# AGENDA

# Waiāri Kaitiaki Advisory Group Meeting

# Wednesday, 10 August 2022

**I hereby give notice that a Waiāri Kaitiaki Advisory Group Meeting will be held on:**

**Date:** **Wednesday, 10 August 2022**

**Time:** **9.30am**

**Location:** **Hei Marae**
**154 Manoeka Road**
**Te Puke**

*Please note that this meeting will be livestreamed and the recording will be publicly available on Tauranga City Council's website: www.tauranga.govt.nz.*

**Marty Grenfell**

**Chief Executive**

# Terms of reference - Waiāri Kaitiaki Advisory Group

## Membership

| | |
|---|---|
| **Co-chairs** | Two members to be appointed as co-chairs.<br>Commissioner Shadrach Rolleston, Co-chair representative of consent holder; and<br>Darlene Dinsdale – Mokopuna o Tia me Hei, Co-chair representative of iwi/hapū |
| **Tauranga City Council representatives (2)** | Commissioner Shadrach Rolleston<br>Commissioner Bill Wasley |
| **Western Bay of Plenty District Council representatives (2)** | Mayor Garry Webber<br>Deputy Mayor John Scrimgeour |
| **Iwi/ hapū representatives (4)** | Jo'el Komene - Tapuika Iwi Authority<br>Maru Tapsell – Te Kapu o Waitaha<br>Darlene Dinsdale - Mokopuna o Tia me Hei<br>Manu Pene - Ngāti Whakaue ki Maketu (Te Hononga) |
| **Iwi/hapū representatives (alternates)** | Tapuika Iwi Authority<br>Te Kapu o Waitaha<br>Mokopuna o Tia me Hei<br>Ngāti Whakaue ki Maketu (Te Hononga) |
| **Bay of Plenty Regional Council representative (non-voting)** | Consents Manager |
| **Quorum** | Two representatives from the consent holders and two representatives from iwi/hapu, including one of the Co-chairs. However, where a major decision is required, the quorum will be one representative from each entity.<br><br>The Bay of Plenty Regional Council representative is not counted towards quorum. |
| **Decision making** | By consensus where possible. If consensus cannot be reached, by majority vote.<br>If there is an equal number of votes, the Co-chair who is chairing the meeting has a casting vote. |
| **Meeting frequency** | Four times a year or as required by the group. Meetings to alternate between week and weekend days if possible. |
| **Meeting venue** | To alternate between marae and council venues; or as appropriate to a meeting agenda and agreed by the Co-chairs. |

## Advisory staff

| | |
|---|---|
| **Tauranga City Council** | Chief Executive<br>General Manager: Infrastructure<br>Director: City Waters<br>Manager: Water Services<br>Manager: Water Infrastructure Outcomes<br>Manager: Strategic Māori Engagement |
| **Western Bay of Plenty District Council** | Chief Executive<br>Group Manager: Engineering<br>Utilities Manager |
| **Bay of Plenty Regional Council** | Compliance Officer with responsibility for Resource Consent #65637 |

## Ko te wai te ora o ngā mea katoa

## Background

- The Waiāri Kaitiaki Advisory Group (WKAG) was established by consent conditions to provide advice to Tauranga City Council (TCC) and Western Bay of Plenty District Council (WBOPDC) as the joint consent holders in relation to matters covered under Resource Consent #65637, which authorises the take and use of water from the Waiāri Stream for municipal supply.
- Resource Consent #65637 was granted in 2010; since then there has been significant consolidation of iwi interests in the region.
- Te Kapu o Waitaha (2013) and Tapuika Iwi Authority (2014) have signed historic Treaty Settlements and Te Runanga o Ngāti Whakaue ki Maketu (Te Hononga) are still in negotiations.
- Tauranga City Council has active protocol agreements with Waitaha, Tapuika and Ngāti Whakaue ki Maketu including addendums that set out items and areas of significance to each entity.
- The treaty settlements, protocols, addendums and any subsequent plans submitted by Waitaha, Tapuika and Ngāti Whakaue ki Maketu shall be considered as background and context to the operations of the WKAG.
- Te Maru o Kaituna River Authority was established by the Tapuika Claims Settlement Act 2014 for the purpose of restoration, protection and enhancement of the environmental, cultural and spiritual health and wellbeing of the geographical area of the Kaituna River Catchment. It is a permanent joint committee under the Local Government Act 2002 and co-governance partnership between local authorities and iwi that share an interest in the Kaituna River. Recommendations will be made to Te Maru o Kaituna River Authority where required.

## Role

- To exercise kaitiakitanga in relation to the Waiāri Stream to restore, protect and enhance the awa.
- To provide advice and recommendations to Tauranga City Council and Western Bay of Plenty District Council, as the joint consent holders, in relation to matters covered under Resource Consent #65637 which authorises the taking of water from the Waiāri Stream for municipal supply.

## Scope

- Provide advice and recommendations to the consent holders relating to projects, action or research designed to restore, protect or enhance the health and well-being of the Waiāri Stream.
- Consider the monitoring requirements and outcomes under conditions 7.1 and 7.2 of the consent. Discuss the results of other monitoring undertaken by the group, which may include monitoring the adverse effects on environmental, heritage, cultural, economic and recreational aspects.
- Determine the actions to be taken in response to monitoring reports and make recommendations to the consent holders as appropriate.
- Provide advice and make recommendations to the consent holders and the Bay of Plenty Regional Council in relation to Part 2 and, in particular, to sections 6(e) and 7(a) of the Resource Management Act 1991, as they relate to this consent.
- Inform the Bay of Plenty Regional Council of the effects of the water take authorised under the consent on the mauri and mauriora of the Waiāri Stream.
- Review and provide feedback to Tauranga City Council and Western Bay of Plenty District Council on the Water Conservation Strategy required to be submitted as a condition of the consent.
- Discuss any other relevant matters that may be agreed by the group.
- Work together with the Kaitiaki Group established under Resource Consent RM16-0204-DC.04; which authorises the Western Bay of Plenty District Council to discharge treated wastewater from the Te Puke Wastewater Treatment Plant to the Waiāri Stream.
- Provide advice and recommendations to the consent holders on the future governance model of the Waiāri Stream.
- Provide recommendations to Te Maru o Kaituna River Authority where required.

## Reporting

- The Waiāri Kaitiaki Advisory Group will report to its member entities key discussion points, outcomes and actions following each formal meeting of the Advisory Group.

## Co-chair selection process

- Co-chairs will be appointed every three years in alignment with the local government election cycle. The appointments will take place as soon as is reasonably practical following local government elections.
- The Co-chair representing the consent holder will be appointed by the Tauranga City Council and Western Bay District Councils.
- The Co-chair representing iwi/hapū will be appointed by the iwi/hapū representatives.

*NB:* *Resource consent condition 10.2 defines the membership of the Waiāri Kaitiaki Advisory Group.*

*Resource consent condition 10.7 notes that the Waiāri Kaitiaki Advisory Group shall cease if all members of the group agree the group is to be disbanded. In such case Tauranga City Council and Western Bay of Plenty District Council (as consent holders)[1] shall give written notice of this to the Chief Executive of the Bay of Plenty Regional Council.*

*Advice notes from Resource Consent #65637 include*:

[1] Insertion made for clarity

*(10) The Kaitiaki Advisory Group may make recommendations to the Regional Council to review conditions of this consent in accordance with condition 11 and s128 of the Resource Management Act 1991.*

*For the avoidance of doubt, the Advisory Group is informal in nature and is NOT established as a committee, subcommittee or other subordinate decision-making bodies of Council under clause 30(1) of Schedule 7 of the Local Government Act 2002 and does not have any delegated decision-making powers.*

# Order of Business

## 1 OPENING KARAKIA

## 2 APOLOGIES

## 3 PUBLIC FORUM

## 4 ACCEPTANCE OF LATE ITEMS

## 5 CONFIDENTIAL BUSINESS TO BE TRANSFERRED INTO THE OPEN

## 6 CHANGE TO ORDER OF BUSINESS

# 7 CONFIRMATION OF MINUTES

## 7.1 Minutes of the Waiāri Kaitiaki Advisory Group meeting held on 18 May 2022

**File Number:** **A13730237**

**Author:** **Robyn Garrett, Team Leader: Committee Support**

**Authoriser:** **Robyn Garrett, Team Leader: Committee Support**

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## RECOMMENDATIONS

That the Minutes of the Waiāri Kaitiaki Advisory Group meeting held on 18 May 2022 be confirmed as a true and correct record.

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## ATTACHMENTS

**1. Minutes of the Waiāri Kaitiaki Advisory Group meeting held on 18 May 2022**

# MINUTES

## Waiāri Kaitiaki Advisory Group Meeting

## Wednesday, 18 May 2022

## Order of Business

**MINUTES OF TAURANGA CITY COUNCIL**

**WAIĀRI KAITIAKI ADVISORY GROUP MEETING**
**HELD AT THE MEETING ROOM 1, GROUND FLOOR, 306 CAMERON ROAD, TAURANGA**
**ON WEDNESDAY, 18 MAY 2022 AT 9.30AM**

**PRESENT:** Ms Darlene Dinsdale, Commissioner Shadrach Rolleston, Commissioner Bill Wasley, Mayor Garry Webber, Deputy Mayor John Scrimgeour, Mr Jo'el Komene

**IN ATTENDANCE:** Mr Mokoera Te Amo, Cr Grant Dally (Western Bay of Plenty District Council), EJ Wentzel (Utilities Operations Manager, Western Bay of Plenty District Council), Reuben Fraser (Consent Manager, Bay of Plenty Regional Council), Reuben Gardiner (Senior Planner Water Policy, Bay of Plenty Regional Council), Carlo Ellis (Manager: Strategic Māori Engagement), Richard Conning (Senior Project Manager), Kelvin Hill (Manager: Water Infrastructure Outcomes), Peter Bahrs (Manager: Water Services), Sam Hema (Tangata Whenua Liaison), Keren Paekau (Team Leader: Takawaenga Māori), Jennifer Pearson (Community Engagement Advisor: Infrastructure Delivery), Rodney Clark (Tauranga City Council Water Treatment Manager), Robyn Garrett (Team Leader: Committee Support), Sarah Drummond (Committee Advisor)

**External:** Ryan Orr (GHD, Regional Lead Waikato/Bay of Plenty)

## 1 OPENING KARAKIA

Mr Mokoera Te Amo opened the meeting with a karakia.

## 2 APOLOGIES

### APOLOGY

### COMMITTEE RESOLUTION WA2/22/1

Moved: Commissioner Shadrach Rolleston
Seconded: Mayor Garry Webber

That the apologies for absence received from Mr Manu Pene and Mr Maru Tapsell be accepted.

**CARRIED**

## 3 PUBLIC FORUM

Nil

## 4 ACCEPTANCE OF LATE ITEMS

Nil

## 5 CONFIDENTIAL BUSINESS TO BE TRANSFERRED INTO THE OPEN

Nil

## 6 CHANGE TO ORDER OF BUSINESS

The meeting agreed to take Agenda Item 10.1 before Agenda Item 9.1 due to staff commitments.

## 7 CONFIRMATION OF MINUTES

### 7.1 Minutes of the Waiāri Kaitiaki Advisory Group meeting held on 30 March 2022

**RECOMMENDATIONS**

That the minutes of the Waiāri Kaitiaki Advisory Group meeting held on 30 March 2022 be confirmed as a true and correct record.

With the amendment (page 17) that the Tangata Whenua report was not taken as read as there had not been enough time for the report to be considered properly.

## 8 DECLARATION OF CONFLICTS OF INTEREST

Ms Darlene Dinsdale noted her employment by Tauranga City Council on contract for three waters engagement and would declare any conflict of interest that arose with any agenda item.

## 9 DEPUTATIONS, PRESENTATIONS, PETITIONS

Agenda Item 9.1 was taken later in the meeting.

## 10 BUSINESS

### 10.1 Project Update

**Staff** Richard Conning, Senior Project Manager: Waters

**External** Ryan Orr, GHD – Regional Lead, Waikato/Bay of Plenty

**Key points**

- Feedback from Ngati Whakaue and Waitaha that both iwi supported Tapuika. Water supply would move ahead with Tapuika marae and then extend to other iwi/marae as capacity developed.
- Shortlist how to address needs and aspirations of tangata whenua; this would help decisions around projects for implementation.
- Would like to have a Tapuika representative as part of the team rather than as a stakeholder to be consulted.
- Budget quantum would be refined as projects for implementation were defined; this would be included as part of the Waiāri project budget. Clarification was sought regarding a Western Bay of Plenty District Council (WBOPDC) contribution.

**In response to questions**

Water Supply Roadmap report

- It was suggested that this report be left to lie on the table at this stage, to allow more time for discussions within and between the joint consent holders and Tapuika.
- The staff report was requested by resolution to report back on options of supplying Waiāri water to Tapuika marae and associated papakainga, including costs and options; this road map report was to provide a plan to move forward to meet the resolution requirements in terms of marae water supply.

Points raised in discussion of the report included:

- Clarification was needed in terms of providing a separate supply from Waiāri to marae, there could be implications in terms of direction and associated costs. Insufficient information on costs of a separate supply from Waiāri to each marae.
- Most marae were already connected to Western Bay water supply; clarification was required around what the project was trying to provide. The resolution was specifically in terms of supply of Waiāri water.
- Noted that water flows were dropping and had been for a sustained period of time.
- Western Bay of Plenty District Council had 25% of the Waiāri take under the resource consent which was not being utilised; this allocation could be given to Tapuika to provide for whanau, marae and future growth and development opportunities and to enable exercise of kaitiakitanga.
- Questioned whether drawing water from the wider Waiāri catchment equated to accessing water supply from the Waiāri scheme.
- WBOPDC was already in discussion with marae about water supply and had made the water connections; the conversation about drinking water/wastewater/stormwater should be left between WBOPDC and the marae.
- Concerns should be addressed between WBOPDC and Tapuika Iwi Authority.

Project report

- Noted the downward trend in stream flow illustrated in the graph on pg. 37. Questioned what would happen if the minimum flow level for water take in the consent was reached. If current trends continued, flow could be below 1000 cumecs within two years.
- The same issue was facing other existing source water streams as well. TCC was working on a city-wide water conservation scheme; modelling indicated recovery time was over a year dependent on rainfall. There had been three years of significantly lower rainfall, 30% lower than average. As warning levels were approached, more stringent water conservation measures would be implemented. The trend was levelling out in the other two water source streams but had not seen any stabilisation with the Waiāri. TCC was having fortnightly meetings with Tapuika.
- If minimum flow point was reached, TCC would engage with Tapuika and BOPRC, and the water take would be reduced; however, would be trying to put plans in place before that point was reached so the requirements of city water supply would still be met.
- The consent holders must comply with the resource consent conditions – if the minimum trigger point was reached then the pumps would be turned off.
- Was absolutely urgent that the stream flow decreases were addressed.
- Flow rates were already at an alarming level without provision for any further planned growth and infrastructure.

**COMMITTEE RESOLUTION WA2/22/2**

Moved: Commissioner Bill Wasley
Seconded: Deputy Mayor John Scrimgeour

That the Waiāri Kaitiaki Advisory Group:

(a) Receives the Waiāri Water Supply Scheme: Project Update report; and

(b) Leaves the Water Supply Road Map Report to lie on the table until the next Waiāri Kaitiaki Advisory Group meeting, to enable discussions with Tauranga City Council Commissioners and the joint consent holders.

**CARRIED**

## 11 DEPUTATIONS, PRESENTATIONS, PETITIONS

### 9.1 Bay of Plenty Regional Council - Implementation of the National Policy Statement for Freshwater Management (NPS:FM)

**External** Reuben Gardiner, Senior Planner Water Policy, Bay of Plenty Regional Council

Powerpoint presentation

**Key points**

- The National Policy Statement for Freshwater Management 2020 (NPSFM) required the Bay of Plenty Regional Council to implement its provisions, the Te Mana o te Wai framework and the National Objectives Framework at a regional level through a Regional Policy Statement (RPS), and to engage with tangata whenua in the development of the RPS and the planning documents included in the RPS.
- Other parties, non-Māori, needed to understand Te Mana o te Wai. Te Mana o te Wai was to be applied through every step of the National Objectives Framework.
- Te Hononga: Regional Māori Engagement Plan for Implementing the NPSFM (2020) was being developed by the BOPRC to build relationships with Māori and to enable direct involvement in the implementation of the NPSFM 2020. Tangata whenua would be able to participate in and co-design key decision papers. Recognised that no iwi had the capacity to participate as fully as required or as was possible for a council; Te Hononga included resourcing for iwi participation. Expectations on how BOPRC engaged with iwi were different now, there were a range of options available for engagement across the region.
- Worked with Rotorua Lakes Council and directly affected hapū and iwi around municipal takes and what was an acceptable cultural flow. This needed to be catchment-based.
- Provided overview of timeframes for development of implementation of the NPSFM and regional plan change. Final decisions would be made by the National Freshwater Commissioner.

**Discussion points raised**

- Very important piece of work to refocus priorities and embed mātauranga Māori concepts. Economic development had previously been the main driver. Resetting the framework was critical as were the discussions around Three Waters Reform.
- Need to be looking at impact on the waterways as the first step under Three Waters Reform; consideration of the health and wellbeing of the water bodies must be the first priority.

**COMMITTEE RESOLUTION WA2/22/3**

Moved: Mayor Garry Webber
Seconded: Mr Jo'el Komene

That the Waiāri Kaitiaki Advisory Group:

(a) Receives the Bay of Plenty Regional Council - Implementation of the National Policy Statement for Freshwater Management (NPS:FM) presentation.

**CARRIED**

## 12 BUSINESS

Item - 10.1 Project Update - has been moved to another part of the document.

## 13 DISCUSSION OF LATE ITEMS

Ms Darlene Dinsdale noted the succession planning for Mokopuna Tia me Hei. Mr Hanita Dinsdale was formally named as alternate for Ms Dinsdale and would be attending meetings from now on when possible.

## 14 CLOSING KARAKIA

Mr Mokoera Te Amo closed the meeting with a karakia.

**The meeting closed at 11.05am.**

**The minutes of this meeting were confirmed as a true and correct record at the Waiāri Kaitiaki Advisory Group Meeting held on 10 August 2022.**

.....

**CHAIRPERSON**

## 8 DECLARATION OF CONFLICTS OF INTEREST

## 9 DEPUTATIONS, PRESENTATIONS, PETITIONS

### 9.1 Presentation - NIWA - flow monitoring

## ATTACHMENTS

**Nil**

# 10 BUSINESS

## 10.1 Project Report

**File Number:** **A13668383**

**Author:** **Richard Conning, Senior Project Manager**

**Authoriser:** **Nic Johansson, General Manager: Infrastructure**

## PURPOSE OF THE REPORT

1. To provide a project update.

## RECOMMENDATIONS

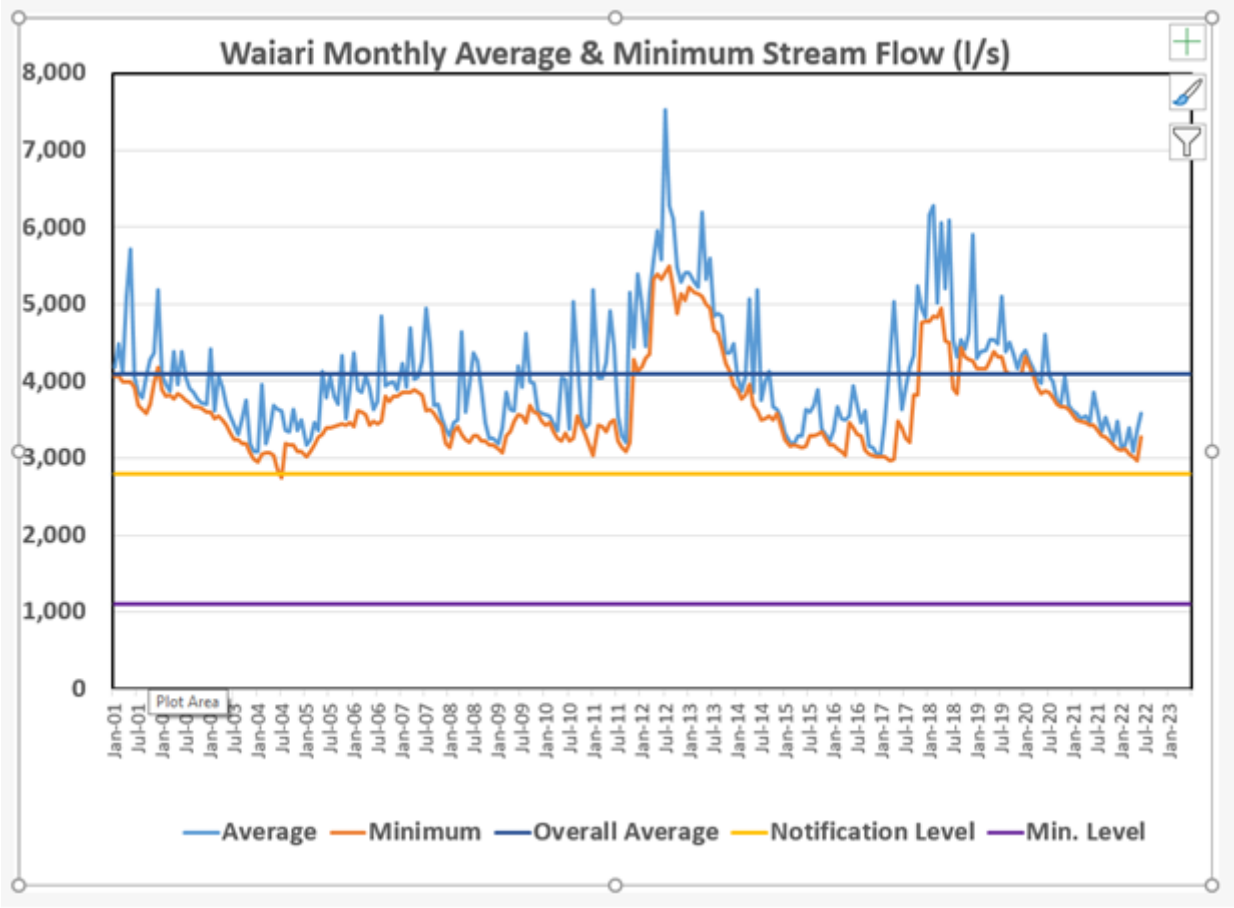
That the Waiāri Kaitiaki Advisory Group:

(a) Receives the Waiāri Water Supply Scheme: Project Update report.

## WAIĀRI STREAM FLOW DATA

2. The Waiāri stream flows, as provided by NIWA, are shown in the graph below for the period January 2001 to June 2022. The maximum flows have been omitted from the graph to allow better definition of the monthly average and minimum flows.

3. The flows have been adjusted by NIWA following revised stream gauging undertaken by NIWA in May 2022. This has resulted in flows being above the notification level. NIWA will provide information on how they undertake stream gauging and flow monitoring, to the Waiāri Kaitiaki Advisory Group on 10 August 2022.



## BACKGROUND

4. The Waiāri Water Supply Scheme provides for the treatment and reticulation (pipeline construction) of up to 60,000m3 fresh water for the growing Western Bay of Plenty. The project has approximately 9 months until completion. The resource consent for the water take is shared between Tauranga City Council (75%) and WBOPDC (25%).

5. The physical works to complete the scheme is being delivered via six different construction contracts being three pipeline contracts, a filtration membrane contract, an intake and pump station contract and a treatment plant construction contract.

6. There are several other professional services contracts that form part of the scheme delivery including design and consenting, cost management, construction observation and software development.

## ECOLOGICAL MONITORING

7. The annual ecological monitoring on the Waiāri was undertaken over the 1st and 2nd of March, the findings report is provided as Attachment 1. Keren Bennett from 4Sight Consulting will provide a presentation on the findings and answer questions in relation to the findings.

## CULTURAL RECOGNITION

8. Effort in relation to the cultural recognition initiative have primarily centred around working with WBOPDC staff to understand what if any support they can provide. They have committed to having wananga with the tangata whenua reps and TCC to work through the priorities and attend monthly meetings. Once the WBOPDC position is clarified, engagement with the tangata whenua representatives can proceed to develop a detailed plan of activities.

## COMMUNITY ENAGEMENT UPDATES

9. The communication and engagement team have been actively keeping the community and stakeholders informed of progress and planned works that may affect them.

10. Works on No 1 Road will take place in the near future to widen the road near the plant entrance, just past Trevelyans, to make entry and exit safer. This will require some traffic management and stop/go with only one lane open during the works.

11. The Commissioners and some staff recently toured the intake and plant site. It was good to see the planting completed last year growing well. We look forward to taking a tour with mana whenua in the near future.

## CONSTRUCTION PROJECT UPDATES

### Consent Compliance: Physical works

12. We have had an independent compliance auditor engaged since the commencement of works to ensure all sites maintain compliance with the resource consent conditions for physical works. Where issues or concerns are identified, they are notified to the contractor, MSQA team and TCC project manager for action. No compliance issues have been identified this reporting period.

13. BOPRC undertake regular compliance checks across all the work sites. To date no non-compliance notices have been issued.

### Intake and Pump Station contract

14. The intake pump station is complete and the commissioning process has commenced. The commencement of the water take has been notified to BOPRC as part of the commissioning process.

15. The planting of the intake and pump station area has been completed and will be maintained by the contractor for two years.

**Water Treatment Plant contract**

16. The majority of the structural works on the water treatment plant building have been completed. Mechanical, electrical and membrane installations are underway and are the primary focus of the team. The treated water reservoir is approximately 95% complete and the water treatment plant is approximately 85% complete.

17. The global supply chain challenges are continuing to have a negative effect on the contractor's ability to complete the works.

**Commissioning and testing**

18. Once the construction contracts are complete there will be a period of commissioning and testing before potable water can be delivered to the community. Commissioning of the water treatment plant is scheduled to commence in mid-August 2022 and is scheduled to be complete by the end of October 2022. It is expected that potable water will be delivered to the community from December 2022.

**Budget**

19. The scheme out turn cost estimate is within the current approved budget.

## ATTACHMENTS

**1. Waiari Stream Biological Monitoring Report 2022 - A13602098** ⇩


# WAIĀRI WATER TREATMENT PLANT: WAIĀRI STREAM MONITORING REPORT 2022

For Tauranga City Council
3Waters

June 2022

**REPORT INFORMATION AND QUALITY CONTROL**

| | |
|---|---|
| **Prepared for:** | 3Waters<br>Tauranga City Council |

| | | |
|---|---|---|
| **Author:** | Keren Bennett<br>Technical Director (Freshwater Ecology) |  |
| **Reviewer:** | Katrina Browne<br>Principal Environmental Management Consultant |  |
| **Approved for Release:** | Keren Bennett<br>Technical Director (Freshwater Ecology) |  |

| | |
|---|---|
| **Document Name** | R_11623_Waiari Stm Biological Monitoring_2022 |

| | | |
|---|---|---|
| **Version History:** | V1 | 17 June 2022 |
| | V2 | 22 June 2022 |

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# 1 INTRODUCTION

Tauranga City Council (TCC) holds resource consent (No. 65637) to take water for municipal supply from the Waiāri Stream, near Te Puke. Conditions 7.1 and 7.2 of the water take consent require biological monitoring to be undertaken over the life of the consent, namely:

- *Three consecutive years prior to construction of the water supply scheme commencing;*
- *Three consecutive years after abstraction reaches a rate greater than 30,000 cubic metres per day;*
- *Once every five years thereafter and between the two survey periods specified above if there is more than 5 years between them for the duration of this consent.*

Specifically, quantitative monitoring of macroinvertebrate communities, fish surveys, macrophyte monitoring and basic water quality monitoring are required.

Conditions 7.1 and 7.2 are further summarised as follows:

*Surveys are to be carried out in February of each year of survey, at four locations along the Waiari Stream;*

- *above and below the water intake site and;*
- *above and below the Te Puke wastewater treatment plant discharge point.*

*Macroinvertebrate samples are to be collected using quantitative protocols, with macrophytes sampled at all four sites and hard-bottomed samples collected from two sites around the proposed intake site.*

*Fish surveys are to be undertaken using single-pass electric-fishing and baited G-minnow traps at all sites.*

*Water quality (temperature, pH, turbidity and dissolved oxygen) are to be recorded at each site.*

Monitoring was initially carried out for three seasons between 2010 - 2012 (Bioresearches, 2010; 2011; 2012); however, commissioning of the water intake project was then put on hold because of reduced demand (Bioresearches, 2012). The project was subsequently rescheduled and, as an additional five years had passed since the 2012 baseline survey, a repeat of the biological monitoring survey was undertaken in 2017 (4Sight, 2017).

Subsequently, construction of the water intake infrastructure and associated instream works commenced in 2018 and is ongoing. 4Sight was commissioned to undertake an additional biological survey in 2019 and annually thereafter (4Sight, 2019; 2020; 2021), prior to the water take commencing. Construction works were underway at the time of the 2019 survey and were ongoing during the 2021 survey. Plant construction was ongoing during the 2022 survey, although all instream and near stream works had been completed. The 2019 through 2021 surveys are additional to the consented requirements and are intended to provide a broader picture of the Waiāri Stream biological features prior to water abstraction commencing. This 2022 survey comprises a second five year survey in line with the requirements of the resource consent.

This report presents the results from the survey of four sites in the Waiāri Stream undertaken over 1 and 2 March 2022.

# 2 SURVEY METHODS

## 2.1 Site locations

Four stream sites were sampled, with the locations at three sites based on those assessed in the 2010 – 2017 surveys (Table 1 & Figure 1). For the 2019 and 2020 surveys infrastructure construction works were underway in the vicinity of the water treatment plant (WTP) intake location and the original Site 2 was not accessible at the time of survey. As such, Site 2 was relocated (Site 2a) to an accessible location approximately 650 metres downstream of the original site. Limitations to safe access and available habitats for survey at Site 2a prompted a review of the downstream 'Site 2' location prior to the 2021 survey. Given the now accessible stream banks below the intake, Site 2 was relocated in 2021 back upstream (Site 2b), closer to the original Site 2 location.

Access to the sites above and below the WTP intake was obtained via the construction accessway and temporary bridge crossing from 244 Te Mātai Road, Te Puke.

Sites 1 and 2b were located upstream and downstream, respectively, of the proposed water intake site. Sites 3 and 4 were located upstream and downstream, respectively, of the Te Puke wastewater treatment plant (WWTP) outfall, in the lower reaches of the stream (Figure 1). Sites were marked by GPS and photographed, so that they could be relocated for future surveys (see Table 1).

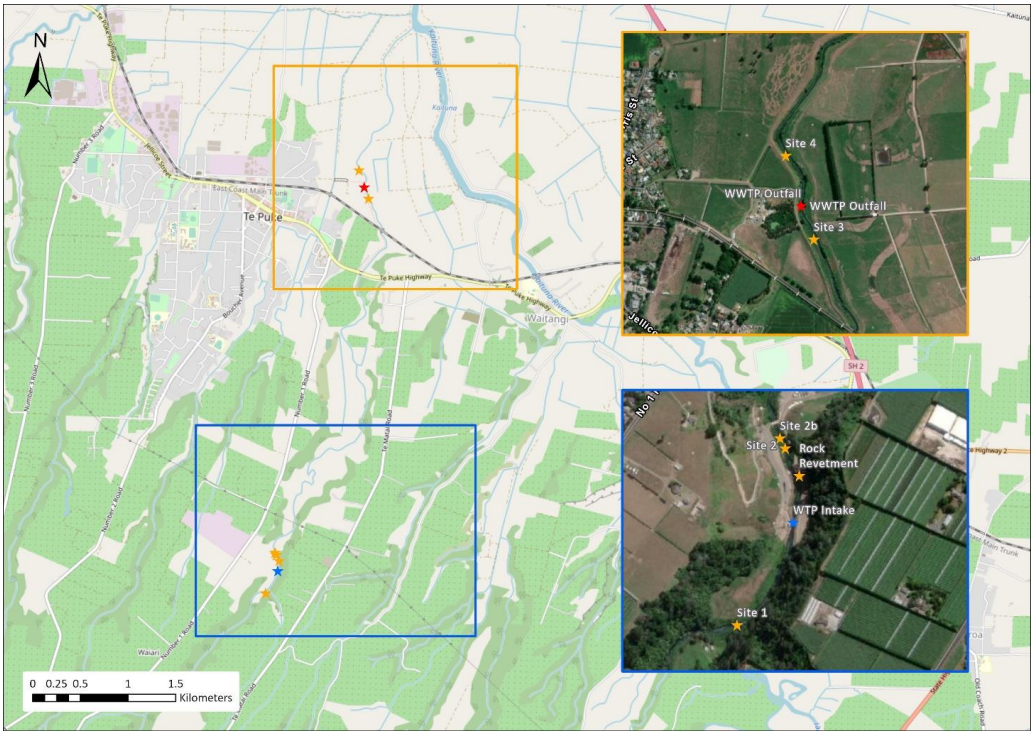


Figure 1: Overview of biological monitoring site locations

Table 1: Site locations and GPS positions

| Site | Site Description | NZGD (1949) | | NZTM (NZGD, 2000) | |
|---|---|---|---|---|---|
| | | Longitude | Latitude | Easting | Northing |
| 1 | Upstream of WTP intake | 176 19 43.38523 E | 37 49 20.58761 S | 1893023 | 5808866 |
| 2b | Downstream of WTP intake (relocated from original Site 2). | 176 19 47.29714 E | 37 49 08.47654 S | 1893132 | 5809236 |
| 3 | Upstream of WWTP outfall | 176 20 21.29839 E | 37 47 05.72566 S | 1894099 | 5812991 |
| 4 | Downstream of WWTP outfall | 176 20 17.69774 E | 37 46 57.46000 S | 1894020 | 5813249 |

## 2.2 Stream flows and rainfall

Rainfall data was obtained for the two months prior to survey, via the Bay of Plenty Regional Council (BOPRC) telemetry data website. Rainfall monitoring is not undertaken within the Waiāri Stream catchment so the 'Waimapu at Glue Pot Rd' monitoring site was chosen to indicate likely rainfall in the surrounding catchment that may influence flows in the Waiāri Stream in the proximity of the water intake point.

Flow data on the Waiāri Stream is collected by NIWA at five-minute intervals via an automated flow meter located at the old Western Bay of Plenty District Council intake, located above the intake site on the Waiāri Stream. Quality checked flow data for the Waiāri Stream for the two month period prior to survey was obtained, to demonstrate the range of flows experienced in the lead-up to the survey.

## 2.3 Biological monitoring

### 2.3.1 Macroinvertebrate monitoring

Macroinvertebrate samples were collected from each of the four sites. The resource consent condition specifies that:

> *Invertebrate samples shall be collected using Protocols C3: Hard-bottomed Quantitative and C4: Soft-bottomed Quantitative of the Ministry for the Environment's "Protocols for Sampling Macroinvertebrates in Wadeable Streams". Hard substrates will be sampled above and below the intake and macrophytes will be sampled at four locations.*

Consistent with the previous monitoring, there was insufficient aquatic plant growth at the upstream sites (Sites 1 and 2b) for macrophytes to be sampled (Bioresearches, 2010, 2011, 2012 and 4Sight 2017, 2019, 2020; 2021). Additionally, areas of cobble and boulder habitat were generally absent, or restricted to the deeper, or faster flowing sections of the stream, with soft sandy substrates dominating the wadeable areas. For practical and safety reasons this precluded the use of either Protocol C3 or C4 (Stark *et al*. 2001), specified in the conditions of consent. Within the shallower, and safely accessible sections of stream, woody debris constituted the largest form of stable habitat and is the recommended alternative sampling habitat in the Ministry for the Environment protocols (Stark *et al*. 2001) when macrophytes are absent from soft-bottomed stream habitats. Therefore, macroinvertebrate samples were collected from the woody debris at the two sites. Four replicate macroinvertebrate samples were collected from wood from both sites.

At each site, the samples were collected by placing a D-net (aperture 400 mm, mesh 0.5 mm) downstream of a section of wood and gently scrubbing the wood with a soft nylon brush to dislodge any invertebrates, allowing the water current to carry individuals into the net. Macroinvertebrates from a total estimated surface area of 1 m² were collected

for each sample before being transferred into a plastic storage container and preserved using 70% - 80% isopropyl alcohol.

At downstream sites (Sites 3 and 4), above and below the WWTP outlet, macrophytes were sampled using methodology from macroinvertebrate sampling Protocol C4: Soft-bottomed Quantitative (Stark *et al*. 2001). Four replicate samples were collected at each site, constituting the submerged tips of macrophytes (sampled macrophytes consisted entirely of the oxygen weed, *Elodea canadensis*). For each replicate sample, approximately 1.0 – 1.5 L of weed was collected in front of the D-net. The weed was transferred to a lidded bucket containing approximately 1.0 L of stream water. The bucket was shaken vigorously twenty times to dislodge individuals and the water contents poured through a 0.5 mm sieve. This shaking process was carried out a further two times for each sample before the contents of the sieve were transferred to a plastic storage container and preserved with isopropyl alcohol. Macrophytes were retained, transferred to a plastic bag, chilled and returned to the laboratory to be dried at 70°C for 24 hours before weighing.

Preserved macroinvertebrate samples were returned to the laboratory and sorted. Macroinvertebrates were identified to the lowest practicable taxonomic level by an experienced taxonomist (B. Stansfield, EIA Limited) and counted utilising sample processing Protocol P3 (Stark *et al*. 2001). Biotic indices were calculated to assess the ecological condition of the community including taxa richness, %EPT, which is the proportional abundance of three generally pollution-sensitive orders of insect recorded from each sample (Ephemeroptera or mayflies; Plecoptera or stoneflies; Trichoptera or caddisflies), the Macroinvertebrate Community Index (MCI) calculated from each site and, as quantitative protocols were used on site, the Quantitative MCI (QMCI). The MCI and QMCI are based on the average pollution sensitivity scores for individual taxa recorded (Stark, 1998). The soft-bottomed MCI variants (MCI-sb and QMCI-sb) were calculated (Stark and Maxted, 2007a). Scores of >120 and >6.0 (for MCI/MCI-sb and QMCI/QMCI-sb, respectively) are indicative of clean water or 'excellent' habitat quality, 100 – 120 and 5.0 – 6.0 are indicative of 'good' quality or mild organic pollution, 80 – 100 or 4.0 – 5.0 are indicative of 'fair' quality or probable moderate pollution, and scores <80 and <4.0 are indicative of 'poor' quality or probable severe pollution (Stark, 1998; Table 2). Raw macroinvertebrate results are presented in Appendix A.

Table 2: Summary of MCI and QMCI values

| Quality | Descriptors | MCI or MCI-sb | QMCI or QMCI-sb |
|---|---|---|---|
| Excellent | Clean water | > 120 | > 6 |
| Good | Doubtful quality/possible mild pollution | 100 - 120 | 5 – 6 |
| Fair | Probable moderate pollution | 80- 100 | 4 – 5 |
| Poor | Probable severe pollution | < 80 | < 4 |

#### 2.3.2 Macroinvertebrate data analysis

Statistical analysis and trend analysis of all eight years of data was undertaken to inform comparison between sites.

All data were first checked, grouped by ecological index and sampling location, whether they were normally distributed using visual observation in a Q–Q plot and statistically using a Shapiro-Wilk Normality Test. Data within each group were generally normally distributed and there were about 32 data points per group so parametric methods were used (e.g., ANOVA).

Data from each site within each group were analysed for trends using Kendall's nonparametric test for a monotonic trend (with continuity correction) from 2010 to 2022.

#### 2.3.3 Macrophyte monitoring

Macrophyte species composition was recorded from visual assessments of macrophyte cover at each site. Five replicate cross stream transects, at 10 m intervals, were used to identify macrophyte species present at each site and visually estimate the percentage of cover for each identified macrophyte species.

Water depth and/or swift stream flows prevented in-stream transects from being safely undertaken.

#### 2.3.4 Fish surveys

To sample fish communities three unbaited fyke nets and five marmite baited Gee minnow traps were deployed at each site. Water depth, soft sediments and swift stream flow conditions prevented the possibility of effective electric fishing at all sites.

All fish captured were identified, counted and their size estimated before being returned to their habitats. A Quantile Index of Biotic Integrity (QIBI) was calculated for each site based on fish species present, altitude and distance inland (Joy and Henderson, 2007; Surin 2016).

#### 2.3.5 Water Quality Monitoring

Water temperature, dissolved oxygen levels, conductivity, pH and turbidity were measured at each site on two occasions using a pre-calibrated hand-held water quality meter (model YSI ProPlus). Measurements were made at each site at the commencement of field surveys on 1 and 2 March.

# 3 RESULTS

## 3.1 Stream flows and rainfall

Small rainfall events occurred on occasion throughout January and early February (Figure 2; Figure 3). The largest of these rain events occurred three weeks before the survey, with 66mm of rain recorded on 6 and 7 February at the Waimapu gauging sites (Figure 2).

Flows in the Waiāri Stream were relatively stable over the period leading up to the 2022 field surveys, with an average flow rate of 3,148 l/s (3.148 $m^3$/s) at the NIWA recording station (above Site 1; Figure 2). Elevations in flow due to rain events were evident in the leadup to the surveys, with the largest rain event in early February resulting in a maximum flow rate of 4,177 l/s on 7 February. Data indicates that stream flows had returned to base levels for the two weeks preceding the surveys.

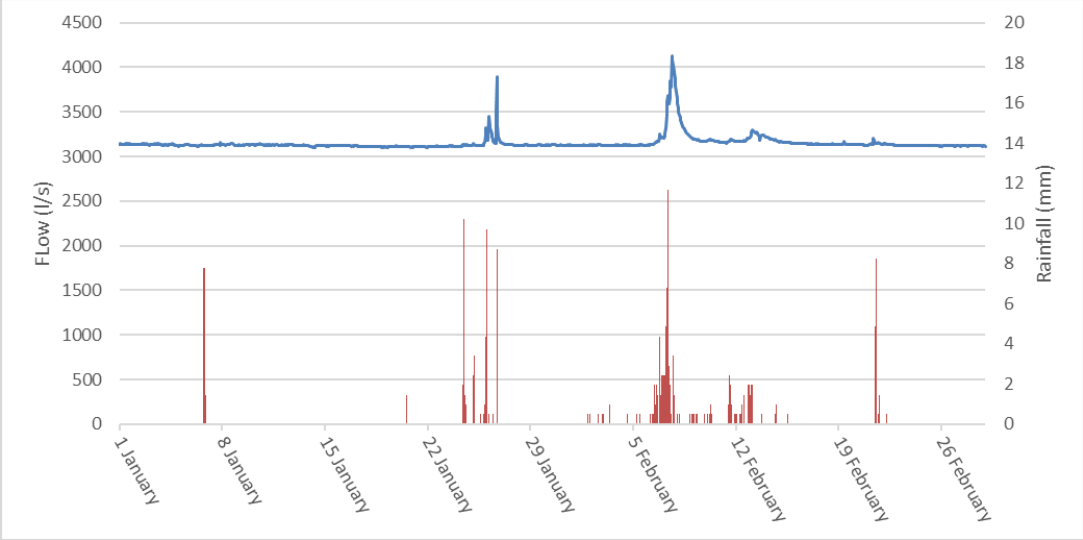


Figure 2: Waiāri Stream flow data (hourly averages) for the two-month period leading up to the 2022 field surveys (blue line). Quality checked data provided by NIWA. Hourly rainfall from the 'Waimapu at Glue Pot Rd' rainfall monitoring site for the same period (red bars). Data coutesy of BOPRC. Note differing scales for flow and rainfall data.

## 3.2 Instream habitats

### 3.2.1 Upper Waiāri Stream – Sites 1 and 2

Sites 1 (Figure 3) and 2b (Figure 4), were located upstream and downstream from the proposed WTP intake, respectively. There was little change in habitat features and vegetation cover at Site 1 from the previous year's survey, with the fenced stream banks dominated by exotic weeds such as mugwort (*Atemisia* sp.), kikuyu (*Cenchrus clandestinus*), bindweed (*Calystegia* sp.) and montbretia (*Crocosmia* sp.).

Site 1, upstream of the WTP intake, was located on a relatively straight section of moderately fast flowing stream. Consistent with previous surveys, deposited woody debris was scattered through the reach alongside occasional large boulders and cobbles and could be safely accessed along the stream margin by wading.

At the time of this survey, instream construction works were complete, with the weir and intake structures in place. Consistent with the 2021 site surveys, stream banks below the intake were again accessible, so Site 2b was surveyed in an area closer to the original Site 2 location. A fast-flowing riffle comprising woody debris and cobbles was present

at the downstream extent of the site. Woody debris at the margins of this area could be safely accessed and were sampled for macroinvertebrate communities. Prior to the 2021 survey, the eastern (true right) bank below the weir had been reinforced with rock revetement. These large rocks also provided a stable substrate for macroinvertebrate colonisation and stands of watercress (*Nasturtium officianale*) had established along the stream edge. The reach through this area is relatively low gradient and had been colonised by mobile sandy substrates (Figure 4, right), in comparison to 2021 when a deeper channel had been evident.

Near Site 2b, where bank recontouring has occurred on both banks to enable instream works for construction of the WTP, replanting of native species has occurred; these plants are establishing well; however, weed species are common and encroaching into the plantings in places.

Figure 3: Site 1; stream features with woody debris evident.

Figure 4: Site 2b; lower fast flowing woody riffle area (left) and view of low gradient reach below the weir and intake location (right), with deposited sand dominated substrates.

Due to the steep bank edges and swift flows, rooted aquatic vegetation was rare at these sites; however, as noted above, watercress and starwort (*Callitriche stagnalis*) had established at the lower gradient stream margin among the rock revetment at Site 2b. Moss and a light cover of filamentous green algae were evident on the stable rock and large woody debris surfaces at both sites.

#### 3.2.2 Lower Waiāri Stream – Sites 3 and 4

Site 3 (Figure 5) and Site 4 (Figure 6), located upstream and downstream of the WWTP outfall, respectively, are approximately 2 km upstream of the Waiāri Stream confluence with the Kaituna River. This section of the stream flows through low-lying flood plains, dominated by pastural land use and is flanked on both sides by grazed stop-banks used

for flood control. Consistent with previous surveys, riparian vegetation was predominantly a mix of pastural grasses and common pasture weeds, with the occasional willows present, typically on the true right (eastern bank).

Figure 5: Site 3; sand dominated substrates, with *Elodea* weed beds evident at the margins.

Figure 6: Site 4; overview of weed beds and sand dominated substrates.

Instream habitats were consistent with those observed in previous year's surveys, with the stream bed through each reach characterised by soft sandy substrates, with finer silty sediments trapped within the macrophyte beds growing along the margins. The exotic oxygen weed *Elodea canadensis* were present as dense beds at the margin of each bank at both sites.

## 3.3 Macroinvertebrate communities

The 2022 macroinvertebrate data is presented in its entirety in Appendix A and is summarised in Table 3, Figure 7 and Figure 8.

Table 3: Summary of macroinvertebrate indices collected from the Waiāri Stream, 2022.

| Site | Sample | No. of taxa | No. EPT taxa | %EPT+ | MCI-sb | QMCI-sb |
|---|---|---|---|---|---|---|
| **1** | A | 22 | 9 | 33.2 | 112 | 2.6 |
| | B | 23 | 12 | 26.4 | 107 | 5.0 |
| | C | 16 | 9 | 22.4 | 120 | 5.0 |
| | D | 18 | 8 | 28.4 | 117 | 5.1 |
| ***Mean*** | | *19.8* | *9.5* | *27.6* | *114.1* | *4.4* |
| ***SEM**** | | *1.65* | *0.87* | *2.24* | *2.9* | *0.61* |
| **2** | A | 22 | 11 | 18.0 | 105 | 4.8 |
| | B | 22 | 11 | 33.8 | 105 | 5.0 |
| | C | 14 | 5 | 3.4 | 104 | 4.2 |
| | D | 27 | 13 | 23.9 | 104 | 1.9 |
| ***Mean*** | | *21.3* | *10.0* | *19.8* | *104.5* | *4.7* |
| ***SEM*** | | *2.69* | *1.73* | *6.36* | *0.43* | *0.18* |
| **3** | A | 14 | 5 | 1.8 | 84 | 2.2 |
| | B | 13 | 5 | 2.5 | 77 | 2.2 |
| | C | 16 | 9 | 2.6 | 92 | 2.2 |
| | D | 11 | 5 | 0.9 | 89 | 2.1 |
| ***Mean*** | | *13.5* | *6* | *2.0* | *85.6* | *2.2* |
| ***SEM*** | | *1.04* | *1.00* | *0.40* | *3.26* | *0.02* |
| **4** | A | 12 | 6 | 2.6 | 98 | 2.7 |
| | B | 12 | 4 | 3.6 | 86 | 3.1 |
| | C | 12 | 5 | 3.6 | 79 | 2.9 |
| | D | 11 | 3 | 1.9 | 73 | 3.8 |
| ***Mean*** | | *11.8* | *4.5* | *2.9* | *83.9* | *3.1* |
| ***SEM*** | | *0.25* | *0.65* | *0.42* | *5.46* | *0.25* |

+ %EPT (abundance) = the proportion of the community abundance made up by EPT

* SEM = standard error of the mean

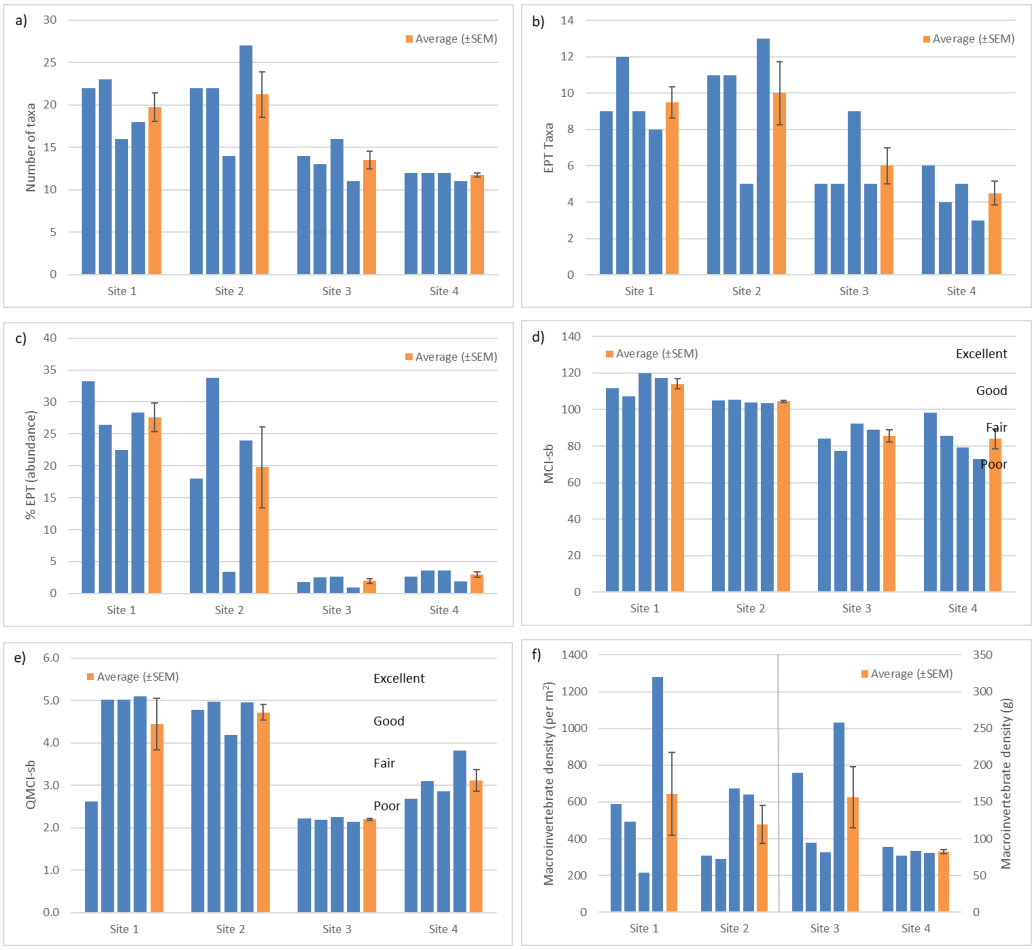


Figure 7: Macroinvertebrate indices including a) total number of taxa, b) total number of EPT taxa, c) % EPT (abundance), d) MCI-sb score, e) QMCI-sb* score and f) macroinvertebrate density. Average site scores (±SEM) are illustrated in orange.

### 3.3.1 Upper Waiāri Stream – Sites 1 and 2

The macroinvertebrate communities at the sites surrounding the WTP intake had moderately high diversity with a mean taxa richness of 20 (±1.7 SEM[1]) at Site 1 and 21 (±2.7 SEM) at Site 2 (Figure 7a).

The macroinvertebrate communities at Sites 1 and 2 were typically dominated by true flies (Diptera), in particular non-biting Chironomid midge larvae from the Tanytarsini group. These taxa feed on fine organic matter, including algae. Algae growth was moderately well established on stable wood substrates at both these sites. True flies comprised 65% to 76% of the total abundance of each sample at Site 1, and 63% to 81% of the total abundance at Site 2 (Figure 8). The dominance of true flies was lower in comparison to the 2021 survey, as caddisflies were proportionally more

[1] SEM = standard error of the mean

abundant in the 2022 survey, predominantly the sandy cased caddisfly *Pycnocentria*. These caddisflies also feed on algae amongst biofilms on substrates.

Taxa from the generally sensitive EPT (Ephemeroptera, Plecoptera, Trichoptera, or mayflies, stoneflies and caddisflies) group of insects comprised, on average, around half of the taxa richness in the upper Waiāri Stream sites; namely 9.5 (± 0.9 SEM) of the 20 taxa recorded from samples at Site 1, and 10 (± 1.7 SEM) of the 21 taxa recorded from Site 2 (Figure 7b). However, as a proportion of the community, EPT comprised between 22% and 33% of the total community abundance at Site 1 (average 27.6% ± 2.2 SEM), and from 3% to 34% of the community abundance at Site 2 (average 19.8 ± 6.4 SEM) (Figure 7c). This indicated that while the number of EPT taxa was relatively diverse at these sites, they were typically present in low to moderate numbers within the community.

The MCI-sb scores for Site 1 ranged from 107 to 120 (mean 114.1 ± 2.9 SEM), predominantly indicating 'good' habitat quality on this survey occasion (Figure 7d; Stark and Maxted, 2007a). MCI scores from Site 2 were marginally lower on this occasion, ranging between 104 to 105 (mean 104.5 ± 0.4 SEM), also indicating 'good' instream habitat quality.

The QMCI score, which considers the abundance of each scoring taxon, ranged from 2.6 to 5.1 (mean 4.4 ± 0.6 SEM) at Site 1, indicative of 'good' overall habitat quality. At Site 2 the QMCI scores ranged between 4.2 and 5.0 (mean 4.7 ± 0.2 SEM), also indicative of 'good' habitat quality (Figure 7e).

Consistent with previous surveys, macroinvertebrate densities (Figure 7f) were variable between samples at both sites but, on average, were higher at Site 1 (mean 643 individuals/m² ± 226 SEM) than at Site 2 (mean 477 individuals/m² ± 104 SEM).

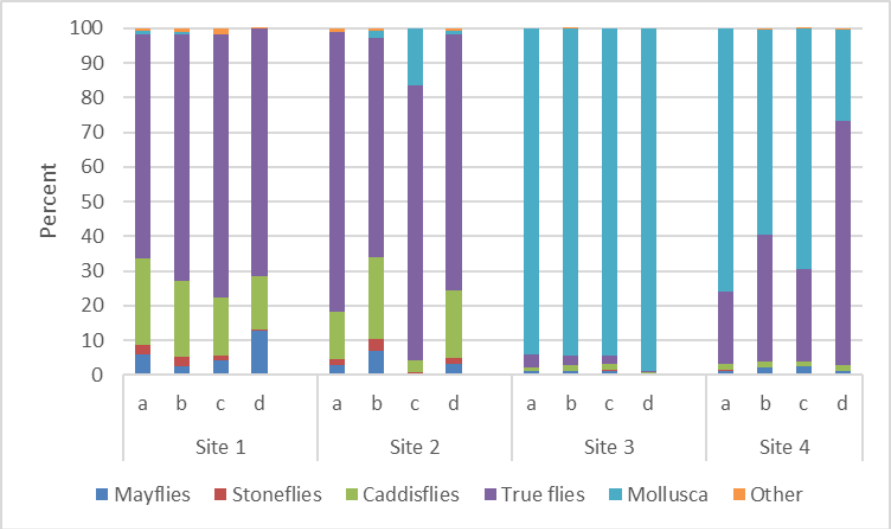


Figure 8: Percentage composition of major taxonomic groups at each site.

### 3.3.2 Lower Waiāri Stream – Sites 3 and 4

Sampling of macroinvertebrate communities utilising the weed beds within the lower Waiāri Stream recorded a similar diversity of taxa at both sites, with a mean taxon richness of 13.5 (± 1.0 SEM) at Site 3, upstream of the WWTP discharge, and 11.8 (± 0.3 SEM) at the most downstream Site 4 (Table 3, Figure 7a).

Similar to previous recent surveys, the macroinvertebrate communities at both lower Waiāri Stream sites were dominated by molluscs, predominantly the native common freshwater snail *Potamopyrgus,* which grazes on algae (Figure 8). At Site 3, molluscs comprised 94% to 99% of each sample abundance and at Site 4 comprised 26% to 76% of the total sample abundance. True flies (Diptera) were more common at Site 4, downstream of the WWTP, comprising between 21% and 70% of sample abundance. The non-biting Tanytarsini chironomid midge was the most

common true fly taxon; these midges are common in streams with aquatic plants and feed on fine organic matter including algae.

EPT taxa were recorded in moderate diversity from both sites and comprised on average 6.0 (± 1.0 SEM) of the 13.6 taxa recorded from Site 3, and 4.5 (± 0.7 SEM) of the 11.8 taxa recorded from Site 4 (Figure 7b). This equated to an average of 44% (± 4.6 SEM) and 38% (± 5.0 SEM) of the taxa richness at each site, respectively. However, overall EPT taxa made up only 2.0% (± 0.4 SEM) of the total community abundance at Site 3 and 2.9% (± 0.4 SEM) of the total community abundance at Site 4 (Figure 7c). This indicated that while the number of EPT taxa was moderately diverse at these sites, they were typically present in low numbers within the community.

Of general interest was the increased presence of the double gill mayfly *Austronella*. This mayfly was first recorded in samples from the Waiāri Stream in low numbers in 2020 but was not recorded from the five surveys prior to that. *Austronella* was again recorded in low numbers in 2021 but was increasingly common in the most recent survey, particularly in the lower stream (Sites 3 and 4). *Austronella* is one of the less commonly recorded mayflies and is not particularly sensitive (individual MCI-sb score of 4.7) but can be found feeding on diatom algae and other organic matter in both weed beds or stony bottomed streams[2].

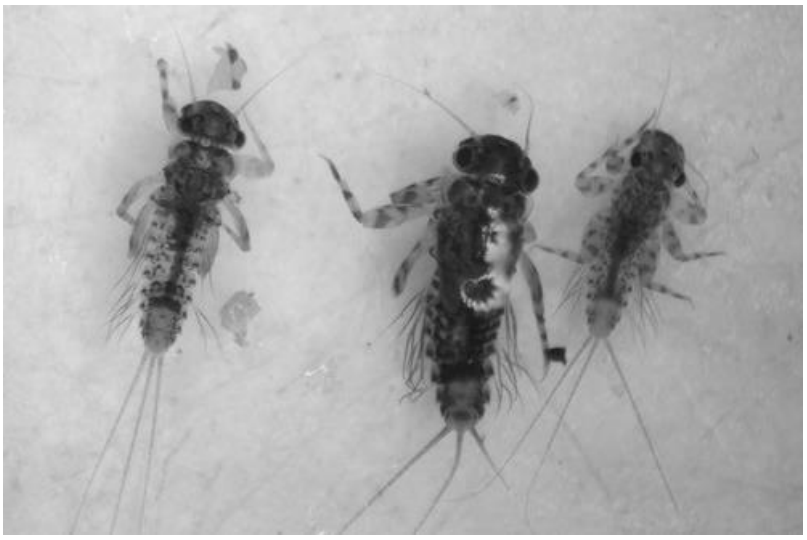

Figure 9: *Austronella* mayfly larvae; MCI-sb score of 4.7 (image courtesy of B. Stansfield, EIA).

MCI-sb scores ranged from 77 - 92 (mean 85.6 ± 3.3 SEM) at Site 3, upstream of the WWTP discharge, and from 73 – 98 (mean 83.9 ± 5.5 SEM) at Site 4, below the discharge (Figure 7d). individual sample scores at both sites ranged from 'poor' to 'fair' instream habitat quality with average scores at both sites indicating 'fair' instream habitat quality.

QMCI-sb scores at Site 3 were similar between samples, ranging between 2.1 to 2.2 (average 2.2 ± 0.02 SEM) and between 2.7 to 3.8 (average 3.1 ± 0.25 SEM) at Site 4, indicating 'poor' instream conditions at Site 3 and 'poor' to 'fair' conditions at Site 4 (Figure 7e). The disparity between habitat quality reflected by MCI and QMCI scores reflected the numerical dominance of lower scoring, or more tolerant taxa within the community such as snails and midges. Few higher scoring taxa were present at these sites, and typically only in low abundance.

Macroinvertebrate densities, expressed as per gram of dried weight of oxygen weed, was higher, but very variable at Site 3 above the WWTP outfall (average 156 individuals per g ± 41.7 SEM) and very similar but lower at Site 4 below the outfall (average 83 per g ± 2.6 SEM; Figure 7f).

[2] https://www.landcareresearch.co.nz/tools-and-resources/identification/freshwater-invertebrates-guide/identification-guide-what-freshwater-invertebrate-is-this/jointed-legs/insects-and-springtails/mayflies/double-gill-mayfly-austronella/

### 3.3.3 Comparisons with previous years

Comparison of the 2022 macroinvertebrate community results with data collected from the previous seven surveys, undertaken between 2010 – 2021 (Bioresearches 2010, 2011, 2012; 4Sight 2017, 2019, 2020, 2021), reiterates the findings of previous years that there is a high degree of natural variability in community composition and most indices (Figure 10). Inter-annual variability is a natural feature of stream macroinvertebrate monitoring due to the natural spatial and temporal variability of instream environments.

Results continue to indicate that macroinvertebrate community indices remain consistently higher at upper Waiāri Stream sites in comparison to lower Waiāri Stream sites, with greater taxa diversity, number of EPT taxa, and higher MCI-sb and QMCI-sb scores typically identified from Sites 1 and 2 in the upper stream catchment (Figure 10a, b, d and e). These macroinvertebrate indices in 2022 were found to be very similar to those recorded in the previous few years, and within the range recorded across all previous surveys. The only notable difference was an increase in %EPT abundance in the upper stream in comparison to previous years, other than 2010 (Figure 10c).

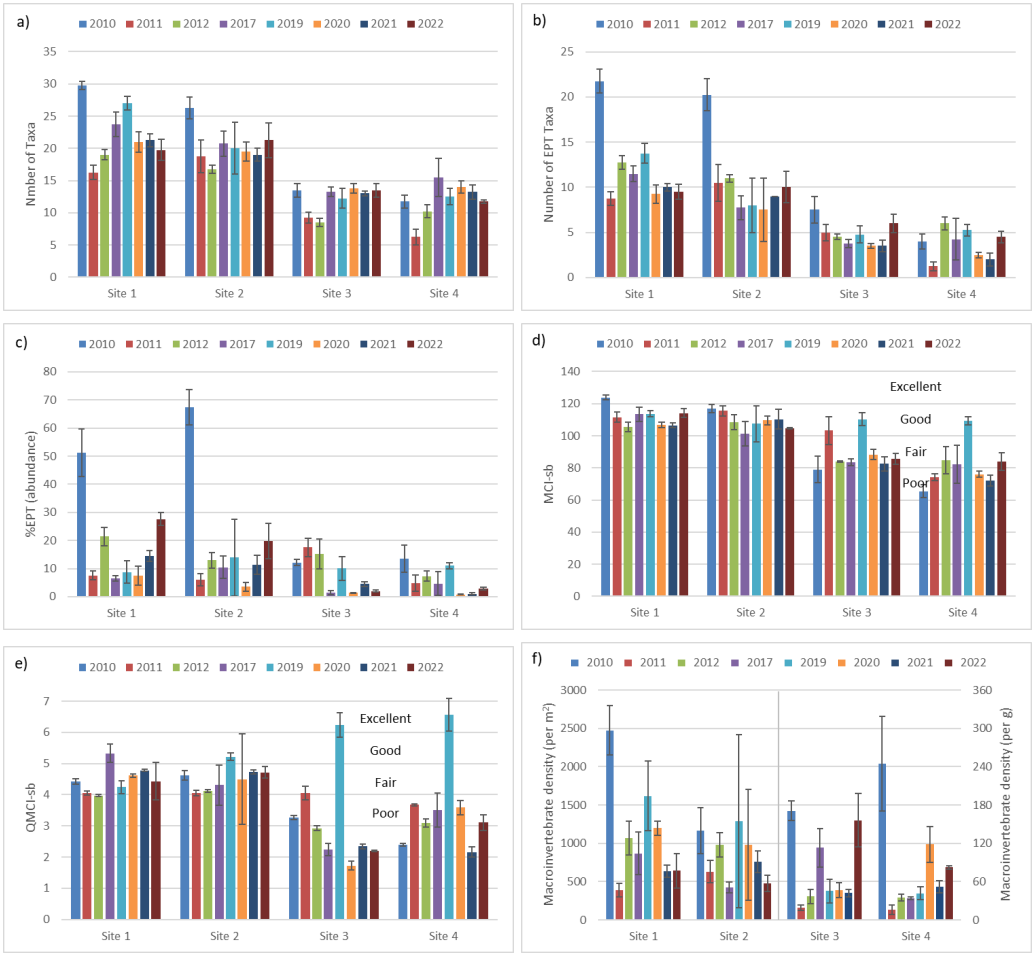


Figure 10: Average (+SEM) macroinvertebrate indices including a) taxa richness, b) EPT taxa richness, c) % abundance of EPT (individuals), d) MCI score, e) QMCI score and f) macroinvertebrate density for each site for all surveys; 2010 – 2022.

### 3.3.4 Statistical and trend analyses

With the 2022 data survey, baseline data (obtained prior to the water take commencing) has been collected over eight surveys in the years between 2010 and 2022. To better understand the variability in some calculated metrics observed across the survey period, data analysis in the form of statistical comparisons and trend analyses across and between sites was undertaken.

Larned and Snelder (2012) and Stark and Maxted (2007b) recommend that trend analysis be conducted only on sites with at least 10 years of data. Nonetheless, data analysis was undertaken on the basis that we consider this to be an assessment of the baseline conditions of the stream, in the absence of the water take, and continuation of the preliminary investigation into the potential to detect trends with the data already collected.

Means (averages) of each index were plotted for each site by year and fitted with a linear fit (Figure 11). These plots simply illustrate the relationships between each metric and time at each stream site. The plots provide a visual indicator of data patterns, and a formal trend analysis was then undertaken to understand whether these patterns comprised statistically significant trends.

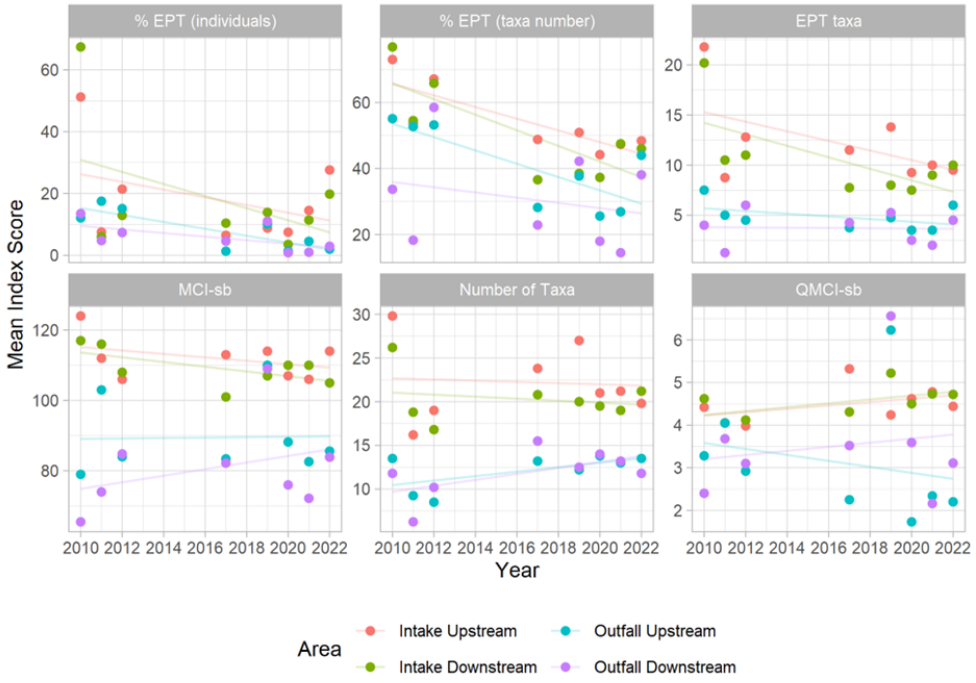


Figure 11: Linear fit of means results by site. For sites above and below the WTP intake (Site 1 and 2; Intake upstream and Intake downstream, respectively) and above and below the WWTP outfall (Sites 3 and 4; Outfall upstream and Outfall downstream, respectively).

Results of statistical comparisons (ANOVA) are visually presented as box plots in Figure 12. In that figure the statistical significance of the differences in means within each index is shown (Tukey's Honest Significant Difference test). Different letters indicate a statistically significant difference (e.g. 'a' and 'b' are significantly different but 'a' and 'ab' are not).

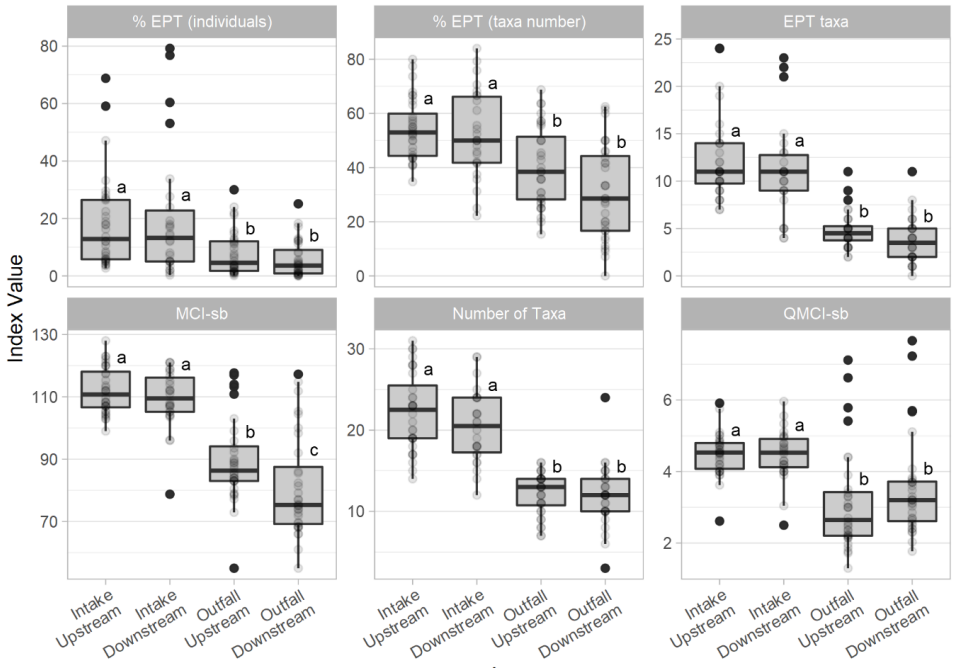


Figure 12: Summary of macroinvertebrate index results for all years for each macroinvertebrate index. Values more than 1.5 times the interquartile range (grey box) are presented as solid black circles. Individual results are presented as transparent circles. The statistical significance of the difference in means is indicated by the letter above each boxplot (sites with the same letter are not statistically different).

Key outcomes of the statistical comparisons presented in Figure 12 are summarised below:

- The mean metric values for the upper Waiāri Stream sites (Site 1 and 2; upstream and downstream of the WTP intake site) were statistically higher than those of the lower stream sites (Sites 3 and 4; upstream and downstream of the WWTP outfall) for all the metrics measured.
- There was no statistical difference between metric values upstream (Site 1) and downstream (Site 2) of the WTP intake for all metrics.
- Similarly, there was no statistical difference between metric values upstream (Site 3) and downstream (Site 4) of the WWTP outfall, with the exception of MCI-sb. Mean MCI-sb scores downstream of the WWTP outfall (Site 4) were statistically lower than those recorded upstream of the outfall.

Results of the trend analysis are summarised in Table 4. Key outcomes are described below:

- Site 1 and Site 2 (near the WTP intake), and Site 3 (upstream of the WWTP outfall) each have changing trends across three of the six metrics.
- Declining trends in the proportion of EPT taxa (%EPT taxa) were recorded for all three sites, and Sites 1 and 2 also show a declining trend in EPT taxa richness.
- The proportion of the community abundance made up by EPT (%EPT individuals) showed a declining trend at sites 3 and 4 near the WWTP outfall.
- The addition of the 2022 data has meant the slight declining trends in EPT taxa richness at Site 3 and in EPT abundance (%EPT individuals) at Site 1 in 2021 are no longer statistically apparent.
- MCI-sb scores show a slight declining trend at the upper Waiāri Stream Site 2 (downstream of the WTP intake). With the addition of the 2022 data, the slight declining trend in MCI-sb scores at Site 1 (in the data set up to 2021) is no longer significant.

- QMCI-sb scores at Site 1 (upstream of the WTP intake) had a small, positive trend, indicating a small overall increase in the proportion of higher scoring (more sensitive) taxa within samples.
- Index scores for Site 4 (downstream of the WWTP outfall) showed little to no trend over time in comparison to other sites. The number of taxa (taxa richness) was slightly positive and % EPT (individuals) was slightly negative. There was no significant trend for any other index at this site.

Table 4: Summary of results from Kendall's nonparametric test for a monotonic trend from 2010 to 2021. Statistically significant results for negative and positive trends are indicated by -ve (pink) and +ve (teal).

| Site | No. Taxa | EPT taxa | % EPT (individuals) | % EPT (taxa number) | MCI-sb | QMCI-sb |
|---|---|---|---|---|---|---|
| Site 1: upstream of WTP intake | | -ve | | -ve | | +ve |
| Site 2: downstream of WTP intake | | -ve | | -ve | -ve | |
| Site 3: upstream of WWTP outfall | | | -ve | -ve | | -ve |
| Site 4: downstream of WWTP outfall | +ve | | -ve | | | |

## 3.4 Fish communities

### 3.4.1 Survey results

Nine native and one exotic fish species were recorded during the 2022 fish surveys (Table 5).

Table 5: Fish and large macroinvertebrate species captured during fish sampling, 2022. (* = schools observed)

| Genus | Species | Common Name | WTP Intake | | WWTP Outfall | |
|---|---|---|---|---|---|---|
| | | | Site 1 | Site 2 | Site 3 | Site 4 |
| *Anguilla* | *dieffenbachii* | Longfin eel | 1 | 1 | 4 | |
| | *australis* | Shortfin eel | | 1 | 3 | |
| *Galaxias* | *fasciatus* | Banded kōkopu | 2 | | | |
| | *maculatus* | Īnanga | 6 | 16 | 51* | 145* |
| *Gobiomorphus* | sp. | juvenile bully | | 2 | 1 | 7 |
| | *cotidianus* | Common bully | | | 1 | 1 |
| | *gobioides* | Giant bully | | | | 3 |
| | *huttoni* | Redfin bully | 5 | 6 | 1 | 1 |
| *Retropinna* | *retropinna* | Smelt | | | 3 | 20 |
| *Mugil* | *cephalus* | Mullet | | | | 1 |
| *Salmo* | *trutta* | Brown trout | 1 | 1 | | |
| *Paranephrops* | *planifrons* | Koura, freshwater crayfish | 1 | | 1 | |
| **Total number of fish** | | | **15** | **27** | **64*** | **177*** |

Consistent with previous years, schools of īnanga were observed at both sites in the lower Waiāri, typically in association with the macrophyte beds. Īnanga were also recorded from nets at all sites.

Longfin eel / tuna (*Anguilla dieffenbachii*) were recorded at all sites except Site 4, downstream of the WWTP (Figure 13). Redfin bully (*Goboiomorphus huttoni*) were recorded at all sites, but were most abundant in the upper stream sites, near the WTP intake. Other 'unidentified' bullies were recorded and tended to all be very small fish that were not easily identified in the field but were likely to be redfin bully and/or common bully juveniles. Three giant bullies (*G. gobioides*) were recorded from the lower Waiāri Stream (Site 4) (Figure 13). These fish are naturally uncommon so are recorded rarely from the lowermost, low gradient reaches of streams and rivers.

Banded kōkopu (*Galaxias fasciatus*) were recorded in the upper Waiāri Stream at Site 1 (Figure 14). This species, one of the migratory whitebait species, was first recorded from the Waiāri Stream in 2021, also from sites near the WTP.

A large adult brown trout (*Salmo trutta*) was observed at Site 2, below the WTP intake and a small group of young fish was observed near the intake location (Figure 14). A large mullet was also observed at Site 4, in the lower Waiāri Stream.

The Fish QIBI calculated for all sites was indicative of 'excellent' habitat quality or connectivity for fish migrations at all sites (Table 6; Joy and Henderson, 2007).

Table 6: Fish QIBI scores, 2022.

| Site | | QIBI score | Rating |
|---|---|---|---|
| Upper Waiāri | Site 1 – upstream of WTP intake | 54 | Excellent |
| | Site 2 – downstream of WTP intake | 52 | Excellent |
| Lower Waiāri | Site 3 – upstream of WWTP outfall | 56 | Excellent |
| | Site 4 – downstream of WWTP outfall | 50 | Excellent |

Figure 13: Longfin eel from Site 2 (left); large common bully (to left of picture), and two giant bullies (right) collected from Site 4

Figure 14: Banded kōkopu from Site 1 (left); large trout observed at Site 2 in front of rock revetement (right)

#### 3.4.2 Comparison with previous years

Visual representation of the range of fish species recorded from the Waiāri Stream over the full survey period is provided for the upper stream and the lower stream sites in Table 7 and Table 8, respectively. These tables include a summary of the fish QIBI scores calculated for each site based on fish presence during each survey occasion.

The results indicate that longfin eel, īnanga and redfin bully have been recorded at all sites on most survey occasions. In the lower stream (Sites 3 and 4; Table 8) common bullies are also recorded on most occasions, and shortfin eel are recorded regularly. Smelt are more commonly recorded from the lower stream than the upper stream sites. Giant bully and mullet have only been recorded from the lower stream near the WWTP. Banded kōkopu and giant kōkopu have only been recorded from the upper stream sites, near the WTP intake. Giant kōkopu are most commonly recorded from lower elevation stream reaches so, given their presence at the upper stream sites, could reasonably be expected to be recorded in the lower stream near the WWTP. However, the lower Waiāri Stream has little habitat complexity, likely because of channelising in the late 1960s to 1970s, which may explain their absence. Features such as trailing vegetation or large woody debris, that these fish use for cover, are almost entirely absent through the lower stream.

Overall, the fish communities through both the upper and lower stream reaches are diverse, with ten native species and three exotic species being recorded across the surveys to date. The surveys have added to knowledge of fish communities, having identified three species that had not previously been recorded from the stream and detailed in the New Zealand Freshwater Fish Database records: namely giant kōkopu, banded kōkopu and giant bully. On most occasions, the fish QIBI scores have typically indicated excellent habitat quality or connectivity for fish migrations at all sites (Table 7 and Table 8).

Table 7: Summary of fish species recorded in the upper Waiāri Stream during each survey over the full survey period. Fish QIBI scores are colour coded (green = excellent; yellow = good; orange = moderate; red = poor)

| Genus | Species | Common Name | Site 1 – upstream of WTP | | | | | | | | Site 2 – downstream of WTP | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2010 | 2011 | 2012 | 2017 | 2019 | 2020 | 2021 | 2022 | 2010 | 2011 | 2012 | 2017 | 2019 | 2020 | 2021 | 2022 |
| *Anguilla* | sp. | unidentified eel | | | | | | | | | | | | | | | | |
| | *australis* | Shortfin eel | | | | | | | | | | | | | | | | |
| | *dieffenbachii* | Longfin eel | | | | | | | | | | | | | | | | |
| *Galaxias* | *fasciatus* | Banded kōkopu | | | | | | | | | | | | | | | | |
| | *maculatus* | Īnanga | | | | | | | | | | | | | | | | |
| | *argenteus* | Giant kōkopu | | | | | | | | | | | | | | | | |
| *Gobiomorphus* | sp. | juvenile bully | | | | | | | | | | | | | | | | |
| | *cotidianus* | Common bully | | | | | | | | | | | | | | | | |
| | *gobioides* | Giant bully | | | | | | | | | | | | | | | | |
| | *huttoni* | Redfin bully | | | | | | | | | | | | | | | | |
| *Retropinna* | *retropinna* | Smelt | | | | | | | | | | | | | | | | |
| *Mugil* | *cephalus* | Mullet | | | | | | | | | | | | | | | | |
| *Oncorhynchus* | *mykiss* | Rainbow trout | | | | | | | | | | | | | | | | |
| *Salmo* | *trutta* | Brown trout | | | | | | | | | | | | | | | | |
| *Gambusia* | *affinis* | Gambusia | | | | | | | | | | | | | | | | |
| **Fish QIBI** | | | **52** | **44** | **48** | **50** | **46** | **40** | **52** | **54** | **52** | **50** | **48** | **46** | **52** | **52** | **54** | **52** |

Table 8: Summary of fish species recorded in the lower Waiāri Stream during each survey over the full survey period. Fish QIBI scores are colour coded (green = excellent; yellow = good; orange = moderate; red = poor)

| Genus | Species | Common Name | Site 3 | | | | | | | | Site 4 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2010 | 2011 | 2012 | 2017 | 2019 | 2020 | 2021 | 2022 | 2010 | 2011 | 2012 | 2017 | 2019 | 2020 | 2021 | 2022 |
| *Anguilla* | sp. | unidentified eel | | | | | | | | | | | | | | | | |
| | *australis* | Shortfin eel | | | | | | | | | | | | | | | | |
| | *dieffenbachii* | Longfin eel | | | | | | | | | | | | | | | | |
| *Galaxias* | *fasciatus* | Banded kōkopu | | | | | | | | | | | | | | | | |
| | *maculatus* | Īnanga | | | | | | | | | | | | | | | | |
| | *argenteus* | Giant kōkopu | | | | | | | | | | | | | | | | |
| *Gobiomorphus* | sp. | juvenile bully | | | | | | | | | | | | | | | | |
| | *cotidianus* | Common bully | | | | | | | | | | | | | | | | |
| | *gobioides* | Giant bully | | | | | | | | | | | | | | | | |
| | *huttoni* | Redfin bully | | | | | | | | | | | | | | | | |
| *Retropinna* | *retropinna* | Smelt | | | | | | | | | | | | | | | | |
| *Mugil* | *cephalus* | Mullet | | | | | | | | | | | | | | | | |
| *Oncorhynchus* | *mykiss* | Rainbow trout | | | | | | | | | | | | | | | | |
| *Salmo* | *trutta* | Brown trout | | | | | | | | | | | | | | | | |
| *Gambusia* | *affinis* | Gambusia | | | | | | | | | | | | | | | | |
| **Fish QIBI** | | | **52** | **58** | **58** | **52** | **52** | **52** | **38** | **56** | **54** | **58** | **52** | **52** | **52** | **28** | **48** | **50** |

## 3.5 Macrophyte communities

Visual clarity was excellent at the time of the survey and allowed for visual estimation of the macrophyte community at all sites (Figure 15).

Macrophytes were relatively scarce at both sites near the WTP intake location, largely due to the steep, and generally unstable nature of the immediate stream banks and mobile sand substrates. Small patches of watercress (*Nasturtium officinale*) and starwort (*Callitriche stagnalis*) were present in places at Site 1 and a filamentous green algae and moss complex was apparent attached to the stable, embedded woody debris and large boulders.

At Site 2 below the WTP intake aquatic plants were typically rare, other than where watercress has established in shallow margins in association with the recontoured banks and rock revetment on the eastern (true right) bank (Figure 4).

At the lower Waiāri Stream sites (Sites 3 and 4) surrounding the WWTP outfall, and consistent with previous years surveys, the exotic oxygen weed *Elodea canadensis* was the dominant macrophyte, consisting of dense weed beds concentrated at the stream margins. Estimated coverage of *Elodea* averaged 47% and 59% of the stream bed at Sites 3 and 4, respectively (Figure 15).

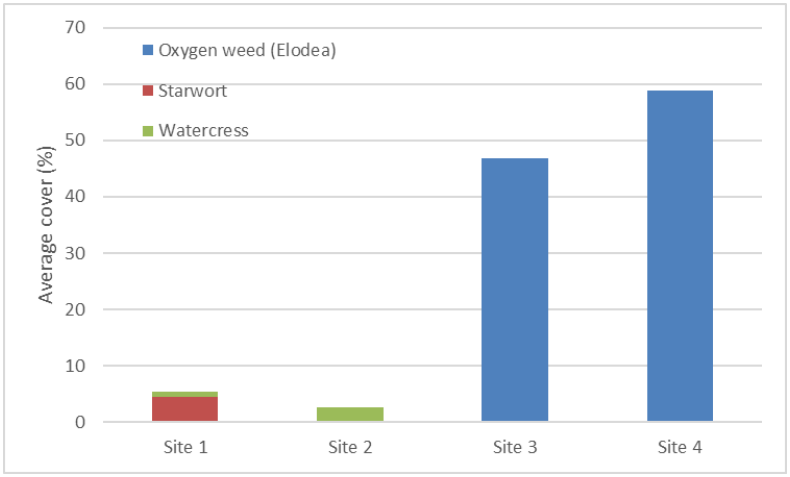


Figure 15: Macrophyte community composition and average stream bed cover based on visual assessments

## 3.6 Water Quality

Basic water quality measurements were collected from each site on 1 March and again on 2 March 2022 (Table 9). Timing of site visits meant that measurements were made at varying times through each day. Measurements from the upper Waiāri Stream (Sites 1 and 2) were taken in the morning to mid-morning of each day (between 8.45am and 11.55am) and early afternoon and morning in the lower stream (Sites 3 and 4; between 8.15am and 2.30pm). Results indicated high basic water quality at all sites (Table 9). Water quality sampling conditions on both days were undertaken during warm, sunny conditions.

Water quality monitoring from Sites 1 and 2 surrounding the WTP intake location determined that the water temperatures were seasonally cool (13.1°C – 13.8°C), well oxygenated (105% - 109%; 11.0 mg/L – 11.3 mg/L), with relatively low conductivity (around 74 µs/cm) and pH between 6.9 and 7.3. Turbidity was similarly very low at both sites, ranging between 0.0 and 0.2 NTU.

In the lower Waiāri Stream, at Sites 3 and 4 surrounding the WWTP, spot sampling of water quality occurred early afternoon on 1 March and early morning on 2 March. Water temperature varied by around 1°C – 1.4°C between sampling events at each site, being warmer during the mid-afternoon than in the morning (15.1°C vs 13.7°C at Site 3

and 14.7°C vs 13.7°C at Site 4). Dissolved oxygen levels were at saturated levels at both sites on both survey occasions, but were highest in the afternoon, ranging between 98% - 116% and 10.2 mg/L – 11.6 mg/L. Diurnal variation in oxygen levels is a natural feature of streams and can be exacerbated where dense weed beds are present. Conductivity at both lower Waiāri Stream Sites 3 and 4 was relatively low (76 µs/cm – 79 µs/cm) but, consistent with previous surveys, was very marginally elevated in comparison to the upper stream Sites 1 and 2. Recorded pH levels ranged between pH 6.6 and pH 7.3 so were similar, but slightly more variable, to those recorded in the upper Waiāri Stream (Table 9).

Table 9: Water quality parameters recorded on 1st and 2nd March 2022.

| Parameter | WTP Intake | | | | WWTP Outfall | | | |
|---|---|---|---|---|---|---|---|---|
| | Site 1 | | Site 2 | | Site 3 | | Site 4 | |
| Date (2022) | 1 Mar | 2 Mar | 1 Mar | 2 Mar | 1 Mar | 2 Mar | 1 Mar | 2 Mar |
| Time (NZDST) | 10:30 | 11:55 | 8:45 | 10:50 | 14:30 | 9:15 | 13:20 | 8:15 |
| Temperature (◦C) | 13.3 | 13.8 | 13.1 | 13.6 | 15.1 | 13.7 | 14.7 | 13.7 |
| Dissolved oxygen (%) | 108 | 109 | 105 | 107 | 116 | 102 | 114 | 98 |
| Dissolved oxygen (mg/L) | 11.3 | 11.3 | 11.0 | 11.1 | 11.6 | 10.6 | 11.6 | 10.2 |
| Conductivity (µS/cm) | 74.0 | 73.6 | 74.4 | 74.1 | 75.5 | 76.1 | 78.4 | 78.5 |
| pH | 7.2 | 6.9 | 7.3 | 6.9 | 6.7 | 6.7 | 7.3 | 6.6 |
| Turbidity (NTU) | 0.0 | 0.2 | 0.0 | 0.1 | 0.3 | 0.2 | 0.2 | 0.2 |

## 4 DISCUSSION

This report provides outcomes of the 2022 ecological survey of the Waiāri Stream, consistent with requirements of conditions 7.1 and 7.2 of resource consent 65637 for the Waiāri Water Treatment Plant (WTP) water take. The outcomes of this survey form part of the baseline ecological assessments of the stream, prior to the WTP being completed and the water take commencing. In accordance with consent conditions, the survey focuses on the habitats surrounding the proposed WTP intake and the downstream Te Puke Wastewater Treatment Plant outfall (WWTP). Three years of baseline monitoring was initially carried out between 2010 – 2012 then, due to the project being temporarily halted, surveys were repeated in 2017 (after five years), to augment those earlier studies, in the lead-up to commissioning of the WTP. Surveys, additional to the consent requirements, were completed in 2019, 2020 and 2021 and were intended to provide a broader picture of the Waiāri Stream community prior to the water take commencing. The 2022 survey comprises the eighth baseline survey of the stream and the second five year repeat in line with the consent requirements.

Works associated with the construction of the WTP, intake and associated infrastructure commenced in 2018 and were ongoing, but nearing completion at the time of survey. Large scale instream and marginal works were underway during the 2019 and 2020 surveys. During the 2021 survey the stream reach surrounding the WTP intake had been recontoured and stabilised and instream works were limited to the area immediately surrounding the future intake location. In 2022 all instream works were complete, with works largely confined to outfitting the intake buildings adjacent to the stream. Consistent with the 2021 survey, instream sampling at Site 2 occurred closer to the original Site 2 location (Site 2b).

The stream below the WTP intake has been modified by works, with recontouring of the banks occurring for a distance below the intake and associated weir structure. Rock revetment was installed on the eastern (true right) bank. While a deep channel was evident in front of the revetment in 2021, since then sand had been deposited through this reach below the weir. Consistent with 2021, wood debris was largely absent through the modified reach, other than within a fast-flowing riffle downstream of the instream works reach. Wood at the marginal areas of the riffle was accessible and sampled for macroinvertebrate communities.

While the consent conditions prescribe specific methodologies for the ecological assessment, some modifications were necessary due to instream conditions and safety concerns making some prescribed methods impractical. Where necessary modifications were made, they followed best practice methodologies (i.e. Stark *et al*. 2001) and were consistent with the modifications previously made for earlier baseline surveys (Bioresearches 2010, 2011, 2012; 4Sight 2017, 2019, 2020, 2021).

Within the uppermost (Site 1 and Site 2) and in the lower (Sites 3 and 4) reaches surveyed, stream widths and depths were typically uniform. Substrates at all sites were dominated by coarse sands and pumice gravels, with larger substrates, such as cobbles and boulders found predominantly in the deeper or faster flowing areas or near the central stream channel in the upper stream sites only. Large woody debris was also scattered through the upper stream reaches. In the lower stream (Sites 3 and 4) sand deposits formed the dominant bed type.

Wood, and the new rock revetment at Site 2 represented the most stable habitat for colonisation by macroinvertebrate communities in the upper Waiāri Stream. Sand dominated the substrate in the lower stream, with a higher proportion of fine, silt material present amongst macrophyte beds closest to the banks. Macrophytes comprises the dominant habitat for aquatic biota in the lower stream.

Consistent with previous baseline surveys, swift stream flows coupled with cool, clear, low conductivity, well oxygenated water that was pH normal at all sites indicated excellent basic water quality throughout the Waiāri Stream.

Macrophyte growth was largely absent at the upper stream sites (Site 1 and 2). Small areas of watercress were present at the margins of the stream at Site 2, including in conjunction with the shallow margins of the rock revetment. At the lower sites near the WWTP outfall (Sites 3 and 4), and consistent with all previous surveys, the exotic oxygen weed *Elodea* dominated the macrophyte community, forming thick growths in beds along the channel edges. With a lack of any hard substrates this weed provides the most significant stable substrate for macroinvertebrate communities, whilst also providing additional resources such as shelter for small fish species. Overall, surveys confirm that the macrophyte communities described in this report, while variable in extent between survey years, are characteristic of the upper and lower reaches of the Waiāri Stream.

A moderate amount of within-site variability was recorded in macroinvertebrate communities during the survey (Figure 7), consistent with previous years surveys. Nevertheless, there were some clear distinctions between the macroinvertebrate communities from survey sites around the proposed WTP intake site (Sites 1 and 2) and the WWTP outfall (Sites 3 and 4) (Figure 7). Overall, all macroinvertebrate community metrics were higher in the upper stream (Sites 1 and 2) in comparison to the lower stream (Sites 3 and 4).

Macroinvertebrate Community Index (MCI-sb) scores overall indicated 'good' instream conditions in the upper stream sites on this survey occasion. Samples from Site 3 and Site 4 in the lower stream ranged between indicators of 'poor' and 'fair' instream conditions but had an average of 'fair' conditions at both sites. QMCI scores in the upper stream fell within the 'good' range, and the 'poor' (Site 3) to 'fair to poor' (Site 4) habitat quality category in the lower stream, indicating the numerical dominance of lower scoring taxa, those more tolerant of degraded instream conditions.

The 2022 survey comprised the eighth survey of the Waiāri Stream and adds to the baseline data set before the WTP becomes operational. Data analysis in the form of statistical comparisons and trend analyses across and between sites was undertaken. Larned and Snelder (2012) and Stark and Maxted (2007b) recommend that trend analysis be conducted only on sites with at least 10 years of data. Nonetheless, data analysis was undertaken on the basis that we consider this to be an assessment of the baseline conditions of the stream, in the absence of the water take, and continuation of the preliminary investigation into the potential to detect trends with the data already collected.

Statistical analysis confirmed the observations that the mean metric values for the upper Waiāri Stream sites (Site 1 and 2) were statistically higher than those of the lower stream sites (Sites 3 and 4). However, there was no statistical difference between metric values upstream (Site 1) and downstream (Site 2) of the WTP intake. That was largely consistent with the 2021 analysis of seven years of data, other than for the total number of taxa, where numbers in 2021 were statistically lower at Site 2. Similarly, there was no statistical difference between index values upstream (Site 3) and downstream (Site 4) of the WWTP outfall, with the exception of MCI-sb. Mean MCI-sb scores downstream of the WWTP outfall (Site 4) were statistically lower than those recorded upstream of the outfall. This was consistent with the analysis from 2021.

The trend analyses picked up some trends for the eight years of data available (Table 4). Site 1 and Site 2 in the upper stream and Site 3 above the WWTP each have declining trends in the proportion of EPT taxa (%EPT taxa), and Sites 1 and 2 also show a declining trend in EPT taxa richness. The proportion of the community abundance made up by EPT (%EPT individuals) showed a declining trend at Sites 3 and 4 near the WWTP outfall. MCI-sb scores show a slight declining trend in the upper Waiāri Stream Site 2. QMCI-sb scores at Site 1 had a small, positive trend, indicating an overall increase in the proportion of higher scoring (more sensitive) taxa within samples. Site 3 had a small negative trend in QMCI-sb scores. Metric scores for Site 4 (downstream of the WWTP outfall) showed trends over time for two metrics: the number of taxa was slightly positive and % EPT abundance was slightly negative.

The addition of the 2022 data meant that the small declining trends observed at Site 1 (MCI-sb and %EPT (abundance)) and at Site 3 (EPT taxa richness) were no longer statistically significant.

Care needs to be taken when assessing the ecological significance of apparent trends. The Bay of Plenty Regional Council (BoPRC), when assessing trends in State of the Environment macroinvertebrate monitoring data, for a similar range of metrics, apply a "scale of significance" to assess the weight of evidence that observed trends were indicative of real changes to the invertebrate community (Surin *et al*, 2017). On that basis, four or more metrics displaying a trend was regarded as being 'strong' evidence of changes to the overall invertebrate community composition at that site. Based on that approach, trends at Sites 1 -3 may indicate 'moderate' evidence of change, and at Site 4 'minor' evidence of change to the overall invertebrate community composition. Given these trends are occurring in the absence of the water take, these results indicate that there may be other factors within the catchment that are impacting the biological health of the Waiāri Stream.

Nine native fish species were recorded from the Waiāri Stream during the 2022 survey including two species, īnanga and longfin eel, classified as 'at risk – declining' in the most recent threat classification lists (Dunn *et al*. 2018). Giant bully are classified as 'at risk – naturally uncommon'. The remaining recorded fish species are 'not threatened'. The Fish QIBI for all sites indicated 'excellent' habitat quality and/or connectivity for fish migration (Joy and Henderson, 2007; Suren, 2016).

Comparison of fish data collected from the eight years of survey has determined that overall, the fish communities through both the upper and lower stream reaches are diverse, with ten native species and three exotic species being

recorded to date. The surveys have added to knowledge of fish communities, having identified three species that had not previously been recorded in the New Zealand Freshwater Fish Database records: namely giant kōkopu, banded kōkopu and giant bully. On most occasions, the fish QIBI scores have typically indicated excellent habitat quality or connectivity for fish migrations at all sites (Table 6 and Table 7).

## 4.1 Summary

Consistent with previous surveys, the 2022 survey determined that the Waiāri Stream provides habitat for a relatively diverse range of macroinvertebrate taxa and native fish species. Variation in aquatic biota recorded between the upper and lower stream sites are most likely due to a difference in sampling methodology, as well as habitat changes as the stream moves from a higher gradient, mid catchment reach to the lower gradient reach within a low-lying floodplain, rather than due to significant changes in water quality. Spot sampling of basic water quality measurements on the days of survey indicate that the stream maintains cool, clear, well oxygenated water with pH within the normal range.

Results from this 2022 survey are generally consistent with those recorded in the earlier baseline stream surveys undertaken between 2010 and 2021. Analysis of the full data set collected from eight years of baseline surveys indicated there were minor declining trends, and occasional increasing trends, in some macroinvertebrate indices across all sites; however, Site 4, downstream of the WWTP outfall generally maintained little evidence of change over time. As the WTP intake has not yet commenced, and the surveys comprise baseline data, these results indicate there may be other factors that may be impacting the longer-term biological health of the Waiāri Stream. While the preference is to have ten years data to ensure robust trends analysis (Larned and Snelder 2012, Stark and Maxted 2007b), as construction of the WTP and associated infrastructure is nearly at completion, further baseline surveys before the WTP take commences may not be possible. Nonetheless, the data set collected to date will allow future comparisons with post-commissioning biological data.

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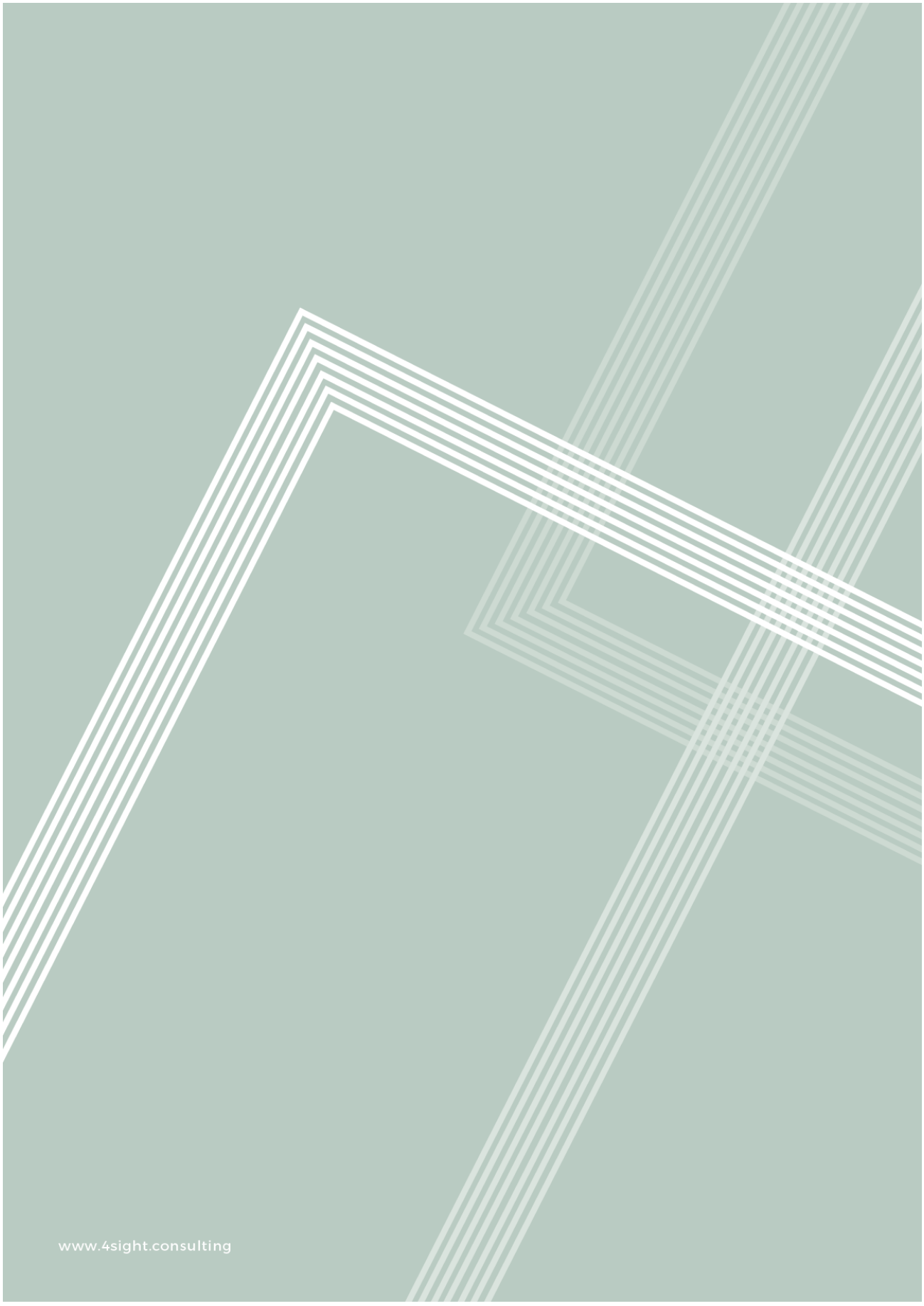
**Appendix A:**

**Raw macroinvertebrate data - 2022**

| Taxa | MCI-sb score | Site 1 – above WTP intake | | | | Site 2 – below WTP intake | | | | Site 3 – above WWTP outlet | | | | Site 4 – below WWTP outlet | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | A | B | C | D | A | B | C | D | A | B | C | D |
| Mayfly Austroclima | 6.5 | 23 | 8 | 8 | 160 | 6 | 17 | | 11 | | | 1 | | | | | |
| Mayfly Austronella | 4.7 | | | | | | 1 | 1 | 3 | 10 | 5 | 2 | 2 | 2 | 5 | 5 | 6 |
| Mayfly Deleatidium | 5.6 | | 1 | | | | 1 | | | | | | | | | | |
| Mayfly Nesameletus | 8.6 | 9 | 3 | 1 | 2 | 2 | 1 | | 2 | | | | | | | | |
| Mayfly Rallidens | 3.9 | | | | | 1 | | | 3 | | | | | | | | |
| Mayfly Zephlebia | 8.8 | 3 | | | | | | | 2 | 3 | | 3 | 2 | 5 | 4 | 7 | |
| Stonefly Megaleptoperla | 7.3 | | 2 | | | | | | | | | | | | | | |
| Stonefly Spaniocerca | 8.8 | | | | | 2 | 1 | | | | | | | | | | |
| Stonefly Zelandobius | 7.4 | 15 | 12 | 3 | 7 | 3 | 9 | 5 | 11 | | | 2 | 1 | 1 | | | |
| Caddisfly Aoteapsyche | 6.0 | 2 | 4 | 1 | 6 | 4 | 6 | | 1 | | | | | | | | |
| Caddisfly Beraeoptera | 7.0 | | 1 | | | | | | | | | | | | | | |
| Caddisfly Confluens | 7.2 | | | 1 | | | | | | | | | | | | | |
| Caddisfly Hudsonema | 6.5 | | | | | | | | 1 | 1 | 1 | | | 1 | | 2 | |
| Caddisfly Hydrobiosis | 6.7 | 3 | 1 | 3 | 2 | 1 | 5 | 1 | 3 | | | 1 | | | | | |
| Caddisfly Neurochorema | 6.0 | 7 | 21 | 16 | 9 | 23 | 22 | 9 | 24 | | | 1 | | | | | |
| Caddisfly Oxyethira | 1.2 | 3 | 3 | | | 1 | | 5 | 2 | 4 | 1 | 3 | 1 | 3 | 1 | 1 | 5 |
| Caddisfly Pycnocentria | 6.8 | 132 | 67 | 12 | 160 | 8 | 16 | 7 | 84 | 3 | 4 | 3 | 8 | 2 | 4 | 3 | 3 |
| Caddisfly Pycnocentrodes | 3.8 | | 8 | 3 | 17 | 4 | 19 | | 6 | | 1 | 1 | | | | | 1 |
| Caddisfly Triplectides | 5.7 | 1 | 2 | | | 1 | | | 2 | 2 | 1 | 1 | 1 | 4 | 1 | | |

| Taxa | MCI-sb score | Site 1 – above WTP intake | | | | Site 2 – below WTP intake | | | | Site 3 – above WWTP outlet | | | | Site 4 – below WWTP outlet | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | A | B | C | D | A | B | C | D | A | B | C | D |
| Caddisfly Triplectidina | - | | | | | | | | | | | | | | | 1 | |
| Dragonfly Antipodochlora | 6.3 | | | | | | | | 1 | | | | | | | | |
| Dobsonfly Archichauliodes | 7.3 | | | | | 1 | | | | | | | | | | | |
| Beetle Elmidae | 7.2 | 2 | 4 | 4 | 3 | 1 | 2 | | 2 | | | | | | | | |
| Beetle Hydrophilidae | 8.0 | 1 | | | | | | | | | | | | | | | |
| Beetle Staphylinidae | 6.2 | | | | | 1 | | | | | | | | | | | |
| True Fly Aphrophila | 5.6 | 1 | 3 | 7 | 4 | 3 | 3 | 2 | 3 | | | | | | | | |
| True Fly Austrosimulium | 3.9 | 15 | 5 | 1 | 1 | | | | | | | 2 | | | | | |
| True Fly Chironomus | 3.4 | | | | | 1 | | | 1 | 1 | | | | | | | |
| True Fly Empididae | 5.4 | | 2 | | 4 | | 1 | 2 | 3 | | | | | | | | |
| True Fly Harrisius | 4.7 | 2 | | 2 | 11 | | 6 | 2 | 2 | | | | | | | | |
| True Fly Limonia | 6.3 | 1 | | | | | | | | | | | | | | | |
| True Fly Maoridiamesa | 4.9 | | 1 | | 1 | 4 | 4 | | 1 | | | | | | | | |
| True Fly Mischoderus | 5.9 | | | | | 2 | | | | | | | | | | | |
| True Fly Muscidae | 1.6 | | 1 | | | 3 | 1 | | 1 | | | | | | | | |
| True Fly Orthocladiinae | 3.2 | 5 | 4 | 13 | 6 | | 4 | 4 | 5 | 9 | 1 | 6 | 1 | 3 | 9 | 10 | 13 |
| True Fly Polypedilum | 8.0 | 6 | | 6 | 4 | | 2 | 6 | | | 2 | | | 6 | 4 | 4 | 9 |
| True Fly Tanypodinae | 6.5 | 1 | | | 2 | 2 | 1 | 2 | 1 | 1 | | | 1 | | | | |
| True Fly Tanytarsini | 4.5 | | 336 | 133 | 880 | 232 | 162 | 516 | 456 | 28 | 10 | 6 | | 112 | 128 | 120 | 346 |

| Taxa | MCI-sb score | Site 1 – above WTP intake | | | | Site 2 – below WTP intake | | | | Site 3 – above WWTP outlet | | | | Site 4 – below WWTP outlet | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | A | B | C | D | A | B | C | D | A | B | C | D |
| True Fly Tanytarsus | - | 348 | | | | | | | | | | | | | | | |
| Spiders Dolomedes | 6.2 | | 1 | | | | | | | | | | | | | | |
| Mollusc Ferrissia | 2.4 | | | | | | | | | 4 | 3 | 2 | 2 | | 1 | | |
| Mollusc Physella (Physa) | 0.1 | | | | | | | | | 15 | 20 | 3 | 3 | 19 | 10 | 12 | 13 |
| Mollusc Potamopyrgus | 2.1 | 6 | 3 | | | | 6 | 112 | 6 | 960 | 424 | 536 | 1528 | 422 | 216 | 336 | 125 |
| Mollusc Sphaeriidae | 2.9 | | | | | | | | | 1 | | | | | | | |
| Oligocheates | 3.8 | 1 | | | | | | | | | | | | | 1 | | 1 |
| Hirudinea (Leeches) | 1.2 | | | | | | | | | | 1 | | | | | | |
| Nemertea | 1.8 | | | | | | | | 2 | | | | | | | | 1 |
| Hydroids | 1.6 | | | | | | | | | | | | | | | 1 | |
| **Number of Taxa** | | **22** | **23** | **16** | **18** | **22** | **22** | **14** | **27** | **14** | **13** | **16** | **11** | **12** | **12** | **12** | **11** |
| **EPT Value** | | **9** | **12** | **9** | **8** | **11** | **11** | **5** | **13** | **5** | **5** | **9** | **5** | **6** | **4** | **5** | **3** |
| **Number of Individuals** | | **587** | **493** | **214** | **1279** | **306** | **290** | **674** | **639** | **1042** | **474** | **573** | **1550** | **580** | **384** | **502** | **523** |
| **% EPT** | | **33.2** | **26.4** | **22.4** | **28.4** | **18.0** | **33.8** | **3.4** | **23.9** | **1.8** | **2.5** | **2.6** | **0.9** | **2.6** | **3.6** | **3.6** | **1.9** |
| **% EPT Taxa** | | **40.9** | **52.2** | **56.2** | **44.4** | **50.0** | **50.0** | **35.7** | **48.2** | **35.7** | **38.5** | **56.3** | **45.5** | **50.0** | **33.3** | **41.7** | **27.3** |
| **MCI-SB score** | | **111.8** | **107.1** | **120.1** | **117.4** | **105.2** | **105.3** | **104.0** | **103.6** | **84.0** | **77.2** | **92.3** | **88.9** | **98.3** | **85.5** | **79.2** | **72.7** |
| **QMCI-sb score** | | **2.61** | **5.01** | **5.02** | **5.09** | **4.78** | **4.97** | **4.18** | **4.95** | **2.22** | **2.18** | **2.25** | **2.14** | **2.68** | **3.10** | **2.85** | **3.82** |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## 10.2 Mauri Model

**File Number:** **A13669275**

**Author:** **Richard Conning, Senior Project Manager**

**Authoriser:** **Nic Johansson, General Manager: Infrastructure**

### PURPOSE OF THE REPORT

1. To present the functional mauri model and to seek the endorsement of the Waiāri Kaitiaki Advisory Group ahead of the implementation of the model

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### RECOMMENDATIONS

That the Waiāri Kaitiaki Advisory Group:

(a) Receives the Mauri Model report;

(b) Endorses the implementation of the mauri model.

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### EXECUTIVE SUMMARY

2. The joint Waiāri water take consent (RC65637) requires the consent holders to:

> *10.1 Form a Kaitiaki Advisory Group to liaise and meet for the following purposes:*
>
> *To provide an advisory role to the consent holder and the Regional Council in relation to Part 2 and, in particular, to sections 6(e) and 7(a) of the Resource Management Act, as they relate to this consent; and*
>
> *To inform the Regional Council of the effects of the water take authorised under this consent on the mauri and mauriora of the Waiari Stream;*

3. To this end Mahi Maioro Professionals (Dr. Kepa Morgan) was engaged to develop a mauri model to quantify the effects of the water take on the mauri and mauriora of the Waiāri stream. The quantification is enabled through the creation of a mauri and mauri ora monitoring framework that will communicate real-time digital mauri0meter reporting of bio-physical attributes alongside Iwi, Hapori and whānau mauri indicators.

4. The digitised reporting platform that has been created is based on the Mauri Model Decision Making Framework which has the ability to incorporate the worldview sensitivities, is aligned with the four well-being ontology in the Local Government and Resource Management Acts. The basis for reporting is the mauri0meter graphic which is also incorporated into all of the indicator thresholds. Meaning that the measurements reported are all consistent with one another and able to be combined in dimensions.

### MODEL DEVELOPMENT

5. Mahi Maioro Professionals facilitated seven wānanga between July 2019 and July 2022 and held a number of one to one sessions with Tapuika, Waitaha, Ngati Whakaue ki Maketu and Mokopuna Tia Me Hei to develop a historic timeline for the Waiāri and identify and develop indicator sets for the four mauri dimensions that will be assessed by the mauri model. The four dimensions are Iwi mauri (cultural), hapori (Social), Waiāri ecosystem (environmental) and whānau mauri (economic).

6. Most recently Mahi Maioro Professionals facilitated an indicator thresholds wānanga at Tapuika Iwi Authority offices on 13 July 2022. In depth feedback was provided by the Iwi representatives participating. These discussions have been incorporated into the

spreadsheet build and scoreable indicator sets with complete thresholds have now been created for all four mauri dimensions. There are now 29 x Iwi mauri (cultural) indicators, 12 x hapori (Social) indicators, 12 Waiāri ecosystem (environmental) indicators, and 10 x whānau mauri (economic) indicators. The indicator sets for each dimension are provided in Attachment 1.

7. The updated indicator sets have been circulated to Iwi representatives to trial score attribution using the Wānanga spreadsheet. The intention is to trial the indicator scoring for the Iwi mauri indicators, in particular, prior to launching the digital reporting platform for Waiāri mauri. The adoption of the indicator sets, indicator thresholds and digitised reporting platform will achieve proof of concept for the Waiāri mauri and mauri ora monitoring. Further indicators can be added to supplement the comprehensive set already created as Councillors and other experts may want to add indicators able to represent the attributes most important to themselves.

8. The digitised reporting of the four regularly monitored water quality attributes and the cultural flow has been demonstrated to the Iwi representatives in April and feedback incorporated. With the adoption of the current version of the mauri and mauri ora monitoring and reporting platform, ongoing effort will be directed towards socialising the monitoring learnings provided more widely amongst the Iwi represented on the Waiāri Kaitiaki Advisory Group. This phase of effort will also continue to refine the current indicator thresholds, add new digitised indicators, and improve the quality of monitoring activities.

## IMPLEMENTATION

9. Implementation of the mauri model will include the following actions and activities:

- Addition of explanation pages and the video induction to the website prototype.
- Mobile phone cradles at appropriate locations to enable Iwi and public participation in monitoring. This will bring a live aspect to Hapū and Hapori Mauri dimensions.
- Installation of iPou at appropriate locations to enable Iwi and public participation in monitoring. This will bring a live aspect to Hapū and Hapori Mauri dimensions.
- Incremental addition of new data sources to mauri reporting platform as become available.
- On-going wānanga to socialise and refine Mauri and Mauri Ora monitoring and reporting. Six wānanga are proposed to be held between September 2022 and December 2024.
- Project analysis functionality of Mauri Model based assessment tool.

10. In addition an opportunities to install in-situ automated real-time water quality monitoring at locations upstream and downstream of water intake and the deployment of mobile in stream monitoring equipment to supplement the data gathered at the intake is being discussed with Mahi Maioro Professionals.

## TE OHU PARAWAI O TE WAIĀRI

11. Mahi Maioro Professionals have been approached to work with Te Ohu Parawai o Te Waiāri regarding similar requirements around the Te Puke Wastewater Treatment Plant resource consent renewal. There is an opportunity to share some costs where duplication may otherwise occur if the parties are in agreement. There is also the opportunity to combine the projects with the intention of creating a catchment-based understanding of changes in mauri and mauri ora of the Waiāri.

12. It is recommended that engagement is undertaken with Te Ohu Parawai o Te Waiāri to determine if a joint approach is supported.

## ATTACHMENTS

**1. Waiari Wananga Indicators July 2022 - A13678833** ⇩

Ngāti Tūheke

| Number | Indicator | Description | Threshold | Description |
|---|---|---|---|---|
| 1a | Kohi kai - Marae Kawa | Marae kawa observed Āri | +2 | Available at all events |
| | | | +0 | Available for all important events |
| | | | -0 | Barely suitable for important events |
| | | | -2 | Kore - neither sufficient nor suitable for marae events |
| 1b | Kohi kai - Marae Kawa | Marae kawa observed Koura | +2 | Available at all events |
| | | | +0 | Available for all important events |
| | | | -0 | Barely suitable for important events |
| | | | -2 | Kore - neither sufficient nor suitable for marae events |
| 1c | Kohi kai - Marae Kawa | Marae kawa observed Tuna | +2 | Available at all events |
| | | | +0 | Available for all important events |
| | | | -0 | Barely suitable for important events |
| | | | -2 | Kore - neither sufficient nor suitable for marae events |
| 1d | Kohi kai - Marae Kawa | Marae kawa observed Kākahi | +2 | Available at all events |
| | | | +0 | Available for all important events |
| | | | -0 | Barely suitable for important events |
| | | | -2 | Kore - neither sufficient nor suitable for marae events |
| 1e | Kohi kai - Marae Kawa | Marae kawa observed Watakirihi | +2 | Available at all events |
| | | | +0 | Available for all important events |
| | | | -0 | Barely suitable for important events |
| | | | -2 | Kore - neither sufficient nor suitable for marae events |
| 1f | Kohi kai - Marae Kawa | Marae kawa observed Trout | +2 | Available at all events |
| | | | +0 | Available for all important events |
| | | | -0 | Barely suitable for important events |
| | | | -2 | Kore - neither sufficient nor suitable for marae events |
| 2a | Kohi kai - Mohiotanga Āri | Tikanga - practices of kai gathering are in use. Species and ecosystem mauri are appropriate | +2 | Always available for kohingakai |
| | | | +0 | Monitoring & Ngāti Tūheke availability |
| | | | -0 | Rāhui needed because of mauri o te wai or scarcity |
| | | | -2 | Aukati / need legal access / water quality unacceptable |
| 2b | Kohi kai - Mohiotanga Koura | Tikanga - practices of kai gathering are in use. Species and ecosystem mauri are appropriate | +2 | Always available for kohingakai |
| | | | +0 | Monitoring & Ngāti Tūheke availability |
| | | | -0 | Rāhui needed because of mauri o te wai or scarcity |
| | | | -2 | Aukati / need legal access / water quality unacceptable |
| 2c | Kohi kai - Mohiotanga Tuna | Tikanga - practices of kai gathering are in use. Species and ecosystem mauri are appropriate | +2 | Always available for kohingakai |
| | | | +0 | Monitoring & Ngāti Tūheke availability |
| | | | -0 | Rāhui needed because of mauri o te wai or scarcity |
| | | | -2 | Aukati / need legal access / water quality unacceptable |
| 2d | Kohi kai - Mohiotanga Kākahi | Tikanga - practices of kai gathering are in use. Species and ecosystem mauri are appropriate | +2 | Always available for kohingakai |
| | | | +0 | Monitoring & Ngāti Tūheke availability |
| | | | -0 | Rāhui needed because of mauri o te wai or scarcity |
| | | | -2 | Aukati / need legal access / water quality unacceptable |
| 2e | Kohi kai - Mohiotanga Watakirihi | Tikanga - practices of kai gathering are in use. Species and ecosystem mauri are appropriate | +2 | Always available for kohingakai |
| | | | +0 | Monitoring & Ngāti Tūheke availability |
| | | | -0 | Rāhui needed because of mauri o te wai or scarcity |
| | | | -2 | Aukati / need legal access / water quality unacceptable |
| 2f | Kohi kai - | Tikanga - practices of kai gathering are in use. Species and ecosystem mauri | +2 | Always available for kohingakai |
| | | | +0 | Monitoring & Ngāti Tūheke availability |

| | | | | |
|---|---|---|---|---|
| 2f | Mohiotanga Trout | In use: species and ecosystem mauri are appropriate | -0 | Rāhui needed because of mauri o te wai or scarcity |
| | | | -2 | Aukati / need legal access / water quality unacceptable |
| 3a | Kohi kai - Hononga | Connection to tāonga **Ā**ri | +2 | Unrestricted access for Manawheua |
| | | | +0 | All weather controlled access |
| | | | -0 | Seasonal / conditional access |
| | | | -2 | No access provided |
| 3b | Kohi kai - Hononga | Connection to tāonga Koura | +2 | Unrestricted access for Manawheua |
| | | | +0 | All weather controlled access |
| | | | -0 | Seasonal / conditional access |
| | | | -2 | No access provided |
| 3c | Kohi kai - Hononga | Connection to tāonga Tuna | +2 | Unrestricted access for Manawheua |
| | | | +0 | All weather controlled access |
| | | | -0 | Seasonal / conditional access |
| | | | -2 | No access provided |
| 3d | Kohi kai - Hononga | Connection to tāonga K**ā**kahi | +2 | Unrestricted access for Manawheua |
| | | | +0 | All weather controlled access |
| | | | -0 | Seasonal / conditional access |
| | | | -2 | No access provided |
| 4 | Te Mana o Te Wai Mana Motuhake | Cultural Allocation of Flow - use is aligned to Iwi Priorities | +2 | Hapū has total autonomy in aligning flow alocation to Iwi Priorities for 100% of available flow |
| | | | +0 | Hapū mana recognition by equal representation determining flow alocation for 100% of available flow |
| | | | -0 | Hapū mana recognition by equal representation determining priorities for cultural allocation |
| | | | -2 | Mana o Te Wai Cultural Allocation not considered by Council |
| 5a | Kaitiakitanga | Recognition and empowerment of obligation to enhance mauri | +2 | Fully empowered to enhance and protect mauri of Waiāri |
| | | | +0 | Partnership with Regional Council |
| | | | -0 | Recognised by Regional Council |
| | | | -2 | Exclusion |
| 5b | Kaitiakitanga | Recognition and empowerment of obligation to enhance mauri | +2 | Fully empowered to enhance and protect mauri of Waiāri |
| | | | +0 | Partnership with District Council |
| | | | -0 | Recognised by District Council |
| | | | -2 | Exclusion |
| 5c | Kaitiakitanga | Recognition and empowerment of obligation to enhance mauri | +2 | Fully empowered to enhance and protect mauri of Waiāri |
| | | | +0 | Partnership with Department of Conservation / Forest and Bird |
| | | | -0 | Recognised by Department of Conservation / Forest and Bird |
| | | | -2 | Exclusion |
| 5d | Kaitiakitanga | Recognition and empowerment of obligation to enhance mauri | +2 | Fully empowered to enhance and protect mauri of Waiāri |
| | | | +0 | Partnership with Farmers / Land Owners |
| | | | -0 | Recognised by Farmers / Land Owners |
| | | | -2 | Exclusion |
| 6 | Operational Involvement | Rangatiratanga Staff levels and representation | +2 | Iwi are represented all levels of organisation and contributing to decision making impacting Waiāri |
| | | | +0 | Te Arawa Iwi hold 20% of staff positions in operations related to Waiāri |
| | | | -0 | Māori hold 20% of staff positions in operations related to Waiāri |
| | | | -2 | No Tangata Whenua involved in operations |
| 7 | Rauemi | Traditional practices supported by the availability of plant species between Old WB intake and confluence with Kaituna River | +2 | Sufficient rauemi are available from the riperian margins of Waiāri for traditional use |
| | | | +0 | Resources are being regenerated within all of the riperian margins of Waiāri for traditional use |
| | | | -0 | Resources are being regenerated in 50% of the riperian margins of Waiāri for traditional use |
| | | | -2 | No rauemi are able to be harvested from the Waiāri riperian margins |
| | | Revitalisation through resources | +2 | Access to all significant sites on the Waiāri with i-Pou (information/korero) communicating relevance |

| | | | | |
|---|---|---|---|---|
| 8a | Mātauranga | created and shared that maintain the relevance of sites of historical significance | +0 | Three access points to Waiāri important sites with i-Pou |
| | | | -0 | Two access points to Waiāri important sites |
| | | | -2 | No access provided to significant sites |
| 8b | Mātauranga Site | Dedicated wānanga site for identifying and passing on hapū mātauranga | +2 | Dedicated wānanga site established for transmission of mātauranga |
| | | | +0 | Dedicated wānanga site secured, but not yet developed |
| | | | -0 | Agreement to establish wānanga site suitable for transmission of mātauranga |
| | | | -2 | No site |
| 9a | Waka transport | Maintain mātauranga related to waka journeying on Waiāri | +2 | Multiple access points for easy access to the Waiāri for waka and important sites |
| | | | +0 | Three access points provide access to the Waiāri for waka and important sites |
| | | | -0 | Two access points provide access for waka and some important sites |
| | | | -2 | No access provided for waka |
| 9b | Waka transport | Moving about rohe, connectivity of sites, and access | +2 | From available access points Waiāri is suitable for journeying to majority of culturaly important sites |
| | | | +0 | From the available access points the Waiāri is suitable for journeying to three culturaly important sites |
| | | | -0 | From available access points the Waiāri is suitable for journeying to two culturaly important sites |
| | | | -2 | No access to culturally important sites |
| 10 | Landings (scale) | Carparks, rubbish, waka, public, tourism, recreation, sport. | +2 | Landings are named and maintained under contract by Mana Whenua |
| | | | +0 | Two landings are named and managed under contract by Mana Whenua |
| | | | -0 | A landing is named, well managed and maintained by Council |
| | | | -2 | A landing is managed by Council |
| 11 | Cultural Flow | Waiāri flow consistent with Iwi Values | +2 | 200% of consent limit |
| | | | +0 | Resource Consent Notification Limit plus 25% |
| | | | -0 | Resource Consent Notification Limit |
| | | | -2 | Minimum Ecological Flow |

Hāpori

| Number | Indicator | Description | Threshold | Description |
|---|---|---|---|---|
| 1 | Manu / bombs | Hononga - depth and clarity of wai, safety to use bridge | +2 | Several safe access points to manu location, adequate water depth, potable water quality and safe egress from Awa, parking area with safe connection to Awa |
| | | | +0 | Access to manu location, adequate water depth, exceeds swimmable water quality and safe egress |
| | | | -0 | Adequate water depth, Swimmable water quality |
| | | | -2 | Safety issues associated with access, water quality and eggress that eliminate connection to place |
| 2 | Water-based Recreation | Opportunities to access the Waiāri for recreational purposes including parking and access to river edge | +2 | Multiple (>6) access points for recreational purposes including parking and formed access to river edge |
| | | | +0 | Two access points for recreational purposes include parking and formed access to river edge |
| | | | -0 | Access locations for recreational purposes including legal access to river edge |
| | | | -2 | No legal access to Waiāri Awa |
| 3 | Walkways | Accessibility of walkways adjacent awa and suitability for different uses and attractive aesthetics | +2 | Access adjacent Waiāri for walking >50% length include parking and formed access to walkways |
| | | | +0 | Minimum two access locations for walking including parking and formed access to river edge |
| | | | -0 | Access locations for walking including legal access to river edge |
| | | | -2 | No legal access to walkways adjacent Waiāri Awa |
| 4 | Local history | Sites of importance and relevant history shared through i-Pou | +2 | All culturally important sites along Waiāri have i-Pou with relevant korero |
| | | | +0 | Four i-Pou located along the Waiāri with Iwi korero regarding site name and importance |
| | | | -0 | One i-Pou located along the Waiāri with Iwi korero regarding site name and importance |
| | | | -2 | No Iwi korero accessible by community members visiting Waiāri Awa |
| 5a | Landscape aesthetics | Riperian planting - extent and width | +2 | Riperian margins are >5m over 80% length of river between old WB intake and Kaituna confluence |
| | | | +0 | Riperian margins are >5m over 50% length of river between old WB intake and Kaituna confluence |
| | | | -0 | Riperian margins are >5m over 33% length of river between old WB intake and Kaituna confluence |
| | | | -2 | Riperian margins poorly managed over 50% of length between old WB intake and Kaituna confluence |
| 5b | Landscape aesthetics | Riperian planting quality native species | +2 | Riperian margins consist more than 80% well established native species providing shading and habitat |
| | | | +0 | Riperian margins consist more than 50% well established native species providing shading and habitat |
| | | | -0 | Riperian margins consist more than 50% native species providing kai for manu and safe habitat |
| | | | -2 | Riperian margins are of inconsistent quality with invasive pest species and poor fencing |
| 6 | Swimability | Water clarity, algae, disease causing organisms, polution | +2 | Multiple safe access points for swimming, adequate water depth, potable water quality and safe egress from Awa, parking area with formed access to Awa |
| | | | +0 | Access to 3 swimming locations, adequate depth, swimable water quality and safe egress from Awa |
| | | | -0 | Adequate water depth and swimable water quality |
| | | | -2 | Safety issues associated with access, water quality and eggress when attempting to swim in the Waiāri |
| 7a | Representative Body Effectiveness | Effectiveness of Regional Councillors' communications with their constituents | +2 | Reorua communications consistent with Te Tiriti o Waitangi obligations to the satisfaction of Iwi/Hapū |
| | | | +0 | Communications are consistent with The Treaty principles + reo rua to the satisfaction of Iwi/Hapū |
| | | | -0 | Communicating with all constituents and communications are consistent with The Treaty principles |
| | | | -2 | Communications do not acknowledge the Treaty principles or use Māori language |
| 7b | Representative Body Effectiveness | Effectiveness of District Councillors' communications with their constituents | +2 | Reorua communications consistent with Te Tiriti o Waitangi obligations to the satisfaction of Iwi/Hapū |
| | | | +0 | Communications are consistent with The Treaty principles + reo rua to the satisfaction of Iwi/Hapū |
| | | | -0 | Communicating with all constituents and communications are consistent with The Treaty principles |
| | | | -2 | Communications do not acknowledge the Treaty principles or use Māori language |
| 8a | Quality of Treaty Relationship | Quality of the relationship between Regional Councillors and Iwi/Hapū | +2 | Te Tiriti o Waitangi reflected in the relationship to the satisfaction of Iwi/Hapū |
| | | | +0 | Council meets legal requirements and Iwi/Hapū are getting reciprocal value from the relationship |
| | | | -0 | Council meet the legal obligations set by the Principles of The Treaty |
| | | | +2 | Te Tiriti o Waitangi reflected in the relationship to the satisfaction of Iwi/Hapū |

| | | | | |
|---|---|---|---|---|
| 8b | Quality of Treaty Relationship | Quality of the relationship between Distrcit Councillors and Iwi/Hapū | +0 | Council meets legal requirements and Iwi/Hapū are getting reciprocal value from the relationship |
| | | | -0 | Council meet the legal obligations set by the Principles of The Treaty |
| | | | -2 | Council are not meeting their legal obligations |
| 9 | Mana whakahaere | Role in economic development opportunities that arise | +2 | Hapū autonomy in economic activity and equal representation |
| | | | +0 | Council policy on development concession |
| | | | -0 | Consultation on development concession |
| | | | -2 | Not considered |

Waiāri Intrinsic

| Number | Indicator | Description | Threshold | Description |
|---|---|---|---|---|
| 1a | Mauri state of Waiāri | Biodiversity aspirations adopted by Department of Conservation | +2 | Biodiversity is fully representative of historic enhanced state |
| | | | +0 | Partnership established and working towards reinstatement |
| | | | -0 | Recognition of Iwi aspirations and role as Manawhenua |
| | | | -2 | Exclusion from processes |
| 1b | Mauri state of Waiāri | Biodiversity aspirations supported by Regional Council | +2 | Biodiversity is fully representative of historic enhanced state |
| | | | +0 | Partnership established and working towards reinstatement |
| | | | -0 | Recognition of Iwi aspirations and role as Manawhenua |
| | | | -2 | Exclusion from processes |
| 1c | Mauri state of Waiāri | Biodiversity aspirations supported by Forest and Bird and local community organisations | +2 | Biodiversity is fully representative of historic enhanced state |
| | | | +0 | Partnership established and working towards reinstatement |
| | | | -0 | Recognition of Iwi aspirations and role as Manawhenua |
| | | | -2 | Exclusion from processes |
| 2 | Monitoring for mauri state reporting | Ecological parameter monitoring | +2 | Monitoring of bio-logial parameters is fully aligned with maramataka, mātauranga and Iwi involvement |
| | | | +0 | Monitoring based on annual study aligned with the maramataka and with Iwi involvement |
| | | | -0 | Ecological reporting that is meaningful and informs Iwi undertanding of the scientific changes occurring |
| | | | -2 | Consent compliance but monitoring data does not support understanding or mauri state reporting |
| 3 | Monitoring for mauri state reporting | Physical parameter monitoring | +2 | Monitoring of six physical parameters in place at two locations to facilitate real-time mauri state reporting |
| | | | +0 | Monitoring of six physical parameters in place to facilitate mauri state reporting |
| | | | -0 | Regular monitoring of physical parameters in place at Water intake to facilitate mauri state reporting |
| | | | -2 | Monitoring data does not support mauri state reporting |
| 4 | Waiāri DO | Disolved Oxygen | +2 | Limits determined through scientific analysis and Policy statements such as NPSFM 20202 |
| | | | +0 | |
| | | | -0 | |
| | | | -2 | |
| 5 | Waiāri N | Nitrates | +2 | Limits determined through scientific analysis and Policy statements such as NPSFM 20202 |
| | | | +0 | |
| | | | -0 | |
| | | | -2 | |
| 6 | Waiāri DRP | Phosphates | +2 | Limits determined through scientific analysis and Policy statements such as NPSFM 20202 |
| | | | +0 | |
| | | | -0 | |
| | | | -2 | |
| 7 | Waiāri T | Temperature | +2 | Limits determined through scientific analysis and Policy statements such as NPSFM 20202 |
| | | | +0 | |
| | | | -0 | |
| | | | -2 | |
| 8 | Waiāri TSS | Total Suspended Solids | +2 | Limits determined through scientific analysis and Policy statements such as NPSFM 20202 |
| | | | +0 | |
| | | | -0 | |
| | | | -2 | |
| 9 | Waiāri E-coli | Indicator of faecal colliforms | +2 | Limits determined through scientific analysis and Policy statements such as NPSFM 20202 |
| | | | +0 | |
| | | | -0 | |
| | | | -2 | |
| 10 | Vegetation | Riperian Planting to priovide habitat and bank stability | +0 | Riperian planting is well established more than 90% of awa length and reflects the native plant varieties |
| | | | -0 | Riperian planting has reintroduced native plant varieties over more than 50% |
| | | | -2 | Riperian margins are dominated by pest plants and exotics |

Economic

| Number | Indicator | Description | Threshold | Description |
|---|---|---|---|---|
| 1 | Mana whakahaere | Role in economic development opportunities that arrise | +2 | Hapū autonomy in economic activity and equal representation |
| | | | +0 | Council policy on development concession |
| | | | -0 | Consultation on development concession |
| | | | -2 | Not considered |
| 2 | Trade | Historic involvement in trading and transportation. Involvement in commercial activity (status accorded Hapū and Iwi) | +2 | Iwi as project partners in infrastructure development |
| | | | +0 | Infrastructure Project development levy 2% (Yurok precedent) |
| | | | -0 | Infrastructure project connection to place |
| | | | -2 | No acknowledgement accorded Iwi |
| 3 | Water Supply | Economic Good. Acknowledgement of Ngāti Tūheke contribution. | +2 | Water supply invoicing acknowledges Waiāri source and includes Iwi development levy |
| | | | +0 | Water supply invoicing acknowledges Waiāri source and generosity of Iwi |
| | | | -0 | Water supply invoicing acknowledges Waiāri source and Iwi |
| | | | -2 | Water supply transactions do not acknowledge Iwi |
| 4 | Operational Involvement | Staff levels and representation | +2 | Iwi are employed at all levels of organisation |
| | | | +0 | Te Arawa Iwi hold 20% of staff positions |
| | | | -0 | Māori hold 20% of staff positions |
| | | | -2 | No Mana Whenua employed in operations |
| 5 | Landings (scale) | Carparks, rubbish, tourism. | +2 | Landings are maintained under contract by Mana Whenua |
| | | | +0 | Two landings are managed under contract by Mana Whenua |
| | | | -0 | Two landings are well managed and maintained by Council |
| | | | -2 | A landing is managed by Council |
| 6 | Mana Motuhake I | Economic independence of marae | +2 | 100% of marae connected and no supply or maintenance charges |
| | | | +0 | 50% of marae connected and no supply or maintenance charges |
| | | | -0 | Marae connected to own bore or paying for potable supply |
| | | | -2 | Marae rated for water supply and connection by Council |
| 7 | Mana Motuhake II | Economic independence of whānau | +2 | Papakainga developments connected and no supply or maintenance charges |
| | | | +0 | 60% papakainga developments connected and no supply charges |
| | | | -0 | 30% papakainga developments connected and no supply charges |
| | | | -2 | Papakainga rated for water supply and connection by Council |
| 8 | Marae water supply Mauao to Matatā | Equity of access | +2 | 100% of marae connected to Waiāri supply or equivalent |
| | | | +0 | 50% of marae connected to Waiāri supply or equivalent |
| | | | -0 | Marae connected to own bore and potable to WHO standards |
| | | | -2 | Substandard water supply does not comply WHO standards |
| 9 | Iwi Development Water Allocation | Iwi development aspirations are not restricted by previous BOPRC water allocation decisions | +2 | More than 5% allocation of water utilised for iwi development |
| | | | +0 | 5% allocation of available water for iwi development aspirations |
| | | | -0 | 2% allocation of available water for iwi development aspirations |
| | | | -2 | No allocation of available water for Iwi purposes |
| 10 | Mana whakahaere | Role in economic development opportunities that arise | +2 | Hapū autonomy in economic activity and equal representation |
| | | | +0 | Council policy on development concession |
| | | | -0 | Consultation on development concession |
| | | | -2 | Not considered |

## 11 DISCUSSION OF LATE ITEMS

## 12 CLOSING KARAKIA