



STATE OF THE TAKIWĀ

Ngā Wai Pounamu



Te Waipounamu Freshwater Report 2007:
Cultural Health Assessment of South Island Waterways

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Te Rūnanga o NGĀI TAHU

mō tātou, ā, mō kā uri ā muri ake nei
for us and our children after us

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Top Row (L to R): Waianakarua River Mouth; Koukourārata Stream Mouth; Te Au Nui / Mataura Falls

Middle Row (L to R): Waikare/Chamberlains Ford; Arahura River Bridge; Ōpihi River State Highway 1 Bridge

Bottom Row (L to R): Māngai Piri/Niagara Falls; Ōkana River; Ōnuku Stream (Photographs: C. Pauling, 2007)

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Ngā mihi mahana ki a koutou katoa

Whakarāpopotanga / Executive Summary

This report outlines the results of a cultural environmental health assessment of South Island waterways undertaken by Te Rūnanga o Ngāi Tahu, in-conjunction with Ngāi Tahu Papatipu Rūnanga, between March and November 2007. This study was carried out as part of the Te Waipounamu Freshwater Project 2007, funded by the Ministry for the Environment's Sustainable Management Fund.

The purpose of the study was to undertake baseline assessments and report on the cultural health of selected freshwater sites within Te Waipounamu using the Takiwā cultural environmental monitoring and reporting tool. The sites were selected due to their traditional and contemporary significance as mahinga kai, or food gathering areas. The monitoring was also undertaken to further test the Takiwā tool for wider distribution and use.

Overall, the results of the study using the Takiwā assessment tool and other assessment methods found selected South Island waterway sites to be in a state of moderate to poor cultural health.

In particular, the assessments and analysis point towards significant issues with the management of the riparian zone and the importance of this area as both a habitat for native plants, birds, fish and other wildlife and as a buffer from the negative impacts of surrounding land-use. The study also highlights significant issues with non-point and point source discharges and the failure of E. coli recreational water quality standards to protect customary freshwater food gathering practices and users.

The majority of sites displayed a complete lack of native riparian or wetland vegetation, extensive modification of the riparian margin and often intensive land-use right up to the edge of waterway. A number of sites had visible and direct discharges entering the waterway.

Although the overall assessment was moderate to poor, there were some sites and features that were seen as positive and provide ideas for how future management may be able to improve the cultural health of waterways. These included the presence and abundance of remnant and/or restored native riparian vegetation and the separation of waterways from intensive land-use.

Protecting, enhancing and extending adequate native riparian and wetland buffers and other native vegetation patches within intensively used rural and urban catchments and continuing to deal with sources of contaminants, both point and non-point, will be the most important challenges for the future management of waterways in Te Waipounamu.

Developing a national standard for freshwater food gathering quality and systematically recording and reporting on this will also be important into the future.

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1 Te Whakatūwheratanga / Introduction

Water is a taonga of the utmost importance to Māori. For Ngāi Tahu, water plays a central role in the culture, traditions and ongoing identity of the iwi, particularly in relation to the custom of mahinga kai. As Tau, Goodall, Palmer and Tau (1990) explain "water is held in the highest esteem because the welfare of the life that it contains determines the welfare of the people reliant on those resources" (p4-12). Water is therefore not only a source of food and physical sustenance, but a source of mana and spiritual sustenance, being intricately linked to, and reflective of, the well-being of tāngata whenua.

Through the customary gathering of food and other resources from rivers, lakes and estuaries, Māori have historically, and continue to, collect a range of valuable environmental information in relation to waterway health and well-being. This information however has not traditionally been recorded in a form that is readily accessible, useable or defensible in a modern context and is therefore often under-utilised in resource management decision making.

To compound this issue, both statutory monitoring agencies and conventional western science driven water monitoring struggle to adequately include Māori cultural values, such as freshwater food gathering quality and standards, in data gathering techniques, analysis and reporting.

Related to this are long held concerns by Māori over the degradation of New Zealand's water environments and the erosion of traditional relationships with water, particularly with regard to customary rights, access, ownership and management (Ellison 2007).

The 1997 State of New Zealand's Environment Report highlighted a number of significant issues facing the health of freshwater including widespread pollution from both point and non-point sources, and the loss of natural character and habitat quality from drainage, flood control, removal of riparian vegetation, waste disposal, stormwater and agricultural runoff (Taylor & Smith, 1997, p7.6). A recent review of national water quality trends by Scarsbrook (2006) reveals that non-point source pollution has become an even greater concern.

On top of this, Māori continue to raise water related concerns under the Resource Management Act and to the Waitangi Tribunal.

In response to these issues, Te Rūnanga o Ngāi Tahu have been developing the State of the Takiwā tool, which is aimed at allowing tāngata whenua to systematically record, collect, collate and report on the cultural health of significant sites, natural resources and the environment within their respective takiwā, and in-turn play a greater role in environmental management.

In 2007, over 100 freshwater sites from over 20 catchments throughout the South Island were assessed using the Takiwā tool, to test and refine the method for wider application, and to develop a report on the health of freshwater resources of Te Waipounamu from a cultural perspective.

This report presents the results of this study along with an overview of the Takiwā tool and its methods.

2 Te Puna / Takiwā Monitoring Tool

The Takiwā Monitoring tool used within this study is an important factor in the development of this report. To fully appreciate and understand the data presented, the following section outlines how the Takiwā database and monitoring forms were developed, structured and used.

2.1 What is State of the Takiwā?

State of the Takiwā is an environmental monitoring approach developed by Te Rūnanga o Ngāi Tahu as part of their Ki Uta Ki Tai - Mountains to the Sea Natural Resource Management framework (Pauling 2003) and outlined in the tribal vision, Ngāi Tahu 2025 (Te Rūnanga o Ngāi Tahu 2001). Its development has been partly funded by the Ministry for the Environment and supported by Environmental Science and Research, Manaaki Whenua Landcare Research, NIWA, Envirolink Southern Community Laboratories, Environment Southland and Environment Canterbury.

In simple terms, State of the Takiwā describes a cultural values based environmental monitoring and reporting system that is aimed at facilitating tāngata whenua to gather information, assess and report on the cultural health of significant sites, natural resources and the environment within their respective takiwā, that will in turn assist them in managing the environment into the future.

State of the Takiwā is a play on words from the conventional, largely western science based State of the Environment approach, but that takes into account Māori cultural values, such as mauri and mahinga kai, and that aims to complement standard scientific measures of environmental health.

Ngāi Tahu 2025 defines State of the Takiwā as “[a]n environmental monitoring and reporting approach that integrates Mātauranga Māori and Western Science to gather information about the environment and to establish a baseline for the creation of policy and improvement of environmental health. A programme developed as an alternative to conventional state of the environment reporting used by the Ministry for the Environment that takes into account tāngata whenua values” (TRoNT 2001, p47-48).

The major objective behind State of the Takiwā is to ensure that tāngata whenua can build robust and defensible information on the health of the environment, which can in turn be used to assess the effectiveness of both internal policy and practices as well as those of external agencies, including local councils who have statutory responsibilities to undertake monitoring and report on the state of the environment (Pauling 2004).

Central to the approach is the gathering of information on the health of the environment using specially developed data-forms and the collation of this information into a specifically designed database from which analysis is possible and reports can be prepared. An overview of the Takiwā forms and database is included below.

2.2 The Takiwā Database

Takiwā is a specially developed Microsoft Access 2002 runtime application linked to a physically separated database, which can be run on any PC by downloading it from an installation CD-ROM. The database is password protected, and all data entries are automatically stamped with the initials of who created it and when, and who last modified it. The database also has facilities for creating dated backup copies of the data tables, which can be stored remotely to ensure the safety of the data. It also includes an easy to use Helpfile and has a bi-lingual interface that can display key headings in either Te Reo Māori or English, depending on the current user's preference.

The primary aim of the Takiwā database is to facilitate data collection and make information available to tāngata whenua, to help them identify and quantify the current or changing quality of a particular site, and to be able to report this data in an easy, clear and repeatable way. This is achieved by the inclusion of a site assessment module for storing, analysing and reporting data collected on particular sites, and a print centre where monitoring forms for data collection and standard reports can be produced.

2.2.1 Site Assessment Module

The Site Assessment module identifies environmental monitoring sites and records details from both present-day visits by participants as well as historical information. Data gathered is in a combination of reasoned multi-choice evaluation of criteria (eg. access for harvesting: 1 = very poor -- 5 = very good), and ad-hoc comments of visitor impressions (see Figure 1 below). Within this module, details based on Takiwā Monitoring, Cultural Health Index and SHMAK forms can be entered to describe a geographically-defined site and the details of the visit as well as being able to assess environmental and other qualities in a consistent fashion over time.

Site Assessment Workbench

Site Assessment

NZ Region: Canterbury
Catchment: Ihutai
Site: Waikānaki
Visit: 4 May 2007 CP/TL/MR/NTN
Questionnaire: 1 CP/TL/MR/NTN
SHMAK

Assessment of 4 May 2007 by CP/TL/MR/NTN Page is editable Q Code: Q00022_00001

Name of assessor: CP/TL/MR/NTN From: Number of people represented: 4

Site Assessment

1. Pressure on the site: 1 2 3 4 5
2. Degree of modification: 1 2 3 4 5
3. Access for harvesting: 1 2 3 4 5
4. Willingness to harvest: 1 2 3 4 5
5. Site is wāhi tapu? ☐
6. Would you return? No ☐ Yes ☐ Not soon
7. Actions that would improve site: ☒ Better management ☐ Interpretation / signage
☐ Consider owning/purchasing ☐ Restoration of native species
☐ Protection / access arrangement with owner ☐ Pest / weed control
Anything else: Stormwater needs looking into - why drain into an otherwise natural area?
8. Overall health: 1 2 3 4 5 A pleasant place to visit

Index Calculations

Health Assessment Index: 2.1 Analyse
Abundance Index: 14.0
Cultural Health Index: A-01.5 0.0

For this questionnaire: Recalculate See B Abundance Analysis

Ecosystems Species Lock tab More buttons Allow editing Print Centre For all Questionnaires: Recalc All Show factors Edit Factors

Figure 1. Takiwā Site Assessment Module

The structure of the database ensures that, in the future, the data can be interrogated to answer such questions as:

- Has quality improved or deteriorated over the years?
- How many sites of interest exist in different areas?
- How much information is available on that area?
- Who has visited it (for assessment) and when?
- Have native birds, plants, etc improved or deteriorated over the years?
- At which sites have people seen kererū, totara, or other listed taonga?
- How have their presence changed over the years?

The Site Assessment module also includes a section labelled 'journal' where important historical information and references about a particular site can be stored. A further feature is the image portal where an unlimited number of photographs or other diagrams (.jpg, .gif or .bmp format) can be associated with the site.

In order to grade and compare sites and visits, index calculations have been included within the database. These include an overall site health assessment index, a species abundance index, and the Cultural Health Index for waterways (Tipa & Tierney 2003 & 2006). The Site Assessment module also includes a module to enter data from the Stream Health Monitoring and Assessment Kit (Biggs, Kilroy & Mulcock 2000) and to produce scores for stream habitat quality, and invertebrate and periphyton health. All indexes can be recalculated for either the current questionnaire, or for all questionnaires in the database (Mattingley 2005 & 2007).

2.2.2 Takiwā Monitoring Forms

Takiwā includes a series of specially developed monitoring forms which can be printed directly from the database, used to gather information about sites and facilitate the storage and reporting of data from the field. These include the Takiwā Site Definition, Visit and Assessment forms. Takiwā also currently includes forms for the Cultural Health Index and Stream Health Monitoring and Assessment Kit.

The aim of the Takiwā monitoring forms are to record observations and assessments by tāngata whenua for a particular site and at a particular time relating to key cultural values and indicators of environmental health, such as mahinga kai.

The forms were developed and tested through discussion with and use by both tāngata whenua groups and monitoring experts and by reviewing previously developed monitoring tools.

Feedback dictated that the monitoring forms needed to be simple, rather than being overly complicated or abstract and that the forms should attempt to capture the cultural information and values about a site, which is normally internalised during mahinga kai (food gathering) or similar activities and often called 'anecdotal information'.

The overall goal of the data collection and storage achieved by the form and database was to make this important information more defensible, accessible, useable and quantitative.

Forms and indicators from other monitoring toolkits were investigated and used to identify relevant formatting as well as the type of questions that could be used to capture appropriate information in relation to cultural values and indicators. These included:

- Kaimoana Monitoring Guidelines (Otaraua Hapū 2003);
- Cultural Steam Health Index (Tipa & Tierney 2003 and 2006);
- Iwi-Stream Health Monitoring and Assessment Kit (Ogilvie & Penter 2001);
- Māori Indicators Wetland Monitoring Tool (Harmsworth 2002);
- Forest Monitoring and Assessment Kit Site Assessment Kit (Handford & Associates Ltd 2003);
- NIWA Freshwater Fish Database Form (NIWA 2003).

From this analysis and discussion with tāngata whenua and other experts, the following indicators were identified as being most important to include in the main Takiwā monitoring form:

- Heritage/Site Significance;
- Amount of pressure on the site from external factors;
- Levels of modification/change at a site;
- Suitability of the site for harvesting mahinga kai;
- Access issues in relation to the site;
- Overall health/state of a site;
- Presence, abundance and diversity counts for native bird, plant and fish species, other culturally significant resources as well as exotic (including pest and weed) species; and
- Willingness to return to the site.

Other details that were seen as being important to record were in relation to general visit and site details (date, time, weather conditions, site location, legal protection etc). This was achieved by the development of two separate but interdependent forms – The Site Definition and Visit Details Form. The visit details form also includes prompts to ensure photographic references are recorded for a site. The tool also includes forms for recording data using the Cultural Health Index and the Stream Health Monitoring and Assessment Kit.

Examples of all the forms included in Takiwā and used in this study are shown in Appendix A.

2.2.3 Data Management and Interpretation

The Takiwā database is designed by, and for, tāngata whenua, and as such gives local iwi, hapū and whānau the ability to manage the data they gather in a way that is appropriate for them. This includes how data is collected, stored, analysed, and also how data is shared with others. It is tāngata whenua, as the users of Takiwā that lead the data management process. Importantly, only tāngata whenua can interpret what the results mean to their cultural values.

To facilitate the sharing of data from monitoring activities, the Takiwā tool includes a data transfer module. The data transfer module also allows for the centralised storage of data, for example with rūnanga, hapū, or iwi organisations. The centralisation of data can in turn facilitate the regional and national collection, analysis and reporting of cultural monitoring data. It also allows for the centralisation of certain functional database information and

tables and for updates of these to be sent to all users. However, as explained earlier decisions about access to and sharing of data are to be made by tāngata whenua. If an agency wants access to any data held within Takiwā they must seek approval of tāngata whenua.

The transfer module works by allowing users to both export and import selected data, including those relating to different catchments, sites, visits and Takiwā or SHMAK assessments. By allowing tāngata whenua to select which information they share, Takiwā provides security around sensitive cultural information, such as that associated with wāhi tapu or silent file areas. Takiwā 2.0 simply puts the selected information in a separate database transfer file that is suitably named and ready for transferring. The data can simply be emailed to another user or uploaded through a USB device.

The Takiwā tool also allows tāngata whenua users to analyse and report on monitoring activities, and interpret their own data, through a printable query and reporting function.

2.2.4 Takiwā Reporting Functions

The Takiwā reporting function allows users to print a range of reports by simply selecting the type of report (from a range of options) and pushing a print button within the database. These reports can also be exported to Word or Excel to assist in report writing or graphic representations of the data. Again, tāngata whenua have control over the type and level of information they share.

This is made possible through a 'Print Centre' that offers a range of different reports for sites, visits and questionnaires. The print centre is accessed through buttons on both the Takiwā Main screen and on the Site Evaluation screen.

When a user is in the print centre, it already knows which Site, Visit and Questionnaire were last used on the Site Evaluation screen, and these are listed, with the last one viewed being already selected.

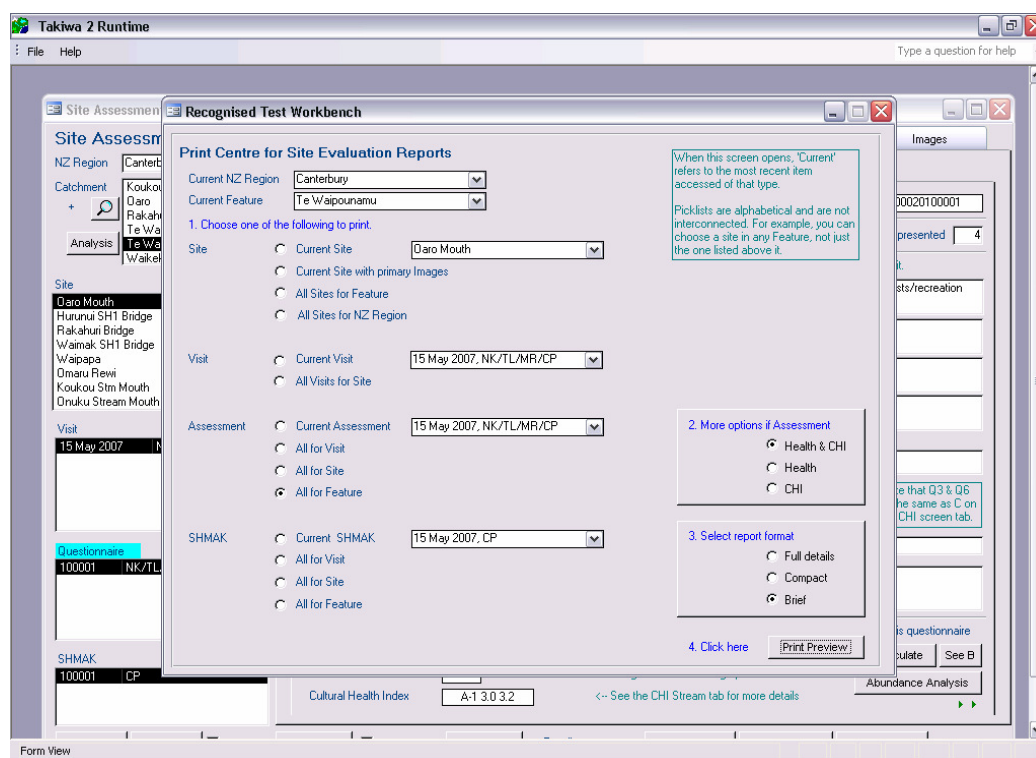


Figure 2. Takiwā Report 'Print Centre'

3 Ngā Kauneke / Methods

The major data collection undertaken within this study was conducted between March and November 2007. It was facilitated by a central coordinator from Te Rūnanga o Ngāi Tahu and involved working with members of Papatipu Rūnanga from around Te Waipounamu. In total, over 100 sites from over 20 catchments and across 4 regions of the South Island were assessed.

The rūnanga monitoring teams were also supported by researchers and monitoring staff from ESR, NIWA, Manaaki Whenua Landcare Research, Envirolink/Hills Laboratories, Environment Canterbury, Environment Southland, and the Otago Regional Council.

The data collection primarily involved cultural health site assessments using the Takiwā tool. This was further complemented by the use of the Cultural Health Index, Stream Health Monitoring and Assessment Kit and electric fishing surveys and the collection and testing of water samples for the analysis of E.coli and antibiotic resistant E.coli.

From the total number of sites monitored, 17 reference sites were selected for final analysis and reporting. These sites were chosen to give a good geographical representation of the sites monitored and due to their significance as traditional and/or contemporary mahinga kai (food gathering sites and/or areas).

The following sub-sections give an outline of the planning undertaken, people involved, equipment used, sites assessed, and methods used to collect data at each site, as well as an overview of the data analysis undertaken.

3.1 Kōrero Arotake / Monitoring Hui and Planning

To initiate the study, hui were held with Papatipu Rūnanga within Canterbury, Otago and Southland to select catchments and sites and to discuss and refine the methods to be used.

From these meetings, monitoring plans were developed that guided the data collection activities and included:

- A background to the field work, the aims and expected outcomes;
- An explanation of the area and sites to be assessed;
- A timetable and schedule of activities;
- The data collection methods;
- A budget;
- Health and Safety considerations;
- Maps, Assessment forms and other important information.

The monitoring plans for the Canterbury, Otago and Southland regions are included as Appendix B.

3.2 Tāngata Arotake / Monitoring Team

The following people were involved in the initial hui and fieldwork:

Hui/Fieldwork:

- Norm Kerei-Keepa, Raewyn Solomon (Kāti Kuri - Kaikōura)
- Nukuroa Tirikatene-Nash, Makarini Rupene, Te Marino Lenihan (Ngāi Tūāhuriri - Nth Canterbury/Christchurch)
- Rewi Couch (Ngāti Wheke - Rāpaki)
- Peter Ramsden, Te Whetu Apai (Ngāti Huikai - Koukourārata)
- Waitai Tikao, Tim Manawatu (Ngāi Tarewa - Ōnuku)
- Iaeen Cranwell, Naomi Bunker, Maatakiwi Wakefield (Ngāti Irakehu/Mako - Wairewa)
- Lisa Smith, David O'Connell (Ngāi Te Ruahikihiki – Taumutu/Waihora)
- Mandy Home (Kāti Huirapa – Arowhenua/South Canterbury)
- Gail Tipa, Rua Macallum, Mary Whitau, Myra Tipa, Kyle Nelson (Kāti Hateatea – Moeraki)
- Rewi Anglem (Hokonui), Stewart Bull (Oraka Aparima), Gail Thompson (Awarua), Don Mowat (Waihopai), Rodney Trainor (Hokonui), Michael Skerrett (Te Ao Marama), Aaron Leith (Waikawa), Jane Kitson (Murihiku/Southland)
- Craig Pauling (Te Rūnanga o Ngāi Tahu)

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- John Aitken (Envirolink/Hill Laboratories)
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- Clive Howard Williams, Ngaire Phillips (NIWA)
- Jason Arnold (NT Waihora Coordinator)
- Jenny Bond, Adrian Meredith, Dave Aires, Leigh Skerten (Environment Canterbury)
- Chris Arbuckle (Environment Southland)
- Garth Harmsworth, Jamie Ataria, Louis Tremblay (Landcare Research)
- Barry Mattingley (ESR)
- Jaroz Adams (Ngāi Tai, formerly NIWA)
- Kati Thompson, Mike Thompson (MfE)

3.3 Taputapu Arotake / Monitoring Equipment

The following equipment was used during the study and fieldwork:

- Vehicles (Private and Rental)
- Takiwā forms, CHI forms, SHMAK Kit, manual and forms
- Electric Fishing Machine, Probe and Nets
- Waders and Protective Jacket/Gear
- E.coli kit (Vials, Chilly pads, Chilly Bin, Forms)
- Digital Camera, GPS unit and Binoculars
- Maps and Monitoring Plan
- Pens, folders and identification booklets
- First Aid Kit
- Tea and Coffee
- Laptop and Takiwā software (for the storage and analysis of data)

3.4 Wāhi Arotake / Monitoring Sites

As mentioned in 3.1 above, target catchments were selected by Papatipu Rūnanga groups at the planning hui and initial monitoring sites were then chosen from within these selected catchments. The sites contained a good mix of traditionally significant sites, land use issues, historical changes, as well as sites of contemporary significance. Some sites were also chosen to correspond with sites being used for monitoring by other programmes and agencies, while other sites were simply chosen due to ease of access.

Monitoring within the Canterbury Region was carried out within 7 catchments:

- Ōaro River, Kaikoura (4 sites);
- Te Ihutai /Avon-Heathcote Estuary, including the Avon and Heathcote Rivers, the Estuary and Pegasus Bay (30 sites);
- Ōmaru Stream, Lyttelton Harbour (4 sites);
- Koukourārata Stream, Port Levy (4 sites);
- Ōnuku Stream, Akaroa Harbour (4 sites);
- Wairewa/Lake Forsyth, including the Ōkana and Ōkuti Rivers (12 sites); and
- Waihora/Lake Ellesmere, including the Waikirikiri/Selwyn River, Huritini/Halswell River, Kaituna River and Waikekewai Stream (20 sites).

Monitoring within the Southland Region was carried out within 2 catchments:

- Mataura River (9 sites); and
- Waikawa River (5 sites).

Monitoring within the Otago Region was carried out within 1 catchment:

- Waianakarua River (5 sites).

A full list of the sites monitored in each region are included in the monitoring plans within Appendix B.

In addition to the above, sites were also assessed within the following catchments:

North Canterbury

- Hurunui River (1 site) ;
- Rakahuri/Ashley River (1 site) ;
- Waimakariri River (1 site) ;

South Canterbury

- Opihi River (1 site) ;

Tai Poutini / West Coast

- Arahura River (3 sites) ; and
- Lake Kaniere (1 site).

Monitoring data from cultural assessments done within the Waiau River, Southland (12 sites) in March 2005 were also included in the study (Pauling, Mattingley & Aitken, 2005).

From the total number of sites monitored, 17 were selected as reference sites for Te Waipounamu and for final analysis and reporting. These sites were chosen to give a good geographical representation of the total number of sites monitored and due to their significance as traditional and/or contemporary mahinga kai or food and resource gathering areas/sites.

These sites are shown on the map on the following page.

Ngā Wai Pounamu Assessment Sites



3.5 Kauneke Arotake / Data Collection & Assessment

The data collection undertaken within the study involved the following types of assessment:

1. Takiwā Site Assessments;
2. E.Coli Water Testing;
3. Cultural Health Index (CHI) Waterway Assessments;
4. Stream Health Monitoring (SHMAK) Assessments; and
5. Electric Fishing Surveys.

Further details of the methods for the different assessment methods used in the study are outlined in the following sub-sections. The general process followed for the data collection at all sites involved the following steps:

- After arriving at the site, the monitoring team gathered together so that any appropriate mihi, karakia and/or kōrero could be given.
- The team then completed the Site Definition and Visit Details forms, including obtaining GPS coordinates and photographic records for the site.
- The team then completed the Takiwā site assessment form and gathered the water sample for E.coli testing. At all river/stream sites the team then undertook the various tests as part of the SHMAK kit, completed the Cultural Health Index water quality form, before finally undertaking an electric fishing survey of the site.
- Before departing, a general kōrero/discussion was held about the site, and travel and other details about the next site and/or activity.

3.5.1 Takiwā Site Assessments

The first step of the Takiwā site assessment involved completing the Site Definition form. This required recording information on the site name, referring to both traditional and current names, the location, legal protection issues, and the traditional significance and condition of the site, as well as recording the exact geographical details using a GPS receiver. For Takiwā assessments, a site is defined as the area within 100 metres of the point of monitoring.

In the second step, visit specific details such as the individuals involved, the date, time, weather conditions and other information relevant to the visit, including photographic records are then recorded on the Visit Details form.

The third step involved completing the site assessment form. The first part of the site assessment form involved ranking the following aspects of site health using a 1 to 5 scale, where 1 is the least/worst score and 5 is the highest/best score:

- Amount of pressure from external factors;
- Levels of modification/change at the site;
- Suitably for harvesting mahinga kai;
- Access issues;
- Willingness to return to the site (simply a yes or no answer); and
- Overall state/health of the site.

The second part of the site assessment form involved undertaking abundance and diversity counts for native bird, plant and fish species, other resources (such

as stone, bone or driftwood) as well as introduced plant and animal species. This was achieved via visual and aural identification of individual species along with a weighting given to their relative abundance (few/some/many) at the site. The assessment of fish species was undertaken at all river sites through electric fishing (see section 3.5.5 below).

The assessment of taonga plant species also included a question to indicate the relative dominance of native species versus exotic or weed species at the site. This is represented as a percentage of the total site area covered by the taonga plants and gives an important indicator of change at the site over time.

From this information, index scores are quantified for overall site health (total averaged factor scores out of 5) and species abundance (an open ended number, which can be positive or negative and where higher is better). The site health score is then assigned a rank from very good to very poor and used in the overall analysis of the catchment (Pauling 2007).

3.5.2 E.Coli Water Testing

E.coli water testing involved two assessments, using a single 100ml water sample collected from each site:

- Laboratory analysis to quantify the total E.coli in the sample (per 100mls).
- Further laboratory analysis of the sample to identify the main source of any E.coli present in the river water, through antibiotic resistance analysis.

Water samples were collected in plastic screw top 100ml vials, labelled with the site code, put on ice in a chilly bin, and delivered to Hill's Laboratory for analysis within 24 hours. Results from the laboratory analysis were then sent back to the monitoring team for inclusion in the analysis of the study.

3.5.2.1 Background to E.coli and Anti-biotic Testing

Faecal Coliforms are a group of bacteria that include E.coli. Members of the coliform group also include other bacteria that may be found in the soils, and also in the intestines of birds. A positive faecal coliform result therefore indicates the possibility of faecal contamination, but is not totally reliable.

The presence of E.coli, however, indicates contamination with faecal material from the intestinal tract of a mammal or birds. As a general rule, the drinking water standard uses the detection of 1 E.coli in 100ml of water as rendering it unfit for human consumption (Ministry of Health 2000). There are also standards for shell-fish gathering and contact recreation (Ministry for the Environment 2003). A summary of these standards are included as Appendix C of this report.

Drinking water supplies susceptible to contamination with sewage or other excreted matter may cause outbreaks of diarrhoea or intestinal infections. Kaimoana gathered near faecally contaminated water may also contain intestinal pathogens because shellfish filter and concentrate organisms inside their body.

It is sometimes difficult to detect bugs like campylobacter that cause health problems, because they occur in very low numbers. Instead we rely on tests that will reveal the presence of bugs associated with faeces (such as E.coli and faecal coliforms) that show contamination of the water, but do not usually cause harm themselves.

A further piece of analysis that can be carried out with E.coli is the detection of antibiotic resistance. Antibiotic resistance in E.coli is a strong indication that the E.coli has previously been exposed to antibiotics, or has acquired the antibiotic resistance factor by association with an E.coli containing the factor. Specific antibiotics (eg. Apramycin) are uniquely associated with the agricultural use of antibiotics, and the detection of this resistance indicates agricultural origin of the E.coli. Resistance to other antibiotics used solely by humans can therefore indicate contamination from human effluent and so on. Moreover, a sample showing no resistance or 'sensitivity' indicates the contamination is from a natural source, such as a bird or from the soil (Pauling et al 2005).

3.5.3 Cultural Health Index Waterway Assessment

The Cultural Health Index (CHI) was developed by Gail Tipa and Laurel Tierney with support from the Ministry for the Environment and Te Rūnanga o Ngāi Tahu. The original CHI was completed in 2003 (Tipa & Tierney 2003), with a revised version being published in 2006 (Tipa & Tierney 2006).

The methodology for the Cultural Health Index is very similar to the Takiwā site assessment, where a form is completed relating to a number of ranking questions, along with the identification of valued bird, plant and fish species. The major difference is that the Cultural Health Index is focussed solely on assessing the cultural health of the waterway at a particular site, rather than land resources over the entire site. Other obvious differences are the exclusion of assessments for pest and weeds and other resources. Another difference in the CHI is the grading and scoring system associated with it.

The CHI has three components - traditional association, mahinga kai and stream health. To derive the index at a particular stream site, first traditional association is identified, then mahinga kai values are assessed, and finally cultural stream health is evaluated. Almost all the necessary data for these measures are derived from the recording forms.

Component 1 – Site status

This identifies whether or not the site is of traditional significance to tāngata whenua and can be determined when the sites are first selected. The second part of the status grade indicates whether tāngata whenua would return to the site in future.

Stream sites are classified according to traditional association and intention to use in the future, including:

- *Is there a traditional association between tāngata whenua & the site?* Sites of traditional significance are assigned an 'A'. Sites that do not have a traditional association are assigned a 'B'.
- *Would Māori come to the site in the future?* Whether the tāngata whenua would return to the site or not is also recorded. If the tāngata whenua would return, the site is awarded a 1, and if not, a 0.

Component 2 – Mahinga kai

Examining the health of mahinga kai recognises that mauri is tangibly represented by the physical characteristics of a freshwater resource, including the indigenous flora and fauna, the fitness for cultural usage and its productive capacity.

The mahinga kai measure has four elements, each of which is scored on a 1–5 basis (1 is poor health, 5 is very healthy):

1. Identification of mahinga kai species present at the site. A score is given depending on the number of species present. The productive capacity of a site is reflected in the ability of the freshwater resource to yield mahinga kai.
2. Comparison between the species present today and those sourced traditionally from the site. A score is given based on the number of species of traditional significance that are still present. Maintaining cultural practices, such as the gathering of mahinga kai, is an important way of ensuring the transfer of cultural values through the generations.
3. Access to the site. *Do tāngata whenua have physical and legal access to the resources they want to gather?*
4. Assessment of whether tāngata whenua would return to the site in the future as they did in the past.

The four mahinga kai elements are then averaged to produce a single score between 1 and 5.

Component 3 – Cultural stream health

The cultural stream health measure is the average of 1–5 scores awarded to each of eight individual indicators:

- | | |
|-----------------------------|--------------------------------|
| 1. Water quality | 5. Riparian vegetation |
| 2. Water clarity | 6. Riverbed condition/sediment |
| 3. Flow and habitat variety | 7. Use of riparian margin |
| 4. Catchment land use | 8. Channel modification |

The Overall Cultural Health Index

The three components are brought together in an overall Cultural Health Index score. When the CHI is calculated for a specific site, a score is generated and expressed as: **A-0 / 2.1 / 4.2** where:

- A identifies the site as traditional (rather than a B for non-traditional)
- 0 indicates that Māori would not return to this site in the future (1 indicates they would return)
- 2.1 is the mahinga kai score (score of 1-5)
- 4.2 is the overall evaluation of stream health (score of 1-5)

(Tipa & Tierney 2003 & 2006)

3.5.4 Stream Health Monitoring (SHMAK) Assessment

The Stream Health Monitoring and Assessment Kit (SHMAK) was developed by the National Institute of Water and Atmospheric Research (NIWA) in partnership with Federated Farmers of New Zealand and partly funded by the Ministry for the Environment (MfE) (Biggs et al 2000).

An Iwi-SHMAK kit was also developed by NIWA in partnership with Te Rūnanga o Ngāi Tahu and funded by MfE (Ogilvie & Penter 2001).

SHMAK allows the measurement of water flow/velocity, pH, temperature, conductivity, clarity, streambed composition, riparian vegetation, invertebrates, periphyton and catchment activity through the use of a number of monitoring

instruments and the recording of data onto forms. The information collected is ranked using a scoring system to understand how healthy the stream is and how it may be changing over time.

SHMAK was used to collect the following types of data and using the following methods:

Biological Data

Common and easily recognised biological indicator organisms known to be characteristic of certain stream health conditions were observed and/or counted, including:

- Types of stream invertebrates (e.g., insects, snails).
- Types of periphyton (algae/slimes on the bed of the stream).

This was achieved by scooping samples into containers and using an identification sheet to identify and record the different species present.

Stream Habitat Data

Measurements and observations of physical and chemical conditions at a monitoring site, consisting of:

- Water velocity (measuring the time it takes an object to float a set distance downstream);
- Water pH (using pH strips dipped in a separate water sample from the site);
- Water temperature (using a thermometer dipped in a separate water sample);
- Water conductivity (using a conductivity meter dipped in a separate water sample);
- Water clarity (using a water clarity tube filled with water from the site)
- Composition of the stream bed (by observation and estimation of percentages of rocks, gravels, sand, plants, etc);
- Presence and extent of loose, silty deposits on the stream bed (by observation and estimation according to a set guide); and
- Stream-bank vegetation at the site (by observation and estimation of percentages of different types of vegetation).

Each monitoring observation was recorded on special forms and assigned a score. Individual factor scores were then combined to develop overall scores for stream habitat, invertebrates and periphyton health. An overall rating for sites was then calculated based on pre-determined rankings within the SHMAK methodology. These scores depend on the type of stream which is in turn based on the composition of the stream-bed and the relative abundance of fine substrates in the bed (Biggs et al 2000).

3.5.5 Electric Fishing

Electric Fishing is a method widely used to survey fish within wadeable rivers and streams. The method involves the use of a specially designed machine that creates an electric field in the water that temporarily stuns fish to facilitate their capture in nets for closer inspection and identification.

This study utilised the Kainga EFM 300 packset in-conjunction with a hand held scoop net and larger mesh net. The EFM 300 consists of a battery-powered backpack generator unit, a fibreglass wand with cathode, and an earthing wire. The machine allows output voltage, frequency, and pulse width to be controlled and also incorporates a timer that records the number of minutes in use. The EFM 300 also includes four separate safety circuits to maximise user safety. Both machine and net operators wear full length neoprene waders and rubber safety gloves, with cotton inners during surveying (NIWA 2007).

Surveys were typically conducted over a 10-20 metre stretch of river at each monitoring site and involved one pass on each bank, taking between 10-20 minutes in total. Voltage settings were normally 300 volts and adjusted to optimise the electric field according to the indicator on the wand. Fish were scooped out, counted and inspected to ascertain the species type and record their general size, before being returned to the water. At some sites a selection of fish were also photographed. Data on fishing time, distance of river fished, fish numbers, species and size were recorded on the fish section of the Takiwā site assessment form.

3.6 Data Analysis

After the fieldwork was concluded, data from the completed monitoring forms was loaded into the Takiwā database, from which scores for the Takiwā, Cultural Health Index and SHMAK assessments were calculated.

Scores from the 17 selected reference sites were then analysed and graphed using excel and used to show the relative rankings of the sites from very good to very poor. Other data was also extracted from the database in relation to the presence and abundance of native and exotic species and how these related to the relative scores of each site.

Individual indicator scores from each assessment tool were also isolated, totalled and averaged across the sites. This allowed an evaluation of the relative significance of different aspects of stream health to be undertaken.

E.coli and anti-biotic resistance test results were obtained from Hills Laboratories and the data entered into excel spreadsheets. The data was then assessed against national drinking water, shellfish gathering and recreational standards for E.coli and graphed to show the number of samples that passed and failed the different standards, as well as the number that had anti-biotic resistance.

These results are outlined and discussed in the following section.

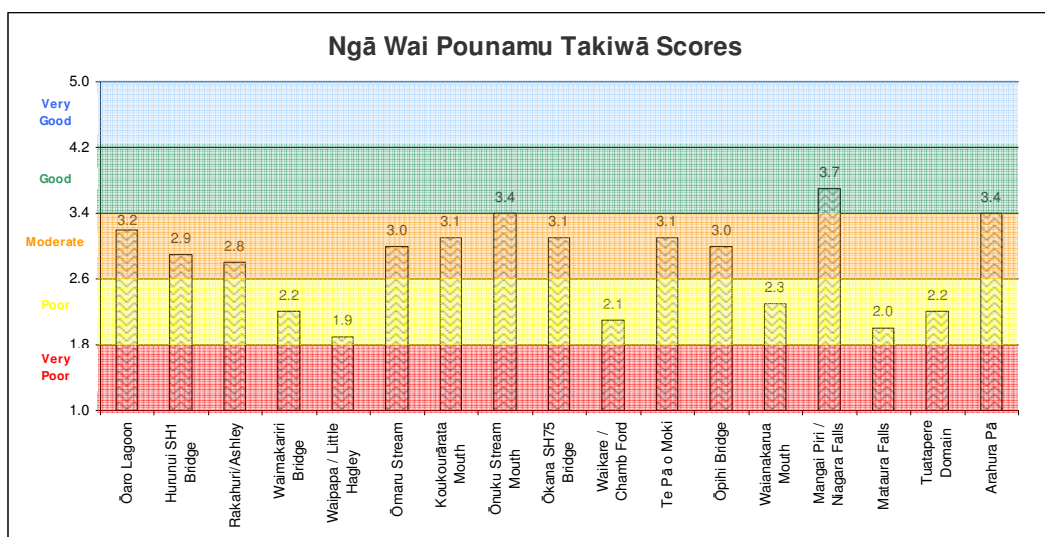
4 Ngā Hua / Results

This section outlines the results of the fieldwork and subsequent analysis carried out within the study.

4.1 Takiwā Site Assessments

Takiwā assessment results across the monitoring sites ranged from good to poor, with the majority being of moderate health (47%). A further 35% of the sites were rated as poor and only 18% (or 3 sites) achieved a good rating. No sites were rated as very poor or very good.

Takiwā assessment results are shown in the graph below.



Overall, the sites scored well on access, willingness to harvest and return indicators but poorly on pressure, modification, and in particular native species abundance indicators.

Māngai Piri (3.7), Arahura (3.4) and Ōnuku (3.4) were the highest ranking sites, while Waipapa (1.9), Mataura Falls (2.0) and Waikare (2.1) were the lowest scoring.

Features of high scoring sites included intact native riparian buffers, and a lack of modification or pressure on the margins. Features of low scoring sites included a lack of native riparian buffers (or any buffer at all), high modification or intense pressure (both rural and urban land-use) on the margins, and often directly visible point source and/or non-point source discharges and pollution.

Full results for the Takiwā assessments are included as Appendix D, along with a record of site photographs in Appendix H.

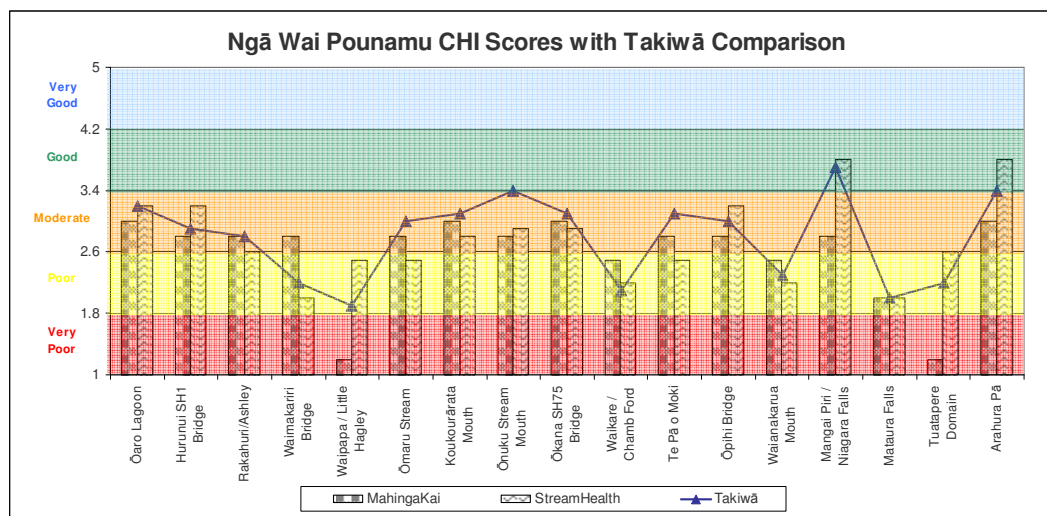
4.2 CHI Assessments

CHI results supported the Takiwā assessments, with some sites demonstrating slightly better stream health scores, but lower mahinga kai scores overall. 59% of sites were rated as moderate, with a further 35% as poor.

Catchment landuse, margin vegetation and river margin use indicators showed poor health, while water clarity and habitat variety indicators received high ratings.

Māngai Piri and Arahura (both 3.8) were the highest scoring sites for stream health, while Matura and Waimakariri were the lowest (both 2.0).

The overall CHI results are shown in the graph below, along with a comparison to the Takiwā site scores.

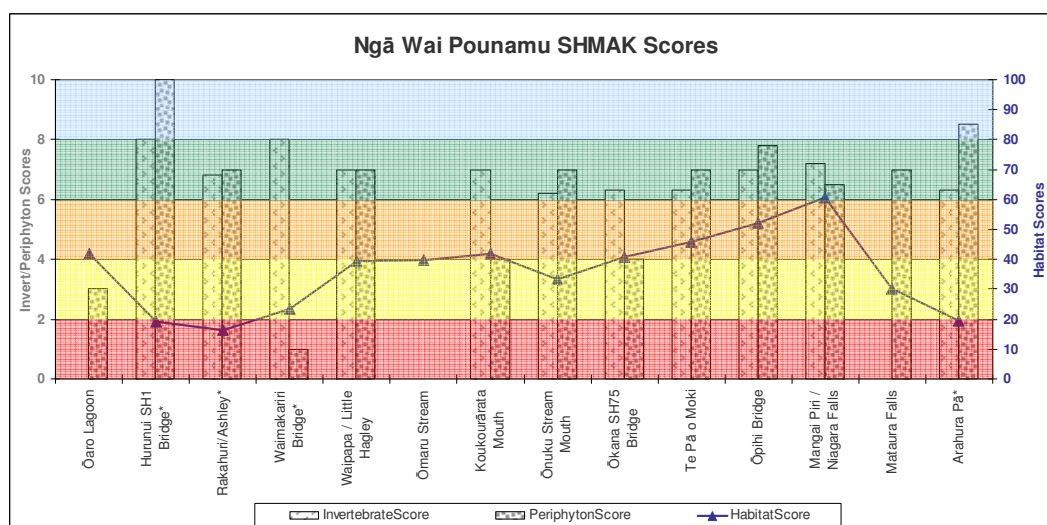


Full results for the CHI assessments are included as Appendix E.

4.3 SHMAK Assessments

Only 14 sites were able to be tested using SHMAK and the results for these sites highlighted some interesting differences in overall ratings when compared with the Takiwā and CHI scores. SHMAK scores identified a greater number of higher rating sites, with the majority achieving good ratings.

Scores were particularly high for invertebrate, and in some cases periphyton indicators, but were poorer across habitat indicators. The results are shown in the graph below.



* Indicates an incomplete site record

In terms of the individual habitat indicators, clarity, temperature and pH indicators were higher scoring overall, while conductivity, margin vegetation and riverbed deposits all scored poorly and supported the Takiwā and CHI assessment results.

Full results for the SHMAK assessments are included as Appendix F.

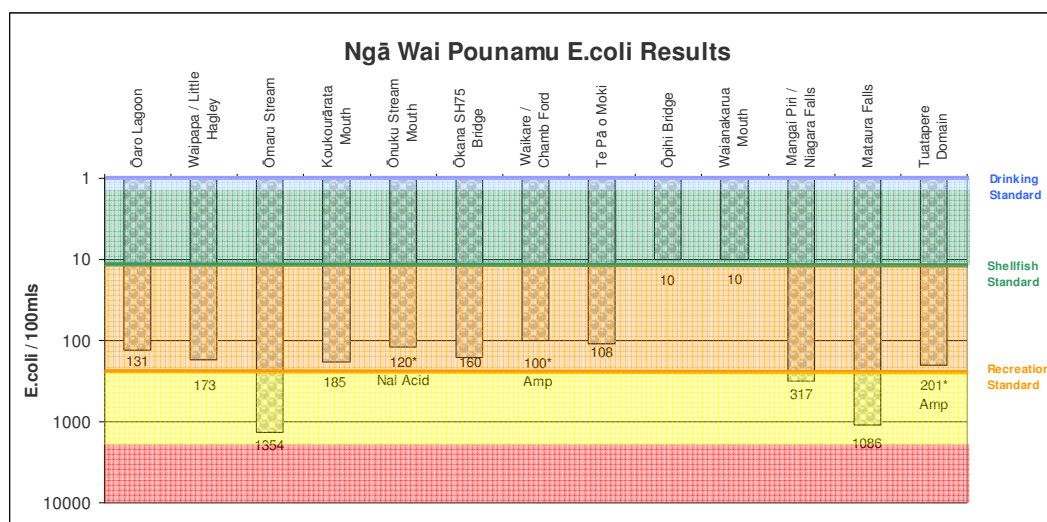
4.4 E.coli Water Testing and Anti-biotic Resistance

E.Coli results for the Ngā Wai Pounamu sites supported the cultural assessments, achieving mainly moderate to poor ratings. Only 2 sites of the 13 sites tested (Ōpihi and Waianakarua) were under the shellfish/food gathering standard, while 3 sites failed the recreational standard for water quality. No sites were fit for drinking. Two sites, Matura Falls (1086 E.coli/100mls) and Ōmaru Stream (1354 E.coli/100mls), had extremely high results.

Furthermore, 3 sites (Ōnuku, Waikare and Tuatapere) that achieved the recreational standard showed resistance to antibiotics, with Ampicillin being the most common. The occurrence of Ampicillin in the samples is disturbing because it is an anti-biotic of the penicillin group most commonly used by humans to treat bacterial infections, and can therefore indicate human sourced contamination at these sites (Aitken, 2007).

The other anti-biotic identified in the E.coli results was Nalidixic Acid, a member of the quinolone group of anti-biotics used to treat urinary tract infections and extensively in agriculture. This can therefore indicate both human and agricultural sourced pollution (Aitken, 2007).

These results are shown in the graph below.



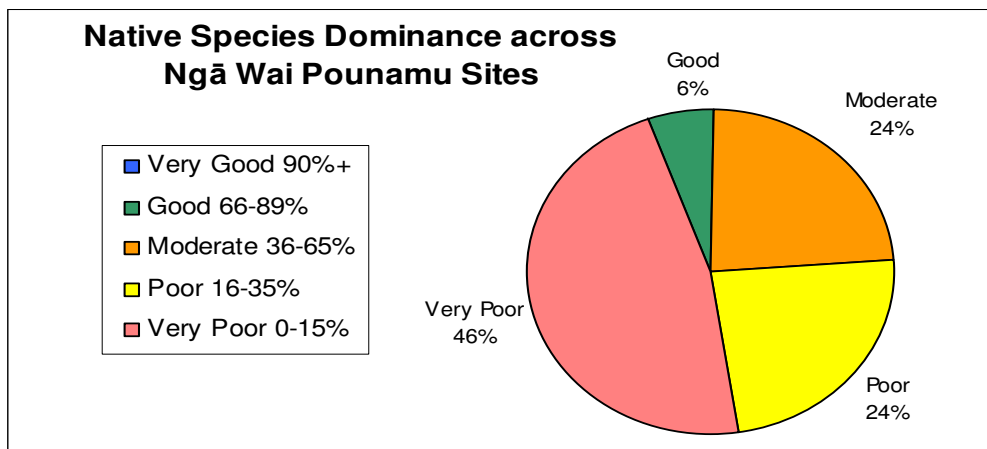
Full results for the E.coli testing are included as Appendix G.

4.5 Native Species Abundance

Native species abundance indicators measured for all sites included the abundance of native plant, bird and fish species minus the abundance of exotic species, the comparative numbers of traditional and contemporary species present and the dominance of native vegetation at each site.

Overall, native species abundance and in particular native vegetation dominance across all sites was poor. 46% of sites had less than 15% of the site area dominated by native vegetation, with a further 24% having less than 35% dominance. Only 2 sites (Māngai Piri and Tuatapere) had greater than 50% native vegetation dominance.

The results for native vegetation dominance are shown in the graph below.



Of the native plants distributed across the sites, Ti Kouka (cabbage tree) was the most prevalent, being found at 11 sites. Harakeke (NZ Flax) (7 Sites), Karamū (*Coprosma robusta*) and Koromiko (*Hebe salicifolia*) (both 5 sites) were the next most common.

Kāroro (Black backed gulls) were the most common native bird, being encountered at 8 sites. This was followed by kāhu (NZ Hawk) & pīwaiwaka (Fantail) which were found at 5 sites each.

Common bully (6 sites) and Tuna/Longfin eels (5 sites) were the most common native fish species encountered.

The most common plant or animal encountered across all sights however were exotic pasture grasses and weeds (15 sites). Willow (13 sites), broom (9 sites) and Gorse (7 Sites) were the next most common exotic plant species. Rock Pigeons (4 sites) and Cattle (3 sites) were most exotic animals encountered.

4.6 Discussion

When taking into account the results of all types of assessment undertaken, the cultural health of waterways within Te Waipounamu is considered to be moderate to poor. The assessments and analysis indicate widespread modification and degradation in the cultural health of South Island waterways, particularly with regards to native riparian vegetation and associated wildlife.

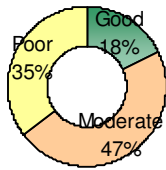
While the waterways monitored are functioning in some form, they are highly modified and under continual pressure from surrounding land-use, particularly along the margins. Most strikingly, only 3 out of the 17 sites analysed received a good rating. Furthermore, all assessments point towards significant issues with the management of the riparian zone and the importance of this area as both a habitat for native plants, birds, fish and other wildlife and as a buffer from the negative impacts of surrounding land-use.

The combined monitoring results from all assessments are shown on the map and graphs on the following page.

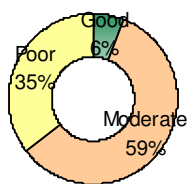


Ngā Wai Pounamu Combined Site Assessment Results

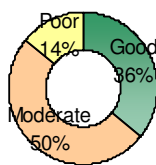
Ngā Wai Pounamu Takiwā
Overall Site Ratings



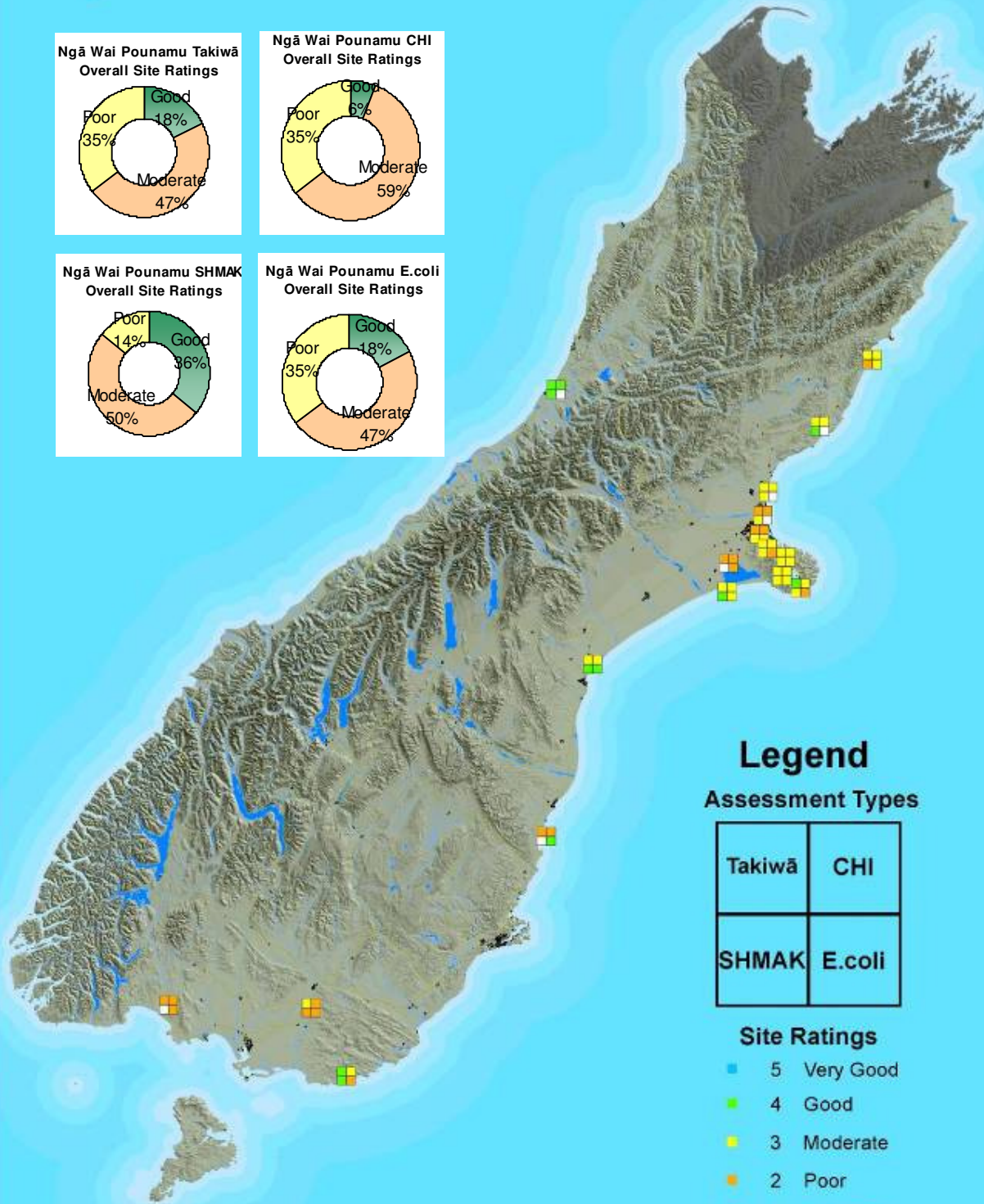
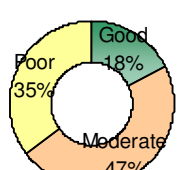
Ngā Wai Pounamu CHI
Overall Site Ratings



Ngā Wai Pounamu SHMAK
Overall Site Ratings



Ngā Wai Pounamu E.coli
Overall Site Ratings



Legend

Assessment Types

Takiwā	CHI
SHMAK	E.coli

Site Ratings

- 5 Very Good
- 4 Good
- 3 Moderate
- 2 Poor
- 1 Very Poor
- Not Assessed

The lack of native riparian and wetland vegetation was apparent at the majority of sites. In most cases, such as the larger river sites of Rakahuri, Waimakariri, Waikare, Ōpihi, and Waianakarua, riparian areas were completely void of native vegetation, being replaced by exotic vegetation, such as willows, or gorse and broom. While such species may still provide a buffer from surrounding land-use, in other cases no buffer exists at all, with pasture or other types of intensive land-use being present right to the edge of the waterway. As well as the important ecological function that a vegetated riparian or wetland zone provides, native riparian and wetland vegetation is an important cultural indicator of health, providing significant habitat and breeding areas for native birds, fish and insects, and in particular mahinga kai species.



A common view of riparian zones across the sites showing a lack of native riparian vegetation, the dominance of exotic species and intense riparian landuse. Left: Koukourārata, Right: Waianakarua

Takiwā, CHI and SHMAK indicators for margin condition, vegetation and the abundance of native species were particularly poor across all sites. The only sites that had healthy native riparian vegetation were Māngai Piri and Arahura, with Ōnuku and Tuatapere having moderately healthy margins. A number of other sites, including Waipapa, Ōmaru, Ōkana and Te Pā o Moki, did however show promise with efforts being made to restore native riparian vegetation along these streams. These projects are mostly led by local marae.



Signs of Promise: Left: Ōmaru Stream and Right; Waikewai Stream, Te Pā o Moki - examples of native riparian restoration in action

The pressure on waterways from surrounding land-use and the associated impacts of non-point and point source pollution were another feature across the majority of the sites. A number of sites had visible and direct discharges entering the waterway, while a number of others showed obvious signs of problems from non-point pollution and/or intensive margin land-use. This was supported by assessment data from both the CHI and SHMAK, which revealed significantly lower scores across all the sites for stream and river bed condition, bed deposits and sedimentation as well as conductivity. Periphyton results at a number of sites including Ōaro, Waimakariri, Ōkana and Koukourarata were also poor, a further indication of intensive land-use and associated pollution discharge issues.

The assessments and analysis also identified that there are very few areas that remain unaffected by land-use and discharge issues. Even the two highest rating sites, Arahura on the West Coast and Māngai Piri on the fringe of the Catlins, have intensive land-use, including dairying and forestry, within the lower catchment areas upstream of the monitoring sites. However, the most extreme example of intensive margin landuse, modification and discharge issues was found at the Mātaura Falls site. Surrounded on either bank by primary processing plants, this highly significant mahinga kai site for the taking of kanakana (lamprey eels) has lost its natural riparian zone and is subject to regular industrial discharges from the factories on the river margins. On a positive note, the local marae have been successful in gazetting a Mātaitai reserve to protect and enhance the management of the river along a 10 kilometre stretch, including the Falls site.



Extreme modification: Top: Te Au Nui/Mātaura Falls as it was in the 1800s and Bottom: The Falls today overshadowed by primary processing plants.



The assessments also highlighted unacceptable levels of faecal contamination across the majority of sites. While most sites achieved the recreational standard for E. coli, only 2 sites passed the current national shellfish standard and 3 of the sites that passed the recreational standard contained E. coli that were resistant to human and agricultural anti-biotics. From a cultural perspective, a major value of waterways is their ability to provide for mahinga kai. In this respect, the recreational standard is insufficient to protect the values of tāngata whenua, as the expectation is that water should be clean enough to eat from, not just swim in. The assessment results therefore raise questions about the effectiveness of our management of non-point and point source discharges as well as the current standards for which waterways are monitored for and managed under. Investigation into an adequate water quality standard for freshwater food gathering is therefore urgently required. This would provide some protection and piece of mind to those who continue to practice the gathering of food and other resources from freshwater environments, as well as other users of freshwater.

Finally, from the assessments and analysis undertaken, major factors both positively and negatively influencing cultural health across the study sites have been identified, and provide the basis for potential actions that may improve the cultural health of South Island waterways into the future.

Factors associated with higher ranking sites and scoring included:

- the presence and abundance of remnant and/or restored native vegetation along the riparian buffer and within significant parts of the catchment (eg. Māngai Piri, Arahura, Onuku, Te Pā o Moki, Ōmaru);
- the separation of the waterway from intensive urban or rural land-use (eg. Māngai Piri, Ōaro, Ōnuku).

Factors associated with lower ranking sites and scoring included:

- the absence of native riparian vegetation (eg. Waikare, Waimakariri);
- the occurrence of intensive urban or rural land-use right up to the margin of the waterway and resulting non-point source pollution issues (Mataura Falls, Koukourārata, Waipapa, Waianakarua, Te Pā o Moki); and
- the influence of direct or visible stormwater inputs, wastewater discharges and other point source pollution (eg. Mataura Falls, Tuatapere, Waipapa).

A full list of recommendations for the future management South Island waterways, based on these findings are outlined in the following section along with the overall conclusions of the study.

5 Te Whakamutunga / Conclusions

While water holds significant values for Māori and the wider community, many waterways have undergone dramatic modification and show obvious signs of degradation and stress.

This report outlines the results of a cultural health study of South Island waterways undertaken by Te Rūnanga o Ngāi Tahu in-conjunction with members of Ngāi Tahu Papatipu Rūnanga aimed at quantifying how Tāngata Whenua view the current health of waterways.

Overall, the results of the study found selected South Island waterway sites to be in a state of moderate to poor cultural health.

In particular, the assessments and analysis point towards significant issues with the management of the riparian zone and the importance of this area as both a habitat for native plants, birds, fish and other wildlife and as a buffer from the negative impacts of surrounding land-use. The study also highlights significant issues with non-point and point source discharges and the failure of *E. coli* recreational water quality standards to protect customary freshwater food gathering practices and users.

The majority of sites displayed a complete lack of native riparian or wetland vegetation, extensive modification of the riparian margin and often intensive land-use right up to the edge of waterway. A number of sites had visible and direct discharges entering the waterway.

Although the overall assessment was moderate to poor, there were some sites and features that were seen as positive and provide ideas for how future management may be able to improve the cultural health of waterways. These included the presence and abundance of remnant and/or restored native riparian vegetation and the separation of waterways from intensive land-use.

Protecting, enhancing and extending adequate native riparian and wetland buffers and other native vegetation patches within intensively used rural and urban catchments and continuing to deal with sources of contaminants, both point and non-point, will be the most important challenges for the future management of waterways in Te Waipounamu.

Developing a national standard for freshwater food gathering quality and systematically recording and reporting on this will also be important into the future.



5.1 Recommendations

1. That all waterways which continue to be important for local food gathering are managed and enhanced for food gathering quality into the future.
2. That increased protection and enhancement of waterways through the development of native riparian buffer zones be investigated and implemented, particularly on all currently unplanted crown, public and council owned areas. (These buffer zones should be at least 10 metres wide and planted according best practice planting guides, and/or fenced where appropriate).
3. Greater advocacy, rates relief and other economic methods for the protection and enhancement of native riparian buffer zones in currently un-vegetated or un-fenced areas on private land.
4. The development of national policy to require native riparian buffer zones and other on-site treatment systems, such as stormwater swales and constructed treatment wetlands, when any land adjacent to any waterway (including drains) is subdivided, developed or subjected to a land-use change.
5. Greater research into the impacts of, and solutions for, treating and dealing with non-point and point source pollution of waterways.
6. The development of a national water quality standard for freshwater food gathering and a regular monitoring programme associated with this standard. This would also include specific provision for freshwater gathering in the water quality classes in the third schedule of the Resource Management Act 1991.
7. That regional councils and other monitoring agencies are encouraged to shift or adjust monitoring sites to align with key cultural monitoring sites identified by tāngata whenua.
8. The protection and enhancement of any existing significant areas of native flora and fauna, particularly wetlands, within all catchments and continued support of community based ecological restoration efforts.
9. Interpretation of the cultural and historical significance of selected sites including but not limited to: specific native plant restoration (species of traditional significance), archaeological surveys, information panels and/or artwork/sculpture.
10. Continued regular monitoring, including cultural assessments, to understand the success, or otherwise, of future management and development of the catchment.
11. Specific measures to ensure cultural assessments are part of national environmental monitoring programmes for freshwater, including national state of the environment monitoring and reporting.

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7 Āpitihanga / Appendices

Appendix A - Takiwā Monitoring Forms used within the Ngā Wai Pounamu Study

Appendix B - Monitoring Plans for Canterbury, Otago & Southland Sites

Appendix C - National Drinking, Recreation and Shellfish Standards for Water

Appendix D - Takiwā Assessment Data Set for the Ngā Wai Pounamu Study

Appendix E - CHI Assessment Data Set for the Ngā Wai Pounamu Study

Appendix F - SHMAK Assessment Data Set for the Ngā Wai Pounamu Study

Appendix G - E .coli Testing Data Set for the Ngā Wai Pounamu Study

Appendix H - Site Photograph Record for the Ngā Wai Pounamu Study

Appendix A – Takiwā Monitoring Forms used within the Ngā Wai Pounamu Study

State of the Takiwā

Site Definition Form

Site Code

Site Name Defined by on / /

Assessment type: (tick one) ☐ New site ☐ Update

Region of NZ *eg Otago* Catchment/Feature *eg Waiau River*

Zone (tick one) ☐ Mountains ☐ Hills ☐ Upper Plains ☐ Mid Plain ☐ Lowland Plains
☐ Urban ☐ Coastal/marine ☐ Other. Specify:

Ecosystem Types ☐ Alpine ☐ Native forest ☐ Exotic forest ☐ Tussock/dryland ☐ Farm/agrisystem
☐ River/Stream ☐ Lake/Wetland ☐ Estuary/Lagoon ☐ Coastal/Dune ☐ Marine
☐ Other. Specify:

Ownership: ☐ Private ☐ Council ☐ DOC ☐ Maori ☐ LINZ
☐ Crown ☐ Unknown ☐ Other. Specify:

Mana Whenua

Site Description (100m radius. Including site issues, pressures and general notes):

Legal Protection: ☐ Informal/none ☐ Reserve ☐ NZAA site/silent file ☐ Legal covenant ☐ Conservation
☐ Other. Specify:

Settlement Site: ☐ Nohoanga ☐ Topuni ☐ Tribal property ☐ SA ☐ Unsure

SITE-SIGNIFICANCE DETAIL Is this a traditional site? Yes No Unsure Are there any signs of traditional use? Yes No

Significance of site: ☐ Urupa ☐ Pā/Kāinga ☐ Mahinga kai ☐ Wāhi Pakanga ☐ Other

Please explain site significance / List any observations:

Traditional Abundance List species and resources traditionally known to be present at this site.

NGĀ MANU / BIRD SPECIES		Abundance			NGĀ IKA / FISH SPECIES		Abundance		
<input type="text"/>		Few	Some	Lots	<input type="text"/>		Few	Some	Lots
<input type="text"/>		Few	Some	Lots	<input type="text"/>		Few	Some	Lots
<input type="text"/>		Few	Some	Lots	<input type="text"/>		Few	Some	Lots
<input type="text"/>		Few	Some	Lots	<input type="text"/>		Few	Some	Lots
NGĀ RAKAU / PLANT SPECIES		Abundance			OTHER TAONGA / Natural Resources		Abundance		
<input type="text"/>		Few	Some	Lots	<input type="text"/>		Few	Some	Lots
<input type="text"/>		Few	Some	Lots	<input type="text"/>		Few	Some	Lots
<input type="text"/>		Few	Some	Lots	<input type="text"/>		Few	Some	Lots
<input type="text"/>		Few	Some	Lots	<input type="text"/>		Few	Some	Lots
<input type="text"/>		Few	Some	Lots	<input type="text"/>		Few	Some	Lots

Geographical Position Area (sq m) Altitude (m) Map No (if 260 series)
East North Accuracy/Offset (m)

Photos taken? Yes No Direction facing, Photo 1: Photo 2: Photo 3: Photo 4:

Use camera on 35mm or equivalent. Preferably take four photos, facing North, East, South and West, from the GPS reference point. Also consider Upstream, Downstream, etc.

Describe these photos:

OFFICE USE ONLY Entered into Takiwā database by: Date: / /

Photo filed: ☐ Filename:
Site mapped: ☐ TUMONZ/GIS code:

State of the Takiwā

Visit Form

Site Code

Use a separate form for Questionnaire

Visit Code

VISIT DETAILS Site Name: No. in Group:

Visit date: / / Time: : am / pm Hours at Site:

Visitor Name: ☐ First visit here? ☐ First evaluation here?

Visitors from: Visit Purpose:

Weather Centre

1. Temperature:
Enter °C here °C
or
indicate approximately
on scale below

Hot

Warm

Mild

Cool

Cold

Freezing

25°C or more

20

15

10

5

0°C or less

2. Cloudiness
(circle one)
Clear sky
Mainly clear
Streaky
Partly cloudy
Heavy
Breaking
Overcast

3. Precipitation
(circle one)
None
Mist or fog
Drizzle
Light
Moderate
Heavy
Hail
Snow

4. Wind If wind, circle its direction
(circle one)
None
Minimal
Light
Stiff or breezy
Gusty
Strong

5. Moon: Circle the shape or tick if not applicable: ☐

First Q

Full

Last Q

New

<<< waxing | waning >>>

6. Tide: Draw a circle on the sea-level curve, or tick if not applicable: ☐

7. Extra comment on weather:

Heritage/Archeological Details

Are there any signs of traditional use?

☐ Yes ☐ No

Describe signs / list observations:

Site Issues or Pressures:

Site Actions or Responses:

Recent Flow Conditions
Circle the number best describing the past 6 weeks:

5 Stable flow

4 Brief flooding (less than 2 days)

3 Several brief floods

2 Prolonged flooding (5 days +)

1 Prolonged low flows

Recent Land Use Conditions (Up to 1 km upstream and within 500m of banks.)
List any disturbances to the stream that are noticed or known (last 6 weeks). eg stock in channel, wastes, chemicals, stormwater, weed clearance, earthworks, etc.

Photos taken? Yes No Direction facing, Photo 1: Photo 2: Photo 3: Photo 4:

Use camera on 35mm or equivalent. Preferably take four photos, facing North, East, South and West, from the GPS reference point. Also consider Upstream, Downstream and of any s

Describe these photos:

OFFICE USE ONLY Entered into Takiwā database by: Date:

Site previously mapped: ☐ Photo filed: ☐ Filename:

Site mapped: ☐ TUMONZ/GIS code:

State of the Takiwā

Site Assessment - General

Site Code

A Visit form is also needed

Assessment Code

Visit Code

ENTRY DETAILS Site Name:

Visit date:

Visitor Name:

Number of people represented:

A. SITE ASSESSMENT DETAILS

For each question, please circle the appropriate number, then explain it in the box following.

1. How would you describe the pressure on this site?

Immense pressure 1 2 3 4 5 Minimal pressure

Details (including recreational access, surrounding landuse, discharges, etc.):

2. What is the degree of modification/change at this site?

Extreme modification 1 2 3 4 5 Low modification

Details (including drainage, burning, discharges, abstractions, developments):

Questions 3, 4, 5 and 6 consider suitability for harvesting mahinga kai

3. Do you consider access to this site is sufficient to harvest mahinga kai?

Not able to gather 1 2 3 4 5 No restrictions

Details:

4. Would you harvest mahinga kai at this site?

Definitely no 1 2 3 4 5 Definitely yes

Details:

5. Tick if site is wahi tapu: ☐

6. Would you return to this site in the future?

Yes No

Details:

7. What actions are required to improve the health of this site? Tick relevant boxes.

☐ Better management by landowner, council, etc.

☐ Interpretation / Signage

☐ Consideration of ownership/purchase by tribe/rūnanga.

☐ Restoration of native species

☐ Protection / Access arrangement for significant sites with landowner

☐ Pest / weed control

☐ Other

Specify:

7. How would you describe the overall health of this site?

Very unhealthy 1 2 3 4 5 Very healthy

Details (including any problems, pressures, issues, smells etc. noticed):

Next page for Abundance questions ...

B. ASSESSMENT OF ABUNDANCE For each question, please list the species that you can see or hear, and circle their abundance. If they are mahinga kai species, please tick the MK box. List more on blank paper if necessary.

1. NGĀ RAKAU MĀORI / NATIVE PLANT SPECIES	Abundance	MK	Notes	(condition, habits, etc.)
	Few Some Lots	<input type="checkbox"/>		
	Few Some Lots	<input type="checkbox"/>		
	Few Some Lots	<input type="checkbox"/>		
	Few Some Lots	<input type="checkbox"/>		
	Few Some Lots	<input type="checkbox"/>		
	Few Some Lots	<input type="checkbox"/>		
	Few Some Lots	<input type="checkbox"/>		
	Few Some Lots	<input type="checkbox"/>		
	Few Some Lots	<input type="checkbox"/>		
	Few Some Lots	<input type="checkbox"/>		

1a. What % of the total site area is covered by native plant species? (within 100m radius)

0% a little 25% 50% 75% most 100%

2. NGĀ MANU MĀORI / NATIVE BIRD SPECIES	Abundance	MK	Notes	(condition, habits, etc.)
	Few Some Lots	<input type="checkbox"/>		
	Few Some Lots	<input type="checkbox"/>		
	Few Some Lots	<input type="checkbox"/>		
	Few Some Lots	<input type="checkbox"/>		
	Few Some Lots	<input type="checkbox"/>		
	Few Some Lots	<input type="checkbox"/>		
	Few Some Lots	<input type="checkbox"/>		
	Few Some Lots	<input type="checkbox"/>		

3. NGĀ IKA MĀORI / NATIVE FISH SPECIE	Abundance	MK	Notes	(condition, habits, etc.)
	Few Some Lots	<input type="checkbox"/>		
	Few Some Lots	<input type="checkbox"/>		
	Few Some Lots	<input type="checkbox"/>		
	Few Some Lots	<input type="checkbox"/>		
	Few Some Lots	<input type="checkbox"/>		
	Few Some Lots	<input type="checkbox"/>		

4. NGĀ TAONGA MĀORI / Other Natural Resources	Abundance	MK	Notes	(condition, etc.)
	Few Some Lots	<input type="checkbox"/>		
	Few Some Lots	<input type="checkbox"/>		
	Few Some Lots	<input type="checkbox"/>		
	Few Some Lots	<input type="checkbox"/>		

5. INTRODUCED PLANTS AND ANIMALS	Abundance	MK	Notes	(condition, controls, signs, etc.)
	Few Some Lots	<input type="checkbox"/>		
	Few Some Lots	<input type="checkbox"/>		
	Few Some Lots	<input type="checkbox"/>		
	Few Some Lots	<input type="checkbox"/>		
	Few Some Lots	<input type="checkbox"/>		
	Few Some Lots	<input type="checkbox"/>		
	Few Some Lots	<input type="checkbox"/>		
	Few Some Lots	<input type="checkbox"/>		
	Few Some Lots	<input type="checkbox"/>		
	Few Some Lots	<input type="checkbox"/>		

OFFICE USE ONLY Entered into Takiwa database by:

Date:

Use general assessment code if have one >> Assessment Code

Visit Code

ENTRY DETAILS Site Name:

Visit date:

Visitor Name:

Number of people represented:

A. Cultural Stream Health Assessment

For each question, please circle a number.

	Unhealthy		Healthy
1. Catchment Land Use	Land heavily modified Wetlands and marshes lost	1 2 3 4 5	Appears unmodified
2. Vegetation - banks & margins (100m either side)	Little or no vegetation - neither exotic nor indigenous	1 2 3 4 5	Complete cover of vegetation - mostly indigenous
3. Use of the river banks & margins (100m either side)	Margins heavily modified	1 2 3 4 5	Margins unmodified
4. Riverbed conditions (sediment)	Covered by mud, sand, slime or weed	1 2 3 4 5	Clear of mud, sand, slime and weed
5. Changes to river channel	Evidence of modification, eg stopbanks, straightening, gravel removal, shingle build-up	1 2 3 4 5	Appears unmodified
6. Water Quality, eg foams, oils, slime, weeds, etc.	Appears polluted	1 2 3 4 5	No pollution evident
7. Water clarity	Water badly discoloured	1 2 3 4 5	Water is clear
8. A variety of habitats	Little or no current, uniform depth and limited variety of flow related habitats	1 2 3 4 5	Current and depth varies, creating a variety of flow related habitats
9. Overall health of the river at this site	Very unhealthy	1 2 3 4 5	Very healthy

Please explain your answer:

B. MAHINGA KAI SPECIES

For each question, please list the species that you can see or hear, and circle their abundance. You can use a blank page to list more if necessary.

BIRDS: Please list the mahinga kai bird species that you can see at this site

1.	2.	4.	3.
5.	6.	7.	8.

PLANTS: Please list the mahinga kai plant species that you can see at this site

1.	2.	4.	3.
5.	6.	7.	8.

C. SITE ACCESS FOR HARVESTING MAHINGA KAI

Do you consider access to this site is sufficient to harvest mahinga kai?

Not able to gather at this site 1 2 3 4 5 Able to gather - no restrictions

Please explain your answer:

Would you return to this site in the future? Yes No

OFFICE USE ONLY Entered into Takiwa database by:

Date:

ENTRY DETAILS Site Name:

Visit date:

Visitor Name:

Number of people represented:

A. STREAM HABITAT

Please enter answers in boxes. You can do the calculations and circle the scores if you want, or leave that task to be done automatically later in the database.

A1 Habitat Quality

Flow velocity Time an object travelling down the centre of the stream (do 3 times): seconds
 Distance travelled: metres Divide distance by the average time of seconds
 ... to get an average velocity of m/sec

eg. For 10m in 38s
 Velocity = 0.26 m/s
 Score = 8

From velocity: less 0.1 0.3 0.7 1.0 more
 Circle the Score: 1 8 10 5 3

Water pH From the pH: less 5.5 6.5 8 9.5 more
 Circle the Score: -5 5 10 5 -5

Water temperature °C Temp: less 5 10 15 20 25 30 more
 Time of day: Score: 5 8 10 8 5 1 -5

Water conductivity uS/cm Cond: less 50 150 250 400 more
 Score: 20 16 10 6 1

Water clarity (Take 3 readings): cm Calculate average clarity: cm
 Note: for ease of use, scale is in opposite order to that in SHMAK doc.
 Clarity: less 35 55 70 100 more
 Score: 1 3 5 8 10

A2 Composition of the Stream Bed *

Estimate materials making up the stream bottom (to nearest 10%).

	Enter %	Score
Bedrock	<input type="text"/>	-10
Boulders > 25 cm	<input type="text"/>	10
Large cobbles 12 - 25	<input type="text"/>	20
Small cobbles 6 - 12	<input type="text"/>	10
Gravels 0.2 - 6	<input type="text"/>	0
Sand	<input type="text"/>	-10
Mud or silt	<input type="text"/>	-20
Man-made, eg concrete	<input type="text"/>	-20
Woody debris	<input type="text"/>	0
Water plants, rooted in stream bed	<input type="text"/>	0
Check you have 100%	<input type="text"/>	

A3 Bank Vegetation *

True left = left bank looking downstream

Estimate vegetation within 5 metres of the banks (to nearest 10%)

	% , true left	% , true right	Score
Native trees	<input type="text"/>	<input type="text"/>	10
Wetland vegetation	<input type="text"/>	<input type="text"/>	10
Tall tussock grassland, not improved	<input type="text"/>	<input type="text"/>	8
Introduced trees (willow, poplar)	<input type="text"/>	<input type="text"/>	8
Other introduced trees (conifers)	<input type="text"/>	<input type="text"/>	5
Scrub	<input type="text"/>	<input type="text"/>	5
Rock, gravels	<input type="text"/>	<input type="text"/>	5
Short tussock grassland, improved	<input type="text"/>	<input type="text"/>	3
Pasture grasses and weeds	<input type="text"/>	<input type="text"/>	-10
Bare ground, roads, buildings	<input type="text"/>	<input type="text"/>	-10
Check you have 100%	<input type="text"/>	<input type="text"/>	

A4 Deposits

Tick best estimation of loose deposited material on the stream bed

None noticed	<input type="checkbox"/>	10
Fine, mainly by edge thickness < 1 mm	<input type="checkbox"/>	5
Moderate, edge & elsewhere 1 - 3 mm	<input type="checkbox"/>	0
Moderate to thick, patchy, most of bed 3 - 5 mm	<input type="checkbox"/>	-5
Thick, most horizontal surfaces > 5 mm	<input type="checkbox"/>	-10

* NOTE: For A2 and A3 the relative scores are shown but percentage-weighted calculations can't be calculated here.
 Use the database to automatically do this and get an overall score for each.

B. STREAM-BED LIFE**B1 Invertebrates**

For each of 5 stone, sediment or water plant samples, tick a box if you can see any of these.

	1	2	3	4	5	Score
Worms (eg thin brown/red)						1
Flatworms, leeches						3
Freshwater crustaceans (amphipods, water fleas)						5
Small bivalves (up to 4 mm across)						3
Snails (4-6 mm across, rounded)						3
Snails (1-3 mm across, pointed)						4
Limpet-like molluscs (Latia, up to 8 mm wide)						7
"Axehead" caddis (Oxyethira, 2-3 mm long)						3
Midge larvae (3-7 mm long, white - red)						2
Damselfly larvae						4
Crane fly larvae						5
Beetle larvae and adults						6
Caddisfly larvae (rough stony cases, or of sticks & free living)						6
Smooth-cased caddisfly larvae (Olinga, to 10 mm, chestnut-brown)						9
Spiral caddis (Helicopsyche, to 3 mm wide)						10
Mayfly larvae (2-15 mm long)						9
Stonefly larvae (large species, to 20 mm)						10

B2 Periphyton (on exposed surfaces)

Using the same 5 samples, tick a box if you can see any of these.

	1	2	3	4	5	Score
Thin mat/film Under 0.5 mm thick	Green					7
	Light brown					10
	Black or dark brown					10
Medium mat 0.5 - 3 mm thick	Green					5
	Light brown					7
	Black or dark brown					9
Thick mat Over 3 mm thick	Green or light brown					4
	Black or dark brown					7
Filaments, short Under 2 cm long	Green					5
	Brown or reddish					5
Filaments, long Over 2 cm long	Green					1
	Brown or reddish					4

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Date:

Appendix B – Monitoring Plans for Canterbury, Otago and Southland Sites.

State of the Takiwā Monitoring Work Plan – Oaro Cultural Health Review: 2007

This plan outlines the proposed process for undertaking the monitoring fieldwork and data gathering for the Oaro catchment, as part of the Te Waipounamu Freshwater Project.

The plan begins with a brief background to the project and the purpose for the monitoring. The plan also includes a description of the area to be researched and a detailed action plan for the monitoring fieldwork. This action plan includes the proposed dates of the monitoring, a timetable and schedule of activities, the data collection methodology, expected outcomes, resources and OSH provisions.

The plan also includes an appendix of monitoring forms and other relevant information to assist the monitoring fieldwork.

1 Tāhuhu kōrero/Background

The proposed monitoring fieldwork outlined in this plan is being undertaken as part of the Ngāi Tahu led SMF funded project called "State of the Takiwā - Te Waipounamu Freshwater Report 2007".

The fieldwork is being facilitated by Craig Pauling (Te Rūnanga o Ngāi Tahu), in conjunction with Raewyn Solomon (Kaikoura), with support from Environment Canterbury, NIWA and Envirolink Laboratories.

The major purpose of the fieldwork is to undertake baseline cultural health assessments of the Oaro catchment through the gathering, analysis and reporting of data collected using the Takiwā cultural environmental monitoring and reporting tool.

The assessments will provide data for inclusion in the Te Waipounamu Freshwater Report 2007, as well as assisting in testing and refining the Takiwā tool being used. The data also provides baseline information for an ongoing monitoring regime for the area and can also begin to help measure the success of, and inform, the future management of these areas. The data may also help to complement the ongoing work of monitoring resource consents, developments and other activities in the catchment into the future.

On 30 November 2006, a hui was held at Wairewa Marae with Papatipu Rūnanga to introduce the Takiwā tool, the current project, and to discuss and plan the monitoring programme. Representatives from Tūāhuriri, Onuku, Koukourarata, Wairewa, Taumutu Rūnanga, Envirolink and Environment Canterbury were present. Monitoring targets were identified by all rūnanga present, with those not present being contacted separately, including Kaikoura, where targets and dates were further discussed.

This plan outlines the agreed outcomes, milestones and plans for the fieldwork from this meeting and subsequent discussions.

1.1 Expected Outcomes

- Introduction, training and further testing of the Takiwā system by rūnanga/iwi members.
- Training and application of CHI, SHMAK and E.Coli testing by rūnanga.
- Collection of baseline Takiwā data, including the CHI, SHMAK and E.coli data for the Oaro catchment at various sites from the source to the sea.
- Storage, analysis and reporting of this data to assist future management and planning and to contribute to the Te Waipounamu Freshwater Report.

1.2 Milestones

- Identify monitoring sites and targets in the Oaro catchment, important resources such as people and equipment needed and develop a plan for the gathering of data in conjunction with rūnanga monitoring team members (Nov 2006 - March 2007);
- Provide training to rūnanga monitoring team members in the use of the Takiwā 1.0 software and other environmental monitoring processes (Nov 2006 - March 2007).
- Undertake the gathering of data from the selected sites and input the collected data into Takiwā 2.0 (by June 2007);
- Analyse the collected data and contribute to Te Waipounamu Report (by July 2007);
- Present these findings back to rūnanga members (by Aug 2007).

1.3 Area To Be Researched – Oaro River

The Oaro River is a river of immense cultural importance to the Ngati Kuri subtribe of Ngai Tahu. Particularly, its lagoon type river mouth which is home to both traditional and contemporary settlement and urupa sites, as well as being an important mahinga kai area for freshwater fish and birds. The Waiotane stream, which is fed by a number of springs and that flows into the lagoon area, is a wahi tapu, being a site where warriors were cleansed before and after battle.

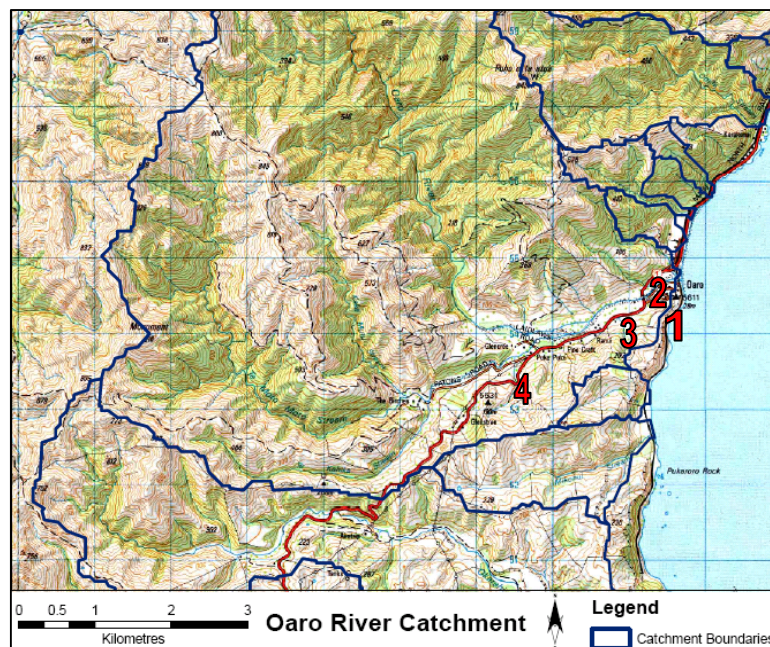
The Oaro river flows from the Hundalee Ranges to the Kaikoura coast, running parallel with State Highway one through this area. The river is subject to agricultural, forestry, tourism and residential impacts, and has been subject to gravel takes, dumping and significant road realignments and works in the past.

Cultural monitoring has never been undertaken to assess the extent of change of the Oaro. Therefore it is proposed that a number of sites spread throughout the catchment (Ki Uta Ki Tai – from the source to the sea) are to be assessed as part of the project. These sites are listed in the following sub-section and shown on Map 1.

1.4 Monitoring Sites

Oaro River

1. Oaro Lagoon
2. Waiotane
3. Oaro Bridge
4. Birches Rd



2 Monitoring Action Plan

2.1 Monitoring Team

The following people will be involved in the monitoring:

- Craig Pauling (TRoNT)
- Makarini Rupene (Tuahuriri)
- Te Marino Lenihan (Tuahuriri)
- Nukuroa Tirikatene-Nash (Tuahuriri/Kaikoura)
- Norm Kerei Keepa (Kaikoura)
- Raewyn Solomon (Kaikoura)

2.2 Dates of Monitoring work

The monitoring/data collection will take place on 25 May 2007 . A timetable of events and initial dates for are outlined in the table below.

2.3 Timetable & Schedule of Work to be undertaken

	Day 1 – Friday, 25 May 2007
7.30am	Travel Chch – Oaro
10.30am	Arrive/Assess site 1 – Oaro Mouth
	Requirements: Takiwa/CHI/SHMAK/E.coli/EFish
11.30am	Arrive/Assess site 2 – Waiotane
	Requirements: Takiwa/CHI/SHMAK/E.coli/EFish
12.30pm	Arrive/Assess site 3 – Oaro Bridge
	Requirements: katoa
	LUNCH
2.30pm	Arrive/Assess site 4 – Birches Road
	Requirements: Takiwa, CHI, SHMAK and E.coli
4pm	Kua mutu - Hoki ki te kainga

State of the Takiwā Monitoring Work Plan – Ihutai Cultural Health Review: Kahuru/Autumn 2007

This plan outlines the proposed process for undertaking the monitoring fieldwork and data gathering for the Ihutai catchment, as part of the Te Waipounamu Freshwater Project.

The plan begins with a brief background to the project and the purpose for the monitoring. The plan also includes a description of the area to be researched and a detailed action plan for the monitoring fieldwork. This action plan includes the proposed dates of the monitoring, a timetable and schedule of activities, the data collection methodology, expected outcomes, resources and OSH provisions.

The plan also includes an appendix of monitoring forms and other relevant information to assist the monitoring fieldwork.

1 Tāhuhu kōrero/Background

The proposed monitoring fieldwork outlined in this plan is being undertaken as part of the Ngāi Tahu led SMF funded project called "State of the Takiwā - Te Waipounamu Freshwater Report 2007".

The fieldwork is being facilitated by Craig Pauling (Te Rūnanga o Ngāi Tahu), in conjunction with Te Marino Lenihan and Makairini Rupene (Ngāi Tūāhuriri), and Rewi Couch (Te Hapū o Ngāti Wheke) with support from Jenny Bond (Environment Canterbury), NIWA and Envirolink Laboratories.

The major purpose of the fieldwork is to undertake baseline cultural health assessments of the Ihutai catchment, including the Ōtakaro (Avon) and Ōpawaho (Heathcote) rivers, through the gathering, analysis and reporting of data collected using the Takiwā cultural environmental monitoring and reporting tool.

The assessments will provide data for inclusion in the Te Waipounamu Freshwater Report 2007, as well as assisting in testing and refining the Takiwā tool being used. The data also provides baseline information for an ongoing monitoring regime for the area and can also begin to help measure the success of, and inform, the future management of these areas. The data may also help to complement the ongoing work of monitoring resource consents, developments and other activities in the catchment into the future.

On 30 November 2006, a hui was held at Wairewa Marae with Papatipu Rūnanga to introduce the Takiwā tool, the current project, and to discuss and plan the monitoring programme. Representatives from Tūāhuriri, Onuku, Koukourarata, Wairewa, Taumutu Rūnanga, Envirolink and Environment Canterbury were present. Monitoring targets were identified by all rūnanga present, which were then followed up to clarify sites and dates.

This plan outlines the agreed outcomes, milestones and plans for the fieldwork from this meeting and subsequent discussions.

1.1 Expected Outcomes

- Introduction, training and further testing of the Takiwā system by rūnanga/iwi members.
- Training and application of CHI, SHMAK and E.Coli testing by rūnanga.
- Collection of baseline Takiwā data, including the CHI, SHMAK and E.coli data for the Ihutai Catchment at various sites from the source to the sea.
- Storage, analysis and reporting of this data to assist future management and planning and to contribute to the Te Waipounamu Freshwater Report.

1.2 Milestones

- Identify monitoring sites and targets in the Ihutai Catchment, important resources such as people and equipment needed and develop a plan for the gathering of data in conjunction with rūnanga monitoring team members (Nov 2006 - March 2007);
- Provide training to rūnanga monitoring team members in the use of the Takiwā 1.0 software and other environmental monitoring processes (Nov 2006 - March 2007).
- Undertake the gathering of data from the selected sites and input the collected data into Takiwā 2.0 (by May 2007);
- Analyse the collected data and contribute to Te Waipounamu Report (by July 2007);
- Present these findings back to rūnanga members (by Aug 2007).

1.3 Area To Be Researched – Te Ihutai Catchment

Tai ki uta; lhu tai maroro

*From the nose of the tide back to the land; To where the sea sinks down
(on the continental shelf).*

Ihutai / the Avon-Heathcote Estuary is a place of immense cultural significance to tangata whenua, with people having lived and gathered food in the estuary area for over 600 years.

The estuary provided vital access to a network of waterways stretching from Te Waihora (Lake Ellesmere) to the Kowai River and the estuary channel provided an opening to the fishing grounds of Te Tai o Maha-a-nui (Pegasus Bay).

The first settlers were the Waitaha iwi who lived in two main kaika around the estuary: Raekura and Te Kai o Te Karoro. They built whare from local flax, raupo and trees. Later in the 1500s, the Ngāti Māmoë iwi had a settlement near the estuary on Tauhinu Korokio, today's Mt Pleasant.

About one hundred years after this, Ngāi Tahu under chief Turakautahi, established a pā north of the Waimakariri, called Kaiapoi, along with the settlement of Rāpaki in Whakaraupo, Lyttelton Harbour under, Te Rakiwhakaputa.

While Ngāi Tahu did not live alongside the estuary itself, people from both Kaiapoi and Rāpaki visited and used the area as a mahinga kai in a similar way to their predecessors.

The estuary was rich with tuna (eels), kanakana (lamprey), inaka (adult whitebait), patiki (flounder) and pipi. Kumara and aruhe (edible fern root) were grown in the sandy soils at the mouth of the Ōtakaro. Manuka weirs were built around the mouth of the river during the eel migrations and patiki were abundant in the mudflats across the middle of the estuary, an area called Waipatiki (flounder water).

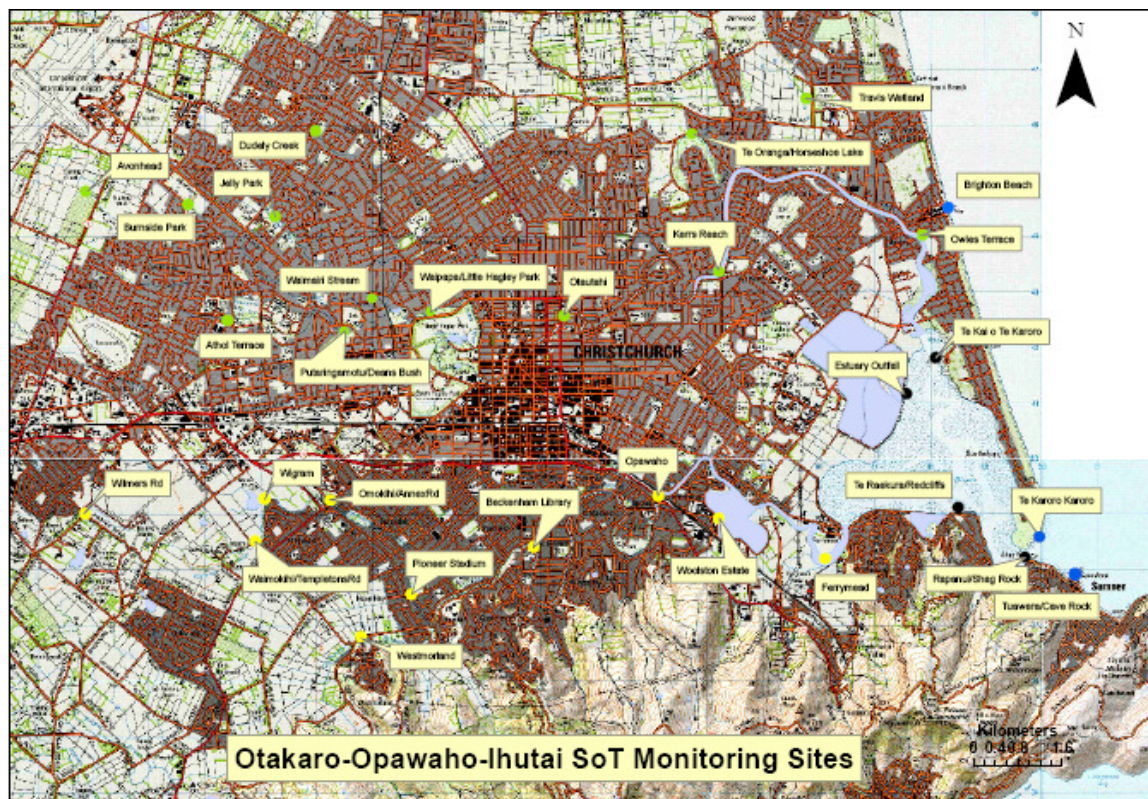
The estuary was part of a large network of food resources and trading between families. Such trading helped maintain tribal connections throughout the South Island.

The settlement of Christchurch has taken an almost irreversible toll on Te Ihutai. Drainage of the original swamplands of Christchurch has led to extreme sedimentation within both the Avon and Heathcote Rivers and the estuary itself. Industrial and domestic development has seen the destruction of native vegetation and riparian margins, degradation of water quality and local extinction of native fish and bird species and also resulted in the depositing of pollution and toxins within the estuary.

This has led to the estuary and its catchment being of little, if any value as a mahinga kai for tangata whenua, in turn having serious implications on cultural identity and wellbeing.

In particular, the taking of the Te Ihutai Māori Reserve in 1956 under the Public Works Act as part of the Christchurch sewage works development and the subsequent discharge of human effluent into the estuary has been difficult for the tangata whenua to deal with. So much so, that the owners of the reserve would not accept the money offered as compensation, because they would only accept a similar area of land having similar characteristics to that which was taken (Tikouka Whenua 2007; TWK, 1990; Ihutai Trust 2006).

Cultural monitoring has never been undertaken to assess the extent of change within the estuary catchment or of the current health of the catchment. Therefore it is proposed that a number of sites spread throughout the catchment (Ki Uta Ki Tai – from the source to the sea) are to be assessed as part of the project. These sites are listed in the following sub-section and shown on Map 1.



1.4 Monitoring Sites

Ōtakaro / Avon River

1. Avonhead @ Russley Road
2. Burnside Park/West Burn
3. Wairarapa Stream @ Jelly Park
4. Dudley Creek
5. Waimairi Stream @ Royds Rd
6. Ilam Stream @ Athol Terrace
7. Putaringamotu/Deans Bush
8. Waipapa/Little Hagley Park
9. Ōtautahi/Kilmore St
10. Kerrs Reach
11. Te Oraka/Horseshoe Lake
12. OruaPaeroa/Travis Wetland
13. Owles Terrace

Ōpawaho / Heathcote River

14. Wilmers Rd/Warren Park
15. Waimokihi/Templetons Rd
16. Wigram Basin
17. Omokihi/Annex Rd (Linden Grove)
18. Pioneer Stadium
19. Westmorland
20. Beckenham Library
21. Opawaho/Garlands Rd Bridge
22. Woolston Industrial Estate
23. Settlers Reserve/Ferrymead

Te Wahapu-Ihutai / Estuary

24. Te Kai a Te Karoro/Jellicoe Park
25. Te Karoro Karoro/South Brighton Spit
26. Estuary Outfall
27. Raekura/Redcliffs
28. Rapanui/Shag Rock

Te Tai o Maha-a-nui / Pegasus Bay

29. Tuawera/Cave Rock/Sumner Beach
30. OruaPaeroa/New Brighton Beach

2 Monitoring Action Plan

2.1 Monitoring Team

The following people will be involved in the monitoring:

- Craig Pauling (TRoNT)
- Te Marino Lenihan (Ngāi Tūāhuriri)
- Makarini Rupene (Ngāi Tūāhuriri)
- Nukuroa Tirikatene-Nash (Ngāi Tūāhuriri)
- Rewi Couch (Te Hapū o Ngāti Wheke)*

* May not be present at all times

2.2 Dates of Monitoring work

The monitoring/data collection will take place over the autumn period from March - May 2007. A timetable of events and initial dates for are outlined in the table below.

2.3 Timetable & Schedule of Work to be undertaken

	Day 1 – Friday, 16 March 2007	Day 2 – Friday, 30 March 2007
11.30am	Meet at TWP House, travel to first site	Meet at TWP House, travel to first site
12pm	Arrive/Assess site 1 – Wairarapa	Assess site 7 – Kerrs Reach
	Requirements: Katoa	Requirements: katoa
1pm	Arrive/Assess site 2 - USCA	Assess site 8 – Te Oraka
	Requirements: Katoa (Lunch)	Requirements: Takiwa/Ecoli (lunch)
2pm	Arrive/Assess site 3 - Putaringamotu	Assess site 9- Travis Wetland
	Requirements: katoa	Requirements: Takiwa / Ecoli
3pm	Arrive/Assess site 4 - Waipapa	Assess site 10- Anazc Terrace
	Requirements: Takiwa, CHI, SHMAK and E.coli	Requirements: katoa
4pm	Arrive Assess site 5 – Puari	Assess site 11- Bexley Wetland
	Requirements: Takiwa, CHI, SHMAK and E.coli	Requirements: katoa
5pm	Arrive Assess site 6 - Otautahi	Assess site 12 – Jellicoe (Spit/Beach&Outfall ??)
	Requirements: Takiwa, CHI, SHMAK and E.coli	Requirements: Takiwa/E.coli
6pm	Kua mutu - Hoki ki te kainga	Kua mutu - Hoki ki te kainga
	Day 3 – Friday, 13 April 2007	Day 4 – Friday, 20 April 2007
11.30am	Meet at TWP House, travel to first site	Meet at TWP House, travel to first site
12pm	Arrive/Assess site 13 – Waipuna	Assess site 19 – Garlands Rd
	Requirements: Katoa	Requirements: katoa
1pm	Arrive/Assess site 14 – Templetons Rd	Assess site 20 – Ferrymead
	Requirements: Katoa (Lunch)	Requirements: Takiwa/Ecoli (lunch)
2pm	Arrive/Assess site 15 – Annex Rd	Assess site 21 – Humphries Dr
	Requirements: katoa	Requirements: Takiwa / Ecoli
3pm	Arrive/Assess site 16 – Pioneer Stadium	Assess site 22 – Beachville Rd
	Requirements: Takiwa, CHI, SHMAK and E.coli	Requirements: katoa
4pm	Arrive Assess site 17 – Bowenvale Tc	Assess site 23 - Rapanui
	Requirements: Takiwa, CHI, SHMAK and E.coli	Requirements: katoa
5pm	Arrive Assess site 18 – Hillsborough Rd	Assess site 24 – Tuawera
	Requirements: Takiwa, CHI, SHMAK and E.coli	Requirements: Takiwa/E.coli
6pm	Kua mutu - Hoki ki te kainga	Kua mutu - Hoki ki te kainga

State of the Takiwā Monitoring Work Plan – Te Pātaka Cultural Health Review: 2007

This plan outlines the proposed process for undertaking the monitoring fieldwork and data gathering for catchments of Te Pātaka a Rakaihautū/Banks Peninsula, as part of the Te Waipounamu Freshwater Project.

The plan begins with a brief background to the project and the purpose for the monitoring. The plan also includes a description of the area to be researched and a detailed action plan for the monitoring fieldwork. This action plan includes the proposed dates of the monitoring, a timetable and schedule of activities, the data collection methodology, expected outcomes, resources and OSH provisions.

The plan also includes an appendix of monitoring forms and other relevant information to assist the monitoring fieldwork.

1 Tāhuhu kōrero/Background

The proposed monitoring fieldwork outlined in this plan is being undertaken as part of the Ngāi Tahu led SMF funded project called "State of the Takiwā - Te Waipounamu Freshwater Report 2007".

The fieldwork is being facilitated by Craig Pauling (Te Rūnanga o Ngāi Tahu), in conjunction with Iaeen Cranwell (Wairewa/Takuahi), Peter Ramsden (Koukourarata), Rewi Couch (Te Hapū o Ngāti Wheke), Tim Manawatu (Onuku), with support from Environment Canterbury, NIWA and Envirolink Laboratories.

The major purpose of the fieldwork is to undertake baseline cultural health assessments of selected catchments of Te Pātaka, including the Koukourarata, Onuku, Wairewa and Omaru, through the gathering, analysis and reporting of data collected using the Takiwā cultural environmental monitoring and reporting tool.

The assessments will provide data for inclusion in the Te Waipounamu Freshwater Report 2007, as well as assisting in testing and refining the Takiwā tool being used. The data also provides baseline information for an ongoing monitoring regime for the area and can also begin to help measure the success of, and inform, the future management of these areas. The data may also help to complement the ongoing work of monitoring resource consents, developments and other activities in the catchment into the future.

On 30 November 2006, a hui was held at Wairewa Marae with Papatipu Rūnanga to introduce the Takiwā tool, the current project, and to discuss and plan the monitoring programme. Representatives from Tūāhuriri, Onuku, Koukourarata, Wairewa, Taumutu Rūnanga, Envirolink and Environment Canterbury were present. Monitoring targets were identified by all rūnanga present, with those not present being contacted separately, and then followed up to clarify sites and dates.

This plan outlines the agreed outcomes, milestones and plans for the fieldwork from this meeting and subsequent discussions.

1.1 Expected Outcomes

- Introduction, training and further testing of the Takiwā system by rūnanga/iwi members.
- Training and application of CHI, SHMAK and E.Coli testing by rūnanga.
- Collection of baseline Takiwā data, including the CHI, SHMAK and E.coli data for Te Pātaka at various sites from the source to the sea.
- Storage, analysis and reporting of this data to assist future management and planning and to contribute to the Te Waipounamu Freshwater Report.

1.2 Milestones

- Identify monitoring sites and targets on Te Pātaka, important resources such as people and equipment needed and develop a plan for the gathering of data in conjunction with rūnanga monitoring team members (Nov 2006 - March 2007);
- Provide training to rūnanga monitoring team members in the use of the Takiwā 1.0 software and other environmental monitoring processes (Nov 2006 - March 2007).
- Undertake the gathering of data from the selected sites and input the collected data into Takiwā 2.0 (by June 2007);
- Analyse the collected data and contribute to Te Waipounamu Report (by July 2007);
- Present these findings back to rūnanga members (by Aug 2007).

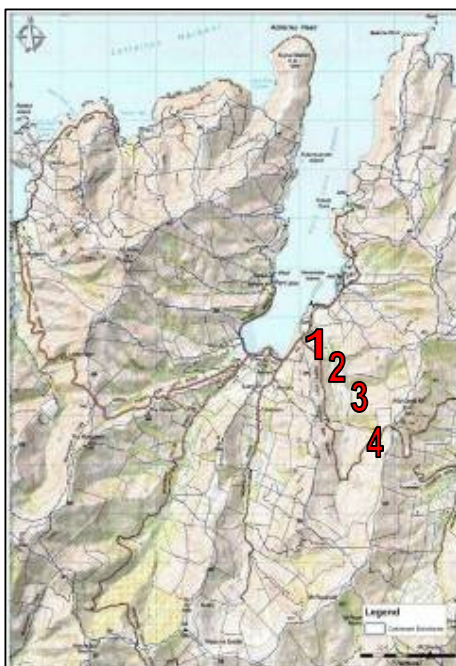
1.3 Area To Be Researched – Te Pātaka a Rakaihautū

Te Pātaka a Rakaihautū is an early name for Banks Peninsula and refers to the food storage house of Rakaihautū, an important Waitaha chief and ancestor of Ngāi Tahu Whānui. It was given its name due to the abundance and availability of birds and other resources food the forests which once dominated the Peninsula.

There are four Ngāi Tahu communities on Te Pātaka, including Koukourarata (Port Levy), Rapaki (within Lyttelton Harbour), Onuku (within Akaroa Harbour) and Wairewa (Little River/Lake Forsyth).

The settlement of Christchurch and the wider Peninsula, and the associated native forest clearance and the subsequent development of agricultural land on the Peninsula itself, has caused dramatic change to the indigenous landscapes of Te Pātaka.

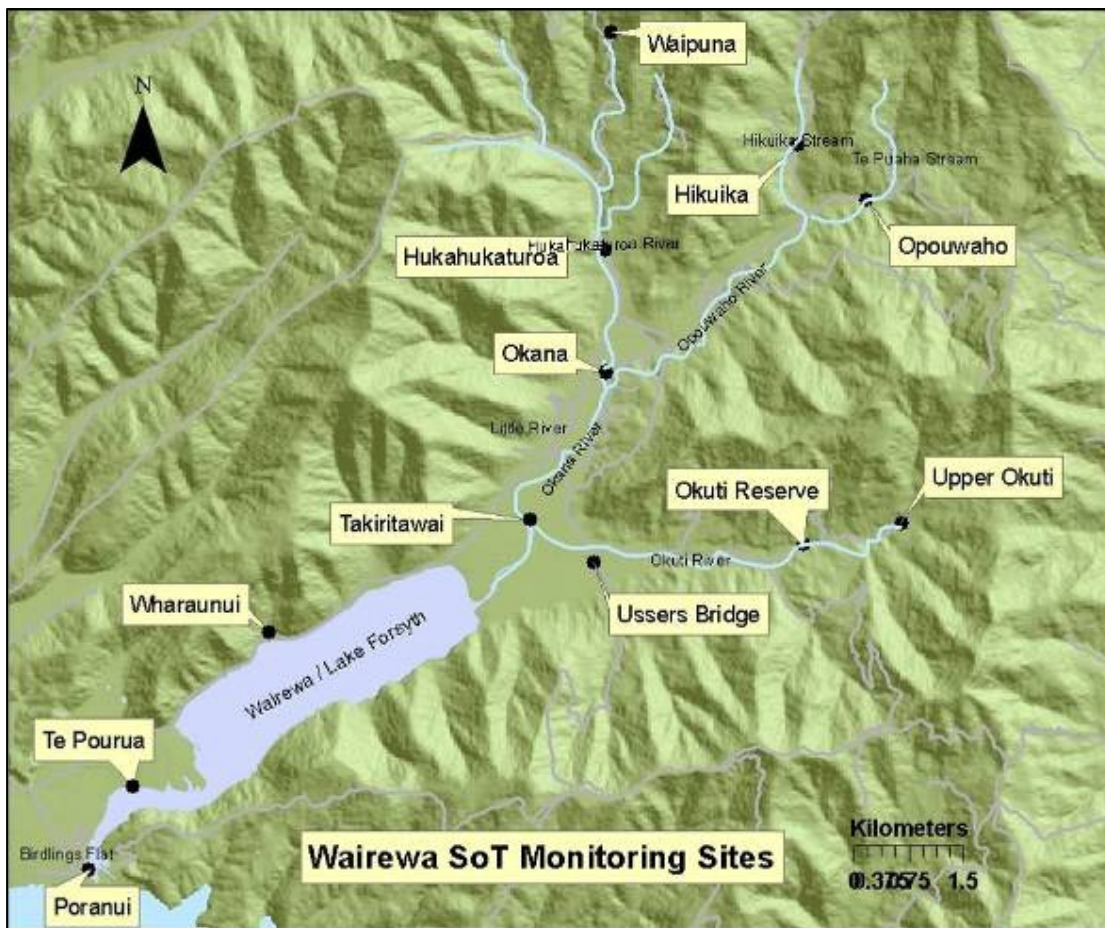
Cultural monitoring has never been undertaken to assess the extent of change on Te Pātaka. Therefore it is proposed that a number of sites spread throughout the catchment (Ki Uta Ki Tai – from the source to the sea) are to be assessed as part of the project. These sites are listed in the following sub-section and shown on the Maps below.



Koukourarata SoT Sites



Onuku SoT Sites



1.4 Monitoring Sites

Omaru / Rapaki

1. Woolshed
2. Rewi's Yard
3. Wheke Marae
4. Omaru Mouth

Onuku Stream / Onuku

1. Awaiti Intake
2. Upper Marae
3. Onuku Marae
4. Awaiti Mouth

Koukourata Stream / Koukourarata

1. Upper Koukou
2. Mid Koukou
3. Koukou intake
4. Koukourarata Mouth

Wairewa / Lake Forsyth

1. Poranui/Birdlings Flat
2. Pourua/Power Boat Club
3. Wharaunui/Catons Bay
4. Takiritawai
5. Upper Okuti
6. Okuti Reserve
7. Ussers Bridge
8. Okana @ SH Bridge
9. Waipuna
10. Hukahukaturua
11. Hikuika
12. Opouwaho

2 Monitoring Action Plan

2.1 Monitoring Team

The following people will be involved in the monitoring:

- Craig Pauling (TRoNT)
- Rewi Couch (Te Hapū o Ngāti Wheke/Rapaki)
- Peter Ramsden (Koukourarata)
- Te Whetu Apai (Koukourarata)
- Tim Manawatu (Onuku)
- Waitai Tikao (Onuku)
- Iaeen Cranwell (Wairewa)
- Jenny Bond (Ecan)

2.2 Dates of Monitoring work

The monitoring/data collection will take place in May 2007. A timetable of events and initial dates for are outlined in the table below.

2.3 Timetable & Schedule of Work to be undertaken

	Day 1 – Tuesday, 17 April 2007	Day 3 – Wednesday, 30 May 2007	Day 2 – Wednesday, 02 May 2007
8.30am	Travel Chch – Onuku Marae	Travel Chch – Koukourarata	Travel Chch – Rapaki
10.30am	Arrive/Assess site 1 – Awaiti Intake	Assess site 1 – Koukou Mouth	Arrive/Assess site 1 – Rewi's Yard
	Requirements: Takiwa/CHI/SHMAK/E.coli/EFish	Requirements: Takiwa/CHI/SHMAK/E.coli/EFish	Requirements: Takiwa/CHI/SHMAK/E.coli/EFish
11.30pm	Arrive/Assess site 2 – Upper Marae	Assess site 2 – Koukou Intake	Arrive/Assess site 2 – Wheke Marae
	Requirements: Takiwa/CHI/SHMAK/E.coli/EFish	Requirements: Takiwa/CHI/SHMAK/E.coli/EFish	Requirements: Takiwa/CHI/SHMAK/E.coli/EFish
12.30pm	LUNCH	LUNCH	LUNCH
1.30pm	Arrive/Assess site 3 – Onuku Marae	Assess site 3- Koukou Mid	Arrive/Assess site 3 – Omaru Mouth
	Requirements: Takiwa/CHI/SHMAK/E.coli/EFish	Requirements: Takiwa/CHI/SHMAK/E.coli/EFish	Requirements: Takiwa/CHI/SHMAK/E.coli/EFish
2.30pm	Arrive/Assess site 4 – Awaiti Mouth	Assess site 4- Upper Koukou	Arrive/Assess site 4 – Woolshed
	Requirements: Takiwa/CHI/SHMAK/E.coli/EFish	Requirements: Takiwa/CHI/SHMAK/E.coli/EFish	Requirements: Takiwa/CHI/SHMAK/E.coli/EFish
3.30pm	Kua mutu - Hoki ki te kainga	Kua mutu - Hoki ki te kainga	Kua mutu - Hoki ki te kainga
	Day 4 – Friday, 20 April 2007		
8.30am	Travel Chch – Wairewa	1.30pm	Assess site 6 – Okuti Res
10.00am	Assess site 1 – Poranui		Requirements: katoa
	Requirements: Takiwa/Ecoli	2.00pm	Assess site 7 – Ussers Bridge
10.30pm	Assess site 2 – Pourua		Requirements: katoa
	Requirements: Takiwa/Ecoli	2.30pm	Assess site 8 – Okana
11.00pm	Assess site 3 – Wharaunui		Requirements: katoa
	Requirements: Takiwa / Ecoli	3.00pm	Assess site 9 – Waipuna
11.30pm	Assess site 4 – Takiritawai		Requirements: katoa
	Requirements: katoa	3.30pm	Assess site 10 – Hukahukaturao
12.30pm	LUNCH		Requirements: katoa
1.00pm	Assess site 5 – Upper Okuti	4.00pm	Assess site 11/12 – Hikuika/Opouwaho
	Requirements: katoa		Kua mutu - Hoki ki te kainga

State of the Takiwā Monitoring Work Plan – Waihora Cultural Health Review: 2007

This plan outlines the proposed process for undertaking the monitoring fieldwork and data gathering for Te Waihora/Lake Ellesmere, as part of the Te Waipounamu Freshwater Project.

The plan begins with a brief background to the project and the purpose for the monitoring. The plan also includes a description of the area to be researched and a detailed action plan for the monitoring fieldwork. This action plan includes the proposed dates of the monitoring, a timetable and schedule of activities, the data collection methodology, expected outcomes, resources and OSH provisions.

The plan also includes an appendix of monitoring forms and other relevant information to assist the monitoring fieldwork.

1 Tāhuhu kōrero/Background

The proposed monitoring fieldwork outlined in this plan is being undertaken as part of the Ngāi Tahu led SMF funded project called "State of the Takiwā - Te Waipounamu Freshwater Report 2007".

The fieldwork is being facilitated by Craig Pauling (Te Rūnanga o Ngāi Tahu), in conjunction with Lisa Smith (Taumutu) and Jason Arnold (Waihora), with support from Environment Canterbury, NIWA and Envirolink Laboratories.

The major purpose of the fieldwork is to undertake baseline cultural health assessments of selected sites around Te Waihora through the gathering, analysis and reporting of data collected using the Takiwā cultural environmental monitoring and reporting tool.

The assessments will provide data for inclusion in the Te Waipounamu Freshwater Report 2007, as well as assisting in testing and refining the Takiwā tool being used. The data also provides baseline information for an ongoing monitoring regime for the area and can also begin to help measure the success of, and inform, the future management of these areas. The data may also help to complement the ongoing work of monitoring resource consents, developments and other activities in the catchment into the future.

On 30 November 2006, a hui was held at Wairewa Marae with Papatipu Rūnanga to introduce the Takiwā tool, the current project, and to discuss and plan the monitoring programme. Representatives from Tūāhuriri, Onuku, Koukourarata, Wairewa, and Taumutu Rūnanga, Envirolink and Environment Canterbury were present. Monitoring targets were identified by all rūnanga present, with those not present being contacted separately, and then followed up to clarify sites and dates.

This plan outlines the agreed outcomes, milestones and plans for the fieldwork from this meeting and subsequent discussions.

1.1 Expected Outcomes

- Introduction, training and further testing of the Takiwā system by rūnanga/iwi members.
- Training and application of CHI, SHMAK and E.Coli testing by rūnanga.
- Collection of baseline Takiwā data, including the CHI, SHMAK and E.coli data for Te Pātaka at various sites from the source to the sea.
- Storage, analysis and reporting of this data to assist future management and planning and to contribute to the Te Waipounamu Freshwater Report.

1.2 Milestones

- Identify monitoring sites and targets around Te Waihora, important resources such as people and equipment needed and develop a plan for the gathering of data in conjunction with rūnanga monitoring team members (Nov 2006 - March 2007);
- Provide training to rūnanga monitoring team members in the use of the Takiwā 1.0 software and other environmental monitoring processes (Nov 2006 - March 2007).
- Undertake the gathering of data from the selected sites and input the collected data into Takiwā 2.0 (by June 2007);
- Analyse the collected data and contribute to Te Waipounamu Report (by July 2007);
- Present these findings back to rūnanga members (by Aug 2007).

1.3 Area To Be Researched – Te Waihora

The earliest name for Te Waihora is Te Kete Ika a Rakaihautū and refers to the fish basket of Rakaihautū, an important Waitaha chief and ancestor of Ngāi Tahu Whānui. It was given its name due to the abundance and availability of fish species, particularly tuna (eels), patiki (flounders), inanga (whitebait), piharau (lamprey) and aua (smelt), which are abundant in the lake.

There are six Ngāi Tahu communities with interest in the lake including those from Te Pātaka o Rakaihautu/Banks Peninsula - Koukourarata (Port Levy), Rapaki (within Lyttelton Harbour), Onuku (within Akaroa Harbour) and Wairewa (Little River/Lake Forsyth), as well as Ngāi Tūāhuriri (Kaiapoi) and Taumutu, within whose Takiwā the lake sits.

To Ngāi Tahu, Te Waihora represents a major mahinga kai and an important source of mana. The management and sustainable use of quality traditional food and other cultural resources of Te Waihora maintains and enhances the rangatiratanga and kaitiaki role of Ngāi Tahu in recognition of this tribal taonga. This encompasses whakapapa, mauri, rangatiratanga and mana, kaitiakitanga, rāhui, and cultural use, gathering methods and opportunities.

Many customary practices have been maintained today through the continued preference for traditional food and customs. Many of these practices however, are in jeopardy of being lost due to unsustainable practices in other sectors of the community and through actions that have resulted in a degraded environment. This impacts on the health and well-being of the waterways and natural resources and the ability of Ngāi Tahu to access the life sustaining resources

It is proposed that a number of sites spread around the margin of the lake are to be assessed as part of the project. These sites are listed in the following sub-section and shown on Map 1.

1.4 Monitoring Sites

Waihora / Lake Ellesmere

1. Waiomakua, Kaitorete Spit
2. Kaituna
3. Huritini/Halswell River
4. North Greenpark Sands, Wolfes Road
5. Mid Greenpark Sands, Clarkes Road
6. Lower Selwyn Huts
7. Coes Ford
8. Chamberlains Ford
9. Coalgate
10. Whitecliffs
11. Irwell Stream
12. Boggy Creek
13. Harts Creek
14. Pakoau, Johnsons Rd
15. Commonage Water Tower
16. Whakamatakiuru/Fishermans Point
17. Te Korua
18. Waikekewai
19. Awapunapuna
20. Muriwai



2 Monitoring Action Plan

2.1 Monitoring Team

The following people will be involved in the monitoring:

- Craig Pauling (TRoNT)
- Lisa Smith (Taumutu)
- David O'Connell (Taumutu)
- Cavan O'Connell (Taumutu)
- Jason Arnold (Waihora)
- David Aires (Ecan)
- David Hewson (Ecan)

2.2 Dates of Monitoring work

The monitoring/data collection will take place in April 2007. A timetable of events and initial dates for are outlined in the table below.

2.3 Timetable & Schedule of Work to be undertaken

	Day 1 – Wednesday, 11 April 2007	Day 2 – Thursday, 12 April 2007
8am	Travel Chch to Waihora.	Travel Chch to Waihora
9am	Arrive/Assess site 1 –Boggy Creek Mouth	Assess site 8 – Lower Selwyn Huts
	Requirements: Takiwa/CHI/SHMAK/E.coli/EFish	Requirements: Takiwa, CHI, SHMAK and E.coli
11am	Arrive/Assess site 2 – Irwell River Mouth	Assess site 9 – Greenpark Sands (North)
	Requirements: Takiwa/CHI/SHMAK/E.coli/EFish	Requirements: Takiwa and E.coli
12am	Arrive/Assess site 3 – Harts Creek Mouth	Assess site 10 – Greenpark Sands (Mid)
	Requirements: Takiwa/CHI/SHMAK/E.coli/EFish	Requirements: Takiwa and E.coli
1pm	Arrive/Assess site 4 - Pakoau	Assess site 11 - Halswell River Mouth
	Requirements: Takiwa and E.coli	Requirements: Takiwa/CHI/SHMAK/E.coli/EFish
2pm	Arrive Assess site 5 – Water Tower	Assess site 12 – Kaituna
	Requirements: Takiwa and E.coli	Requirements: Takiwa/CHI/SHMAK/E.coli/EFish
3pm	Arrive Assess site 6 – Fishermans Point	Assess site 13 –Waiomakua
	Requirements: Takiwa and E.coli	Requirements: Takiwa and E.coli, 4WD
4pm	Arrive Assess site 7 – Te Koru (west end)	Arrive/Assess site 14 – Kaitorete Spit (lower)
	Requirements: Takiwa and E.coli, 4WD	Requirements: Takiwa and E.coli, 4WD
5pm	Kua mutu - Whakahokia ki te kainga	Kua mutu - Whakahokia ki te kainga
	Day 3 – Sunday, 9 April 2007	Day 4 – Saturday, 28 April 2007
10.30am	Travel Chch – Whitecliffs	Travel Chch - Taumutu
12pm	Arrive/Assess site 1 – Whitecliffs	
	Requirements: Takiwa/CHI/SHMAK/E.coli/EFish	
1pm	Arrive/Assess site 2 – Coalgate	Assess site 1 – Te Awapunapuna
	Requirements: Takiwa/CHI/SHMAK/E.coli/EFish	Requirements: Takiwa/CHI/SHMAK/E.coli/EFish
2pm	Arrive/Assess site 3 – Chamberlains Ford	Assess site 2 – Waikekewai
	Requirements: Takiwa/CHI/SHMAK/E.coli/EFish	Requirements: Takiwa/CHI/SHMAK/E.coli/EFish
3pm	Arrive/Assess site 4 – Coes Ford	Assess site 3 – Muriwai
	Requirements: Takiwa, CHI, SHMAK and E.coli	Requirements: Takiwa/CHI/SHMAK/E.coli/EFish
4pm	Kua mutu - Hoki ki te kainga	Kua mutu - Hoki ki te kainga

State of the Takiwā Monitoring Work Plan – Waianakarua Cultural Health Assessment: June 2007

This plan outlines the proposed process for undertaking the monitoring fieldwork and data gathering for the Waianakarua catchment as part of the Te Waipounamu Freshwater Project.

The plan begins with a brief background to the project and the purpose for the monitoring. The plan also includes a description of the area to be researched and a detailed action plan for the monitoring fieldwork. This action plan includes the proposed dates of the monitoring, a timetable and schedule of activities, the data collection methodology, expected outcomes, resources and OSH provisions.

The plan also includes an appendix of monitoring forms and other relevant information to assist the monitoring fieldwork.

1 Tāhuhu kōrero/Background

The proposed monitoring fieldwork outlined in this plan is being undertaken as part of the Ngāi Tahu led SMF funded project called "State of the Takiwā - Te Waipounamu Freshwater Report 2007".

The Waianakarua project is being facilitated by Craig Pauling (Te Rūnanga o Ngāi Tahu) in conjunction with Gail Tipa (Tipa Associates) and involves Papatipu Rūnanga representatives with support from NIWA, Otago Regional Council Staff and Envirolink Laboratories.

The major purpose of the project is to undertake baseline cultural health assessments of the Waianakarua catchment through the gathering, analysis and reporting of data collected using the Takiwā cultural environmental monitoring and reporting tool.

The assessments will provide data for inclusion in the Te Waipounamu Freshwater Report 2007, as well as assisting in testing and refining the Takiwā tool being used. The data also provides baseline information for an ongoing monitoring regime for the area and can also begin to help measure the success of, and inform, the future management of these areas. The data may also help to complement the ongoing work of monitoring resource consents, developments and other activities in the catchment into the future.

On 11 June 2007, a hui was held at Moeraki Marae to introduce the Takiwā tool, the current project, and to discuss and plan the monitoring programme. Representatives from Moeraki and Arowhenua Rūnanga, NIWA and the Otago Regional Council were present.

This plan outlines the agreed outcomes and milestones for the project from this meeting.

1.1 Expected Outcomes from the Project

- Introduction, training and further testing of the Takiwā system by iwi members.
- Training and application of CHI, SHMAK and E.Coli testing by rūnanga/iwi.
- Collection of baseline Takiwā data, including the CHI, SHMAK and E.coli data for the Waianakarua catchment at various sites from the source to the sea.
- Storage, analysis and reporting of this data to assist future management and planning and to contribute to the Te Waipounamu Freshwater report, as well as information for ongoing monitoring of the Waianakarua River.

1.2 Project Milestones

- Identify monitoring sites and targets in the Waianakarua Catchment, important resources such as people and equipment needed and develop a plan for the gathering of data in conjunction with rūnanga monitoring team members (June 2007);
- Provide training to rūnanga monitoring team members in the use of the Takiwā software and other environmental monitoring processes (June 2007).
- Undertake the gathering of data from the selected sites and input the collected data into Takiwā (May 2007);
- Analyse the collected data and contribute to Te Waipounamu Report (by July 2007);
- Present these findings back to the rūnanga (Aug 2007).

1.3 Research Area – Waianakarua Catchment

The Waianakarua catchment is a significant river to the tangata whenua of North Otago, particularly Moeraki Rūnanga.

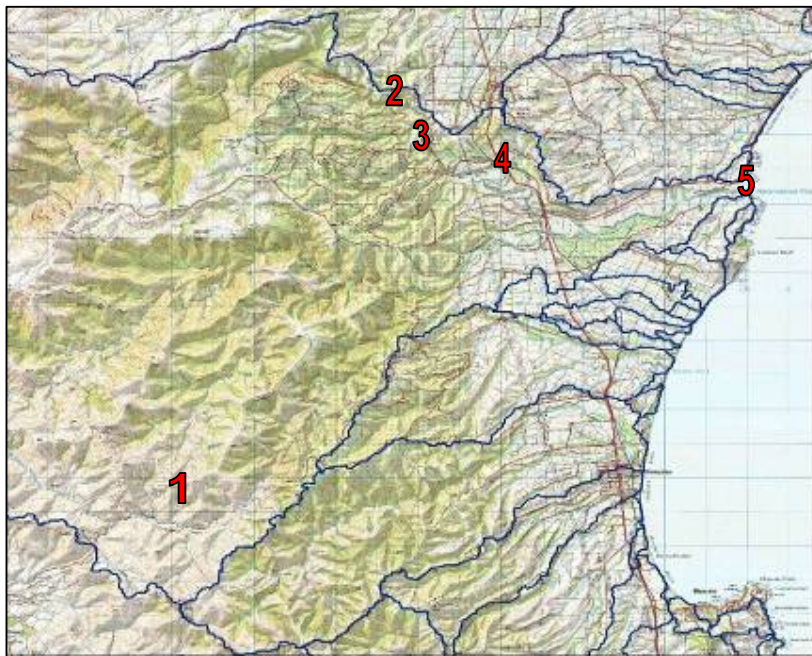
The Waianakarua has three upper branches, the South, Middle and North, which come together on the coastal side of State Highway One.

The South Branch is dominated by agricultural landuse, while the North Branch is dominated by exotic forestry. A tribal nohoanga or campsite is also situated the North Branch, within an existing DoC reserve near Camp Iona.

The lower stretches of the river, from above the State Highway to the coast have a number of gravel take operations in activity.

1.4 Monitoring Sites

1. Razor Back Rd/Sweetwater Creek (Upper South Branch)
2. Waianakarua Nohoanga (Nth Branch)
3. Waianakura Ford (North Branch)
4. Millhouse Gravel Take (North Branch)
5. Waianakarua Mouth



2 Monitoring Action Plan

2.1 Monitoring Team

The following people will be involved in the monitoring:

- Craig Pauling (TRoNT)
- Rua Macullum (Moeraki)
- Mandy Home (Arowhenua/Waihao)
- Myra Tipa (Moeraki)
- Mary Whitau (Moeraki)
- Kyle Nelson (Tipa Associates)
- Gail Tipa (Tipa Associates)
- Matt Dale (Otago Regional Council)
- Ngaire Phillips (NIWA)

2.2 Dates of Monitoring work

The monitoring/data collection will take on 11 and 12 June 2007. A timetable of events is outlined in the table below.

2.3 Timetable & Schedule of Work to be undertaken

	Day 1 – Tuesday		Day 2 – Wednesday
	11 June 2007		12 June 2007
	Training and Planning	8.30-8.30	Breakfast and Depart for next site
		9.30am	Arrive/Assess site 3 – Millhouse Gravel Take
			Requirements: All
1.30pm	Arrive/Assess Site 1 – Razor Back	11.00am	Arrive/Assess site 4 – Nohoanga
	Requirements: All		Requirements: All
3.30pm	Arrive/Assess Site 2 – Waiana Mouth	12.00pm	Arrive/Assess site 5 – Ford
	Requirements: All		Requirements: All
5.00pm	Kua mutu i tēnei ra – Finish for day	1.30pm	Lunch - Hampden
	Accommodation: Moeraki Marae		
6.00pm	Kai a te po / Dinner	2.30pm	Kua mutu – Hoki atu ki Dunedin/Chch

State of the Takiwā Monitoring Work Plan – Mataura/Waikawa Cultural Health Assessment: May 2007

This plan outlines the proposed process for undertaking the monitoring fieldwork and data gathering for the Mataura and Waikawa catchments, as part of the Te Waipounamu Freshwater Project.

The plan begins with a brief background to the project and the purpose for the monitoring. The plan also includes a description of the area to be researched and a detailed action plan for the monitoring fieldwork. This action plan includes the proposed dates of the monitoring, a timetable and schedule of activities, the data collection methodology, expected outcomes, resources and OSH provisions.

The plan also includes an appendix of monitoring forms and other relevant information to assist the monitoring fieldwork.

1 Tāhuhu kōrero/Background

The proposed monitoring fieldwork outlined in this plan is being undertaken as part of the Ngāi Tahu led SMF funded project called "State of the Takiwā - Te Waipounamu Freshwater Report 2007".

The fieldwork is being facilitated by Craig Pauling (Te Rūnanga o Ngāi Tahu) in-conjunction with Papatipu Rūnanga representatives with support from NIWA, Environment Southland Staff and Envirolink Laboratories.

The major purpose of the fieldwork is to undertake baseline cultural health assessments of the Mataura and Waikawa catchments through the gathering, analysis and reporting of data collected using the Takiwā cultural environmental monitoring and reporting tool.

The assessments will provide data for inclusion in the Te Waipounamu Freshwater Report 2007, as well as assisting in testing and refining the Takiwā tool being used. The data also provides baseline information for an ongoing monitoring regime for the area and can also begin to help measure the success of, and inform, the future management of these areas. The data may also help to complement the ongoing work of monitoring resource consents, developments and other activities in the catchment into the future.

On 12 April 2007, a hui was held at Waihopai Marae to introduce the Takiwā tool, the current project, and to discuss and plan the monitoring programme. Representatives from Te Ao Marama, Awarua, Waihopai, Hokonui and Oraka-Aparima Rūnanga, Manaaki Whenua, NIWA, Envirolink and Environment Southland were present. Monitoring targets were identified by all rūnanga present, which were then followed up to clarify.

This plan outlines the agreed outcomes, milestones and plans for the fieldwork from this meeting and subsequent discussions.

1.1 Expected Outcomes from the Project

- Introduction, training and further testing of the Takiwā system by iwi members.
- Training and application of CHI, SHMAK and E.Coli testing by rūnanga/iwi.
- Collection of baseline Takiwā data, including the CHI, SHMAK and E.coli data for the Mataura and Waikawa catchments at various sites from the source to the sea (Ki Uta Ki Tai).
- Storage, analysis and reporting of this data to contribute to the Te Waipounamu Freshwater report, as well as information for ongoing monitoring of the Mataura Mataitai.

1.2 Project Milestones

- Identify monitoring sites and targets in the Mataura and Waikawa Catchments, important resources such as people and equipment needed and develop a plan for the gathering of data in conjunction with rūnanga monitoring team members (April 2007);
- Provide training to rūnanga monitoring team members in the use of the Takiwā software and other environmental monitoring processes (April 2007).
- Undertake the gathering of data from the selected sites and input the collected data into Takiwā (May 2007);
- Analyse the collected data and contribute to Te Waipounamu Report (July 2007);
- Present these findings back to Te Ao Marama (Aug 2007).

1.3 Research Area – Mataura/Waikawa Rivers

The Mataura and Waikawa catchments are rivers of immense cultural significance to tangata whenua, particularly due to the annual seasonal harvest of kanakana (lamprey eels) at Matuara Falls and Niagra Falls.

In particular, the Mataura river catchment was a major trial for the people of Murihiku to Lake Whakatipu and the Te Koroka source of pounamu (greenstone) at the head of the lake.

Due to its place in the history and traditions of Ngai Tahu Whānui the Mataura was included as a Statutory Acknowledgement Area in the Ngāi Tahu Claims Settlement Act 1998. Schedule 42 of the Act summaries the Ngai Tahu association with the Mataura River stating:

The area of the Mataura River above the Mataura Falls was traditionally used by the descendants of the Ngati Mamoe chief, Parapara Te Whenua. The descendants of Parapara Te Whenua incorporate the lines of Ngati Kuri from which the Mamaru family of Moeraki descend. Another famous tupuna associated with the river was Kiritekatēka, the daughter of Parapara Te Whenua. Kiritekatēka was captured by Ngai Tahu at Te Anau and her descendants make up the lines of many of the Ngai Tahu families at Otakou....The Mataura was an important mahinga kai, noted for its indigenous fishery. The Mataura Falls were particularly associated with the taking of kanakana (lamprey).

The 1966 *Encyclopaedia of New Zealand*, edited by A. H. McIntock gives an overview of the catchment as well as an historical perspective of the condition of the Mataura River, stating:

Rising on the east side of the Eyre Mountains, the Mataura flows south-eastward and then south for 120 miles and enters the sea at Toetoes Bay, 20 miles east of Bluff. A whaling station, Toitois (now Fortrose), was established at the mouth in the mid-1830s.

The catchment area is 281 sq. miles, and floods occurred in March 1913 of 177,000 cusecs and in June 1955 of 29,904 cusecs. A representative rate of flow for the upper reaches of the river was measured on 28 January 1955 at Parawa Bridge of 260 cusecs, and on 16 June 1955 at Gore Bridge of 8,370 cusecs.

The upper reaches of the river traverse a small inter-mountain basin at Garston and pass through a narrow, deeply incised gorge between Athol and Waikaia district. The remainder of its course passes through rolling and flat farm country in the Waimea Plains and the Mataura Valley.

Settlements along the river include the towns of Gore and Mataura, which were initially established at fords on the river in the early days of horse and bullock transport.

The Mataura River is a favourite resort of anglers and is the greatest brown trout water in New Zealand.

There have been many attempts to explain the meaning of the name Mataura. It may be an ancient name, as Mataura was an ancestor of Ngatoro-i-rangi, the priest of the Arawa canoe. It may possibly mean reddish, brown face, or glowing face (Bryce Leslie Wood, M.Sc., New Zealand Geological Survey, Dunedin www.teara.govt.nz/1966/M/MatauraRiver/MatauraRiver/en)

The settlement of the wider Mataura area mentioned by Wood (1996) above, and in particular the agricultural development of the catchment has taken a visible toll on the river, particularly the Mataura Falls area. The townships of Gore, Mataura and Edendale have significant agricultural based industrial sites including meat works, dairy factories and timbermills, all discharging wastes into the river. The Mataura Falls is perhaps the most dramatic example of this, being surrounded on each side by industrial factories (ad photo of falls). Inputs from these factories, as well as sewage and stormwater discharges from the surrounding townships have had an historical impact on the catchment, its water quality, the abundance of mahinga kai species, as well as the ability of tangata whenua to gather these species. The Mataura is however regarded as an important Trout fishery.

The Waikawa catchment has had a different history, being located away from the main agricultural and industrial centres of Southland. The catchment sits within the Catlins Region on Eastern Southland, a popular tourist area, and amongst the Catlins Forest Park, with forestry being a major land use in the catchment. A nohoanga site is situated at Niagara Falls.

Cultural monitoring has never been undertaken within the catchment to assess the current health of the catchment. Therefore it is proposed that a number of sites spread throughout the catchment (Ki Uta Ki Tai – from the source to the sea) are to be assessed as part of the project.

These sites are listed in the following sub-section and shown on Map 1.

1.4 Monitoring Sites

Mataura River

1. Robert Creek (Mataura Valley)
2. Piano Flat/Waikaia River
3. Riversdale (Mataura/Waikaia Confluence)
4. Gore
5. Mataura Falls
6. Tuturau
7. Edendale
8. Gorge Road Bridge
9. Fortrose

Waikawa River

10. Waikawa Valley/Forest
11. Marinui
12. Waikawa Fork
13. Mangaipiri/Niagara Falls
14. Waikawa Estuary/Trypot Bay

2 Monitoring Action Plan

2.1 Monitoring Team

The following people will be involved in the monitoring:

- Craig Pauling (TRoNT)
- Rodney Trainor (Te Ao Marama/Hokonui)
- Rewi Anglem (Hokonui)
- Aaron Leith (Awarua/Environment Southland)*
- Don Mowat* (Te Ao Marama / Waihopai)
- Environment Southland Staff*

* May not be present at all times

2.2 Dates of Monitoring work

The monitoring/data collection will take place between 17-19 May 2007. A timetable of events and initial dates for are outlined in the table below.

2.3 Timetable & Schedule of Work to be undertaken

	Day 1 – Thursday		Day 2 – Friday
	17 May 2007		18 May 2007
8.10am	Depart Chch-Invercargill Flight NZ 8071	8.00-8.30	Breakfast and Depart for next site
9.30am	Arrives Airport/Pick up cars/gear/kai	9.00am	Arrive/Assess site 5 – Mataura Falls
11.00am	Arrive Gore – pick up gear and lunch		Requirements: All
12.30pm	Arrive/Assess site 1 – Fairlight/Robert Creek	10.30am	Arrive/Assess site 6 – Tuturau
	Requirements: All (Lunch)		Requirements: Takiwa
2.30pm	Arrive/Assess site 2 - Riversdale	12.00pm	Arrive/Assess site 7- Edendale (lunch)
	Requirements: All		Requirements: All and Lunch
3.30pm	Arrive/Assess site 3 – Piano Flat	2pm	Arrive/Assess site 8- Gorge Road Bridge
	Requirements: All		Requirements: All
4.30pm	Arrive Assess site 4 - Gore	3.30pm	Arrive/Assess site 9 - Fortrose
	Requirements: Takiwa, CHI, SHMAK and E.coli		Requirements: Takiwā/E.coli
5.30pm	Kua mutu i tēnei ra – Finish for day	5.30pm	Arrive/Assess site 10 – Quarry Hills
	Accommodation: O Te Ika Rama Marae, Gore		Requirements: Takiwa/E.coli
6.00pm	Kai a te po / Dinner (self cater/restaurant)	6.30pm	Accommodation/Dinner: Waikawa (Leiths)

	Day 3 – Saturday 19 May 2007		
8.00-8.30	Breakfast and Depart for next site		
9.00am	Arrive/Assess site 11 – Mokoreta/Tahakopa Rd	12.00pm	Arrive/Assess site 14 – Niagra Falls (lunch)
	Requirements: All		Requirements: All
10.00am	Arrive/Assess site 12 – Waikawa Valley	1.00pm	Arrive/Assess site 15 – Waikawa Harbour
	Requirements: All (Lunch)		Requirements: All
11.00pm	Arrive/Assess site 13 – SH92	2.30pm	Kua mutu – Hoki atu ki Invercargill/Chch
	Requirements: All		Flight NZ 2634 Departs 4.10pm

Appendix C – National Drinking, Recreation and Shellfish Standards for Water

Microbiological Water Quality Guidelines for Marine & Freshwater Recreational Areas

Ministry for the Environment - 2003

Freshwater Contact Recreation:

No single sample greater than 260 E. coli/100 mL.

Marine Water Contact Recreation:

No single sample greater than **140 enterococci/100 mL**.

Shellfish Gathering:

The median faecal coliform content of samples taken over a shellfish-gathering season shall not exceed a Most Probable Number (MPN) of 14/100 mL, and not more than 10% of samples should exceed an MPN of 43/100 mL (using a five-tube decimal dilution test).

New Zealand Drinking Water Standards

Ministry of Health - 2000

E. coli

The indicator organism chosen to indicate possible faecal contamination of drinking-water is E. coli.

Thermotolerant coliforms (faecal coliforms) and total coliforms (which include both faecal and environmental coliform bacteria) may also be used to monitor water quality, but the results are harder to interpret than those from E. coli. If total coliforms or faecal coliforms are used for drinking-water monitoring to demonstrate compliance with the Standards instead of E. coli, a positive result shall be treated as though it were an E. coli result.

E. coli should not be present in drinking-water in the distribution zones.

However, unlike the drinking-water leaving the treatment plant, whose microbiological quality is under the control of the treatment plant management, the quality of drinking-water in the distribution zones may be subjected to contamination from a variety of influences.

Some of these may arise from poor management practices, such as faulty reservoir construction and maintenance, or poor sanitary practices by water supply workers.

Other contamination sources arise from the water users themselves, such as poor sanitation while making connections to the service or inadequate backflow prevention.

E. coli may, therefore, occasionally be found in the reticulation. The presence of E. coli must always be followed up.

If more than 0.2mg/L free available chlorine (FAC) is maintained in the drinking-water supply reticulation, coliform bacteria and E. coli are rarely, if ever, found. For this reason it is permissible to substitute monitoring of FAC for some (but not all) of the E. coli monitoring.

Appendix D –Takiwā Assessment Data Set for the Ngā Wai Pounamu Study

Takiwā Scores

Ngā Wai Pounamu Study

Site Name	Site Order	Visit Date	Pressure	Modification	Access	Harvest	Return	Overall	Abundance	Species	Plant Species	Plant Score	Current Species	Trad Species	Current VsTrad	CvsT Score	Takiwā	T Score Rank	Takiwa Rating
Ōaro Lagoon	1	15-May-07	2	2	5	5	5	4	-6	1	40	3	15	52	28.846	2	3.2	3	Moderate
Hurunui SH1 Bridge	2	24-Aug-07	3	3	4	5	5	3	-5	1	5	1	8	42	19.048	1	2.9	3	Moderate
Rakahuri / Ashley	3	24-Aug-07	3	2	5	4	5	3	-6	1	0	1	5	43	11.628	1	2.8	3	Moderate
Waimakariri Bridge	4	24-Aug-07	1	2	4	2	5	3	-2	1	1	1	5	44	11.364	1	2.2	2	Poor
Waipapa/Little Hagley	5	16-Mar-07	1	2	2	1	1	3	7	2	40	3	9	30	30	2	1.9	2	Poor
Ōmaru Stream	6	02-May-07	3	2	4	4	5	3	10	2	20	2	16	46	34.783	2	3.0	3	Moderate
Koukourārata Mouth	7	30-May-07	3	2	5	4	5	3	19	3	5	1	15	47	31.915	2	3.1	3	Moderate
Ōnuku Stream Mouth	8	17-Apr-07	4	2	4	5	5	3	13	3	45	3	12	47	25.532	2	3.4	4	Good
Ōkana SH75 Bridge	9	22-May-07	2	3	5	4	5	3	7	2	20	2	13	46	28.261	2	3.1	3	Moderate
Waikare/Chamb Ford	10	09-Apr-07	1	2	4	2	5	2	-10	1	1	1	0	39	0	1	2.1	2	Poor
Te Pā o Moki	11	20-Apr-07	3	2	4	4	5	3	14	3	25	2	15	46	32.609	2	3.1	3	Moderate
Ōpihi Bridge	12	20-Nov-07	3	3	5	4	5	4	-4	1	0	1	4	46	8.6957	1	3.0	3	Moderate
Waianakarua Mouth	13	12-Jun-07	2	1	4	4	5	2	-13	1	1	1	5	46	10.87	1	2.3	2	Poor
Māngai Piri/Niagara	14	19-May-07	3	3	5	5	5	4	11	2	60	3	26	45	57.778	3	3.7	4	Good
Mataura Falls	15	17-May-07	1	1	2	4	5	2	2	1	1	1	6	43	13.953	1	2.0	3	Moderate
Tuatapere	16	03-Mar-05	3	1	3	1	1	3	14	3	80	4	10	44	22.727	1	2.2	2	Poor
Arahura Pā	17	09-Sep-07	2	3	5	5	5	4	13	3	30	2	16	47	34.043	2	3.4	4	Good

2.4 2.1 4.1 3.7 4.5 3.1 3.8 1.8 22.0 1.9 10.6 44.3 23.7 1.6 **2.8**
 Below Below Sig Above Above Sig Above Just Above Sig Below Sig Below Sig Below
 -0.4 -0.7 1.3 0.9 1.7 0.3 -1.0 -0.9 -1.2

Appendix E – CHI Assessment Data Set for the Ngā Wai Pounamu Study

Cultural Health Index Scores

Ngā Wai Pounamu Study

Site Name	Site Order	Visit Date	CHI	Site Status	Return	Mahinga Kai	Stream Health	Catch LandUse	Margin Vege	Margin Use	Bed Cond	Channel	Water Quality	Water Clarity	Hab Variety	River Health	Combo Score	C Score Rank	C Score Rating
Ōaro Lagoon	1	15-May-07	A-1 3.0 3.2	A-1	1	3.0	3.2	3	3	3	3	1	4	5	4	4	3.1	3	Moderate
Hurunui SH1 Bridge	2	24-Aug-07	B-1 2.8 3.2	B-1	1	2.8	3.2	2	2	3	4	3	4	4	4	3	3.0	3	Moderate
Rakahuri / Ashley	3	24-Aug-07	B-1 2.8 2.6	B-1	1	2.8	2.6	2	2	2	3	2	3	4	3	3	2.7	3	Moderate
Waimakariri Bridge	4	24-Aug-07	B-1 2.8 0.0	B-1	1	2.8	2	1	2	2	3	2	2	2	2	3	2.4	2	Poor
Waipapa/Little Hagley	5	16-Mar-07	A-0 1.2 2.5	A-0	0	1.2	2.5	1	3	3	2	3	3	3	2	2	1.9	2	Poor
Ōmaru Stream	6	02-May-07	A-1 2.8 2.5	A-1	1	2.8	2.5	2	0	2	3	4	3	3	3	3	2.7	3	Moderate
Koukourārata Mouth	7	30-May-07	A-1 3.0 2.8	A-1	1	3.0	2.8	2	2	1	3	4	2	4	4	2	2.9	3	Moderate
Ōnuku Stream Mouth	8	17-Apr-07	A-1 2.8 2.9	A-1	1	2.8	2.9	2	2	2	3	3	4	4	3	3	2.9	3	Moderate
Ōkana SH75 Bridge	9	22-May-07	B-1 3.0 2.9	B-1	1	3.0	2.9	2	2	3	2	4	3	3	4	3	3.0	3	Moderate
Waikare/Chamb Ford	10	09-Apr-07	A-1 2.5 2.2	A-1	1	2.5	2.2	1	2	3	2	2	2	3	3	2	2.4	2	Poor
Te Pā o Moki	11	20-Apr-07	A-1 2.8 2.5	A-1	1	2.8	2.5	1	3	2	2	2	3	4	3	3	2.7	3	Moderate
Ōpihi Bridge	12	20-Nov-07	A-1 2.8 3.2	A-1	1	2.8	3.2	2	2	3	4	4	3	4	4	3	3.0	3	Moderate
Waianakarua Mouth	13	12-Jun-07	A-1 2.5 2.2	A-1	1	2.5	2.2	1	2	2	2	2	2	4	3	2	2.4	2	Poor
Māngai Piri/Niagara	14	19-May-07	A-1 2.8 3.8	A-1	1	2.8	3.8	3	4	4	4	4	3	4	4	4	3.3	3	Moderate
Mataura Falls	15	17-May-07	A-1 2.0 2.0	A-1	1	2.0	2	2	1	1	3	1	1	4	3	2	2.0	2	Poor
Tuatapere	16	03-Mar-05	A-0 1.2 2.6	A-0	0	1.2	2.6	2	3	3	3	2	2	3	3	3	1.9	2	Poor
Arahura Pā	17	09-Sep-07	A-1 3.0 3.8	A-1	1	3.0	3.8	2	3	3	4	3	5	5	5	4	3.4	4	Good

Total

2.6

2.8

1.8

2.2

2.5

2.9

2.7

2.9

3.7

3.4

2.9

2.7

Sig
Belc

Belc

Below

Abo

Below

AI

Si
Ab

Si
Al

e Al

Appendix F – SHMAK Assessment Data Set for the Ngā Wai Pounamu Study

SHMAK Scores (Habitat)
Ngā Wai Pounamu Study

Site Name	Site Order	Visit Date	Habitat Score	Habitat Rating	Flow	Flow Score	pH	pH Score	Temp	Temp Score	Cond	Cond Score	Clarity	Clarity Score	Bed Score	Bank Veg	Bed Deposit	Deposit Score	Hab Ave/5
Ōaro Lagoon	1	15-May-07	41.9	Good	0.00	1	6.5	10	12	10	200	10	100	10	-4.5	5.4	Moderate	0	2.3
Hurunui SH1 Bridge*	2	24-Aug-07	19.1	Incomplete	0.00	0	0	0	0	0	0	0	0	0	9	10.1	Moderate	0	1.6
Rakahuri / Ashley*	3	24-Aug-07	16.4	Incomplete	0.00	0	0	0	0	0	0	0	0	0	11	0.4	Fine	5	1.8
Waimakariri Bridge*	4	24-Aug-07	23.4	Incomplete	0.00	0	0	0	0	0	0	0	0	0	6.5	11.9	Fine	5	2.4
Waipapa/Little Hagley	5	16-Mar-07	39.3	Moderate	0.16	6	6.5	10	14.5	10	170	10	100	10	-9	12.3	Thick	-10	2.0
Ōmaru Stream	6	02-May-07	39.7	Moderate	0.25	6	6	5	10.5	10	230	10	70	8	1.5	-0.8	Moderate	0	2.1
Koukourārata Mouth	7	30-May-07	42	Good	0.29	6	7	10	8	8	230	10	73	8	10.5	-10.5	Moderate	0	2.3
Ōnuku Stream Mouth	8	17-Apr-07	33.3	Moderate	0.17	6	7	10	12	10	240	10	100	10	3.5	-11.2	Moderate to thick	-5	2.0
Ōkana SH75 Bridge	9	22-May-07	40.8	Good	0.18	6	7.5	10	12	10	180	10	80	8	14	-12.2	Moderate to thick	-5	2.2
Te Pā o Moki	11	20-Apr-07	45.7	Good	0.33	10	6.5	10	11.5	10	220	10	100	10	-4	-0.3	Moderate	0	2.7
Ōpihi Bridge	12	20-Nov-07	52.3	Good	0.33	10	6.5	10	18	8	60	16	100	10	4.5	-6.2	Moderate	0	2.8
Māngai Piri/Niagara	14	19-May-07	60.7	Very Good	0.67	10	7	10	9	8	160	10	40	3	3	16.7	Moderate	0	2.9
Mataura Falls	15	17-May-07	30	Moderate	1.82	3	9	5	6	8	80	16	82	8	-10	-5	Fine	5	1.8
Arahura Pā*	17	09-Sep-07	19.6	Incomplete	0.00	0	0	0	0	0	0	0	0	0	14	0.6	Fine	5	2.1

36.0

0.3

4.6

5.0

6.4

8.1

6.6

126.4

8.0

60.4

6.1

3.6

0.8

0.0

2.2

*Incomplete record

64.0

90.0

92.0

112.0

85.0

50.0

11.2

0.0

Ave

Score

6.4

9.0

9.2

11.2

8.5

3.6

0.8

0.0

out of 5

3.2
4.5
4.6
2.8
4.3
1.8
0.4
0.0
Flow
pH
Temp
Cond
Clarity
Bed
Vege
Deposits

SHMAK Scores (Invert/Peri/Overall)
Ngā Wai Pounamu Study

Site Name	Site Order	Visit Date	Invert Score	Invert Rating	Peri Score	Peri Rating	Stream Rating	Overall score/5	Ranking	Rating
Ōaro Lagoon	1	15-May-07	0	No Rating	3	Poor to Moderate	Outlier	1.3	2	Poor
Hurunui SH1 Bridge*	2	24-Aug-07	8	Very Good	10	Very Good	Good - Very Good	3.5	4	Good
Rakahuri / Ashley*	3	24-Aug-07	6.8	Good	7	Good	Good - Very Good	2.9	3	Moderate
Waimakariri Bridge*	4	24-Aug-07	8	Very Good	1	Very Poor	Good - Very Good	2.3	3	Moderate
Waipapa/Little Hagley	5	16-Mar-07	7	Good	7	Good	Very Good	3.0	3	Moderate
Ōmaru Stream	6	02-May-07	0	No Rating	0	No Rating	Outlier	2.1	3	Moderate
Koukourārata Mouth	7	30-May-07	7	Good	4	Moderate	Good - Very Good	2.6	3	Moderate
Ōnuku Stream Mouth	8	17-Apr-07	6.2	Good	7	Good	Good	2.9	3	Moderate
Ōkana SH75 Bridge	9	22-May-07	6.3	Good	4	Moderate	Moderate	2.4	3	Moderate
Te Pā o Moki	11	20-Apr-07	6.3	Good	7	Good	Good	3.1	4	Good
Ōpihi Bridge	12	20-Nov-07	7	Good	7.8	Good	Good - Very Good	3.4	4	Good
Māngai Piri/Niagara	14	19-May-07	7.2	Good	6.5	Good	Good - Very Good	3.2	4	Good
Mataura Falls	15	17-May-07	0	No Rating	7	Good	Outlier	1.8	2	Poor
Arahura Pā*	17	09-Sep-07	6.3	Good	8.5	Very Good	Very Good	3.2	4	Good

	5.4	5.7	2.7
*Incomplete record	76.1	79.8	
	6.9	6.1	
	3.5	3.1	
	Inverts	Peri	

Appendix G – E .coli Testing Data Set for the Ngā Wai Pounamu Study

E.coli Results

Ngā Wai Pounamu Study

Site Name	Site Order	Visit Date	Ecoli / 100mls	Anti-biotic Resistance	Ecoli Test Comment	Sulph	Tet	Gent	Amp	Nalacid	Rank Score	Rating
Ōaro Lagoon	1	15-May-07	131	None	-	s	s	s	s	s	3	Moderate
Hurunui SH1 Bridge	2	24-Aug-07	NA	NA	-	-	-	-	-	-	x	Not Assessed
Rakahuri / Ashley	3	24-Aug-07	NA	NA	-	-	-	-	-	-	x	Not Assessed
Waimakariri Bridge	4	24-Aug-07	NA	NA	-	-	-	-	-	-	x	Not Assessed
Waipapa/Little Hagley	5	16-Mar-07	173	No result	-	-	-	-	-	-	3	Moderate
Ōmaru Stream	6	02-May-07	1354	No result	-	-	-	-	-	-	2	Poor
Koukourārata Mouth	7	30-May-07	185	None	-	s	s	s	s	s	3	Moderate
Ōnuku Stream Mouth	8	17-Apr-07	120	Yes	Nal Acid	s	s	s	s	r	2	Poor
Ōkana SH75 Bridge	9	22-May-07	160	None	-	s	s	s	s	s	3	Moderate
Waikare/Chamb Ford	10	09-Apr-07	100	Yes	Ampicillin	s	s	s	r	s	2	Poor
Te Pā o Moki	11	20-Apr-07	108	None	-	s	s	s	s	s	3	Moderate
Ōpihi Bridge	12	20-Nov-07	10	None	-	s	s	s	s	s	4	Good
Waianakarua Mouth	13	12-Jun-07	10	None	-	s	s	s	s	s	4	Good
Māngai Piri/Niagara	14	19-May-07	317	None	-	s	s	s	s	s	2	Poor
Mataura Falls	15	17-May-07	1086	None	-	s	s	s	s	s	2	Poor
Tuatapere	16	03-Mar-05	201	Yes	Ampicillin	s	s	s	r	s	2	Poor
Arahura Pā	17	09-Sep-07	NA	NA	-	-	-	-	-	-	x	Not Assessed

Appendix H – Site Photograph Record for the Ngā Wai Pounamu Study



01a OaroMth



01b OaroMth



01c OaroMth



01d OaroMth



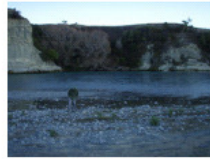
01e OaroMth



02a Hurunui



02b Hurunui



02c Hurunui



02d Hurunui



02e Hurunui



03a Rakahuri



03b Rakahuri



03c Rakahuri



03d Rakahuri



03e Rakahuri



04a Waimakariri



04b Waimakariri



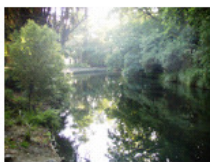
04c Waimakariri



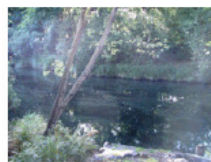
04d Waimakariri



04e Waimakariri



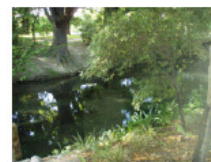
05a Waipapa



05b Waipapa



05c Waipapa



05d Waipapa



05e Waipapa



06a Omaru



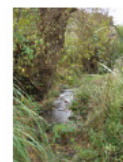
06b Omaru



06c Omaru



06d Omaru



06e Omaru



07a Koukou



07b Koukou



07c Koukou



07d Koukou



07e Koukou



08a Onuku



08b Onuku



08c Onuku



08d Onuku



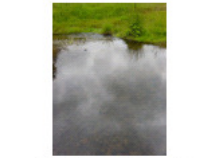
08e Onuku



09a Okana-Riparian



09b Okanadown



09c Okana-Channel



09d Okanaup



09e Okana Plantings



10a Waikare Down



10b Waikare Up



10c WaikirikiriCoalgate



10d WaikirikiriCoalgate



10e WaikirikiriCoalgate



11a Te Pa o Moki



11b Te Pa o Moki



11c Te Pa o Moki



11d Te Pa o Moki



11e Te Pa o Moki



12a Opihi



12b Opihi



12c Opihi



12d Opihi



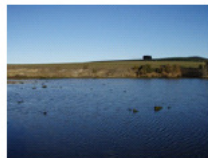
12e Opihi



13a WaianaMth



13b WaianaMth



13c WaianaMth



13d WaianaMth



13e WaianaMth



14a MangaiPiri



14b MangaiPiri



14c MangaiPiri



14d MangaiPiri



14e MangaiPiri



15a Mataura



15b Mataura



15c Mataura



15d Mataura



15e Mataura



15f Mataura



15g Mataura



15h Mataura



15i Mataura



15j Mataura



16a Tuatapere



16b Tuatapere



16c Tuatapere



16d Tuatapere



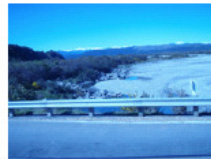
16e Tuatapere



17a Arahura



17b Arahura



17c Arahura



17d Arahura



17e Arahura



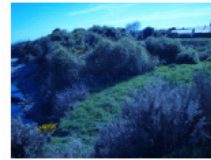
17f Arahura



17g Arahura



17h Arahura



17i Arahura



17j Arahura