CULTURAL VALUES, FLOW & WATER MANAGEMENT ISSUES

FOR THE

WAIKIRIKIRI / SELWYN - TE WAIHORA CATCHMENTS

Using data collected by the
Taumutu / Tuahuriri COMAR Team &
Horomaka COMAR Team

Prepared by Tipa & Associates
February 2013

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TE WAIHORA BOARD, THE KAITIAKI RUNANGA, OR TE RUNANGA O NGAI TAHU

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PART ONE – BACKGROUND

1.1 Introduction

The story of Te Waihora begins with the arrival of Waitaha and Ngai Tahu oral traditions that tell of Räkaihautü, who beached his waka at Whakatü (Nelson) and divided the new arrivals in two, with his son Te Rakihouia taking one party to explore the east coastline and Räkaihautü taking another southwards by an inland route over the Southern Alps/Kä Tiritiri o te Moana. Te Rakihouia discovered the coastal lake (now Te Waihora) on his coastal journey south claiming the abundant resources of the area for his fathers. Hence the lake being named Te Kete Ika a Räkaihautü the fish basket of Räkaihautü.

For Ngai Tahu, Te Waihora has thus always been a highly valued food source, as first evidenced by its name Te Kete Ika a Rakaihautu. Historically, the lake and surrounding areas were renowned for its abundance of fish, waterfowl, plants (including medicinal plants), and special muds used for dyeing (Palmer and Goodall 1989: 14). Kaitorete Spit is also important and historically was a thoroughfare from Banks Peninsula to the south. Many camp sites and urupa (burial site) found along the spit (Tau et al. 1990: 5–48) are testament to the history of use and occupation. The area is also of national importance as the site of the largest pingao plantation in the country (Waitangi Tribunal 1991: 155).

Generations later, when Ngati Mamoe arrived from Te Ika a Maui (the North Island), settling among the Waitaha a prominent man of this tribe Tutekawa, established his home at Waikäkahi (Birdlings Flat), and pronounced Te Waihora as his own hence the lake's second name, Te Kete Ika a Tutekawa - the fish basket of Tutekawa.

When Ngai Tahu came south they proclaimed Orariki, Taumutu their home and thus the resources of the lake as their own.

The site of Orariki pä is the Hone Wetere Church at Taumutu and its associated urupa. Kaikanohi, a fishing camp and settlement on Kaitorete Spit provided a place to reside when travelling down the Spit if the lake was open. Evidence of tool making, pounamu working and bird and fish preservation have been found at the site, which is now subject to erosion. Te Pä o Moki, was established as an outpost for the son of Te Ruahikihiki and the current whare, Ngati Moki, was built on native reserve at Taumutu as a runanga hall in 1893. The earth mound defences at both Orariki and Ngati Moki Marae remain clearly visible today.

These historic travels of tupuna are introduced because they symbolise the links between the cosmological world of the atua and present generations, which serves to reinforce tribal identity, solidarity and continuity between generations. It documents the events that shaped the environment of Te Wai Pounamu and Ngai Tahu as an iwi and provides the context underpinning Te Waihora as a tribal taonga

This report is concerned with the hydrology of Waikirikiri-Te Waihora catchments. However a starting point has to be an understanding the significance of Te Waihora to Ngai Tahu whanui.

Te Waihora: Looking to the north east

The food and other resources of Te Waihora were not simply exploited on an ad hoc basis. Natural resource management was practised. It involved a set of beliefs about the relationship of humans to the natural world, knowledge of the natural environment and application of that knowledge and beliefs through laws and customs to control the community's relationship with the environment.

1.2 Report purpose

Environment Canterbury have identified as two of its Kaitiakitanga Targets in the Canterbury Water Management Strategy (CWMS)

From 2010:

- *…*
- *Formally recognise Te Runanga o Ngai Tahu Freshwater Policy and, in each zone, work towards resolving issues related to Ngai Tahu policies on:*
  - ***environmental flows that afford protection to instream values***
  - *direct discharge of point source contaminants to water*
  - *the unnatural mixing of water sourced from different waterbodies*
  - *addressing non point source pollution through a range of measures including regulatory control*

By 2015:

- *…*

- ***A programme for identifying cultural preferences for river and stream flow agreed in each zone***
- *…*

This report describes a participatory process currently being applied in the Waikirikiri-Te Waihora Catchment where representatives of the kaitiaki runanga are in the process of assessing the river flows necessary to protect cultural interests. We will analyse their data to identify cultural flow preferences via application of Cultural Opportunity Mapping, Assessment and Responses (COMAR) (Tipa and Nelson 2008). The result will be the identification, by Tangata whenua, of their preferred flows, and specification of other management actions deemed necessary to recognise and provide for their cultural interests with respect to the freshwater resources of the Waikirikiri-Te Waihora. Data collection will conclude at the end of December 2012.

1.3 Project objectives and methodology

The objective of this interim report is to:

1) Collate some of the publicly available cultural information pertaining to interests of Ngai Tahu whanui associated with the Waikirikiri - Te Waihora Catchments;

2) Prepare maps, diagrams and photographs, as appropriate, that identify the extent and/or location of their interests;

3) Identify flow related issues associated with these interests that are of concern to Manawhenua that need to be addressed by Environment Canterbury.

The principal sources of historical information were the written records held by Ngai Tahu, while the initial sources of contemporary data are whanau hui and statements made in other forums. These data will be complemented in the final report by the data being collected during the field assessments being undertaken during 2011/2012.

1.4 Sites being assessed by runanga teams

The location of Te Waihora is shown in Figure 1 while the sites that are being assessed are listed below in Table 1.

Figure 1: The location of Te Waihora

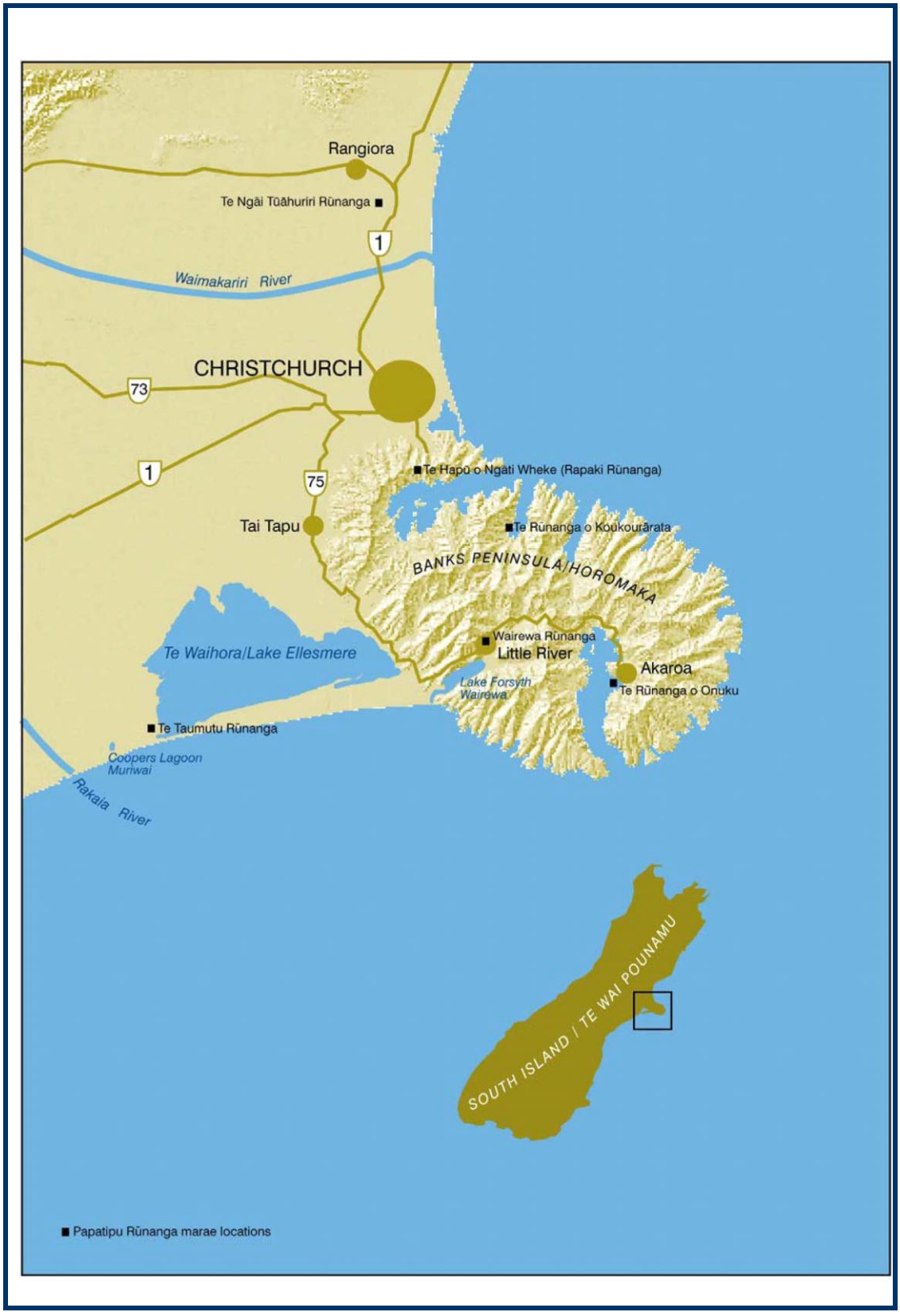


Table 1: Sites that are being assessed by Whanau

Name of site	Minimum flow set	Assessed previously by runanga team
1. L-11 – Wolfes Road	Y	Y
2. L-11 – Moirs Property	Y	Y
3. Waikirikiri at Coes Ford	Y	Y
4. Silverstream at Lincoln Leeston Road	Y	Y
5. Miles Drain - Pannetts Rd	Y	Y
6. Harts Creek - Lower Lake Rd	Y	Y
7. Doyleston Drain - Lower Lake Rd	Y	Y
8. Irwell River – Leeston / CHCH Rd	Y	Y
9. Hanmer Rd Drain - Lower Lake Rd	Y	Y
10. Boggy Creek - Lower Lake Rd	Y	Y
11. Waikekewai Creek at Taumutu Beach	Y	Y
12. Birdlings Brook at Lochheads Rd	Y	Y
13. Taumutu Creek	Y	Y
14. Springs Creek	?	
15. L-1	?	
16. Waikirikiri River at Whitecliffs		
17. Hororata River at Glentunnel Bridge		
18. Kowai		
19. Wainiwaniwa		
20. Tramway		
21. Tentburn		
22. Jollies		
23. Lee River		
24. Kaituna River – Kaituna Valley Road		Y
25. Prices Stream		Y
26. Halswell River at Tai Tapu Bridge		Y
27. Halswell River – outlet to lake in vicinity of Greenpark Huts		Y
28. Knights Creek		Y

1.5 Report structure

The first section describes the purpose of this interim report.

The second section, called "The Waikirikiri - Te Waihora catchments", provides an overview of the catchments defining river characteristics, biodiversity, and introducing why the catchments are a taonga to Ngai Tahu whanui. The material largely comes from secondary sources.

The third section, describes the process used to identify the flow preferences of tangata whenua and their perceived management needs.

The fourth section, the cultural association with Waikirikiri - Te Waihora, summarises the catchment's overall importance to Tangata whenua. This section describes the history of the Waikirikiri - Te Waihora catchments and its fish, birds, and some of the plants of the catchment that are a taonga to Ngai Tahu. It highlights the stories of whanau and their interactions with the Waikirikiri - Te Waihora thus recognising that Tangata whenua relate to the region in deeply personal ways that influence all aspects of their lives. This draws together secondary sources (including evidence given by whanau), MacKay papers; all of which are publicly available.

The fifth section links the value of the Waikirikiri - Te Waihora to tangata whenua aspirations and their perceived water management issues, especially flow related issues.

The final two sections look more closely at water management needs.

1.6 Ngai Tahu and Te Waihora

Te Taumutu is the acknowledged Kaitiaki Runanga for Te Waihora. The four Banks Peninsula Runanga: Ngati Wheke (based at Rapaki), Koukourārata (Port Levy), Onuku (Akaroa) and Wairewa (based at Little River) also have an interest in Te Waihora. Ngai Tūāhuriri and Te Taumutu Runanga also have interests up to the main divide. These Runanga all have kaitiaki responsibilities.

Kaitiakitanga is the concept of stewardship, and is expressed through actions to protect natural resources including the involvement of Runanga in the decision making and management of those resources. Water is central to Ngai Tahu resource management philosophy of ki uta ki tai – from the mountains to the sea. For Ngai Tahu this requires a holistic view of the world, including the integration of legislation and management frameworks, and the cooperation of all agencies responsible for water.

A significant feature of Te Waihora is Kaituna Lagoon which is located at the eastern end at the mouth of the Kaituna River; it is only distinct from the open waters of Te Waihora at low lake levels. The lagoon is particularly shallow and provides an important refuge for wildlife with its sheltered waters during storms. The lagoon is also significant because it is the area of Te Waihora that brings together all of the runanga of mid Canterbury, namely Te Ngai Tuahuriri, Wairewa, Koukourarata, Onuku, Te Taumutu and Te Hapu o Ngati Wheke (Rapaki). Ngai Tahu from Banks Peninsula/Horomaka accessed the resources of Te Waihora via Kaituna Valley.

1.7 Ownership of Te Waihora Lakebed by Ngai Tahu

The lakebed of Te Waihora was returned to Ngai Tahu ownership in 1998 as part of the Ngai Tahu Claims Deed of Settlement. Te Waihora Management Board (as an advisory board to Te Runanga o Ngai Tahu) worked with the Department of Conservation (DOC) on a joint management plan for the lakebed and surrounding DOC-administered lands. The Ngai Tahu owned lands are shown in Figure 2.

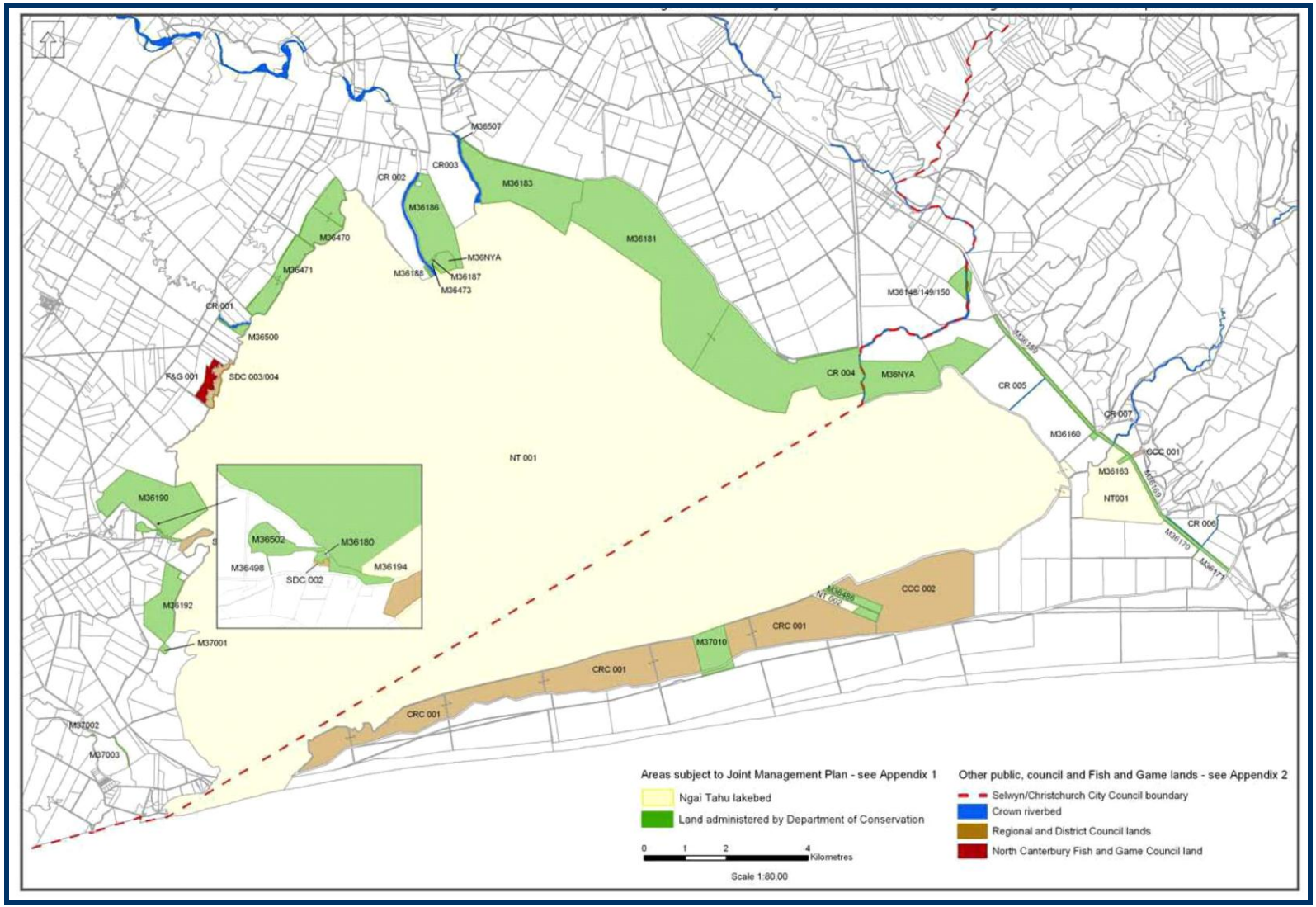


Figure 2: Land Tenure around Te Waihora[1]

[1] Sourced from Te Waihora Joint Management Plan

PART 2: AN OVERVIEW OF WAIKIRIKIRITE WAIHORA CATCHMENTS

2.1 Te Waihora

Te Waihora is a tribal taonga; and has been home to a permanent settlement for many generations because it provided abundant mahinga kai all year round. The lake remains one of New Zealand's most important wetlands; and is internationally significant for the abundance and diversity of wildlife.

Te Waihora is a large, shallow brackish coastal lake. It is New Zealand's fifth largest lake covering approximately 20,000 ha with approximately 75 kilometres of shoreline. These figures change markedly however, with lake level changes. The lake is up to 3.6 metres deep with an average depth of 2.1 metres at the average lake level of 0.9 metres above mean sea level (m amsl).

Te Waihora has a catchment of 276,000 ha, including hill and high country, downs and plains. It receives inflows from surface runoff, groundwater-fed tributaries, groundwater percolation, seawater inflows, and artesian springs. The groundwater hydrology of the area is complex and poorly understood, as is the connection between groundwater, spring flow and lake levels.

Kaituna Lagoon

Approximately 40 rivers, streams and artificial drains feed Te Waihora from the surrounding catchment. Major waterways are the Selwyn/Waikirikiri, flowing directly from the foothills, the Irwell River/Waiwhio, LII/Ararira, Halswell River/Huritini and Harts Creek/Waitatari, all originating within 19 km of Te Waihora and the Kaituna River from Banks Peninsula/Horomaka. Maintaining natural flows in the rivers and springs that feed Te Waihora and the quantity and quality of these waters is important for maintaining and improving the mauri/health of Te Waihora.

Te Waihora is an important link in the chain of coastal lagoons/estuaries of the east coast for birds. Thousands of years ago Te Waihora was the estuary of the Waimakariri and Rakaia Rivers. It is influenced by wind and the inflows (and outflows) from around 40 key inflows: groundwater directly and surface water from spring fed streams, the Waikirikiri River, the drainage network, and Banks Peninsula streams. Today the lake is hypertrophic, high in nutrients and highly turbid mainly due to sediment re-suspension by wind that helps to limit algae growth. Te Waihora is opened periodically to the sea in accordance with the Te Waihora / Lake Ellesmere Water Conservation Order.

2.2 Waikirikiri /Selwyn River

The Waikirikiri has its headwaters in the Rockwood Range and flows east for 80 kilometres across the Canterbury Plains before emptying into Te Waihora. The Waikirikiri is very seasonal and is fed from two sources; from rain in the foothills and springs in the lower plains. It is high and flood-prone in winter and early spring, but low during summer. In the foothills, the Waikirikiri flows year-round. The river is an important mahinga kai trail for hapu at Te Waihora.

On the plains, the riverbed is highly permeable, and as soon as it reaches the plains, water is lost into the aquifers. There is evidence that the reach of the river, which dries entirely, has been extending in distance and duration over recent decades.

Upstream of Te Waihora shallow groundwater rises back to the surface and the Waikirikiri flows again making the lower reaches popular for a range of valued including swimming, camping and picnicking.

2.3 Foothills, Upper Plains Streams and Wetlands, and Water-races

This area contains the springs, wetlands and streams of the Malvern Hills and Hororata Plains feeding into the Waianiwaniwa, Hororata and Waikirikiri. These are of varying size draining diverse geologies and landforms. Remnant wetlands exist along the valleys and at the toe of the foothills with more extensive wetlands in the upper slopes and summits of the foothills. The Waianiwaniwa Valley has large population of Canterbury mudfish. Significant native forest shrub-land and tussock grassland vegetation in the valleys and headwaters contain threatened plant species. The plains are a highly modified environment with pastoral and arable agriculture dominating the landscape.

The stock water-race network began operation over 120 years ago providing 360 km of reliable water for agricultural uses bringing significant economic gain. As well as supporting agricultural activities, over the years of operation there has been a gain in amenity and biodiversity values, including mudfish habitat and bird life, while also providing urban street and rural visual amenity.

2.4 Lowland Streams /Banks Peninsula Streams

The lowlands consist of spring-fed streams on the lower plains, and ephemeral streams of southern Banks Peninsula. Seasonal fluctuations of groundwater are generally small due to rainfall recharge, the flows of the Rakaia and Waikirikiri Rivers, water abstraction and irrigation recharge. Over recent decades, flows in many of the lowland streams have declined, in some cases significantly. Spring-fed

streams are often characterised by the variable management practices around them. Banks Peninsula by contrast has volcanic geology, erodible loess soils, short steep catchments and moderate intensity of land use on the flat. Flows are highly variable, at times intermittent depending on rainfall and water quality is highly susceptible.

The lowland streams are highly prized for the aesthetic, recreation, and food gathering they provide. The Halswell and Irwell Rivers, and the Waikekewai and Harts Creeks are important habitat for native fish and invertebrates. Remnant wetlands in these highly modified lower plains land environments can still support native locally-rare plant communities. Muriwai /Coopers Lagoon to the south of Te Waihora has significant salt marsh and bird habitat and is of significant cultural value to Ngai Tahu.

Stock access to the Halswell River

2.5 The Drainage Network

The network drains land that was converted from wetland or swamp to what is now productive farm land. This network is located on private land or on council road reserve, and takes storm water and helps to reduce flooding on the plains. Ten classified drainage districts, manage the almost 500 km of drain, many of which are located in the Lincoln/ Leeston area. The Halswell River is included in this drainage network as well as the extensive network of private drains that connect to the publicly managed drains. These drains include some important areas of lowland habitat and provide an opportunity to improve lowland and wetland biodiversity and habitat, while still ensuring their primary function. It is essential that the habitat values of drains be recognised and provided for. Many now represent substitute habitats that sustain populations of taonga species, and contribute significant flows to more natural watercourses.

Drains, including Doyleston Drain, have habitat values that need to be recognised.

2.6 The Coastal environment

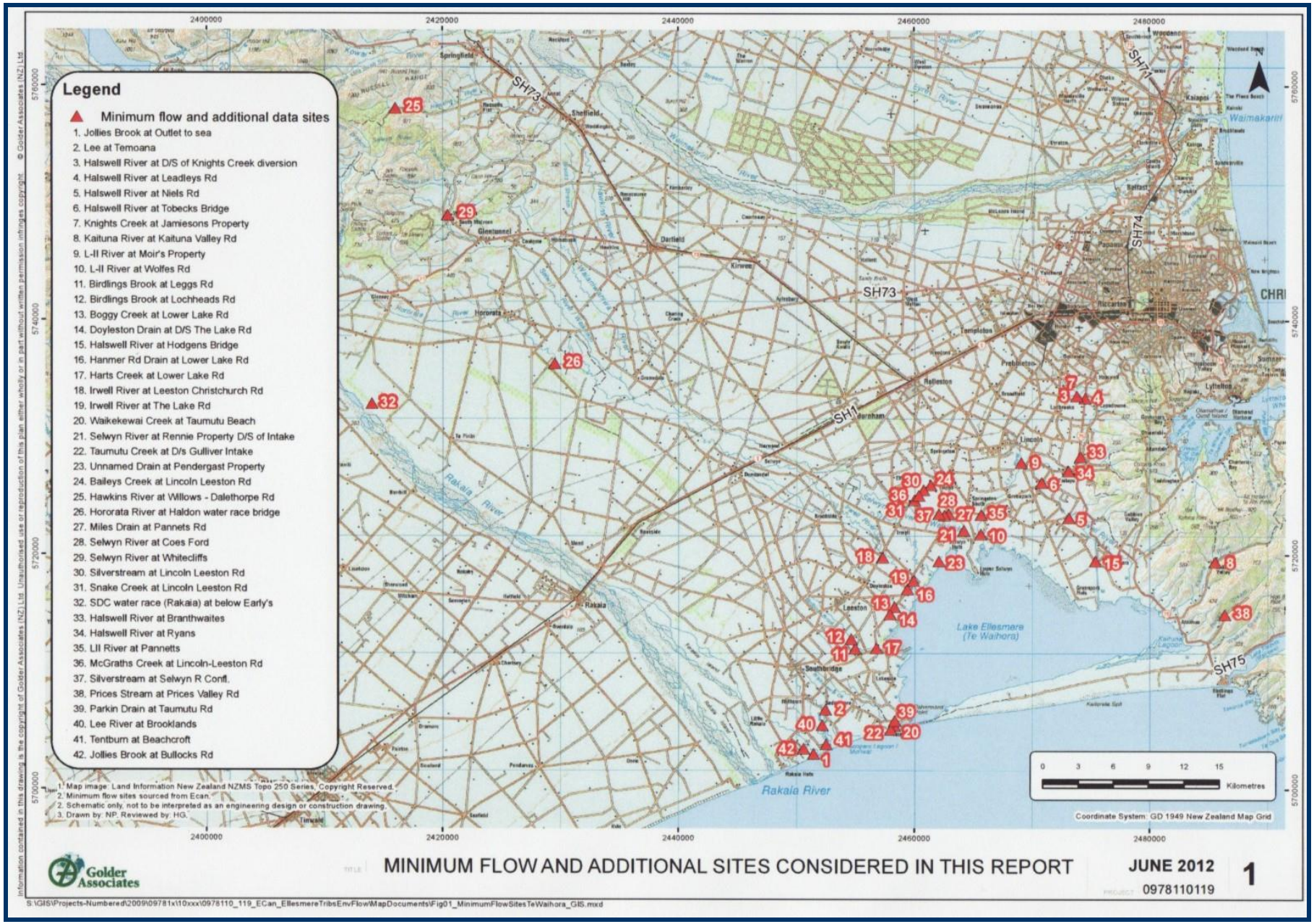
Te Waihora has no permanent outlet to the sea. Historically, the lake would naturally breach Kaitorete Spit at a lake level of about 4 m amsl. At this level, the lake would stretch inland beyond Taitapu/Tai Tapu and into Kaituna and Gebbies Valleys.

There are written records of tangata whenua opening the lake to the sea to prevent flooding of occupation sites. Today, the lake is now mechanically opened to the sea.

2.7 Links to other studies

Figure 3 (Golder and Associates Ltd 2012) identifies the locations of minimum flow sites considered by Golder and Associates on behalf of Environment Canterbury[2].

[2] This report is considered more fully in section 6 and 7 of this report.



Golder Associates

MINIMUM FLOW AND ADDITIONAL SITES CONSIDERED IN THIS REPORT

JUNE 2012

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PART 3: THE PROCESS TO INCORPORATE CULTURAL PERSPECTIVES IN FLOW SETTING

3.1 An overview of the process

The process that is currently underway involves the identification of values and interests of Tangata whenua. This process is consistent with the flow setting framework proposed by the Ministry for Environment (1998) which requires the identification of instream values, determination of instream management objectives, application of technical methods, determination and application of the new flow regime, and monitoring of the effects of a changed regime on the instream values and objectives. The six stages of the process are summarised in Table 2.

Table 2: A process to incorporate cultural interests in flow regimes.

STEP	OBJECTIVE OF STEP AND APPLICATION IN THE CASE
1. Initiating the project	To identify the body representing Tangata whenua and secure mandates.
2. Documenting the association	a. To identify the multiple dimensions that collectively represent cultural association with the study area. b. To identify the attributes used to assess whether environmental flows are sufficient to sustain cultural interests. c. To examine how their experiences are impacted by aquatic conditions, in particular river flow. d. To document perceptions of changes to flow patterns over time, and the impact of these changes on cultural values.
3. Cultural Opportunity mapping	a. To identify the cultural values associated with specific sites, together with the opportunities sought at each site given the values identified b. To formulate a catchment wide concept map that visually depicts water management issues (including flow) perceived by Tangata whenua as impacting their experiences at the sites identified. Interrelationships between issues are also mapped.
4. Focusing the investigation	a. To critically review the data collected and to focus on environmental flows and specific flow issues affecting the waterways being investigated. b. To distinguish between: 1) cultural values, opportunities, and issues to be evaluated as part of existing Environmental Flow Assessments (EFAs); 2), cultural values, opportunities, issues (and consequently flow attributes) that are place specific but could be addressed within an existing EFA; 3) those cultural values, opportunities, issues and flow attributes that were unlikely to be adequately addressed via existing EFA methods and are more appropriately addressed through a cultural assessment .
5. Cultural Opportunity assessments	a. To undertake assessments at sites to assess whether environmental flows sustain cultural values and provide the opportunities sought. b. To assess each site under different flow conditions using the attributes previously identified by Maori.
6. Analysis to inform decision making	Qualitative analysis and statistical analysis to identify flow thresholds, flow related issues, and management priorities.

Flow can also be manipulated to provide cultural opportunities. However, this process assumes that most Maori are capable of describing the opportunities they seek. The cultural

opportunities sought are informed by traditional, historic and/or contemporary values, and may be akin to ecological, economic, recreational, aesthetic, and social opportunities sought by others, while some are distinctly cultural. A range of techniques for assessing opportunities have emerged in the last twenty years including a Recreation Opportunity Spectrum (Clarke and Stankey 1979), Water Recreation Opportunity Spectrum, Tourism Opportunity Spectrum, and Forestry Opportunity Spectrum. Proposing an opportunity approach builds on this body of literature.

The cultural assessments that are currently underway are premised on sites identified by Maori as culturally significant being assessed in a process akin to Customer Satisfaction Assessments (CSAs) and environmental preference studies using attributes of flow previously identified by Maori. A series of interviews with Maori from across the South Island provided descriptions of river flows, how rivers are used, and the attributes that describe healthy vibrant flows that support cultural uses. From these descriptions nineteen "flow attributes" were extracted and listed on an assessment form.

The nineteen attributes of river flow are represented on an assessment form with Likert scales, and conclude with open ended questions. Ryan and Cessford (2003) argue for inclusion of a non-response option when developing an assessment form, which was adopted because it enables use of a generic list of flow attributes. Where an attribute is not relevant given the cultural values and cultural opportunities associated with a particular site, the non-response option is marked. In this way the assessment form should not need to be changed from site to site, or between catchments. The Cultural Flow Preferences (and importantly the critical thresholds) are calculated from the scores awarded for each of the attributes which are categorised into four themes: gathering of foods and other materials for Cultural Use (nine attributes); Wai Maori (freshwater) which has four attributes; Hauora (well being) with three attributes, and Cultural Landscapes, including uses of Maori lands, reserves, easements and so forth (three attributes).

3.2 The Team

The assessments were taken by mandated representatives of the kaitiaki runanga. As noted in the Hakatere, Waihao-Wainono, Opihi and Orari Reports, the majority of the team have a lifetime of experience interacting with the wetlands, streams, rivers and coastline within their takiwa. They know their rivers and continue to source kai from multiple sites across the takiwa. It is this expertise that they bring to the assessment process.

PART 4: TANGATA WHENUA – THE PEOPLE OF THE LAND

The Waikirikiri - Te Waihora catchments have a wide variety and abundance of wildlife and it is understandable why people were, and continue to be, attracted to the catchment. In this part of the report we provide an overview of the cultural association with the Waikirikiri - Te Waihora catchments[3]. We focus in particular on how it relates to the kaitiaki targets of the CWMS.

4.1 Background

Within the CWMS specific kaitiakitanga targets are prescribed. Those relevant to this report are listed below:

From 2010:

- *Prevent further loss or degradation of Ngai Tahu nominated wahi taonga*
- Increase understanding in each zone of the customary values and uses associated with specific waterbodies or parts of waterbodies

By 2015:

- *All degraded wahi taonga and mahinga kai waterways nominated by Ngai Tahu have an active restoration programme in place that responds to cultural priorities*
- A report on the health of all Ngai Tahu nominated waterbodies using Ngai Tahu Cultural Health Monitoring Tool
- Identified customary uses (current and potentially restored) for all waterways

By 2020:

- *Increased the abundance of, access to and use of mahinga kai.*
- All marae and associated papakāinga have access to high quality drinking water

By 2040:

- *Protection, in accordance with Ngai Tahu values and practises, of wahi taonga and mahinga kai waterways*

There are wahi taonga and wahi tapu (including wai tapu) found throughout the Waikirikiri - Te Waihora catchments. Many of these were included in Te Whakatau Kaupapa (Tau et al 1990).

4.2 Land ownership.

As noted above, Ngai Tahu is the owner of Te Waihora lakebed (as shown in Figure 2).

3 Please note that the information contained in this report is information that is already in the public domain and is therefore publicly available. It has been collated and discussed in the context of flow management.

4.3 Wahi Tapu / Taonga[4]

With this history of settlement, occupation and resource use, places of importance to the iwi, local hapu and whanau were shaped. For Ngai Tahu, the term wähi taonga refers to places that hold the respect of the people in accordance with kawa and tikanga. O'Connell (undated) explains that some sites are of tribal significance while others are important to the hapu and whanau who visited, lived at, or had special affiliations to that area. Prominent hills, landforms, springs, remaining areas of indigenous vegetation and archaeological sites are examples of physical taonga. Recorded Maori archaeological sites around Te Waihora include pä sites (fortified settlements), kainga (undefended settlements), urupa (burial grounds and single burial sites), borrow pits (small quarries from which sand or gravel was removed and added to gardens to improve the soil for kumara growing), shell middens, cooking ovens, storage pits and isolated artefact find spots.

The focus of this report is water. For Ngai Tahu, water is a taonga left by the ancestors to provide and sustain life. The ability to gather and share food which is a cornerstone of Ngai Tahu society, tradition and mana is reliant on healthy ecosystems and especially water that is fit for human consumption and that is able to support mahinga kai species. Significant cultural sites include: Te Waihora/Lake Ellesmere, Muriwai/Coopers Lagoon, Waikirikiri, the Kaituna River, the Rakaia and Waimakariri braided rivers and their upper catchment wetlands and lakes, and the Rakaia river mouth. More generally, all spring-fed streams, lowland streams and wetlands are of cultural significance, as are areas of mahinga kai and any remaining indigenous biodiversity.

Other taonga can include püräkau (stories), wähi ingoa (place names) or other associations that those living today have with the tupuna (ancestors) who have gone before. Since 1999 Ngai Tahu has identified a range of wahi tapu / wahi taonga. Those found in Waikirikiri - Te Waihora catchments include:

- Ara tawhito (ancient trails)
- Kaika Nohoanga (occupation, settlement sites)
- Mahinga Kai (places where resources including food were/are procured)
- Mauka (important Mountains)
- Pa Tawhito (ancient pā sites)
- Umu ti (earth ovens associated with preparation of kauru)
- Ikoa Tawhito (place names)
- Wähi kaitiaki (resource indicators from the environment)
- Wahi kohatu (rock formations)
- Wahi paripari (cliff areas)

[4] The information in this section comes from the Cultural Impact Report for Central Plains Water Enhancement Phase 11 (O'Connell, undated) , Te Waihora Joint Management Plan, and the evidence of Ngai Tahu whanui to the hearings for the Central Plains resource consents and the amendment to the Lake Ellesmere - Te Waihora WCO.

- Tauranga Waka (canoe mooring sites)
- Tuahu (sites of importance to identity)
- Urupa (human burial sites)
- Repo Raupo (wetlands and swamps) and Wai Maori (important freshwater areas
- Marae
- Wahi pakanga
- Wahi raranga (sources of weaving material)
- Tuhituhi nehera (rock art)
- Wahi tohu (locators and their names within the landscape)
- Wai tapu (scared waters)
- Reserves, easements, entitlements, private lands

WITH RESPECT TO FLOWS:

Ngai Tahu whanui want to ensure that there is no further loss of wahi taonga because of inappropriate water management.

In the paragraphs that follow we describe many of these wahi taonga. A diagram illustrates the interrelationships between these taonga and how they are dependent on a healthy functioning ecological system is included as Appendix 1. The tables that follow in Appendix 2 summarise how these taonga may be impacted by water management and flows in particular.

Place names

Place names and histories provide cultural context. The naming of places by Ngai Tahu is testament to the long history of occupation and travel within the catchment. Important places include camping places enabling food gathering, those associated with creation traditions or tupuna, settlements, and sites renown for the different foods that could be obtained. Places and their names formed vast oral 'maps' that were an integral part of the culture of Ngai Tahu. Many of the place names describe the characteristics of the waterbodies or the adjacent riparian and terrestrial environs.

Figure 4 shows the wealth of Ngai Tahu place names as recorded by Riki Ellison, a Ngai Tahu elder, in 1979[5].

Ingoa Tawhito (place names) associated with Waikirikiri - Te Waihora catchments that are in the public domain are included in the table where we also try to identify other taonga values associated with the area/site; and identify the location - if known.

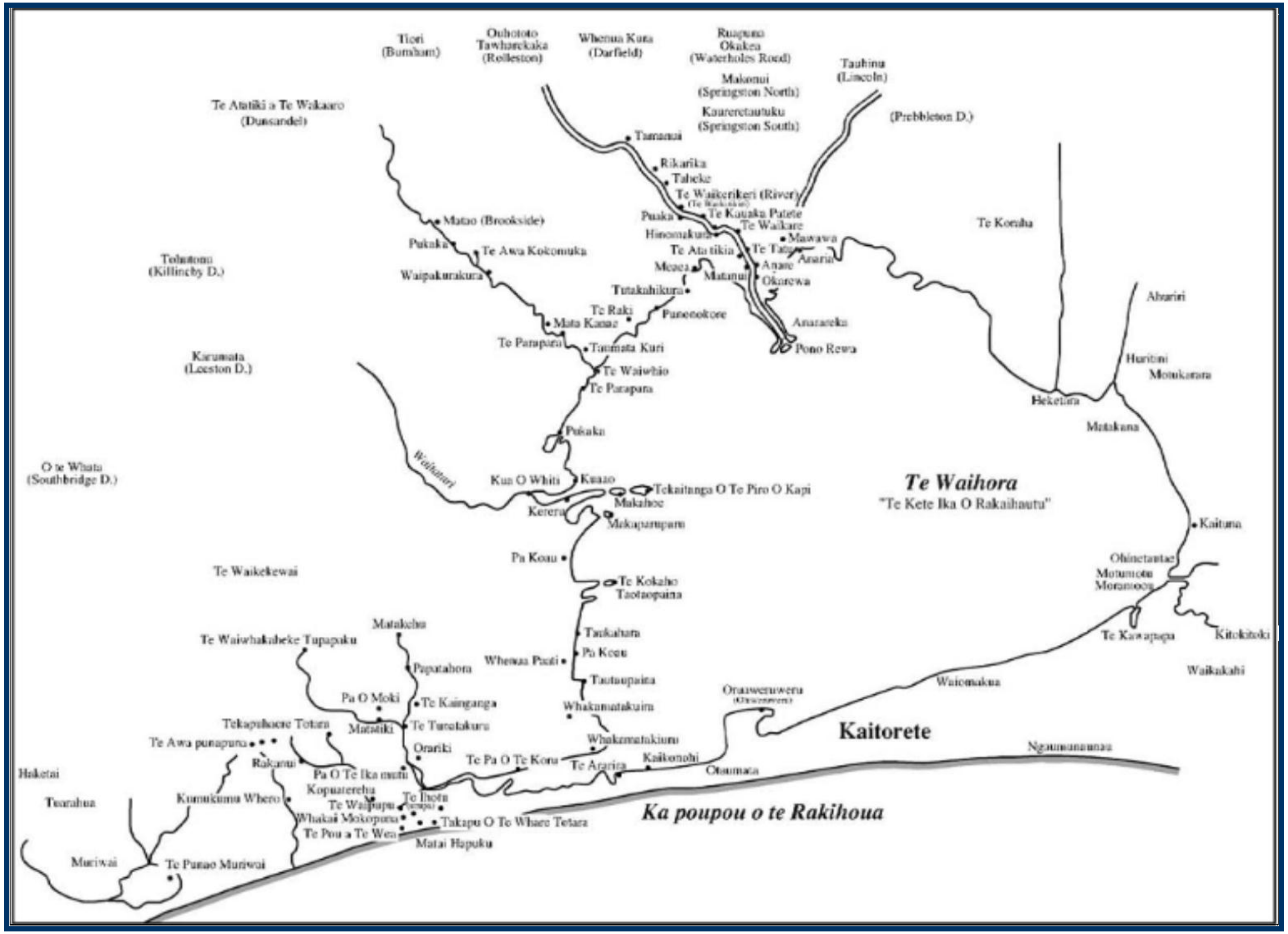
[5] This map can be found the Te Waihora Joint Management Plan.

- Te Kete Ika a Tutekawa
- Kaituna – a place where eels were plentiful/eaten.
- Waikäkahi (Pä of Tutekawa) - place of the freshwater mussel.
- Orariki - the place of life-giving creatures/a reference to biodiversity.
- Motukarara - the 'island of lizards' later called Rabbit Island
- Te Waihora – spread-out waters.
- Te Koraha - open area of shallow water covering extensive mud flats.
- Taumutu - the high ridge of land.
- Whakamätakiuru - the lookout/ to look outwards; later received the European name Fishermans Point as a name for the fishing settlement.
- Taitapu/Tai Tapu - impenetrable place, or sacred tide.
- Ahuriri – A prominent eel fishing lagoon; the name of a funnel shaped fishing net of great size, used like a hïnaki in tidal rivers (Williams, 1991).

Other place names specific to Te Waihora include the following

Kapukeriki	Food Production Site Kauru, Aruhe,Kiore
Karokaro	
Kua o whiti	in vicinity of Harts Creek
Kereru	
Mimi o Taua	Permanent Settlement Aruhe, Kauru, Tuna, Kiore, Ngä Manu, Turnip
Motukiore	Food Gathering Site Kiore Weka
Mairaki	Food Production Site Käuru Aruhe
Mautohe	Kainga in the Kaituna Valley
Matakanae	
Niho Makuru	Tuna
Okakea	Springs
Otanehakau	Food Production Site Käuru, Aruhe, Kiore, Tuna, Ngä manu
Ohapuku	Food Production Site Käuru, Aruhe,Kiore, Tuna, Ngä manu
Otuteihoka	A Habitation Tuna An Eel Weir
Ohinekakaraiti	Permanent Settlement & Food Production
Ötüpara	Food Production Site Aruhe Kauru
Ötüraparapa	Food Production Site Kauru, Aruhe, Kiore, Tuna, Ngä manu
Orehu	Gully towards Jollie Brook

Omuku	Waterway
Pauri	River
Pukeähua	Permanent Settlement & Food Production
Puaka	A Habitation Tuna An Eel Weir
Pakihi Maroke	
Rikarika	Tuna An Eel Weir
Rangi hauku	A ridge in Kaituna Valley
Taramata	A Settlement with permanent stockade that belonged to Tü Te Waimate of Rapuwai and Ngäti Mämoe. Weka, Aruhe, Tuna
Taumatarua	Production Site Kauru Aruhe
Te Awaakeake	Food Production Site Kauru, Aruhe,Kotukutuku, Tutu,
Te Notï	Food Production Site Käuru, Aruhe, Kotukutuku, Tutu,
Te Awatutu	Food Production Site Käuru, Aruhe, Kotukutuku, Tutu,
Tararoa	Tuna An Eel Weir
Tamanui	A Habitation & Eel Weir
Täheke	Tuna
Te Kauaka	Permanent Settlement & Food Production
Te Awapunapuna	Between two waterways
Te Wai Tamapua	A swamp
Tamata kuri	Up the Irwell
Te Parapara	Up the Irwell
Te Raki	A stream bed
Te Awakokomuka	
Waikohuwai	Food Production Site Käuru, Aruhe, Kiore, Tuna, Ngä manu
Whakarewa	Food Gathering Site Tuna An Eel Pond
Whakaepa	Permanent Settlement & Food Production
Waianiwaniwa	Food Production Site Tuna, Pipiki, Weka, Koreke,
Whenua a Kura	Food Gathering Site Pond Whenua a Kura Food Gathering Site Pond
Waipakurakura	Up the Irwell
Ruapuna	Springs


Tiori
(Burnham)
Ouhototo
Tawharekaka
(Rolleston)
Whenua Kura
(Darfield)
Ruapuna
Okakea
(Waterholes Road)
Tauhinu
(Lincoln)
Makomui
(Springston North)
Te Atatiki a Te Wakaaro
(Dunsandel)
Kaureretautuku
(Springston South)
(Prebbleton D.)
Tamanui
Rikarika
Taheke
Te Waikerikeri (River)
Puaka
Te Kauaka Putete
Te Waikare
Matao (Brookside)
Te Koraha
Hinomakura
Mawawa
Pukaka
Te Awa Kokomuka
Te Ata tikia
Te Tata
Anaria
Tohutonu
(Killinchy D.)
Meaea
Anare
Waipakurakura
Matanui
Okorewa
Tutakahikura
Ahuriri
Te Raki
Punenokore
Anarareka
Mata Kanae
Te Parapara
Taumata Kuri
Pono Rewa
Karumata
(Leeston D.)
Te Waiwhio
Huritini
Te Parapara
Motukarara
Heketara
Matakana
Pukaka
O te Whata
(Southbridge D.)
Waikirikiri
Kua O Whiti
Kuaao
Tekaitanga O Te Piro O Kapi
Te Waihora
Makahoe
"Te Kete Ika O Rakaihautu"
Kerera
Mokaparupara
Kaituna
Pa Koau
Ohinetamatea
Te Waikekewai
Motumotu
Te Kokaho
Moranoa
Taotaopaina
Matakehu
Taukahara
Te Waiwhakaheke Tupapaku
Te Kawapapa
Kitokitoki
Whenua Piati
Pa Koau
Paputahora
Waikakahi
Tautaupaina
Pa O Moki
Te Kainganga
Waiomakua
Orauweruweru
Whakamatakuiru
Tekapuhaere Totara
Te Turatakuru
Kaitorete
Whakamatakiuru
Te Awa punapuna
Orariki
Ngaumanaunau
Kaikanohi
Rakanui
Te Pa O Te Koru
Te Ararira
Haketai
Pa O Te Ika mutu
Otumata
Kopuaterehu
Te Ihota
Tuarahua
Kumukumu Whero
Te Waipupu
Ka poupou o te Rakihoua
Whakaii Mokopuna
Takapu O Te Whare Totara
Te Pou a Te Wera
Matai Hapuku
Muriwai
Te Punao Muriwai

WITH RESPECT TO FLOWS:

In addition to the taonga value of the place name itself, value also stems from knowing, being able to see the meaning of the place name when viewing the characteristics of the landscape, and being able to use sites as tupuna did.

Wai[6]

Without water no living thing, plant, fish or animal can survive. Water is taonga and this taonga value refers to values associated with the water itself, the resources living in the water and the resources in the wider environs that are sustained by the water. Further, water is a holistic resource and needs to be managed as such

Awa of the Waikirikiri Catchment include:

- Hororata – Hororata River
- Waianiwaniwa – Waianiwaniwa/Waireka River
- Pauri – Hawkins River
- Te Mimi o Taua – Glendore Creek
- Otäneäkau – Tributary of Upper Waikirikiri
- Te Awatutu – Tributary of Upper Hawkins River
- Waikohuwai – Blacks Stream
- Te Awaakeake – Tributary of Hawkins River (near Waddington)

Other awa feeding Te Waihora include

- Selwyn iRiver - Waikirikiri
- Irwell River - Waiwhio,
- LII - Ararira,
- Halswell River - Huritini
- Harts Creek – Waitatari
- Waikekewai
- Te Raki
- Boggy Creek
- Kaituna
- Prices

Wai tapu

Specific freshwater sources are valued because of their status or usage. Values (both tangible and intangible) associated with specific freshwater resources include: the role of particular freshwater resources in creation stories; the role of those freshwater resources in historical accounts; the proximity of settlements and/or historical sites in or adjacent to specific freshwater resources; the value of freshwater resources as a source of tribal identity; mahinga kai; the use of freshwater resources as access routes or transport courses; and the continued capacity for future generations to access, use and treasure the resource (Ministry for Environment, 1998). Waters could be classed as Wai Tapu (sacred waters) or Wai Taonga (treasured waters). Expanding on this, traditional water classifications, which draw on the classifications proposed by Douglas (1984, 1), Palmer and Goodall (1989) Rochford (2003), and Williams (2006), offer another understanding the distinctive characteristics and values associated with different waterbodies. The classifications, as summarised in Table 3, denote saltwater and freshwater categories, distinguish other waters on the basis of physical character or levels of degradation, and identify specific cultural uses of different types of water.

[6] The information is from O'Connell (undated)

Table 3: Summary of Traditional Water Classifications

Classifications by geographic location *Ki uta ki tai*	Classifications by spiritual description	Classification by physical description	Classification by special uses
Waimaori freshwater	*Waimaori* • becomes waimaori when it comes into unprotected contact with humans. . • has a mauri (which is generally benevolent) and which can be controlled by ritual.	*Waimaori* - is the term used to describe water that is running freely or unrestrained, or to describe water which is clear or lucid	*Waimaori* - is normal, usual and ordinary
	Waiora • Pure water is termed Te Waiora a Tane, and to the Maori it contains the source of life and wellbeing. • is the spiritual and physical expression of Rakinui the sky father, shedding tears at the loss of Papatuanuku, the earth. The rain is waiora	*Waiora* - The purest form of water	*Waiora* • is used to purify and heal. • can remain pure, as waiora, only if its contact with humans is protected by appropriate ritual prayers. • has the potential to give life, to sustain wellbeing, and to counteract evil
	Wai whakaheke tupapaku - Classed as wai tapu		*Wai whakaheke tupapaku* • are water burial sites
	Wai tohi - Classed as wai tapu		*Wai tohi* • used by a tohunga during initiation and baptism ceremonies.
	Waikino - is water, which has been polluted or debased, spoilt or corrupted. In waikino, the mauri has been altered so that the supernatural forces are non-selective and can cause harm to anyone	*Waikino* - describes water, which is rushing rapidly through a gorge, or water where there are large boulders or submerged snags which give the potential to cause harm to humans.	
	Waimate • has lost its mauri or life force • has the potential to cause ill fortune, contamination or distress to the mauri of other living things, including people, their kai moana or their agriculture. The subtle differences between waikino and waimate seem to be based on the continued existence of a mauri (albeit damaged) in the former, and its total loss in the latter	*Waimate* • is dead, damaged or polluted water which has lost its power to rejuvenate either itself or other living things. • has a geographical meaning; to denote sluggish water, a backwater to a main stream or tide, but in this sense the waimate retains its mauri.	
Waimataitai - brackish water; the interface of freshwater & sea.			.
Waitai - the sea, the surf or the tide, sea water	*Waitai* - has returned to Tangaroa in the natural process of generation, degradation and rejuvenation.	*Waitai* - Rough, angry or boisterous like the surf, or the surge of the tide.	
		Waipuna, or springs had various uses including mahinga kai, tüähu, waiwhakaheketüpäpaku	
Waihapua - refer to coastal estuaries and lagoons. Te Waihora is a waihapua			

WITH RESPECT TO FLOWS:

Wai tapu include Wai whakaheke tupapaku (water burials)[7]. In the context of this report, manawhenua are seeking the absolute protection of freshwater resources that are considered tapu, and seek the protection of the sufficient quantities of high quality waters of taonga value.

Maunga[8]

Maunga (Mountains) play an important role in spiritual and cultural beliefs of Ngai firstly as gateways to the atua (gods), and secondly as the gatherers of the tears of Rakinui (Sky Father), which in turn nourish Papatuanuku (Earth Mother). The maunga of the Waikirikiri hold a mixture of tupuna names, appearance names and use names. They generally act as reference points that guide people to a particular food gathering site. As they approach the maunga, they then refer to other icons such as waterways, trees or rocks to guide them.

Maunga of the Waikirikiri:

- Motukiore – Woolshed Hill
- Tarauri – Mount Misery
- Ruahine – Cairn Hill
- Pukeähua – Abners Head
- Pukemärama – Racecourse Hill
- Käkäpötahi – Malvern Hills

Kainga Noho/Pa Tawhito

Ngai Tahu lived an itinerant lifestyle and constantly moved following the seasonal variances of their mahinga kai. During the warmer months, a larger amount of time was spent in the higher altitudes, and during winter they generally retreated to their permanent coastal villages. In a contemporary sense, although there are provisions for papakainga housing in the District Plan, there is a need to ensure that there are sufficient quantities of drinking water to enable lands to be developed for papakainga housing.

WITH RESPECT TO FLOWS:

Ngai Tahu whanui want to ensure that flows in the rivers and the quality are conducive to

1) a range of cultural uses e.g. mahinga kai, swimming, camping being undertaken at the nohoanga.

2) Papakainga housing being established as envisaged in the District Plan

Urupa

Urupa are burial sites. Generally larger urupa are associated with the more permanent living settlements in the area. It must be noted though that there have been many accidental discoveries of urupa which have gone unrecorded, or have been desecrated or destroyed. Known Urupa in the Waikirikiri Catchment include:

- Whakaepa Pa – Coalgate
- Ohinekakaraiti – Junction of Köwai & Waimakariri Rivers

7 See Tau et al (1990) Te Whakatau Kaupapa.
8 The information is from O'Connell (undated)

It is likely that there urupa associated with the following sites:

- Te Mimi o Taua
- Taramata
- Pakarä
- Pukeähua
- Te Kauaka
- Otuteihoka
- Puaka
- Tamanui
- Tokorewa

WITH RESPECT TO FLOWS:

Burial sites of tupuna are wähi tapu and their modification or destruction is prohibited. Ngai Tahu whanui want to ensure that 1) flows in the river do not increase the scale or extent of erosion (through benching, undercutting, erosive force) and 2) quality of water does give cultural offence

T u a h u [9]

Tüähu, or sacred altars, were important sites of significance. Tüähu played an important role in traditional Ngäi Tahu tikanga (customs) including matakite (foretelling the future), waitohi (blessings/baptisms), karakia (incantations), whakanoa (cleansing), as well as being a medium that connected with ngä atua (the gods). The tüähu were the tools of the tohunga to aid them in the task they had before them.

Tüähu could range from being a specially arranged area within a pa or living area, to being a tree or clump of vegetation or a waipuna (spring). Since the embracing of Christianity, Ngäi Tahu have come to rely less on the role of the tüähu and such the locations of many tüähu are now unknown. This is not to say though that some members of the iwi or hapu still use these tüähu for their traditional purposes. Known Tüähu of the Waikirikiri Catchment

- Taramata
- Whakaepa
- Ohinekakaraiti
- Pukeähua

WITH RESPECT TO FLOWS:

Burial sites of tupuna are wähi tapu and their modification or destruction is prohibited. Ngai Tahu whanui want to ensure that 1) flows in the river do not increase the scale or extent of erosion (through benching, undercutting, erosive force) and 2) quality of water does give cultural offence

[9] The information is from O'Connell (undated)

Wahi pakanga[10]

Wähi pakanga are places where historical battles took place between iwi, hapü or whänau. The sites automatically inherit a wähi tapu (sacred site) status given the blood that has been shed upon it. Equally, those killed on the battle field were often buried in close proximity to the site and thus wähi pakanga also have associated urupä. In absence of a known burial site, the wähi pakanga is treated in the same reverence as if it were an urupä and those killed are in fact buried there. Prior to the attacks of Te Rauparaha in the early 1830's, Ngäi Tahu had been engaged in a large inter whänau feud aptly named Te Kaihuaka (Eat Relations). During this feud the Pa on Ripapa Island, whose chief was Taununu, was attacked by a Kaiapoi taua (war party). In utu (revenge), Taununu and his people travelled without detection to the pa of Whakaepa, near Coalgate and lay siege on the outpost killing all of its occupants. The site of the Whakaepa Pa remains a wähi pakanga and holds special significance for Ngäi Tahu whänau whose tupuna (ancestors) were killed there.

WITH RESPECT TO FLOWS:

Burial sites of tupuna are wähi tapu and their modification or destruction is prohibited. Ngai Tahu whanui want to ensure that 1) flows in the river do not increase the scale or extent of erosion (through benching, undercutting, erosive force) and 2) quality of water does give cultural offence

Marae

As noted earlier, Te Pä o Moki, was established as an outpost for the son of Te Ruahikihiki. The current whare, Ngäti Moki, was built on native reserve at Taumutu as a rünanga hall in 1893.

WITH RESPECT TO FLOWS

Providing sufficient safe drinking water is fundamental for the whanau of Taumutu Marae.

Ara Tawhito (Ancient Trails)[11]

Ngai Tahu whanui advised that tupuna would have travelled throughout the catchment when harvesting mahinga kai from the river valleys. Further to the fact that this catchment contained large numbers of birds, such as ducks and weka, kiore, and fish, it must also be noted that this valley was an important stopover for parties journeying through to Whakamätau (Lake Coleridge) and further to Noti Raureka (Browning Pass) to gather pounamu from the Arahura River. It was also a stopover for parties travelling northwest over Ötäneuru (Porters Pass) and into the Waimakariri basin.

[10] The information is from O'Connell (undated)
[11] The information is from O'Connell (undated)

WITH RESPECT TO MANAGEMENT:

Ngai Tahu whanui want to ensure that access is provided throughout the catchment, especially to sites that are used by Tangata whenua. Linkages between sites of significance is also vitally important to whanau.

Mahinga kai

Ko nga hau ki etahi waahi, ko nga kai ki Orariki
No matter from which way the wind blows one can procure food at Te Waihora

Te Waihora Joint Management Plan has adopted a vision based on mahinga kai. This vision reflects the unique cultural values associated with Te Waihora and emphasizes the ecological processes and services that they contend are undervalued by contemporary resource management strategies.

The mahinga kai vision prioritizes efforts to re-naturalize processes that sustain mahinga kai and provides a direct and culturally appropriate means for monitoring and reporting restoration progress to whanau, hapu, and iwi. The mahinga kai sourced from the catchment is listed in Table 4.

Table 4: Mahinga kai species in the Waikirikiri – Te Waihora system[12]

Kai whenua (from the land)	
Māori name	**English name**
aruhe/tauhinu	fern root*
harakeke	flax*
kākaho	reeds
kiore	rat [9]
kōwhitiwhiti	watercress (introduced)
kūmara	kumara
māmia	sedge*
paru	mud
pīngao	sand sedge*
pūhā	sour thistle
raupō	bullrush/raupo*
rongoā	medicinal plants
tī kouka	cabbage tree*
tororaro	wiggy wig
wīwī/whiwhi/ wewe	rushes*
Ika (fish)	
aua	yellow-eyed mullet
īnanga, mata/ua	whitebait
kanakana/ piharau	lamprey
kōkopu	kōkopu
mohoao	black/common flounder
pāraki	smelt
pātiki	3-corner flounder/ whitebelly
pātiki totara	yellow-belly flounder
tuna	eel
ūpokororo	grayling
kākahi	freshwater mussels
waikōura	freshwater crayfish
tuaki	cockles×
A number of other marine fish species also intermittently inhabit Te Waihora and are sourced as mahinga kai.	

Manu (birds)	
Māori name	**English name**
hua kakī ānau	black swan eggs°
hua manu	other bird eggs
kakī ānau	black swan°
karoro	black-backed gull*
kererū	wood pigeon*+
kōau	black+*, pied*, little shag*
kōtuku	white heron+*
kuruwhengi/ pāteke	New Zealand shoveller*
matuku	Australasian bittern+
pākura/pūkeko	pukeko*°
pāpango/ raipo	New Zealand scaup/ black teal+
pateke/ tarawhatu	brown teal+*
pārera /māunu	grey duck*°
pūtakitaki	paradise shelduck+*
rīrīwaka	bar-tailed godwit+
ruru koukou	morepork+*
tarāpuka	Red-billed gull+
tete	grey teal×*
whiowhio	blue duck+

+ Protected under the Wildlife Act 1953.

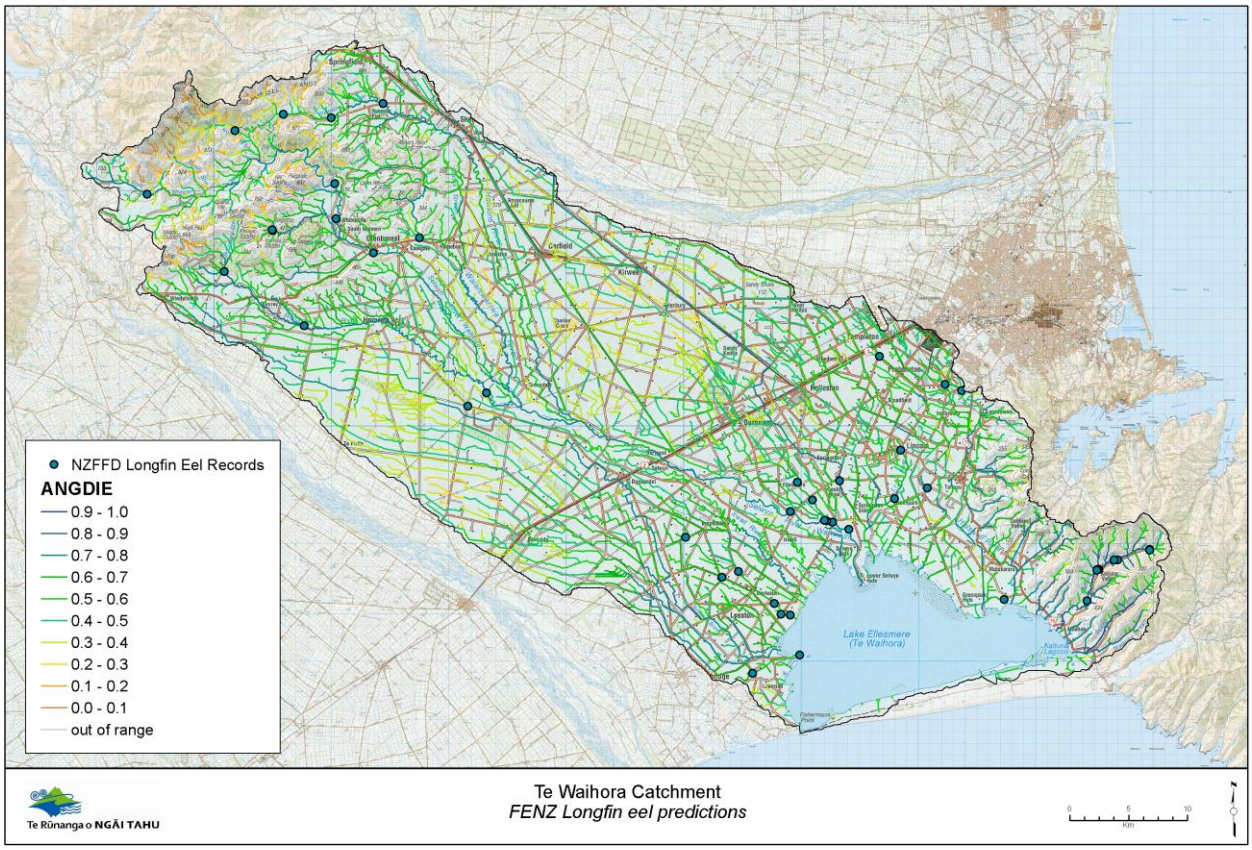
× Customary fisheries "Shellfish species" under the Ngāi Tahu Claims Settlement Act 1998.

* Taonga Species under the Ngāi Tahu Claims Settlement Act 1998.

° Game birds under the Wildlife Act 1953

Mahinga kai is the ultimate indicator of the cultural health of an ecosystem (Goodall, 2003). Using the Freshwater Ecosystems of NZ (FENZ) geo-database we are able to map the distribution of habitats for valued mahinga kai species in the Waikirikiri - Te Waihora system. For example, we have overlaid on the maps sites from the New Zealand Freshwater database where long fin eels (top map) and short fin eels (bottom map) have been recorded. Other species maps are in Appendix 3.

[12] This table can be found the Te Waihora Joint Management Plan


NZFFD Longfin Eel Records
ANGDIE
0.9 - 1.0
0.8 - 0.9
0.7 - 0.8
0.6 - 0.7
0.5 - 0.6
0.4 - 0.5
0.3 - 0.4
0.2 - 0.3
0.1 - 0.2
0.0 - 0.1
out of range
Lake Ellesmere (Te Waihora)
Te Rūnanga o NGĀI TAHU
Te Waihora Catchment
FENZ Longfin eel predictions
0 5 10
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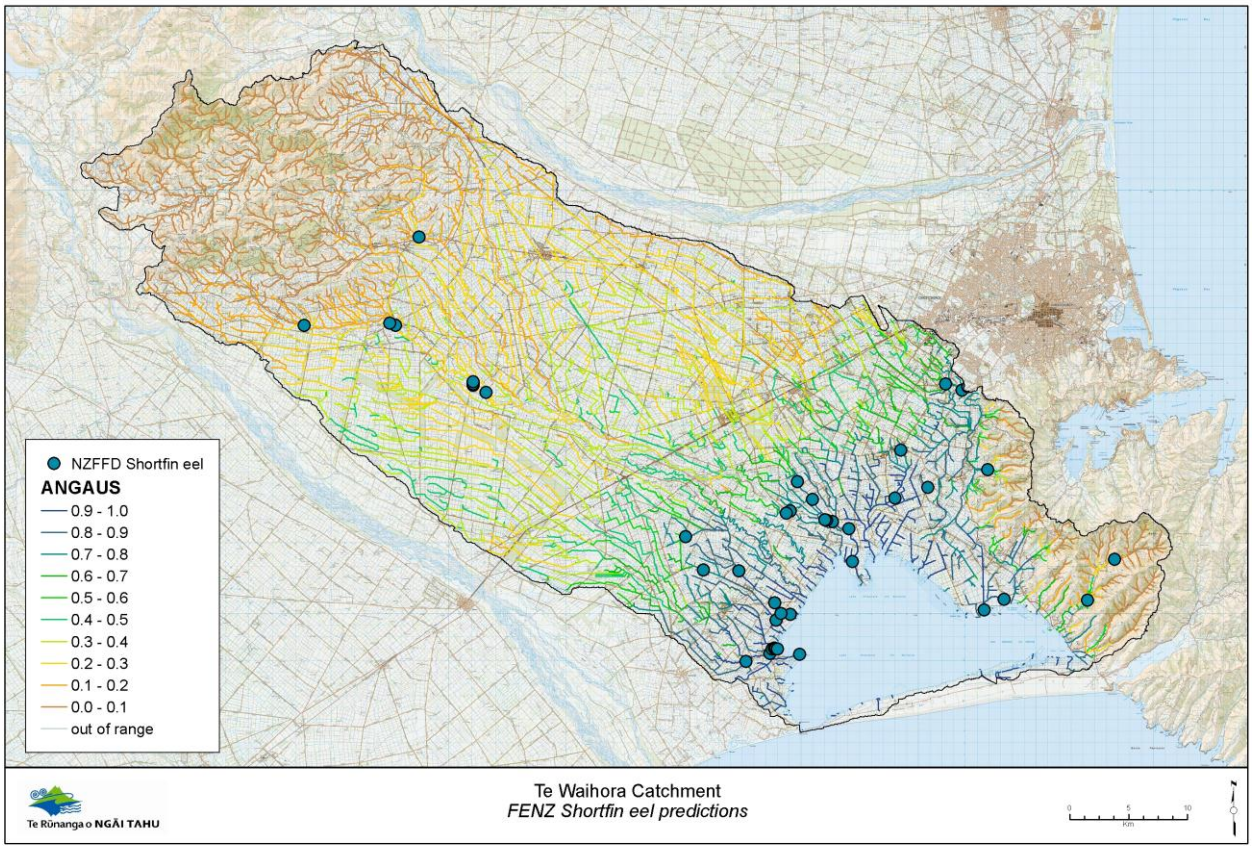

NZFFD Shortfin eel
ANGAUS
0.9 - 1.0
0.8 - 0.9
0.7 - 0.8
0.6 - 0.7
0.5 - 0.6
0.4 - 0.5
0.3 - 0.4
0.2 - 0.3
0.1 - 0.2
0.0 - 0.1
out of range
Te Rūnanga o NGĀI TAHU
Te Waihora Catchment
FENZ Shortfin eel predictions
0 5 10
Km

WITH RESPECT TO MANAGEMENT:

Ngai Tahu whanui want to restore the distribution of species to their historic range – ki uta ki tai. Protecting long fin tuna is a priority. Abundance and condition of species is also to be enhanced.

Water quality and water quantity are essential to sustaining mahinga kai within the Waikirikiri - Te Waihora catchments. The ecological function and health of the catchment become a holistic measure of water management, and provide a pathway toward the restoration and maintenance of mahinga kai.

To provide context for realising a mahinga kai vision, in Part 6 we begin by describing changes to ecosystem processes observed by Ngai Tahu resulting in a shift from a mahinga kai based economy historically. We then highlight attributes of the hydrology, geomorphology, habitat and network connectivity, riverine biotic community, and riparian vegetation that are considered by whanau to be essential in the sustained production of mahinga kai.

Wahi raranga

This site is similar to a mahinga kai but differs in that it is specifically valued for the weaving resources that are found there. A wähi raranga is more often a stand of harakeke (flax) but can also include species such as taramea (spaniard), ti kouka (cabbage tree), neinei (shrub), raupö (bulrush), and toetoe. In many cases wähi raranga were planted specifically to supply a food preparation or habitation site. This is a well-known fact for such plants as harakeke that, depending on the variety, can be used for different purposes.

WITH RESPECT TO MANAGEMENT:

Ngai Tahu whanui want to protect existing remnants of native vegetation and encourage the replanting on indigenous species valued for their cultural uses.

Ngahere

The location and distribution of remaining areas of native vegetation perform an important function as ecological corridors for toanga bird species seeking, for example food sources and nesting sites both within the forest blocks and in adjoining areas of native vegetation. Plants found in the catchments are summarised in Table 5[13].

Common Name	Māori Name	Botanical Name	Significance
akeake	akeake	*Dodonea viscosa*	at its distribution limit
bog rush		*Schoenus pauciflorus*	important to Ngai Tahu
bullrush	raupō	*Typha angustifolia*	taonga species
cabbage tree	tī rākau/ tī kōuka	*Cordyline australis*	taonga species
club rush	wīwī	*Bolboschoenus caldwellii*	important to Ngai Tahu
common rush	wīwī	*Juncus gregiflorus*	taonga species
coprosma	karamū	*Coprosma robusta, coprosma lucida, coprosma foetidissima*	taonga species
fernroot (bracken)	aruhe	*Pteridium aquilinum var. esculentum*	taonga species
giant umbrella sedge	toetoe	*Cyperus ustulatus*	rare in Canterbury
jointed wire rush	oioi	*Leptocarpus similis*	important to Ngai Tahu
knobby clubrush	wīwī	*Isolepis nodosa*	important to Ngai Tahu
kōwhai	kōwhai /kōhai	*Sophora microphylla*	taonga species
lake clubrush / tall sedge	kuta	*Schoenoplectus validus*	important to Ngai Tahu
NZ flax	harakeke	*Phormium tenax*	taonga species
ngāio	ngāio	*Myoporum laetum*	taonga species
NZ broom	maukoro	*Carmichaelia appressa*	important to Ngai Tahu
orchid	māikaika	*Spiranthes sinesis*	rare native
pīngao	pīngao	*Desmoschoenus spiralis*	taonga species
pukio	pukio	*Carex secta*	important to Ngai Tahu
purple mimulus		*Mimulus repens*	uncommon (Sparse)
ruatahi	toetoe/ ruatahi	*Carex coriacea*	important to Ngai Tahu
saltmarsh ribbonwood		*Plagianthus divaricatus*	
sea rush	wīwī	*Juncus maritimus*	taonga species

WITH RESPECT TO MANAGEMENT:

Ngai Tahu whanui want to protect existing remnants of native vegetation and encourage the replanting on indigenous species, especially in the headwaters and on riparian margins.

[13] This table can be found the Te Waihora Joint Management Plan

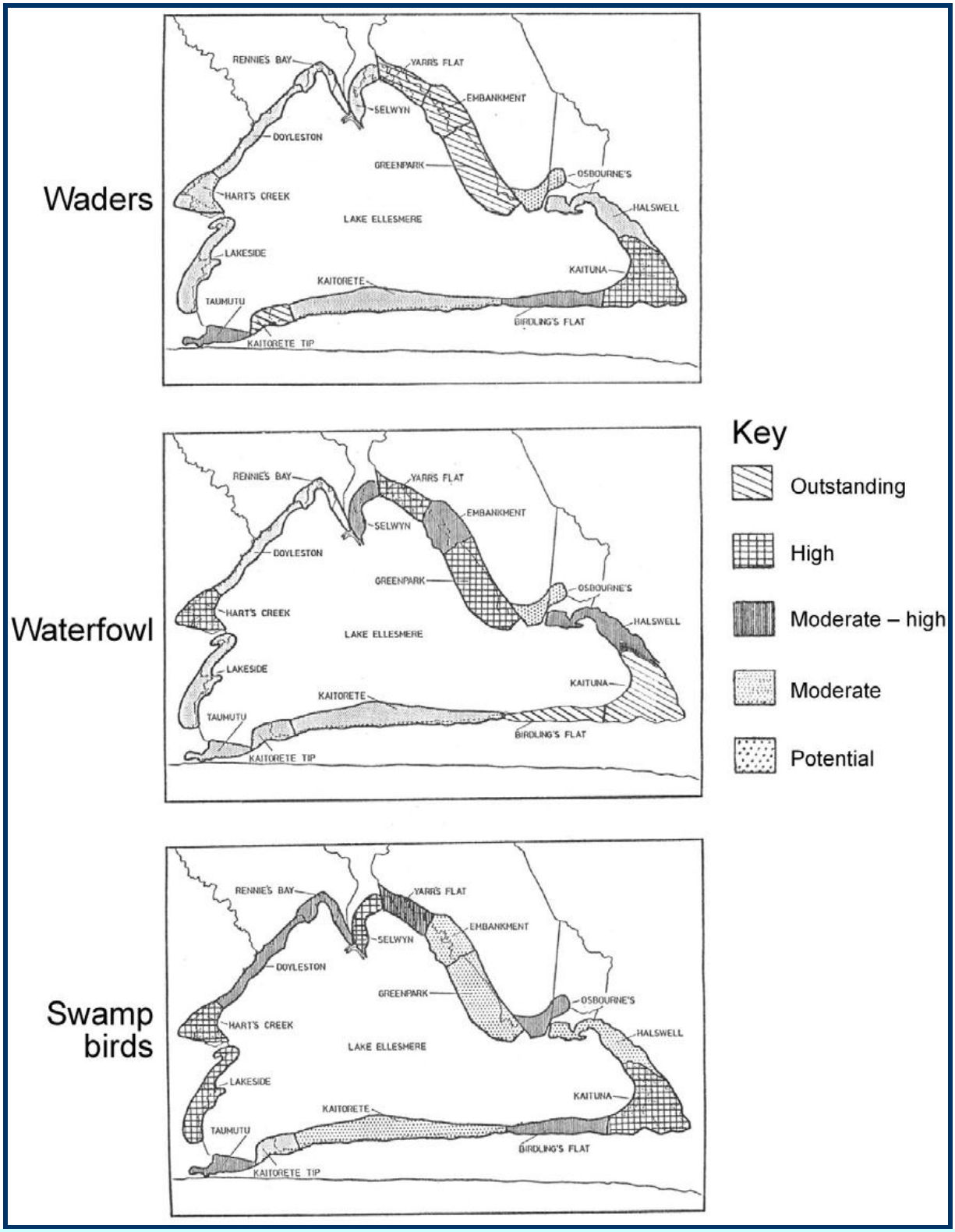
Taonga species

There are numerous bird species within the catchment, many of which are classed as taonga species in the Ngai Tahu Claims Settlement Act 1998 as detailed in the Table that follows[14].

Common Name	Māori Name	Scientific Name	Significance
Australasian bittern	matukuhurepo	*Botaurus poiciloptilus*	nationally endangered
Australasian/New Zealand shoveler	kuruwhengi	*Anas rhynchotis*	game bird taonga species
banded dotterel	powhera, tuturiwhatu	*Charadrius bicinctus bicinctus*	gradual decline taonga species
bar-tailed godwit	kuaka	*Limosa lapponica*	migrant
black shag	kōau	*Phalacrocorax carbo novaehollandiae*	sparse taonga species
black stilt	kakī	*Himantopus novaezelandiae*	nationally critical taonga species
black swan	kakī anu	*Cygnus atratus*	game bird important to Ngāi Tahu
black-billed gull	akiaki, katatē	*Larus bulleri*	serious decline
black-fronted tern	tara	*Sterna albostriata*	serious decline taonga species
black-tailed godwit	kuaka, rakakao	*Limosa limosa*	migrant
broad-billed sandpiper		*Limicola falcinellus*	migrant
brown teal	pateke/ tarawhatu	*Anas aucklandica chlorotis*	taonga species
Canada goose		*Branta canadensis*	game bird
caspian tern	taranui	*Sterna caspia*	nationally vulnerable taonga species
curlew sandpiper		*Calidris ferruginea*	migrant
great knot		*Calidris tenuirostris*	migrant
grey duck	pārera	*Anas superciliosa superciliosa*	taonga species game bird
grey phalarope		*Phalaropus fulicaria*	migrant
grey teal	tete	*Anas gracilis*	taonga species
kingfisher	kōtare	*Todiramphus sanctus*	taonga species
little shag	kawaupaka kōau	*Phalacrocorax melanoleucos brevirostris*	taonga species
little stint		*Calidris minuta*	migrant
little tern	tara	*Sterna albifrons*	taonga species
mallard duck		*Anas platyrhynchos*	game bird
marsh crake	koitareke	*Porzana pusilla affinis*	sparse
marsh sandpiper		*Tringa stagnatilis*	migrant
paradise shelduck	pūtakitaki	*Tadorna variegata*	taonga species game bird
pied stilt	poaka	*Himantopus himantopus leucocephalus*	taonga species

Habitats used by the various bird species are shown over the page in Figure 4[15].

[14] This table can be found the Te Waihora Joint Management Plan



WITH RESPECT TO MANAGEMENT:

Inflows to Te Waihora need to enhance the quantity and quality of habitat for taonga bird species at all life stages.

[15] This figure can be found the Te Waihora Joint Management Plan

There are also a number of fish species within the catchment: again many of these are classed as taonga species in the Ngai Tahu Claims Settlement Act 1998 as shown in the following table[16].

Common Name	Māori Name	Scientific name	Present in Lake	Present in Tributaries	Significance[15]
banded kōkōpu		*Galaxias fasciatus*	✓	✓	important to Ngāi Tahu recreational catch not threatened
black flounder	mohoao	*Rhombosolea retiaria*	✓	✓	important to Ngāi Tahu commercial not threatened
brook char		*Salvelinus fontinalis*		✓	introduced
brown trout		*Salmo trutta*	✓	✓	introduced recreational sports fish
Canterbury galaxies		*Galaxias vulgaris*		✓	not threatened
Canterbury mudfish	kōwaro	*Neochanna burrowsius*		✓	taonga fish species nationally endangered
catfish		*Ameiurus nebulosus*	✓	✓	introduced pest fish
common bully	kokopara	*Gobiomorphus cotidianus*	✓	✓	not threatened
common shrimp			✓	✓	taonga fish species
common smelt	paraki/ ngāiore	*Retropinna retropinna*	✓	✓	taonga fish species not threatened
common sole	pātiki rori	*Peltorhamphus novaezeelandiae*	✓		occasional visitor
freshwater crayfish	waikōura	*Paranephrops*		✓	possibly locally threatened
freshwater mussels	kākahi	*Hyridella*		✓	possibly locally threatened important to Ngāi Tahu
giant bully	kokopara	*Gobiomorphus gobioides*		✓	taonga fish species not threatened
goldfish		*Carassius auratus*	✓	✓	introduced
greenback flounder	pātiki	*Rhombosolea tapirina*	✓		important to Ngāi Tahu commercial occasional visitor
hake		*Merluccius australis*	✓		introduced occasional visitor
īnanga	īnanga	*Galaxias maculatus*	✓	✓	important to Ngāi Tahu recreational catch not threatened
kahawai		*Arripis trutta*	✓		not threatened

[15] Including threat extinction rankings from Molloy, J (et al.) 2001.

[16] This table can be found the Te Waihora Joint Management Plan

Common Name	Māori Name	Scientific name	Present in Lake	Present in Tributaries	Significance[15]
koaro		*Galaxias brevipinnis*	✓	✓	important to Ngāi Tahu recreational catch not threatened
lamprey	kanakana	*Geotria australis*	✓	✓	important to Ngāi Tahu transitory not threatened
long-finned eel	tuna	*Anguilla dieffenbachia* and *A. dieffenbachii*	✓	✓	important to Ngāi Tahu commercial nationally threatened (gradual decline)
perch		*Perca fluviatilis*	✓	✓	coarse fish recreational sports fish
quinnat/ chinook salmon		*Oncorhychus tshawytscha*	✓	✓	introduced recreational sports fish occasional visitor
rudd		*Scardinius erythrophthalmus*	✓	✓	introduced noxious pest fish
sand flounder	pātiki	*Rhombosolea plebeia*	✓		important to Ngāi Tahu commercial
short-finned eel	tuna	*Anguilla australis*	✓	✓	important to Ngāi Tahu commercial not threatened
sprat		*Sprattus antipidum*	✓		introduced occasional visitor
tench		*Tinca tinca*	✓	✓	coarse fish Recreational sports fish`
torrentfish	piripiripōhatu	*Cheimarrichtys fosteri*	✓	✓	taonga fish species
upland bully		*Gobiomorphus breviceps*		✓	not threatened
yellowbelly flounder	pātiki tōtara	*Rhombosolea leporina*	✓		important to Ngāi Tahu commercial
yellow-eyed mullet	aua	*Aldrichetta forsteri*	✓		important to Ngāi Tahu commercial not threatened

WITH RESPECT TO MANAGEMENT:

Flows need to ensure the protection of habitats used by all taonga species at all life stages.

Wähi Kohätu (Rock Formations)

Ngai Tahu whanui advised that there are a number of interesting rock formations in the Waikirikiri - Te Waihora catchments. They do not want to see such sites impacted by inundation or micro-climates (which can be created from changes in the extent of irrigated land area), or changing groundwater levels.

WITH RESPECT TO MANAGEMENT:

Ngai Tahu whanui wants to protect valued cultural landscapes that comprise waterway, geological features and evidence of cultural use (e.g. rock shelter, campsite, marae etc).

Reserves, easements

There are a number of reserves, easements and entitlements in the Waikirikiri - Te Waihora catchments. Ngai Tahu surrendered title to significant tracts of lands in the nineteenth century however small tracts of land were identified as reserves for Ngai Tahu. Many of the reserves and fishing easements can be traced back to Crown Grants to Ngai Tahu whanui which stem from the Southern Purchase Deeds negotiated between 1844 and 1857. For lands that were granted to enable the continuation of a food gathering lifestyle, certain guarantees were provided with respect to the nature of natural resources that were to sustain this lifestyle.

Table 2: A list of some of the native reserves in the province of Canterbury[17]

Reserve Name	Size (acres)	Interest
Section 232 Lyttelton	1	
Section 12,373 Waikawa	150	
Old Kaiapoi pa	5	An implied trust reserved by Mantell
Little River	4	An old urupa
Kaiapoi	2640	Reserved in 1848 by Mantell in terms of Kemps Purchase
Kaikanui	4	Reserved in 1848 by Mantell in terms of Kemps Purchase
Rapaki	850	Reserved in 1849 by Mantell in terms of the Port Cooper Purchase
Purau	9	Reserved in 1849 by Mantell in terms of the Port Cooper purchase
Koukourarata	1361	Reserved in 1849 by Mantell in terms of the Port Levy purchase
Opukutahi	432	Reserved by Mr Hamilton in 1856
Onuku	426	Reserved by Mr Hamilton in 1856
Wairewa	440	Reserved by Mr Hamilton in 1856
Taumutu	76	Reserved in 1848 by Mantell in terms of Kemps Purchase
Taumutu	42	Reserved in 1848 by Mantell in terms of Kemps Purchase
Arowhenua	376	Reserved in 1848 by Mantell in terms of Kemps Purchase
Waipopo	187	Reserved in 1848 by Mantell in terms of Kemps Purchase
Te Upoko o Rakaitaweka	20	Reserved in 1848 by Mantell in terms of Kemps Purchase
Tauhinu	23	Reserved in 1848 by Mantell in terms of Kemps Purchase
Waimatemate	40	Reserved by the Canterbury Association
Waikawa	138	Selected in lieu of reserve at Hakataramea
Rakipaua	20	Reserved in 1848 by Mantell in terms of Kemps Purchase

[17] Alexander Mackay (1872) A Compendium of Official Documents relative to Native Affairs in the South Island, Memorandum on the origination and management of native reserves in the Southern Island Pages 338 and 339 of Volume 2.

Kaiapoi	72	Reserved by the Governor General to supplement land at Kaiapoi
Kaiapoi	200	Award of the Native Land Court in 1868 in fulfillment of the terms of Kemps Deed of June 1848
Kaiapoi	350	Award of the NLC[18], 1868 in fulfillment of Kemps Deed June 1848
Kaiapoi	450	Award of the NLC, 1868, in fulfillment of Kemps Deed of June 1848
Kaiapoi	15	Award of the NLC, 1868, in fulfillment of Kemps Deed of June 1848
Kaiapoi	10	Award of the NLC, 1868, in fulfillment of Kemps Deed of June 1848
Kaiapoi	20	Award of the NLC, 1868, in fulfillment of Kemps Deed of June 1848
Kaiapoi	10	Award of the NLC, 1868, in fulfillment of Kemps Deed of June 1848
Kaiapoi	10	Award of the NLC, 1868, in fulfillment of Kemps Deed of June 1848
Taumutu	128	Award of the NLC, 1868, in fulfillment of Kemps Deed of June 1848
Little River	100	Award of the NLC, 1868, in fulfillment of Kemps Deed of June 1848
Arowhenua	2	Award of the NLC, 1868, in fulfillment of Kemps Deed of June 1848
Arowhenua	150	Award of the NLC, 1868, in fulfillment of Kemps Deed of June 1848
Arowhenua	30	Award of the NLC, 1868, in fulfillment of Kemps Deed of June 1848
Arowhenua	20	Award of the NLC, 1868, in fulfillment of Kemps Deed of June 1848

WITH RESPECT TO FLOWS:

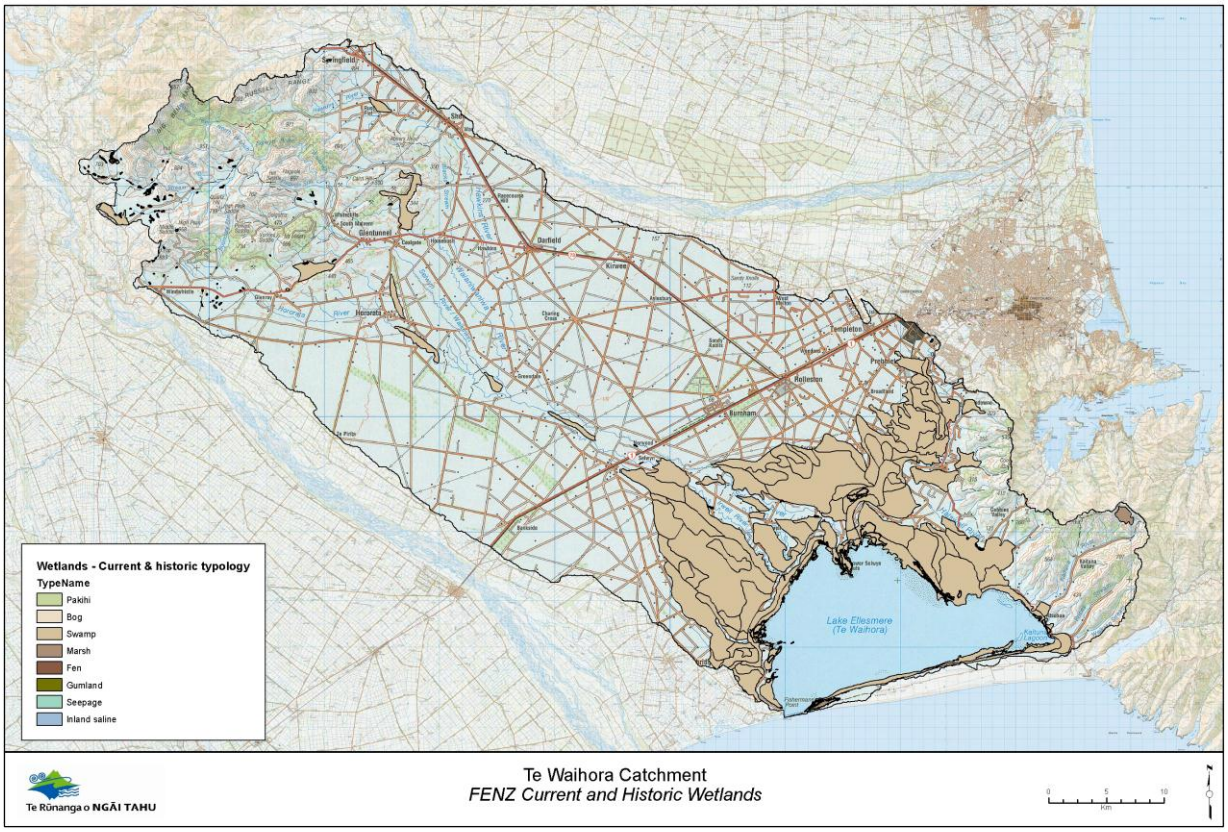
Manawhenua want to ensure that the health of the river-lake system enables them to occupy and use the reserves to which they are entitled – right that has been acknowledged by the Crown as early as 1868 and as recently as The Ngai Tahu Claims Settlement.

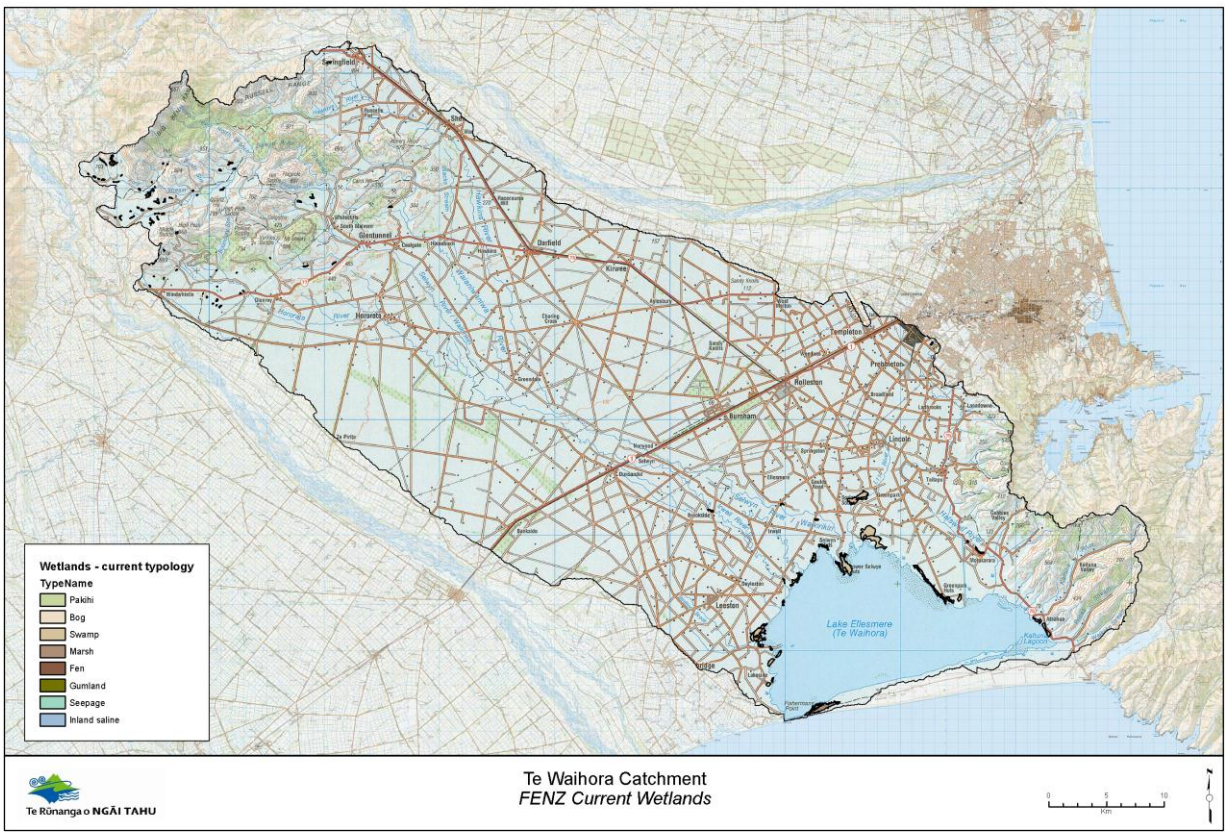
Repo raupo

"Repo Raupö" is the general term applied to wetlands. These areas were important sources of mahinga kai or were rich in biodiversity that supported species that were considered important mahinga kai. These areas were also valued for such things as paru (mud for dye).

Using FENZ we are able to identify the extent of wetlands historically and compare that to the range and distribution of wetlands today.

[18] NLC refers to the Native Land Court


Wetlands - Current & historic typology
TypeName
Pakihi
Bog
Swamp
Marsh
Fen
Gumland
Seepage
Inland saline
Lake Ellesmere (Te Waihora)
Te Rūnanga o NGĀI TAHU
Te Waihora Catchment
FENZ Current and Historic Wetlands
0 5 10 Km


Wetlands - current typology
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Inland saline
Lake Ellesmere (Te Waihora)
Te Rūnanga o NGĀI TAHU
Te Waihora Catchment
FENZ Current Wetlands
0 5 10 Km

WITH RESPECT TO FLOWS:

Whanau want to ensure the protection of existing wetlands but would prefer to see opportunities created to restore wetlands to their historic range. A programme of reinstatement should be investigated. This could include the lake being raised.

4.4 Spiritual significance of intergenerational links

People have inhabited Waikirikiri - Te Waihora catchments because they could find food season by season, access water and building materials, and collect plants for food, medicine, and crafts. Whanau continue to live in the catchment because of the resources the rivers and lake afford. However, there is a unique relationship that exists between Tangata whenua and the Waikirikiri - Te Waihora catchments. A spiritual relationship enables them to understand their role in the world, to respect the rivers and lake, to interact with these as their tupuna did, to value their intrinsic worth as an integral ecosystem that sits at the core of their identity and wellbeing.

WITH RESPECT TO FLOWS:

Ngai Tahu whanui want to restore the associations with the Waikirikiri - Te Waihora catchments by restoring significant cultural landscapes that are dependent on sufficient quantities of high quality water. This will in turn enable the re-establishment of cultural practices and uses essential to the cultural wellbeing of whanau, hapu and iwi.

Harts Creek

Selwyn River

PART 5: THE PREFERENCES OF WHANAU

5.1 Valued characteristics

From the overview in Part 4 it is clear that:

- Water is precious and needs to be managed as a taonga. Source waters in particular need to be protected from alteration. Spring heads are valued source waters.
- A healthy catchment is not just about water, but many other parts need to be in good order to comprise a healthy catchment. The biodiversity is sustained the waters. If the biodiversity is healthy, then people are healthy.
- Tangata whenua interact with all of the Waikirikiri - Te Waihora catchments.
- Clean water of sufficient quantities is associated with a sense of wellbeing among whanau. Ensuring plentiful supplies of clean water, especially at the marae, are available is fundamental.
- Valuing and providing for diversity, interconnectedness and the cycle of life is important.
- Mahinga kai lies at the core of Ngai Tahu culture and identity.
- A healthy catchment will enable whanau to use their reserves and their lands.
- Remaining wetlands need to be protected from any further alteration. Further, a programme of reinstatement of historic wetlands should be pursued.
- Water is a key feature in many of the cultural landscapes of Waikirikiri - Te Waihora that are highly valued by Tangata whenua.

In Table 6 that follows we break down the valued characteristics of the system. There are two levels of specification:

- firstly we discuss the different zones within the catchments; and
- then where possible we consider each of the sub-catchments.

Table 6: Summary of Culturally Significant Features of Streams and Reaches in the lowlands around Te Waihora

Zone name	Valued Characteristics of Zone and Stream
Te Waihora	**Greenpark Sands -** extends along 13 kilometres of lakeshore from the LII River /Ararira to the Halswell River/Huritini. The Sands • contain a range of nationally significant wetland vegetation within saline to freshwater habitats • have particular value because of their size and essentially undisturbed combination of halophyte and freshwater plant species. • of outstanding importance for wader birds, especially migrant species, and of high importance for waterfowl. • retains the range of indigenous wetland vegetation that gave rise to the "outstanding" rating in the 1980s. • Important patiki / fishing areas / grounds **Lake side of Kaitorete Spit –** is a large area of low salinity lagoon-edge native vegetation more continuous than elsewhere around Te Waihora. • The extent of sea rush and saltmarsh ribbonwood present makes this area one of regional botanical importance. • It is of "outstanding" importance for waterfowl at the eastern end and for waders at the western end. Since the 1980s the eastern end has degraded but the balance is of similar or better quality.

	Taumutu Commonage and Lakeside – is an area of mudflats, saltmarsh and localised freshwater swamp areas, with small offshore islands. • It is of "high" value for swampbirds. • Since the 1980s, the Commonage part (Mäori freehold land under long-term lease) has degraded, but the balance retains its value.
Some of the tributaries feeding to Te Waihora, especially the lower reaches of tributaries	**Harts Creek/Waitatari** – • has been largely invaded by willow species over recent years, but there are remaining areas of botanical interest, especially the understory species to the willow canopy. • Extensive raupö beds fringe the lake-edge. The area is of "high" value for waterfowl and swampbirds. • Despite the spread of willow the area has retained its values **Area north of Lake Road South, Irwell River/Waiwhio -** A narrow area of undisturbed native freshwater vegetation that is of regional botanical importance. Area has retained its values in some parts but has suffered from grazing pressure in others. **Selwyn River/Waikirikiri to west bank of LII/Ararira River** - Area contains extensive stands of native freshwater vegetation including taller raupö and tall sedge. It is of regional botanical importance and of "high" importance for swampbirds.
In and around the marae – Te Pa o Moki	• Water for marae is sourced from a shallow well. Water is considered to be of high quality at present. • Some of the waterways around the marae are wai tapu and use has been limited. • Mahinga kai was undertaken in waterbodies further away from the marae because of the tapu status of some waters in the vicinity of the marae.
Kaituna Lagoon	Kaituna Lagoon, at the extreme east of Te Waihora, has permanent shallow water even during low lake levels, with small islands, sand spits, mudflats, raupö and rushes. • It provides sheltered waters for wildlife during storms. • The areas of mud-flats, rushes and raupö are of botanical interest. • It is of "outstanding" mportance for waterfowl, and of high value for wader and swamp birds. • It has changed little since the 1980s. • It is an area of importance for many Ngäi Tahu as this area provided access to the vast resources of Te Waihora from Banks Peninsula Horomaka. Similarly, Kaitorete Spit provided an important access way between Banks Peninsula/Horomaka and the Canterbury Plains/Ngä Päkihi Whakatekateka o Waitaha.

5.2 Opportunities sought

In Table 7 we summarise in general terms the opportunities sought by Tangata whenua.

Table 7: Summary of Current and Future Cultural Opportunities for streams and Reaches in the lowlands around Te Waihora

Zone name and important streams	Opportunities Sought
Te Waihora	• Areas around the lake been retired from farming and have returned to wetlands. Wetlands and riparian margins restored and protecting mauri. • Whanau are confident that there is no discharge of contaminant into water, or onto land in circumstances which may result in that contaminant entering Te Waihora. • Mahinga kai resources at Te Waihora are restored and enable successful customary use. • Whanau are confident that all mahinga kai species sourced from Te Waihora are culturally fit for human consumption. • Käinga nohoanga around Te Waihora are used by whanau. • Whanau have access to and customary use of indigenous plants and animals and other natural materials from Te Waihora • Ecological processes ensure abundant and healthy Indigenous plant and animal communities of Te Waihora and their distribution is more akin to historical levels. • Indigenous biodiversity, mahinga kai and taonga species flourish while significant plant and animal pests have declined in number. • The physical and cultural linkages between Banks Peninsula/Horomaka, Kaituna Valley and the Kaituna lagoon, and between Waikekewai stream and Te Korua is restored. • Te Waihora once again plays a vital role in the chain of coastal lagoons and wetlands throughout New Zealand. • Stock are fenced out of all lake margins. • Riparian indigenous vegetation around Te Waihora and within the catchment effectively reduce sediment discharges and introduced aquatic weed growth. • Whanau have access to all sites significant for cultural purposes and use. • Lake edge erosion is minimised. • Wetland reclamation has been reversed and wetlands are being created or reinstated. • Water quality has improved significantly. • Areas of inshore lake have clear water that enables fishing by gaff and spear e.g. flounder spearing

All tributaries feeding to Te Waihora, including the lower reaches of tributaries	• Abundant populations of taonga species, especially abundant mahinga kai (most notably eels) are restored to their historic range throughout catchments
	  ○ Species have access throughout river systems at key stages of their life cycle
	• Access is provided to traditional sites to gather kai and natural resources
	• Fences stop stock accessing any of the waterways.
	• Lands in the headwaters have been retired and native bush is regenerating.
	• Landscape features that are important to cultural landscapes are retained – flows, clarity, quality, indigenous vegetation, taonga species, and channel morphology.
	• Wetlands and riparian margins are restored and protecting mauri.
	• Environmental flows are set in all Te Waihora tributaries that
	  ○ maintain the natural character and appearance of the waterway
	  ○ sustain cultural values and sites valued for particular cultural purposes, including wähi tapu, wähi taonga
	  ○ cumulatively provide required freshwater inflows to Te Waihora that balance saltwater contributions, especially in summer.
	• Whanau are confident that there is no discharge of contaminant into water, or onto

	land in circumstances which may result in that contaminant entering water. • Importantly there is no drainage of, or discharge of contaminants to, water burial sites • Whanau are satisfied that there is no unnatural mixing of waters sourced from different waterbodies. • Whanau are confident that all mahinga kai species sourced from tributaries to Te Waihora are culturally fit for human consumption. • Käinga nohoanga throughout catchments are used by whanau. • Whanau have access to and customary use of indigenous plants and animals and other natural materials from the Waikirikiri -Te Waihora system. • Ecological processes ensure abundant and healthy Indigenous plant and animal communities of Waikirikiri - Te Waihora catchments and their distribution is akin to historical levels. • Indigenous biodiversity, mahinga kai and taonga species flourish while significant plant and animal pests have declined in number. • Corridors of indigenous vegetation and habitats exist from the mountains to the sea. • The physical and cultural linkages between Banks Peninsula/Horomaka, Kaituna Valley and the Kaituna lagoon, and between Waikekewai stream and Te Korua is restored. • Riparian indigenous vegetation within the Waikirikiri - Te Waihora catchments effectively reduce sediment discharges and introduced aquatic weed growth. • Whanau have access to all sites significant for cultural purposes and use. • Wetland reclamation has been reversed and wetlands are being created or reinstated. • Water quality has improved significantly. • In rainfed streams, flow variability has been introduced to o address issues of extended low flows o ensure flows at the right times to trigger crucial life cycle stages • Flow are sufficient to provide fish passage so that species can reach habitats in headwaters. o Where the flows needed for eel passage have not been determined by an in-depth assessment of flow needs, the requirement needs to be determined at the shallowest riffle in the stream. The recommendation for eels is for the depth being 300m (based on the measure being 1.5 X 200mm body). Flows are to be provided October to May. • Waipuna are protected, and where identified, are accessible to whanau for cultural purposes • Whanau are satisfied that the features of the mauka, rock formations, gorges are protected. o No impoundments in traditionally significant streams and reaches
In and around the marae – Te Pa o Moki	• High quality drinking water is available. • Whanau are confident that there is no discharge of contaminant into water, or onto land in circumstances which may result in that contaminant entering water. • Importantly there is no drainage of, or discharge of contaminants to waters classed as wai tapu, especially water burial sites • Whanau are satisfied that there is no unnatural mixing of waters sourced from different waterbodies. • A buffer zone around the marae has been established to ensure that there is no intensification of landuse that could impact the quality of drinking water at the marae. • Whanau are satisfied that sufficient water is available for papakainga housing.
Kaituna Lagoon	• Abundant mahinga kai populations – birds, plants and fish • Enhanced water quality make it a desirable place to visit and gather from o quality is fit for gathering and contact recreation • Flow variability ensures access throughout the length of streams at crucial life stages

	• The Halswell River contributes high quality water to Te Waihora. • The discharge from Osbornes Drain is no longer an issue of concern for whanau. • Kaituna River is one of many streams from Banks Peninsula that contributes water of high quality to Te Waihora. • The Lagoon continues to be managed as a kohanga for many taonga species.

5.3 Threats from the perspective of Tangata whenua

In the Table that follows, concerns specific to different parts of the catchment are detailed.

Summary of Perceived Threats to realising Cultural Opportunities for in the Waikirikiri – Te Waihora Catchments

Zone name and important streams	Perceived Issues
Te Waihora *As highlighted by Aunty Ake and Uncle Donald the lake is clearly not what it was, even a generation ago, and it is obviously in a serious state of decline.* *As manawhenua and kaitiaki, we have to live with the indignity of people speaking of our lake as dead and more recently the lake officially being labelled the second worst lake in the country.* *Furthermore, we have dealt with the direct discharge of sewage following the recent earthquakes.* *First, it was drained to half its natural size. Some of the areas drained were wetlands.* *Land use change has since affected the natural resilience the lake once enjoyed.*	**Agriculture** - farming around the lake includes dairy farming, sheep and cattle grazing, and mixed cropping. • Land reclamation for agricultural purposes has occurred, using drains, stopbanks and pumps. • Maintenance of lake edge farming remains a key issue, and periodic lowering of the lake level is undertaken so that productive agricultural land may be maintained. **Access** - Because of natural fluctuations in lake level, some of the wetland freehold land is underwater for much of the time, other than at extremely low lake levels. This affects public access to the lake. **Wetland drainage and land reclamation** for farming has depleted food resources. Lowered water levels have destroyed breeding areas and feeding grounds for birds, eel, and shellfish. **Physical degradation of water quality**, the ecosystem and depletion of traditional kai; degradation of the mauri of the water according to Maori spiritual concepts; loss of mana whenua and the ability to provide food, and consequently loss of the mana of the people (mana tangata). Environment Court in *Lynton Dairies Ltd v Canterbury Regional Council* (C108/05), stated: *[97] To the east of State Highway 1 things change significantly. The area has clearly been subject to extensive land management over the last 100 years, with the aim of converting what was formerly wetlands to pastoral farm land. Much of that is now occupied by dairying and is extensively irrigated. There was very limited evidence to satisfy us that there had been active management of the waterways in this area and we were disappointed to see waterways, including the Irwell, Selwyn, Hanmer Drain, Doyleston, Boggy Creek and Hart Creek all subject to little or no riparian planting or fencing.* *[100] We were shocked at the ever-present effluent smell from all of these waterways and the clear evidence of poor management, excess effluent levels and contamination.* *[101] Te Waihora (Lake Ellesmere) was a significant shock to the Court. The lake is eutrophic, green in colour and seems to be devoid of any riparian management. For example, stock seem to have free access to the water, the margins appear to be subject to chemical spraying regimes and lake levels manipulated for farming rather than the natural values. The lake water is in a serious ecological condition and is in urgent need of attention. Riparian management is required as an absolute minimum.*

In the words of whanau[19]:

I am also concerned about the way the lake is opened and managed.

The middle of the lake has changed in colour from grey to green. In calm conditions, it does not clear in the shallows as much as it used to in the days before the Wahine storm.

There is very little clear water in the shallows of the Lake now, only under certain conditions and never during summer. Some of our customary fishery practices cannot be used now due to very discoloured water.

There are far less black swans which are a native species. There were previously in excess of 80,000. Now, there are around 8,000. Pressure on land use for breeding areas restricts the ability for cultural gathering of swan eggs.

1 have also observed more lake flies and less of the other night insects. The lake has 'flipped' from weedbed/aquatic plant dominated species, to midge dominated species. These were present in the 1950's but never in the numbers present now.

The Wahine storm led to a loss of most of the weed beds in the lake, but it was only the final straw in a series of increasing pressures on the weed beds. A significant pressure was the focus on maintaining the lowest possible lake level to maintain productive land use around the lake. This practice has taken place on a continuous basis for decades.

Inanga Whitebait runs are nowhere near as good as those that the kaumatua talked about. even during my time on the lake. Timing of openings for whitebait is crucial. In my experience, whitebait will be more inclined to enter the lake with better water quality and perhaps breed in and around the lake in significant numbers. The additional opening period will allow for whitebait migration.

If there was an opportunity to open the lake at key times, we will have a more reliable fishery.

There are different types of patiki flounder in the lake. Three corner flounders do not usually prosper in the lake throughout their cycle. There are sometimes lots of small ones, but they do not always grow to useful size. The Timaru whites or Greenbacks are not even present in the lake as juveniles. Something is stopping them growing up and then they completely disappear from the system. This did not happen in the past. It is possible that the timing of recruitment for this species is completely missed by the current opening regime which does not cater for lake opening at optimal times for recruitment.

The lake is under significant pressure. Access to mahinga kai is being threatened. What remains is so fragile and important. Waihora is a whole system from where I can exercise my customary right to mahinga kai and be engaging with the tribal property. Our customary lake is a right that is being impeded and must be protected.

All tributaries feeding to Te Waihora, including the lower reaches of tributaries	• The adverse effects of water abstractions on rivers and cultural associations with them:
	• Increasing pressure to extract water
	• Increasing pressure to store water in tributary catchments e.g. Waianiwaniwa
	• Character of waterways has changed and is still at risk
	• Water quality in tributaries is poor
	  o Agricultural contaminants entering system
	  o Concern at risks of further pollution from land intensification (e.g. dairy farms)
	  o Legacy contamination issues suspected but unknown.

[19] The "words of whanau" have been taken directly from evidence submitted at hearings.

	• Mahinga kai habitats have been lost in mainstem and tributaries. • Excessive sedimentation – clogging of the riverbed by silt especially in lowland waterways • Excessive weed growth that necessitates weed clearance which can impact taonga species. • Reduced numbers of mahinga kai species • Removal of wetland areas • Duration of low flows (minimum becomes the maximum) • Connections – ki uta ki tai - at risk through culverts, drains, dewaterings. • Riparian margins become more modified as move downstream. There is not always a commitment to replant riparian areas. • Levels in spring fed streams are dropping. • The potential effects on resources and values of significance to Ngai Tahu as a result of transfers and mixing of waters between and within catchments: • The effects of irrigation infrastructure on the landscape • Cultural impacts associated with increased water availability and subsequent land use change • Inappropriate extraction from wai tapu and a resultant drop in water levels.

The Halswell River – healthy riparian margins is a priority for whanau.

In the words of whanau:

I have encountered highly discoloured water (sometimes bright green) and the effects of algal blooms at different times in the lake and its tributaries, and I have had to discontinue my activities until it is safer and have also been caused to feel worried for my health and safety, as well as those of my whanau, manuhiri and whanaunga who I may share any harvested food with.

I have experienced the extreme low flows in our streams which impact on the available habitat for our fish, can leave them stranded and which can also result in poor harvests in subsequent years.

Farming has intensified in the area. I have seen first hand the pollution, runoff, sedimentation and drain cleaning that has occurred. Some areas are not fenced, stock are getting access to waterways. Many of the drains and waterways are refuges for various species and are influenced by lake level management at different times of the year. Mechanical removal of sediment from these drains and waterways removes adult and juvenile eels.

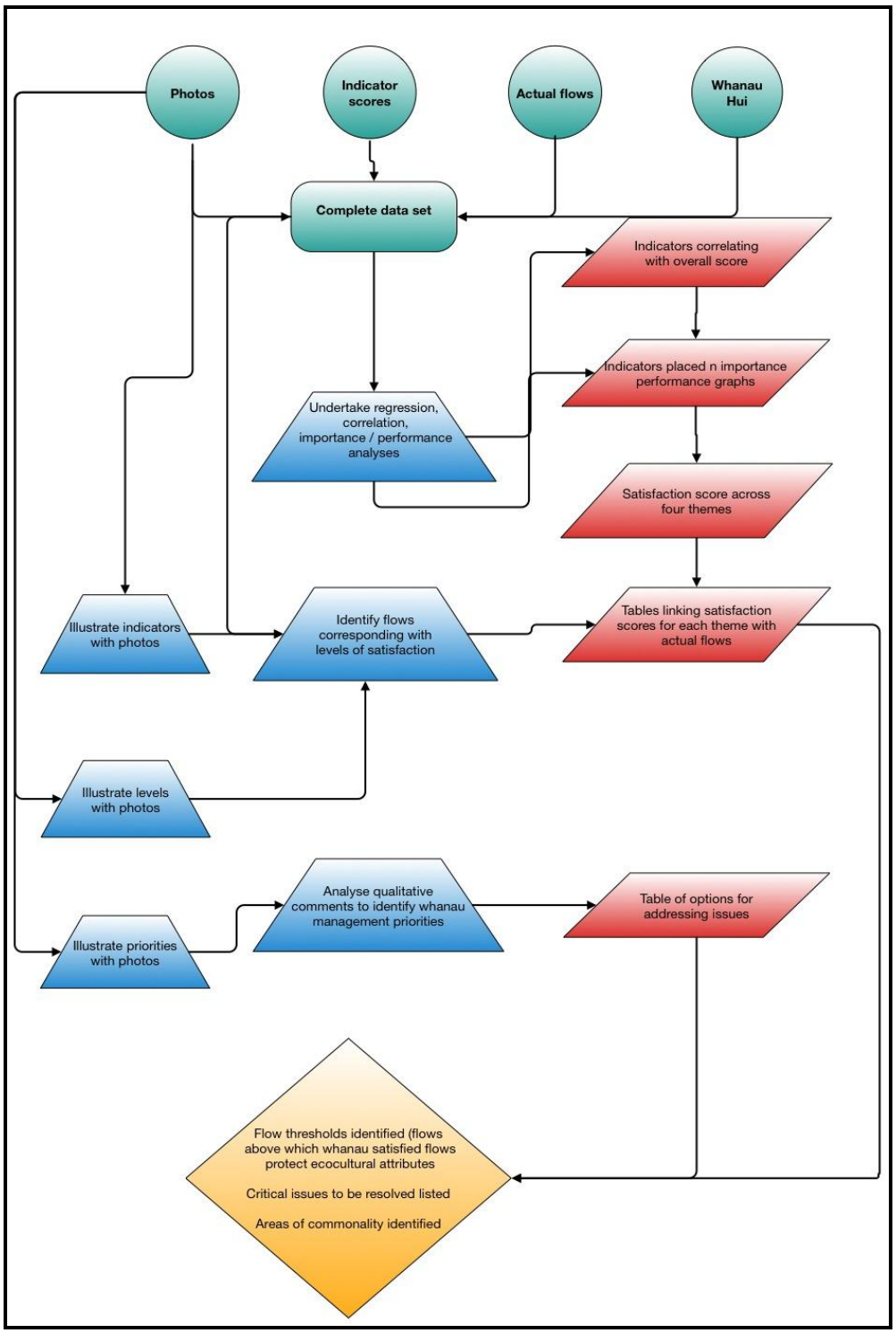
I have seen rotting piles of water weeds and thick sediment along with dead eels that have suffocated on the banks from drain cleaning exercises, which has made me have to choose a totally different area to harvest from, or to not gather at all.

I have waded through waste high mud and sediment that lies in places on the bed of our lake and tributary streams, and which has made it almost impossible for me to set nets or access sites for fishing and harvesting.

In and around the marae – Te Pa o Moki	• There is risk of contamination of waters through land intensification. • Water levels in spring fed streams are dropping. • Connections are being lost.
Kaituna Lagoon	• Concern also at risks of pollution from dairy farms – risk that toxins, antbiotics etc could all be included in the waste stream. • Mouth closes for long periods, potentially impacting migration and recruitment of migrating species especially eels • The freshwater / salt water interface changing with an impact on the biodiversity in the lagoon. • Loss of use leads to loss of practice, loss of tikanga associated with the practice and over time matauranga. • .
Coastal	• The character and composition of the beach is changing • The pattern of coastal erosion has changed and continues to change.

PART 6: RESULTS, ANALYSIS AND MANAGEMENT DIRECTIONS

Te Kete Ika o Rākaihautū/The Fish Basket of Rākaihautū restored



An overview of the Cultural Flow Process illustrating data collection, data analysis and results to be reported.

6.1 A Description Of The Analyses Taken To Enable The Identification Of Preferred Minimum Flows

In the following pages we present data from a range of analyses that help us identify the preferred flows that whanau belief will afford them the opportunities they seek.

Analysis 1

We summarise the attribute scores for the various flows in a colour coded table:

Use	Wai	Health and wellbeing	Cultural landscapes
1.3	4.2	2.7	2.7
2.3			

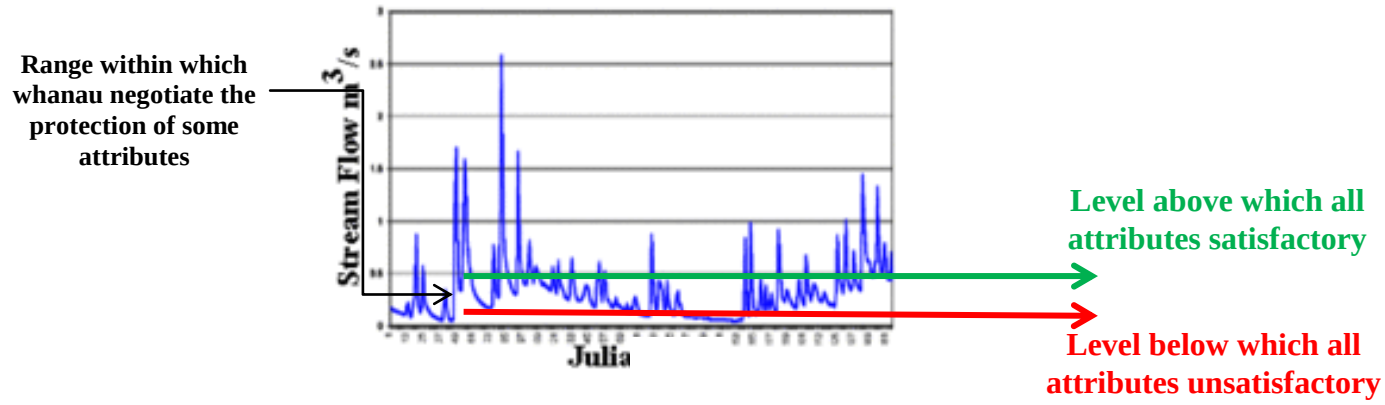
Of the 300+ matrices we have only included those that show the ratings for the COMAR flow recommended in this report. The numbers can range from 1 -7 so the colour coding is

- An attribute scoring less than 2 red
- An attribute scoring between 2 and 4 yellow
- An attribute scoring above 4 green

The number presented in the second line is the score assigned to the overall health of the stream which is based on an assessment of water quality parameters. This assessment is based on a 1 -5 scale.

Analysis 2

Attributes were scored on a 1 -7 scale. We examine the way in which whanau have scored each attribute under different flow regimes.



Analysis 3 – An Importance – Performance Analysis

Importance – Performance Analysis is a technique which is used mostly in quantitative market research. It first involves running a survey which asks the survey participants to rate various attributes which could affect overall satisfaction and finishes with a question asking the participant to rate their overall satisfaction. The analysis which follows compares the importance and performance of the attributes. Comparing the importance and performance of the attributes can give decision makers insights into what

needs improving the most. There are various ways of measuring importance and performance but for this analysis they are measured as follows:

Performance - An attributes performance was estimated simply by taking its mean value

Importance - An attributes importance was estimated by its correlation with overall satisfaction. Correlation is a measure of association between two variables. It indicates the strength and direction of the linear relationship between two variables. The correlation coefficient will always be between 1 and -1.

For each stream we include

- An importance and performance graph; and
- Based on the importance and performance graph, a list of priorities for protection and restoration.

Analysis 4 – Relationships between Attributes -

Correlation matrices for each of the rivers were produced based on the survey attribute data. Correlation matrices are simply a two way table which shows the correlations for each pair of variables. The correlations along the diagonal cells equal one by default and are often omitted when the matrix is displayed. The correlations are symmetric ie (cell x,y) would equal cell (y,x). Often only half the matrix (not included the diagonal) is displayed due to symmetry.

The correlation matrices displayed in this report have the diagonal cells replaced with hyphens (-) and the lower half omitted. The correlations between 0.8 and 1 are in bold. The correlations between -1 and 0 are in red. In the Appendix, for each stream we include a correlation matrix showing the relationship between attributes

Analysis 5 – Regression analysis

When in the field, whanau members assessed each of the 19 attributes and gave an overall rating of satisfaction with the flow observed. They also rated the health of the stream and gave an overall health score. We use the regression analyses and the correlations to confirm that the flow preferences were in fact dictated by the flow attribute assessment and NOT the health score. This is important given that the focus is setting minimum flows.

Analysis 6 – Flow Duration Curves

For some streams we have included a flow duration curve so that whanau know – when identifying their preferences – how often the river flow will be above their preferred levels.

Principles when considering the results of the analysis and determining minimum flows

1. Where the site was regularly visited by a COMAR team, we have based the flow recommendation on their preference.
2. Where a site was visited once by a COMAR team, we have identified their level of satisfaction, their health assessment on the date of the visit, and compared their data to the hydrological data, ecological flow recommendation, and the recommendation by OConnell and Smith.
3. Where a site was not visited by a COMAR team, but visited by O'Connell and Smith, we have maintained the recommendation by O'Connell and Smith.
4. Where a site was not visited by a COMAR team, and has not been visited by O'Connell and Smith, we have supported the ecological flow
5. Where whanau were NEVER satisfied at the flow being observed we have identified the flow levels that received the highest ratings from the COMAR team.
6. Flows are based on an assumption that there will be no further allocation in the Sewlyn Waihora catchment and that overallocation is to be addressed to bring the allocation levels closer to the recommendations in the NES.

6.2 Current Minimum Flows & Recommendations For Streams Visited Regularly

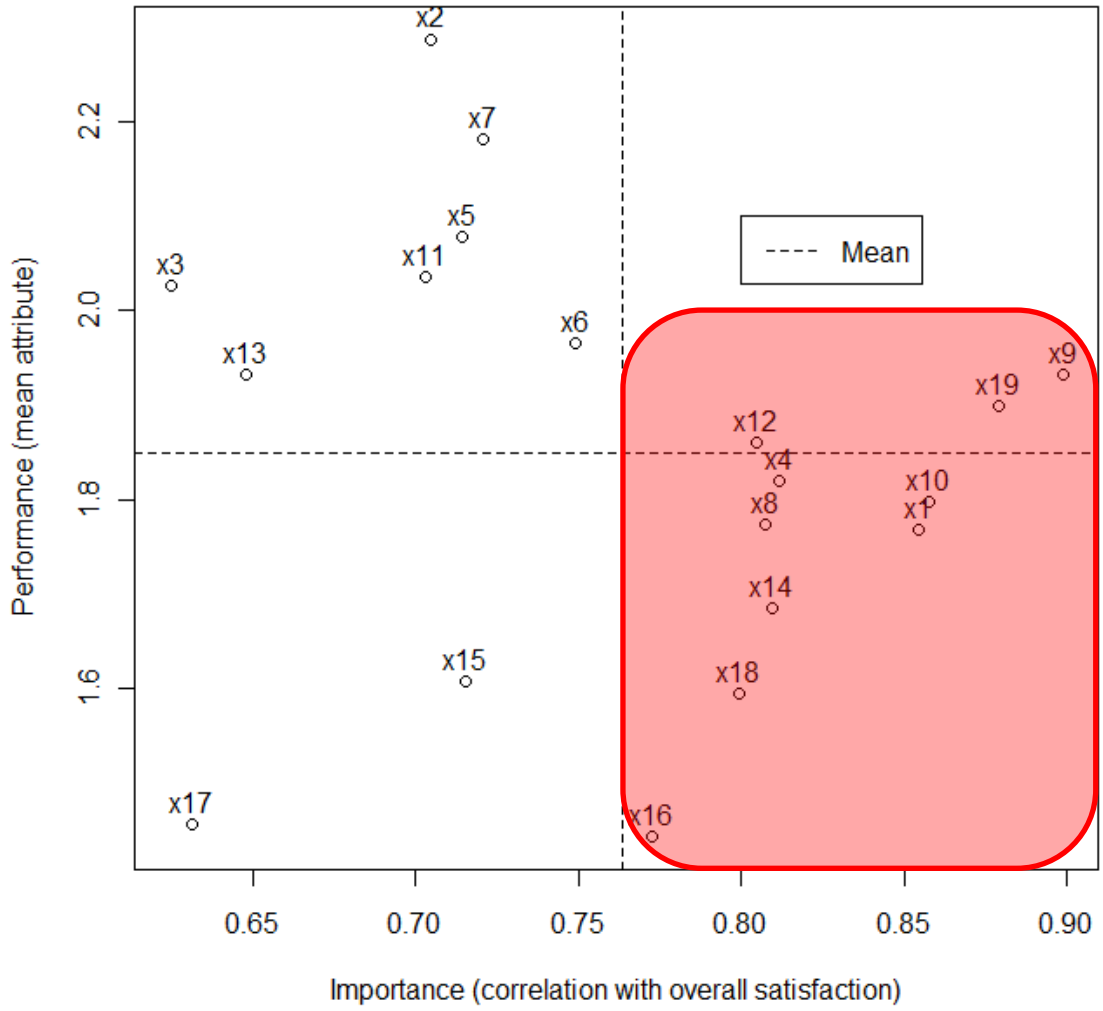
Boggy Creek

Current	Golders	Cultural Flow Preference
100 50	261*	**261**

Photo of current – A flow of 50 l/s was not observed. On the 30th March whanau observed a flow of 139 l/s – the closest to the minimum flow of 100 l/s. It received an overall satisfaction score of 1.8 (out of 7) and a cultural health score of 2. At this level none of the attributes received a satisfactory rating. Whanau oppose the current levels of 50 and 100 l/s

Photo of Golder recommendation – On 5 October flow observed a flow of 258 l/s. At this level the attributes relating to mahinga kai receive an average rating. The COMAR recommendation is consistent with the ecological recommendation

Importance – Performance Graph



Please note

- The low scoring (performance) for the all attributes – i.e. all less than 3 on a 1 -7 scale. This means that management needs to address all attributes.
- If there is a need to prioritise, those attributes that are more important in relation to others are enclosed and highlighted in red. The minimum flow needs to ensure:
  - *x1* *Flow protects features important to place names, tribal stories, whakapapa,etc*
  - *x4* *Flow keeps the river free of weed / algae-* ***across the year's observations this never received a satisfactory score.***
  - *x8* *Flow enables gathering at this site (i.e. is accessible, safe) –* ***this only occurs when flows are at or above that recommended flow***
  - *x9* *Flow enables a range of recreational uses*
  - *x10* *Flow keeps this site free of unnatural gravel buildups -* ***across the year's observations this never received a satisfactory score.***
  - *x12* *Flow enables cultural use of connected wetlands, springs & tributaries*
  - *x14* *Flow enables use of the river for health and wellbeing purposes* ***) These indicators***
  - *x16* *Flow enables whanau to be proud of this site* ***) rated as satisfactory***
  - *x18* *Flow enables development and use of Maori lands / reserves / easements*
  - *x19* *Flows link this site to other culturally significant sites*

Values & Opportunities sought

- Waipuna
- Spring fed
- Mix of riffles and runs
- Important mahinga kai
- Bullies, tuna (short fin & long fin), koaro, inanga,
- Never goes dry
- Important tributary supplying water to western side of lake
- Replanted in purei

Specific issues at this site

Willow encroachment

Weed management

Perceived threats

- Willow encroaching into channel
- High phosphorus
- E-coli above stock water levels on occasion
- Smell of effluent
- Evidence of poor management
- Excess effluent levels
- Contamination
- Low DO levels
- Nitrogen and phosphorus high

Management Priorities

- Fencing and restoration still needed
- Stock exclusion
- Identify contamination sources and address directly
- Limit setting
- Flow needs to exceed 100 l/s.
- Source springs are to be protected.
- Remove the nearby silage pit to remove risk of leaching.
- Edge habitats need to be protected
- Weed management needs to be consistent with any protocols that are agreed in Whakaora te Waihora – weed management has to consider biodiversity needs.
- All of the catchment needs to be managed – not just the reach close to the lake.

Summary matrix showing how themes scored at recommended flow

Use	Wai	Health and wellbeing	Cultural landscapes
2.81	2.54	2.06	2.54
2.3			

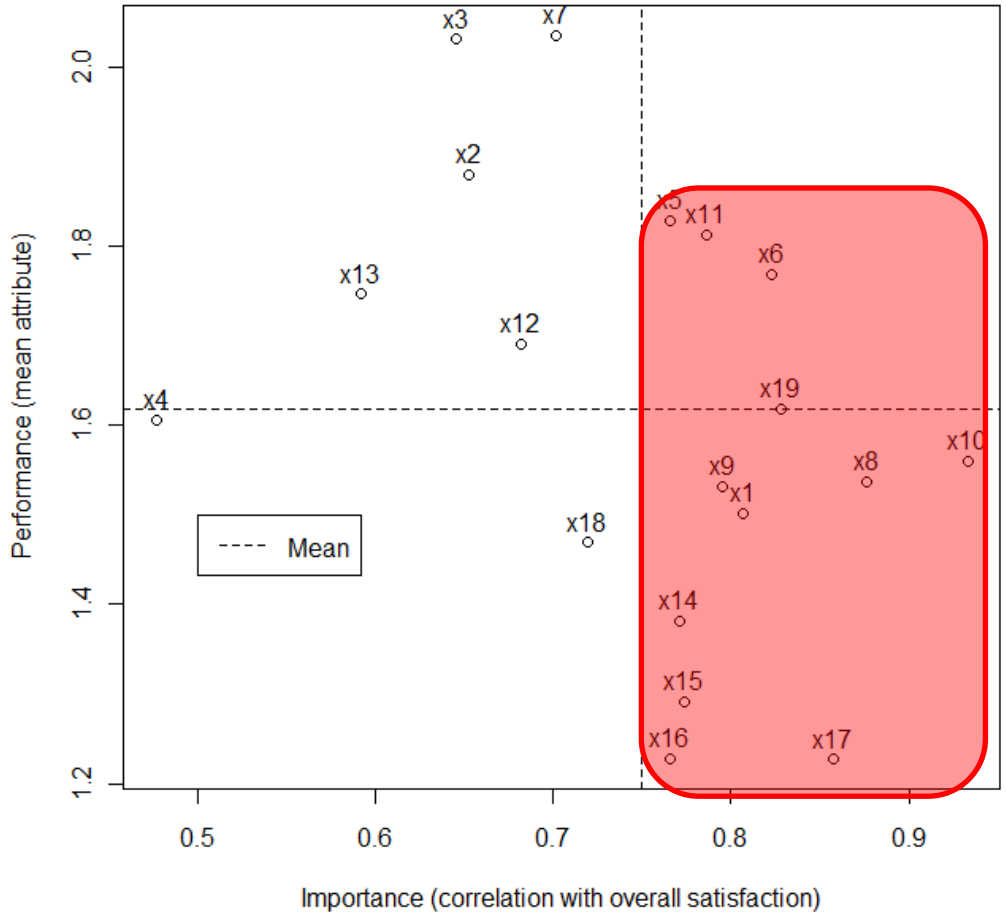
Doyleston Drain

Current	Golders	Cultural Flow Preference
60	5*	**50 – 60 – providing this provides depth of 30cm at eel migration time**

Photo of current - Whanau observed a flow of 69 l/s on the 25th May – the closest to the current minimum of 60 l/s.. It received an overall satisfaction score of 2 and a cultural health score of 2. None of the attributes got a satisfactory rating. Whanau do not support a reduction in the minimum from the current of 60 l/s. Whanau do note that the recommendation of Smith / O'Connell for 50 l/s.

The photo shows a flow of 69 l/s.

Importance – Performance Graph



Please note

- The low scoring (performance) for the all attributes – i.e. less than 2 on a 1 -7 scale. This means that management needs to address all attributes.
- If there is a need to prioritise, those attributes that are more important in relation to others are enclosed and highlighted in red. The minimum flow needs to ensure:
  - *x1* *Flow protects features important to place names, tribal stories, whakapapa, waiata etc*
  - *x5* *Flow provides a range of habitats instream and along riverbank*) ***Only satisfactory for***
  - *x6* *Flow protects mahinga kai species in and around this site*) ***mahinga kai attributes***
  - *x8* *Flow enables gathering at this site (i.e. is accessible, safe)*) ***if above 60l/s***
  - *x9* *Flow enables a range of recreational uses*
  - *x10* *Flow keeps this site free of unnatural gravel buildups*
  - *x11* *Flow keeps riparian wetlands, springs, and/or tributaries connected to mainstem*
  - *x14* *Flow enables use of the river for health and wellbeing purposes*
  - *x15* *Flow contributes to a good feeling about this site*
  - *x16* *Flow enables whanau to be proud of this site*
  - *x17* *Flow protects valued features at this site*
  - *x19* *Flows link this site to other culturally significant sites*

Values & Opportunities sought

- Rises from springs
- More natural below weir (downstream of Lake Road)
- Has mahinga kai values as substitute habitat
- Eels and mudfish present

- Stock excluded
- Riparian planting

Specific issues at this site

Weed management

Sedimentation

Perceived threats

- Highly modified straight channel
- Uniform morphology
- High phosphorus
- Dries most summers
- E-coli above stock water levels on occasion
- Need for planting or fencing
- Smell of effluent
- Evidence of poor management
- Excess effluent levels
- Contamination
- Silted riverbed
- Macracarpa when cut is dropped directly into the waterway.

Management Priorities

- Exclude stock
- Address passage issues – especially at the weir
- Establish habitat
- Manage weeds more sensitively recognising drains are substitute habitat
- Identify and then remove sediment inputs
- Remove macracarpa being deposited into the waterway
- Weed management needs to be consistent with any protocols that are agreed in Whakaora te Waihora – weed management has to consider biodiversity needs.

Summary matrix showing how themes scored at recommended flow

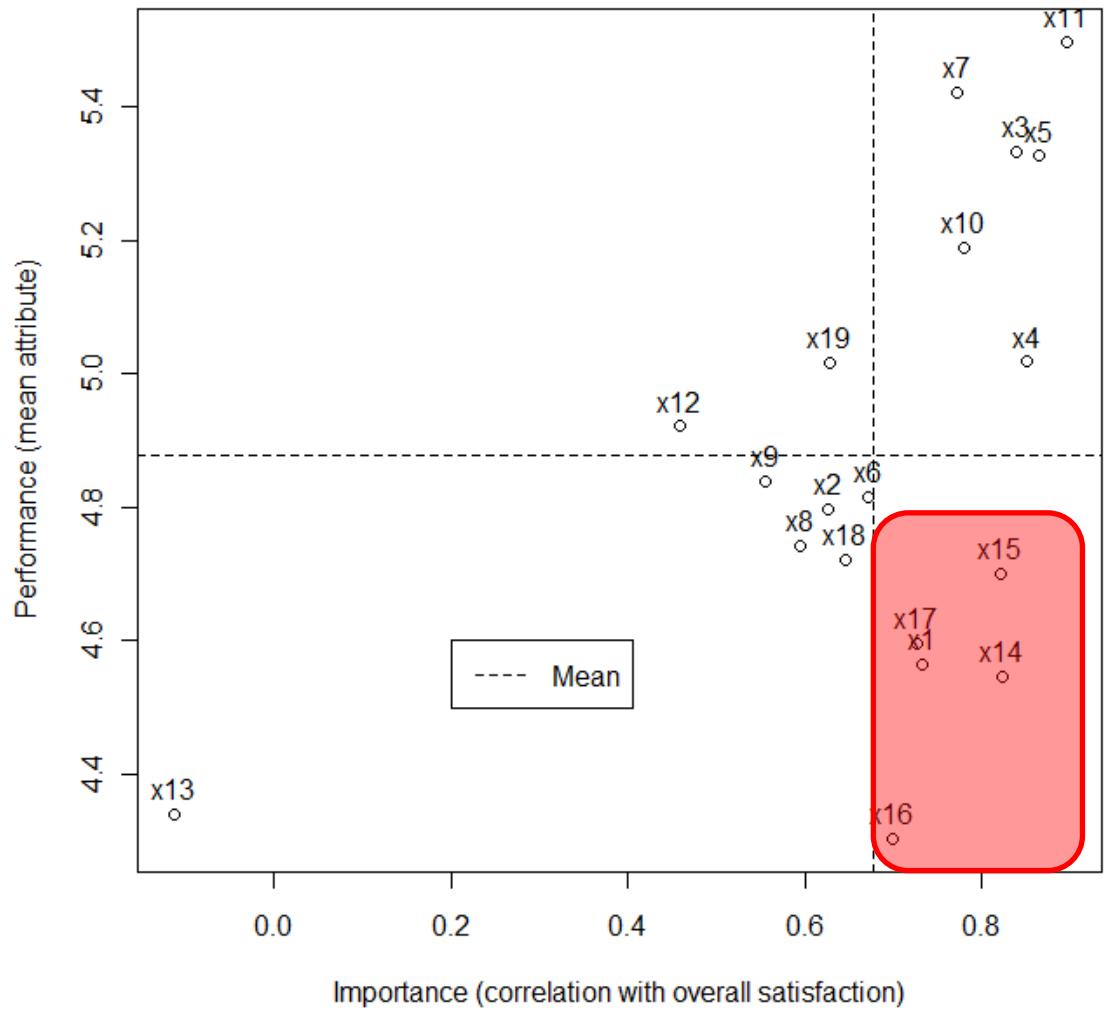
Use	Wai	Health and wellbeing	Cultural landscapes
2.03	2	1.33	1.65

Halswell River at Neills Rd

Current	Golders	**Cultural Flow Preference**
510 550 650	648	**648**

Photo of current – The lowest flow observed by whanau was 755l/s on the 26th March. It received an overall satisfaction score of 5.25 and a cultural health score of 4.25.

Importance – Performance Graph



Please note

- The high scoring (performance) for the all attributes – i.e. none less than 4.4 on a 1 -7 scale.
- If there is a need to prioritise, those attributes that are more important in relation to others are enclosed and highlighted in red. The minimum needs to ensure:
  - *x1* *Flow protects features important to place names, tribal stories, whakapapa, waiata etc*
  - *x6* *Flow protects mahinga kai species in and around this site*
  - *x14* *Flow enables use of the river for health and wellbeing purposes*
  - *x15* *Flow contributes to a good feeling about this site*
  - *x16* *Flow enables whanau to be proud of this site*
  - *x17* *Flow protects valued features at this site*

Values & Opportunities sought

- Shallows and pools
- Koura, tuna (shortfin and long fin) bully, flounder, smolt
- Divers, waterfowl, terns, scaup
- Halswell one of most important tributaries to the lake
- Catchment has significant population of long fin tuna

One of the principal issues in the Halswell (below this site) is weed management.

Photo shows the crane removing weed from the stream

Clumps of weed floating downstream

Perceived threats	Management Priorities
• Channelised • Weeds being actively managed • Silt covered bed • High phosphorus and nitrogen • Water quality issues need to be addressed • Suspected legacy contamination issues arising from discharges from southern Christchurch.	• Ensure that the Halswell River itself contributes the 648 l/s and the level in the river is not maintained artificially by the backflow from a high lake level. • Weed management needs to be consistent with any protocols that are agreed in Whakaora te Waihora – weed management has to consider biodiversity needs.

Summary matrix showing how themes scored at recommended flow

Use	Wai	Health and wellbeing	Cultural landscapes
5.88	5.5	5.8	5.75
4.33			

Flow Duration Curve

The flow duration curve is a plot that shows the percentage of time that flow in a stream is likely to equal or exceed some specified value of interest

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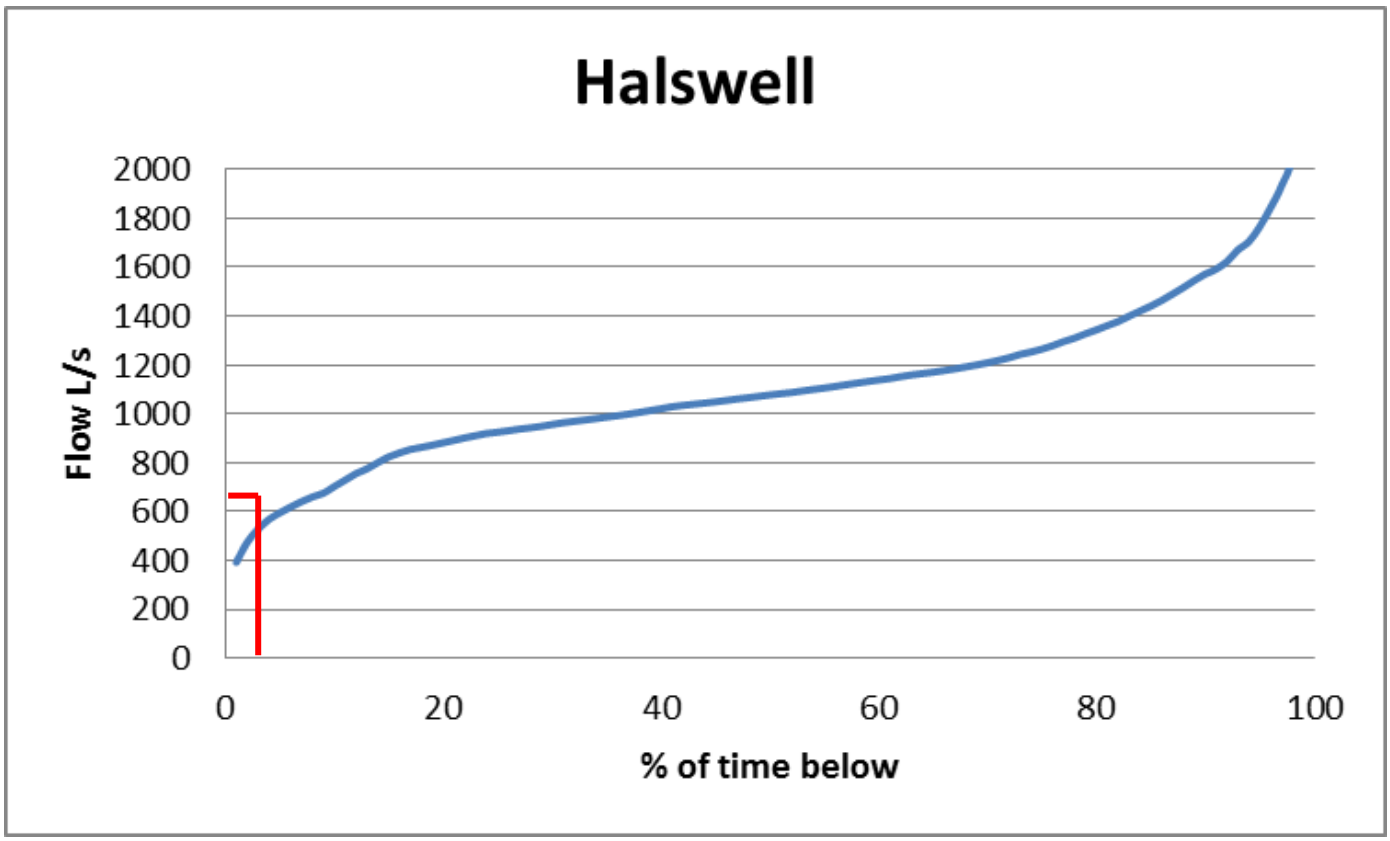
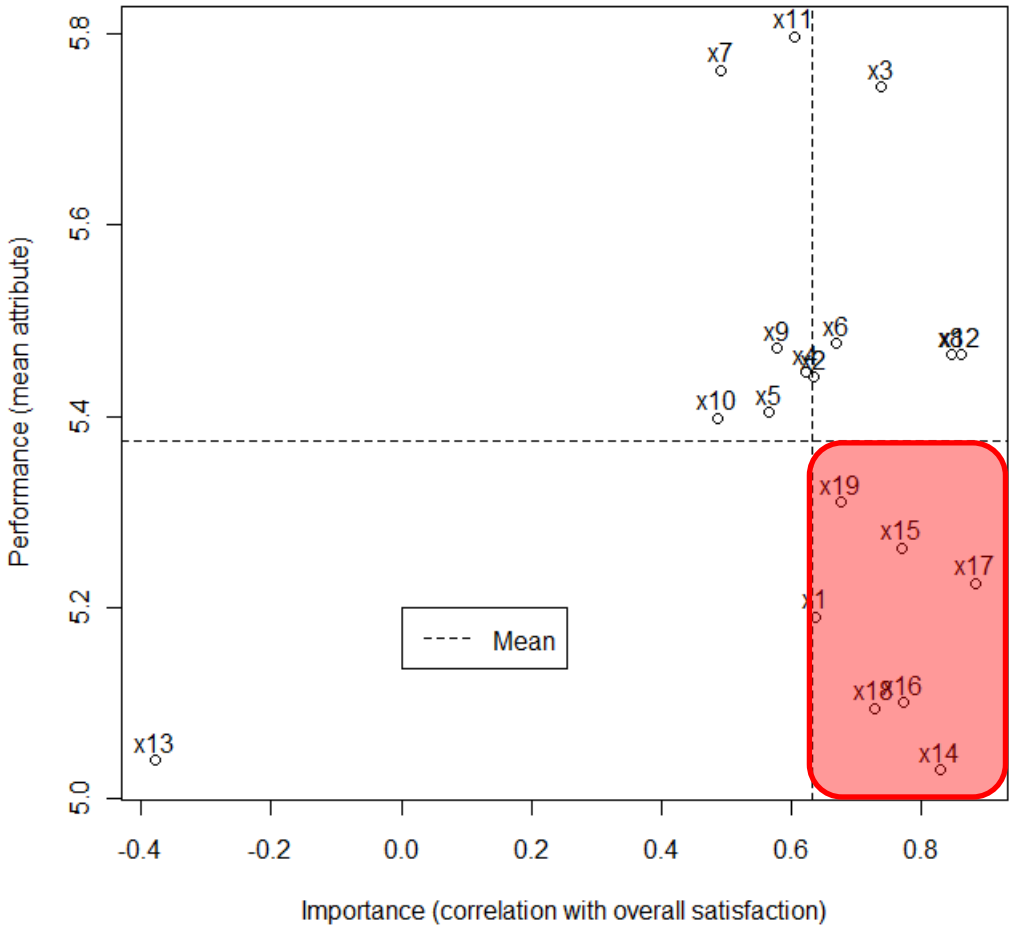


Halswell River at Ryan's Bridge

Current	Golders	**Cultural Flow Preference**
Recorder - no min flow	532	**532**

Whanau observed flows around 530 on 3 occasions. Each time the site received an overall satisfaction score above 5 and a cultural health score above 4. At a flow of 530 l/s on every occasion, all attributes received a satisfactory score.

Importance – Performance Graph



Please note

- The high scoring (performance) for the all attributes – i.e. none less than 5 on a 1 -7 scale.
- If there is a need to prioritise, those attributes that are more important in relation to others are enclosed and highlighted in red. The minimum flow needs to ensure:
  - *x1 Flow protects features important to placenames, stories, whakapapa, waiata etc*
  - *x6 Flow protects mahinga kai species in and around this site*
  - *x14 Flow enables use of the river for health and wellbeing purposes*
  - *x15 Flow contributes to a good feeling about this site*
  - *x16 Flow enables whanau to be proud of this site*
  - *x17 Flow protects valued features at this site*
  - *x18 Flow enables development and use of Maori lands / reserves / easements*
  - *x19 Flow link this site to other culturally significant sites*

Summary matrix showing how themes scored at recommended flow

Use	Wai	Health and wellbeing	Cultural landscapes
5.4	4.5	5.17	5.17
4.25			

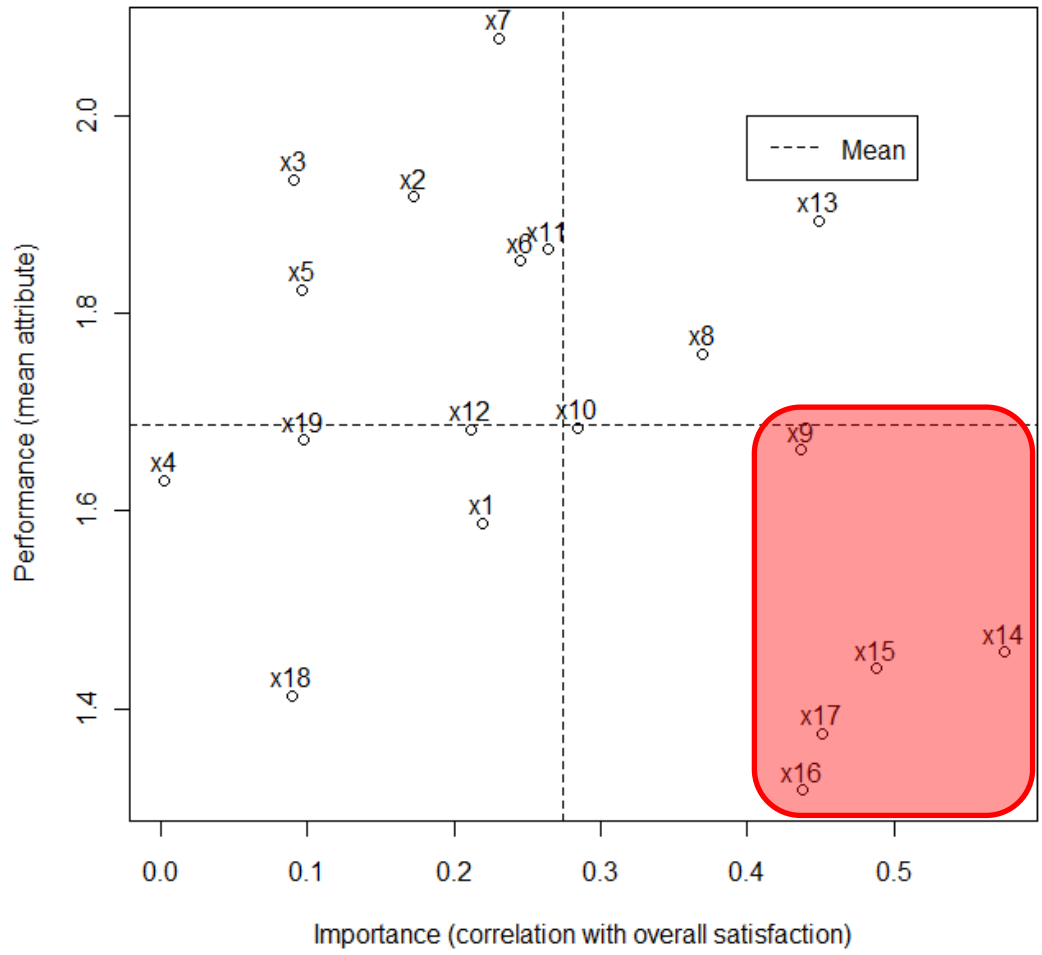
Hanmer Rd Drain at Lower Lake Rd

Current	Golders	**Cultural Flow Preference**
100 200	258	**260**

Photo of current - Whanau observed a flow of 115 l/s on the 30 March. It received an overall satisfaction score of 2 and a cultural health score of 1.75. Other flows observed between 100 – 200 l/s failed to receive a satisfaction score above 2. On each of these occasions none of the 19 attributes received a satisfactory rating.

Photo of preference – Whanau observed a flow of 267 l/s (which is similar to that recommended by Golders) and support their recommendation. The mahinga kai attributes are rated as low – average but compared to the other flows observed are the highest when the flow is around 260 l/s. Thus a COMAR recommendation is consistent with the ecological flow.

Importance – Performance Graph



Please note

- The low scoring (performance) for the all attributes – i.e. none more than 2 on a 1 -7 scale.
- If there is a need to prioritise, those attributes that are more important in relation to others are enclosed and highlighted in red. The minimum flow needs to ensure:
  - *x9* *Flow enables a range of recreational uses* *)*
  - *x14* *Flow enables use of the river for health and wellbeing purposes* *)* ***These never received***
  - *x15* *Flow contributes to a good feeling about this site* *)* ***a satisfactory score***
  - *x16* *Flow enables whanau to be proud of this site* ***) reflecting the stream***
  - *x17* *Flow protects valued features at this site* *)* ***being used as a drain***

Values & Opportunities sought

- Drain flows into the south tributary of Irwell
- Sourced from springs

Perceived threats

- 18 weirs on the drain – some impassable for aquatic fish species
- Affected by irrigation
- Limited riparian cover
- Flow sluggish
- High phosphorus
- Need for planting or fencing

Management Priorities

- Protect source springs
- Manage as a significant tributary to the Irwell
- Address fish passage issues.
- Replant native species
- Exclude stock
- Weed management needs to be

• Smell of effluent • Evidence of poor management • Excess effluent levels • Contamination • Siltation • Nitrogen and phosphorus high	consistent with any protocols that are agreed in Whakaora te Waihora – weed management has to consider biodiversity needs.

Summary matrix showing how themes scored at recommended flow

Use	Wai	Health and wellbeing	Cultural landscapes
2.17	2.38	2.44	2
2.17			

Harts Creek

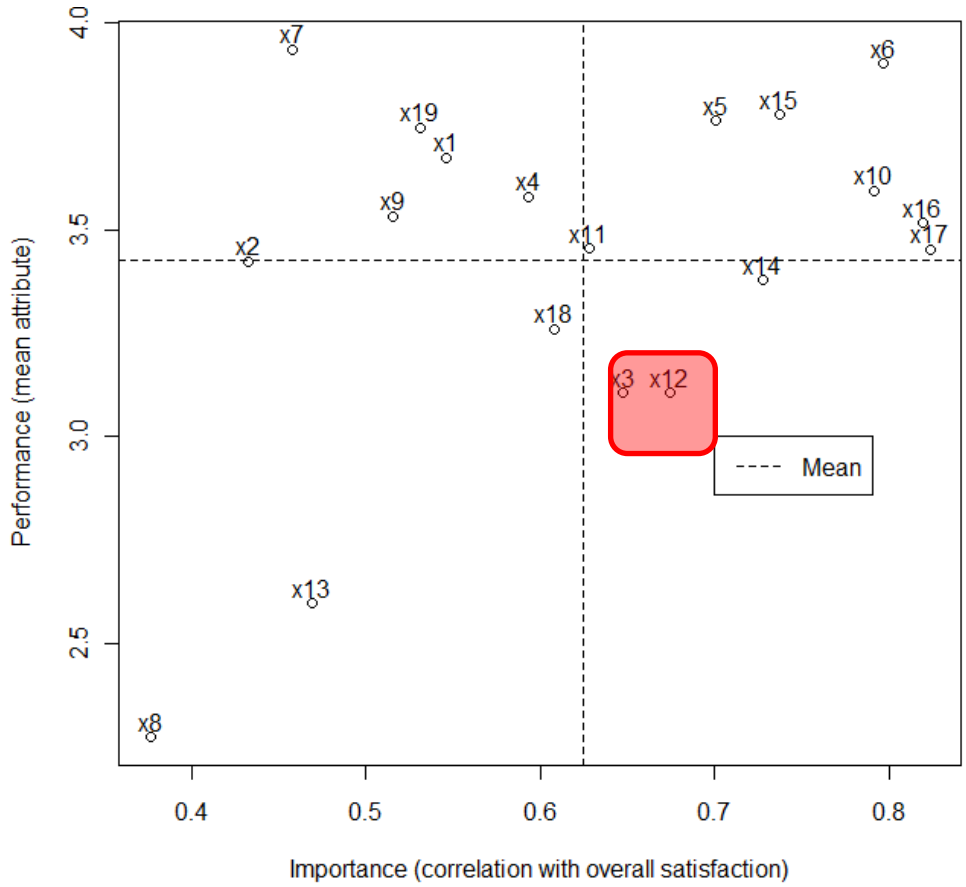
Current	Golders	**Cultural Flow Preference**
1000	748	**1200 - 1400**

The flow of 748 l/s is not supported by whanau.

Photo of current – Whanau observed flow a 1200 l/s. It received an overall satisfaction score of 3.83 and a cultural health score of 3.17. At this level 73% of the attributes were rated as satisfactory. The main concerns at this level related to the impact of low flows on corrections of springs, wetlands, and tributaries.

When flows were at 1400 l/s 89% of the attributes were rated as satisfactory.

Importance – Performance Graph



Please note

The average scoring (performance) for most attributes – i.e. ranging from 2.5 to 4 on a 1 -7 scale. But there are two areas in need to attention:

x3 *Flow keeps the riverbank vegetation watered*) ***Not an issue if flows above 1200l/s***

x12 Flow enables cultural use of connected wetlands, springs etc.) ***Not an issue if flows above 1400l/s***

Values & Opportunities sought

- Raupo dominated swampland around creek
- Lowland springfed stream
- 4 – 8m wide constant flow
- Sustains eeling, camping, picnicking
- Taonga values high
- Contributes significant flow to Waihora
- Sustains bittern population
- Restoration underway
- Traditional placename promoted.

Perceived threats

- Level dropping due to extraction of groundwater
- Need for planting or fencing
- Smell of effluent
- Evidence of poor management
- Excess effluent levels
- Contamination
- Stock have access

Management Priorities

- Further fencing and restoration still needed
- Limit setting
- Manage waterway as a significant to Waihora
- Protect springs
- Investigate the flow needed to maintain connections the lake.

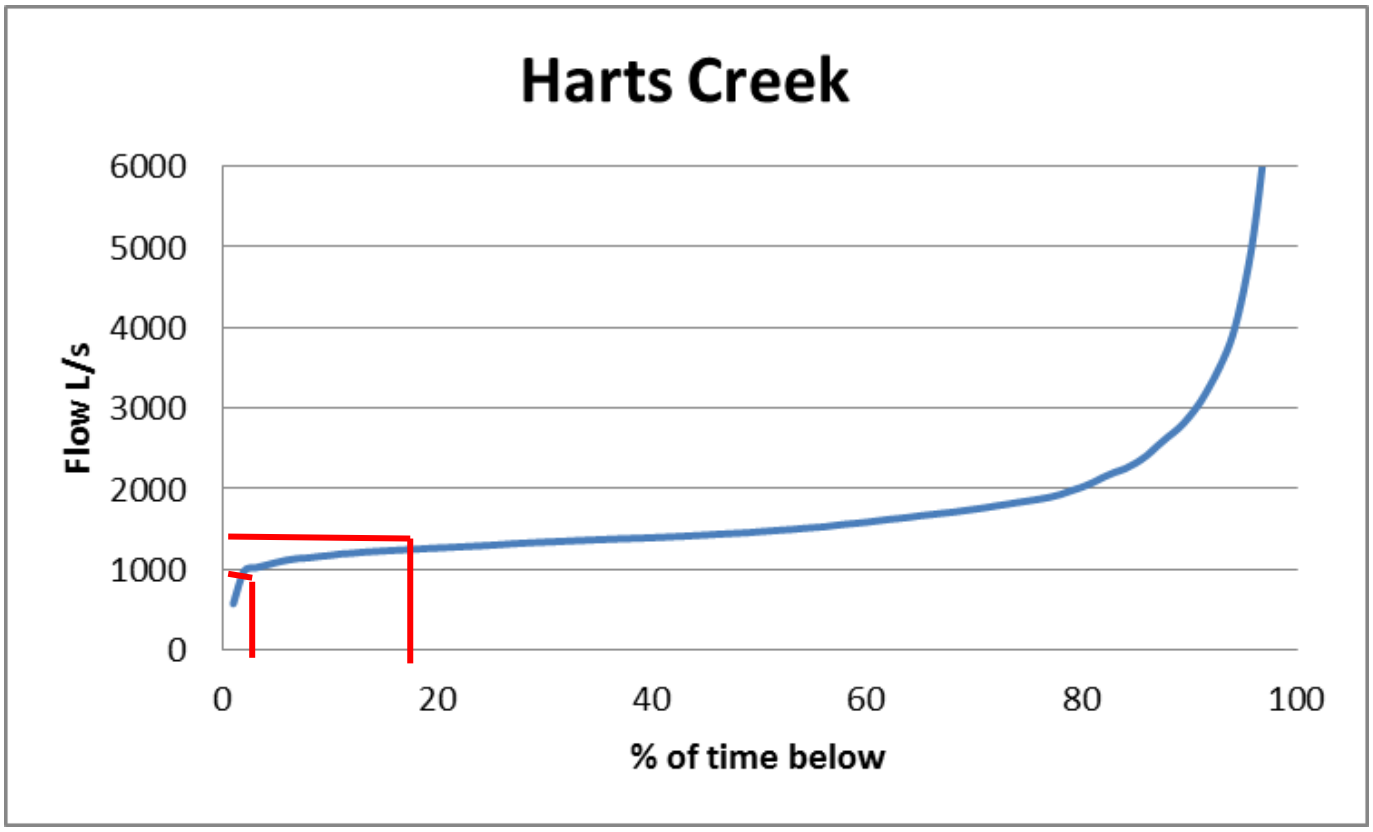
• Nitrogen levels elevated • Channelised • Siltation issues • Flow does not reach the mouth when flows are low.	

Summary matrix showing how themes scored at recommended flow

Use	Wai	Health and wellbeing	Cultural landscapes
4.67	3.58	3.76	4.67
3.83			

Flow Duration Curve

The flow duration curve is a plot that shows the percentage of time that flow in a stream is likely to equal or exceed some specified value of interest.



Irwell River at Lake Rd

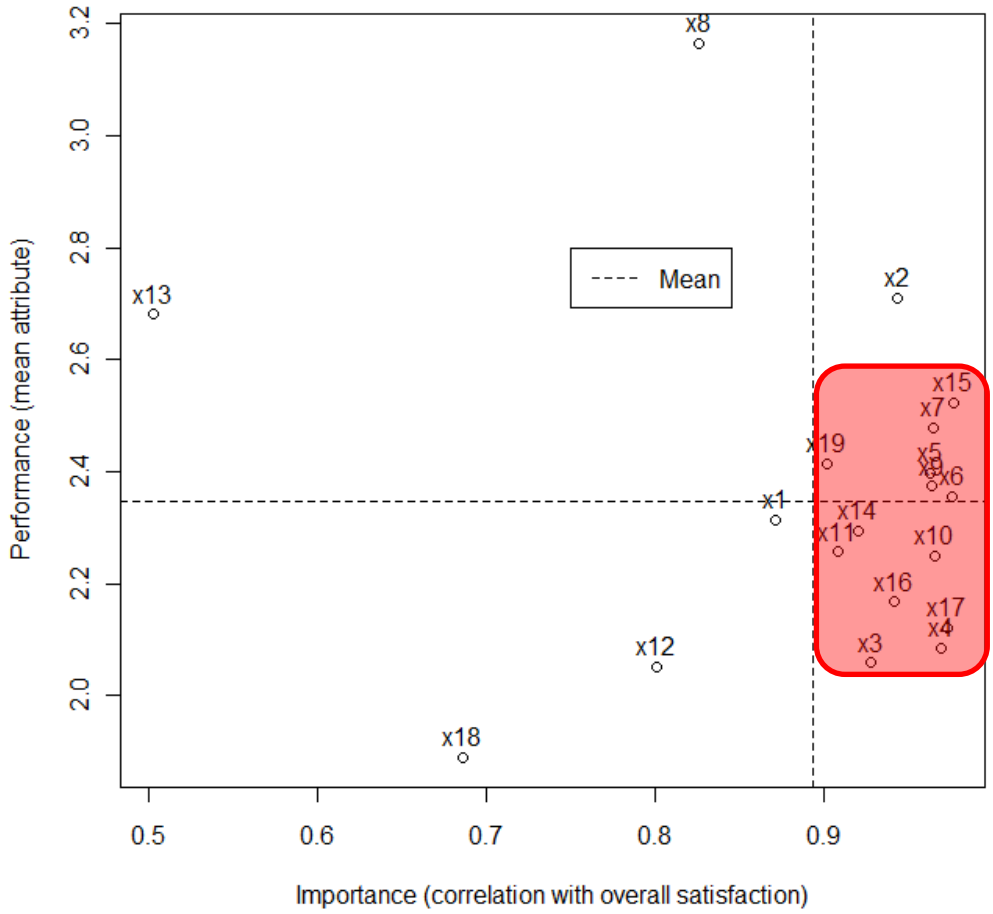
Current	Golders	**Cultural Flow Preference**
300 300	637	**890 l/s – 1100 l/s**

Photo of current - Whanau observed flow of approximately 350 l/s – the flow closest to the minimum. It received an overall satisfaction score of 1 and a cultural health score of 1.2. At this level none of the attributes were rated as satisfactory. When the flow was observed in January 2013 "The flow was gone"

Photo below shows 350 l/s

When flows were at 890 l/s 60% of the attributes were rated as satisfactory – mainly mahinga kai attributes. If flows were at 1100 l/s 89% of attributes would be rated as satisfactory including some health & wellbeing, and cultural landscape attributes . Photo of recommended (approximately 890 l/s)

Importance – Performance Graph



Please note

- The low – average scoring (performance) for the all attributes – i.e. ranging from 2 – 3.2 on a 1 -7 scale.
- If there is a need to prioritise, those attributes that are more important in relation to others are enclosed and highlighted in red. The minimum flow regime needs to ensure:
  - *x3* *Flow keeps the riverbank vegetation watered*)
  - *x4* *Flow keeps the river free of weed / algae*) ***Satisfied if above 900 l/s***
  - *x5* *Flow provides a range of habitats instream and along riverbank*)
  - *x6* *Flow protects mahinga kai species in and around this site*)
  - *x7* *Flow enables fish to move throughout the catchment*)
  - *x9* *Flow enables a range of recreational uses*)
  - *x10* *Flow keeps this site free of unnatural gravel buildups*
  - *x11* *Flow keeps riparian wetlands, springs, and/or tributaries connected to mainstem*
  - *x13* *Flow appears to have been higher recently - evidence is present*
  - *x14* *Flow enables use of the river for health and wellbeing purposes*)
  - *x15* *Flow contributes to a good feeling about this site*) ***Satisfied above 1100 l/s***
  - *x16* *Flow enables whanau to be proud of this site*)
  - *x17* *Flow protects valued features at this site*)
  - *x19* *Flows link this site to other culturally significant sites*) ***Satisfied if above 1200 l/s***

Regression modelling suggested that the health of the site might be influencing the overall level of satisfaction and not solely the level of flow.

Values & Opportunities sought

- Mix of shallows, riffles, pools,
- Spring and rainfall fed
- Gets flows from Selwyn when floods
- Very deep springs in upper river (valued as waipuna)

- Wahi tapu at mouth
- Harakeke highly valued
- Sustains tuna (long fin, short fin)
- Connections to lake, to Selwyn important.
- Connections – ki uta ki tai – important as part of old trail.

Specific issues at this site

Dead fish (trout) observed with others gasping for air at 345 l/s

Sediment blocking the stream at 350 l/s

Perceived threats

- Sediment clogging
- High phosphorus
- Passage impeded by clogging
- Dewatered reaches upstream of Lake Road
- Stagnant in parts
- Need for planting or fencing
- Smell of effluent
- Evidence of poor management
- Excess effluent levels
- Contamination
- Low DO levels
- Elevated phosphorus levels
- Suffers from low flows

Management Priorities

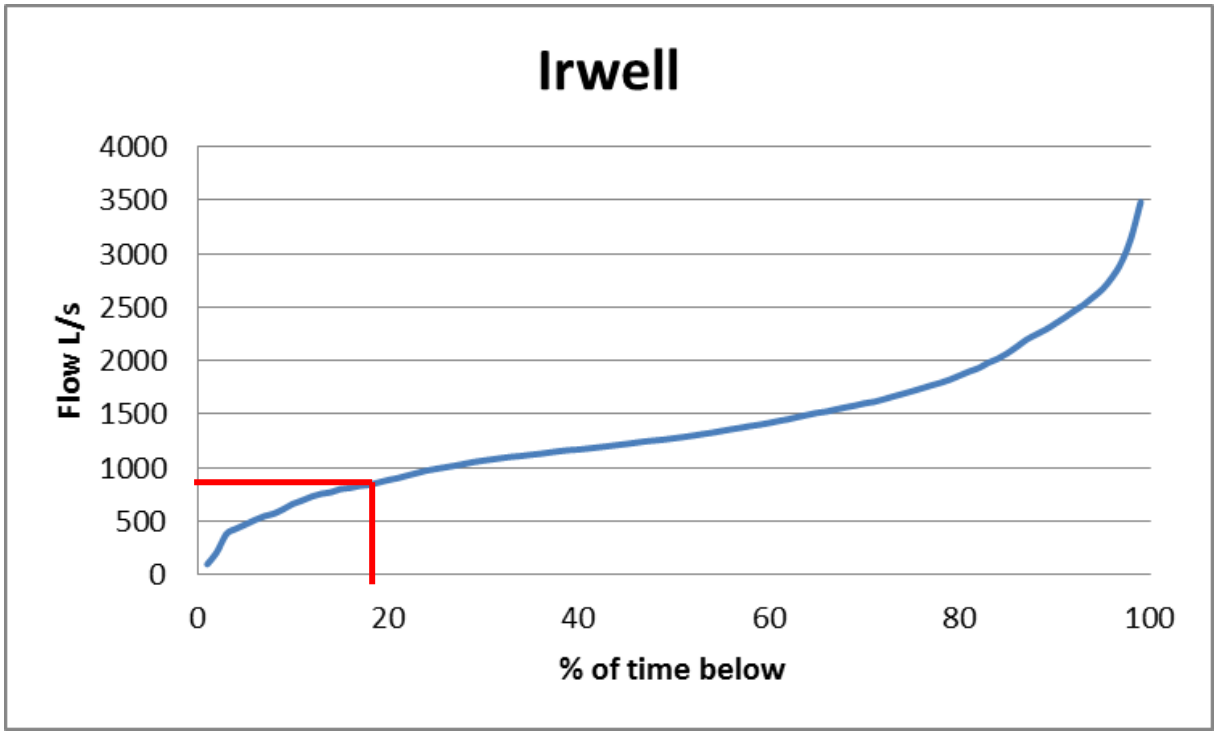
- Protection of springs in the headwaters
- Maintain connections ki uta ki tai
- Waiwhio – traditional name to be promoted.
- Water quality needs to be enhanced.

Summary matrix showing how themes scored at recommended flow

Use	Wai	Health and wellbeing	Cultural landscapes
3.6	2.3	3.44	2.75
3.16			

Flow Duration Curve

The flow duration curve is a plot that shows the percentage of time that flow in a stream is likely to equal or exceed some specified value of interest.



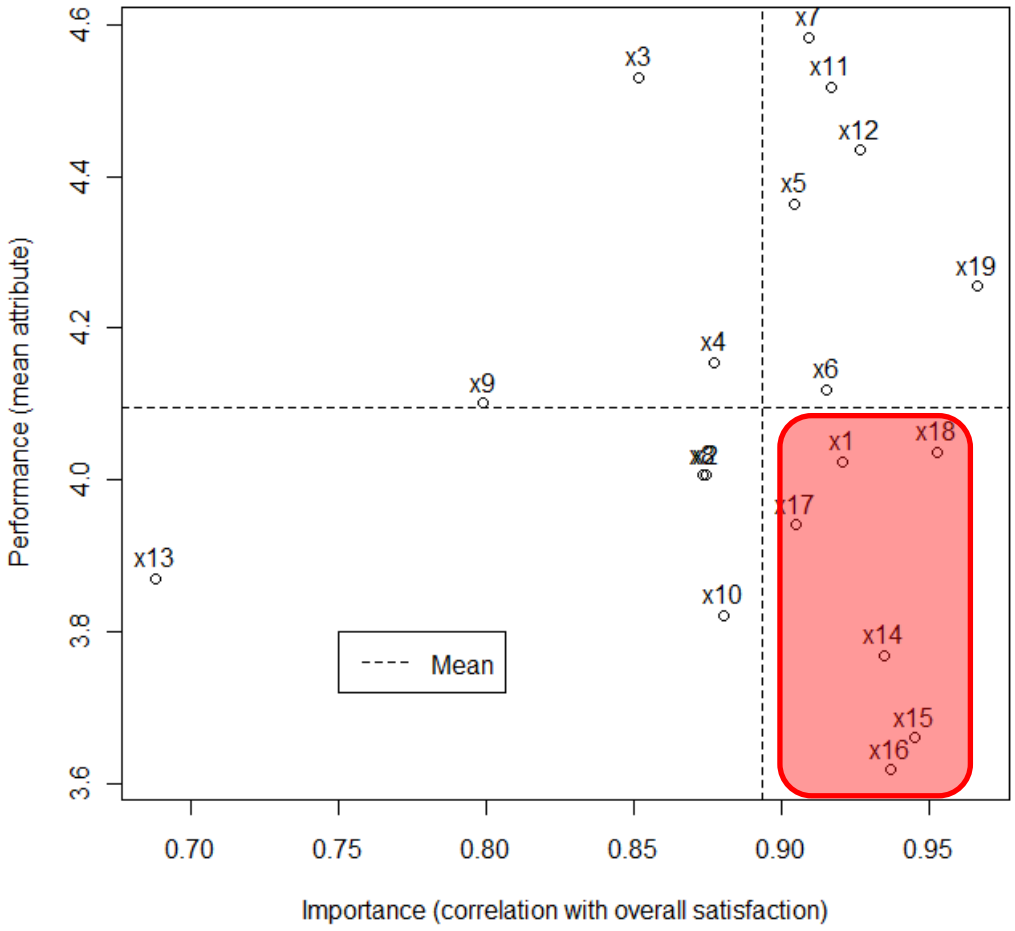
Kaituna River at Kaituna Valley Rd

Current	Golders	**Cultural Flow Preference**
60 325	32*	**100**

Photo of current – Whanau did not see a flow of 60 l/s but they did see a flow of 314 l/s on 12 March, which is the flow closest to the minimum of 325 l/s. Whanau do not support the Golder's recommendation.

Photo of preference – On two occasions whanau observed a flow of approximately 100 l/s. They received on average an overall satisfaction score of 4.6 and a cultural health score of 3.5. At this level the majority of attributes received a satisfactory rating.

Importance – Performance Graph



Please note

- average scoring (performance) for the all attributes – i.e. ranging from 3.6 – 4.6 on a 1 -7 scale.
- If there is a need to prioritise, those attributes that are more important in relation to others are enclosed and highlighted in red. The minimum flow regime needs to ensure:
  - *x14 Flow enables use of the river for health and wellbeing purposes)*
  - *x15 Flow contributes to a good feeling about this site) **Satisfactory above 100 l/s***
  - *x16 Flow enables whanau to be proud of this site)*
  - *x17 Flow protects valued features at this site*
  - *x19 Flows link this site to other culturally significant sites)*
  - *x1 Flow protects features important to place names etc) **Scores best above 145 l/s***
  - *x18 Flow enables development and use of Maori lands / reserves*

Values & Opportunities sought

- Sustains tuna (short fin and long fin), inanga, kokopu, koaro, torrentfish, bullies, smelt, kanakana
- Waterfowl present
  Clean water

Perceived threats

- Degraded in lower reaches.
- Stock access to waterway
- Low flows in summer.
- Sedimentation.

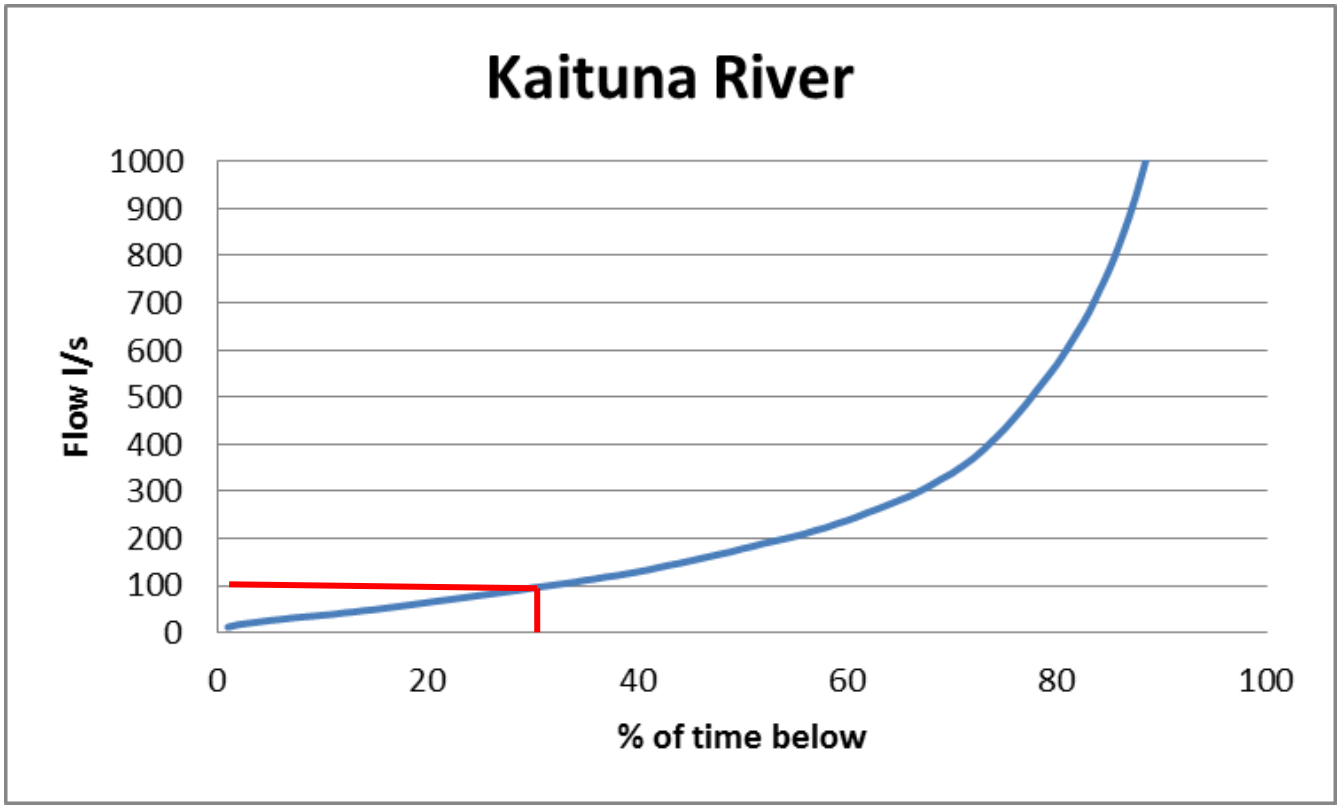
Management Priorities

- Exclude stock
- Replant riparian margins
- Minimise contaminant inputs to the stream
- Minimise sediment inputs to the system
- Ensure that the River itself contributes the 100 l/s and the level in the river is not

	maintained artificially by the backflow from a high lake level.

Summary matrix showing how themes scored at recommended flow

Use	Wai	Health and wellbeing	Cultural landscapes
5.5	5.5	5.68	5.4
4			



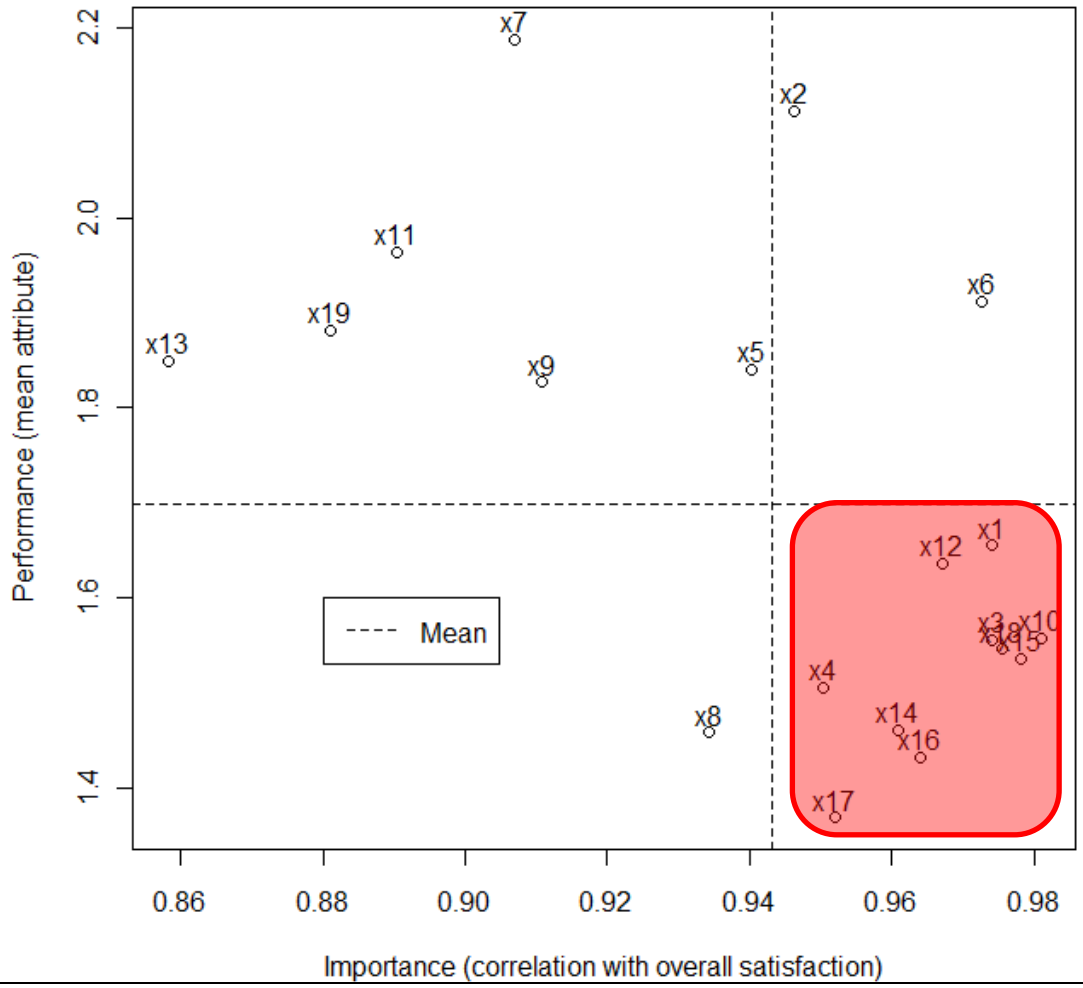
L-II River at Moir's Property

Current	Golders	Cultural Flow Preference
120 120 350 690	Not covered	**290 l/s**

Whanau did not see any of the current flow levels. The lowest flow observed was 160 l/s. It received an overall satisfaction score of 2.33 and a cultural health score of 1.83. None of the 19 attributes received a satisfactory rating at this flow level.

Whanau observed a flow of 290 l/s. It received an overall satisfaction score of 3.83 and a cultural health score of 3. At this level 84% of the attributes were satisfied.

Importance – Performance Graph



Please note

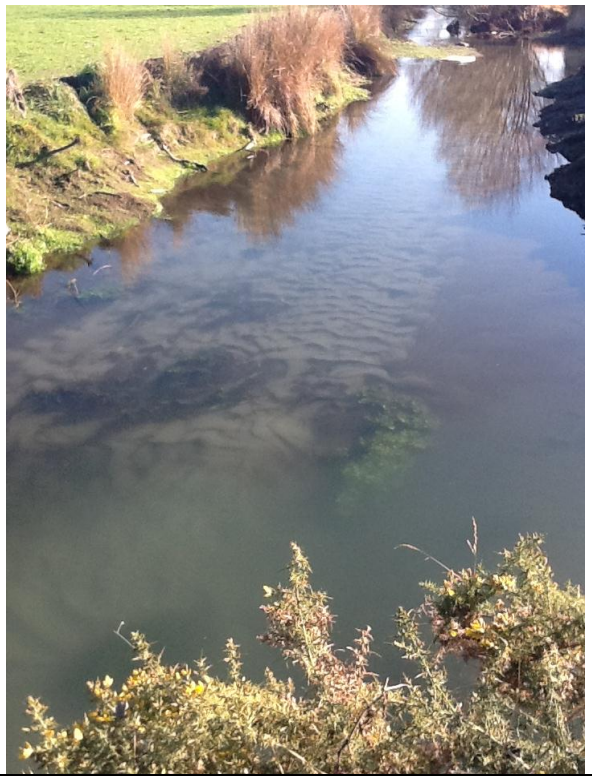
- Low scoring (performance) for the all attributes – i.e. ranging from 1.8 – 2.2 on a 1 -7 scale.
- If there is a need to prioritise, those attributes that are more important in relation to others are enclosed and highlighted in red. The minimum flow regime needs to ensure:
  - *x1 Flow protects features important to place names, stories, whakapapa, waiata etc*
  - *x3 Flow keeps the riverbank vegetation watered*
  - *x4 Flow keeps the river free of weed / algae*
  - *x10 Flow keeps this site free of unnatural gravel buildups*
  - *x12 Flow enables cultural use of connected wetlands, springs & tributaries*
  - *x14 Flow enables use of the river for health and wellbeing purposes*
  - *x15 Flow contributes to a good feeling about this site*

- *x16 Flow enables whanau to be proud of this site*
- *x17 Flow protects valued features at this site*
- *x18 Flow enables development and use of Maori lands / reserves / easements*

Values & Opportunities sought

- Spring fed lowland tributary – one of larger feeding Waihora
- Also fed by drains in upper reaches
- Shallows and pools.
- Wai koura, torrentfish, bullies, tuna (long fin and short fin) kanakana, inanga
- Known to support a significant population of long fin tuna
- Mallards, herons
- Traditional placename promoted.

Specific issues at this site – the photos reflect the issues associated with infestation of weeds and accumulation of sediment



Perceived threats	Management Priorities
• Goldfish • Poor water quality • Sediment increases downstream • Evidence of poor management • Contamination • Algae, weed	• Fencing and restoration still needed, especially in riparian margins • Weed management • Identify contamination sources • Limiting sediment inputs to the stream • Minimising the impacts of subdivisions on waterways • Maintain healthy instream habitats • Weed management needs to be consistent with any protocols that are agreed in Whakaora te Waihora – weed management has to consider biodiversity needs. • The site “needs a bloody good tidy up”

However, seeing a site in this condition raised concerns among team members

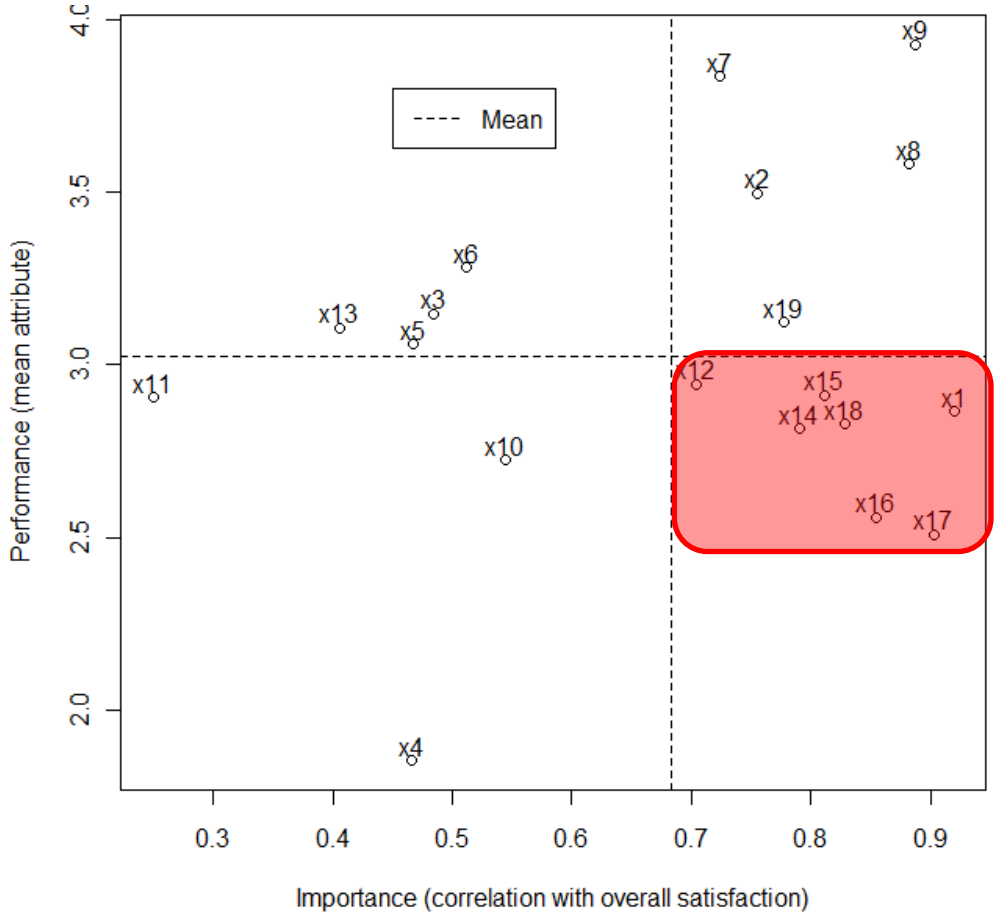
L-II River at Wolfes Rd

Current	Golders	Cultural Flow Preference
560 1330 1500	1240	**2100 – 2400**

Photo of current – Whanau did not observe flows at any of the minimum flow levels. The lowest observed was 2100 l/s. It received an overall satisfaction score of 3.33 and a cultural health score of 2.8. At this level 42% of the attributes received a satisfactory rating.

Photo of preference – At a flow of 2400 l/s 54% of the attributes were satisfied.

Importance – Performance Graph



Please note

- the spread of scoring (performance) for the all attributes – i.e. ranging from below 2 – 4 on a 1 -7 scale.
- If there is a need to prioritise, those attributes that are more important in relation to others are enclosed and highlighted in red. The minimum flow regime needs to ensure:
  - *x1 Flow protects features important to place names etc – **above 2700 l/s***
  - *x12 Flow enables cultural use of connected wetlands, springs etc – **above 2100 l/s***
  - *x14 Flow enables use of the river for health and wellbeing purposes)*
  - *x15 Flow contributes to a good feeling about this site)*
  - *x16 Flow enables whanau to be proud of this site) **above 2400 l/s***
  - *x17 Flow protects valued features at this site)*
  - *x18 Flow enables development and use of Maori lands etc)*

Values & Opportunities sought

- Wai koura present
- Traditional placename promoted.

Specific issues at this site – weed management is an issue – at present weed is dragged from the stream (left) and dumped (right).


It is then placed in the structure shown at left which is located in an open field (right) and left to rot. The odour does not make the site conducive to use.


Perceived threats

- Goldfish, rudd
- Contamination
- Algae, weed
- Sedimentation – a koura was found covered in sediment

Management Priorities

- Weed management needs to be consistent with any protocols that are agreed in Whakaora te Waihora – weed management has to consider biodiversity needs.
- Identify and minimise contamination sources
- The good aquatic plants need to be protected and not removed during weed cleaning operations.

Summary matrix showing how themes scored at recommended flow

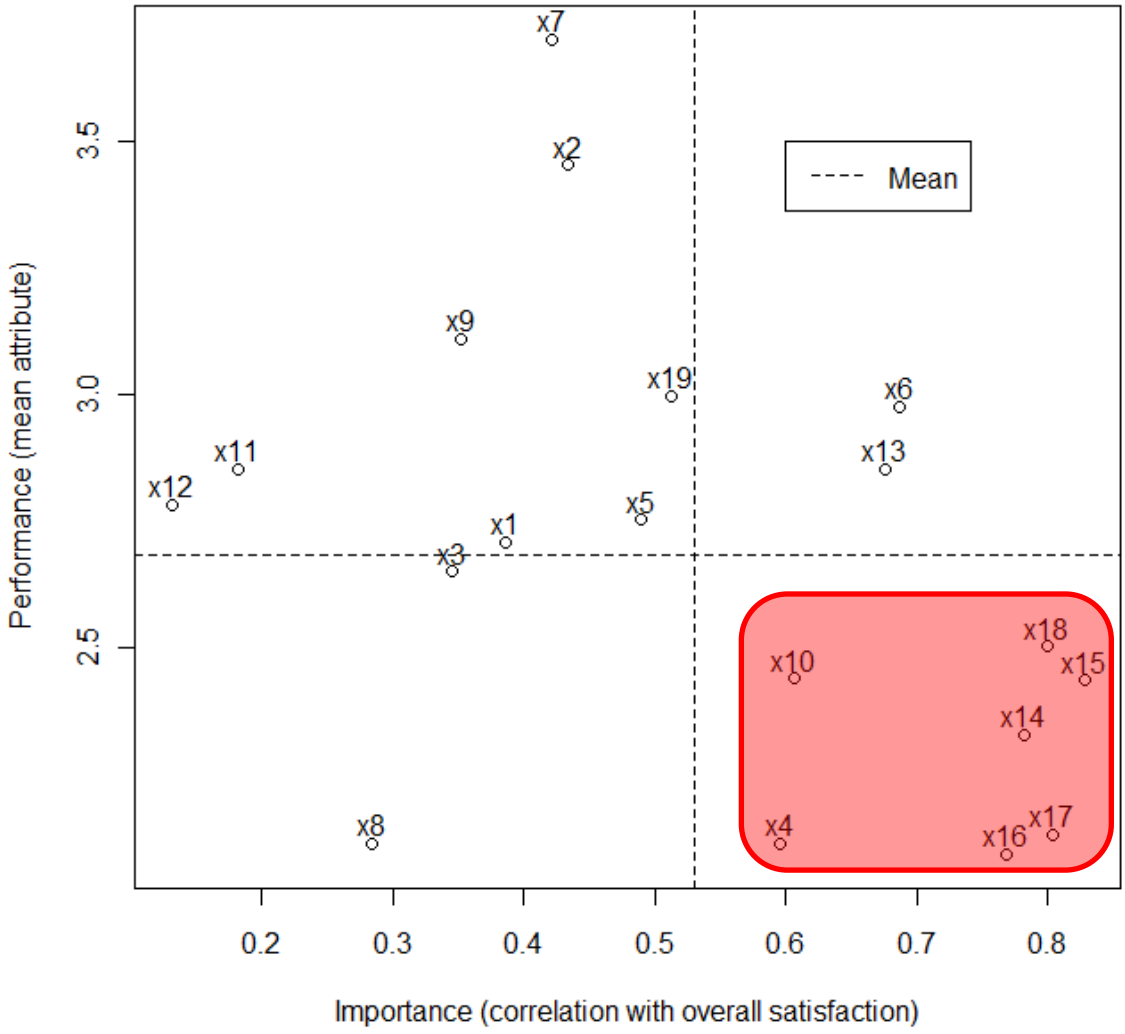
Use	Wai	Health and wellbeing	Cultural landscapes
3.5	3.15	3	2.78
2.8			

L-II River at Pannetts Rd

Current	Golders	**Cultural Flow Preference**
Recorder – no min flow	1274	**2100**

Photo of preference - The lowest observed was 2100 l/s. It received an overall satisfaction score of 3.67 and a cultural health score of 2.83. At this flow 63% of the attributes received a satisfactory rating.

Importance – Performance Graph



Please note

- the narrow range of scoring (performance) for the all attributes – i.e. ranging from below 2.5 – 3.5 on a 1 -7 scale.
- If there is a need to prioritise, those attributes that are more important in relation to others are enclosed and highlighted in red. The minimum flow regime needs to ensure:
  - *x14* *Flow enables use of the river for health and wellbeing purposes*)
  - *x15* *Flow contributes to a good feeling about this site*) ***Above 2100***
  - *x16* *Flow enables whanau to be proud of this site*)
  - *x17* *Flow protects valued features at this site*)
  - *x18* *Flow enables development and use of Maori lands etc*
  - *x4* *Flow keeps the river free of weed / algae* ***– never received a satisfactory rating***
  - *x10* *Flow keeps this site free of unnatural gravel buildups* ***– never received a satisfactory rating***

Specific issues at this site

An open exposed channel with an absence of any riparian cover

Stock grazing to the edge of the river

Perceived threats

- Contamination
- Open exposed channels into stream
- No access due to farming practices right to edge of stream.
- Silage wrap loose at site.
- The branches circled in photo at right were bulldozed into the stream.

Management Priorities

- Improve health of drains feeding in to the L11 at this site. Fencing to be moved back from the drain and restoration of riparian margin needed
- Stock exclusion
- Identify contamination sources
- Limit setting

Summary matrix showing how themes scored at recommended flow

Use	Wai	Health and wellbeing	Cultural landscapes
3.29	3.43	3.22	3.38
2.33			

Miles Drain at Pannets Rd

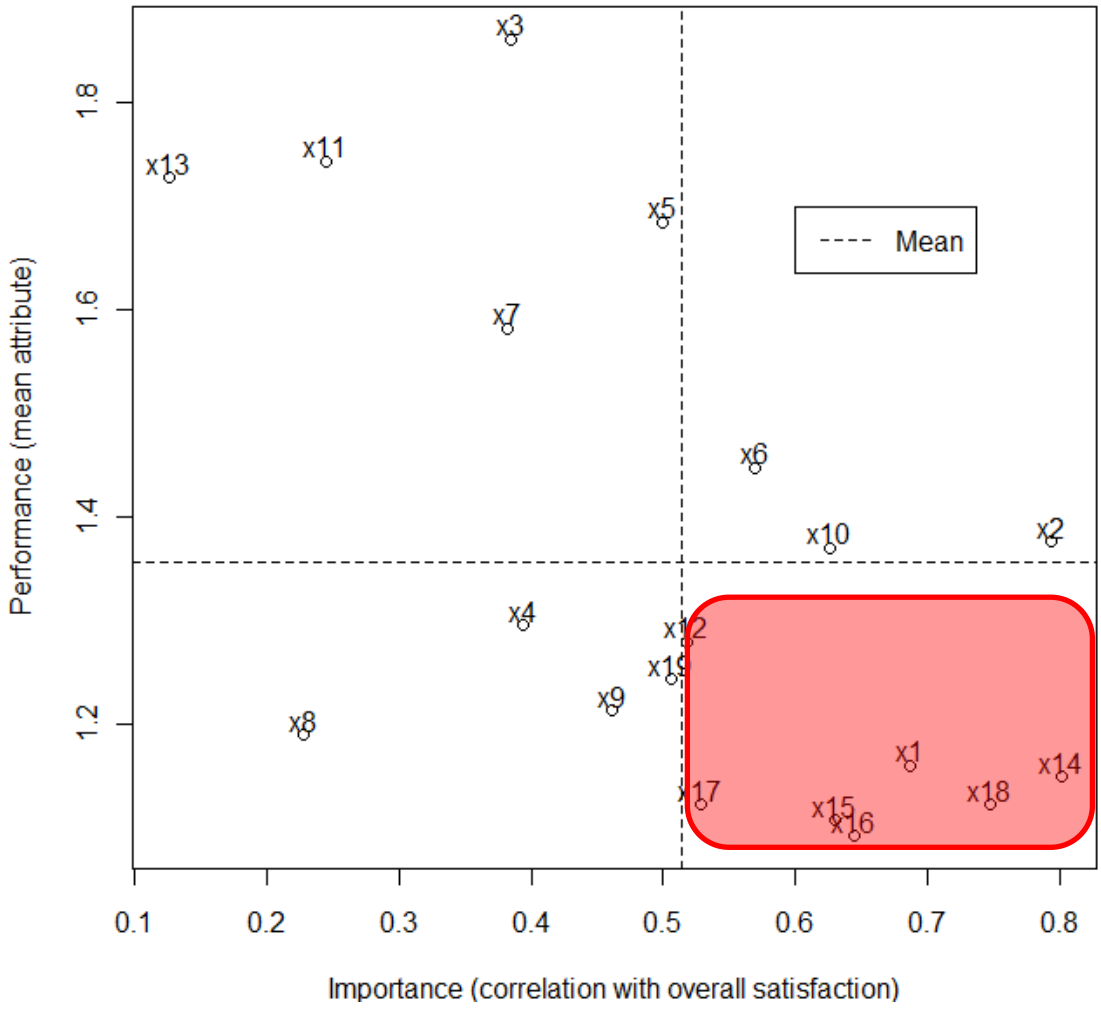
Current	Golders	**Cultural Flow Preference**
30	13*	**30 – this is the recommendation of O'Connell & Smith**

Photo of current – Whanau observed flows of 18 l/s and 23 l/s. On both occasions these flow received an overall satisfaction score of 1 and a cultural health score of 1. "It was dying a bit more each week we visited".

Below is an example of a flow at 30 l/s.

At no stage did any of the attributes receive a satisfactory rating,

Importance – Performance Graph



Please note

- the low scoring (performance) for the all attributes – i.e. ranging from below 1 – 1.8 on a 1 -7 scale.
- If there is a need to prioritise, those attributes that are more important in relation to others are enclosed and highlighted in red. The minimum flow regime needs to ensure:
  - *x1 Flow protects features important to place names, stories, whakapapa, waiata etc*
  - *x12 Flow enables cultural use of connected wetlands, springs & tributaries*
  - *x13 Flow appears to have been higher recently - evidence is present*
  - *x14 Flow enables use of the river for health and wellbeing purposes*
  - *x15 Flow contributes to a good feeling about this site*
  - *x16 Flow enables whanau to be proud of this site*
  - *x17 Flow protects valued features at this site*
  - *x18 Flow enables development and use of Maori lands / reserves / easements*
  - *x19 Flows link this site to other culturally significant sites*

At no stage did any of the attributes receive a satisfactory rating,

Values & Opportunities sought

- Spring fed – spring head to be protected.
- Contributes to water quality and quantity at Coes Ford
- Inanga present in pools.

Specific issues at this site

Perceived threats

- Willow encroaching into channel
- Siltation
- Monkey Musk across channel
- Glyceria a problem
- Heats up in open reaches
- Needs fencing
- Weed left to rot
- Drains blocked and a mess

Management Priorities

- Spring head to be protected
- Fencing and restoration still needed
- Stock exclusion
- Identify contamination sources
- Effective weed management
- Managed as a important contributor to Coes Ford.

Summary matrix showing how themes scored at recommended flow

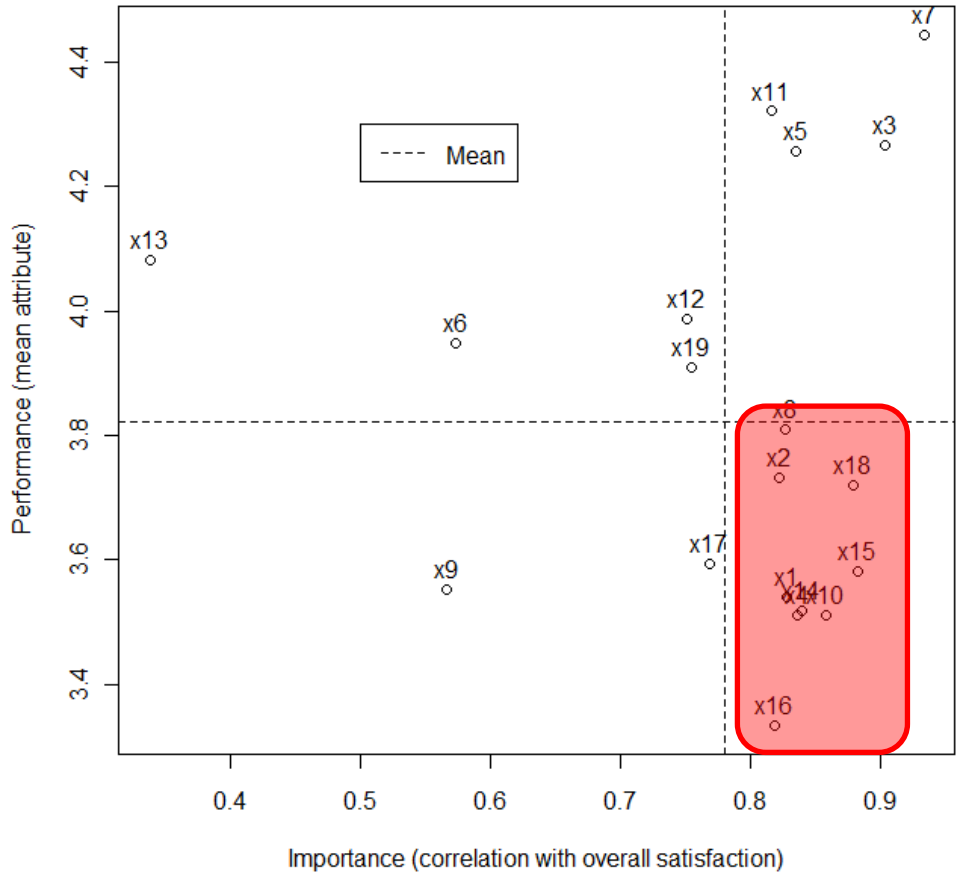
Wai	Use	Health and wellbeing	Cultural landscapes
1	1	1	1
1			

Prices Stream and Prices Valley Road

Current	Golders	**Cultural Flow Preference**
None set	Not covered	**>50 l/s**

Photo of recommended – Whanau observed flows in the range of 46 l/s – 65 l/s on five occasions. Flows above 50 l/s generally received an overall satisfaction score greater than 3 and a health score greater than 3. The flow with the highest number of attributes satisfied (89%) is in excess of 51 l/s

Importance – Performance Graph



Please note

- The average to above average scoring (performance) for all attributes – i.e. ranging from below 3.4 – 4.4 on a 1 -7 scale.
- If there is a need to prioritise, those attributes that are more important in relation to others are enclosed and highlighted in red. The minimum flow regime needs to ensure:
  - *x1* *Flow protects features important to place names etc* *) **above 50 l/s***
  - *x2* *Flow enables use of the site as a mahinga kai* *)*
  - *x4* *Flow keeps the river free of weed / algae*
  - *x8* *Flow enables gathering at this site (i.e. is accessible, safe)*
  - *x10* *Flow keeps this site free of unnatural gravel buildups – **got a satisfactory score on 1 visit***
  - *x14* *Flow enables use of the river for health and wellbeing purposes* *)*
  - *x15* *Flow contributes to a good feeling about this site* *) **above 50 l/s***
  - *x16* *Flow enables whanau to be proud of this site* *)*
  - *x18* *Flow enables development and use of Maori lands etc* *)*

Values & Opportunities sought

- Large areas of native vegetation
- Mahinga kai values significant
- Good water quality
- Inanga present

Perceived threats

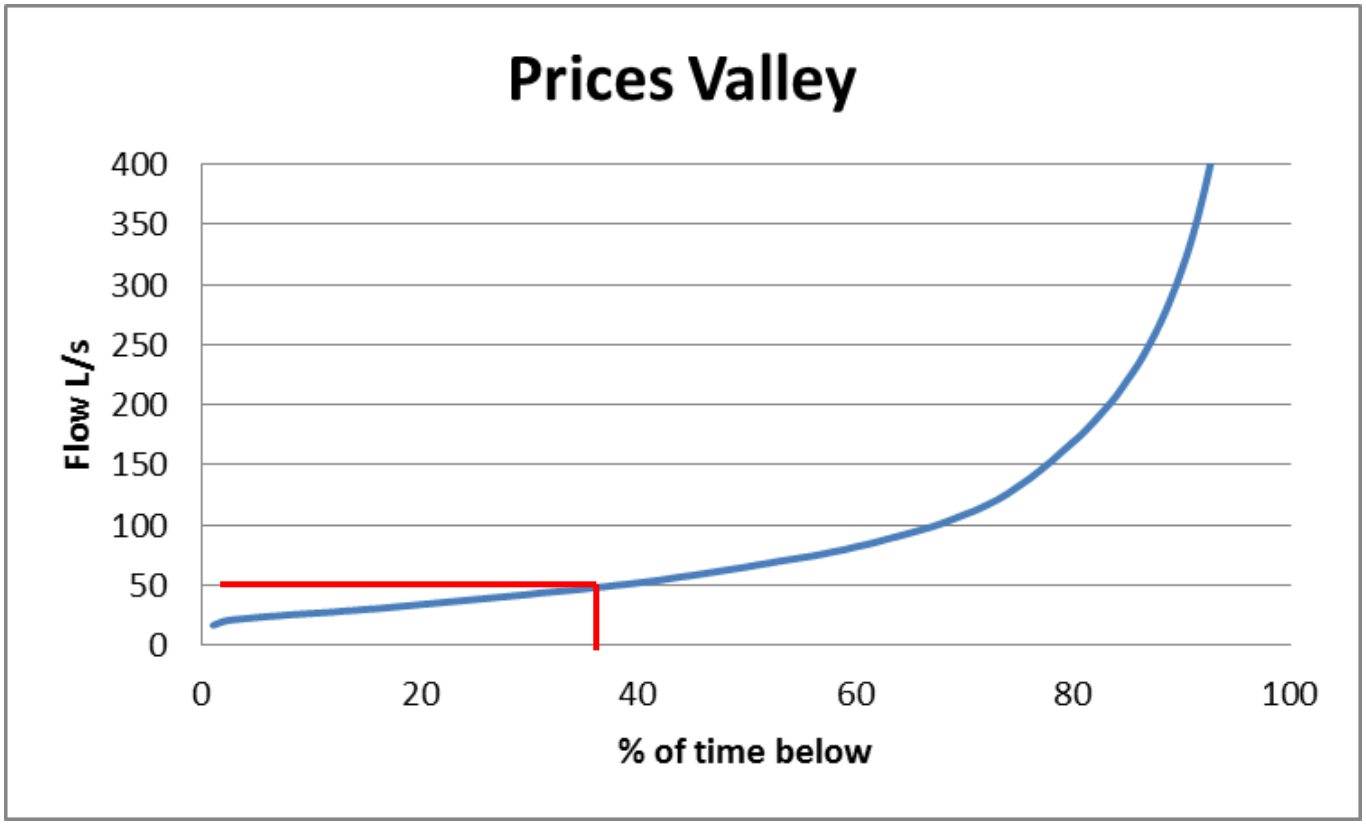
- Willow encroaching into channel
- Goldfish present

Management Priorities

- Fencing and restoration still needed

Summary matrix showing how themes scored at recommended flow

Use	Wai	Health and wellbeing	Cultural landscapes
4.16	4.31	3.75	4.13
3.75			

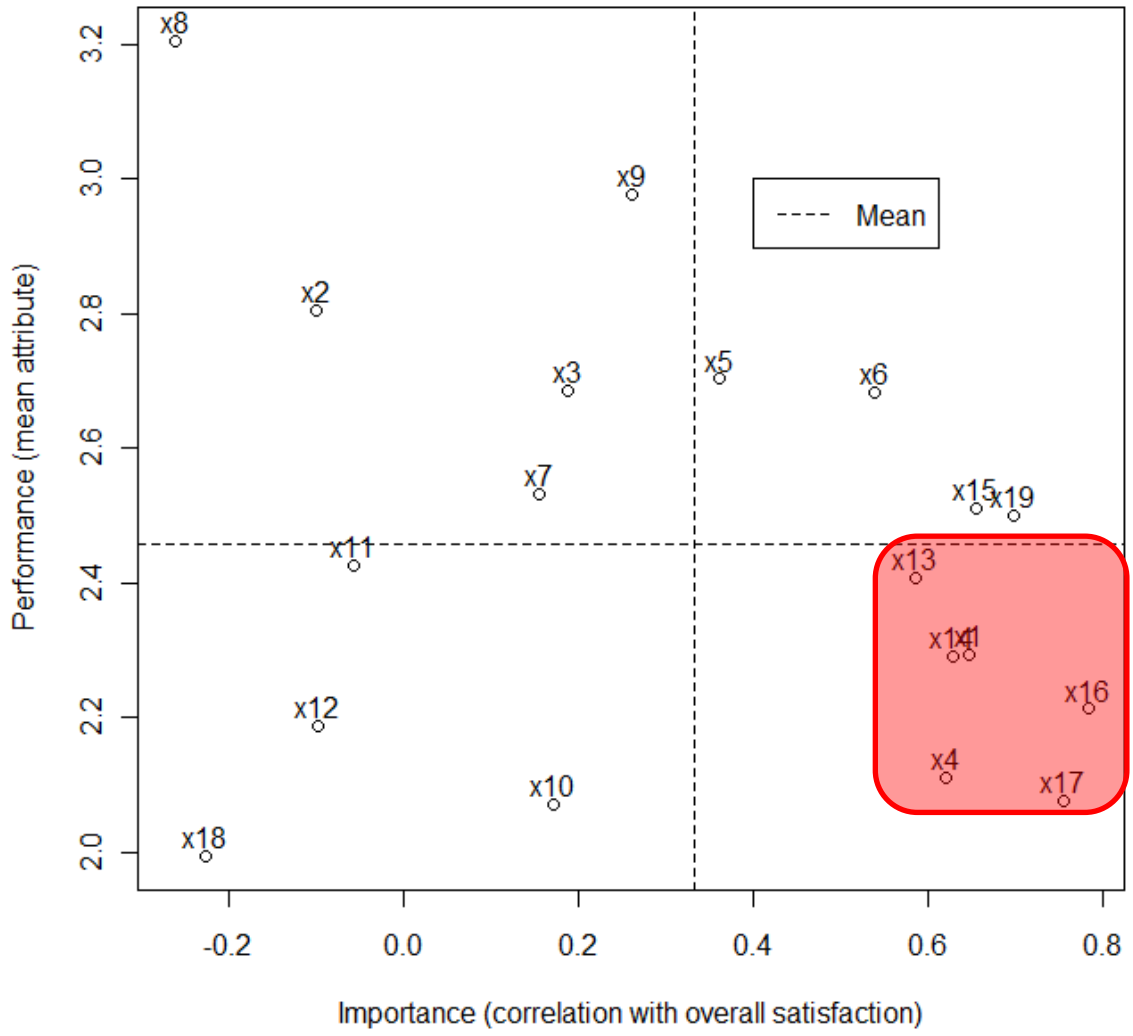


Selwyn River at Coes Ford

Current	Golders	**Cultural Flow Preference**
600 700 1000 600	675*	**1200**

Photo of preference - Whanau observed a flow of 685 l/s. This flow received an overall satisfaction score of 2.83 and a cultural health score of 2. At a flow of 685 l/s none of the attributes received a satisfactory rating. Flows in the range of 900 – 1400 saw the overall satisfaction above 3 and the overall health above 3. The photos below shows the river at 1200 l/s

Importance – Performance Graph



Please note

- the below average scoring (performance) for all attributes – i.e. ranging from below 2 – 3.2 on a 1 - 7 scale.
- If there is a need to prioritise, those attributes that are more important in relation to others are enclosed and highlighted in red. The minimum flow regime needs to ensure:
  - x1 Flow protects features important to place names, stories, whakapapa, waiata etc
  - x4 Flow keeps the river free of weed / algae **– only scored satisfactory when the river was in flood and whanau knew the stream was being cleaned.**
  - x13 Flow appears to have been higher recently - evidence is present)
  - x14 Flow enables use of the river for health & wellbeing purposes) W**hen flow >3000l/**
  - x16 Flow enables whanau to be proud of this site)
  - x17 Flow protects valued features at this site)

Values & Opportunities sought

- Important for recreation, picnicking, camping, swimming
- Shallows, pools, riffles,
- Habitat for open water divers, waterfowl, deep and shallow water waders
- Sustains bullies, tuna (long fin & short fin), torrentfish, kanakana,
- Significant population of long fin tuna
- Plants include Ti Kouka, harakeke, raupo
- In dry years dewatered reach can extend down to Coes Ford

- Good access
- Toilet block
- Traditional placename promoted.

Perceived threats

- Risk of mixing waters of Waimakariri and Rakaia with Selwyn
- Slug of sediment in mainstem – movement of sediment through the catchment is an issue
- Lower flows being experienced for longer
- Dewatered reach upstream of Coes Ford increasing in spatial extent and length of time.
- Partially channelized
- High nitrogen levels

Management Priorities

- Managed as a major tributary of Waihora –
  - Variability introduced especially mid range flows
- Minimise problems associated with weed and algae
  - Identify contamination sources

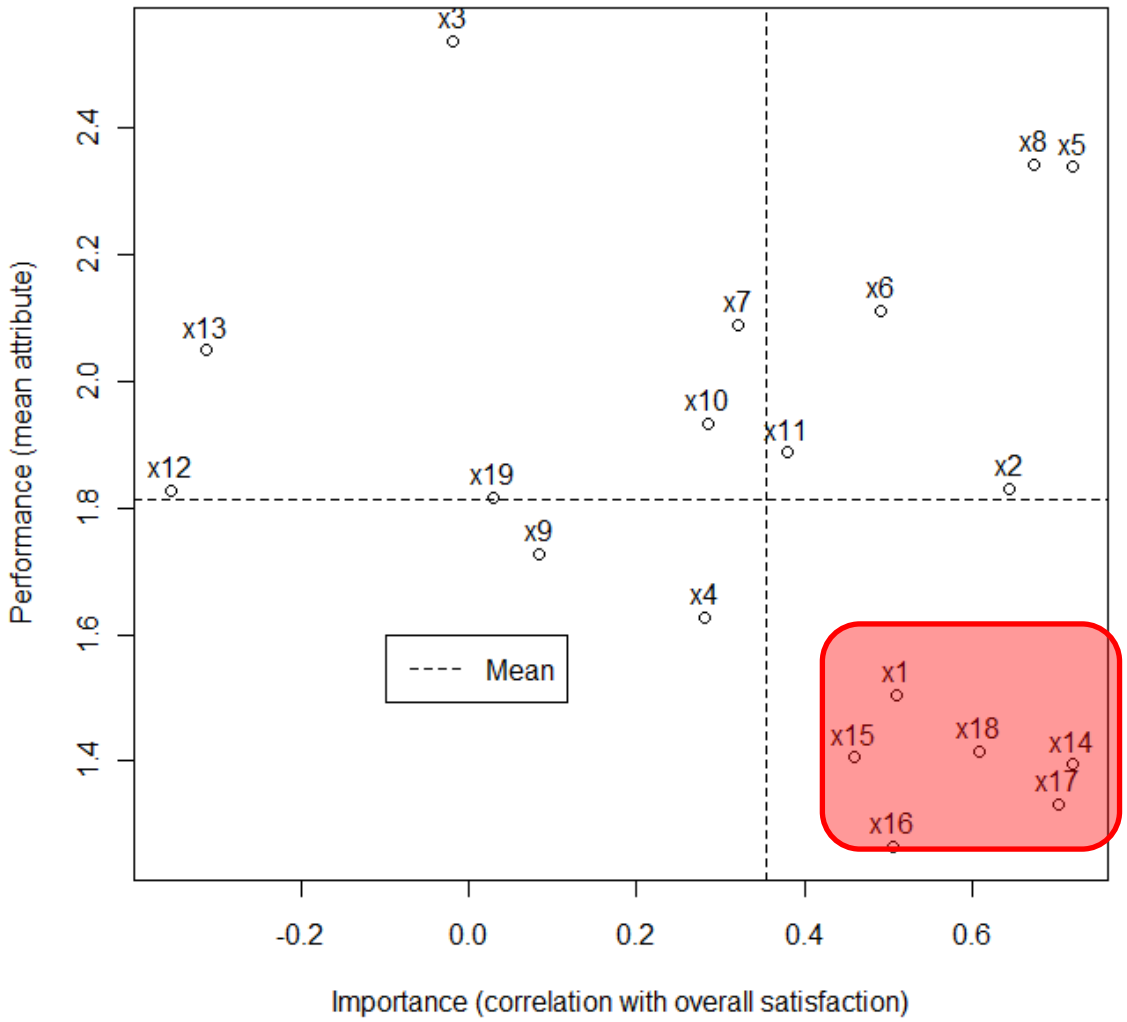
Summary matrix showing how themes scored at recommended flow

Use	Wai	Health and wellbeing	Cultural landscapes
4	2.6	2.6	2.7
3			

Silverstream at Lincoln Leeston Rd

Current	Golders	**Cultural Flow Preference**
60	79*	**120 - this is the recommendation of O'Connell & Smith**

Importance – Performance Graph



Please note

- the poor scoring (performance) for all attributes – i.e. ranging from below 1.4 – 2.4 on a 1 -7 scale.
- If there is a need to prioritise, those attributes that are more important in relation to others are enclosed and highlighted in red. The minimum flow regime needs to ensure:
  - x1 Flow protects features important to place names, stories, whakapapa, waiata etc
  - x14 Flow enables use of the river for health and wellbeing purposes
  - x15 Flow contributes to a good feeling about this site
  - x16 Flow enables whanau to be proud of this site
  - x17 Flow protects valued features at this site
  - x18 Flow enables development and use of Maori lands / reserves / easements

Values & Opportunities sought

- Significant contribution to water quality and quantity at Coes Ford
- Significant tributary to the lake
- Highly valued wetlands
- Spring fed

- Close to Waihora for inanga and smelt
- Tuna and koura present
- Spring heads to be protected.

Perceived threats	**Management Priorities**
• Willow encroaching into channel • Evidence of poor management • Excess effluent levels • Contamination • Nitrogen and phosphorus high	• Siltation • Monkey Musk across channel • Glyceria a problem • Suffers from water quality issues (that impact Selwyn) • Willow, gorse, blackberry are problem weeds • Weeds smothering channel • Channelised • Stock have access • Loss of flow in headwaters

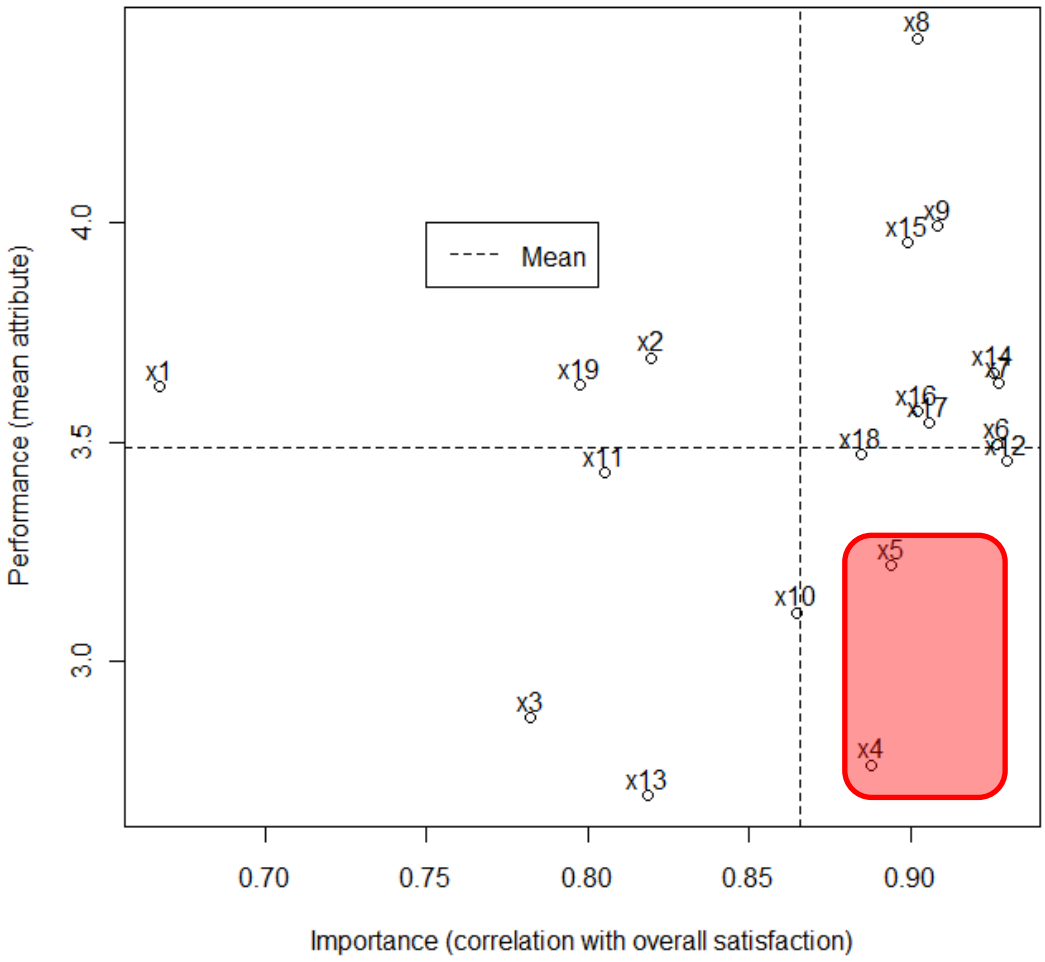
The photos below show the stream in January 2013 –the stream was rated as being in poor health and "smelly"

Waikekewai Creek at Taumutu Beach

Current	Golders	**Cultural Flow Preference**
100 100 100	34*	**No extraction**

Photo of current – Whanau did observe a flow of approximately 100 l/s on two occasions. These flows both received overall satisfaction scores above 3.5 and cultural health scores above 2.5. Approximately 66% of attributes are satisfied as flows around 100 l/s.

Importance – Performance Graph



Please note

- the average scoring (performance) for all attributes – i.e. ranging from below 3 – above 4 on a 1 - 7 scale.
- If there is a need to prioritise, those attributes that are more important in relation to others are enclosed and highlighted in red. The minimum flow regime needs to ensure:
  - x4 Flow keeps the river free of weed / algae
  - x5 Flow provides a range of habitats instream and along riverbank
  - x10 Flow keeps this site free of unnatural gravel buildups

Values & Opportunities sought

- Spring fed
- Inanga, flounder, tuna, bullies, patiki, kanakana
- Waterfowl
- High water quality
- Historic use for water burials (in headwaters)
- Tributaries feeding it are Parkin Drain and Taumutu Creek
- Site is currently being restored in lower reaches

Specific issues at this site – the photos show saltwater entering the stream

Perceived threats

- Siltation
- Adjacent landuse impacts water quality
- Declining water levels

Management Priorities

- Protect the whole catchment as wai tapu
  - No surface extractions
  - No extractions from hydraulically linked groundwater
  - No intensification within buffer of 3km of catchment
- Restoration to be completed
- Existing consents are to expire at the end of their term.

Summary matrix showing how themes scored at recommended flow

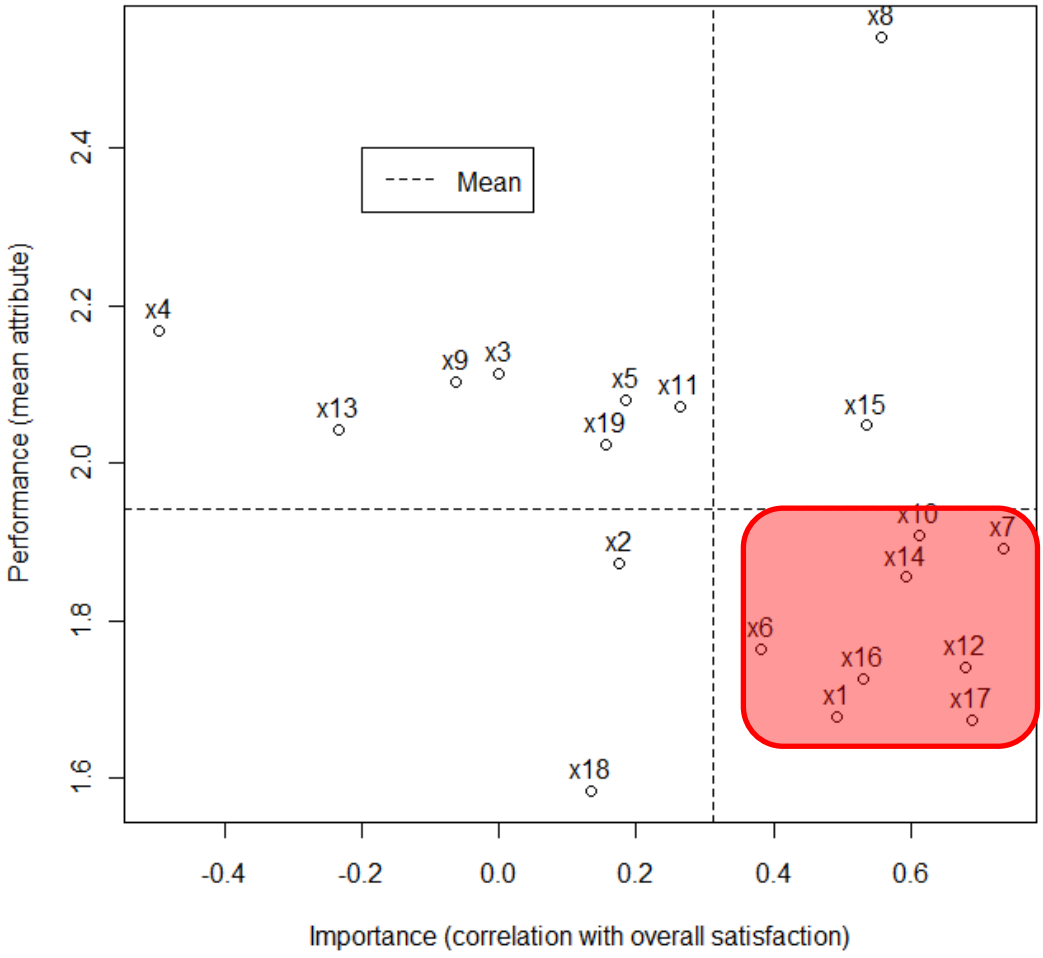
Use	Wai	Health and wellbeing	Cultural landscapes
4.47	4	4.96	4.6
3.8			

Liffey

Current	Golders	**Cultural Flow Preference**
		30 -40 l/s

Photo of preference - Whanau did observe a flow of approximately 30 l/s on five occasions. This is the flow level that scores the highest – ie seeing the greatest number of attributes receiving the highest score. But putting this in context, these flows both received overall satisfaction scores less than 2 and cultural health scores around 2.1. Only occasionally did the odd attribute receive a satisfactory rating.

Importance – Performance Graph



Please note

- the average scoring (performance) for all attributes – i.e. ranging from below 3 – above 4 on a 1 -7 scale.
- If there is a need to prioritise, those attributes that are more important in relation to others are enclosed and highlighted in red. The minimum flow regime needs to ensure:
  - *x1* *Flow protects features important to place names, tribal stories, whakapapa,waiata etc*
  - x17 Flow protects valued features at this site
  - *x10* *Flow keeps this site free of unnatural gravel buildups*
  - *x12* *Flow enables cultural use of connected wetlands, springs & tributaries*
  - *x14* *Flow enables use of the river for health and wellbeing purposes*
  - *x16* *Flow enables whanau to be proud of this site*

Values & Opportunities sought

- Spring fed lowland tributary
- Shallows and pools.
  Koura, torrentfish, bullies, tuna (long fin and short fin) kanakana, inanga

Specific issues at this site

Run off from adjacent urban areas impacts the health of the stream

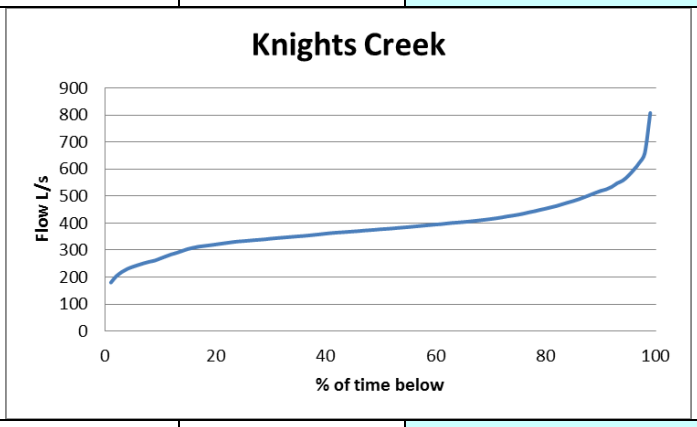
Perceived threats	**Management Priorities**
• Contamination	• Identify contamination sources

Summary matrix showing how themes scored at recommended flow

Wai	Use	Health and wellbeing	Cultural landscapes
1.9	2	1.71	1.5
2.17			

6.3 Current Minimum Flows & Recommendations For Streams Not Visited

River	Values	Current min flow L/s	Golders L/s (% 7DMALF) *70% large spring-fed* *90% smaller spring-fed & hill-fed* ** flow sensitive site*	Cultural Flow Preference
Baileys Creek		40	12*	**40**
Birdlings Brook	• Small lowland stream • Spring sourced • Mix of runs, pools, riffles • High quality habitat for eels (short fin and long fin) • High biomass of eels with large long fins, Koura • Good water quality • Major tributary of Harts Creek	150 200 150 150 150	446	**446**
Birdlings Brook		200	480	**480**
Hororata River (recorder)		30 30	382	**382**
Knights Creek	• Tuna (short fin and long fin), bullies, koura • Drains in headwaters	64 150	228*	**228**
Snake Creek		30	63*	**63**
McGraths Stream		None	Not covered	
Silverstream	• Significant contribution to water quality and quantity at Coes Ford • Significant tributary to the lake • Highly valued wetlands • Spring fed • Close to Waihora for inanga and smelt	None	Not covered	

Taumutu Creek	• Fast flowing • Influenced by lake level • Clear water • Site valued as tuna heke • Spring head to be protected • The stream feeds into the Waikekewai.	None	Not covered	**No extraction**
Knights Creek	• Tuna (short fin and long fin), bullies, koura • Drains in headwaters			
Hawkins River	• Shallows, riffles, rapids, pools • In summer dries above confluence with Selwyn • Bullies, eels (long fin), mudfish, galaxiids, torrentfish			
Kowai	• An environmental flow is set for the point of extraction – no longer will 100% of the flow be taken.			
Wainiwaniwa	• Significant number of sites in the Waianiwaniwa including urupa • Sustains mudfish and tuna			
Springs Creek	• Spring fed lowland tributary • Shallows and pools. • Koura, torrentfish, bullies, tuna (long fin and short fin) kanakana, inanga • Mallards, herons			

6.4 CURRENT MINIMUM FLOWS & RECOMMENDATIONS FOR STREAMS VISITED ON ONE OCCASION

Hororata River at Haldon Water Race Bridge

Current	Golders	Cultural Flow Preference
30 30	382	**382**

Values & Opportunities sought

- Shallows, riffles, rapids and pools
- Sustains galaxids, eels (short fin and long fin)
- Mudfish in lower reaches
- Some eeling, camping
- Dries in middle reaches of the catchment

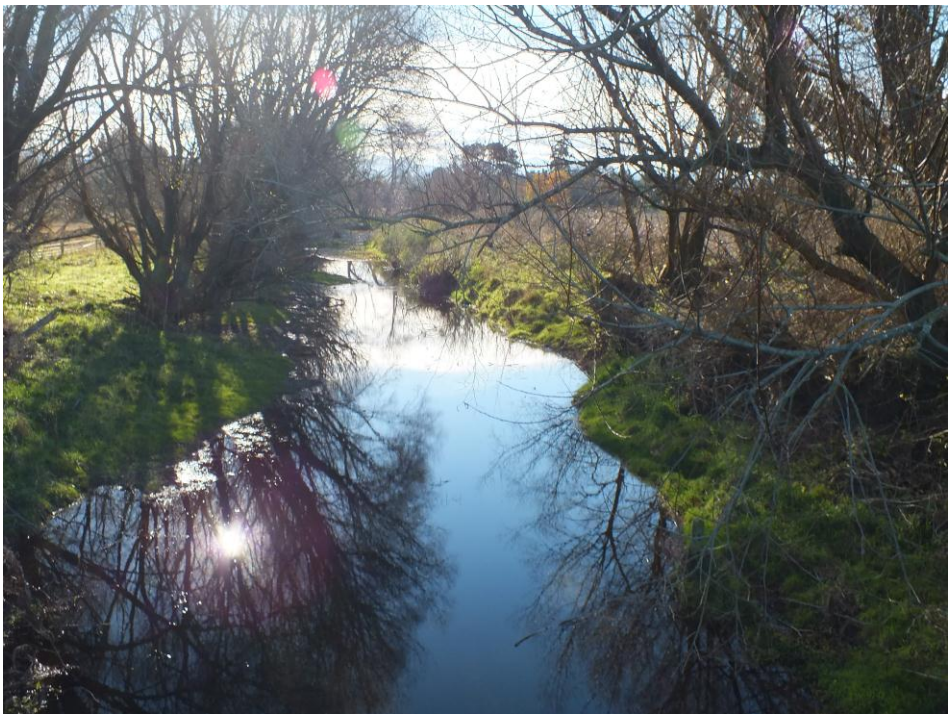
Whanau rated this site poorly across all attributes. Although only 30 l/s can be delivered because of the extraction of water to the Selwyn Water Supply, flows at the recommended 382 l/s need to be provided

With the lows flows being experienced blockage of the river channel is evident.

Jollies Brook at outlet to sea

Current	Golders	Cultural Flow Preference
360 360 360	297	**360 (O'Connell & Smith)**

Photo of current



Values & Opportunities sought

- Lowland spring fed
- Diverse habitats present
- Sustains kanakana
- Extensive native vegetation
- Wahi tapu near beach
- High quality water

Perceived threats

- Limited access for cultural use
- Stock have access
- Siltation
- Loss of riparian vegetation

Management Priorities

- Riparian management
- Stock exclusion
- Maintaining high water quality
- Identifying and removing causes of siltation

Lee River at Temoana

Current	Golders	**Cultural Flow Preference**
700	655	**1500 (O'Connell & Smith)**

Values & Opportunities sought

- Fast flowing, spring fed, not much fluctuation
- Discharges to the Tentburn
- Sustains koura
- Excellent water quality
- Habitat for eel,
- Watercress
- No surface abstractions
- Riparian vegetation healthy in lower reaches

Photo of current

Perceived threats	**Management Priorities**
• No longer flows to Muriwai • Impacted by sediment	

Selwyn River at Whitecliffs

Current	Golders	Cultural Flow Preference
550 965 10000	713	**713**

Values & Opportunities sought

- Sustains koura in upper reaches
- Mudfish habitat
- Important for picnicking, swimming
- Fed by nearby stream
- Pools, riffles and runs
- Good water quality
- Low nutrient levels

Photo of current

Perceived threats

- Willow encroaching
- Contamination
- Risk of algae blooms closing the site

Management Priorities

- High water quality is to be maintained.
- Spring nearby need to be protected.

Tramway Reserve Drain at Leeston Lincoln Road

Current	Golders	Cultural Flow Preference
		50 (O'Connell & Smith)

Values & Opportunities sought

- Watercress present
- Abundant and diverse fauna (including fish)
- Once part of the larger Leeston Doyleston Swamp which could be restored.

Perceived threats

- Steep sided, channelized
- Carries stormwater from Leeston
- Used for emergency discharges of effluent
- Weed clearance an issue
- No longer feeds the wetlands at Taumutu or Muriwai
- Effluent discharge is culturally offensive.
- Silted,
- Channelised
- Intermittent flow

Management Priorities

- An alternative to the emergency overflow from Leeston needs to be found.

Tent Burn at Beachcroft Road

Current	Golders	Cultural Flow Preference
		200 (O'Connell and Smith)

Photo of current

Values & Opportunities sought

- Lowland spring fed
- Waipuna important
- Significant mahinga kai
- Sustains koura, kanakana,
- Provides habitat for waterfowl, open water divers, waders, gulls, terns, swamp rail
- Abundant flax

Perceived threats	**Management Priorities**
• Limited access • Stock access • Siltation throughout	• High water quality is to be maintained. • Stock are to be excluded. • Source of sediment is to be identified and addressed.

6.5 Other recommendations

1: Kowai River

Recommendation Total diversion of the flow is **not** supported.

2. Osborne's Drain

Recommendation The discharge of contaminants to Osborne;'s Drain needs to be enforced. The discharge is to not to enter Te Waihora

3. **Allocation Limits -** Ngai Tahu whanui do not want to see flat lining of the river. They want to see allocation limits set for all streams and waterways. Over time the allocation is to be consistent with

the recommendations in the NES. The exception is the Waikekewai catchment where no extraction is of surface water or hydraulically connected groundwater is to be permitted.

4. **Cumulative Effect -** Ngai Tahu whanui want to see an analysis of cumulative effect – if there are low flows and excessive extraction in tributary streams the effect is compounded in main stem of the waterway.

5. **Flow Variability -** Ngai Tahu whanui support the call by Booker (2008) for flushes and floods to be incorporated into the flow regimes for rainfed streams.

6. **Wai Tapu, Wahi Taonga Zone -** ECan is to work with TRONT and nga runanga to identify the management mechanisms to give effect to a wai tapu or wahi taonga zone.

7. Spring heads – protection of springs is a priority.
   a. Springs in the Irwell (around Dunsandel)
   b. In the Harts Creek Upper Catchment

8. Septic tanks – failing septic tanks need to be addressed, especially in the Halswell catchment and around Lincoln.

9. **Weed management -** Weed management needs to be consistent with any protocols that are agreed in Whakaora te Waihora. Weed management has to consider biodiversity needs. These waterways need to be managed as substitute habitats.

PART 7: MANAGING FOR MAHINGA KAI

Te Kete Ika o Rākaihautū/The Fish Basket of Rākaihautū restored

7.1 Overview

Even though the means to pursue, acquire, and process mahinga kai sourced from Waikirikiri - Te Waihora catchments have changed dramatically, the mahinga kai have remained significant to Ngai Tahu whanui. Historically, the availability of habitats for the harvesting of mahinga kai saw whanau gathering from the rivers, floodplains, and upland habitats across the Waikirikiri - Te Waihora catchments (Figure 3) and throughout the annual cycle. Water from the rivers, tributaries, wetlands and lake supported aquatic-derived foods and sustained the hapu.

Privatized and extractive use of natural resources has environmental consequences, including the degradation of ecosystem processes that once supported the natural production and harvesting of mahinga kai. Restricted access to harvesting could eliminate mahinga kai if habitats supporting a particular species are rare and found only on private lands. Whanau have also observed diminished abundances of fishes which many perceive are insufficient to sustain whanau. Further contaminant loads in fishes may impede their safe consumption by whanau. Additionally, private land ownership and extractive resource use have created challenges to catchment-wide management needed to sustain mahinga kai. Restricted access and degradation of aquatic resources has a secondary impact – adversely impacting the health and wellbeing of the whanau.

> *In hosting visitors to the lake, I have to deal with feelings of both whakama (embarrassed) and whakaiti (small), in telling them about our special lake and some of the issues it faces - but I still do it because it is so special to me, and does provide for me in so many ways, despite its problems and I know how hard we are trying to make it better into the future.*
>
> *Like any pursuits in life, the success of your efforts is a relevant factor. Enthusiasm for traditional practices may fall away if the mahinga kai is not protected and success diminishes.*

Thus, restoring mahinga kai is apt to benefit the health and culture of Ngai Tahu whanau by providing traditional food choices and promoting activities (e.g., hunting, gathering, and fishing) that draw on whanau knowledge and skills.

Maintaining Mahinga kai for cultural use requires integrative, holistic management of resources across the Waikirikiri - Te Waihora catchments.

The outcome envisaged by whanau - *Te Kete Ika o Rākaihautū/The Fish Basket of Rākaihautū restored* - sets out a cultural strategy for natural resource management that may be a useful counterweight to address limitations and unintended ecological consequences of privatized and extractive resource use. It integrates natural resources management with cultural resource needs. It recognises that water is a critical resource for supporting the production of Mahinga kai. The range of aquatic-derived foods in Table 4 confirms the use of the aquatic species throughout the annual cycle.

The long-term production of mahinga kai within the Waikirikiri - Te Waihora and across the usual and accustomed harvesting areas requires a "functional" system as a dynamic aquatic ecosystem that incorporates ecological processes that support the continued production of mahinga kai and their utilization by Ngai Tahu whanui. This section provides a general overview of five components associated with a functional WaikirikiriTe Waihora system (water, geomorphology, habitat and connectivity, aquatic communities, and riparian environs) and summarises changes in these components observed by whanau over the last hundred and fifty years that jeopardize the sustained availability of mahinga kai.

7.2 Wai Maori

Within a mahinga kai context, the concept of "water quality" takes on a broader meaning. In addition to conventional physio-chemical measures, evaluation of water quality in the Selwyn-Te Waihora must also include appropriate measure of communities (e.g. native species abundance and diversity) and hydrologic processes (e.g., flow regime) associated with good health. Regardless of water physio-chemistry, water quality is low anywhere water is managed in ways that are incompatible with the ecological integrity (or "health") of the river. Thus, high quality water must be adequate to support the sustainable production of mahinga kai in terms of

1) its physical properties (e.g., appropriate temperature regime); chemical composition (free of pollutants), biotic constituents (native biotic community), and hydrology (e.g., timing and volume of river flow and spatial distribution of water throughout the system).

2) its cultural properties – free from contamination that gives cultural or spiritual offence e.g. contamination by effluent, or lowering water levels in water burials sites.

Hydrologic aspects center on the flow regime (pattern of water discharge) in the streams. As a general comment, whanau believe the minimum flows observed in the dry months are too low to sustain aquatic and riparian communities. In rainfed streams higher flows are important because they reshape the river channel, provide periodic hydrologic connections, and influence distributions of habitats for aquatic and riparian biota. Additionally, the spatial distribution of surface water across the floodplain drives the active and continuous exchange of water between the river channel and river gravels, as well as subsurface movement of river water through river gravels which Tau et al (1990) contends is vitally important. Whanau have also identified links between the Waikirikiri and Irwell – when the Waikirikiri floods, the flows in the Irwell recover.

Alterations to water: Both the quantity and physiochemical characteristics of water in the Waikirikiri-Te Waihora catchments have been changed principally as a result of irrigation (in the upper reaches of catchments) and drainage (in the lowlands) to enable land use activities. The historical timing and volume of surface water have thus been altered. Changes to surface water flows affect a variety of river functions, including connections between habitats for aquatic biota and patterns of floodplain water movement. Water quality has been degraded by inputs of sediment, fertilizers, pesticides, and other contaminants. Ngai Tahu whanui have observed the negative consequences of these inputs, such as altering the food web by increased growth of noxious weeds and algae and leading to the suspected accumulation of contaminants in water, sediment, and aquatic organisms.

A dewatered reach of the Waianiwaniwa – whanau are concerned that the extent of dry reaches is extending and reaches are drying for longer.

Realising the outcome of Te Kete Ika o Rākaihautū being restored – Three aspects need to be addressed.

1) A functional Waikirikiri-Te Waihora system requires restoring the volumes of river flows necessary to support the production and harvest of Mahinga kai. While the levels in spring fed streams should not be expected to vary significantly over the year, seasonal variations have been noticed. Rain fed streams and waterways that are fed by both rain and springs are expected to reflect seasonal variations. Yet, whanau are concerned that the mid range flows are missing. Baseflow conditions (low flows during the late summer and early autumn) in the Waikirikiri - Te Waihora catchments determine the availability of aquatic habitats within the respective rivers as well as hydrologic connectivity within the river network. Thus, summertime migrations of eels and other species are influenced by the magnitude of baseflow. Whanau have already expressed a desire to see taonga species, such as long fin eels returned to their full historic distribution. Baseflow in any given year also influences water quality (since concentrations or pollutants are influenced by flow volume) and even the temperature regime of the river.
2) In addition to baseflows, management planning for desired flow regimes in the Waikirikiri – Te Waihora catchments requires consideration of the magnitude and frequency of freshes and peak flow events. Whanau are adamant that freshes are essential to "cleanse the river". Freshes and floods maintain morphology and channel pattern, which facilitates the flux of river water through floodplain gravels and maintains a variety of aquatic habitats in the channel and across the floodplain. For examples, floods that are sufficient to mobilize the streambed are critical to the ecological function of the Waikirikiri. Such high-flow events provide temporary surface water connections between main channel and off-channel aquatic habitats, build and rearrange important channel and gravel-bar features thus maintaining habitat diversity, enhance water movement through the floodplain aquifer by cleaning and sorting river sediments thereby facilitating hyporheic water flux, and recharge the alluvial aquifer with water. Whanau contend therefore that a functional river, is dependent on the sufficient magnitude and frequency of freshes and flood events to maintain dynamic channel patterns and adequate water exchange.

3) In addition to the volume of water in the channel, a functional system is defined by the physical, chemical, and biological aspects of water quality. The whanau want waterways to be free from pollutants (e.g., toxicants or excess nutrients) that impair drinking water supplies, alter stream water pH, lower DO levels, and stress or kill native aquatic fauna. Maintenance of appropriate water temperature regimes is especially important because water temperature influences dissolved oxygen concentrations, and stress levels of aquatic organisms – which have been observed at Irwell by whanau members. In short, functional Waikirikiri – Te Waihora catchments would have nutrient and contaminants levels that do not impede Mahinga kai production and the utilization and safe consumption of mahinga kai by Ngai Tahu whanui.

7.3 Geomorphology

Channel structure is dynamic. A streambed down the length of its catchment typically consists of boulders, cobbles, gravels, pebbles, and sand, with finer particles being more prevalent in low gradient reaches. Sediments are transported both longitudinally from the headwaters to the lower river system and laterally.

Alterations to geomorphology: Construction of flow control structures (e.g., stopbanks, weirs), drains and dredging have simplified the complex geomorphology of Waikirikiri - Te Waihora catchments. Although a number of streams in reaches still have a mix of pools, riffles and runs, the prevalence of drains across the lowlands illustrates the associated substantial loss in channel diversity. Such geomorphic alterations affect hydrologic patterns (e.g., flows are largely contained with the simplified artificial channels), geomorphic processes, and water linkages between surface water habitats for aquatic biota. For example a significant secondary loss, as a result of the stopbanks and weirs, is the loss of wetlands and the losses to the larger Waihora complex.

Realising the outcome of Te Kete Ika o Rākaihautū being restored – Whanau believe there are two aspects to be managed: the river morphology and sediment.

River morphology: Waikirikiri – Te Waihora catchments must be dynamic over time and create a variety of diverse channel features (e.g., riffles, pools, side channels, and backwaters). Aquatic organisms often require different habitats at different life stages. These habitats may be located in the main channel, tributaries, and off-channel habitats and utilized at various times throughout the day and/or various times of the year. Such channel complexity also promotes hyporheic exchange (the bidirectional exchange of river water) between the channel and floodplain gravels. Ngai Tahu whanui would expect a functional river, sustaining such physical and biological processes and river-dependent mahinga kai, to have a channel network maintained and reshaped over time by the river's hydrology.

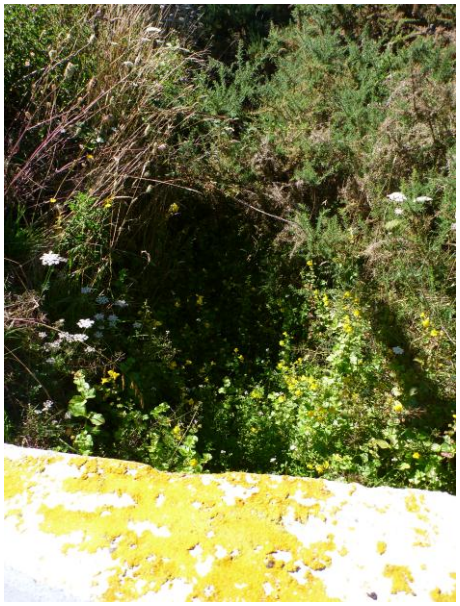
Sediment: Alterations to the river's sediment regime also influence the availability of riverine mahinga kai. Historically, freshes moved sediment through the system. Now, the sediment regime includes pulses of fine sediments from eroded banks on the lower tributaries and agriculture sources adversely affecting the aquatic community by smothering benthic habitats, thereby decreasing oxygen concentration within gravels and affecting the macroinvertebrate

community, and increasing turbidity. Plugging the spaces between gravels, may also decrease the permeability of the streambed and reduce rates of hyporheic exchange. The timing of sediment movement may also affect the migration success of aquatic species. Thus, the timing, volume, and particle sizes of sediment entering the Waikirikiri – Te Waihora catchments must be managed to maintain aquatic communities that support and provide mahinga kai.

7.4 Connectivity among habitats and across the river network

A healthy Waikirikiri - Te Waihora system will be supported by flows of surface water and groundwater that physically transfer nutrients, sediment, energy, and organisms among stream habitats and throughout the system. This "hydrologic connectivity" occurs longitudinally as tributaries flow into Te Waihora, laterally (in rain fed streams) as river water during high flow events spreads out onto the adjacent floodplain (exchanging water between the main channel and secondary channels and to connected catchments[20], and vertically as water moves bi-directionally between the river and underlying river gravels. Longitudinal connectivity flushes sediments downstream to depositional areas, maintaining a clean riverbed for macroinvertebrate habitat and habitats for mahinga kai species. Vertical connectivity moves nutrients between the main channel and hyporheic zone. Lastly, connectivity creates routes for aquatic organisms to move between instream habitats and migrate throughout the river – ki uta ki tai.

Alterations to connectivity: While longitudinal, lateral, and vertical connections are integral to the functioning of waterways, they are adversely impacted by the construction of flow control structures (e.g., weirs), channel incision, drainage, dredging, and increasing sediment inputs that can reduce the exchange of water.



A culvert on Boggy Creek. The channel is blocked by sediment and weed. It is unclear if fish would have passage.

[20] As noted earlier whanau have observed that flood flows in the Waikirikiri enhance springs and flows in the Irwell.

Realising the outcome of Te Kete Ika o Rākaihautū being restored – there are two aspects to be managed:

Habitat linkages: Longitudinal, lateral, and vertical water flow in the Waikirikiri – Te Waihora catchments provide habitat connections that are necessary for supporting the food web for mahinga kai species. These hydrologic linkages may be limited in duration (e.g., when freshes link habitats with the main river channel) or available throughout the year (e.g., surface water connections between tributaries and main river channel). Regardless of duration, these physical connections provide aquatic organisms with "routes" between habitats and are necessary for organisms to complete their life cycles.

In particular, connectivity facilitates fish movement between habitats and river sections. Facilitating passage for fish movement and migrations involves maintaining the river's hydrologic regime and eliminating potential barriers (such as culverts, diversion dams, and river sections that are dewatered or have temperature conditions lethal to eels) across the main river channel, tributaries, and floodplain. Thus, functional Waikirikiri - Waihora catchments would have connections sufficient to support mahinga kai fishes throughout the life cycle and particularly during critical movement and migration periods as shown in Figure 7.

Figure 7: Key migration periods for selected New Zealand indigenous freshwater fish species (⇑ = upstream, ⇓ = downstream)[21].

FRESHWATER FISH			SUMMER			AUTUMN			WINTER			SPRING		
COMMON NAME	SPECIES	LIFE STAGE	D	J	F	M	A	M	J	J	A	S	O	N
Tuna / Eels	*Anguilla australis* & *A. dieffenbachii*	Juvenile	⇑	⇑	⇑	⇑								⇑
Shortfin	*A. australis*	Adult		⇓	⇓	⇓	⇓							
Longfin	*A. dieffenbachii*	Adult		⇓	⇓	⇓	⇓	⇓				⇓	⇓	
Common smelt (riverine)	*Retropinna retropinna*	Juvenile	⇑	⇑	⇑	⇓	⇓	⇓	⇓				⇓ ⇑	⇓⇑
		Adult	⇑	⇑	⇑	⇓	⇓	⇓						⇑
Īnanga	*Galaxias maculatus*	Larvae	⇑	⇑	⇓	⇓	⇓				⇑	⇑	⇑	⇑
		Adult	⇑	⇑	⇓	⇓	⇓	⇓ ⇑	⇑	⇑	⇑	⇑	⇑	⇑
Kōaro	*G. brevipinnis*	Juvenile					⇓	⇓	⇓		⇑	⇑	⇑	⇑
		Adult [a]					⇑ ⇓	⇓ ⇑	⇓ ⇑	⇓ ⇑				
Common bully	*Gobiomorphus cotianus*	Juvenile	⇑	⇑	⇑	⇓	⇓	⇓	⇓		⇓	⇓	⇓ ⇑	⇓⇑
Torrentfish	*Cheimarrichthys fosteri*	Larvae	⇑	⇑	⇑ ⇓	⇓	⇓	⇓						⇑
		Adult [a]	⇑ ⇓				⇓ ⇓	⇓ ⇑	⇓ ⇑	⇑	⇑	⇑		⇓

[a], More research is needed to confirm the migration period.

[21] Supplied by Dr Erica Williams (NIWA).

Lateral inundation: Rainfed systems should experience inundation events similar to historical patterns that shape habitats for riverine organisms and allow for sediment deposition on the floodplain.

7.5 Riverine community: native community structure and health

A waterway's food web is supported in part by primary production and the breakdown of both terrestrial and aquatic derived organic matter. Historically and recently, the Waikirikiri – Te Waihora catchments have supported significant fish populations. Native fauna are adapted to specific instream conditions (e.g., temperature, flow, and streambed sediment) and need to be supported by intact food web linkages.

Alterations to the native riverine community: Many native fish populations have declined because of reductions in surface water flow, water quality changes, available habitats, and network connectivity. Meanwhile, non-native species have been introduced into the system, potentially further adversely affecting native communities.

Realising the outcome of Te Kete Ika o Rākaihautū being restored The Waikirikiri – Te Waihora catchments have macroinvertebrate communities that are an integral component of each river's food web and a food resource for mahinga kai fishes. Many types of macroinvertebrates have low tolerances for water quality impairment and specific benthic habitat requirements. Thus, management of the Waikirikiri – Te Waihora catchments should protect water quality and habitat conditions so that native macroinvertebrates thrive in the Waikirikiri Waihora catchments.

7.6 Riparian vegetation: native community structure and health

Willow, gorse, blackberry and glyceria are common riparian species along a number of the Waikirikiri – Te Waihora tributary catchments. Growth and success of riparian vegetation are linked to river hydrology patterns. In addition, riparian vegetation uses river baseflows and groundwater for water sources in the dry, hot summer months.

Riparian vegetation influences instream conditions by increasing bank stability, shading, and inputs of organic matter, and add important structural component in rivers, increasing habitat complexity. Indigenous vegetation is highly valued as in addition to its resource utility value to Ngai Tahu, many species provide bank stability, and nesting habitat for birds.

Alterations to native riparian vegetation: Native riparian vegetation has been dramatically reduced while some introduced riparian species have become established. Such changes in riparian abundance and composition have affected the health of the Waikirikiri - Te Waihora catchments and the abundance and distribution of taonga species.

Realising the outcome of Te Kete Ika o Rākaihautū being restored Waikirikiri – Te Waihora catchments will encompass a diverse community of native riparian vegetation which serves to increase

bank stability, become wood inputs, and provide shade. These functions contribute to healthy mahinga kai. Increased bank stability reduces bank erosion, decreasing fine sediment inputs that can smother benthic and spawning habitats. Shade by riparian vegetation reduces solar radiation, potentially creating localized pockets of thermal refugia for aquatic organisms. Lastly, leaf litter from riparian vegetation provides seasonal inputs of organic matter that benefit the food web. Thus, increasing the abundance of native riparian vegetation are important management considerations for restoring and sustaining functional Waikirikiri – Te Waihora catchments.

Ngai Tahu is responding to this challenge through the restoration wetland and riparian plants in and around the lake. Current sites and areas being re-planted and actively managed for restoration include: the Lower Waikekewai stream, Te Pa o Moki (Taumutu Marae), Orariki, Te Awapunapuna, Muriwai (Coopers Lagoon), Te Waiomakua, Ahuriri Greenpark, Pakoau and Waikirikiri (Waikirikiri Delta). These sites are being managed to create or re-create natural riparian zones, buffer surrounding land use, increase habitat, bring back part of what has been lost and, to allow for, and ensure, future harvest potential.

7.7 Managing tuna resources[22]

Longfin eels (Anguilla dieffenbachii) are endemic to New Zealand, and concerns about their overall status have meant they are listed on DoC's threatened species classification as "species in gradual decline" (Hitchmough et al. 2007). Compared to shortfins, longfins are slower-growing, have longer generation times, and have been more affected by reduced upstream access. Within Te Waihora/ Lake Ellesmere, the major tributaries are closed to commercial eel fishing. Presently reserve areas extend throughout the length of the tributaries including a radius of 1.2 km around the mouth of the Irwell, Selwyn, LII and Halswell Rivers, and Harts Creek. In addition to these reserves, Kaituna Lagoon is managed as a kohanga (recreational and customary fishing only) under the Joint Management Plan.

The tributaries of Waikirikiri – Te Waihora are of particular importance because they are one of the very few lowland areas where commercial eel fishing is prohibited and hence they represent relatively unmodified populations of eels.

As longfins prefer flowing water (Jellyman et al. 2003), there will always have been substantial numbers of longfins in the lower reaches of tributaries and associated lake margins.

- A sample of 305 eels collected from the lake in the early 1940's was 25 % longfins (Cairns 1941),
- A sample collected in 1948 was 27 % longfins (Shorland and Russell 1948).
- There is little doubt that the proportion of longfins within the lake has reduced drastically over the period of the commercial fishery.

Although longfins have been described as habitat generalists (Glova et al. 1998), the species does have a preference for flowing water (Jellyman et al. 2003).

[22] This information comes from the Jellyman & Graynoth study in 2010.

The electric fishing in a range of tributaries caught a total of 768 eels, of which 46% were longfins. Of the 9 sites sampled, longfins exceeded shortfins at 6 sites. The two sites dominated by shortfins were both slow flowing (Hanmer Road Drain and lower Irwell). Of some concern though the percentages of small eels, especially longfins, in the tributaries of Te Waihora/Lake Ellesmere are low. Longfins dominated the upper sites in the Halswell River, Harts Creek, and LII River.

The stony riffle habitats favoured by small longfins (Jellyman et al. 2003) are scarce in the tributaries, and hence where they do occur, they contain relatively high numbers of juvenile eels. For example, the riffle areas sampled in Harts Creek (~ 110 m length) are the only such habitat in the lower 6 km of that stream.

The Jellyman study concluded that there are robust population sizes of short fin eels within the Te Waihora/Lake Ellesmere tributaries.

Sizes of fyke-netted eels exceeded those from all regularly fished rivers listed for longfins, and lengths of shortfins were only exceeded by two of the 13 regularly fished rivers. For longfins, data from two comparable sites in National Parks, Lake Rotoiti and Company Creek, were included as the only two populations entirely free from any commercial exploitation. Shortfins were generally comparable in size to those from Company Creek, while longfins from lower Harts Creek and lower Waikirikiri were close to those from both Lake Rotoiti and Company Creek. Obviously, the tributaries have a good assemblage of large eels of both species.

Average annual length increments (mm/year) are generally similar to those from previous Te Waihora/Lake Ellesmere studies.

The number of migrant female longfin eels was estimated at 540 per annum. This is a significant number and exceeds the estimated number of migrant female eels from commercially fished rivers such as the Aparima in Southland (240 per annum (Jellyman & Graynoth 2002). It is important that efforts are made to open the lake to the sea in the autumn to permit the spawning migrations of these fish.

The quantity of large eels that a waterway can maintain is largely dependent upon the availability of suitable habitat (Burnet 1952; Graynoth et al. 2008). As eels grow, they spend less time within the substrates, and need to find larger cover items to provide shelter, such as undercut banks and debris clusters in rivers, and weed banks in lakes. This has implications for the way that Te Waihora/Lake Ellesmere tributaries are managed as retention of cover (aquatic plants, undercut banks, debris clusters/willow roots, and shelter and shade from riparian plantings of rushes and trees) is essential to maintaining a high biomass of longfin adult eels.

However, it is not only the amount of suitable habitat that is important, but also the quality of that habitat. While eels are tolerant of relatively poor water quality, when faced with low levels of dissolved oxygen they will "gulp" at the surface to obtain atmospheric oxygen, will come into shallower areas where there is more likelihood of more dissolved oxygen, and will seek out river mouths or springs where cooler water contains more dissolved oxygen. If they are unable to move to areas where there are higher levels of oxygen (e.g. because they are retained within a fyke net), then they will die.

With any continued decline in water quality and associated oxygen depletion, the accessibility to flowing water, with associated higher levels of dissolved oxygen, will be of increasing importance to eels, especially longfins.

Given these concerns, the habitat for longfins provided by tributaries is of crucial importance. Within the tributaries, retention of stable riffle areas low down in the catchment is very important for juvenile eels of both species, but especially for longfins. Likewise, retention and addition of instream cover, enhanced by vegetated riparian margins, is essential for larger eels (> 300 mm) when they move from being substrate-dwellers to living above the substrates and seek areas of shelter to avoid daylight.

Previous studies of eel movements within the lake have indicated that larger eels (those say > 300 mm), tend to stay within a defined area and not move extensively (Jellyman et al. 1996). For longfins, their preference for flowing water, means tributaries can retain stable populations of this species.

Reserves within tributaries or at the mouths of tributaries provide important refuges for this species.

Finally, lower reaches of tributaries can provide important refugia should the lake become increasingly prone to multiple stressor events like a combination of high water temperatures and significant algal blooms, with a consequent reduction in dissolved oxygen.

The national status of longfins is a cause for concern. The critical factor in managing eel stocks is maximising the number of females that escape to sea to spawn each year. The Te Waihora/Lake Ellesmere tributaries could potentially provide ~ 2 % of the annual New Zealand production of longfin female eels, and hence their continued protection from overharvesting is of particular importance. Likewise, any habitat enhancements from improved flows and water quality improvement can only enhance this situation. Providing flows to enhance populations in the Waikirikiri – Te Waihora catchments is a priority.

PART 8: IMPLICATIONS OF THE MAHINGA KAI VISION FOR TE WAIHORA

8.1 Overview

Maintaining a healthy Waikirikiri - Te Waihora system for mahinga kai requires managing for the range of dynamic aquatic conditions – across streams, springs, wetlands and lake - throughout the year.

8.2 Additional management needs

In addition to the five components discussed above in section 6, there are another set of management imperatives:

Commoditization of water (and aquatic resources) is a roadblock to the sustainability and longevity of mahinga kai and their utilization by whanau - Treating water and aquatic resources as commodities for extractive, private use emphasizes the use and trading of individual resources, rather than the importance of a functional river and lake system supporting both human needs and ecosystem processes. The current economic system, based on the concept of private property, is firmly entrenched within the Waikirikiri - Te Waihora catchments. Although it may be considered by many neither feasible nor even desirable to attempt to supplant the existing economic system, efforts to maintain and restore whanau access to customary sites for harvesting mahinga kai is essential, and opportunities for reinstating wetlands and replanting vegetation must be investigated in order to facilitate and assist lake and river restoration.

River characteristics vary across the catchments**.** Therefore while some management goals can be set for the respective catchments of Waikirikiri - Te Waihora, depending on the context and structure of the reach, management and restoration strategies to support the production of mahinga kai will need to be tailored.

Groundwater & surface water should be managed as a single resource - Levels of groundwater and surface water are intricately linked. Thus, management of extractive water consumption of both surface water and groundwater must consider the hydrologic regime of the river, habitat and system connectivity, and the role served by healthy riparian vegetation (ki uta ki tai).

Management will need to incorporate restoration and maintenance of river processes - As such, management and restoration strategies must identify mechanisms of influence and address ecological processes at relevant spatial and temporal scales and focus on re-naturalization of riverine processes.

8.3 Monitoring and reporting

Mahinga kai provides an appropriate context in which to report management and restoration progress to whanau. Each species could be considered as one of the reporting metrics (e.g. abundance, distribution, restoration efforts, restoration achievements, and policy and regulatory mechanisms). Ultimately, the most direct and culturally appropriate indication of the progress in delivering flows in the waterways feeding Te Waihora will be measured by whanau and hapu continuing to access, harvest, process, preserve, and share mahinga kai at the marae and in their homes.

8.4 Concluding comments

The mahinga kai-focused vision for Te Waihora aims to maintain a river and lake system by embracing an expansive view of "water management" that includes a functional river and associated processes for the sustained longevity of mahinga kai. This vision calls attention to the maintenance of stream flows and water quality by focusing on the ecological health of the system, which sustains riparian, riverine and lake mahinga kai. The vision for a healthy system reflects a river and lake system that is highly dynamic and shaped by not only physical and biological processes but also interactions and interconnections among those processes. Such a vision requires that management strategies should emphasize the importance of: 1) hydrology (including the timing, volume, and quality of water flows); 2) geomorphic processes; 3) longitudinal, lateral, and vertical connectivity among habitats and across the catchments; 4) the health of the riparian vegetative community; and 5) the health of the native aquatic species.

The mahinga kai-focused vision highlights direct linkages between the ecological health of aquatic environs and the health and well-being of Ngai Tahu members. Degradation of the rivers and lake, water quality, and associated ecological processes results in the loss of mahinga kai. In additional to providing a clean and healthy natural environment for whanau members and other residents of the Ngai Tahu rohe, improving the availability of mahinga kai can contribute to sustaining knowledge, and traditions that promote the physical health of whanau. Finally, the vision provides resource managers with a framework for involving mandated representatives in management dialogues. Within such a framework, monitoring and restoration efforts can concentrate on improving the ecological functionality of the waterways, which sustains mahinga kai, and ultimately cultural identity.

APPENDICES

Appendix 1: Dependency of wahi taonga on ecological health

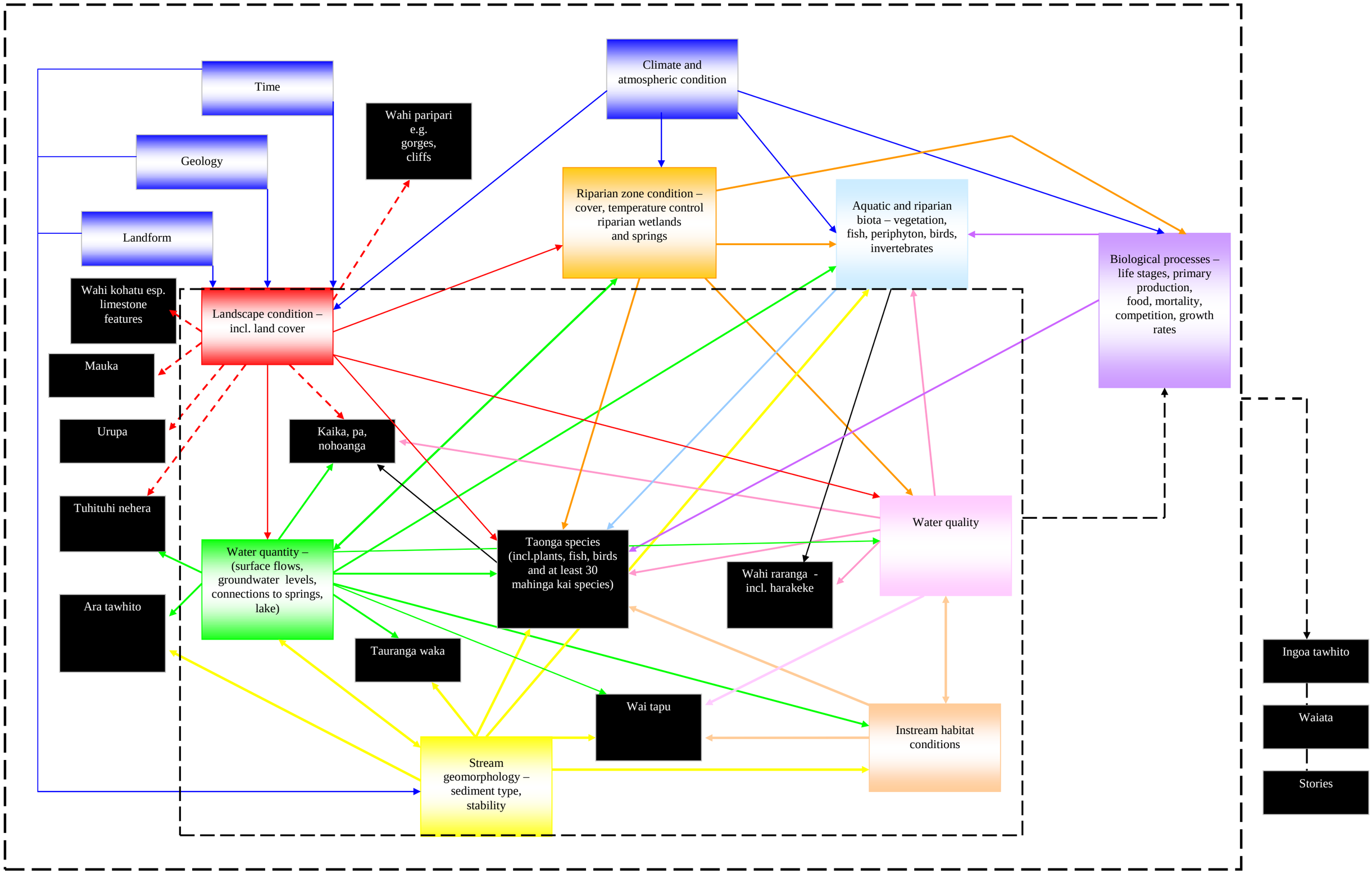
Appendix 2: Dependency of wahi taonga on water management, especially flows.

Appendix 3: Distribution maps for some taonga species.

Appendix 4: Maps of wahi taonga from the Selwyn District Council District Plan.

Appendix 5: Excerpts re the management of wahi taonga from the Selwyn District Council District Plan.

Appendix 1: Eco cultural system in Selwyn - Waihora



Appendix 2: Dependencies of Wähi Tapu/Taonga

Tangata whenua are likely to engage in flow setting processes to achieve specific outcomes. Protecting waahi tapu and waahi taonga is likely to be one the outcomes specified. Since 1999 Ngai Tahu has identified a range of wahi tapu / wahi taonga. It is necessary to refer to the respective iwi plans to see how they are identified, and the policy frameworks in place to ensure their protection.

1. Ara tawhito (ancient trails)
2. Käika Nohoanga, pa (occupation, settlement sites)
3. Mahika Kai (places where resources including food were/are procured)
4. Mauka (important Mountains)
5. Tauranga Waka (canoe mooring sites)
6. Tuhituhi Neherä (Rock drawing sites)
7. Urupa (human burial sites)
8. Umu (earth ovens)
9. Ikoa Tawhito (place names)
10. Wähi kohätu (rock formations)
11. Wähi mahi kohätu (quarry sites)
12. Wähi paripari (cliff areas)
13. Wähi raranga (sources of weaving material)
14. Repo Raupö (wetlands and swamps)
15. Puna (freshwater springs)

WAHI TAONGA CLASS	WATER DEPENDENCIES	FLOW RELATED DEPENDENCIES

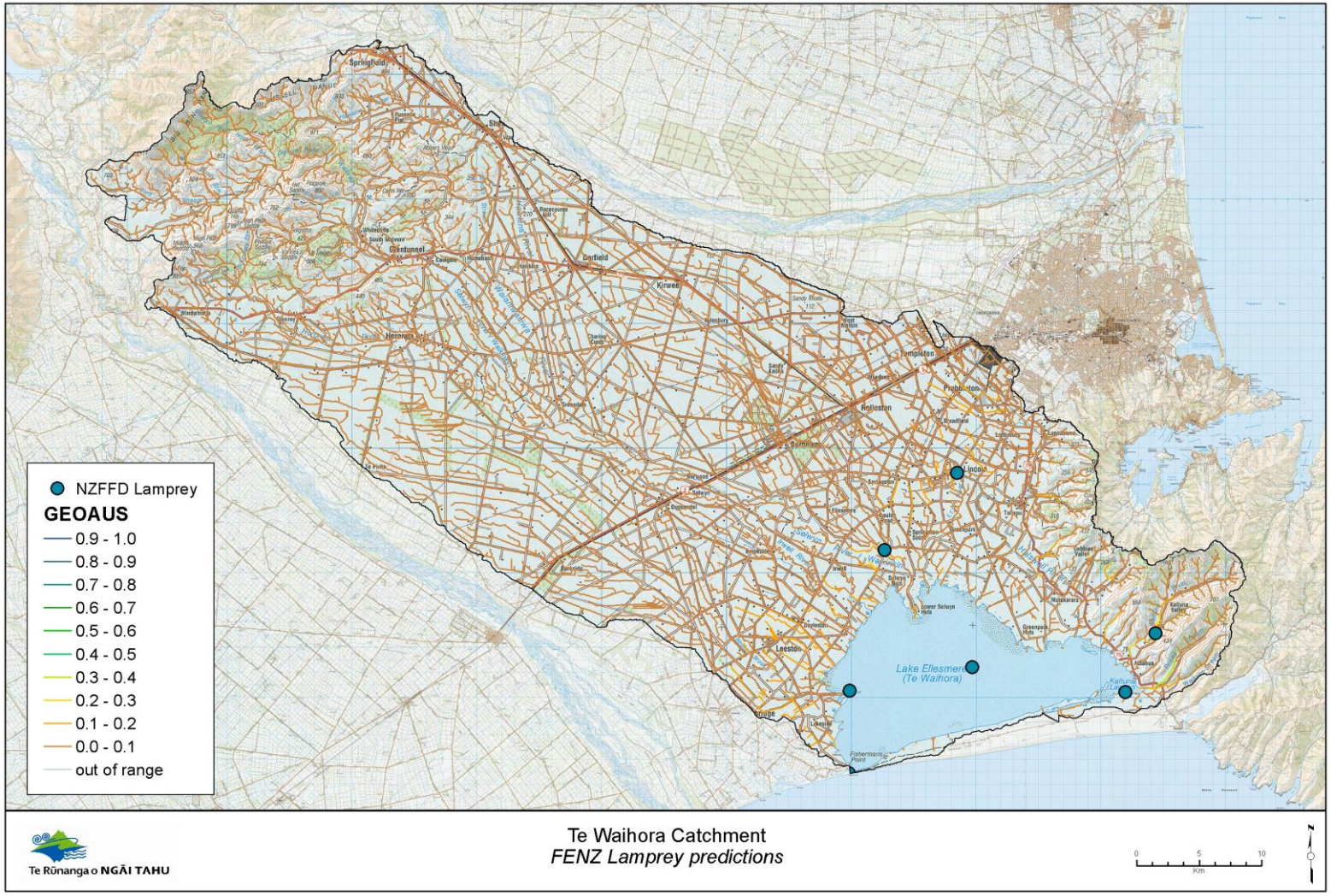
1. Mahinga kai (places where foods are procured and or produced). "Kai awa" and "kai roto" refers to the foods and resources sourced from rivers and lakes respectively.	• Oxygen – fish get this from water
	• Food – for plants, birds and fish
	  ○ Fish eat algae, invertebrates, worms
	  ○ birds eat fish, invertebrates, worms, seeds etc from riparian plants
	  ○ plants need nutrients
	• Habitat (a place to live) – riparian, channel structure, patterns and quantity of sediments, contaminants, interactions between fish and invertebrates, competition with predators (fish, birds, plants, invertebrates etc)
	• Temperature of water
	• Cover in aquatic ecosystems – protects species from predators, high temperatures, high turbulence
	• Life cycle stages triggered by flows
	• Gathering methods dependent on flows
	• Transportation – if access dependent on boating etc
	• Turbidity – linked to oxygen concentrations. Suspended matter affects growth rates, movements etc, affects streambed
		• **Oxygen** – fish species are sensitive to interruptions in water supply (pools V flow). Higher flows help oxygenate deeper water. Colder waters hold oxygen. Links to temperature.
		• **Food** – flow dislodges material that drifts and is available as food.
		• Habitat (a place to live) – habitat varies by species and life stage (spawning, incubation, rearing, living).
		• **Temperature** – species have optimal temperature ranges for survival. Links to riparian vegetation etc (and shade). Temperatures are inversely proportional to flows e.g. high flows low temperature, low flows high temperatures.
		• **Cover** – affected by debris in stream; ratio of sands, gravels, cobbles; vegetation in and adjacent to stream; pools and overhang banks etc; stream depth and turbulence
		• **Life cycle stages** – triggered by freshes, but need to consider sequence, scale and timing of freshes – for all, but inter species variations. Migration, freshes because flow has to be sufficient to cover instream structures etc. high flows enable fish to cover vast distances in short period of time.
		• **Gathering** – methods change with flows; affects fishing experience, flows can change catch rates
		• **Transportation** - affect boatability, access,
		• **Turbidity** - amount of sediment in water column is dependent on velocity and turbulence. Flows affect aggradation.
		  ○ High flows may make water turbid and care people from using
		  ○ A lot of focus has been on fish but they ate only one part of the kai gathered.

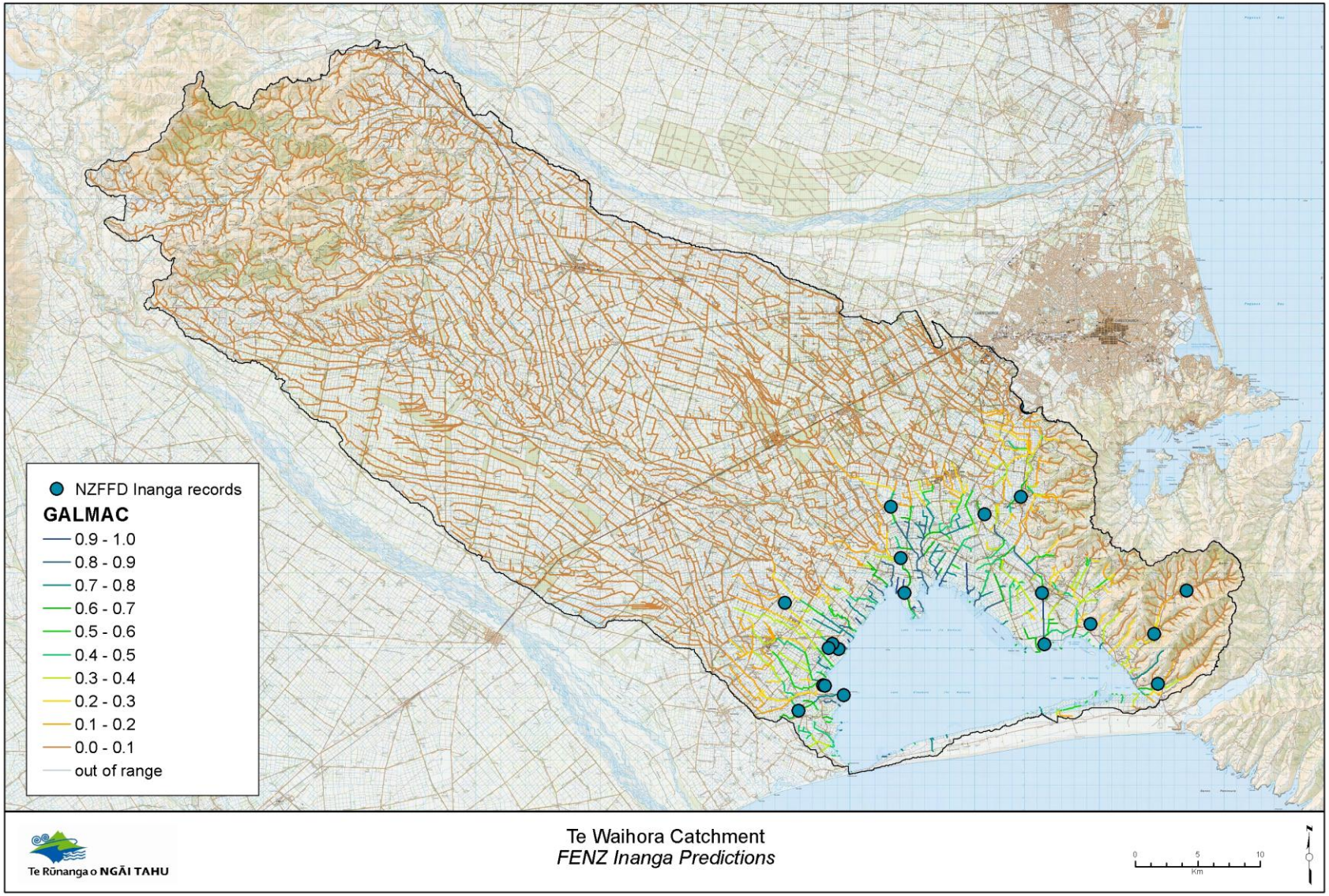
WAHI TAONGA CLASS	WATER DEPENDENCIES	FLOW RELATED DEPENDENCIES
2. Taonga species	• Food • Habitat (a place to live) • Cover • Life cycle stages • Movement corridors	• **Food** – links to Box 1 (food for all parts of the food chain) • **Habitat** (a place to live) – riparian habitats important – i.e. habitats on riverbed and floodplain. Flows create conditions for growth; keep water tables high; supplies nutrients etc; variation establishes site specific conditions e.g. high flows move seeds etc. Flows work channels, banks, alter soil moisture etc • **Cover** – flows provide protection especially for riverbed bird species, clear weeds etc. • **Riparian vegetation** provides woody debris to rivers, intercept sediments & nutrients etc. Vegetation lessen velocities helps reduce flood peaks by facilitating infiltration to groundwater into the ground during high flows and releasing back to the channel as flows subside. • **Life cycle stages** • **Movement corridors** – free movement for life cycle stages or to move to better habitats. Reduces risk of getting stranded.
4. Wahi raranga – sources of weaving materials	See earlier notes water and riparian area	See earlier notes water and riparian area
6. Wahi ana – important cave areas	• Ground water • Freshes and floods	• Ground water infiltration • Ground water levels • Freshes and floods affect shape of rock formations
7. Tuhituhi nehera – rock drawing areas	• Ground water • Freshes and floods	• Ground water infiltration • Ground water levels • Infrastructure (e.g. irrigation) can create micro climates
8. Wahi paripari – cliff areas	Channel shaping flow regimes	Flows change erosion, deposition, aggradation

WAHI TAONGA CLASS	WATER DEPENDENCIES	FLOW RELATED DEPENDENCIES
10. Wahi kohatu – rock formations	Channel shaping flow regimes	• Dominant river in relation to cliffs or rock formations can be dislocated when river at low flows. • Flows changes erosion, deposition, aggradation patterns • Can get bath tub ring effects
12. Maunga	Flows make connections – maunga to the sea	Flows make and maintain connections
14. Wahi ingoa	• May be water related • Can become dislocated	• Names could describe waterway, reaches of waterways, and/or physical characteristics of waterway • Names could describe flow dependent features within the catchment – wetlands, puna, rocks, cliffs,
16. Pa tawhito – ancient pa sites	Links directly to mahinga kai and water quality	Links directly to mahinga kai and water quality. • People could only reside because resources were available to sustain whanau and there was a potable water supply • Access to the pa would have been needed – possibly a water based transport route with a tauranga waka (landing site) at the pa.
17. Tauranga waka	Water based activity	Location dependent on specific water characteristics • Traditional tauranga waka • Contemporary boat ramps
18. Ara tawhito	Land and water based trails link to water	Links to boatability, access, connections, mahinga kai

WAHI TAONGA CLASS	WATER DEPENDENCIES	FLOW RELATED DEPENDENCIES
19 Puna	See all of above	• Specific waterbodies may be valued for combination of flow related characteristics e.g. bathing dependent on vortex, swimming related on depth and velocity in relation to access • Streams have a shape, a channel, a floodplain, and a flow. • Movement of sediment linked to stream energy (velocity, turbulence, slope and flow). • Water quality - Flows influence dilution capacity, AND Flows impact the saltwater / freshwater interface
20. Repo raupo	See all of above	• Specific waterbodies may be valued for combination of level related characteristics • Wetlands support a range of taonga species and a range of mahinga kai values

Appendix 3: Examples of predicted distributions of taonga species with an overlay of recordings from the New Zealand Freshwater Database




NZFFD Inanga records
GALMAC
0.9 - 1.0
0.8 - 0.9
0.7 - 0.8
0.6 - 0.7
0.5 - 0.6
0.4 - 0.5
0.3 - 0.4
0.2 - 0.3
0.1 - 0.2
0.0 - 0.1
out of range
Te Rūnanga o NGĀI TAHU
Te Waihora Catchment
FENZ Inanga Predictions
0
5
10
Km

Appendix 4: Maps of the location of some of the wahi taonga in the Waikirikiri – Te Waihora catchments

Appendix 5: Descriptions of some of the wahi taonga in the Waikirikiri – Te Waihora catchments

References

TO REITERATE THIS INTERIM REPORT IS A DRAFT WORKING DOCUMENT

IT HAS NOT YET BEEN ENDORSED BY TE WAIHORA BOARD, THE KAITIAKI RUNANGA, OR TE RUNANGA O NGAI TAHU