Title: Biodiversity of Te Awarua-o-Porirua Whaitua

Purpose: To introduce Te Awarua-o-Porirua Whaitua Committee to the biodiversity of the Whaitua and its current state, management, issues and trends.

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BIODIVERSITY OF TE AWARUA-O-PORIRUA WHAITUA

Contents

1. Introduction

Biodiversity is short for biological diversity, a term that is used to describe the variety of plant and animal species living within a habitat or ecosystem. This paper provides an introduction to the biodiversity of Te Awarua-o-Porirua Whaitua focusing on its wild indigenous components. More detailed explanations of each topic can be found by consulting the references in the text, all of which are hyperlinked for further reading in Section Six.

Section Two provides an overview of biodiversity in the Whaitua. It traces a brief ecological history of the Whaitua since the arrival of humans, describes its current components, and notes their connections to the management of water. It then provides a summary of some of the broad issues currently affecting biodiversity in the Whaitua and some of the steps that are being taken to address these.

Sections Three to Five explore the Whaitua's terrestrial, freshwater (including freshwater wetlands) and marine biodiversity (including saltwater wetlands), respectively. These sections each note some important sites and species, selected because they illustrate some of the wider values being managed and some of the activities used to protect them. These sections also identify a selection of relevant issues and trends for each environment.

This paper has three underlying messages. First, indigenous biodiversity has suffered substantial decline since the arrival of humans. Much of the original forest cover has been removed and the waterways have been degraded. Second, there remain many valued sites and species in the Whaitua. However, further developments (eg, new housing, roading), along with the effects of ongoing land uses, continue to affect these and other forms of biodiversity in the catchment. Third, a range of organisations, authorities, iwi and community groups are working to better understand, manage and restore biodiversity in the Whaitua.

2. Overview

2.1 Changes to the biodiversity of the Whaitua

Successive human influences on the Whaitua have led to a decline of biodiversity values and ecosystem health. Ngai Tara were the first human arrivals to the Whaitua (Bellingham, 1998). They initially settled near Paremata Point in the Pauatahanui arm of Te Awarua-o-Porirua Harbour around 600 years ago (Blaschke et al., 2010). At that time, the harbour was surrounded by tall, dense podocarp/broadleaf forest (see Appendix 1) with wetlands in low-lying areas and saltmarsh around the estuary margins. The estuary was largely sandy with clear waters supporting extensive seagrass and shellfish beds, and abundant fish and birdlife, including moa and kiwi (Stevens & Robertson, 2013).

The harbour and its surrounds provided abundant food for the first human inhabitants. They dug in the sands for tuangi (cockles) and pipi, trapped birds, hunted moa, netted whitebait, caught marine fish with baited lines, and cultivated kumara crops (Bellingham, 1998). Around 1600, Ngai Tara were displaced by Ngati Ira. Gradually the abundance of food sources began to diminish. Forests were cleared to allow for kumara cultivation, particularly on low east-facing slopes. Around a third of the native vegetation in the Pauatahanui was cleared for these purposes (Blaschke et al., 2010).

In the early 19th century Ngati Ira were displaced by Ngāti Toa and large-scale European settlement began soon after. Over the course of the next century most of the remaining native forests were burnt, most wetlands were drained, and the land was converted to pasture for farming (PCC, 2015). By the 1940s over 80% of the catchment was grassland. However, since then, the predominance of grassland has reduced. The extent of woody vegetation has increased to over 40% of the catchment, partly due to the planting of pine forests through the 1970s to 1990s, but also due to the retirement of farmland (Blaschke et al., 2010).

Clearance of forests and drainage of wetlands has greatly increased sedimentation rates to the harbour. This has led to a gradual shift from clear waters and clean sands to muddier substrates and more turbid (muddy) waters in the estuaries (Stevens & Robertson, 2013). Reclamation and other harbour edge modifications (eg, for roads, rail, and commercial development) have also resulted in a major loss of habitat for coastal and marine plants and wildlife (PCC, 2015). Many of the remaining shellfish beds have been contaminated by pollutants, and saltmarsh and seagrass beds have been lost. Saltmarsh habitat, for example, has been reduced by around 50% in the Pauatahanui Inlet and over 95% in the Onepoto Arm (Blaschke et al., 2010).

2.2 What biodiversity in the Whaitua looks like today

Today, much terrestrial habitat for biodiversity is provided by plantation forests, parks and gardens, and pasture grassland environments which collectively comprise around 70% of the Whaitua's land area. Around 15% of the Whaitua's pre-human native forests also remain, although they are altered in structure and mostly located in upland areas (see Appendix 2). Good examples of these forests are found in Battle Hill Bush Reserve, Karahena Bay Bush and Porirua Scenic Reserve. These environments are home to many common native forest birds along with a few rarer species such as rifleman, whitehead and falcon (Blaschke et al., 2009).

On the coast, an important red-billed gull breeding colony is located at Wairaka Point, a site that also provides breeding habitat for nationally endangered reef heron. Nearby Pukerua Bay has been listed as a significant coastal site for birds in the Wellington region, providing seasonal or core habitat for five threatened or at risk species (McArthur et al., 2015). Many coastal and forested areas in the Whaitua also provide habitat for lizards such as skinks and geckos, along with several unusual or rare plant species.

Red-billed gull (left) and Karahena Bay Bush (right).

There are approximately 276 kilometres of permanently flowing streams in the Whaitua, most of which flow into Te Awarua-o-Porirua Harbour. The largest streams are the Porirua, Pauatahanui and Horokiri. These environments provide habitat for a wide range of aquatic life including plants, invertebrates and fish. The Whaitua contains sixteen species of native freshwater fish alone, many of which are threatened or at risk (a full list of threatened species found in the Whaitua is included in Appendix 3).

There are ten natural freshwater wetlands remaining in the Whaitua. Most of these are under two hectares in size, but Taupo Swamp (36 hectares) is one of the largest wetlands in the Wellington region (see Section 3). It was formed by the uplift of an outlet of Te Awarua-o-Porirua Harbour during the 1855 earthquake and contains large areas of flaxland, with raupo and reedland also present.

In the marine environment, remaining areas of seagrass and saltmarsh are important features of the harbour. Seagrass provides important habitat for marine invertebrates and fish, while saltmarsh at Pautahanui Inlet is a nationally significant site for wetland and coastal birds (PCC, 2015). The estuary contains a rich invertebrate fauna and one of the largest concentrations of cockles in New Zealand.

Yellow-eyed mullet (left) and a juvenile rig shark (right) caught during a 2013 Te Awarua-o-Porirua Harbour fish survey.

Te Awarua-o-Porirua Harbour is an important environment for many fish species that require estuaries for all or part of their life stages. Forty-three species of fish were recorded from surveys of the harbour in 2013. The most common species were yellow-eyed mullet, kahawai, and spotties (Lyon et al., 2013). Importantly, the harbour provides a nursery ground for juvenile rig sharks, the delicious basis of our much-loved fish and chip industry! (See story Appendix 4). We also know that a range of whale and dolphin species live or traverse along the west coast directly offshore from the Whaitua (Berkenbusch et al., 2013).

2.3 Connections to the management of water

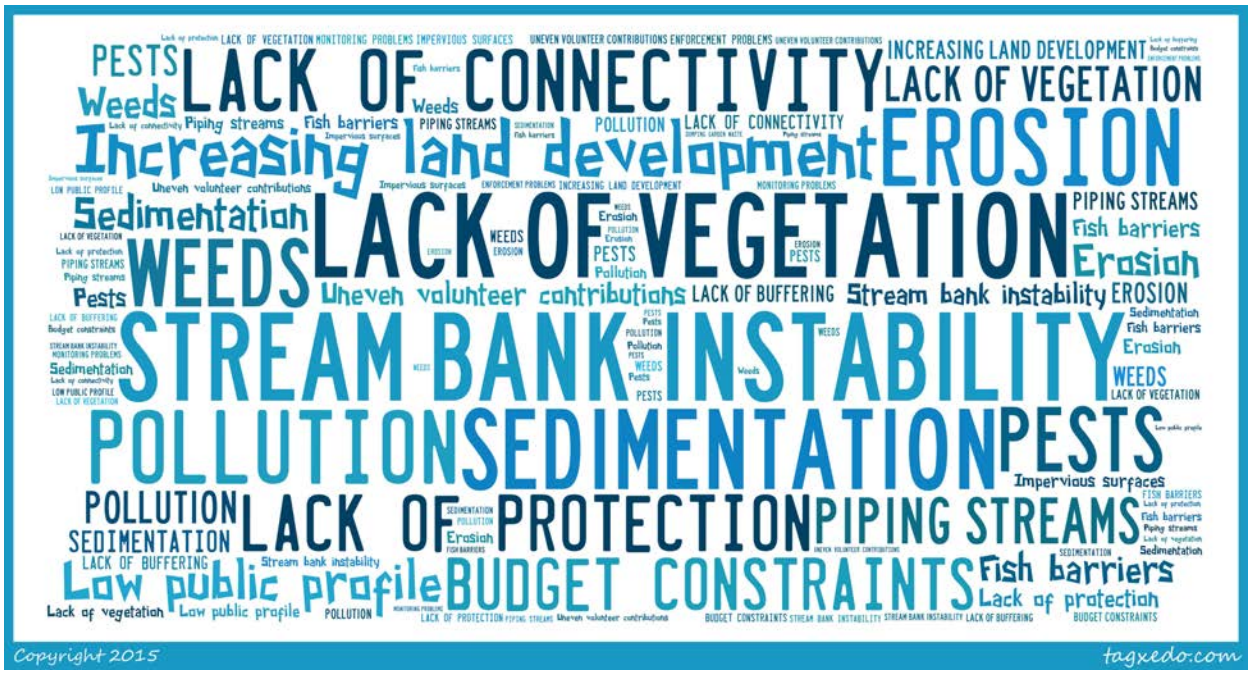
The management of biodiversity values is connected to the management of water quality and quantity in the Whaitua. Generally, healthy waterways support healthy biodiversity, just as healthy biodiversity supports healthy waterways. It is important to note, however, that many of the ecological functions provided by clean waterways do not require native species and some native species do not require especially healthy waterways (eg, native eels which often survive in quite polluted waterways). This should not be taken as a reason to de-emphasise the importance of native biodiversity. It is simply to note that many of the ecosystem services provided by biodiversity are not unique to local native biota and can often be performed by introduced species (see McAlpine & Wotton, 2009).

The table below provides some examples of the ways biodiversity supports healthy waterways (left column) and how better management of waterways can improve the health of biodiversity (right column).

How biodiversity assists healthy waterways	How waterways can better assist biodiversity
Wetlands and riparian vegetation help filter sediment, nutrients and pollutants entering waterways	Limiting water extraction ensures that stream and wetland habitats do not dry out over summer months
Vegetation helps to stabilise soil and prevent erosion into waterways. Birds disperse seeds across the catchment, helping to increase the cover of vegetation	Limiting chemical and nutrient inputs to waterways limits negative effects on aquatic life
Many aquatic species 'clean' waterways by filtering fine organic particles from the water column for consumption	Limiting the extent of impervious surfaces means that water is able to soak into the ground (rather than draining directly to waterways) and recharge stream habitats
Wetlands regulate water flows by trapping water volume during peak flows	Removal of artificial stream linings and barriers support the passage of fish upstream and extends the range of potential spawning sites

2.4 Overview of current issues

There are a wide range of issues affecting biodiversity in the Whaitua. These are explored in more detail in the follow sections. The most significant problems relate to losses of habitat, reductions in water quality, and changes in hydrology. Below is a 'word cloud' depicting a selection of other current issues (adapted from Blaschke et al., 2009).



2.5 What is being done about it?

A range of organisations, authorities, iwi and community groups contribute to biodiversity management and restoration in the Whaitua. This includes the Department of Conservation (DOC) which is guided by its Conservation Management Strategy for the region, incorporating notable sites such as Pauatahanui Inlet and Colonial Knob Scenic Reserve (see DOC, 1996). Local government contributions are provided by Greater Wellington Regional Council (GWRC), Porirua City Council (PCC) and Wellington City Council (WCC). The activities of these authorities are primarily guided by the Regional Policy Statement, regional and district plans, and Te Awarua-o-Porirua Harbour and Catchment Strategy and Action Plan (see PCC, 2015), of which all councils are key stakeholders alongside Ngāti Toa.

In addition to this restoration and enhancement work, several groups are undertaking ongoing monitoring work. GWRC, for instance, monitors the harbour, streams and several terrestrial sites within the Whaitua to improve our understanding of the existing ecological health and trends of the area. Recent work includes broad-scale habitat mapping, investigations of sediment quality, identification of whitebait spawning grounds, and other freshwater fish surveys.

3. Terrestrial biodiversity

3.1 Important sites and species

Colonial Knob Scenic Reserve and adjacent **Porirua Scenic Reserve** protect some of the most significant areas of native forest in the Whaitua. The reserves comprise a mosaic of modified primary podocarp-broadleaf forest, mature semi-coastal forest and some pastureland. The ridgetop vegetation contains a cloud forest community (DOC, 1996). A threatened gecko species as well as other plant and animal species uncommon in the Wellington region have been recorded here. The reserves are managed collaboratively by PCC, DOC, and GWRC who control a range of pest animals and weeds. Since pests have been controlled in the reserves, yellow-crowned kakariki numbers have increased significantly and are now a regular sight in the area. In addition, birds from surrounding protected areas are naturally re-colonising, particularly from reserves on Kapiti and Mana Islands and from the Zealandia sanctuary. These include species such as kaka, re-crowned kakariki and bellbird.


Tui (left) and native and exotic forest at Battle Hill Farm Forest Park (right).

Battle Hill Farm Forest Park is a Regional Park managed by GWRC. A small but significant remnant of the pre-human forest in this area remains in the park supporting a forest containing typical Wellington forest species such as titoki, tawa, and kohekohe alongside swamp-loving kahikatea, pukatea and swamp maire. Around half of the park is planted in pines, with much of the remainder in pasture. GWRC is working with school groups and the local community to restore two large wetland areas and plant along stream banks. This will help provide habitat for wildlife and improve the water quality in the Horokiri Stream and the Pauatahanui Inlet. Other native plantings and ongoing pest control have improved habitats for a wide range of birds on the property from tui, fantails and kereru (forest-loving species) to mallards and paradise shelducks (grassland-loving species). Each winter the park hosts a series of Arbour Days where individuals and groups are encouraged to plant and care for trees in the park. Schools in the local area usually volunteer their time for these days.

Whitireia Park (left) and planted shore spurge (right).

Another Regional Park, **Whitireia**, overlooks the northern Onepoto arm of the harbour. Although the park is mostly pasture grassland, it also contains two hectares of remnant coastal kohekohe forest. This forest has two rare tree species (large leaved milk trees) which are being supplemented by planted ones. Te Onepoto Bay in the park provides good habitat for many water birds and the estuary provides a rich feeding ground. Common bird species here include kingfisher, white-faced heron, and shag species. Alongside GWRC, a local community group (Whitireia Park Restoration Group) is helping to restore a range of habitats in the park. This work includes restoring lizard habitat on the north-west escarpments and planting dunes at Onehunga Bay and Kaiaua Bay with native plant species such as spinifex and pingao and threatened species such as shore spurge, sand daphne, and native iris. These species provide habitat for native insects and lizards, maintain the structure of the dunes, and help restore elements of the park's past ecosystem.

3.2 Current issues and trends

- **Pest control is having a positive effect in some areas.** The increase in pest animal control over recent years in reserves throughout the Whaitua has led to an increase in the number and diversity of native forest birds. Weed control measures have also reduced competition with native plants at some sites (Blaschke et al., 2009).

- **Some native forests are being legally protected as public reserves or as open space covenants through the Queen Elizabeth II National Trust.** Small remnant areas of native forest are scattered throughout the catchment, mainly at the edges and on private land. However, there remain areas of native forest and other habitats without sufficient protection (Blaschke et al., 2009).

- **Ongoing land development in the Whaitua is leading to the clearance of further forest and shrubland communities**. The impacts of this development on terrestrial biodiversity need to be carefully managed.

- **The majority of the significant terrestrial ecological sites identified in the Whaitua are under two hectares in size**. The small size of these remnants means that they are vulnerable to pest and weed incursions, and other threats, and conservation activities are required to maintain their native biodiversity values (Boffa Miskell, 2001).

4. Freshwater biodiversity

4.1 Important sites and species

Taupo Stream, **Kakaho Stream**, **Horokiri Stream**, **Pauatahanui Stream**, **Porirua Stream** and **Duck Creek** all have high native fish diversity due to their good connection with the harbour and coast. These streams and their tributaries are all listed in the Proposed Natural Resources Plan (the regional plan) as watercourses with significant indigenous biodiversity values, providing habitat for threatened native fish species, six or more migratory fish species, and inanga spawning habitat. The Horokiri Stream, for example, is home to fourteen native fish species (two threatened and six at risk), including inanga which is the most common of the whitebait fishery species as well as introduced brown trout which is valued as a sports fish. There are a number of pressures on these streams that affect the size and health of fish populations. These pressures include channelisation of the stream bed, high water temperatures and erosion due to a lack of riparian vegetation cover, high levels of suspended sediment, chemical pollution and nutrients from adjacent land uses, and barriers to fish passage caused by various structures (eg, weirs, perched culverts) in the stream bed (Blaschke et al., 2009).

Lower reach of Porirua Stream (left) and inanga (right).

Kenepuru Stream drains the largest of the seven catchments emptying into Porirua Stream. Seven kilometres of this stream run through Bothamley Park which, at 107 hectares in area, will soon become Porirua City's second largest reserve. The stream itself is highly modified and has suffered incremental losses of biodiversity and natural character. This has been recognised by local residents who have voiced their concerns at the state of the waterway. Historically, the stream has suffered from a range of issues, such as a lack of community engagement, erosion and sedimentation problems, ongoing pollution, barriers to fish passage, a lack of streamside vegetation, and the presence of riparian weeds. Recent restoration activities by PCC, GWRC, and the local community are beginning to improve the state and resilience of the waterway (see Forsyth & Todd, 2012).

Perched culvert emptying into Kenepuru Stream (left) and Taupo swamp flaxland (right).

Taupo swamp (Ara harakeke) is one of the few remaining large wetlands in the Wellington region. Rising to 20 metres above sea level at its north end, the 30 hectare swamp is home to a number of threatened plant species and provides habitat for many species of native fish such as longfin eel and banded kokopu. Most of its southern end has been drained and developed for industrial use and playing fields. However, the remaining northern extent of swamp is owned and protected by the Queen Elizabeth II National Trust (Blaschke et al., 2010). Threats to the swamp are managed by PCC and GWRC. These threats include the downstream impacts of surrounding development (eg, sedimentation, hydrological changes), weed incursions, fire, and chemical pollution from the adjacent highway.

4.2 Current issues and trends

- **Populations of native fish species in the Whaitua face a number of different pressures**. These include changes in habitat such as channelisation and sedimentation, inputs of contaminants such as nutrients and chemicals, drainage of wetlands, obstructions to fish passage (eg, perched culverts), competition or predation from introduced species, and commercial and recreational harvest of some species (eg, whitebait, eels) (Blaschke et al., 2009).

- **Invertebrate community health is poor in some streams in the Whaitua – in particular those with highly urbanised catchments such as the Porirua Stream** (see map Appendix 6). Around 110 different types of aquatic invertebrates (eg, insects, snails and worms) have been recorded in streams in the Whaitua. The types of invertebrates found in a stream are a useful indicator of overall stream health as different species have different tolerances to contaminants (eg, sediment and chemicals) and changes in stream habitat (eg, channel straightening, lack of riparian vegetation).

- **Stream banks and unstable soils need more vegetation cover.** Cover helps to prevent sedimentation of waterways (see story Appendix 7) and provide shade which reduces the likelihood of algal blooms (Biggs, 2000). This is recognised as a priority management action in Te Awarua-o-Porirua Harbour and Catchment Strategy and Action Plan. As identified in Section One of this paper, various initiatives are currently underway to re-vegetate streambanks and erodible land.

- Headwater streams have been lost to piping and land reclamation. Urban development has been the main driver of this habitat loss. Headwater streams are generally small and can be dry at some times of the year, but they perform many vital ecological functions including slowing flood flows, storing nutrients and contaminants, and providing habitat for fish and invertebrates (Storey, 2010). About 4.7 kilometres of streams were lost into pipes in the Whaitua over 2003-2008 alone (Blaschke et al., 2009).

5. Marine biodiversity

5.1 Important sites and species

Porirua Harbour is the only estuary in the lower North Island with significant **seagrass** beds. Seagrass provides important habitat for a range of marine and coastal wildlife. Unfortunately, recent research suggests that around 40% of the harbour's seagrass beds have been lost since the 1960s. Decline in the area of seagrass over the last century is mainly attributed to excessive sediment inputs which smother the plants and reduce water clarity. The loss of seagrass may also be related to elevated water column nitrate which has been recorded at concentrations which are toxic to seagrass. The replacement of seagrass beds with sea lettuce and bare muddy substrates leads to a decrease in the diversity of the harbour as fewer organisms can tolerate the changed conditions. Seagrass restoration is a management action identified in Te Awarua-o-Porirua Whaitua Strategy and Action Plan. However, this is a difficult task requiring suitable growing conditions to be re-established and the precise causes of the original losses to be identified (Matheson & Wadhwa, 2012).

Pauatahanui Wildlife Reserve (left) and royal spoonbill (right).

The **Pauatahanui Inlet** contains the most significant saltmarsh in the lower North Island and is ranked second for conservation importance in the Wellington region (Michaels & Wells, 2014). The inlet contains many resident and migratory native birds and a succession of native vegetation communities from tidal mudflats to coastal forest (DOC & Forest & Bird, n.d.). Over half of the wetland bird species recorded in the inlet have conservation threat rankings of threatened or at risk. Several areas of the inlet are protected as reserves, including the Pautahanui Wildlife Reserve (43 hectares), Duck Creek Scenic Reserve (one hectare), and Horokiri Wildlife Management Reserve (five hectares). The Pauatahanui Wildlife Reserve is a good example of collaborative biodiversity management by multiple stakeholders. The reserve is owned jointly by the Forest and Bird Protection Society and DOC, with part of the reserve covenanted to the Queen Elizabeth II National Trust. The reserve is managed by Forest and Bird and DOC with support from GWRC.

Cockles (left) and community volunteers alongside GWRC staff surveying cockles (right).

The Guardians of Pauatahanui Inlet and community volunteers have carried out eight three-yearly surveys of **cockles** in the intertidal zone of Pauatahanui Inlet since 1992. These surveys provide important information about the abundance and size structure of cockle populations. The health of cockle populations might also be used as an indicator of broader environmental health in the inlet. The 2013 survey found that the cockle population had increased from 277 million in 2010 to 336 million. Cockle numbers were increasing at most of the ten sites surveyed (Michaels & Wells, 2014).

5.2 Current issues and trends

- **Invertebrate and fish communities living within the harbour are moderately diverse**. Following successive sediment quality surveys, the invertebrate communities in the Pauatahanui Arm appear to be in better overall health as a result of better sediment quality, than in the Onepoto Arm of the harbour (Oliver & Conwell 2014). Populations of many fish species are also more abundant in the Pauatahanui than the Onepoto Arm (Lyon et al., 2013).

- **Although only a small area of the pre-human saltmarsh cover remains in the harbour, saltmarsh cover has not changed significantly since 2008.** In many areas of the harbour, saltmarsh is absent or restricted to narrow bands which greatly limit their role in buffering the estuary from sediment and nutrient inputs. Most of the estuary margin has been modified and bounded by artificial structures (eg, riprap seawalls, roads) with the terrestrial land cover dominated by grassland and residential and commercial development. However, several areas of saltmarsh are now benefiting from council- and community-lead restoration initiatives (Stevens & Robertson, 2013).

- **Historical declines and continued losses of some rooted vegetation (eg, seagrass) are an ongoing issue.** Estuaries function best with large areas of rooted vegetation as well as healthy vegetation on their margins. Loss of this habitat reduces ecological, fishery and aesthetic values, and adversely impacts on an estuary's role in flood and erosion protection, contaminant mitigation, sediment stabilisation and nutrient cycling (Stevens & Robertson 2013).

- **The number of coastal birds using the Pauatahanui Inlet has declined over the last 30 years.** Surveys carried out by the Ornithological Society of New Zealand over this period show that the total number of birds using the inlet has declined by about 50%. While most of this decline is due

to a large reduction in the numbers of common species (eg, black-backed gulls), the numbers of some regionally and nationally threatened species have also declined. This includes familiar species such as shags (80-85% population decline) and red-billed gulls (70% decline). Reasons for declines in some species are as yet unclear and it should be noted that other species, such as royal spoonbill and banded dotterel, have increased their populations over the same period.

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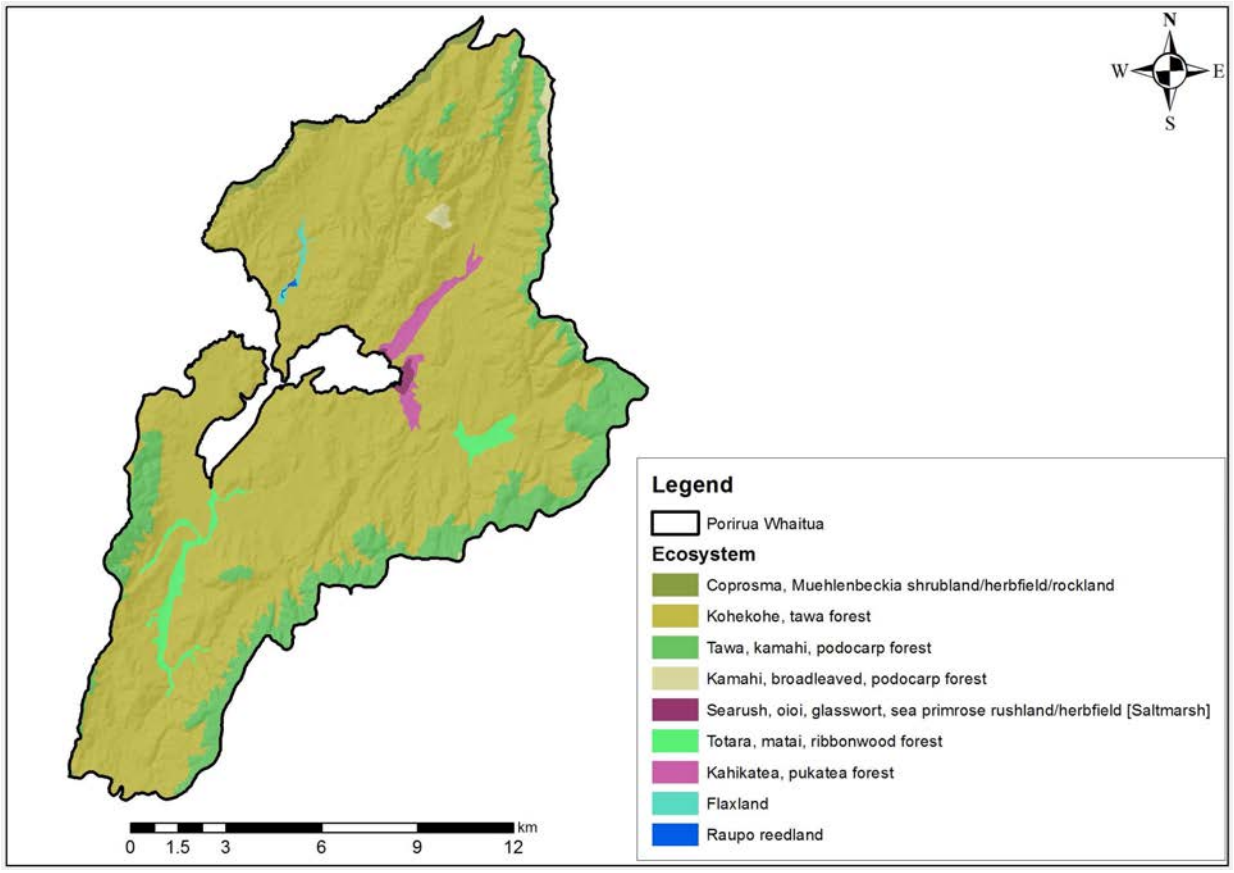
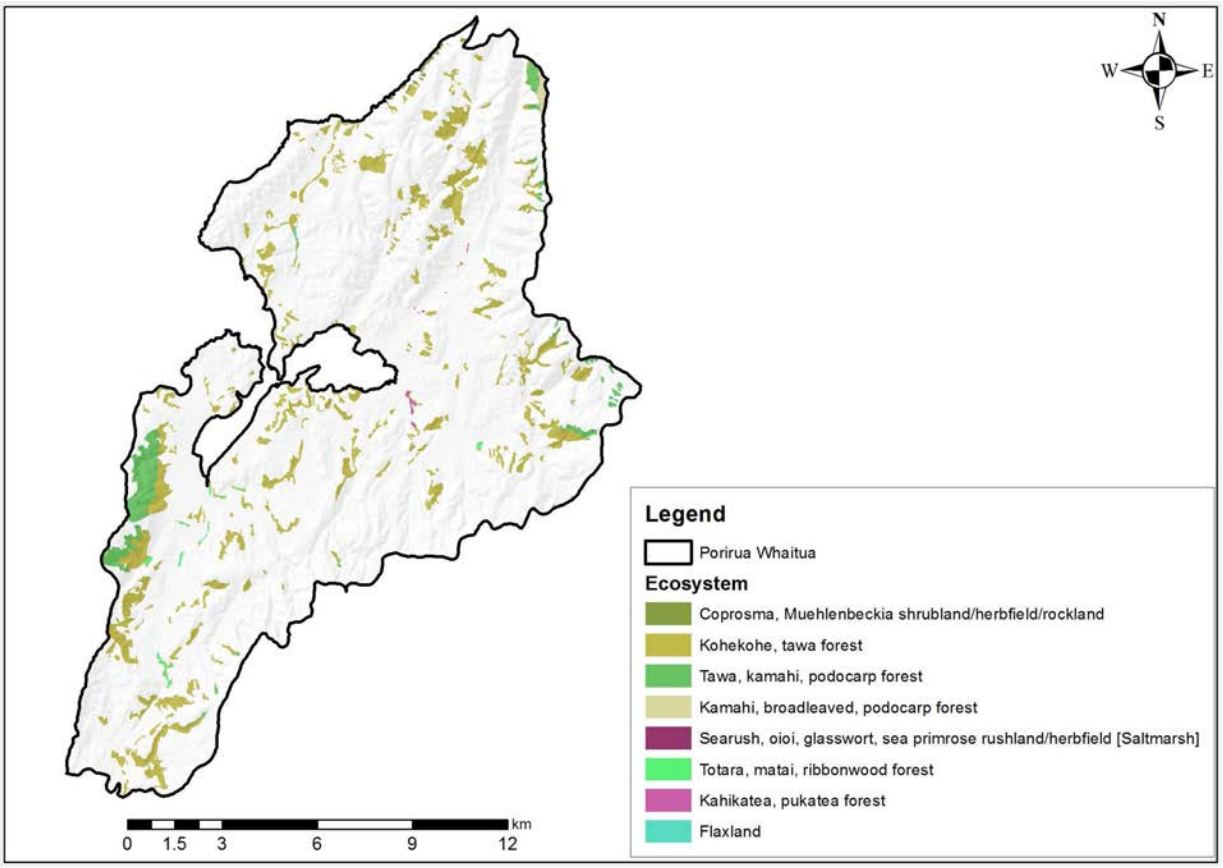
Appendices

Appendix 1: Pre-human terrestrial vegetation of the Whaitua (Source: Crisp & Singers, 2015, unpublished data).



Appendix 2: Remnant native terrestrial vegetation of the Whaitua (Source: Crisp & Singers, 2015, unpublished data).



Appendix 3: Nationally threatened species in the Whaitua (Source: DOC national threat classification lists).

Common Name	Scientific Name	Conservation Status
Birds		
White heron	*Ardea modesta*	Threatened: Nationally Critical
New Zealand shore plover	*Thinornis novaeseelandiae*	Threatened: Nationally Critical
Black-billed gull	*Larus bulleri*	Threatened: Nationally Critical
Black-fronted tern	*Chlidonias albostriatus*	Threatened: Nationally Endangered
Reef heron	*Egretta sacra sacra*	Threatened: Nationally Endangered
Wrybill	*Anarhynchus frontalis*	Threatened: Nationally Vulnerable
Bush falcon	*Falco novaeseelandiae* "bush"	Threatened: Nationally Vulnerable
Caspian tern	*Hydroprogne caspia*	Threatened: Nationally Vulnerable
Pied shag	*Phalacrocorax varius varius*	Threatened: Nationally Vulnerable
Banded dotterel	*Charadrius bicinctus bicinctus*	Threatened: Nationally Vulnerable
New Zealand dabchick	*Poliocephalus rufopectus*	Threatened: Nationally Vulnerable
Red-billed gull	*Larus novaehollandiae scopulinus*	Threatened: Nationally Vulnerable
North Island kaka	*Nestor meridionalis septentrionalis*	Threatened: Nationally Vulnerable
New Zealand pied oystercatcher	*Haematopus finschi*	At Risk: Declining
Eastern bar-tailed godwit	*Limosa lapponica baueri*	At Risk: Declining
New Zealand pipit	*Anthus novaeseelandiae novaeseelandiae*	At Risk: Declining
White-fronted tern	*Sterna striata striata*	At Risk: Declining
Pied stilt	*Himantopus himantopus leucocephalus*	At Risk: Declining
Rifleman	*Acanthisitta chloris*	At Risk: Declining
Little penguin	*Eudyptula minor*	At Risk: Declining
Little black shag	*Phalacrocorax sulcirostris*	At Risk: Naturally Uncommon
Royal spoonbill	*Platalea regia*	At Risk: Naturally Uncommon
Black shag	*Phalacrocorax carbo novaehollandiae*	At Risk: Naturally Uncommon
Long-tailed cuckoo	*Eudynamys taitensis*	At Risk: Naturally Uncommon
Variable oystercatcher	*Haematopus unicolor*	At Risk: Recovering
Red-crowned parakeet	*Cyanoramphus novaezelandiae*	At Risk: Relict
Spotless crake	*Porzana tabuensis*	At Risk: Relict
Plants		
Pygmy button daisy	*Leptinella nana*	Threatened: Nationally Critical
	Crassula peduncularis	Threatened: Nationally Critical
New Zealand carrot	*Daucus glochidiatus*	Threatened: Nationally Vulnerable
Thick-leaved mahoe	*Melicytus crassifolius*	At Risk: Declining
Poroporo	*Solanum aviculare var. aviculare*	At Risk: Declining
Puha	*Sonchus kirkii*	At Risk: Declining
Rawiritoa	*Kunzea amathicola*	At Risk: Declining
Swamp nettle	*Urtica linearifolia*	At Risk: Declining
Shrimp-flowered greenhood	*Pterostylis porrecta*	At Risk: Naturally Uncommon
Grassland greenhood	*Pterostylis foliata*	At Risk: Naturally Uncommon
	Melicytus obovatus	At Risk: Naturally Uncommon
Native musk	*Thyridia repens*	At Risk: Naturally Uncommon
Sun orchid	*Thelymitra formosa*	At Risk: Naturally Uncommon
Large-leaved milk tree	*Streblus banksii*	At Risk: Relict
Lizards		
Whitaker's skink	*Oligosoma whitakeri*	Threatened: Nationally Endangered
Brown skink	*Oligosoma zelandicum*	At Risk: Declining
Southern North Island forest	*Mokopirirakau* "southern North Island"	At Risk: Declining
Wellington green gecko	*Naultinus punctatus*	At Risk: Declining
Fish		
Shortjaw kokopu	*Galaxias postvectis*	Threatened: Nationally Vulnerable
Lamprey	*Geotria australis*	Threatened: Nationally Vulnerable
Longfin eel	*Anguilla dieffenbachii*	At Risk: Declining
Torrentfish	*Cheimarrichthys fosteri*	At Risk: Declining
Koaro	*Galaxias brevipinnis*	At Risk: Declining
Inanga	*Galaxias maculatus*	At Risk: Declining
Redfin bully	*Gobiomorphus huttoni*	At Risk: Declining
Giant kokopu	*Galaxias argenteus*	At Risk: Declining

Appendix 4: Article in the Kapi Mana News, 22 May 2013.

Breeding ground: Porirua harbour is a vital place for lemonfish to breed. Photo courtesy of NIWA.

And would you like poisons with that?

By JO FAGAN
Biodiversity adviser, Greater Wellington Regional Council

You might not realise it, but if you live between Pukerua Bay and Johnsonville, then you are in the Porirua Harbour catchment. This means that your local streams empty into Porirua Harbour and what you do at your place can often affect the creatures that live there, and people that play there or eat food from there.

Did you know that Porirua Harbour is the most important rig (lemonfish) breeding ground for the entire lower North Island? It's also incredibly important for birdlife, with over half of the wetland bird species recorded in Pauatahanui nationally threatened or "at risk" species. It's also fantastic for boating, kayaking, walking, fishing, playing, photographing and just enjoying.

We all love our harbour, but we haven't been taking good care of it, allowing too much dirt and pollution to get into it, and it is now in trouble. Together, we can save it for our children and their children to enjoy as much as we do.

We will regularly be explaining why your streams and harbour are so special. We'll be talking about the fantastic things people in your community are doing to help keep these important waterways healthy, and what you can do at your place.

Creature feature

When you get a big feed of fish and chips, you're more than likely eating rig, otherwise known as lemonfish, spotted dogfish or sand shark.

Rig mainly feed on animals that burrow in the sea floor, especially crabs. Chemical pollution coming down streams gets stuck to the muddy sand on the sea floor, and burrowing creatures eat it. These poisons then pass into the fish, and into us when we eat them. Over the next year we'll be talking about things we can all do to keep chemical pollution out of the harbour, and out of our fish and chips. It's not too late – we can still save our harbour.

How you can help your stream and harbour

Tip any leftover chemicals like cleaners down the sink; never wash them into roadside gutters which drain into streams and the harbour.

Harbour heroes

Jeff Chapman is a teacher at Aotea College who lives in Titahi Bay.

He does all he can to make sure his family doesn't pollute their local stream and harbour.

To keep chemicals out of our fish and chips he doesn't use cleaning products to clean his house or driveway. And he doesn't wash his car at home because he doesn't want the soapy water loaded with poisons from the exhaust residue to wash down the roadside gutter and into his local stream. Jeff is a harbour hero and you can be too.

▮ If you have any questions or comments about this column, email GWRC at: Porirua.Harbour@gw.govt.nz.

Appendix 5: Article in the Kapi Mana News, 25 June 2013.

Join in the planting to help our streams and harbour

Greater Wellington Regional Council have a number of planting days coming up and extra hands are always welcome, so make a note of when the one nearest you takes place.

Native plants stabilise the soil and keep the stream and harbour water clean and healthy for us to use and play in.

Over the past 150 years people have removed a lot of native plants from the Porirua catchment, destroying the food and homes of some of our most precious native animals. Now the complex system of different plants and animals that keep our streams and harbour healthy is out of balance.

Planting days:

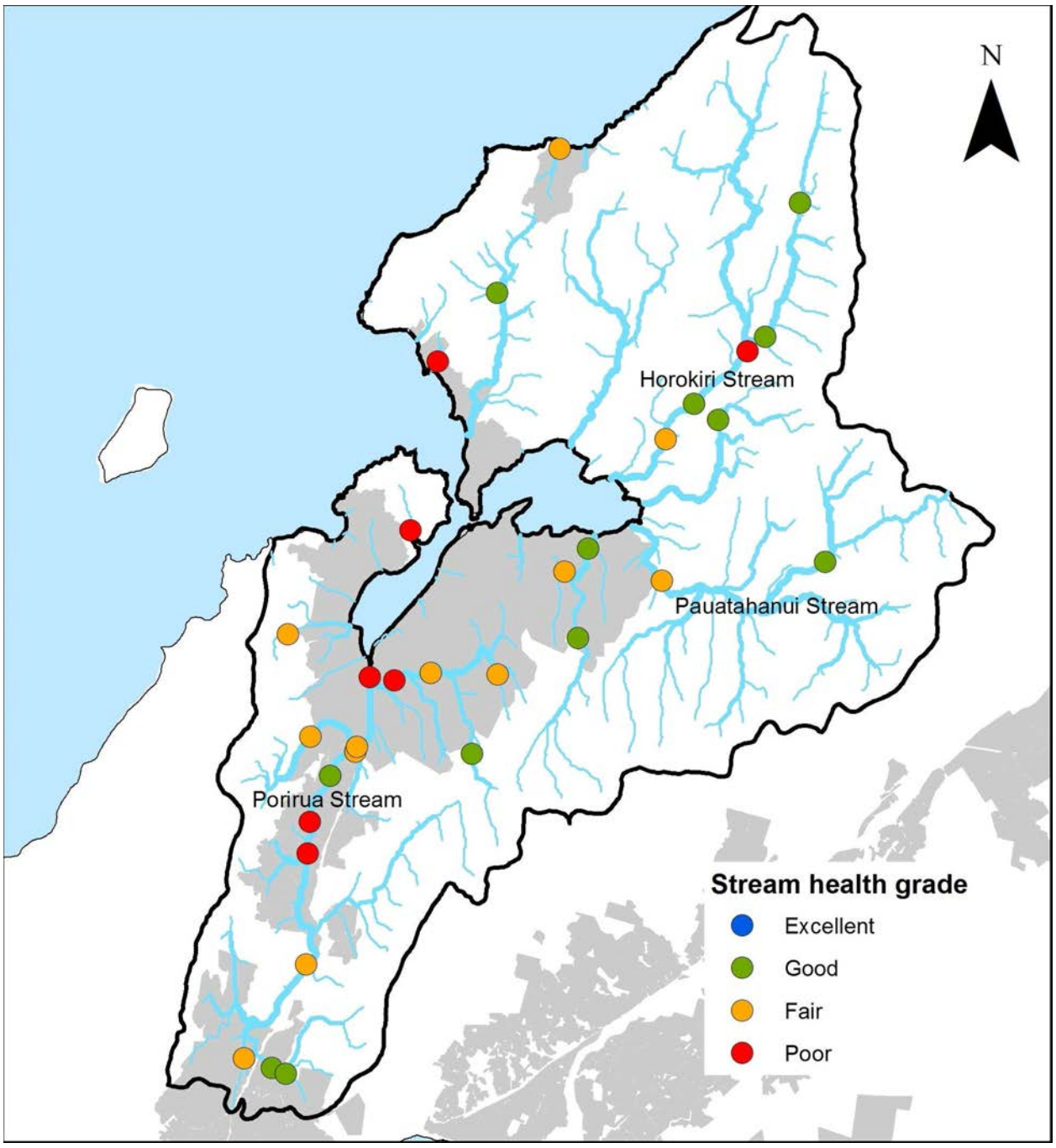
Forest & Bird working bee, Pauatahanui Wildlife Reserve, entrance through Paremata Rd car park, June 30, 10am to noon, free barbecue at the end.

Whitireia Park Restoration Group planting day, eight minutes walk east of Onehunga Bay, July 14, 10am to 1pm, back up day July 21, if wet. If unsure about the weather, contact Chris Gibbons on 027 264 0871.

Don't forget to bring gloves and spades if you have them and warm, rainproof clothes if it's wet.

Getting into it: Julianna Jaquiery at a recent Whitireia Park working bee. **Photo: SUPPLIED**

Appendix 6: Stream ecosystem health in the Whaitua based on invertebrate community composition (Source: GWRC unpublished data).



Appendix 7: Article in the Kapi Mana News, 27 August 2013.

Why soil needs to be cherished

Let's make sure we look after our plants and wild life

By JO FAGAN
Wellington Regional Council

The biggest threat to Porirua Harbour is soil washing off land into streams that empty into the harbour.

Soil is valuable. We need it to grow food. It takes about 10,000 years to form and one big rain to wash away if it is left bare.

The easiest way to keep your soil at your place is to plant into it.

We want to help you use native plants to make your garden and back yard even more beautiful.

By planting native plants you can attract fascinating native animals, such as birds, lizards and butterflies, and keep your valuable soil on your land, where it belongs.

Lizards love messy, untidy gardeners. They need to hide from predators like rats, cats and hedgehogs, so they like plants close together.

Good plants for lizards are native ferns, tussock grasses and sedges, New Zealand daphne, flaxes and astelias.

Muehlenbeckias and divaricating coprosmas attract birds, lizards and native copper butterflies and are currently very popular for adding texture to gardens.

Sun-seeker: Common skinks can be found throughout the Kapi-Mana area, often in your garden.
Photo: RICHARD ROMIJN

Good plants to make your garden a feast for nectar-feeding birds and lizards include rata species, manuka and koromiko.

Fruit eaters prefer coprosmas, iconic nikau palms and kawakawa, also known as the New Zealand pepper tree.

Kawakawa leaves make a refreshing peppery tea and the ripe fruit tastes like papaya with peppery seeds. You can even burn dried leaves as an insect repellent.

Check out doc.govt.nz for more garden plants that provide food for native creatures all year round.

One of the lizards most likely found in your garden is the common skink. They love to lie in the sun, so look for them on sunny days. Common skinks range in colour from striped brown in grass to dark colours on the coast.

Lizards are an important part of our native ecosystems, so when you keep them safe in your garden, you're helping to repair the complex system of plants and animals that keep our streams and harbour healthy.

Students at Pukerua Bay School have created a skink garden at school. They provided flat sunny spots for the lizards to lie in and lots of safe hiding places.

Teacher Andrew Wooster said the skink garden helped his students enjoy and understand nature and sustainability.

Check out our website for previous articles about Porirua Harbour, gw.govt.nz/porirua.

Jo Fagan represents Porirua Harbour Strategy Group.