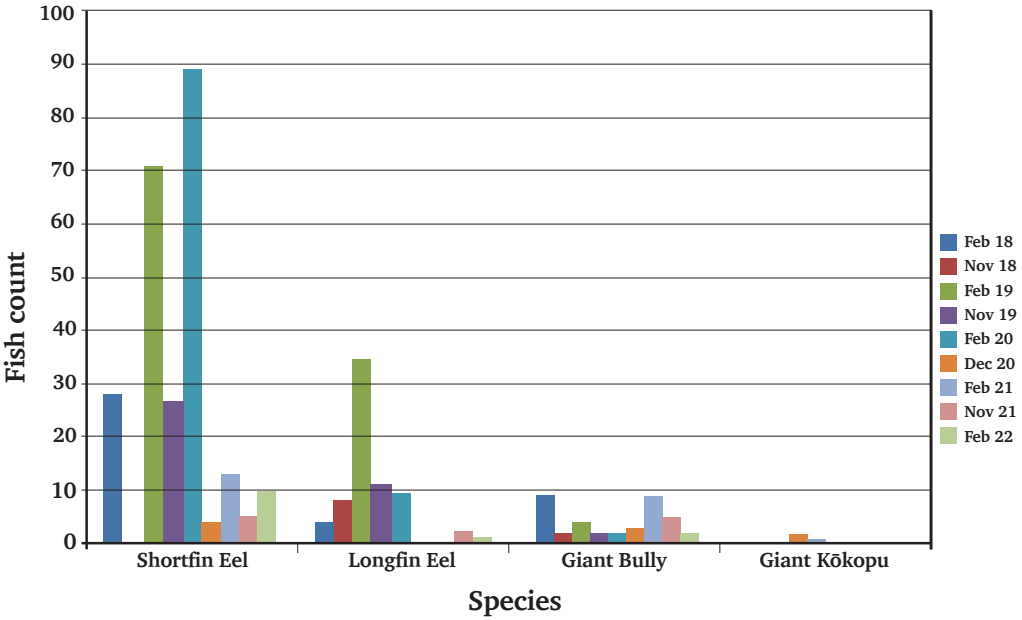


Fig. 5: Number of fish captured over time (excluding inanga) downstream of St Ronans Weir

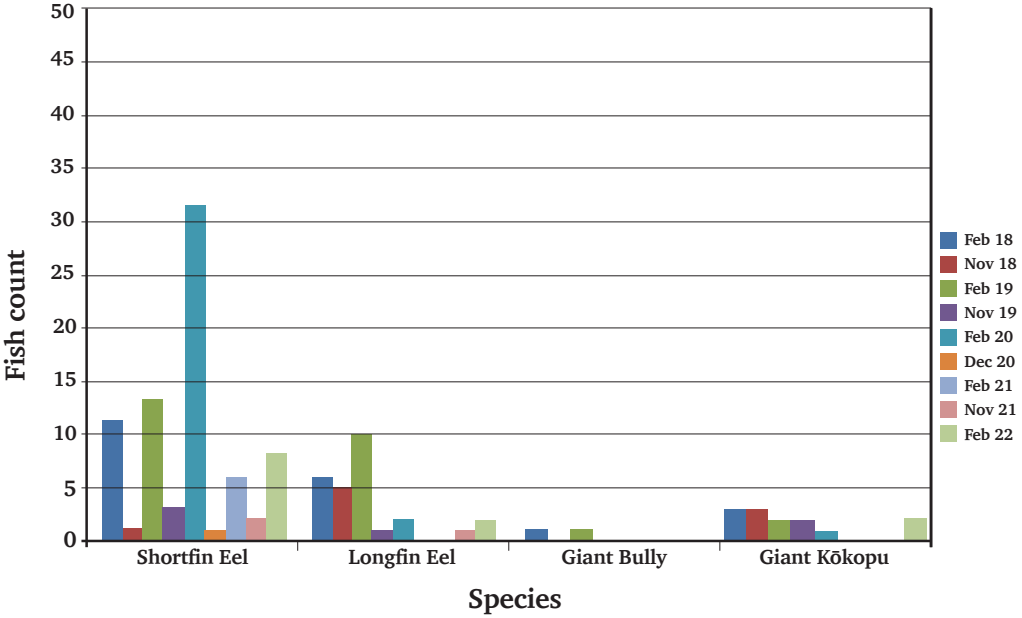


Fig. 6: Number of fish captured over time (excluding inanga) upstream of St Ronans Weir - all surveys

Observations to date are:

- In the 2018 and 2019 surveys, large numbers of inanga were captured but the numbers have declined dramatically in more recent surveys (Fig. 4).
- The number of inanga captured upstream of the weir is generally much lower than the number downstream of the weir (Fig. 4).
- Many more shortfin eels are captured than longfin eels upstream and downstream of the weir. Eel numbers peaked in February 2020 but since then have dropped significantly (Figures 5 and 6).
- Giant and common bullies are mostly captured below the weir with numbers varying between surveys (Fig. 5). Individual bullies have occasionally been captured above the weir.
- Giant kōkopu are captured in very small numbers, mostly upstream of the weir (Fig.6).
- Shrimps are regularly captured.
- On a couple of occasions kōura have been captured below the weir.

Macroinvertebrate Surveys

Three-monthly macroinvertebrate surveys are carried out at a site downstream of the Birdwood Road Bridge. The site is divided into two parts – a 20 m long run section below the sharp bend where the stream meets Cleary Street and a 10 m long riffle section immediately upstream. The stream morphology has evolved over time due to sediment movement with a weak riffle now present in the run section.

Kick samples are obtained by disturbing the bed (see Fig. 7) and capturing the dislodged macroinvertebrate specimens in a D-net positioned downstream. The aggregated samples from the two sections are analysed separately.

Fig. 7: Obtaining a kick sample by disturbing the streambed in the run section

The species commonly found in the macroinvertebrate surveys are described in the wildlife chapter (Chapter 12).

Each species in a standard National Institute of Water and Atmospheric Research (NIWA) list has a tolerance score. Sampled species in the run and riffle sections are counted to determine whether they are abundant, common or rare. The tolerance scores for all species are added together and divided by the number of species present to determine the stream health score (SHS). The SHS is tracked over time to assess trends in the stream health.

Figures 8 and 9 show the SHS from each survey from January 2018 for the run and riffle sections respectively. It is difficult to discern a clear long-term trend as the SHS fluctuates between surveys.

However, it appears that the SHS for the run section may be very gradually increasing over time, although it remains on the

margins of poor/fair (i.e. a score of about 4). The SHS for the riffle section showed a definite increasing trend from 2018-2020, but dropped back slightly after the October 2020 survey. Both sections showed a drop in the April and July 2019 surveys following weed clearance from the stream bed.

The results from the macroinvertebrate and fish surveys are entered into the following national databases: Macroinvertebrates

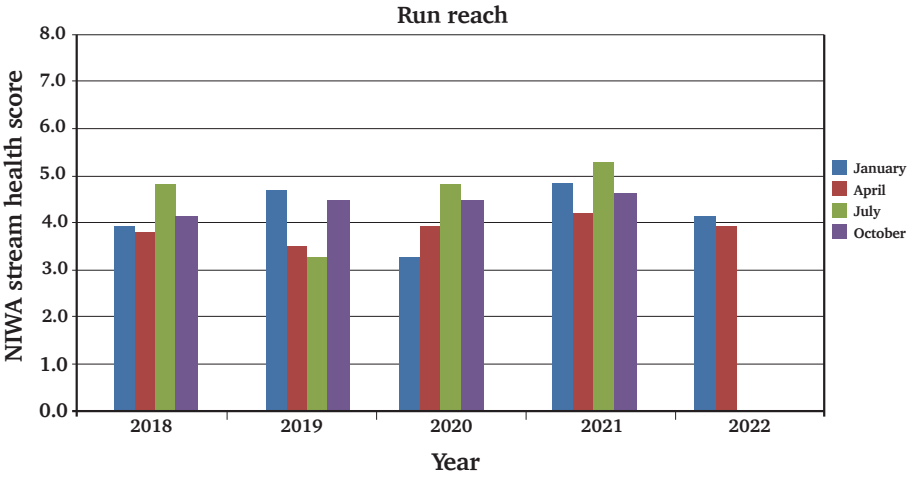


Fig. 8: Stream health score for run section from 2018-present

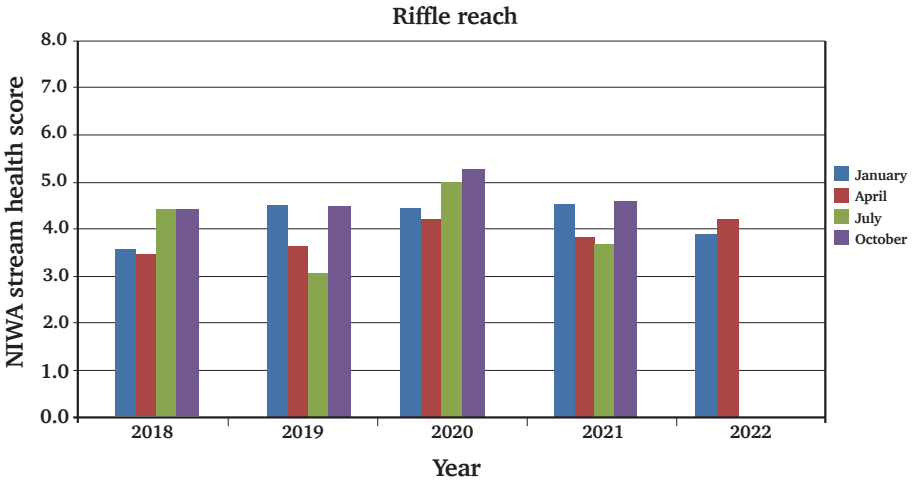


Fig. 9: Stream health score for riffle section from 2018-present

- NZ Water Citizens Database (NIWA); Fish - NZ Freshwater Fish Database (NIWA).

Summer Intern Projects
FWS has supported other projects carried out by GWRC's student interns employed over the summer period. One project related to the fish passage investigation for the St Ronans Avenue weir project which involved achieving a better understanding of the hydraulic behaviour of the weir over the full range of flow conditions.

In 2018-2019, FWS supported two students to undertake a riffle / pools survey from the Naenae concrete channel to the Bell Road ridge. The students produced a set of maps identifying riffles, pools and vegetation coverage along the stream channel, designed to assist with improving fish habitat.

Worcester Polytechnic Student Projects
For the past eight years, GWRC has hosted students from Worcester Polytechnic Institute in Massachusetts, USA, working on a range of projects at the intersection of technology, society and environment. Several of the projects have been associated with the Waiwhetū Stream including:

- Investigating Flood and Climate Change Perception in the Hutt Valley (2015)
- Analysing Perceptions of Residents Living with Flood Protection in Lower Hutt (2018)
- Improving Flood Warning systems – Pilot Project with communities associated with the Waiwhetū Stream (2019)
- Adapting to Rising Sea Levels in Seaview at the mouth of the Waiwhetū Stream (2020)
- Assessing Innovative Freshwater Management Solutions for the Hutt Valley (2022)

A big thank you to all those who have helped with the citizen science projects.

Grant and Rosemary Webby

Inanga ready to be counted after transfer from the fyke nets into the counting bins

From the net into the bin to be counted

CHAPTER TWELVE

WILDLIFE

Many creatures make the Waiwhetū Stream and its environment their home. These include fish, many birds and both aquatic and terrestrial invertebrates.

In 2021 WilderLab (www.wilderlab.co.nz) carried out eDNA analyses on samples of Waiwhetū Stream water. The results indicated the presence of many organisms in the stream: plants, algae, bacteria, ciliates, mammals, birds, fish, rotifers, snails, worms, insects and fungi. FWS collected the eDNA samples using a kit supplied by WilderLab. Six samples were collected corresponding to the macroinvertebrate sampling areas, the three fish sampling areas below the weir and one sample from just above the St Ronans Avenue weir (Fig.1).

Rosemary Webby

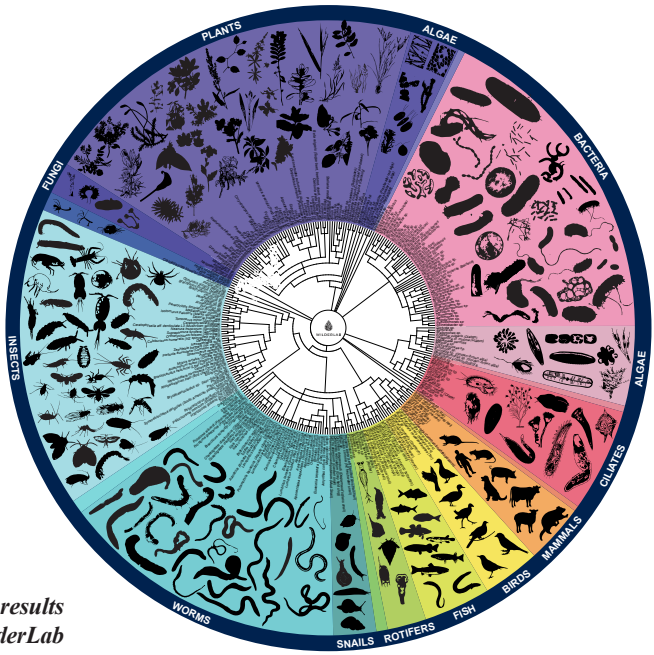


Fig 1 eDNA results by WilderLab

Inanga

Longfin eel

Giant bully

Kōura

Pūkeko and juvenile

Little shag

Damselfly larva (and amphipod)

Kōtuku, seen in 2011

CHAPTER THIRTEEN

ADVOCACY

One of the catalysts for establishing the Friends of Waiwhetū Stream (FWS) was the work that Hutt City Council (HCC) and the Greater Wellington Regional Council (GWRC) had undertaken from 2001 to 2008 to remove toxic waste that had built up through industrial discharges to the stream. Following on from that expensive work, it became clear that retaining the *status quo* with no one stepping up to advocate for the stream would result in the pollution being allowed to return. The group's aim of making Waiwhetū Stream a healthy and functioning ecosystem that is treasured and enjoyed by all, means speaking up on matters that do not support our vision.

FWS's first engagement on matters that affect the stream was a consent renewal to operate the Wastewater Treatment plant in Seaview. In initially seeking a long-term consent, there was engagement on the part of HCC and GWRC with community groups, including the Friends, who informed the operators that the existing systems of discharging into Waiwhetū Stream were not acceptable. After some discussion, a short-term consent, accompanied by a condition of on-going discussions to address concerns with the discharges, was requested. The Friends have been in discussion with Wellington Water (WW) and are regularly informed of activities that lessen the likelihood of discharges.

The Friends have regularly provided comment to HCC through their processes, notably on District Plan changes in 2016. The group's main recommendation was to promote hydraulic neutrality, the concept that the storm runoff from any new

development should be no greater than that which would have occurred from site prior to the development occurring, for all new developments in the city, so that stormwater is not immediately piped to the stream. This benefits the stream by more closely mimicking a natural rain event where water drains more slowly to the stream, reducing flooding and contaminants.

The Friends have consistently advocated for the stream over the last decade in a positive and pragmatic manner that has benefitted the community and the stream.

Michael Ellis

Purple paint discharged into the stream in 2013. Tracking down such pollutants can be difficult for GWRC. Image: Graham Harding

CHAPTER FOURTEEN

COMMUNITY CONNECTION

Informing the wider community of the efforts to restore the stream has involved several media activities over the years. Early on, a website was created as well as a Facebook page and these are both still managed today. Through these sites people could find out when activities were planned. People also signed up to be on the emailing list which, at the end of 2021 had over 150 contacts. Over the years, there have been articles about the Friends posted onto Neighbourly and in the Hutt News.

An information noticeboard on the corner of Birdwood Road and Riverside Drive also keeps people informed about the group's activities. Printed leaflets about the Friends are stored there for the public to pick up. In 2019, the Hutt City Council (HCC) created distance markers along the stream to help walkers and other users navigate the stream corridor.

Every year in November, the Friends hold a public AGM and local city councillors often attend as well as representation by Greater Wellington Regional Council (GWRC) and HCC. At the AGM a visiting speaker often gives an informative talk about environmental issues and then the chair details all the activities the Friends have carried out that past year. Local politicians and the mayor have also attended our popular AGMs.

One ongoing project is the installation of historical signs. Three signs will be erected in 2022 after several years of research and design. It is hoped that there may be more such signs detailing aspects of the history of the stream and local environment.

The Friends of Waiwhetū Stream also connect with other environmental community groups in the wider region at various events organised by HCC and GWRC.

Rachel Tallon

CHAPTER FIFTEEN

THE FUTURE

Waiwhetū Stream's future largely depends on the evolution of the city – more intensive housing and changes in weather patterns will impact the health of the stream unless properly mitigated. The human impacts of living by the Stream will need everyone to take a sense of guardianship, or kaitiakitanga, for the Waiwhetū Stream environment.

Small things, such as installing water retention tanks, and being careful to prevent chemicals from activities such as washing cars from entering drains, all add up. It is important to continue to advocate for good housing design and urban planning that protects the stream. With climate change and intensive housing, stormwater run-off presents an increased flood risk. Advocacy also includes educating the public in understanding how to care for the wildlife that lives in the stream so a proper balance can be maintained.

Authorities need to ensure that pipes and other water infrastructure are properly managed, maintained and renewed so that only rainwater enters the stream and our wastewater treatment plant upgraded to ensure discharges to the stream stop. Residents could help by reporting leaks and contamination events promptly to the Hutt City Council (HCC) (https://www.huttcity.govt.nz/people-andcommunities/community-safety/report-a-problem).

As the Chair of Friends, I would like to see the stream become a local treasure whereby people can walk the length of the stream as a walking trail, with the gaps along the stream connected and bridged.

It would provide a destination for local residents and visitors the same way the Te Whiti Riser walkway has been for the city.

With the Friends and other groups providing art installations, rest spots, and planting and maintenance over the last decade, and continuing to provide these, the stream will continue to evolve into a treasured asset, taonga, of our community.

Michael Ellis

At the AGM in 2020 Deputy Mayor Tui Lewis thanks Dr Merilyn Merrett for her many years as chairperson

APPENDIX ONE

LIST OF SPECIES PLANTED

Scientific Name	Common Name
Gymnosperms	
Dacrycarpus dacrydioides	kahikatea
Dacrydium cupressinum	rimu
Podocarpus totara	tōtara
Prumnopitys ferruginea	miro
Prumnopitys taxifolia	mataī
Ferns	
Asplenium bulbiferum	hen and chickens fern
Asplenium oblongifolium	shining spleenwort
Blechnum novae-zelandiae	kiokio
Cyathea dealbata	silver fern
Cyathea medullaris	mamaku
Cyathea smithii	soft-leaved tree fern
Dicksonia fibrosa	whekī-ponga
Dicksonia squarrosa	whekī
Flowering plants - dicots	
Alectryon excelsus	tītoki
Aristotelia serrata	wineberry
Beilschmiedia tawa	tawa
Brachyglottis repanda	rangiora
Carmichaelia australis	whip broom
Carpodetus serratus	putaputawētā
Clematis forsteri	green clematis
Clematis paniculata	clematis
Coprosma grandifolia	raurēkau
Coprosma lucida	
Coprosma propinqua	
Coprosma robusta	karamu

Coprosma rotundifolia	round-leaved coprosma
Leptocophylla juniperina	prickly mingimingi
Dodonaea viscosa	akeake
Dysoxylum spectabile	kohekohe
Elaeocarpus dentatus	hīnau
Fuchsia excorticata	kōtukutuku, tree fuchsia
Geniostoma rupestre	hangehange
Griselinia littoralis	broadleaf
Hebe stricta var. atkinsonii	koromiko
Hedycarya arborea	pigeonwood
Hoheria sexstylosa	long-leaved lacebark
Ileostylus micranthus	mistletoe
Knightia excelsa	rewarewa
Kunzea ericoides var. ericoides	kanuka
Laurelia novae-zelandiae	pukatea
Leptinella squalida	
Leptospermum scoparium	mānuka
Leucopogon fasciculatus	mingimingi
Linum monogynum	rauhuia
Lophomyrtus bullata	ramarama
Macropiper excelsum	kawakawa
Melicope simplex	
Melicope ternata	wharangi
Melicytus lanceolatus	narrow-leaved māhoe
Melicytus obovatus	
Melicytus ramiflorus	māhoe
Metrosideros robusta	northern rātā
Myoporum laetum	ngaio
Myrsine australis	māpou
Myrsine salicina	toro
Neomyrtus pedunculata	rōhutu
Nestegis lanceolata	white maire
Fuscopora fusca	red beech
Nothofagus solandri	black beech
Olearia paniculata	akiraho
Olearia solandri	coastal tree daisy
Olearia virgata	twiggy tree daisy
Pennantia corymbosa	kaikōmakō
Pimelea prostrata	Strathmore weed

Pittosporum eugenioides	tarata, lemonwood
Pittosporum tenuifolium	kōhūhū
Plagianthus divaricatus	saltmarsh ribbonwood
Plagianthus regius	lowland ribbonwood
Pseudopanax arboreus	five finger
Pseudopanax crassifolius	lancewood
Pseudowintera axillaris	horopito
Raukaua anomalus	
Rhabdothamnus solandri	taurepo, New Zealand gloxinia
Schefflera digitata	patē
Sophora molloyii	kōwhai
Sophora tetraptera	kōwhai
Streblus banksii	milk tree
Syzygium maire	swamp maire, waiwaka
Weinmannia racemosa	kāmahi

Flowering plants - monocots

Arthropodium cirratum	rengarenga lily
Astelia fragrans	bushflax
Carex dissita	
Carex flagellifera	
Carex geminata	
Carex lessoniana	rautahi
Carex māorica	Māori sedge
Carex secta	pūrei
Carex virgata	pūkio, swamp sedge
Cordyline australis	cabbage tree
Cortaderia toetoe	toetoe
Cyperus ustulatus	giant umbrella sedge
Dianella nigra	blueberry, turutu
Juncus gregiflorus	
Juncus krausii subsp. australiensis	sea rush
Leptocarpus similis	oioi
Libertia grandiflora	
Phormium cookianum	whaririki, mountain flax
Phormium tenax	harakeke, swamp flax
Poa cita	silver tussock
Rhopalostylis sapida	nīkau
Schoenoplectus tabernaemontani	lake clubrush, kuawa

APPENDIX TWO

WILDLIFE OBSERVED

Birds	Macroinvertebrates	Other organisms of interest
bellbird (korimako)	*amphipods*	*cranefly adults*
blackbird	*beetle*	*damsefly adults*
black swan	*caddisfly axehead larvae*	*mayfly adults*
chaffinch	*caddisfly free living larvae*	*monarch butterfly/ caterpillars*
ducks mallard	*caddisfly net-spinning larvae*	*other terrestrial insects*
duck muscovy	*clam fingernail*	*plants aquatic and terrestrial*
duck paradise (pūtangitangi)	*cranefly larvae*	*seals occasionally (usually pups)*
falcon (kārearea)	*damselfly larvae*	*wētā*
fantail (pīwakawaka)	*dobsonfly larvae*	
geese Canada	*leech*	
goldfinch	*kōura*	
greenfinch	*mayfly nymph flat*	
grey warbler (rironiro)	*mayfly nymph spinygilled*	
gull black -backed (karoro)		
gull red -billed (tarāpunga)	*midge larvae*	

Birds	Macroinvertebrates	Other organisms of interest
heron white- faced (matuku)	*midge non-biting larvae*	*Pests include:*
heron white (kōtuku) (2011)	*mosquito pupa*	*hedgehogs (Rishworth)*
kingfisher (kōtare)	*shrimp*	*mice*
kererū (wood pigeon)	*snail left-handed*	*rabbits (Rishworth)*
magpie Australian	*snail mud*	*rats*
morepork (ruru)	*stone fly larvae*	*wasps*
pigeon feral/rock		
Pūkeko	*worms flat*	
royal spoonbill	*worms segmented*	
Scaup		
shags various (little, pied, black)	**Fish**	
shining cuckoo (pīpīwharauroa)	*bully common*	
silver eye (tauhou)	*bully giant*	
sparrow hedge (dunnock), house	*eel longfin (tuna)*	
spur winged plover	*eel shortfin (tuna)*	
starling	*inanga*	
swallow welcome	*kōkopu giant*	
thrush		
tūī		

APPENDIX THREE

OUR COMMUNITY

A very big thank you to all the helpers and volunteers (both individuals and organisations) who throughout these ten years have devoted their time and energies to our various activities: Cape Pondweed eradication, Rishworth Reserve, Weed Busters and Weed Warriors, stream cleaning, maintenance and rubbish collection, citizen science, planting and other projects.

Early Committee

Merilyn Merrett Chair
(founding member)

Michael Ellis Deputy Chair
(founding member)

Paul Alcock
(founding member)

Brian Almand
(founding member)

Andrew Campbell Stokes

Vera Green-Bargiacchi
(founding member)

Ewan Lincoln

Fiona Lincoln

Jim Mikoz

Henry Steele
(founding member)

Grant Webby
(founding member)

Ros Wech
(founding member)

Alan White

Graham Woolf
(founding member)

With assistance from
Te Rira Puketapu

Other Committee members

Chrissie Burt
Roy Edney
Brendan Elks
Katie Elks
Erich Kusel
Josh van Lier
Karyn McLean
Andrew Reinders
Rachel Tallon
Rosemary Webby
Phillip Zhou

Plants provided courtesy of the following persons and organisations
Forest & Bird Nursery, Wellington
Greater Wellington Regional Council
Hutt City Council
Mainland Island Restoration Operation (MIRO)
Vivien Pohl
Barbara de Ste Croix
Henry Steele

SUPPORTING ORGANISATIONS

Whitebait Connection (now Mountains to Sea)
Liz Gibson
Sarah Kachwalla
Zoe Studd

Greater Wellington Regional Council
Alistair Allan
Graeme Campbell
Penny Fairbrother
Michael Greer
Ross Jackson
Mike Jensen
Prue Lamason
Grace Leung
Sheryl Miller
Travis Moody
Francie Morrow
Dame Fran Wilde

Hutt City Council
Campbell Barry
Lisa Bridson
Craig Cottrill
Andrew Foster
Riba Greally
Bruce Hodgins
Paul Jansen
Janet Lawson
Tui Lewis
Kristan Robinson
Bruce Sherlock
Ray Wallace

Wellington Water
Michelle Chew
Iqbal Idris
Diana Isaac
Sandro Lopez Fernandez
Jane Nichols

A thank you to our local MPs who have been very supportive
Ginny Andersen & Chris Bishop

Community groups

Aurecon
BNZ 'Closed for good'
Bunnings
Callaghan Innovation
Church of Latter Day Saints, Petone
Conservation Volunteers NZ
Corrections – Community service
Dulux NZ
Eastern Hutt Rotary
English Teaching College
Gracefield School
Hutt Intermediate School
IAG
Kelson School
Maanaki Trust
Naenae Primary School
Opus International Consultants
Our Lady of the Rosary School
St James Sea Scouts
St John Cadets
St. Paul's Church Group
Stantec
Te Ara Whanui
Transpower
Wā Ora Montessori School
Waiwhetū Pippins
Wellington Electricity
WorkZone Scaffolds

Franz Hubmann, at work demolishing a dead willow trunk. The contribution of such incredible volunteers is a testament to our whakataukī.

Ma tini ma mano ka rapa te whai

Many hands make light work

APPENDIX FOUR
TIMELINE OF FWS

The Waiwhetū Stream Working Group (WSWG) began in 2000. It was led by Les Roberts until 2010.

In 2008 the WSWG's vision for a stream corridor was instrumental in advocating for the decontamination of the streambed from industrial discharges.

PRE 2010

In tandem with development of a floodplain management plan by GWRC and HCC began to engage the community to take up guardianship of the stream.

Initial restoration work of the WSWG is complete and the focus changed.

2011

A public meeting held at Te Māori building on 30 June endorsed the formation of a community stream group to be named FWS.

A transitional committee was set up. This was eventually to become FWS. GWRC and HCC asked Dr Merilyn Merrett to chair it.

Derek Wilshire provides guidance on setting up the terms of reference for the group

28 November 2011, the inaugural FWS AGM

Two groups (OP & FWS) start removing Cape Pondweed from the stream.

Monthly stream corridor rubbish collection begins.

Planting began with 400 *Carex secta*

2012

Ewan Lincoln (Secretary) and Fiona Lincoln organised workshops for FWS to establish goals and objectives.

In July 2012, Rishworth Reserve urban forest restoration project begins. Planting has continued with over 7000 plants planted

2013

FWS secretary Andrew Campbell-Stokes produces a pictorial 'weeding, maintenance and structures plan', setting out action points for the future. These are updated in 2015 and 2016.

Alan White suggests regular 'coffee' meetings with GWRC, HCC and FWS. These collegial meetings helped form a holistic approach to stream management.

2014

Cape pondweed groups disband after removal of infested length of stream is achieved.

First picnic table (by St Ronans weir) installed.

Weed Busters is initiated and continues until 2016.

2015

In an effort to improve inanga upstream migration and naturalise the lower channel through Naenae Park, Craig Cottrill (HCC) supported a FWS initiative to begin trialling the removal of concrete berms.

2016

Channel naturalisation efforts in Naenae Park also include in-channel 'rock baffles' and plantings along the berm.

The number of plantings along the stream increases until this year, then tapers off.

The picnic table by St Ronans weir with mosaics by Rachel Silver are completed, as are the pink granite carvings at Bell Road.

2017

GWRC approach FWS to begin citizenship science projects.

Brendan Elks from Naenae Nature Trust contacts FWS and the two begin to work together.

Inanga spawning trial

2018

Naturalisation of concrete channel down from Rata Street, Naenae begins.

Citizen science (fish and macroinvertebrates surveys) activities initiated.

2019

Andrew Campbell-Stokes and Merilyn Merrett met with Mayor Ray Wallace to set out a further five-year plan for the stream.

Two-year weed mat trial begun.

Distance markers along the stream are installed.

Bird counts and pest control begins in Rishworth Reserve.

2020

Cape pondweed is declared eradicated from the stream

Small mammal monitoring and trapping begins at Rishworth Reserve.

Sculpture by Jason Dench is installed near Te Whiti Park.

2021

Weed Warriors begins after being postponed by COVID-19.


Wellington Community Trust
HUTT CITY
Wellington Airport
Regional Community Awards
2014
~ WINNER ~
Heritage &
Environment
Friends of
Waiwhetu
Stream


2021 HUTT CITY WELLINGTON AIRPORT
REGIONAL COMMUNITY AWARD
in recognition of the voluntary community service of
Friends of Waiwhetū Stream
Winner in the Heritage and Environment Category
Thank you for being a star in our community
Wellington Community Trust
HUTT CITY


2014 HUTT CITY WELLINGTON AIRPORT
REGIONAL COMMUNITY AWARD
in recognition of the voluntary community service of
Friends of Waiwhetu Stream
Winner in the Heritage & Environment Category
Thank you for being a star in our community
HUTT CITY

APPENDIX FIVE

AWARDS & NOMINATIONS

2012
Finalist in GWRC Encore Awards

2014
Awarded Hutt City Council and Wellington Airport Regional Community Award - in Heritage and Community Section

2015
Chairperson Merilyn Merrett awarded the Hutt City Council Civic Community Service Award

2019
Finalist in Keep New Zealand Beautiful Annual Award – in Community Group Award Section

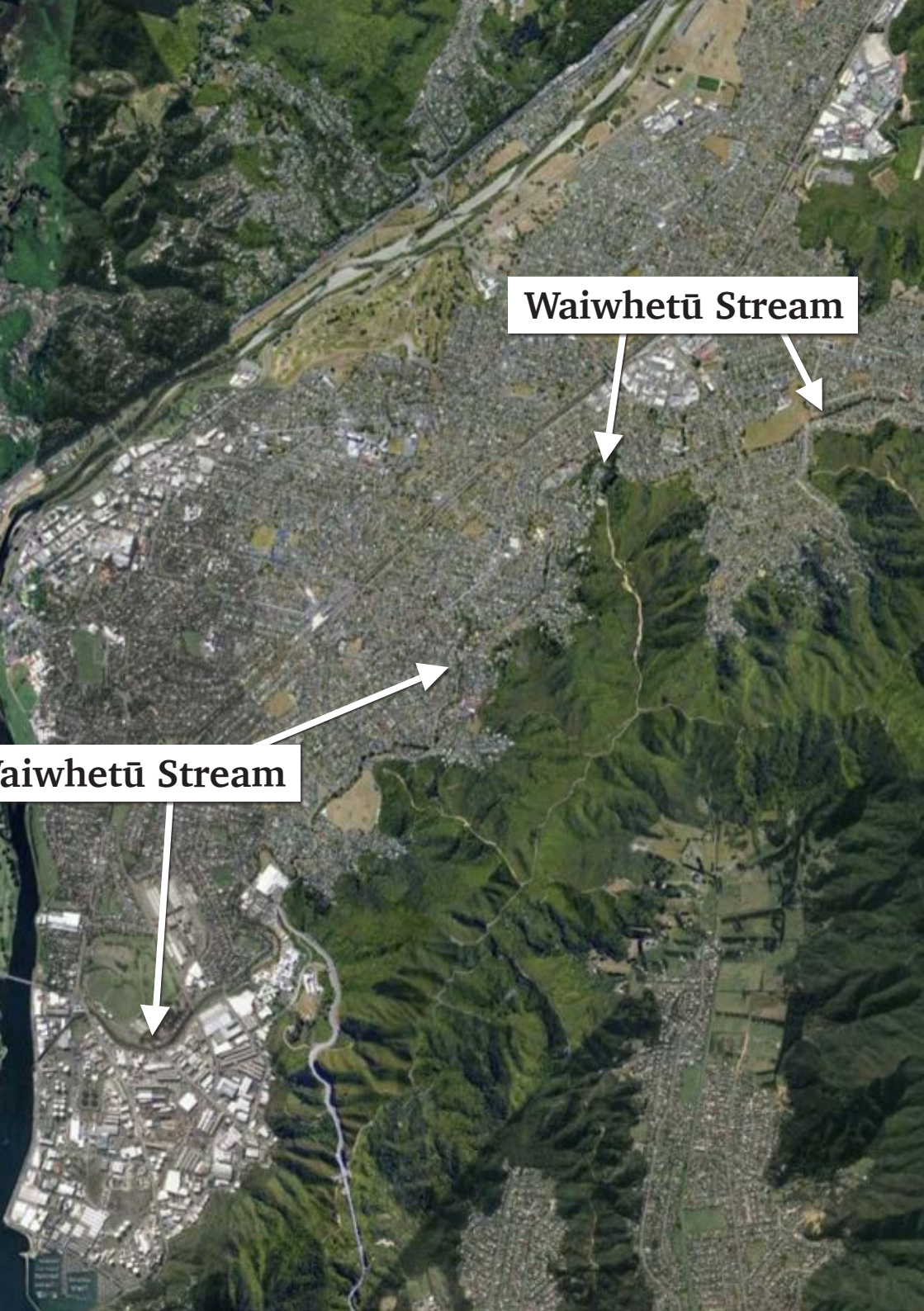
2020
Finalist in NZ Biosecurity Awards

2021
Awarded Hutt City Council Community Awards - in Heritage and Environment category. This qualified the group as a finalist in the Wellington Airport Regional Awards.

Email: friends.waiwhetu.stream@gmail.com

Website: www.waiwhetu-stream.org.nz

Friends of Waiwhetu


Waiwhetū Stream
aiwhetū Stream

Thanks also to sponsors who contributed towards the publication of this booklet:

FRIENDS OF WAIWHETŪ STREAM

Greater Wellington
Te Pane Matua Taiao

HUTT CITY
TE AWA KAIRANGI

NAENAE NATURE TRUST

CallaghanInnovation
Te Pokapū Auaha o Aotearoa

DAMWATCH
ENGINEERING BEYOND THE SURFACE