



Te Mana o te Wai, Te Oranga o te Tāngata

PREPARED FOR THE PARLIAMENTARY COMMISSIONER
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E Oho! Awakening Aotearoa

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Photography

Cover image: Ohaki Pā (Ngāti Tahu ki Ohaki) on the banks of the Waikato awa. Repo and ngāwhā in foreground. This photo conveys a complex cultural and hydrological system, and the importance of understanding intersectionality for best freshwater modelling and outcomes.

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Executive Summary

This report was commissioned by the Parliamentary Commissioner for the Environment (PCE). It contributes to an investigation on the suitability of freshwater models for use in a range of regulatory settings in Aotearoa New Zealand. As an Officer of Parliament, the PCE Simon Upton, is independent from the government of the day. His role is to provide clear independent advice to the New Zealand Parliament that influences decisions on environmental issues. This report contributes to that robust information base, ensuring a thorough consideration of Tāngata Whenua in this context to support good advice, well informed by mātauranga Māori.

The investigation for this report examines Tāngata Whenua use of freshwater models, or involvement in modelling processes. A stocktake of 33 models provided breadth of analysis, and simple trends are identified through the aid of a 'traffic light system'. Three specific case studies (chosen from the 33 in the stocktake) provided depth of analysis to complement the broader analysis. The significant number of models identified (n=33) demonstrated purposeful use of models by Tāngata Whenua. However, the purpose was generally responding to water quality or quantity issues related to (mis)management of land use activities and degradation of mauri, or consent applications of proposed activities that would potentially cause adverse effects to water bodies. In many cases the use of models was not at catchment scale but the examples provided useful insights and learnings relevant to the research, that may inform catchment scale modelling.

The reactive use of models by Tāngata Whenua was related to the wider resource management context, and the effects-based freshwater management regime developed through the Resource Management Act (RMA). During the past 30 years, under the RMA, societal pressures, and economic productivity (particularly primary industries) has markedly increased, while water quality significantly declined. Management complexities and the need for water quality and quantity models, unsurprisingly, has also increased. Models have generally been employed to help address real or potential adverse effects on water, demonstrating a deficit model.

However, the National Policy Statement for Freshwater Management (2020) and concept of Te Mana o te Wai (TMOTW), a Te Ao Māori concept that must be given effect across all freshwater management contexts, involving all interested parties (councils, community, Tāngata Whenua). TMOTW appears to offer a new space of potentiality for freshwater modelling and management to shift to a more positive paradigm based on wellbeing and abundance. TMOTW includes a hierarchy of obligations which disrupts the status quo of freshwater management to privilege and prioritise the health and wellbeing of waterbodies and associated ecosystems first and foremost, people and animals second, and economic and other interests and values third.

The report found that the NPS-FM 2020 and TMOTW is a game changer for freshwater modelling. In particular due to the necessity for councils to adapt the way they approach modelling, including use of 'best information' and a blanket adjustment regarding model purpose and anticipated outcomes to give effect to TMOTW. Adaptation is necessary to ensure equal valuing of mātauranga and tikanga and equitable opportunities for Tāngata Whenua involvement to their desired extent, in relation to respective catchments within their rohe or takiwā. Although TMOTW is a Te Ao Māori concept, the policy includes roles and responsibilities for councils, tangata whenua, and communities. Modelling that provides for TMOTW will deliver mutual benefits for all.

The holistic and integrated systems approach associated with tangata whenua is unique and highly valuable in the modelling context. What became apparent was the emphasis on 'best information' but lack of attention on 'best practice' for modelling which did not align with Te Ao Māori. Tāngata whenua consider tikanga ('best practice') to be just as fundamental as mātauranga ('best information'), thus prompting subsequent discussion and recommendations regarding this policy gap.

In general, stronger requirements for culturally appropriate and effective modelling that does prioritise TMOTW and ideally shifts the modelling purpose from being reactive to adverse effects on water, to being proactive and outcomes focused for more regenerative and abundant freshwater management pathways. The report considers all things through a Te Ao Māori lens, recognizing issues and gaps in the current system regarding Tāngata Whenua. It then makes recommendations for system-wide improvements that would better empower and enable Tāngata Whenua and the ability to give effect to TMOTW through appropriate design, use, evaluation and accountability in the modelling context.

Note: At the time of publication, a National-led government in coalition with New Zealand First and ACT which does not support the NPS-FM or TMOTW has come into power. On the 20th December 2023 this new government repealed the Natural and Built Environment Act (2023) and the Spatial Planning Act (2023). It has also repealed the Three Waters legislation.

This comment is included because these Acts were fundamental to the resource management reforms referred to throughout this report. Regardless though of which government is in power or which resource management system is enacted at any specific time, the analysis, discussion, and ideas about Tāngata Whenua involvement in freshwater models and modelling that are presented in this report remain poignant.

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SECTION I

INTRODUCTION & METHODOLOGY

Introduction

This report is an in-depth investigation into current use of modelling in relation to Tāngata Whenua and freshwater management. The research involved a stocktake analysis of 333 models, and a deeper dive into three case studies from different rohe and catchments across Aotearoa New Zealand (Aotearoa): Kaipara Moana, Rotorua, and Mohaka me Waihua respectively. Finding a variety of modelling types and purposes being applied by or with Tāngata Whenua, including quantitative, qualitative, and conceptual models.

The report is divided into three sections. The first introduces the policy context and matters associated with Tāngata Whenua and the freshwater modelling context. The second presents findings and insights from the stocktake and case studies. And the third offers a discussion, recommendations for freshwater practitioners (relevant to Tāngata Whenua and councils), and conclusion. The report was written to inform the Parliamentary Commissioner's overall inquiry and report on the topic of modelling and freshwater management at catchment scales in Aotearoa. It will also be published as a stand-alone resource.

This research is not limited to the National Policy Statement for Freshwater Management (NPS-FM). However, the national policy statement is a key regulatory driver of freshwater management, with specific requirements on councils including the implementation of the National Objectives Framework (NOF), and direction for involving Tāngata Whenua and giving effect to Te Mana o te Wai (TMOTW). Therefore, the NPS-FM and TMOTW provide the general focus.

Ideally, the analysis would have included an example of a full collaborative implementation process of the NOF by council, Tāngata Whenua, and community, including the use of models at various stages. However, such an example could not be found. The contexts and insights provided by the stocktake and three case studies instead, give an idea of various possibilities for 'best information' and 'best processes' which could inform system-wide improvements including additions to the NOF.

Freshwater Policy Context

The National Policy Statement for Freshwater Management (NPS-FM 2020) and the National Environmental Standards to Freshwater (NES-F 2020) are Aotearoa's core instruments for national direction on water management under the Resource Management Act (RMA) 1991¹. Successful implementation of both relies on multiple lines of evidence including, but not limited to, modelling. In Aotearoa, the Treaty of Waitangi/Te Tiriti o Waitangi (Te Tiriti) (1840) underpins the basis for a plurality of freshwater governance and management between Māori and the New Zealand Government.

Te Tiriti recognises that Iwi (tribes) and Hapū (sub-tribes) each have their own mātauranga (customary knowledge), tikanga (best practices), kawa (rituals), and rights to rangatiratanga (authority and leadership) and self-determination. The mana (prestige/integrity/authority) and mauri (life force) of Iwi and Hapū is associated with specific rohe (tribal boundaries) and catchments, providing opportunities for both independent and inter-dependent freshwater management and Kaitiakitanga (Māori ethic of care) where interests and potential benefits overlap.

Te Ao Māori or the Māori world and worldview is often used as a catch-all for Indigenous Māori/iwi/hapū worldviews. However, this gives a false impression that there is one homogenous Māori worldview. As indicated, multiple Māori/iwi/hapū views exist – which are based on their rohe, whakapapa (ancestry) and whanaungatanga (relationality) between the respective people and place. Therefore, there is not one Māori view on freshwater modelling and TMOTW. These views will vary between rohe and Tāngata Whenua groups.

Almost two centuries have passed since Te Tiriti was signed. Over that time, the Crown successfully colonized Aotearoa – assuming control and establishing a status quo that privileges western science and values. The current legislative context was constructed through successive governments, subordinating, and marginalizing all things Māori, including mātauranga, tikanga, and kawa (for example through the Tohunga Suppression Act 1907, and banning of Māori language in schools from mid-1800s). Despite that, Māori culture has remained strong in Aotearoa and has been increasingly acknowledged and valued since a notable resurgence of Māori identity began in the 1970s. Te Tiriti is referred to (increasingly) in many pieces of legislation including those that regulate freshwater management.

¹ The Resource Management Act is in the process of being replaced by two new resource management Acts.

For the past 30 years, the RMA ‘regulated’ impacts on the environment through a permissive, effects-based system which focused more on the consequences of activities rather than adequate regulation of the activities themselves. NIWA’s Chief Scientist argues that under the RMA both water quantity and quality have declined (Larned, 2022:4-5). Concerns and demand for more stringent freshwater management increased over time. The past decade saw development of the NPSFM with multiple iterations (2014, 2017, 2020). The most significant change through those iterations for Tāngata Whenua was the increased strength of the concept “Te Mana o te Wai”. The 2020 iteration offered the greatest potential for shifting freshwater management paradigms for Aotearoa, with a requirement that councils “must give effect to Te Mana o Te Wai”. The TMOTW policy is included below.

Te Mana o te Wai Provisions

TMOTW is provided for throughout the NPS-FM (2020). Key provisions are presented below.

Policy 1.3 Fundamental concept – Te Mana o te Wai

Concept

- (1) Te Mana o te Wai is a concept that refers to the fundamental importance of water and recognises that protecting the health of freshwater protects the health and well-being of the wider environment. It protects the mauri of the wai. Te Mana o te Wai is about restoring and preserving the balance between the water, the wider environment, and the community.
- (2) Te Mana o te Wai is relevant to all freshwater management and not just to the specific aspects of freshwater management referred to in this National Policy Statement.

Framework

- (3) Te Mana o te Wai encompasses 6 principles relating to the roles of tangata whenua and other New Zealanders in the management of freshwater, and these principles inform this National Policy Statement and its implementation.
- (4) The 6 principles are:
 - (a) Mana whakahaere: the power, authority, and obligations of tangata whenua to make decisions that maintain, protect, and sustain the health and well-being of, and their relationship with, freshwater
 - (b) Kaitiakitanga: the obligations of tangata whenua to preserve, restore, enhance, and sustainably use freshwater for the benefit of present and future generations
 - (c) Manaakitanga: the process by which tangata whenua show respect, generosity, and care for freshwater and for others
 - (d) Governance: the responsibility of those with authority for making decisions about freshwater to do so in a way that prioritises the health and well-being of freshwater now and into the future
 - (e) Stewardship: the obligations of all New Zealanders to manage freshwater in a way that ensures it sustains present and future generations
 - (f) Care and respect: the responsibility of all New Zealanders to care for freshwater in providing for the health of the nation.
- (5) There is a hierarchy of obligations in Te Mana o te Wai that prioritises:
 - (a) first, the health and well-being of water bodies and freshwater ecosystems
 - (b) second, the health needs of people (such as drinking water)
 - (c) third, the ability of people and communities to provide for their social, economic, and cultural well-being, now and in the future.

‘Part 2: Objective and policies’ reinforces the hierarchy of obligations, with emphasis of TMOTW and Tāngata Whenua active involvement in freshwater management by the first two (of 15) policies.

2.1 Objective

(1) The objective of this National Policy Statement is to ensure that natural and physical resources are managed in a way that prioritises:

- (a) first, the health and well-being of water bodies and freshwater ecosystems
- (b) second, the health needs of people (such as drinking water)
- (c) third, the ability of people and communities to provide for their social, economic, and cultural well-being, now and in the future.

2.2 Policies

Policy 1: Freshwater is managed in a way that gives effect to Te Mana o te Wai.

Policy 2: Tangata whenua are actively involved in freshwater management (including decisionmaking processes), and Māori freshwater values are identified and provided for.

Implementation of TMOTW is outlined in *‘Subpart 1 Approaches to implementing the National Policy Statement’*.

Subpart 1 – 3.2 Te Mana o te Wai

- (1) Every regional council must engage with communities and tangata whenua to determine how Te Mana o te Wai applies to water bodies and freshwater ecosystems in the region.
- (2) Every regional council must give effect to Te Mana o te Wai, and in doing so must:
 - (a) actively involve tangata whenua in freshwater management (including decisionmaking processes), as required by clause 3.4; and
 - (b) engage with communities and tangata whenua to identify long-term visions, environmental outcomes, and other elements of the NOF; and
 - (c) apply the hierarchy of obligations, as set out in clause 1.3(5):
 - (i) when developing long-term visions under clause 3.3; and
 - (ii) when implementing the NOF under subpart 2; and
 - (iii) when developing objectives, policies, methods, and criteria for any purpose under subpart 3 relating to natural inland wetlands, rivers, fish passage, primary contact sites, and water allocation; and
 - (d) enable the application of a diversity of systems of values and knowledge, such as mātauranga Māori, to the management of freshwater; and
 - (e) adopt an integrated approach, ki uta ki tai, to the management of freshwater (see clause 3.5).
- (3) Every regional council must include an objective in its regional policy statement that describes how the management of freshwater in the region will give effect to Te Mana o te Wai.
- (4) In addition to subclauses (1) to (3), Te Mana o te Wai must inform the interpretation of:
 - (a) this National Policy Statement; and
 - (b) the provisions required by this National Policy Statement to be included in regional policy statements and regional and district plans.

Subpart 1 – 3.4 Tangata Whenua Involvement

- (1) Every local authority must actively involve tangata whenua (to the extent they wish to be involved) in freshwater management (including decision-making processes), including in all the following:
 - (a) identifying the local approach to giving effect to Te Mana o te Wai
 - (b) making or changing regional policy statements and regional and district plans so far as they relate to freshwater management
 - (c) implementing the NOF (see subclause (2))
 - (d) developing and implementing mātauranga Māori and other monitoring.
- (2) In particular, and without limiting subclause (1), for the purpose of implementing the NOF, every regional council must work collaboratively with, and enable, tangata whenua to:
 - (a) identify any Māori freshwater values (in addition to mahinga kai) that apply to any FMU or part of an FMU in the region; and
 - (b) be actively involved (to the extent they wish to be involved) in decision-making processes relating to Māori freshwater values at each subsequent step of the NOF process.
- (3) Every regional council must work with tangata whenua to investigate the use of mechanisms available under the Act, to involve tangata whenua in freshwater management, such as:
 - (a) transfers or delegations of power under section 33 of the Act
 - (b) joint management agreements under section 36B of the Act
 - (c) mana whakahono a rohe (iwi participation arrangements) under subpart 2 of Part 5 of the Act.

(4) To avoid doubt, nothing in this National Policy Statement permits or requires a local authority to act in a manner that is, or make decisions that are, inconsistent with any relevant iwi participation legislation or any directions or visions under that legislation.

Subpart 1 – 3.6 Transparent decision-making

(1) This clause applies to all decisions made by regional councils in giving effect to this National Policy Statement, including but not limited to decisions relating to clauses 3.4 and 3.15.

(2) Every regional council must:

(a) record matters considered and all decisions reached; and

(b) specify the reasons for each decision reached; and

(c) publish the matters considered, decisions reached, and the reasons for each decision, as soon as practicable after the decision is reached, unless publication would be contrary to any other legal obligation.

(3) In this clause, decision includes a decision not to decide on, or to postpone deciding, any substantive issue and, in relation to decisions about mechanisms to involve tangata whenua in freshwater management, includes a decision to use or not use a mechanism.

Importantly, TMOTW applies to all freshwater management – it is an overarching and fundamental concept across all freshwater management. It is not limited to the NPS-FM but rather informs all other parts of the Ministry for the Environment (MFE)'s freshwater management policies. Nor is it limited to Tāngata Whenua. Rather it provides opportunities for everyone to engage in caring for their local waterbodies and take part in giving effect to TMOTW; Tāngata Whenua, councils, and communities (MFE, 2023).

TMOTW was also adopted into the reformed legislation for Water Services management (the Water Services Entities Act 2022), which operates under the Department of Internal Affairs (not MFE). The WSE Act provides for Tāngata Whenua to (among other things) lodge TMOTW Position Statements in relation to all aspects of Water Services including governance and operations, and investment.

The inclusion of TMOTW across agencies and policy provides opportunities for modelling that is more holistic and integrate – more representative of the hydrological system – because, presumable, to give effect to TMOTW (and manage water sensibly), council plans and strategies must be cognizant of and integrated with Water Services. The need for efficient and increasingly accurate modelling across sectors, regions, contexts will continue to increase alongside societal needs for water security, access, and allocation – which, under TMOTW and the hierarchy of obligations, must ensure the health and wellbeing of the waterbodies first and foremost.

Policy Requirements for Modelling and “Best Information”

There are four uses of the terms “model” and “modelling” in the NPS-FM found in:

Part 1 – Interpretation (1.6 Best information); and

Subpart 2 National Objectives Framework (3.29 Freshwater accounting systems).

1.6 Best information

(1) In giving effect to this National Policy Statement, local authorities must use the best information available at the time, which means, if practicable, using complete and scientifically robust data.

(2) In the absence of complete and scientifically robust data, the best information may include information obtained from **modelling**, as well as partial data, local knowledge, and information obtained from other sources, but in this case local authorities must:

- (a) prefer sources of information that provide the greatest level of certainty; and
- (b) take all practicable steps to reduce uncertainty (such as through improvements to monitoring or the validation of **models** used).

(3) A local authority:

- (a) must not delay making decisions solely because of uncertainty about the quality or quantity of the information available; and
- (b) if the information is uncertain, must interpret it in the way that will best give effect to this National Policy Statement.

...

3.29 Freshwater accounting systems

(1) Every regional council must operate and maintain, for every FMU (*Freshwater Management Unit):

- (a) a freshwater quality accounting system; and
- (b) a freshwater quantity accounting system.

(2) The purpose of the accounting systems is to provide the baseline information required:

- (a) for setting target attribute states, environmental flows and levels, and limits; and
- (b) to assess whether an FMU is, or is expected to be, over-allocated; and
- (c) to track over time the cumulative effects of activities (such as increases in discharges and changes in land use).

...

(5) The freshwater quality accounting system must (where practicable) record, aggregate, and regularly update, for each FMU, information on the measured, **modelled**, or estimated:

- (a) loads and concentrations of relevant contaminants; and
- (b) where a contaminant load has been set as part of a limit on resource use, or identified as necessary to achieve a target attribute state, the proportion of the contaminant load that has been allocated; and
- (c) sources of relevant contaminants; and
- (d) the amount of each contaminant attributable to each source.

(6) The freshwater quantity accounting system must record, aggregate, and regularly update, for each FMU, information on the measured, **modelled**, or estimated:

- (a) amount of freshwater take; and
- (b) the proportion of freshwater taken by each major category of use; and
- (c) where a take limit has been set, the proportion of the take limit that has been allocated.

...

There is a strong emphasis on collection and decision-making based on complete and scientifically robust data. Councils are required to have freshwater accounting systems for both quality and quantity for every freshwater management unit (FMU) for which they can use “measured, modelled, or estimated” information. There are no definitions or determinations of what a model is, or what can be considered a model or ‘modelling’.

More detailed information can be found in the Ministry’s *Guidance on the National Objectives Framework of the National Policy Statement for Freshwater Management* produced in 2022 and

updated April 2023. There is a section in the guidance on “*Best information available and use of models*”. The guidance reiterates a preference for real data, rather than modelled, but acknowledges that model use by councils will be necessary in many contexts. For example, “models will be required to identify and understand relationships between values and attributes, and to calculate catchment-scale interactions”. Aside from biophysical aspects, the guidance states (p.31):

Applying mātauranga Māori can also involve models. These can range from conceptual models of relationships within a catchment, to quantitative models developed by tangata whenua.

Although no models are prescribed for use, it is best practice to ensure they meet certain standards so they will provide quality outputs. For the purpose of the NPS-FM, this includes:

- integrating a range of different values, including Māori values, and relationships in a system;
- inputting both quantitative and qualitative data;
- using data that is representative of the catchment or water body type where possible. National data sets can also be useful, and may be necessary, where local data is absent or poor;
- using evidence-based climate projections;
- identifying sources of uncertainty (such as through global sensitivity analysis) and taking action to reduce these;
- ensuring all parts of the model, including all assumptions and uncertainties, are clearly set out and transparently reported; and
- ensuring the information, including modelled data, is representative of the environment and receiving environment. This may include episodic events or total cumulative load to the receiving environment, rather than relying on base flow calculations.

This further guidance offers more clarity for tāngata whenua and mātauranga Māori involvement. Though it is vague and high-level, providing no specific guidance particularly around the ‘how’ which may be necessary where councils have no or little prior experience in this regard.

The lack of explicit provision in the NPS-FM itself, where the language is more heavily weighted towards ‘science’ and scientific certainty, could be inadvertently exclusive of Tāngata Whenua and mātauranga Māori. As Crown Research Institute senior researchers stated in a recent modelling report, the dynamics of collaborative processes, mutual sharing of knowledge, and co-learning through design, development and implementation of models and tools are uncertain and can be uncomfortable. These situations involve a diversity of people, views, and values all assessing the relevance, legitimacy, and credibility of information and making decisions about what and how it will be used (or not). The challenges are associated with more than just communication, but fundamentally different ways of knowing (Duncan, 2016).

In one example, Duncan and Robson-Williams (2018:6) explain, “scientists will have to explain their data, research, models, model inputs and outputs and conclusions to audiences that are likely to have quite different views about what counts as evidence (including forms of knowledge beyond quantifiable science), what is acceptable to extrapolate and model, and the implications for any decision-making that has to take account of uncertainties and unavoidable data gaps (Berkett et al.,

2018; Duncan, 2014; Fenemor, 2014)”. The same difficulties are anticipated for Tāngata Whenua who contribute to collaborative modelling processes, though arguably, they may find it even more challenging given the normative power imbalance that remains entrenched between science and mātauranga at this time.

Each council must meet policy ‘requirements’ but, where a provision is vague or ambiguous (where wording is generally weak rather than an explicit requirement), councils apply their own interpretation. If a council were to choose to interpret ‘best information’ from the policy, in absence of the further guidance which does encourage integration of mātauranga Māori, its information sources could be limited to scientific ones. This tension where expectations and implementation requirements on councils is weak, allows for ongoing privileging of science above mātauranga and maintenance of status quo where a council so decides.

The contention made by late Reverend Māori Marsden (tohunga/expert – scholar, writer, healer, minister, and philosopher) decades ago remains relevant, that for legislation to influence change regarding the ownership, use and management of resources “there must be a commitment to the principles behind that legislation which will not be achieved by enforcement but by a change of attitude effected through intensive education” (Royal, 2003:46). That will be the case for Aotearoa where real transformation in how we engage different knowledges and practices for freshwater modelling and management will rely on the collective commitment to TMOTW by all – Tāngata Whenua, council, and community.

Modelling and the six ‘Te Mana o te Wai Principles’

To support the development of the NPS-FM and TMOTW, Te Kāhui Wai Māori, an independent advisory group to the Minister for the Environment, was established. In 2019, the Kāhui provided a list of recommendations to the Minister for the Environment to guide a managed transition to a new system of care and respect for water. Figure 1 below is taken from the Kāhui’s report (Te Kāhui Wai Māori 2019:4). The figure conveys the Tiriti basis for giving effect to TMOTW, with the provision for leadership from both Tāngata Whenua and Tāngata Tiriti and equitable principles for both worldviews and systems (Mana Whakahaere; Kaitiakitanga; Manaakitanga; Governance; Stewardship; and Care and Respect).

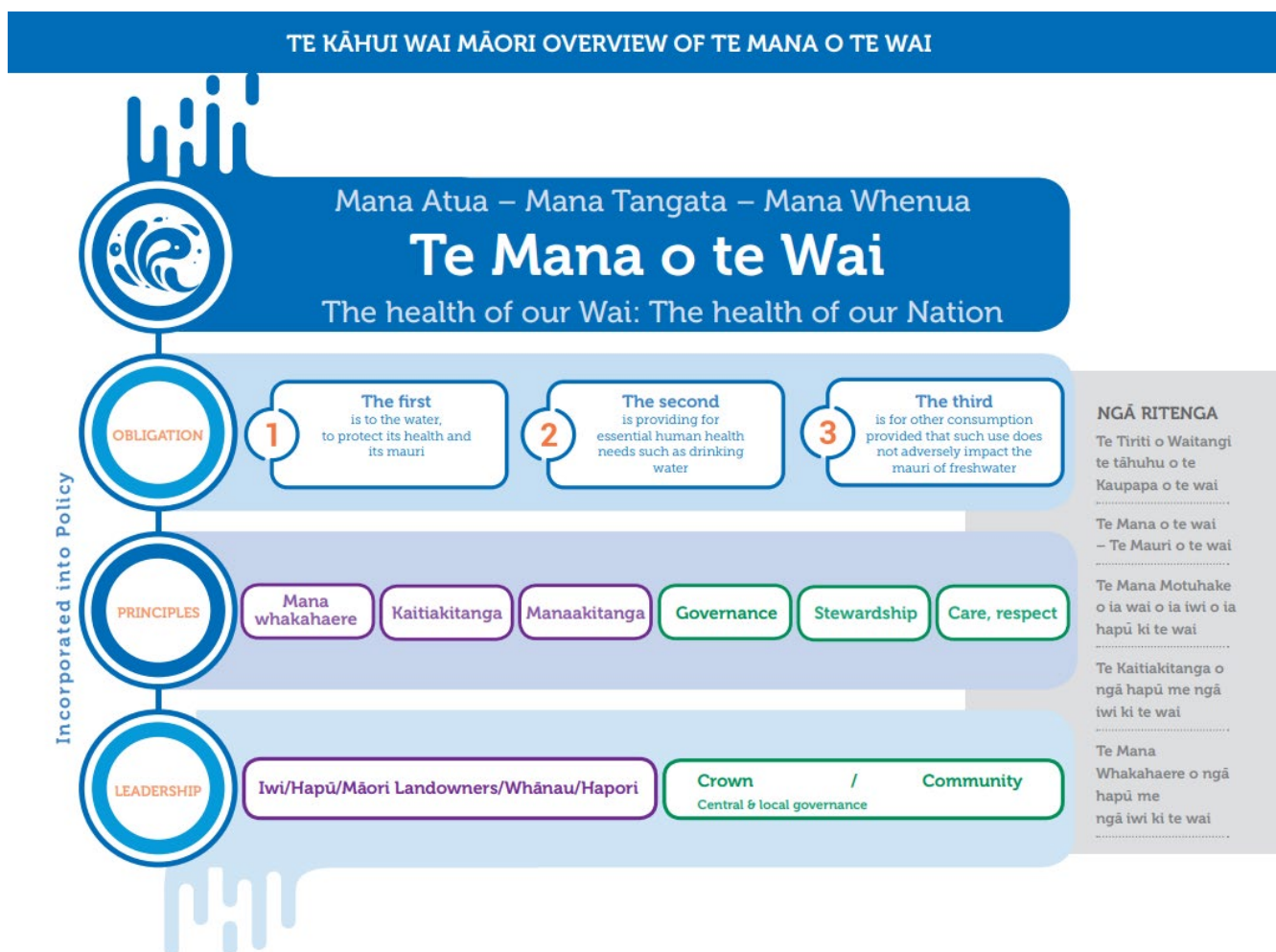


Figure 1: Te Mana o te Wai as conceptualised by Te Kāhui Wai Māori. (Source: Te Kāhui Wai Māori, 2019).

In effect, the TMOTW principles are positioned around three key concepts albeit from two different starting points or worldviews (Te Ao Māori and Te Ao Pākehā), rather than six discrete and totally

independent principles. The model in Figure 1 posits that adequate empowerment and enabling of TMOTW principles across both cultural systems will provide for the Hierarchy of Obligations, beginning with the health and wellbeing of the water itself. Tāngata Whenua can determine what the three respective Māori metrics mean for them for each FMU they have interests in. Councils will need to work with them, and communities, to find ways to give effect to each aspect.

In cases where there is an absence of complete and scientifically robust data, modelling might be employed to assist with finding solutions and implementation pathways. For example, if a Hapū wants to restore the mauri of a waterbody to a certain standard, qualitative and/or quantitative modelling might support their understanding of what has caused the degradation of mauri and what needs to be done to restore it. This could include monitoring mauri over time to determine whether the objective is being met or not.

A variety of models will be needed across many FMUs in response to different water management issues and contexts. It is the council's role and responsibility to offer access, awareness, and provision of information about the benefits and limitations of different models, so that together all parties can give effect to TMOTW.

Tāngata Whenua Involvement “to the extent they wish to be involved”

The policy direction for local authorities regarding Tāngata Whenua involvement (refer wording below), is that they “must actively involve tangata whenua (to the extent they wish to be involved).”

- 1.4 Tangata whenua involvement
- (2) For the purpose of implementing the NOF, every regional council must work collaboratively with, and enable, tangata whenua to:
 - (a) identify any Māori freshwater values (in addition to mahinga kai) that apply to any FMU or part of an FMU in the region; and
 - (b) be actively involved (to the extent they wish to be involved) in decision-making processes relating to Māori freshwater values at each subsequent step of the NOF process.

Mahinga Kai is one of four “compulsory values” in the NPS-FM which is centred around Tāngata Whenua interests and must be included in the NOF process for all FMUs. Regional councils must work collaboratively with, and enable, Tāngata Whenua to identify additional Māori freshwater values in FMUs should they wish. The other three compulsory values are: ecosystem health, human contact, and threatened species.

There are numerous aspects regarding Tāngata Whenua illustrated in Figure 2, that they may wish to be involved in. Many of those might involve modelling, in which case if Tāngata Whenua wish to be involved there is a requirement on councils to make that possible in ways that are appropriate (i.e. inclusive and enabling of mātauranga and tikanga).



Figure 2: Areas for Tangata Whenua engagement (Source: Poipoia Ltd, 2022:27).

Te Mana o te Wai beyond policy

TMOTW is the first policy instrument within Aotearoa New Zealand’s environmental legislation and policy that recognizes and gives effect to environmental sovereignty, in this case te mana (the authority or sovereignty) o te wai (of water itself). Mana whenua are the only ones that can articulate (through whakapapa) what TMOTW means within their rohe and in relation to their freshwater taonga. The implication being that (by default) TMOTW is also the first provision specifically giving effect to the mana, and inherent obligations of Kaitiaki or mana whenua.

What TMOTW looks like, and how models might support and assist giving effect to TMOTW (i.e. what qualifies as ‘best information’ and in particular how modelling can support measuring, restoring, and proactive management for the ‘mauri’ of water) is evolving through practice across rohe and FMUs. However, the conceptual model of TMOTW and the Hierarchy of Obligations which has already been established (and required) through the NPS-FM (2020), offers greater certainty for Tāngata Whenua involvement and mātauranga than previous policy. Restoring the mauri and mana

of water through effective implementation of this Te Ao Māori based model will provide mutual value and benefits for all of Aotearoa, now, and future generations. If councils can acknowledge and comprehend this value offer, it should bode well for increased valuing of mātauranga and creation of space within their current structures and institutions to enable more Tāngata Whenua involvement in freshwater modelling.

Aratohu (Māori models)

A mātauranga-based freshwater (and broader environmental) management paradigm is people and place-based and recognises the interconnections between all things. Holistic data analysis, positioned in a particular place or time within Te Ao Mārama (the world of light and enlightenment in which we live in the everyday), is required to consider the many interrelationships and complexity within the whole. Mātauranga-based ‘best information’ engages intuitive logic and a conceptual mind. Rather than attempting to define a phenomenon, the inquiry usually focuses more on the web of relationships that surround it (Wilson, 2009).

For Tangata Whenua, ‘best information’ traditionally was oratory and more heard and felt than seen or read. As Sir James Henare famed orator of the 20th century explained our indigenous philosophy and hermeneutics are oratory. An oral literature reflecting people and place from te ao tawhito, the old world and oral society, preserved for centuries by memory, through various forms of literary art including whakataukī (proverbial sayings), pūrākau (narratives, often poetic and/or metaphoric), waiata (song) and so on (McRae 2017).

Today, this oral literature is often referred to as ‘ngā kōrero tuku iho’ or narratives handed down across generations, to inspire and inform ongoing embodiment, observational learning, and evolution. Henare described traditional oratory as “a veritable treasure house of genius, wit, condensed wisdom and silent telepathy in the storied souls of our ancestors calling across the ages to their descendants struggling towards the cultural light” (2001:199).

Figure 3 demonstrates the vast pool of knowledge and cultural regulators (including tapu, mana, wairua, hau, mauri) underpinning the ethic of Kaitiakitanga or environmental care. Cultural regulators exist across metaphysical (unseen) realms and physical bounds (Te Ao Mārama: the world of light in which we all exist), binding our freshwater system and other natural taonga together through whakapapa to provide the overall flow of energy and vitality. This intricate relationship is what sustains ‘ecosystem services’ or benefits to people and the economy (Harmsworth and Awatere, 2013).

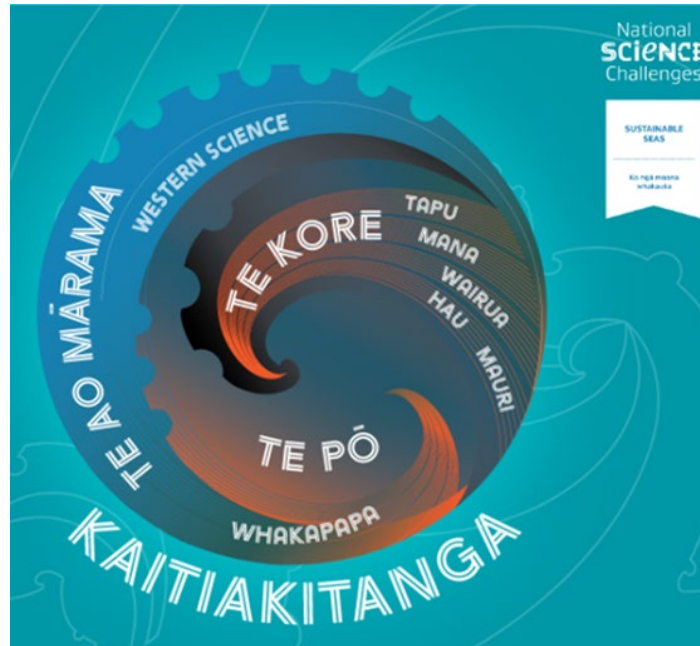


Figure 3: Enabling a Plurality of Management Systems. (Source: Taylor et al., 2022).

Aratohu is a term used to describe “Māori models”. Ara meaning direction, and tohu meaning indicator or sign that tells us something. The term encompasses the evolution of mātauranga and tikanga through spirituality, metaphysics, and philosophy – all linked to material, oral, and psychological cultural aspects (as conveyed in Fig. 3). In the freshwater context, aratohu are models that can support freshwater management and help us as a society to move towards giving effect to TMOTW.

What is meant by ‘models’ or ‘aratohu’ differs between people, place, context. There is a general distinction between conceptual models which are generally qualitative (such as the Māori creation story, TMOTW, or the associated Hierarchy of Obligations for freshwater management), whereas other types of models are quantitative (including mathematical modelling, statistical modelling, and geographic information systems).

A good example of Māori modelling in the freshwater context is the plethora of models that Mahina-a-Rangi Baker (2019), applied to her doctoral research and development within the NPS-FM context for and with her Iwi, Ngāti Awa (refer Table 1 below). Baker was an appointed member of Te Kāhui Wai Māori and is recognised as a leader in this topic for Aotearoa.

Table 1: Different model types illustrated by Ngā Kete o te Wānanga Framework. (Source: Baker 2019: Table 7.1).

NGĀ KETE O TE WĀNANGA	Purpose	Type of knowledge	Tools	Knowledge created in this research
Te Kete Tua-uri	To make meaning of what cannot be directly observed in the world To inform our interpretation of knowledge from Te Kete Aronui, or what we observe	Knowledge of the metaphysical 'real world' beyond what is observable	<ul style="list-style-type: none"> • Kaupapa-tikanga-huanga framework • Hua Parakore framework • Document analysis • Structured interview • Wānanga • Online survey 	<ul style="list-style-type: none"> • Iwi Kaitiakitanga Plan • Te Āti Awa ki Whakarongotai ontology of water • Te Āti Awa ki Whakarongotai Freshwater Health Index
Te Kete Aronui	To make meaning of what we see in the world To inform the creation of knowledge from Te Kete Tua-ātea, our knowledge of how the future will look	Knowledge of the observable world	<ul style="list-style-type: none"> • Influence matrix • Contaminant testing • Fish surveys • Meteorological monitoring • 'Ko te mana, Ko te māramatanga' auditing • Social science survey • GIS 	<ul style="list-style-type: none"> • GIS map of mahinga kai and other sites of significance • Ecotoxicology data • Fish abundance and diversity data • Data on quality of decision-making • Data on intergenerational knowledge transfer • Social survey data
Te Kete Tua-ātea	To have meaningful knowledge of how different scenarios may look	Knowledge about infinite possible realities	<ul style="list-style-type: none"> • Mental models • System narratives • Wānanga • Flow diagram • BBNs 	<ul style="list-style-type: none"> • Conceptual model of water system • BBN model and inferences of water system health • Complete Ngā Kete o te Wānanga method for developing mātauranga Māori inference models

Note: GIS = geographic information system, BBN = Bayesian belief network

Baker's work shows the use of multiple types of models, on the basis of addressing their research purpose regarding tino rangatiratanga in freshwater management. This use emphasises both the potential uptake of quantitative modelling alongside qualitative by Māori, and the importance of doing so within a framework that is culturally appropriate.

Towards a plurality of modelling

There is great potential for western science and other Tangata Tiriti systems to co-exist alongside mātauranga, demonstrated in Figure 3 where the two are positioned alongside one another in Te Ao Mārama. The NPS-FM and requirement to give effect to TMOTW offers a space of potentiality.

However, in practice, giving effect to TMOTW will require confidence and trust in sources and types of data that draw on mātauranga (best information) and tikanga (best practice), as well as 'scientific' information and other knowledge and practice systems. New ways of modelling will need to be developed that can recognise and provide for more than just one kete of 'best information' or knowledge. Successful processes and outcomes regarding mauri and mana will also require

commitment by all involved to the Te Ao Māori principles, and model of TMOTW, underpinning the NPS-FM.

Methodology

This research involved three core components:

1. A desktop-based stocktake of models developed and used by, or in close collaboration with, Tāngata Whenua.
2. Three case studies that provide a deeper dive into examples from the Stocktake.
3. A summary report to share key findings from both and a critical analysis and discussion to inform freshwater modelling in Aotearoa and how we might give effect to TMOTW.

The stocktake analysis focused on 33 relevant models which were identified through primarily desktop research and several word-of-mouth recommendations early in the process.

Each model was analysed against the five key TMOTW and NOF requirements on councils, and the six TMOTW principles (which have been outlined in earlier sections above).

The analysis was a subjective process, conducted by a Māori researcher and resource management practitioner equipped with skills and expertise in freshwater management and Tiriti-centric policy work, meaning that the resultant stocktake and discussion has an indigenous and environmental justice bent.

The application of a traffic light coding system provided a simple visualisation of strengths and weaknesses, supporting quick and easy identification of patterns and trends. That analysis was supported by general considerations: a short description; how it was developed; its purpose and whether the model is/can be used for NPS-FM implementation; alignment with an FMU; and the extent of council commitment.

The full stocktake (spreadsheet showing the 33 exemplar models) is included as a spreadsheet available on the PCE website.

SECTION II

STOCKTAKE & CASE STUDIES

Stocktake

Disclaimer:

The 33 examples offer a range of insights into modelling by, or in collaboration with, Māori entities (including Iwi/hapū/whānau/rūnanga) for freshwater management. The stocktake and its results are indicative of the current state of play and provide a useful gauge for considering Māori involvement in freshwater modelling, in accordance with the critical analysis conducted by the report's author.

This collation of relevant freshwater models is not exhaustive. Nor is it definitive. The analysis represents critical thinking undertaken by the author, however, due to time and capacity constraints, not all 33 models were individually verified with each and every model developer and/or user.

Summary of Findings:

The stocktake showed that Māori use of modelling for water *quality* is more common and better documented than water *quantity*. Results included six water quality specific models, comparative to only one specific to water quantity and allocation (noting it is a conceptual model “Ngā Puna Aroha” designed by Māori researchers but not yet applied, refer Taylor et al. 2021).

More abundant than either water quality or quantity specific models were integrated models (n=15) which provide for both types within a single model. Amongst those, several focused-on climate scenarios rather than freshwater modelling but included useful water modelling components relevant to this context.

The 15 integrated models align with MFE's ‘best information’ guidance (refer Section I) which, for the purpose of the NPS-FM, expects “certain standards” including “evidence-based climate projections” along with “integrating a range of different values, including Māori values, and relationships in a system” and “inputting both quantitative and qualitative data”. A consistent thread woven across the models was the use of Mauri as an indicator of freshwater health and wellbeing.

Assisted by the traffic light approach, several trends were identified across the 33 models. These are briefly summarized below.

Stocktake: Traffic Light Trends

There were several exceptionally 'good' (green) and 'bad' (yellow/red) models identified, but the majority (n=19) did not exhibit extremely 'good' or 'bad' results. The dominance of 'green' and 'yellow' across the stocktake is a positive indication that many of the models are enabling Mana Whenua to engage (at least somewhat) effectively in relation to freshwater modelling and TMOTW.

Five models showed high volumes of average to poor (yellow/red) results for the TMOTW metrics. In most cases where those negative results occurred for the Māori-centric metrics, the associated Tāngata Tiriti metrics measured as average to good (yellow/green).

Regarding the three Māori-centric TMOTW principles, the metrics of 'Kaitiakitanga' and 'Manaakitanga' resulted in substantially more good/green and average/yellow results than 'Mana Whakahaere'. An unsurprising trend given the government's general unwillingness to authentically and meaningfully devolve or share governance power and authority with Tāngata Whenua. Even with the transformative rhetoric associated with the NPS-FM, particularly TMOTW, this result implied that significant work was still required by councils to empower and enable tāngata whenua involvement (particularly Mana Whakahaere) in freshwater modelling and management.

Eight models achieved all good/green evaluations, aligning best with the concept of TMOTW across all six key principles, and the five key council requirements for TMOTW and NOF implementation (actively involve Tāngata Whenua; enable application of diversity of values and knowledge; apply Hierarchy of Obligations; meaningful engagement informs model; and integrated approach ki uta ki tai). Of those eight, the majority (five) were designed and developed by Māori, while the other three were developed in close partnership with Tāngata Tiriti (Waikato Dynamic Model; Ngā Puna Aroha; and Te Puna Kōrero).

Only three of the eight examples are currently applied in practice (Mauri Compass; Mauri Model; and Tipa's Guidance Framework). Each of those three are relatively generic and robust – being developed and evolved over substantial time, and intentionally designed to be adopted and adapted for use in various contexts, and by any/all Mana Whenua (as discussed earlier).

Of the other 'best' (all green) examples, two that were under development at the time this was written – the Ōtākaro Digital Twin and the Rokohouia Digital Twin – look particularly promising. Their design is sophisticated and complex, much like the Kaipara example – Tātaki Wai (which is also in development but did not rate as highly in the TMOTW metrics). The most obvious difference between the two 'best' examples and Tātaki Wai, is the former two are Iwi-led and centric models

being developed by and for Ngāi Tahu. Whereas Tātaki Wai, despite being developed under a co-governance umbrella, is being developed primarily by Auckland Council and is specifically focused on sediment reduction and efficiency with little active involvement or attention on Mana Whenua (at this design and development stage).

The other three 'best' models are all visionary concepts developed in response to gaps that currently exist in freshwater modelling. For example, Ngā Puna Aroha was designed to support water allocation that aligns with mātauranga (best information) and tikanga (best practice); the Waikato Dynamic Model was designed to be an integrated model led by NIWA and co-developed with the Waikato River Authority to look at the whole Waikato River catchment (including Taupō); and Te Puna Kōrero is a partnership model between an Iwi collective and council collective.

The challenge of evaluating models with limited information and through subjective methodologies is the uncertainty in assumptions made. This uncertainty was acknowledged and a precautionary approach applied in relevant cases. For example, where 'Mana Whakahaere' involvement is relatively low (such as in the Kaipara, Tātaki Wai example) this is uncertain because the analyst is not Mana Whenua, meaning she is not in the position to make that judgement.

What may seem 'poor' from an outsider's perspective (e.g. if Kaitiaki were not actively involved in the model's design or development), may not account for other factors which could influence a different result if assessed by Mana Whenua (e.g. perhaps that was an intentional strategy decided by their own governance and there may be an underpinning method to this approach).

In the Hierarchy of Obligations column, uncertainties related to the disconnect between the stocktake which sought to identify and evaluate models against their capacity to give effect to TMOTW, and models that were not specifically designed for freshwater management, the NPS-FM context, or to give effect to TMOTW. This tension made it difficult to gauge how well those models would cater for those purposes.

Regarding the five key requirements on councils, the Hierarchy of Obligations showed the most average/yellow results in a single column. There were many examples where it was difficult to judge whether that model would be capable of addressing knowledge gaps in accordance with the Hierarchy. What this does tell us though, is that where there was a good/green or poor/red result in that column that judgement was made with relative confidence (otherwise it would be average/yellow).

Measuring the extent to which 'diversity of values and knowledge' was enabled was challenging. For example, the SOURCE modelling approach used in the six-year NOF process and proposed plan

change for one FMU by Hawkes Bay Regional Council and its respective FMU Mana Whenua entities and communities. Reports, discussions, and objections by Mana Whenua to the proposed plan change strongly suggest that their expectations for involvement in the modelling (and broader) processes were not met. Though the council reported effective engagement which enabled the use of mātauranga. This example is further discussed in the body of the report.

Generally, where there was uncertainty or lack of confidence, a precautionary approach was adopted which tended to result in an average/yellow rating. Therefore, in many cases an average result represents a moderated (precautionary) assessment which could shift either way (good or bad) if further investigated. It is recommended that greater certainty and confidence in a similar stocktake assessment, requires Mana Whenua to undertake the analysis themselves in relation to their contexts and use of freshwater models.

Stocktake: Discussion

Several models were developed and deployed within the NPS-FM context either by or with Tāngata Whenua but with varying extents of Tāngata Whenua involvement. For example, the Wai Ora Wai Māori model and App was developed by Iwi and Manaaki Whenua Landcare Research Kairangahau Māori (Awatere et al. 2017). It focuses on water quality with both qualitative and quantitative components, and since development has reportedly been considered by other Māori groups in different rohe. Ngā Kete o te Wānanga (Baker 2019), developed by, with, and for Te Āti Awa ki Whakarongotai as part of a PhD inquiry, is a leading example of development and implementation controlled and managed by Iwi, which offers useful insights for other Tāngata Whenua and councils to consider. In a third example, Hawkes Bay Regional Council provided funding for a pilot study whereby hapū had an opportunity to develop a cultural monitoring framework. The model was developed using a clear seven-step Wai māreparepa mātauranga and tikanga based process and tested at this location and another related marae and hapū, with positive feedback at the time from the two hapū.

The common strength of these examples is that they are informed by mātauranga Māori 'best information' and tikanga 'best processes/practices' and respond to Tāngata Whenua values and aspirations, all through Māori leadership and management of the process and outcomes. A weakness regarding the NPS-FM and catchment scale management though, was that the purposes

and outputs of the models tended to focus on a specific part of the overall freshwater management picture (such as management of a single spring, or potential impacts of a proposed activity like wastewater discharge on a waterbody). Therefore, the effectiveness and outcomes of these models is uncertain, particularly at a catchment scale (e.g. refer to Awatere et al. 2017; Baker, 2019; HBRC; 2016; HBRC, 2015 in the stocktake table).

Theoretically, these three models (as examples) could be integrated with or considered alongside science-based models and knowledge. In that manner, regarding the NPS-FM and TMOTW, they could be used to organise, collect, analyse, interpret, and report indicators to monitor the shifts and changes in mauri; to respond to issues, inform planning and policy, plan actions, and underpin the long-term sustainable management of their streams and other taonga.

The value of each model is certainly significant for each entity involved and the individual freshwater management contexts in which they are applied, but it is unclear how the models could or would become a part of a wider NOF process in collaboration with councils and communities for the respective FMUs. Or furthermore, how the data produced could inform and translate into policy and plans for greater influence beyond, say, whenua Māori. Current use of most of those models seemed to be ad hoc in time and space – with a trend where models are developed by/for/with Tāngata Whenua, followed by little noise or ongoing discussion about the use of those models' post-development (such as the HBRC-funded pilot study or the Cambridge wastewater-related example).

Funding limitations and use of 'pilot studies' by councils may be a key contributing factor for limited use of models. This could be a consequence of tight and constrained budgets and attempts by councils to try something out with no real long-term commitment or obligation. However, this ad hoc application seems to reflect more than limitations in funding and resourcing. The research showed limitations in capacity and capability (sometimes on councils' behalf, other times Tāngata Whenua), scope, and space to operate in an alien system. The last two points are in reference to the trend where modelling has been mostly used for responsive purposes, most often related to activities controlled by councils that have or will degrade the mauri of waterways (e.g. uses of the Mauri Model and Mauri Compass for consenting processes often related to storm and wastewater discharges).

For example, the HBRC's funding of Ngāi Te Whatuiāpiti marae/Ngāti Whatuiāpiti Tuturu o Kahungunu to develop a mauri monitoring framework for the Papanui Stream sub-catchment coincided with the HBRC's Ruataniwha Water Storage Scheme proposal (potentially the country's largest water storage dam), to support irrigation and land use intensification in the catchment. A targeted investigation by the council more than a decade ago found that Papanui was a major source

of phosphorus to the Tukituki River and that “sources of phosphorus in the catchment were poorly understood”. Phosphorus concentrations were reportedly increasing over time and it was expected that the “provision of additional irrigation water from the water storage project increases the potential for land use intensification in the Papanui catchment” which unless remedied and managed appropriately, would lead to further phosphorus and sediment export from the catchment (Lynch 2013:i). The development of the mauri monitoring framework was funded around that same time, with initial hapū feedback on the model being positive. Despite that value placed on the model, there is no evidence to indicate any ongoing funding from HBRC for maintenance, use and/or further development of the model. Māori use of models for more generalised freshwater management and not just consenting purposes seems to have increased more recently, including the development of more versatile frameworks and tools which can be used in varied contexts. That trend was illustrated by the examples above and can also be seen in the use of Cultural Health Assessment models such as Tipa’s Cultural Health Index (2004) and more recently developed ‘Guidelines for Undertaking a Cultural Flow Preference Study’ (2018). Generally though, Tāngata Whenua ability to engage in modelling that concerns their whole rohe and freshwater interests appears to remain very limited.

The gap in the use of models by, with, and for Tāngata Whenua in relation to the NPS-FM does not correspond with a lack of need for such models. On the contrary, conversations with Kaitiaki and freshwater managers and practitioners, and substantial desktop research, the need for greater awareness of information gaps and opportunities and capacity for modelling via regional councils is necessary and urgent. Unfortunately, entrenched use of modelling for ‘deficit’ purposes, such as consenting, falls far short of the more transformative ‘outcomes’-focused modelling which TMOTW could support a shift towards.

Several models noted above though are under development, or have been envisioned, to fill the gaps that currently exist. For example, Nga Puna Aroha (Taylor et al. 2020) proposed a tikanga-based freshwater allocation framework and model to support freshwater accounting systems thinking; and Ngāi Tūāhuriri Ngāi Tahu/Christchurch City Council in partnership with the University of Canterbury are developing a digital hydrological twin of the Ōtākaro (Avon) river catchment with ecological, infrastructure, mahinga kai, and climate change data inputs.

Particularly concerning was the lack of awareness and subsequent lack of engagement by Tāngata Whenua in freshwater accounting models, such as the one under development for Kaipara Moana (one of the case studies considered in this report). There are specific NPS-FM requirements on councils to include freshwater accounting systems for every FMU. Theoretically, that provides an

opportunity for Tāngata Whenua to be involved to the extent they wish to be. However, research findings showed that, on the ground, all of those engaged in this research were unaware of this requirement or the significance of being able to influence freshwater accounting (and allocation) in and across their rohe (via FMUs).

With respect to the TMOTW metric results, there was a clear division between results for the Te Ao Māori metrics (Mana Whakahaere, Kaitiakitanga, Manaakitanga) versus the broader Tāngata Tiriti metrics (Governance, Stewardship, Care and respect). The trend where Mana Whakahaere was strong but Governance weak, likely reflected a Māori-led and centric model where the users focused on their own interests and limited their efforts to ensure provision of Governance (due to their priority being Māori outcomes). Whereas in cases where Governance was relatively strong (green/yellow) but Mana Whakahaere was weak (yellow/red) the trend seemed to reflect a model and/or process that reinforced status quo of privileged western values, knowledge, inputs, and outputs over mana whenua equivalents. Further research would be required to test those assumptions. The stocktake conclusion is that no 'perfect' model, ready for adoption and adaptation Aotearoa-wide to give effect to TMOTW, currently exists in the freshwater context. The analysis provided useful insights and helped to identify simple trends, but there were also many limitations. Subsequently, deeper inquiries are necessary to better understand the many complexities. The following section highlights three case studies chosen from the 33 for more in-depth analysis. It starts with summaries of each model which are drawn from the stocktake, then delves into more detail and interpretation informed by interviews, hui, and site visits.

Stocktake: Summaries – Case Studies

Rohe	Model: Name, Year, Who, Where Reference/Link	Type/ Short Description	Key Drivers	5 Key Council Requirements	TMOTW, 3 Key Tangata Whenua Principles	TMOTW, 3 Key Tangata Tiriti Principles	Scale	Council Investment & Commitment
Kaipara Uri; Kaipara	Kōrero Tuku Iho, in development (eta 2025), KMR including Kaipara Uri, KMR Joint Committee 1 May 2023	Conceptual model Intention to establish a series of case studies in places of significance to local tangata whenua communities of the Kaipara catchment. The goal is to work towards restoring the health, wellbeing, and mauri of specific locations through a range of cultural (kaitiaki) actions including building cultural competency through history learning, waiata creation, and ceremonial application. Through practical application, the case study communities will investigate what successful implementation of kaitiakitanga takes, now and into the future. Each case study is estimated to take 2-3 years. As they progress, so will the Kaipara Uri and KMR's understanding of how and what information could be utilised to inform sedimentation reduction plans, modelling, and other parts of KMR's work programme. Kōrero Tuku Iho is envisioned to build a model of kaitiakitanga that can be replicated across the Kaipara. In the context of TMOTW, the development of Kōrero Tuku Iho might assist Kaipara Uri to articulate "TMOTW". In turn, that may inform other process, strategy, governance, or management frameworks related to waimāori within the catchment that are necessary to "give effect to TMOTW". In and of itself, the model is	Kaitiakitanga Restoring mauri Sediment reduction				Six case studies, localised to sub catchments within the wider Kaipara catchment	Yes – and likely to be maintained to the extent Kaipara Uri want it to be over longer term

		insufficient for NPS-FM/TMOTW implementation. However, it provides a critical and foundational step in the modelling and freshwater management process for restoring the mauri of Kaipara Moana.						
	Tātaki Wai, in development (eta early 2024), KMR including Kaipara Uri, KMR Joint Committee 24 July 2023	<p>Integrated Model/Accounting Model A continuous, process-based accounting framework adapted from Auckland Council's Freshwater Management Tool, will produce sub-catchment level (100-200ha) information across all land that drains into the Kaipara Moana, providing a significantly more fine-scale spatial results than previous models. It quantifies the sediment reduction benefit of a spatially explicit mix of mitigations. The model is expected to be complete by early 2024 and its outputs will include the modelled reduction in sediment load that could be achieved with KMR co-investment. The optimised solution provided by Tātaki Wai is based on:</p> <ul style="list-style-type: none"> - modelled baseline water quality state across sediment and other contaminants, including the sources and amounts of contaminants entering waterways, and a time-series view of key indicators, - catchment specific cost estimates of available mitigations and - a spatialised understanding of opportunities for mitigation. <p>The model inputs the biophysical catchment parameters, the available mitigations, and the available level of investment to model the optimised (most cost-effective) solution that KMR can invest in to reduce suspended sediment and the associated reduction in sediment load (as well as other freshwater</p>	Sediment reduction Restoring mauri Stewardship Care				Multiscalar potential	Yes – service level agreement likely with AC, utilising long-term commitment in AC to FWMT approach for ongoing maintenance, versioning, and improvements

		contaminants and physiochemical parameters) to each river system and the Kaipara Moana. Outputs spatially identify a range of opportunities across the landscape to invest in each mitigation type. Alongside an understanding of cultural values and aspirations and operational realities, these high-resolution outputs will inform programme strategy and operational decisions (e.g. Mātai Onekura). At its current stage, Kaipara Uri are driving decisions at a governance level. The focus is on urgent address of sediment reduction and identifying the most efficient and effective actions on-farm. Restoring the mauri of Kaipara will only be possible through substantial, long-term (trans-generational) sediment reduction. The extent of mātauranga and tikanga influence in modelling for Kaipara is likely to increase as Kōrero Tuku Iho develops, and as Tātaki Wai begins to be implemented. This tool could be used to further consider the NPS-FM (such as Freshwater Farm Plans) and TMOTW. Though it has not been developed for council or landowners to meet freshwater requirements it could be used more purposefully in that regard.						
	Mātai Onekura, in development (2023), KMR including Kaipara Uri, KMR Annual Report 2021 - 2022	Conceptual On-farm planning tool to present information, agree remedial action plan and share information back. Can speak with/to the other (aforementioned) tools in the "digital ecosystem" for Kaipara. For example, draft Sediment Reduction Plans can be (and are being) lodged in Mātai Onekura for various projects across all of the Kaipara catchment. The plans include identified actions and locations e.g. (a map showing a farmers property with	Sediment Reduction Stewardship Care Kaitiakitanga Manaakitanga				Farm scale; potentially sub catchment and multisalar	Yes, yes

		mark ups such as: yellow property boundary; green planting/regen; brown new fencing) and associated budget. Though Mana Whenua were not directly involved in the tools design or development, there are a number of Kaitiaki now trained and employed through KMR that are working as Farm Advisors, involved at a technical level. Influence and impact of mātauranga and tikanga may also increase in respective subcatchments and case study areas as Kōrero Tuku Iho develops - over time influencing the whole catchment. This tool could be used to further consider the NPS-FM (such as Freshwater Farm Plans) and TMOTW. Though it has not been developed for council or landowners to meet freshwater requirements it could be used more purposefully in that regard.						
Ngāti Rangiwewehi; Rotorua	Kaitiaki Flows and management regime in the spring-fed Awahou Stream; (which followed Ka Tū Te Taniwha, Ka Ora te Tangata), 2018-2019, Ngāti Rangiwewehi, GNS Science, Rotorua District Council, Our Land and Water Information	Integrated Model / Water quantity focus Ngāti Rangiwewehi used modelling as a tool to ensure mana over their taonga. It is both qualitative and quantitative, providing an opportunity for whānau to participate and contribute on site at the water source as well as in wānanga settings. Iwi determined TMOTW through mātauranga, which was then modelled alongside western science data. Proving to be complementary, the developers established the validity of the Kaitiaki Flows water management framework, grounded in both knowledge systems. The model supports the Hierarchy of Obligations by ensuring life sustaining force of wai first, and allocation for the communities needs second, with ability to consider water allocation for other purposes as they arise. Kaitiaki flow is defined as stream flow >	Mana Whakahaere Kaitiakitanga Manaakitanga				Puna; Awa; Sub catchment	Yes – Ngāti Rangiwewehi have established a kaitiaki flow and advise that water quality, water quantity and water allocation are determined in the conditions of the joint consent they hold with the Lakes District Council in relation to the Awahou catchment. The Bay of Plenty Regional Council is the consenting agency

		<p>consistent with tangata whenua values (e.g., amenity, environment, and spirituality), identified by iwi-based assessment processes. Flow was determined within the unique cultural context of Ngāti Rangiwewehi, who are kaitiaki (guardians) of Awahou Stream and Taniwha Springs in the Lake Rotorua catchment, as part of a flow management regime designed for the co-managers (Ngāti Rangiwewehi and Rotorua Lakes Council) of the Taniwha Springs municipal water supply abstraction consent. The regime, now part of the Taniwha Springs water supply consent application submitted to Bay of Plenty Regional Council, includes kaitiaki flow as a moving minimum mainstem flow that is 90% of daily mean naturalised flow in the Awahou Stream, permanent flow monitoring of Awahou Stream downstream of Taniwha Springs and a web-based information system. Wide participation by Ngāti Rangiwewehi in the process to define the kaitiaki flow regime underlined the importance of kaitiakitanga and co-management roles to the iwi. The process showed how traditional Māori knowledge can be transferred into policy utilising methodologies that may provide a guideline to iwi engagement in other iwi/science water projects. The only concern is whether the regional council will enable the scaling up of this model, which is what Ngāti Rangiwewehi and other iwi would like to see, both through policy and practice.</p>						
Mohaka ki Waihua; Hawkes Bay	Predictive water quality model, developed by Iwi working group in	Predictive model of water quality and ecological state of unmonitored river sites/reaches to inform the	Mana Whakahaere Kaitiakitanga Manaakitanga				Multiscalar capability	Yes, Uncertain extent of commitment

	<p>partnership with independent providers, 2023</p>	<p>development of the Mohaka Freshwater Plan Tangata Whenua workstream Mohaka me Waihua River catchment mana whenua (Ngāti Pāhauwera, Ngāti Hineuru, Ngāti Tūwharetoa, multiple hapū and marae and Māori land trusts working as a collective). The Māori team leading NPS-FM processes in the Mohaka catchment recently commissioned modelling to provide independent information on the predicted state of water quality and ecology at sites of interest to tangata whenua and on Māori land. Regional Council monitoring sites are sparse (being a remote catchment) and lack spatial coverage of areas of interest to tangata whenua. The models were developed from robust national level information and datasets and will them to understand the likely state of water quality and ecology at sites of interest to them and within their own landholdings. This information will be presented and explored by whanau through wānanga planned for Spring 2023/24 > to assist identification of attribute, targets and limits for the catchments from the perspective of tangata whenua. The models cover almost all river reaches and segments in the catchments, allowing tangata whenua to zoom into any area of a river to examine the prediction and if possible to ground truth that prediction against their own experiences, observations and mātauranga.</p>						
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Case Study 1: Developing a “digital ecosystem” for restoring the mauri of Kaipara Moana



Figure 4: Kaipara Uri’s Vision is to “Restore and protect the mauri of Kaipara Moana”. (Image source: Auckland Council accessed 2023).

Aratohu

... E toru ngā ngaru kei runga i te wai o Te Wairoa... he phenomena... mai i uta ki tai... he wai ka tupu ka whati mai i te awa...i ngā rā o mua, i te wā e ora mārika ana te Taiao, he ngaru nui...ka mimiti haere i roto i ngā tau... kua ngaro... te memehatanga o taua ngaru i te hē o te Taiao...te tuatutanga o te ngāhere... ka heke atu te paru ki roto i ngā awa ririki...

There were three waves on the Wairoa... these were a natural phenomenon... from inland to the sea, there was a build-up of water that broke in the river... in the past, when the environment was healthy, there were large waves... however they have diminished over the years... and have gone... they have disappeared through the degradation of the environment... the felling of the forests... sediment and mud now make their way into the streams and tributaries...

This pūrākau accounts for the environmental changes in the Kaipara Moana and Wairoa Awa over time – the Wairoa being the northern part of the catchment which was, at one time, separated by Tāporapora.

When Kaipara was healthy (before the deluge of adverse human impacts), big waves would break up the river. Land use changes over time resulted in degradation of the catchment and sedimentation

of what had evolved from two separated water bodies into an enormous receiving environment for the overall Kaipara catchment. The diminishing waves up the awa can be associated with the diminished energy and mauri of Kaipara Moana. An example of environmental tohu (indicators).

Another Kaipara Uri pūrākau reminds us of the importance of tikanga – doing things in the correct and ethical manner – lest it result in the demise of people and place.

Rongomai (Ariki of the Mahuhu ki te Rangī) and some crew members settled and built their whareniui (meeting house) on Taporapora. The tupuna (ancestors) used the whareniui to recite ancient knowledge, karakia (incantation), waiata (songs) and whakapapa (genealogy) with rangatira (chiefs) from around the region. This whareniui housed their taonga (treasures) brought with them from Hawaiki.

Rongomai married a wahine (woman) from the surrounding area and relocated his kaianga (village) from Taporapora to Manukapua and the Okahukura peninsula. From this kaianga he used the surrounding land and water to gather kai (food) for the people². However, sometime later, Whakataupōtiki took Māhuhu out to sea and uttered a karakia which caused an enormous storm (he tūpuhi nui) to arise.

Te Uri o Hau whaikorero (oration) passed down from generation to generation talks of Rongomai's drowning and of a great tempest that washed away Taporapora because Rongomai did not perform the appropriate karakia before he went fishing³. This storm made its way inland and such was its force that Tāporapora disappeared under the water.

...

Furthermore, a famous tikanga in Kaipara/Wairoa is the sanction on eating Araara or Trevally, which was formed in response to Rongomai's death. When his body was found, it had been eaten by the Araara. Thus, from that time, no Araara was eaten from the Kaipara/Wairoa.

Context and Purpose

The opening pūrākau foreshadowed the necessity of a model that addresses sedimentation. Kaipara Uri have long identified this need as a key component of restoring the mauri of Kaipara Moana. The second one emphasised the significance of getting things right. Both were sourced from a report provided by the Chair of the Kaipara Moana Remediation Programme called *Te Kawa Waiora: A*

² <https://legislation.govt.nz/act/public/2002/0036/latest/DLM156177.html>

³ <https://legislation.govt.nz/act/public/2002/0036/latest/DLM156177.html>

Tangata Whenua inspired Research Project concerning the health, wellbeing and mauri of the Wairoa River, its tributaries, and environs (Royal, 2021).

The Kaipara case study focused on the co-development of a sophisticated water accounting model, aligned with those pūrākau, being designed to help target efforts in a strategic and efficient way.

A series of models, together referred to as a “digital ecosystem”, are under development to target sediment reduction and help to restore the mauri of Kaipara. Each model can be applied independently. However, each model also “speaks to” the other models. They are interrelated, and able to inform one another in different ways. The three models are:

- Kōrero Tuku Iho:** Conceptual, tikanga based model led by Kaipara Uri which captures iwi/hapū/rohe values and narratives and has potential to underpin and inform all other Kaipara models and Kaupapa.
- Tātaki Wai:** The major modelling investment, led by Auckland Council, which focuses on water quality catchment modelling specifically developed to target investment at key sources of erosion and increase speed, effectiveness, and efficiency of actions.
- Mātai Onekura:** On-farm planning tool focused on soil management and remedial action planning.

The Tātaki Wai freshwater management tool is designed to enable the ten-year Kaipara Moana Remediation (KMR) Programme to target funding to the most highly erodible land in the catchment, identify priority wetland sites for restoration to reduce sediment flows over land, and understand what interventions would offer the most cost-effective reduction in sedimentation to waterways.

KMR project information will also be centrally stored to capture important insights at a catchment and sub-catchment scale, contributing to highly accurate modelling of sediment reduction costs and benefits. Overlaying and underpinning all of that will be Ngā Kōrero Tuku Iho – the narratives and mātauranga of Kaipara Uri which will influence how, where, why, and when things are done.

Catchment Management Profile

Mandated Authorities – Kaipara Moana Remediation:

Iwi:	Ngā Maunga Whakahī o Kaipara; Te Rūnanga o Ngāti Whātua; Te Uri o Hau
Hapū:	Several Iwi and hapū whakapapa (connect) to Kaipara. In addition to Ngāti Whātua hapū there are Ngā Puhī and Ngāti Manuhiri hapū.
Kaipara Uri:	When engaging collectively on matters relating to Kaipara Moana and its catchment, the three entities with closest whakapapa to the Kaipara are collectively referred to as the Kaipara Uri, those being: Ngā Maunga Whakahī o Kaipara Development Trust, Te Rūnanga o Ngāti Whātua and Te Uri o Hau Settlement Trust
Crown Agency:	Ministry for the Environment on behalf of the Crown
Regional Council:	Northland Regional Council; Auckland Council
District Council:	Kaipara District Council; Whangārei District Council; Far North District Council
Key Stakeholders:	Crown Research Institutes; Schools; landowners; business owners (e.g., Fonterra, Dairy NZ, Winstone Aggregates); landcare groups; agricultural industry associations
Tākiwa/Area of interest:	The map in Fig. 5 shows a multitude of marae indicating the cultural significance of the Kaipara and how firmly established Māori occupation is within the catchment.
Freshwater Management Unit:	The boundary line between the regional authorities (Northland and Auckland) cuts through the center of Kaipara Moana. Subsequently, the moana comes under two separate council's FMU regimes (refer Figs. 6-7).

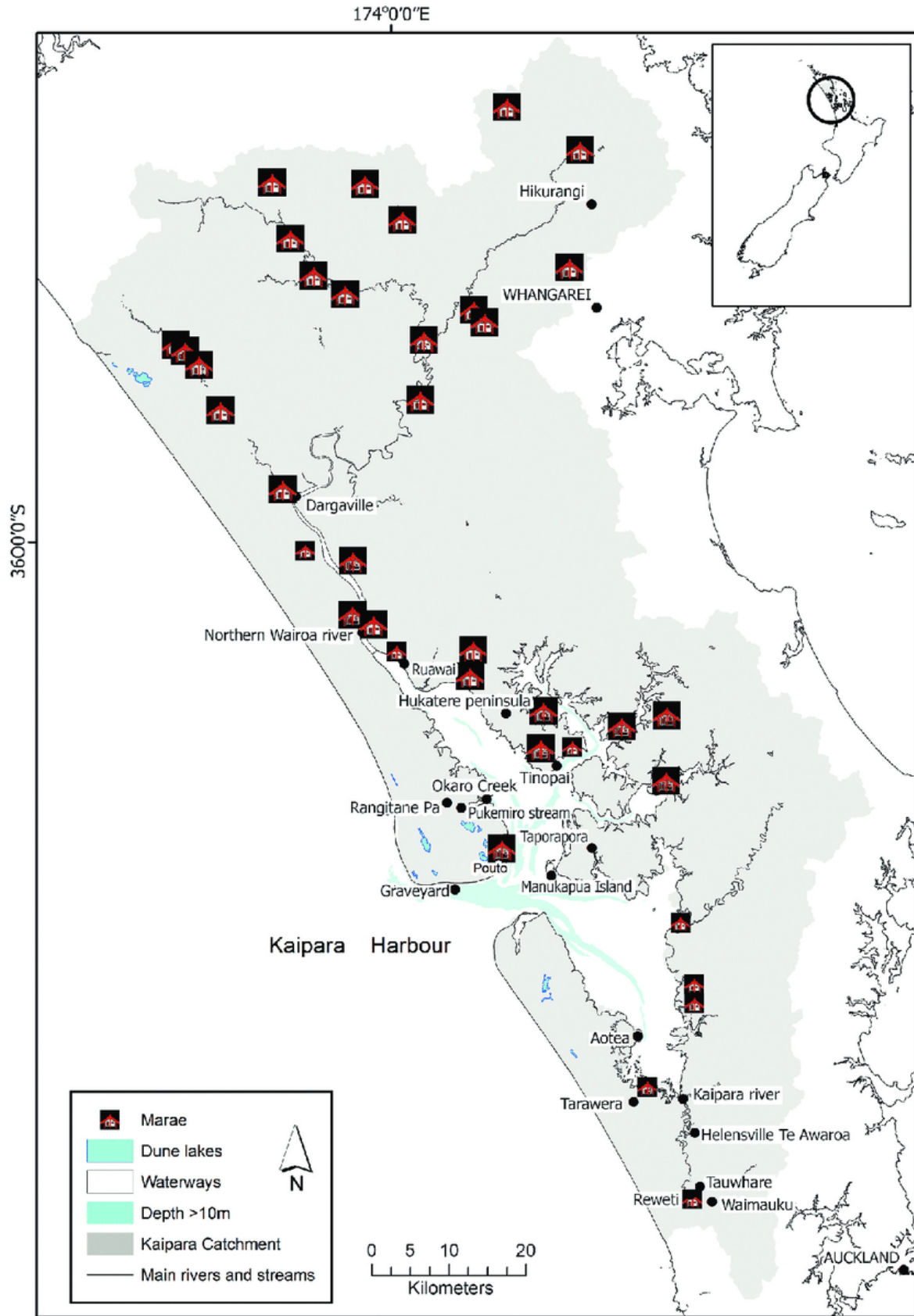


Figure 5: Kaipara moana and catchment with townships and marae. (Inset Aotearoa New Zealand). (Source: Makey et al., 2021).



Figure 6: Northland's FMUs affecting Kaipara Moana. (Source: NRC 2021).

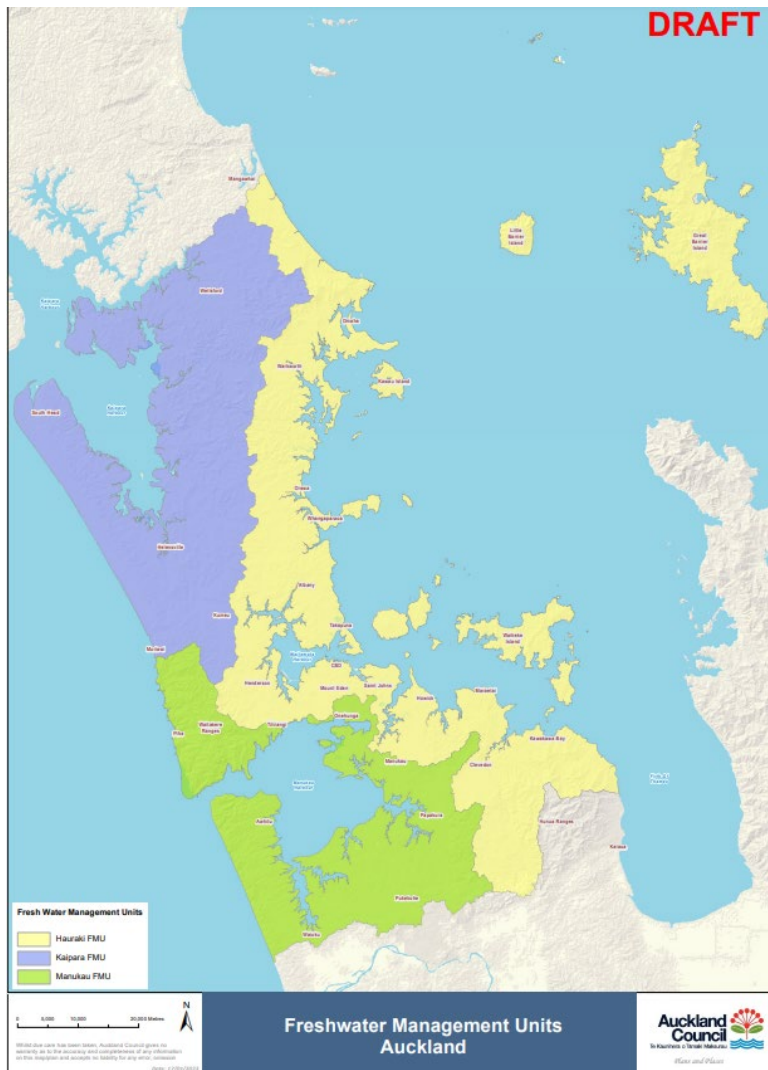


Figure 7: Auckland Council's draft Kaipara FMU. (Source: Auckland Council 2023).

Current Situation

TMOTW for Kaipara, like many places, is associated with and inseparable from its socio-political context. For at least two decades Kaipara Uri has led and organised efforts to address the serious and complex degradation of their taonga, Kaipara Moana.

In 2002, Te Uri o Hau was the first in Kaipara to reach Treaty Settlement with the Crown. The settlement included a Statutory Acknowledgement of Kaipara Moana, which the hapū used to catalyse a whole catchment collaborative, bicultural restoration effort. In 2005 this culminated in the

establishment of the 'Integrated Kaipara Harbour Management Group (IKHMG)'. Because Te Uri o Hau's settlement was earlier than others, the Hapū placed a metaphorical pou (the Statutory Acknowledgement) on behalf of all Ngāti Whātua and Kaipara Uri until such time as all entities had adequate capacity and capability to be involved as active Kaitiaki themselves.

In 2019 the KMR Indicative Business Case was proposed, led by an interim Kaipara Harbour Joint Political Committee, which argued for the development of the digital ecosystem (among other things). Again, this initiative was led by Kaipara Uri alongside other authorities within Kaipara.

Problem Statement

The major issue degrading the mauri of Kaipara Moana is the sedimentation, with approximately 700,000 Tonnes of sediment deposited into the moana each year (seven times more than the pre-human settlement amount) (KMR, 2023). In addition (and related) to the ecological issues were socio-political issues; what some Mana Whenua referred to as the 'governance gap'.

About ten years ago, a quasi-co-governance 'Joint Kaipara Harbour Political Working Party' was established by regional authorities to provide a governance umbrella for the IKHMG. This was to help provide a governance arm in lieu of a formal Treaty settlement arrangement for co-governance of Kaipara Moana which remains 'pending' despite an Agreement in Principle signed in 2014. Mana Whenua were sceptical about the Party's lack of mandate, power, and effectiveness for restoring the mauri of Kaipara (Taylor 2015), spurring efforts to consider alternative pathways for remediation.

Response

The Working Party led the development of the instrumental KMR Indicative Business Case. Over 20 years had already passed since the establishment of the IKHMG and Mana Whenua and wider communities were committed to putting Papatūānuku first. The Business Case was a success. In 2019 Kaipara Moana was the first "At-risk catchment" project confirmed for the Government's Freshwater Work Programme. The Programme recognised that nearly all catchments in Aotearoa were at risk from human activity/ies, and it aimed to deliver national level information to target regulation, investment, and other interventions. 'Exemplar' catchments like Kaipara were chosen as catchment-based models of collaborative freshwater management approaches.

On 9 October 2020, MFE, Ngā Maunga Whakahī o Kaipara, Te Rūnanga o Ngāti Whātua, Te Uri o Hau, Northland Regional Council and Auckland Council signed a Memorandum of Understanding to

establish KMR, a decade-long programme to protect and restore the Kaipara Moana. KMR is intentionally 'inter-generational' acknowledging that sediment level reduction will take time. It is the largest landscape programme underway in Aotearoa, representing new models of co-governance, planning, collaborating and problem-solving to restore the health and mauri of the Kaipara Moana (KMR, 2023).

Substantial funding was invested in the remediation, to kickstart the estimated \$300 million cost of remediation. Initial funding comprised \$100m from the Crown through a Deed of Funding, matched by \$10m each from Northland Regional Council and Auckland Council, as set out in each region's Long-Term Plan (LTP). A further \$80m of remediation activity was budgeted to be sourced in various ways from landowners, industry associations, community, and philanthropic organisations. Such an approach recognises that widespread action across the catchment is necessary, while reflecting that for every dollar of Crown funding, a matched contribution is required.

Development of a digital ecosystem is expected to assist KMR to achieve the vision of restoring the mauri of Kaipara Moana.

The Models:

Kōrero Tuku Iho

The Kōrero Tuku Iho model is a conceptual tool for capturing narratives in relation to Kaipara and the health and wellbeing of her waterways and moana. In the context of TMOTW, this model could help Kaipara Uri to determine what "TMOTW" means to them and the Kaipara community. Narratives offer a basis to inform the NOF and all other processes, strategies, and governance or management kaupapa that relate to freshwater management within their rohe. This model is important for addressing the TMOTW principle 'Mana Whakahaere', because it informs the governance positions and directions, and therefore decision making, of Kaipara Uri.

In and of itself, the Kōrero Tuku Iho model is insufficient for implementing the NPS-FM or TMOTW because it cannot provide a full picture of current and future biophysical states. Tātaki Wai will offer greater scientific certainty and robustness to (ideally) complement the other models. Kōrero Tuku Iho offers a critical foundation to support the identification of values, attributes, and desired outcomes for freshwater management, and ultimately the Kaipara Moana.

Related work has been conducted in the Wairoa catchment in northern Kaipara, with Mana Whenua recording their narratives concerning the health, wellbeing and mauri of the Wairoa River, its tributaries, and environs (Royal 2021). A simple planning template for whānau is provided in the

Wairoa project's report, which provides guidance (a model) for communities to achieve the following:

- Articulate dreams, aspirations and goals regarding the health and wellbeing of the environment and their communities.
- Describe and plan various actions and initiatives designed to achieve those aspirations and success overall.

The template includes ownership, governance, and management aspects, to support community involvement in environmental, particularly freshwater, management. Explicit reference to the Wairoa model is included here because Kōrero Tuku Iho may follow a similar approach. The reference to this template here also provides a reference point assist councils and Mana Whenua that read this report, with collaborative freshwater management initiatives (should they want one).

Tātaki Wai

From a scientific view, Tātaki Wai is a cutting-edge model. It is an operational accounting tool designed for water quality management across catchment scale. It will be used by councils and landowners to target investment (i.e., an accounting model) at key point sources of erosion.

Tātaki Wai is based on open-source models developed by the United States Environmental Protection Agency, used globally to support water management decision-making across a wide range of pollutants, catchment conditions, and management scenarios. Both models used are process-based, continuous models able to forecast the effects of different land use patterns and management interventions on short-term pollution events and long-term water quality. The key relationships between land characteristics, land use, meteorological events, and environmental response are well established, while the conceptual model underpinning the design of Tātaki Wai has been assessed by an independent expert panel to confirm it provides a sound basis to support decision-making in the Kaipara Moana catchment.

Technical products from Tātaki Wai include:

- Geospatial layers – on biophysical and land use information, erosional risk, intervention opportunities (suitable areas at paddock-scale of land on pasture suitable for wetlands, riparian, and highly erodible land interventions) and corresponding contaminant yields.
- Time-series data 2015 - 2022 – on instream contaminants, flow conditions and physiochemistry (to sub-catchment; for baseline, scenario, and managed conditions).
- Action planning strategies – both geospatial and spreadsheet information on the best solutions (x100 incrementally more effective, but least cost, sets of interventions; to sub-catchment).

Mātai Onekura

This third model is an on-farm planning tool to present information, agree a remedial action plan and share information back. This is less of a scientific 'model' but will be used in an interrelated manner with the other tools in the "digital ecosystem" to inform on-farm actions. Data on erosional risk and features is shared with Mātai Onekura and Tātaki Wai, creating benefits for KMR that include:

- Common data used by KMR and its Field Advisors, and that can be accessible to all KMR partners and landholders who are making decisions on reducing erosion and sedimentation.
- Tātaki Wai inputs the biophysical catchment parameters, the available mitigations, and the available level of investment to model the optimised (most cost-effective) solution that KMR can invest in to reduce suspended sediment and the associated reduction in sediment load to each river system and the Kaipara Moana. Outputs spatially identify a range of opportunities across the landscape to invest in each mitigation type.
- Engagement and decisions supported by Mātai Onekura can focus on risks, features, and prioritised opportunities from both fundamental theory (using the data) and integrated catchment accounting (using Tātaki Wai).

Giving Effect to Te Mana o te Wai

KMR were invited to share information with the PCE about its remediation programme and adoption of accounting frameworks. Though appreciative of this opportunity, KMR emphasised that the PCE's focus was more regulatory (i.e. the NPS-FM), which did not intuitively fit with the purpose of Tātaki Wai which was intended to reduce sedimentation (without specific regard for the NPS-FM). KMR agreed that their models are likely to offer valuable insights and implications for NPS-FM implementation (and TMOTW in particular), but were explicit that this case study needed to be contextualised with the model's primary objective and purpose (sediment reduction and restoration of the mauri of Kaipara Moana, rather than freshwater management perse).

To meaningfully consider how the TMOTW principles might align with the Kaipara case study, this section focused on Tātaki Wai. Given KMR's position, the most relevant TMOTW principles for Tātaki Wai are likely 'Stewardship' and 'Care and Respect' because the model, designed and developed by

Auckland Council with little active involvement of Mana Whenua, is primarily intended to support landowners (predominantly Tāngata Tiriti rather than Tāngata Whenua).

Most Significant Te Mana o te Wai Principles:

Stewardship

Tātaki Wai is a distributed model, accounting for local and cumulative effects of major rural resource users (not limited to pasture and inclusive of horticulture and forestry – only optimisation capability is limited to pastoral interventions in the current iteration) from ki uta ki tai, on instream hydrology and physiochemistry. The KMR partnership has identified that managing for the Hierarchy of Obligations in the Kaipara context, requires the management of sediment, with reductions in ongoing erosion needing targeted management to deliver quicker, greater benefit. The objective function led design provides for determining the location and timing for sediment reduction planning. Whilst water quality functions are broader than sediment, initial optimised action planning functions are clearly designed for the most pressing contaminant of resource use in the watershed, causing most marked and widespread degradation in estuarine ecosystem health.

Tātaki Wai will be used to report on agreed and completed actions in sediment reduction plans (from Mātai Onekura) demonstrating outcomes of actions in improving future water quality (e.g., showing stewardship for catchment and waterway health) and enabling adaptive management. Together modelling outputs and place-based priorities can guide a long-term KMR investment strategy. Tātaki Wai's outputs could support a range of engagement with mana whenua, landowners, and communities around opportunities for action to deliver on local priorities for freshwater and the Moana. There are numerous ways that outputs could be translated and used to support local values-led decision-making about where and how to take actions to support objectives. As Tātaki Wai development progresses, KMR is developing a process to ensure users and user needs guide the approaches that are taken.

Care and respect

Tātaki Wai is in development but once completed, it will be used to facilitate farm adviser and landowner action-planning, leading to the development of targeted, evidence-based 'sediment reduction plans' that deliver KMR's vision for least cost. Landowners will choose to apply the model for a variety of reasons. Presumably, this use will be partly motivated by a respect and care for the land and resources being used, which they have a relationship with. Tātaki Wai's design will allow

KMR to forecast the effect of actions in sediment reduction plans and adaptively manage ongoing investments. Importantly, forecasting actions allow KMR to model the future benefits these actions will bring – many years and sometimes decades before these effects are likely to be observable.

Localised outputs demonstrate the connected responsibility of activities for key contaminants affecting health of the Moana and awa. The outputs from Kōrero Tuku Iho will enlighten wider communities, as well as mana whenua, on values and methods for managing freshwater appropriately.

Tātaki Wai is a continuous, distributed and process-based model able to demonstrate the acute and cumulative effects of land use on various measures of water quality producing outputs readily assessed for health of freshwater. Feasibly, the digital ecosystem could encompass values and information gleaned from both a mātauranga lens, particularly through the Kōrero Tuku Iho model, and a western science lens, through Tātaki Wai. To authentically respect and care for Kaipara taonga tuku iho (i.e. Kaipara Moana and her awa) though Mana Whenua may wish to be more involved in future design, development, and use of any/all freshwater management-related tools.

Conclusions

The development of Tātaki Wai responds to the Indicative Business Case and the overall vision and key objective of Kaipara Uri and wider vested parties to restore the mauri of Kaipara Moana. Though Tātaki Wai was not purposefully designed for freshwater management and implementation of the NPS-FM, it will likely assist that outcome.

Regardless of how involved in the design and development phase Kaipara Uri wanted to be, had capacity to be, or were – there will be future opportunities to influence the application and outcomes of Tātaki Wai. For example, Mana Whenua may wish to engage the digital ecosystem through the NOF process, as a mechanism to identify and address freshwater values, outcomes, attributes, and limits.

The restoration and management focus on the moana and marine ecosystems, rather than freshwater, does not preclude the recognition of and provision for TMOTW. Whether freshwater or saltwater is the starting point does not matter. One of the fundamentals of Te Ao Māori is that it is based on inherently, and unequivocally, holistic, and integrated systems thinking. In practice, the whole system will be considered and addressed regardless. Models designed by KMR to restore the mauri of the moana will likely, by default, also restore the mauri (and mana) of the freshwater that flows into Kaipara Moana too.

Case Study 2: Ngāti Rangiwewehi, Freshwater Allocations, and Kaitiaki Flows



Figure 8: Awahou River. (Source: Fine Art Landscape Photography, retrieved from Ngāti Rangiwewehi website).

Aratohu

The Awahou river is a place of healing protected by Pekehaua, the kaitiaki or guardian of Ngāti Rangiwewehi. Te Waro-Uri is the puna from which Ngāti Rangiwewehi life springs forth.

Some say, that Pekehaua carved the river with his tail, and if you dive down deep enough you can still hear Pekehaua swimming around in the depths. It is believed that when you swim in the river you are cleansed and Pekehaua takes away your taumaha or troubles and worries.

Pekehaua made his home in the dark underwater cave called Te Waro-Uri which connected underground channels to other waterways including Hamurana. He would sometimes use these channels to visit Hinerua, a female guardian of Hamurana who lived in Te Puna a Hangarua and the two had tamariki together which were born in the form of teretere or small fish.

In the 1960's the land around Te Waro-Uri was taken by the local council and a pump station was built there which upset the people who thought it would chase away Pekehaua from his home. It was only many years later that the spring was returned to the people of Ngāti Rangiwewehi, some of whom believe that the spirit of Pekehaua and the life-force of Rangiwewehi is now free to return.

(Source: Te Arawa Stories Digital Storehouse, ND).

The significance of Pekehāua is commonly retold by Ngāti Rangiwewehi to emphasise matters of importance. One tribal member recently used the pūrākau of Pekehāua in her Doctoral Thesis, 'Ngā Niho tētē o Pekehāua: An Indigenous Articulation of Governance' (Mahuika 2019). Mahuika framed her theoretical and methodological sections with the following framing (2019:20):

"Anō, ko te Riu o Tāne Mahuta"

In English, this aphorism describes the remains of Pekehāua, as being "like the hollow trunk of Tāne Mahuta", a description of the bare ribs of the taniwha (powerful creature or monster) after he was killed, and the remains of those he had consumed had been extracted from his body. This graphic imagery, and its attendant metaphorical implications, is apt in discussing a uniquely Rangiwewehi way of framing knowledge and the processes we employ to gather, assimilate and engage with our tribal mātauranga (knowledge). Pekehāua had served for a long time as our protector, patrolling our territories and dispatching any rāwaho or foreigner within our tribal boundaries unannounced or unwelcomed. This literal ingestion and embodiment accentuates the key idea that our tribal guardianship is one that, ensures stories and any teachings that traverse our community are appropriately digested in order to be safely and properly housed within a Ngāti Rangiwewehi frame of reference and custodianship... This whakatauākī...reflects our "epistemological constructs", "cultural codes, and world views", and privileges Ngāti Rangiwewehi historical accounts that emphasise the importance of maintaining and protecting our knowledge base as essential to ongoing tribal well-being."

The Thesis was offered as an example in this modelling context because it reflects the mātauranga-a-Rangiwewehi, and the collective mindset, that enabled the development and establishment of the Kaitiaki Flow model. The application of this pūrākau in Mahuika's work highlights the integrity of mātauranga to the Iwi. It cautions others, in this context councils and communities that might engage in modelling with Ngāti Rangiwewehi, to be prepared for critique and testing against the tribe's own values, beliefs, knowledge system, and practices.

Often in collaborative freshwater management initiatives there is a scepticism or cynicism associated with Indigenous knowledge contributions, and a seeming burden of proof on the minority involved. However, here we are reminded that when freshwater management involves their waters and their associations to that taonga, the burden of proof is actually on the council and others that "traverse their community".

Context and Purpose

Ngāti Rangiwewehi developed a process and technical model to assist them to give effect to TMOTW. The development of three core documents was critical for their identification and articulation of values, principles, aspirations, issues, and priorities for freshwater management (refer Fig. 8). The process to identify and assess TMOTW from their perspective, and subsequent model, is Ngāti Rangiwewehi-centric.

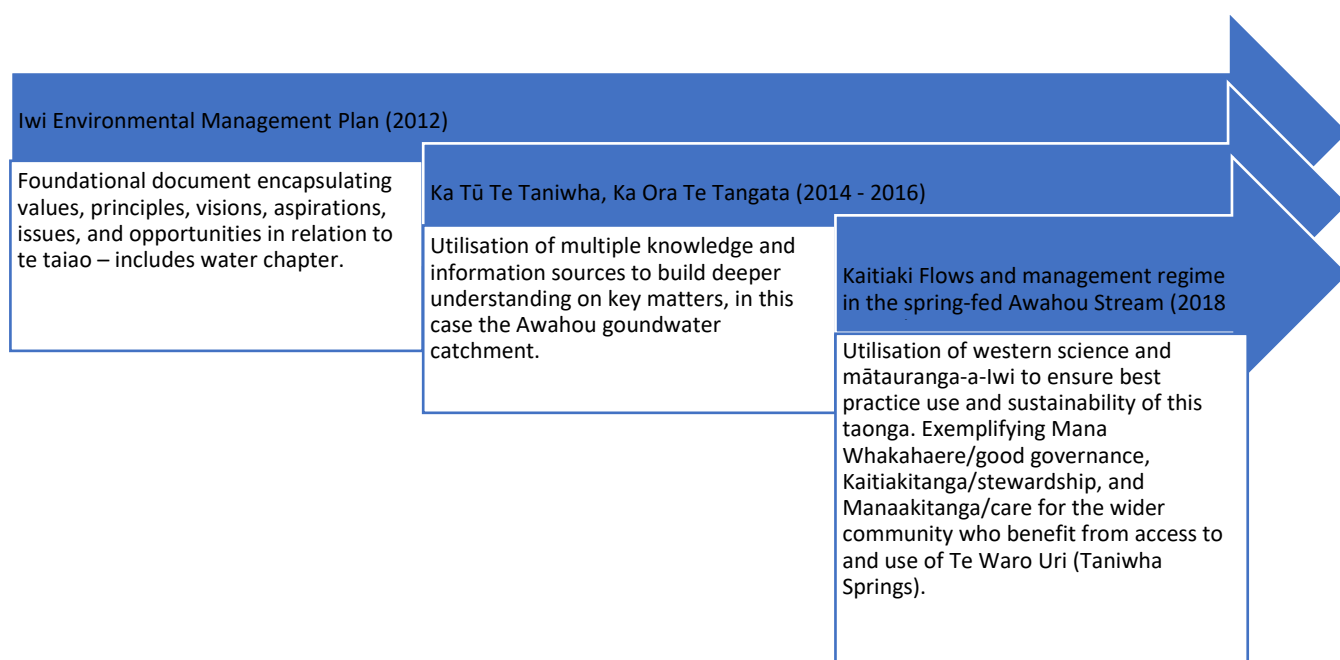


Figure 9: Process Model showing the development of Ngāti Rangiwewehi's freshwater management approach.

The Iwi defined an iwi-science engagement framework (based on Tikanga, Pūnaha and Mahi) to guide their interpretations of kaitiakitanga, mātauranga Māori and pūtaiao/western science in relation to Awahou Stream flow (refer White et al., 2020). This was applied throughout the process of co-developing the Kaitiaki Flows model.

Technical Model

This case study focused on the third and most recent project in Fig. 9, the Kaitiaki Flows and management regime in the spring fed Awahou Stream. The Kaitiaki Flows model (White et al., 2020), and Ka Tū te Taniwha, Ka Ora te Tangata (Ngāti Rangiwewehi, 2015), were both co-developed with GNS Science, building on the content within the Iwi Environmental Management Plan (IEMP). The

model was designed to understand the base flow of the water in-stream system and use the data to establish their own minimum flows for sustainable water take in any water extratio consents. The model assists the Iwi to confidently ascertain flow regimes and advise on allocation and use of their waimāori.

Catchment Management Profile

Mandated Authorities:

Iwi:	Te Maru o Ngāti Rangiwewehi Iwi Authority. Part of the Te Arawa Confederation
Hapū:	Ngāti Rangiwewehi consists of seven hapū: Ngāti Kereru, Ngāti Ngata, Ngāti Te Purei, Ngāti Rehu, Ngāti Tawhaki, Ngāti Whakakeu and Ngāti Whakaokorau.
Regional Council:	Bay of Plenty Regional Council
District Council:	Rotorua Lakes District Council
Key Stakeholders:	GNS Science, Te Arawa Lakes Trust, Te Kotahitanga o Te Arawa Waka Fisheries, Te Roopu Hauora o Te Arawa, Te Whare Hauora o Ngongotaha, Mokoia Island Trust, Te Tumu Kaituna, Mangorewa Kaharoa Te Taumata Trust, Government Agencies

Tākiwa/Area of interest:	Te Waro Uri (Taniwha Springs), Awahou (refer Fig. 10)
Freshwater Management Unit (FMU):	Te Waro Uri is in the Rotorua Te Arawa Lakes FMU (refer Fig. 11)



Figure 10: Core rohe of Ngāti Rangiwēhē and associated ancestral lands. (Source: Ngāti Rangiwēhē Iwi Environmental Plan 2012).

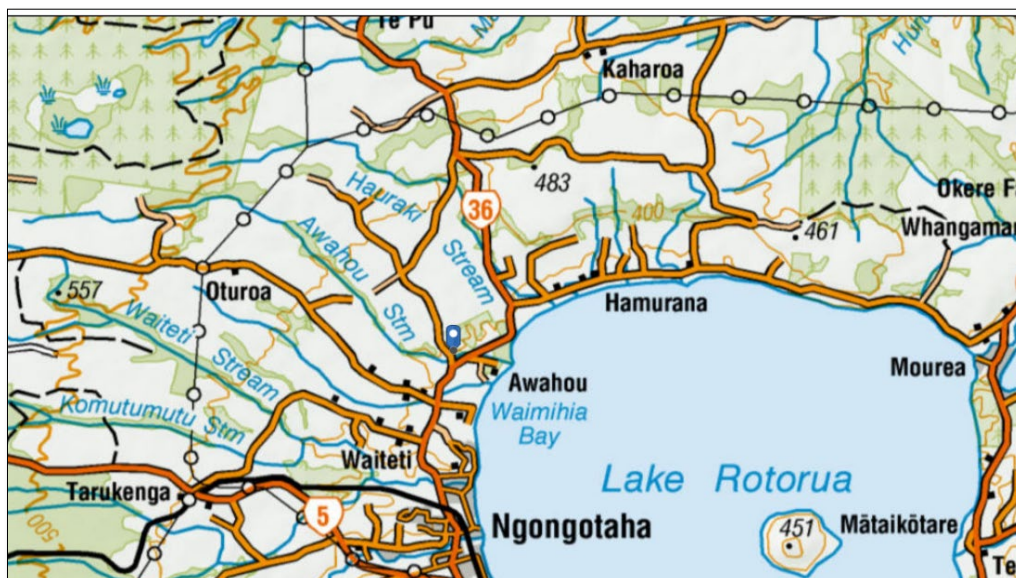


Figure 11: Location of Awahou. (Source: BOPRC 2023).

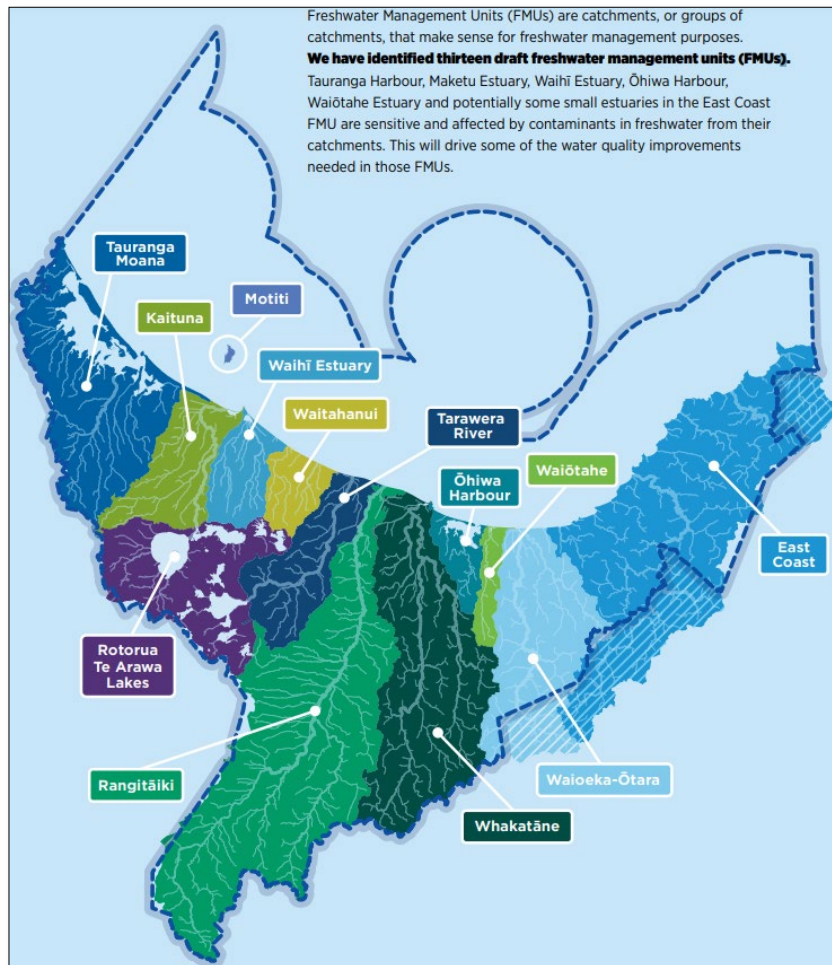


Figure 12: Bay of Plenty Regional Council Freshwater Management Units. (Source: BOPRC 2023).

Current Situation

Ngāti Rangiwewehi is the first Iwi to co-develop a Kaitiaki Flows model based on both mātauranga-a-Iwi alongside western science, which provides the basis for consented take for municipal water supply. The model provides for Ngāti Rangiwewehi in partnership with the Rotorua Lakes District Council (RLDC), to give effect to TMOTW.

The model, unlike any other that was considered for this research, recognises, and provides for all six principles: Mana Whakahaere, Kaitiakitanga, and Manaakitanga in respect of Ngāti Rangiwewehi; and co-governance, stewardship, and care and respect regarding Ngāti Rangiwewehi, councils (BOPRC/RLDC), and communities.

However, the Kaitiaki Flows model for water takes was not built from a clean slate. There is a history of Tiriti breaches, confiscation, and grievances that must be recognised and acknowledged before celebrating the successful development of the model in use today. Thus, a historical overview is provided in the problem statement and response below, contextualizing the rationale and space in which the model was co-developed.

Problem Statement

Te Puna o Pekehāua - Te Waro Uri has great spiritual and cultural significance for Ngāti Rangiwewehi. The puna which is part of a series of puna in this area, was once the home of the great Taniwha Pekehāua described in the introductory pūrākau. Te Waro Uri (also known as Taniwha Springs) is linked by deep underground channels to other waterways and Pekehāua used these channels to visit Hinerua, the female taniwha of Hamurana Springs, another sacred waterway to Ngāti Rangiwewehi. The Iwi knew of these connected underground pathways prior to science confirmation. The whole Awahou-Hamurana complex is of special tribal significance, for spiritual, cultural, recreational, tourism, self-identification and many more reasons. Ngāti Rangiwewehi are Mana Whenua for the whole of the Mangorewa Kaharoa whenua (refer Fig. 13 below), underpinning their right and responsibility to exercise kaitiakitanga over the lands and natural resources. Through traditional and contemporary resource management systems, the Iwi seeks to protect their resources as reflected in their pepeha, purākau and waiata (Te Tari o Ngāti Rangiwewehi, 2021).

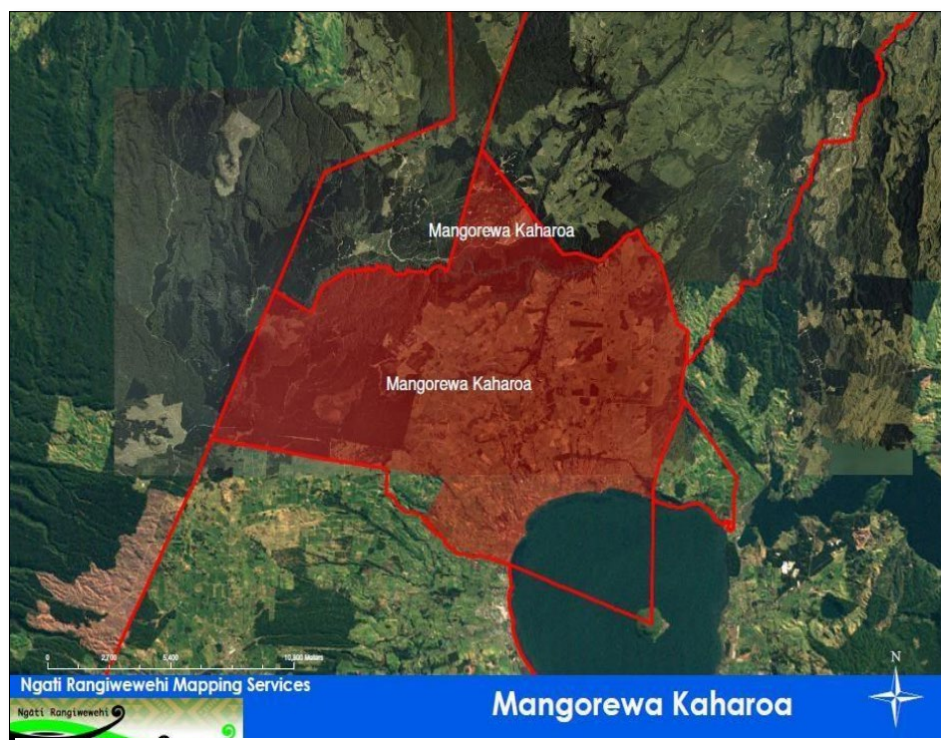


Figure 13: Mangorewa Kaharoa. (Source: Ngāti Rangiwewehi Mapping Services, ND).

However, in 1966 Te Waro Uri, the sacred puna wai (spring), was taken by the Rotorua Borough Council under the Public Works Act for waterworks to supply fresh water to the Ngongotahā area including Awahou. As shown in Fig. 14 below, the area became a designated Local Purpose Reserve under the Rotorua District plan.

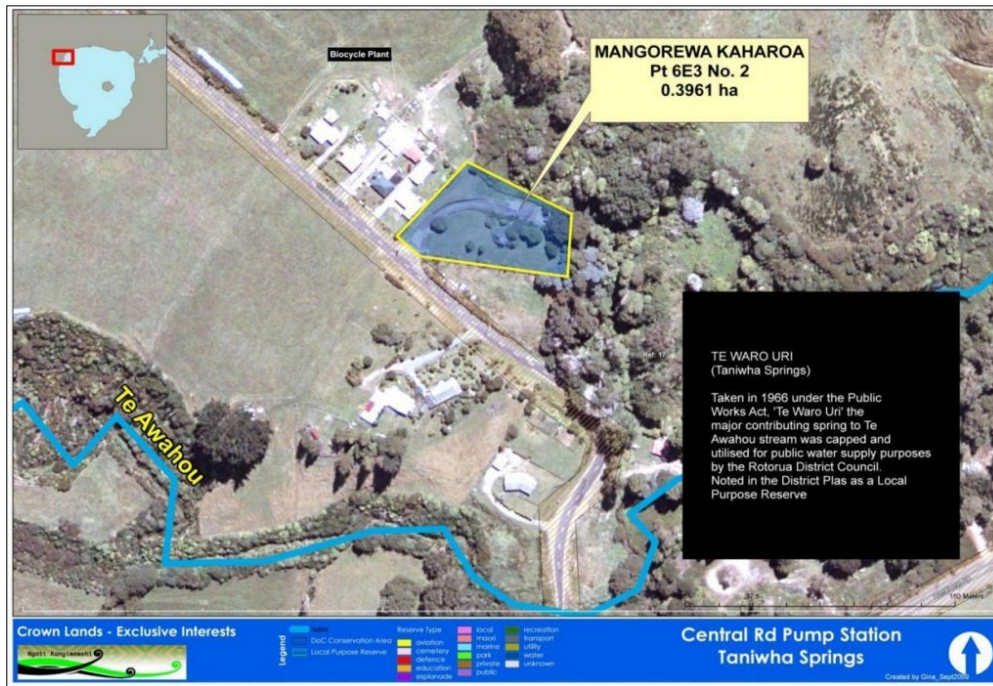


Figure 14: Rotorua Lakes District Council Central Rd Waterworks/Ngongotahā Municipal Water Supply - Te Waro Uri. (Source: Ngāti Rangiwewehi Mapping Services).

The Iwi lost undisturbed access to and use of their taonga, and the integrity of their relationship with this puna. They also lost their ability to collect water for domestic purposes direct from the stream or via their own water pumps; this activity was deemed illegal and the domestic pumps bulldozed by the Council without consultation. Furthermore, those homes were not given fair distribution and access to the water supply. Residents in Awahou had to start paying for the use of their own freshwater, whilst other residents in neighbouring Ngongotahā (who were within the 'Urban Fence') were not rated for their water usage.

The alienation of Te Waro Uri and loss of control, connection, and their relationship with their puna which was associated with land confiscation had physical, spiritual, and cultural impacts on Ngāti Rangiwewehi. As described in the introductory pūrākau, the many waterways within their rohe, and the interconnections and interdependencies between different elements of the hydrological cycle hold considerable significance to the Iwi, especially the Awahou, Hauraki and Hamurana Streams (including the spring's source); and Lake Rotorua-nui-a-Kahumatamomoe, into which these tributaries flow.

Response

The Iwi sought to regain and maintain control over access and use of their taonga.

In 2004, following almost four decades of water takes from the Central Road Waterworks site (including and adjacent to Te Waro Uri) the district council applied for a resource consent which would allow three times greater volumes of water take. Ngāti Rangiwewehi objected to the application and insisted that the Environment Court hearing (Environment Court Appeal [2008] ELRNZ 331) be held at Tarimano Marae in Awahou.

Key parts of the consenting process that empowered and enabled Ngāti Rangiwewehi and TMOTW:

- Established the principle that all important processes and decisions (including hearings) occur on their turangawaewae (Tarimano Marae in Awahou).
- Two external expert witnesses on behalf of the Iwi influenced the Court's decision:
 - o Groundwater Hydrologist – presented evidence on alternative options which were not previously considered by the council's engineers.
 - o Economist – gave evidence on financial impact of the water take on the commercial tourism operation which was in operation at the time.
- The Environment Court decision in *Te Maru o Ngāti Rangiwewehi and Anor v Bay of Plenty Regional Council ENV A095/2008* determined that the Council be granted a 10-year term of consent based on findings that:
 - o Taking water from the springs would have a significant adverse effect on Ngāti Rangiwewehi's identity which could not be addressed by conditions of consent, reducing, abstraction or maintaining a certain minimum flow as effects on cultural values "do not necessarily rise or lower proportionate to the amount of abstraction".
 - o The effects of the abstraction on Ngāti Rangiwewehi were matters of national importance under Section 6(e), as well as Section 7(a) and Section 8;
 - o The Council's consideration of alternative sources in this application was "cursory at best";
 - o The Court did not have jurisdiction to direct the Council to establish an alternative municipal supply from groundwater (which was more costly than taking water from the springs) and noted it was conscious that costs incurred by public authorities for works were an "executive matter for which they have political responsibilities to their electorate"; and

- Evidence showed that when alternative sources of supply were properly assessed according to their cost, technical feasibility, and cultural factors (i.e. impact on Iwi), a municipal supply from groundwater was preferable to taking water from the springs and could be established within 10 years.

The ENVC decision initiated a process of cultural restoration between the Iwi and their taonga, and reconciliation between the government and the Iwi (Ruru, 2009). It further provided a basis for their Treaty settlement and the return of the land and springs (both Te Waro Uri and Hamurana) taken in the '60s.

In 2015 the council unanimously voted for the return of ownership of Te Waro Uri to the Iwi, with the agreement that the council could continue its water take until the consents expired in 2018. A new relationship was formalised through ratification of a Memorandum of Understanding.

With the relationship reconciled and ownership returned to Ngāti Rangiwewehi, it was time to shift their energy towards establishing a freshwater management regime that fit with their mātauranga and tikanga.

The Model

The Kaitiaki Flows model is an integrated model informed by mātauranga (Iwi values and preferred flow levels) and statistical modelling. Following deliberation by the Iwi, of data and information presented to them by GNS Science during two initial hui, the preferred kaitiaki flow was agreed at a third hui. Several optional flows were considered, but the chosen one was a moving minimum mainstem flow that is 90% of the daily-mean naturalised flow.

The associated regime included a new, permanent, stage-recording measurement site to be located downstream of the Taniwha Springs confluence (a site called MS2), with real-time flow monitoring data available through a website. This was a significant improvement on the ad hoc monitoring which had occurred over the four previous decades.

Naturalised flow at this site is calculated by summing the measured flow at MS2 and Taniwha Springs abstraction by the district council. The Kaitiaki Flow dictates when water use is allowed, which is when stream flow at the site is greater than the kaitiaki flow. If there is a risk that near-future stream flow will decline below the kaitiaki flow then the website will generate an alert.

The term 'Kaitiaki Flow' coined by Ngāti Rangiwewehi defines the flow a waterway needs to retain and protect its health and wellbeing, and that of the ecosystem it supports. Unlike western-oriented models used for water management, this model recognises and upholds the integrity of the

respective waterbody as a taonga tuku iho that must be protected first and foremost. It then also provides space to consider sustainable socio-economic use and development by and for the Iwi.

Kaitiaki Flows and Baseflow-Dominated Stream Systems (or Kaitiaki Flows) combined mātauranga-a-Iwi with western science to create a water flow parameter that recognises the intrinsic value of this significant puna and awa complex. Ngāti Rangiwewehi consider the model to be an expression of TMOTW, recognising the Hierarchy of Obligations and the first right and priority goes to the health and wellbeing of waimāori, being consistent with their practice of Kaitiakitanga.

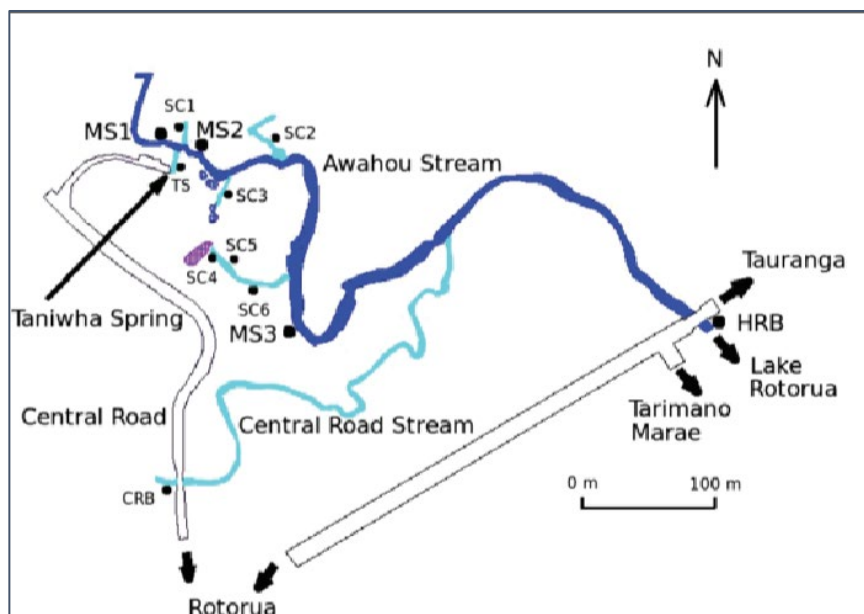


Figure 15: Te Awahou Stream area and springs complex (Source: White et al. 2020:65). Te Awahou Stream main stem (dark blue) is supplied with flow from numerous spring-fed tributaries (teal).

The tributary streams shown in Fig. 15 are: Awahou Stream main stem (MS1, MS2, MS3) and Hamurana Road Bridge (HRB); Taniwha Stream (TS), Central Road Stream (CRB) and unnamed streams (SC1, SC2, SC3, SC4, SC5, and SC6).

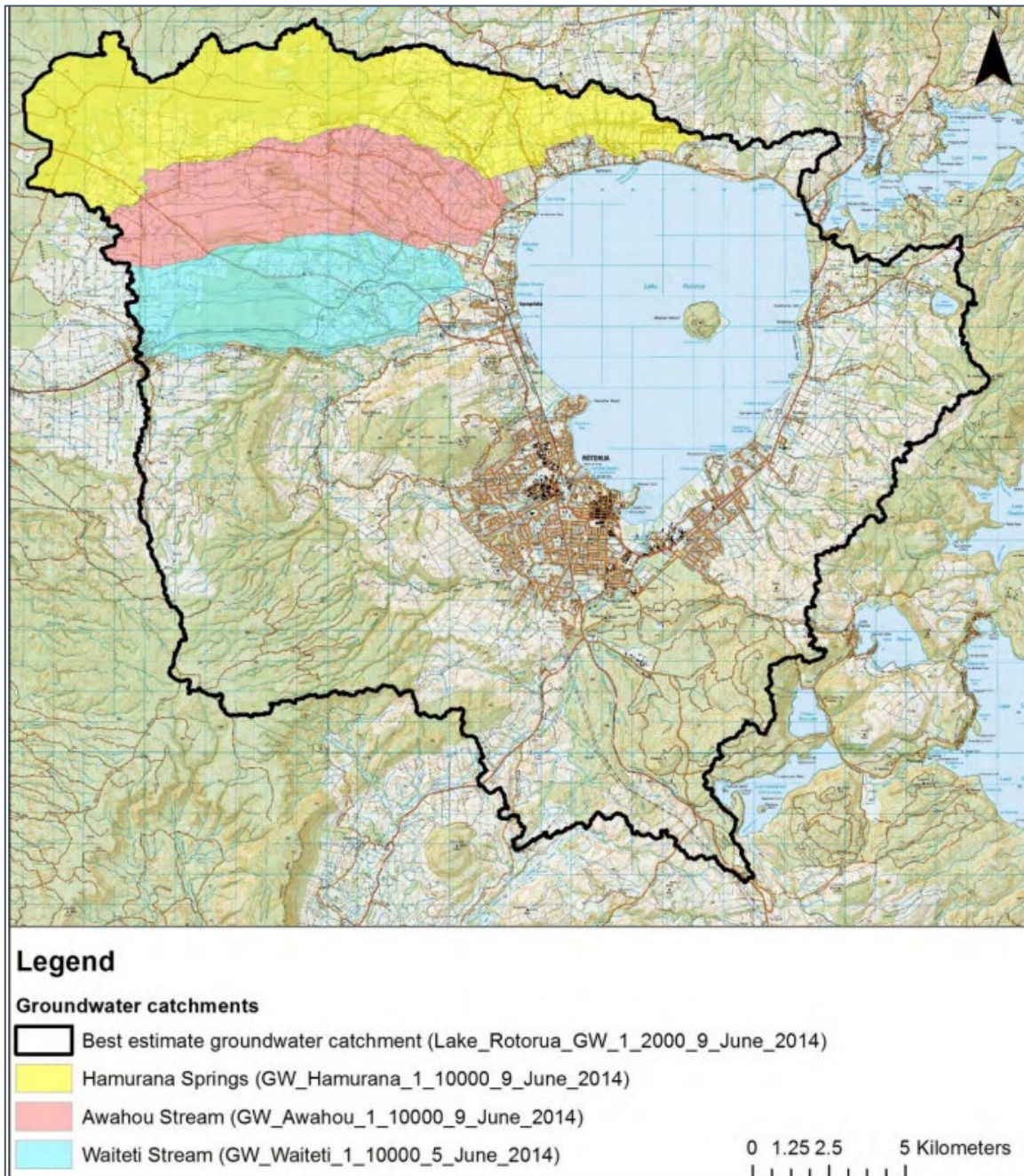


Figure 16: Groundwater Catchments related to Awahou. (Source: White et al. 2014:18).

Giving Effect to Te Mana o te Wai

Ngāti Rangiwewehi had articulated their key freshwater values from a mātauranga Māori framework through the development of the IEMP. This happened during the treaty claims process and was published in 2012. The IEMP underpins the tribe's understanding of TMOTW, which provided the

basis for developing the Kaitiaki Flows model. It is their Iwi tikanga Taiao Policy, lodged with government, confirming Iwi taiao positions and priorities. The IEMP includes excerpts from other key Iwi historical account documents, wānanga, and pūrākau.

Below, a brief discussion regards how the model fits with the TMOTW principles. Because the model has addressed all six principles so effectively, they have been grouped into three pairs of principles based on common purpose (Mana Whakahaere/Governance; Kaitiakitanga/Stewardship; Manaakitanga/Care and Respect).

Most Significant Te Mana o te Wai Principles

Most models considered for this research demonstrated a combination of some strengths and other weaknesses. However the Kaitiaki Flows case study effectively addresses all six principles.

Mana Whakahaere/Governance

The Kaitiaki Flows model enabled Mana Whakahaere (for Ngāti Rangiwewehi) and co-governance (between the Iwi and Rotorua Lakes Council) over water takes regarding Te Waro Uri / Taniwha Springs. The partnership 'Te Puna a Pekehaua Partnership' resulted in a joint resource consent application to the BOPRC for ongoing community water supply. The consent is believed to be the first of its kind, with acknowledgement of the partnership given at the 2022 Local Government NZ Excellence Awards. According to the Rotorua Mayor the joint resource consent for water take between an Iwi and district council exemplifies the community benefit that can be achieved through genuine partnerships with Mana Whenua (Rotorua Lakes Council, 2022).

Kaitiakitanga/Stewardship

If you ask any Ngāti Rangiwewehi uri about the importance of Te Wai Mimi o Pekehāua, we will say "Ko te Awahou mātou, ko mātou ko Te Awahou" and "Nō mātou te wai, nō mātou te kōrero". If you ask Ngāti Rangiwewehi uri what we want for our wai, we will tell you "We want our awa, Puna and roto - strong, clear healthy and free.... our traditional mahinga kai re-established and flourishing... and the life supporting capacity and mauri maintained for current and future generations" (Te Maru o Ngāti Rangiwewehi. 2021:2).

Ngāti Rangiwewehi consider the model to be an expression of TMOTW which supports them to achieve their aspirations outlined in the quote above. The model recognises and responds to the NPS-FM provision for the Hierarchy of Obligations, with the first right and priority going to the health and wellbeing of waimāori, which is consistent with their tikanga and practice of Kaitiakitanga. The Flow prioritises ecosystem abundance first, and municipal water supply second. Socioeconomic

considerations are also considered important, but they come third, consistent with the Hierarchy. The Iwi believes that the Kaitiaki Flows models worked because it recognised and provided for the mana of their taonga, and the mana of their people who were able to lead the process. A framework determined by the people for the people and for those generations to come. This intergenerational approach is fundamental to Kaitiakitanga and good stewardship.

The Iwi position is that the Kaitiaki Flows model is a practical expression of 'Te Mana o Te Wai' particularly with respect to "the first right to the water goes to the water".

The model's development was rigorous. The co-developers took careful steps to understand the Iwi position on how they wished to express their Kaitiakitanga regarding waimāori, combining both mātauranga Māori and western science methodology. The model includes both qualitative and quantitative components. The development process provided opportunities for Iwi members to participate and contribute on site at the water source as well as in wānanga settings. Thus enabling active Kaitiakitanga and robust processes to ensure complete alignment with their principles, values, and anticipated outcomes.

The first part of the process was Iwi/Kaitiaki determination of TMOTW, which drew on their IEMP and earlier project with GNS, Ka Tū Te Taniwha, Ka Ora Te Tangata (2014 - 2016). The base flow parameter considered the concerns raised by the Iwi and ultimately informed development of the cultural-base flow parameter – Kaitiaki Flows. After the Iwi-centric process articulated TMOTW, Ngāti Rangiwewehi felt confident involving western science and working closely with GNS Science to include western science data and scientific modelling components. With the two knowledge systems proving to be complementary, the developers established the validity of the Kaitiaki Flows water management framework, grounded in both.

The resulting model provides confidence from both perspectives, making it sufficiently robust for resource consenting processes. As already mentioned, it is believed to be the first of its kind, disrupting the status quo for water takes and management of puna and water allocations, and offering a new best practice to be adopted and adapted more broadly throughout Aotearoa.

[Manaakitanga/Care and Respect](#)

The Chair of Te Maru o Ngāti Rangiwewehi at the time the model was developed believed that the Kaitiaki Flows model was significant not only for Ngāti Rangiwewehi but for Aotearoa-wide, stating that:

The iwi would like to see the Kaitiaki Flows model utilised as a tool for protecting the health and waterways across the country – so that all iwi can ensure the Kaitiaki Flow in their waterways is protected above all else. (Source: Te Maru o Ngāti Rangiwewehi, 2019).

Ngāti Rangiwewehi explain that Kā Tū te Taniwha and Kaitiaki Flows informed the approach to the co-application for water consent with the district council, to ensure that in sustaining the water requirements of the wider community, the wai and broader ecosystem is protected. Through access, and sustainable use of this ‘resource’, the Iwi and council convey respect and care for the taonga as well as the ecosystems, and the communities that depend on it.

The manaakitanga, generosity, of the Iwi to share their model with Iwi and Aotearoa katoa, should be acknowledged and valued. This model is a koha for Aotearoa – the process provides a best practice model in contexts where modelling is required for water flows to give effect to TMOTW in Iwi and hapū-centric ways.

Conclusions

The Kaitiaki Flows model is grounded in Te Ao Māori and the mātauranga of Ngāti Rangiwewehi. With the driving function of the model being to recognise and uphold the integrity of the respective waterbody as a taonga tuku iho, the Iwi then utilised western science alongside their mātauranga to support an even more comprehensive understanding of their hydrological system. By using the best of both knowledge systems, a model was developed that purposefully acknowledges and strives to uphold TMOTW. Western-oriented models alone have limited capacity to respond to Māori values and principles. However, this model proves that combining the science alongside mātauranga in a model can be a powerful and meaningful way to ensure that the health and wellbeing of the awa is protected first and foremost, but then provides space to consider sustainable socio-economic use and development by and for the Iwi once that first obligation is met.

Case Study 3: Māori-led implementation of the NPS-FM (2020) for the Mohaka me Waihua awa

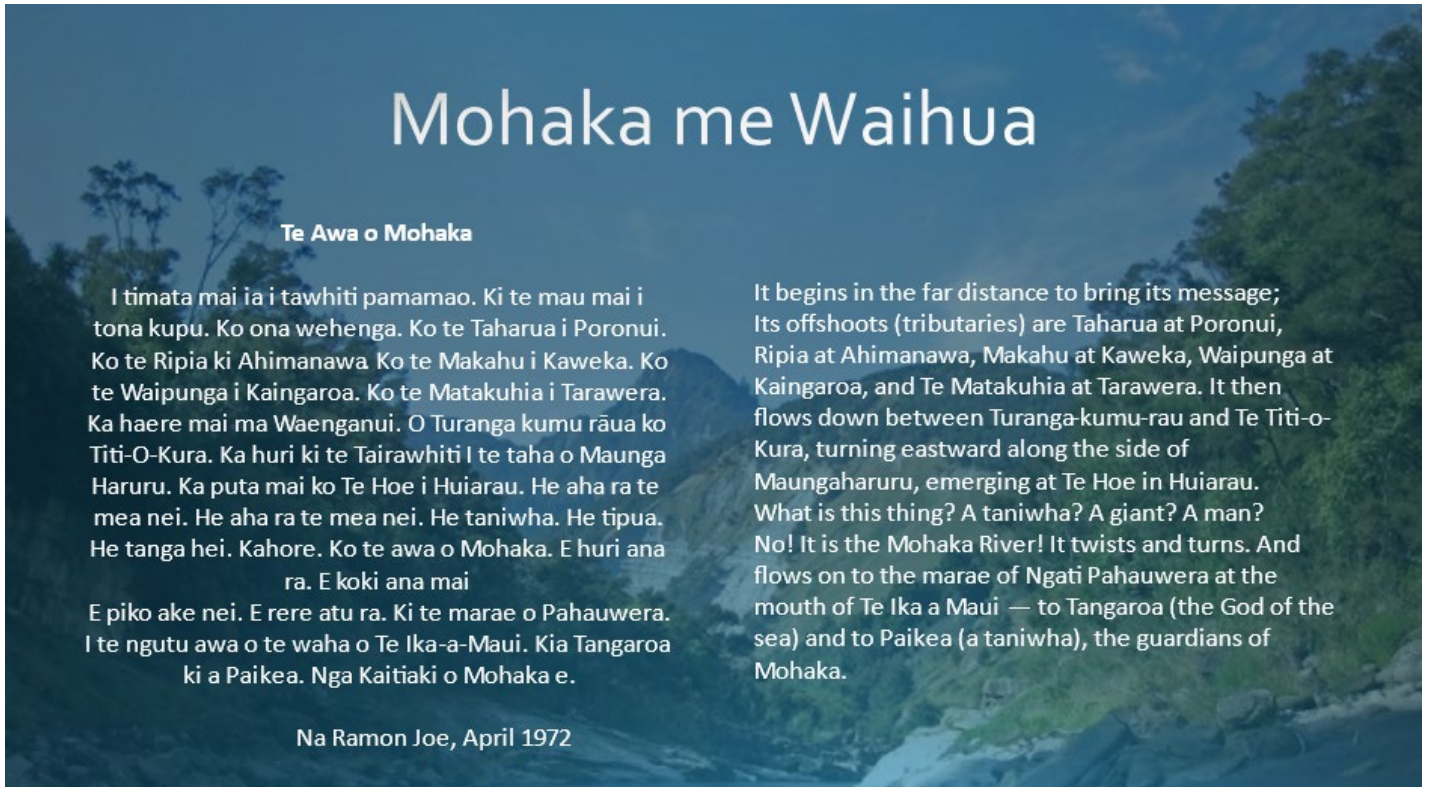


Figure 17: Waiata describing the Mohaka and Waihua Rivers. (Source: Ramon Joe, 1972).

Aratohu

The waiata above “Te Awa o Mohaka” composed by Ramon Joe of Ngāti Pāhauwera (1972) illustrates the relationship between the rivers, Mohaka me Waihua, and associated Mana Whenua. This waiata is recited in numerous places, recounting the significance of the awa as tīpuna, taonga, a source of sustenance, and a source of identity, whakapapa, and pride.

*He mano ngā whetu ki te rangi, he mano ngā kahawai ki te moana.
A thousand stars in the sky, a thousand kahawai in the sea.*

The Mohaka travels through steep, old terraces and cliffs, formed during the Pleistocene. The cliffs deeply incised by the river all the way to the coast, where the waters emerge onto a rugged coastline (Buchanan, 2021). This landscape provides important resources including gravel which cleanses the water and sweetens the kahawai that spawn where river mixes with ocean (reflected in the whakataukī above).

The role of flooding is important. The flood waters dislodge the gravel and hāngī stones, making them periodically available for harvest, an activity integral to the identity and culture of Mohaka. The significance of these taonga/resources is evidenced in Treaty and Marine and Coastal Area (Takutai Moana) Act claims (for example see The Mohaka River Report, 1992; and the Ngāti Pāhauwera Treaty Claims Settlement Act 2012; note the Takutai Moana negotiations are ongoing).



Figure 18: Mohaka River mouth. (Source: Buchanan 2021 | Photo Credit: Ngāti Pāhauwera).

Key freshwater-related concerns include gravel extraction and other activities that may adversely impact the existence of and access to hāngī stones, water quality, the ecosystem, and subsequent relationship between the river and its peoples. Gravel extraction is particularly important, given new provisions under the reformed Resource Management system for ‘resource allocation’. At this point in time, the author is not aware of any holistic and integrated models that could be used to appropriately consider gravel allocation from both a mātauranga and science perspective, a potential modelling opportunity.

Mohakaharara, Taupunga, Opunga

According to The Mohaka River Report (1992:12), there are four types of hāngī stones from the Mohaka:

- Taupunga – a greyish type also used as sinkers.
- Opunga – a whitish, trachyte rock, also used for weapons and sinkers.
- Poutama – a pink type, obtained mainly from the top of the Mohaka river.
- Kowhaturi/Kowhatumakauri – a black/blue type.

The whakataukī “Mohakaharara, taupunga, opunga” refers to the different types of hāngī stones which will not crack when fired. It is a symbolic reference to the strength and unity of the Mohaka River peoples. The stones are considered ‘taonga tuku iho’ (treasure handed down through whakapapa) and are commonly used as koha to other marae.

*Mohaka te awa. He piko he taniwha. He piko he Taniwha.
On every bend a Taniwha.*

Taniwha are explicitly referred to in the introductory waiata. Paikea is the Taniwha that protects the Mohaka River mouth, connecting Mana Whenua here with Iwi and Hapū along the coast who share this common ancestor. Paikea came to Aotearoa on the back of a whale. He controls the sand and shingle and the movement of the river mouth and attracts the fish for their people. Another Taniwha, Hinemako, appears on the beach as a large tuna (or eel) and recognised as a sign of trouble. A third Taniwha appears as a large log in the river mouth area and there are others that reside upriver within the area of tidal influence and beyond.

Context and Purpose

In this case study, Mana Whenua have commissioned their own technical modelling to provide independent information on the predicted state of water quality and ecology at sites of cultural interest, and on Māori land. The water quality models are expected to provide more robust info-spatial coverage, helping to address a lack of council data for their remote catchments. The models were developed from robust national level information and datasets and will enable Tāngata Whenua to understand the likely state of water quality and ecology at sites of interest to them and

within their own landholdings. Conceptually, these models will support Mana Whenua agendas to reclaim tino rangatiratanga and their ability to be active Kaitiaki for their awa.

Catchment Management Profile

Mandated Authorities:

Iwi/Hapū/Tribal: Multiple (refer Fig. 19): Mana Ahuriri; Maungaharuru-Tangitū Trust; Ngāi Tahu; Ngāti Hineuru; Ngāti Manawa; Ngāti Pāhauwera; Ngāti Whare; Te Tira Whakaemi o Te Wairoa; Ngāti Tūwharetoa; and Ngāti Kahungunu.

Regional Council: Hawkes Bay Regional Council

Key Stakeholders: Significant Māori land ownership (refer Fig. 20). No towns in the catchment, only small rural communities (Raupunga only registered drinking supply). Recreationalists including trout fishery/whitewater rafting. 1/3 of catchment is formally protected (e.g., Ngā Whenua Rāhui or DOC conservation areas) for significant biodiversity. Business interests include plantation forestry, orchards, sheep and beef farming, and dairy.

Tākiwa/Area of interest: The Mohaka River rises in the Kaimanawa Ranges, is bound by the Kaweka and Maungaharuru Ranges to the south and east and flows into Hawke's Bay near the Mohaka settlement. The Waihua is a smaller catchment to the north. Small coastal catchments not attached to the Mohaka or Waihua awa such as the Te Awaawa stream would have been included in the councils 'other catchments' not this plan change. Tāngata Whenua had to request for the Waihua catchment to be included, it would have been incorporated in the Wairoa cluster.

Freshwater Management Unit: HBRC began the TANK process in 2012, prior to NPS-FM (2020). Areas delineated by council shown in Figure 23. For some Iwi, only parts of their rohe were included in this FMU, other parts being captured in adjacent FMUs, meaning engagement in additional/separate processes (when they happen). Council's strategy changed since 2012. Initially there were plans for a Taharua and Upper Mohaka Strategy, rather than a Mohaka-specific plan change (alongside other specific place-based plan changes). Now, the council has decided on the Kotahi Plan (a single plan with a Mohaka chapter). Various events (including cyclone Gabrielle) may also result in a delay to this plan change.

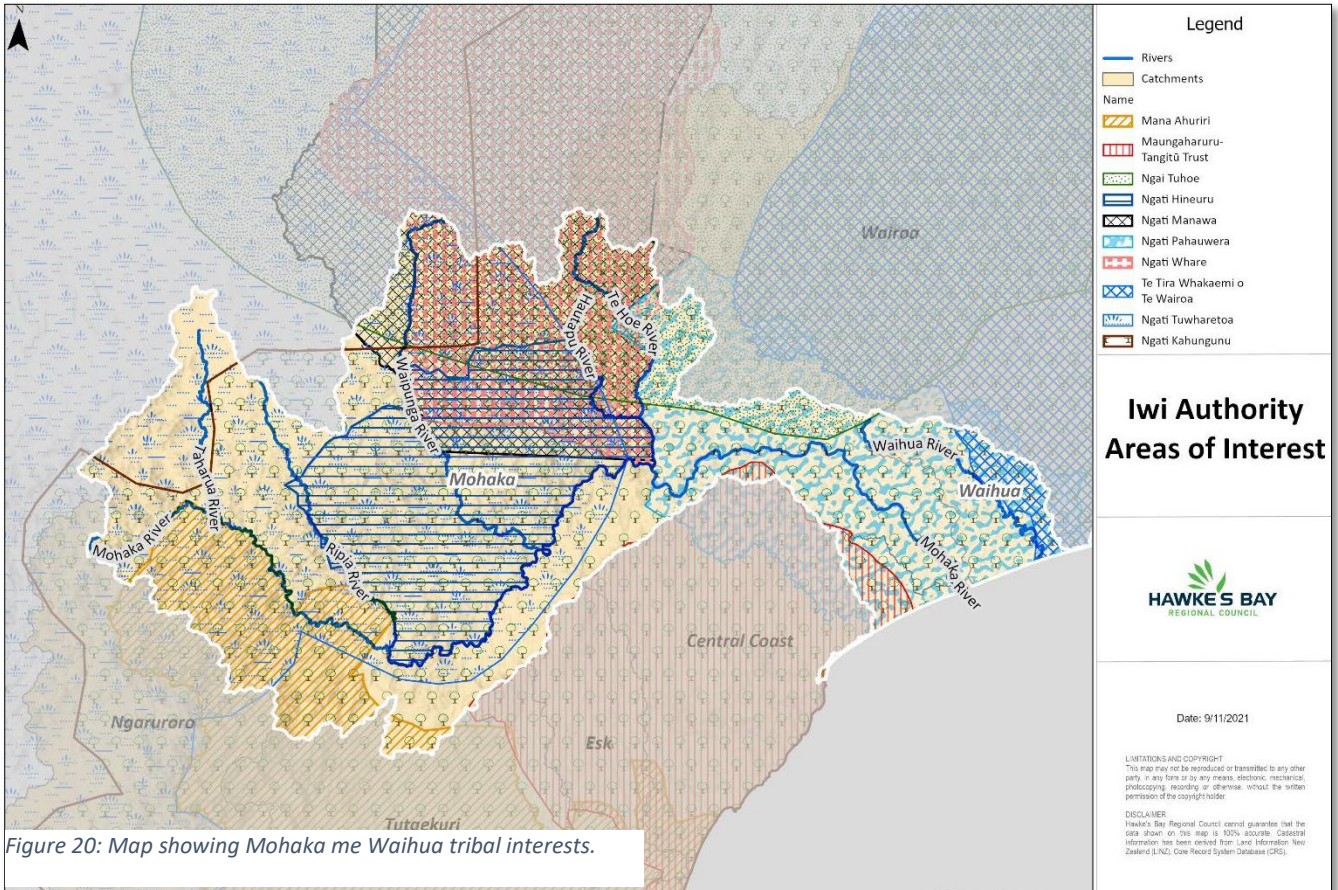


Figure 20: Map showing Mohaka me Waihua tribal interests.

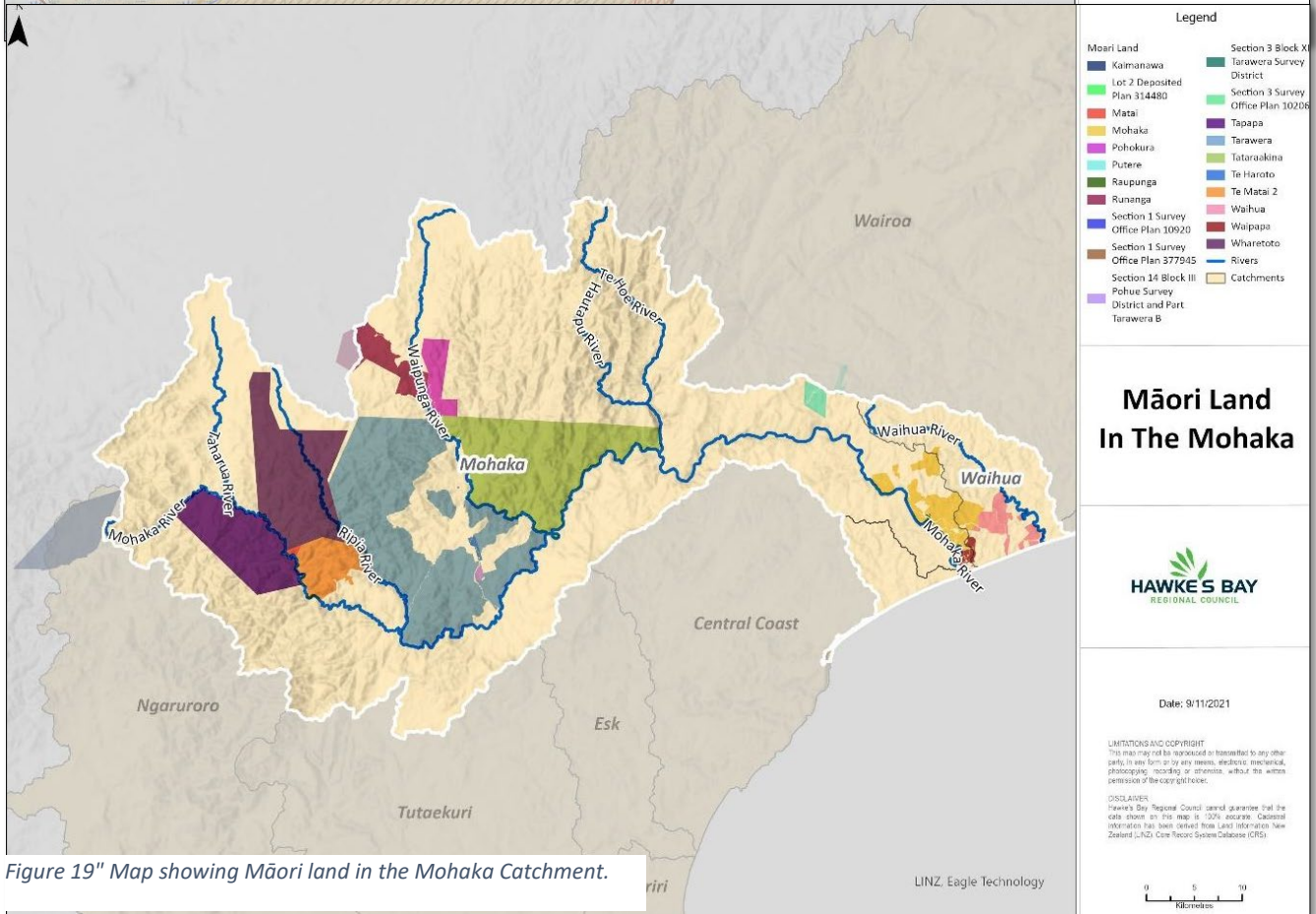


Figure 19" Map showing Māori land in the Mohaka Catchment.

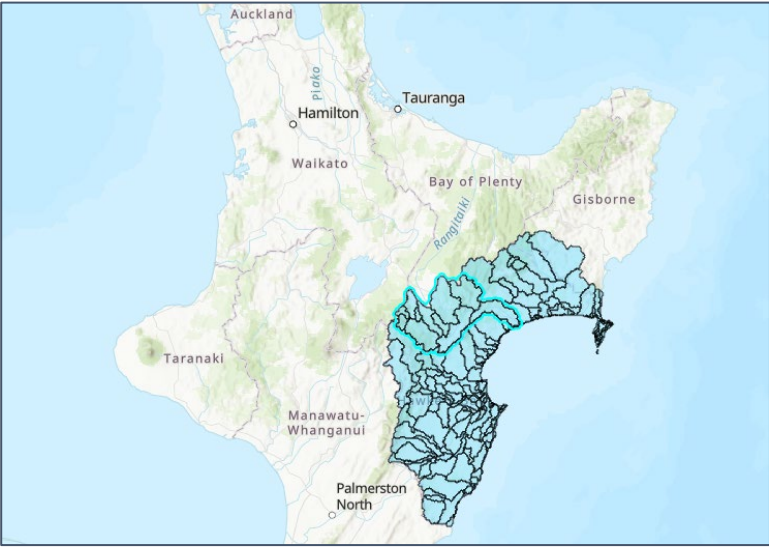


Figure 21: Map showing HBRC Water Management Catchments, highlighting Mohaka. (Source: Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, USGS).

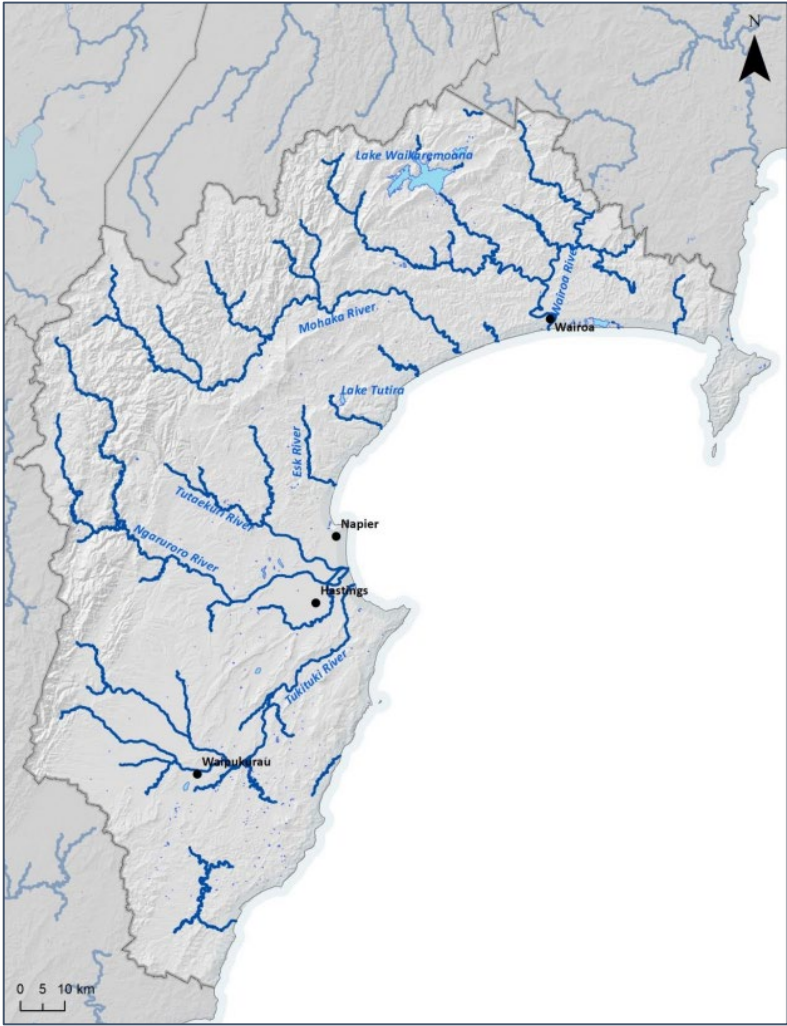


Figure 2221: Major waterbodies in the Hawke's Bay region including Mohaka River. (Source: Ministry for the Environment, ND).

Current Situation

Tāngata Whenua o Mohaka me Waihua successfully negotiated funding from the Hawkes Bay Regional Council to lead their own workstream for NPS-FM implementation and development of the Mohaka Freshwater Management Plan. A working group was established, which invited all Tāngata Whenua within the catchments (refer Figs. 19-20) to participate in freshwater planning conversations for Mohaka and Waihua. This was an important preliminary step to designing regional regulations for Mohaka and Waihua surface and groundwater catchments. The boundaries of Te Awa o Mohaka me Waihua are delineated in the maps, waiata, and other cultural data already presented.

Problem Statement

Despite a very strong and well accounted for relationship between Mana Whenua and their awa, they have still struggled to exercise tino rangatiratanga over their freshwater taonga and ecosystems. Treaty and Takutai Moana grievances and claims negotiation processes have meant ongoing pain and frustration due to having to continuously articulate and defend that relationship. Audiences include the multitudes of Crown actors, the Waitangi Tribunal which informs the Crown, and the New Zealand courts – all systems, spaces, and constructs which privilege western status quo. Some believe these slow and arduous processes are intentional strategies, reminiscent of what Māori Professor Graham Hingangaroa Smith coined as ‘politics of distraction’⁴ on the Crown’s behalf.

For example, the Waitangi Tribunal concluded that the Mohaka River was a tribal taonga when the Treaty was signed and remained so. Tino rangatiratanga over the river, or transfer ownership of its bed or waters, was never ceded. However the Crown had deliberately created statutory provisions which assumed that the Crown owned the riverbed and waters, or which conferred exclusive control over the waters on central or local government, and the Tribunal found that these were in breach of the Treaty (Waitangi Tribunal, 1992).

In relation to the Takutai Moana claim, whilst much of this relationship was expressed and proven again, the Crown’s settlement offer was “insufficient” (personal communication, 21 October 2023). The Crown’s offer in 2022, though better than what was initially offered in 2017, was “still not the full extent of the application and there are inconsistencies around what was given to other parties in the judge’s decision. We have several parts that we are appealing – we are saying that the Mohaka River mouth should be included in Coastal Marine Title, that we should get out to 21km, and that Wāhi Tapu protection should be awarded” (personal communication, 21 October 2023).

The initial Pāhauwera court judgment by the High Court (22 December 2021, ref CIV-2011-485-821 [2021] NZHC 3599) ruled out customary marine title (CMT) and rights over the Mohaka (and other) river mouth/s if the waterways were 'navigable'. This exclusion was made possible through an amendment to the Coal Mines Amendment Act from 1903. However, in a more recent decision regarding a separate claim in relation to Whakatōhea, three judges have reversed that ruling for up

⁴ Professor G.H. Smith coined the phrase ‘politics of distraction’ decades ago. It refers to “the colonizing process of being kept busy by the colonizer, of always being on the 'back-foot', 'responding', 'engaging', 'accounting', 'following' and 'explaining'. These are typical strategies often used over indigenous people. The 'logic' (notwithstanding that many of these practices are not even thought about - they are better described as bad habits) seems to be that if the 'natives' are kept busy doing 'trivial pursuits' there will little time left to complain, question or rebel against the 'status quo' conditions”. Refer Smith (2003).

to 1km up rivers from the coast. In all the evidence regarding the Mohaka River, the mouth is of utmost importance to Mana Whenua, in terms of history of occupation, association, mahinga kai and more.

The western model of “12-nautical miles” as a sensible limit, and the Crown’s use of antiquated legislation to justify prevention of Iwi customary rights, conflicts with Māori models and rationale of tino rangatiratanga, mana, and kaitiakitanga. For example, one claimant in describing the whakapapa connections to Rarotonga and other parts of the Pacific stated, “I consider our links across the Pacific to be important and I describe them here to help explain why a 12 mile limit is not real” (Waaka, 2014).

The same claimant also described their connection to Maui and significance in the context of Mohaka, explaining that:

Maui in reality was an explorer who came to the Pacific at the behest of his ariki Ama Tai Atea...Maui is known throughout the Pacific and he is noted as the discoverer of lands and conqueror of numerous challenges. The mouth of the Mohaka river is called Te Waha O Te Ika a Maui or The Mouth of the Fish of Maui. That is where the hook of Maui went in and it came out of Cape Kidnappers...Just above the bridge near the Mohaka river mouth is a piece of land called arero or the tongue of the fish. There was a kainga there...called Kuiteketeke near a spring called Wairerehua...This land is bordered by the river and was an important whitebait recruitment area that has been compromised by long term gravel extraction. These stories reinforce the link between the land and our moana. They also reinforce our relationship with the Pacific peoples. Those of us who have visited Hawaii and Rarotonga know that they have some similar stories as well as their unique ones.

(Source: Affidavit of Toro Edward Waaka, 2014).

As implied thus far in this case study, western models and Māori models do not always align. In this freshwater management context, Mana Whenua were systematically designed out of freshwater governance and management. That history makes it extremely challenging to then attempt to engage, equally, in a ‘collaborative management’ regime. It seems almost impossible to operate within that western system, in accordance with their own rangatiratanga, mātauranga, and tikanga.

Response

The NPS-FM (2020) has offered greater opportunities for Mohaka me Waihua Mana Whenua involvement in freshwater management. Following an initial council-led attempt at collaboration, it was agreed that for better outcomes for Tāngata Whenua it would be best for them to establish their own project team, with council funding, to manage their Iwi engagement and freshwater planning. All Tāngata Whenua within the catchments (refer Figs. 20-21) were invited to participate in

freshwater planning conversations, and a Tāngata Whenua Leaders Rōpū was established to provide ongoing advice and input regarding tikanga and mātauranga.

Since initiation, the project team has become increasingly aware of data and knowledge gaps. They found a lack of available and accessible scientific data and information pertaining to their cultural interests and concerns (such as those outlined in the pūrākau, waiata, and whakataukī above). Being capable and having capacity, the team chose to develop this work programme themselves, demonstrating their confidence and commitment to getting on with the job and prioritising the health and wellbeing of their ancestral waters.

Giving Effect to Te Mana o te Wai

The project team consists of Tāngata Whenua and trusted colleagues with expertise in freshwater science and policy. Together, they have the capacity and capability to capture, interpret and utilise technical information generated by the models, and then present it and explore it with the Leaders Rōpū and wider Māori communities in respective catchments.

The Rōpū developed three core pou which align with the metrics or principles for implementing TMOTW: Te Pou Mana; Te Pou Kaitiakitanga; and Te Pou Mahi Tahi. These pou create a people and place-specific framework for freshwater management. For example, the pou have been used to frame discussion around the TMOTW principles below.

Most Significant Te Mana o te Wai Principles:

The three Te Ao Māori principles are most significant to this case study given the ongoing power struggle regarding tino rangatiratanga, governance and management. In this context, giving effect to TMOTW will require Tāngata Tiriti (council and wider stakeholders) to provide sufficient space and resourcing for Mana Whenua to adequately step into this regulatory role.

Mana Whakahaere

Te Pou Mana: Mana of all forms is interwoven. As the saying goes, 'ko au te awa, ko te awa ko au'. This lends itself to whakapapa. Whakapapa connects us to the water, to the life that the water sustains, and the encompassing environment. Protecting the water comes first, this will protect the life within the water and sustain the people. At the same time, Te Pou

Mana recognises the autonomy of the individual iwi and hapū, their mana associated with the waters in their rohe, and their role in governing within that rohe.

As described, there is a painful history for Tāngata Whenua that whakapapa to Mohaka me Waihua regarding tino rangatiratanga and the restrictions, rules, and regulations that the Crown and its agencies have (wrongfully) enforced. Early on in the NPS-FM implementation process, Tāngata Whenua could see that they would not get the robust outcomes that they were wanting and came up with an alternative which reset the process and renegotiated the relationship to move forward. This was a necessary measure to ensure the cultural safety, health, and wellbeing of their kaimahi who had found the process difficult.

The reset included establishment of a separate workstream and project team. That team now facilitates and reports to the Leaders Rōpū and Māori landowners throughout the catchments. The team's engagement with Māori landowners, not only iwi and hapū authorities, is intentional. Councils often prefer to limit their scope and resourcing to only mandated Iwi and Post Settlement Governance Entities, which is the extent of their legal requirements. But that approach does not recognise the mana and independence that Māori land trusts have. The Leader's Rōpū and the project team is taking an inclusive approach which acknowledges and seeks to enable mana whakahaere of all Māori with rights and interests in the catchment – Māori land trusts, iwi, and hapū alike. This is consistent with freshwater itself which does not differentiate between constructed mandates, ownership models, or property rights.

In considering Mana Whakahaere, the water quality modelling that is commissioned will offer equitable opportunities for iwi, hapū, Māori landowners and wider communities. They will have the ability to understand the state of water quality relevant to them, and subsequent opportunity to engage in freshwater management should they wish. The models will be able to produce information that responds to cultural concerns and aspirations, for example, the potential impacts on wāhi tapu or the water's capacity and ability to provide customary resources and/or rongoā. In this way, the model will support capability building and assist Tāngata Whenua to exercise Mana Whakahaere. This data remains the property of the Leader's Rōpū and whanaunga that contributed. It will be collated and returned to them on project completion.

Kaitiakitanga

Te Pou Kaitiakitanga: Is the inherited obligation and responsibility of tangata whenua to protect the water and the many taonga it sustains for future generations.

Freshwater management work by the council has been intermittent in the Mohaka me Waihua catchments for more than a decade, over which time there has been a continued decline of water quality from the Taharua catchment where dairying is a major land use activity. Observations by Kaitiaki tell them the water quality is poor – they can see, smell, and taste it in the water. The process is currently paused again while government decides what will happen next in relation to NPS-FM delivery. Most concerning for the Leader’s Rōpū is the lack of care and respect this demonstrates for the awa, their communities, and even their economic and livelihood interests which are also adversely affected by the diminishing health and wellbeing of their awa and ecosystems. Thus far, the Rōpū and project team have struggled to comprehend where TMOTW is given effect to in these processes.

In comparing the 2022 and 2023 Annual plans of the council there is a dramatic shift in council priorities after Cyclone Gabrielle. The impact on the Mohaka me Waihua Freshwater plan and any subsequent plans is a pared back delivery of services, extension of timeframes or reduced budget due to stretched resources. The council’s 2023-2024 Annual plan states, “our Integrated Catchment Management teams have redeployed many staff to support our rural community” (HBRC, 2023:19), so the team’s expectation from council going forward is a very light touch, whole of region approach to any planning work. The project team which has capacity and capability to lead this work themselves is deeply concerned and determined to continue progressing this kaupapa.

The Māori entities attached to the awa have agreed they wish to continue with the Plan Change despite additional pressure from cyclone recovery work (pers. comms, 12 Nov. 2023). The team has begun a process with the Leaders Rōpū and will be reaching out and facilitating wānanga with iwi, hapū, whānau throughout the catchment over the next 12 months. The purpose is to progress identification of attributes, targets, and limits for the catchments from their perspective, which can contribute to the collaborative NOF process.

As part of the team’s outreach and research process the models will be discussed and applied. The models allow hapū and whānau to zoom into any area of a river to examine water quality predictions and where possible, triangulate that prediction against their own experiences, observations and mātauranga. The models cover almost all river reaches and segments in the catchments, making it possible for kaitiaki and Māori landowners throughout the Mohaka and Waihua area to engage in the freshwater management process if they wish.

Manaakitanga

Te Pou Mahi Tahi: Is the responsibility of everyone to work collectively and collaboratively for the benefit of the water. Te Pou Mahi Tahi is about all people, including landowners, working with a universal purpose: to protect the health and well-being of the wai.

The project team is steadfast in its commitment to caring for their taonga and ensuring the health and wellbeing of the water, its ecosystems, and their communities. Commissioning independent modelling to develop deeper understandings of current water quality, and what is needed to improve and protect it, is a prime example of their manaakitanga. Cultural sites, places, and landscapes of significance and aspects of concern to people in the catchments will be given appropriate weight and attention, and modelling will be optimised to meet the priorities of those engaged (rather than being limited by council or their scope). The modelling results and decisions that data informs will benefit all, with the intention of sharing data that is not sensitive with the council and community via published project deliverables.

The mana of the water is interconnected with the mana of the people, and their ability to manaaki. By modelling the right scenarios, they can develop deeper, more robust understandings of how the awa can be cared for so that the awa, in return, can continue its provision of care and ecosystem services for the communities, such as gravel washing and mixing of the waters for the kaimoana, and provision of hāngī stones as koha to others. Such elements of freshwater management and complexities of recognising and giving effect to TMOTW are unlikely to be a typical part of a council-led implementation process. However, for Mana Whenua these cultural components are integral to the regeneration, protection, and long-term sustainability of their waimāori, part and parcel of their role as Kaitiaki and responsible mokopuna of the Mohaka me Waihua awa.

Conclusions

The significance of water quality modelling for the Tāngata Whenua connected to those waterways is that it feels like a positive step forward when there has been challenge after challenge (personal communication, 12 November 2023). This modelling will provide information that may never have been available. The catchment does not have a high population, many stretches are not visible or accessible. These two factors alone often translate to lack of interest or action from those who receive votes or distribute resources. There is a disparity even among the Iwi and Trusts that comprise the Tāngata Whenua of the awa, however the modelling provides equity to those who have less resources, capacity, or capability. The intention is to use western science alongside their mātauranga to ground truth the modelling, with results backing up what is already known and

providing a better understanding of their awa, tributaries and all waters to better inform planning and decision making.

The National Objectives Framework within the NPS-FM: Insights from Case Studies

The National Objectives Framework (NOF) in the NPS-FM is the overarching process for regional councils, with communities and tangata whenua, to implement freshwater management. The MFE’s guidance outlines the intersections between the fundamental concept of TMOTW and other key requirements in the NOF and wider NPS-FM. It also explains the steps of the NOF process and the policy intent for each step, supported by best practice guidance for setting limits on resource use and setting environmental flows and take limits. Figure 35 offers a summary of the NOF. Every step must ‘Give effect to TMOTW’ and ‘Use best information’. There are potential modelling aspects of all of the steps and required components, although the term ‘model/modelling’ is not shown on the figure, perhaps reflective of the Ministry’s approach which has been more covert than overt in relation to modelling and its freshwater management requirements and guidance.

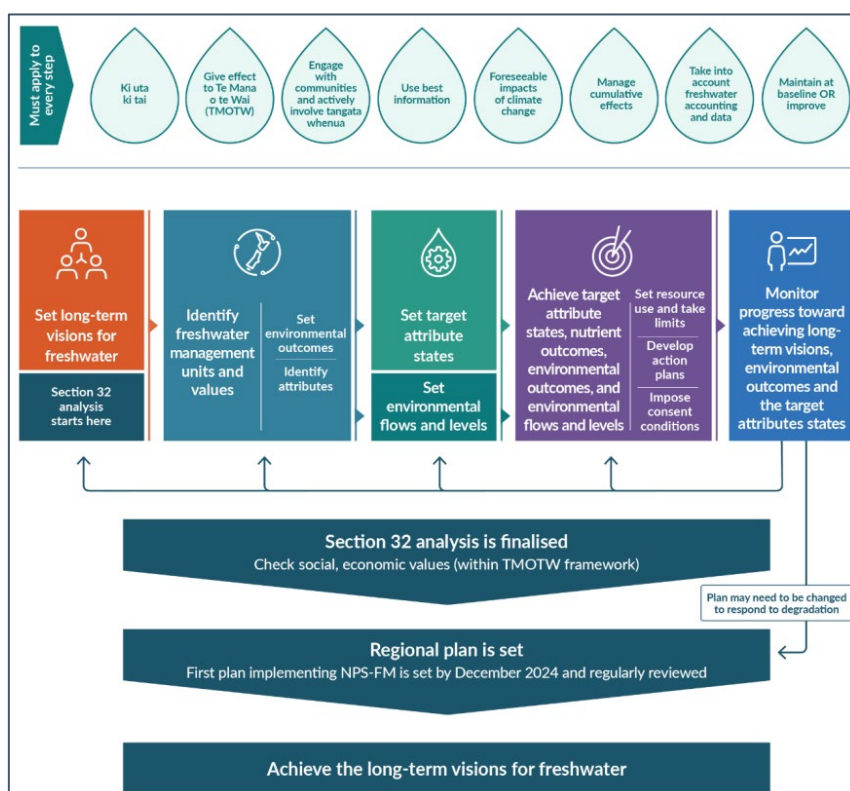


Figure 22: High-level overview of the NOF process. (Source: MFE, 2023:44).

Given that all councils are required to implement the NOF and use best information which in many cases will involve modelling, it is surprising that there isn’t more direction and examples to support councils in what can be a very expensive exercise. As another corollary, there is a list of 11 Figures in

the MFE’s guidance, many of which include modelling aspects but none of which are explicit at first glance.

Figures		
Figure 1:	Maintain and improve – Policy 5	27
Figure 2:	High-level overview of the NOF process	44
Figure 3:	Freshwater NPS-FM cascade from vision setting to methods	46
Figure 4:	From values to target attribute states	55
Figure 5:	Achieving target attribute states and environmental outcomes	66
Figure 6:	Setting nutrient criteria to achieve NPS-FM target attribute states	73
Figure 7:	Sinking lid – accommodating for new users of an over-allocated resource	89
Figure 8:	Process of setting and achieving limits on water takes and resource use	96
Figure 9:	Process for setting flows and levels, and identifying take limits	103
Figure 10:	‘Iron triangle’ of water allocation	108
Figure 11:	Monitoring and responding to degradation	111

Figure 23: List of Figures in the Ministry for the Environment's Guidance of the NOF process. (Source: MFE, 2023:4).

Perhaps it would be sensible for the MFE to develop a figure that specifically regards modelling in the NOF context (e.g. model types, purposes, motivations/interests for use, where models might apply, how they might apply, who might be involved, why etc.). To demonstrate this idea, several suggestions are made in reference to one of the figures (Fig. 23: Freshwater NPS-FM cascade), but conceivably a separate modelling-focused figure could be useful (Table 3 in the Recommendations below might be able to further inform this idea).

Possible considerations regarding modelling in relation to the NOF process and guidance

<p>Interrelated with information & awareness of what's possible. TW & TT could both contribute valuable 'data'. Ideally develop a process (or model) such as: > initial knowledge sharing > building awareness & capabilities > level playing field > gap analysis > prioritisation & potential modelling > long-term visioning > consider options / potential scenarios > determine long-term vision.</p>	<p>Need model/s for choosing/prioritising 'values' in fair & equitable ways. Examples include Tau Ihu council/iwi collective model developed for freshwater governance & management. Conceptual models including waiata, pūrākau, whakatauki/whakatauākī, oriori etc.) offer important insights relevant to 'values'.</p>	<p>Modelling likely required to understand how to achieve the Hierarchy of Obligations, in accordance with the long-term vision and values. Potential for all sorts of models (e.g. refer Baker 2019's use of models).</p>	<p>Major opportunity to utilise both mātauranga & scientific models. Ngāti Rangiwewehi is a great example for use of 'best information' & 'best process'. Recommend adding 'Kaitiaki Flows' as a compulsory consideration alongside environmental flows and levels.</p>	<p>Major opportunity for both mātauranga and western science modelling. Limits, actions, and methods must be aligned with worldviews, values, and anticipated outcomes for both TW & TT – with the shared obligation to ensure the health and wellbeing of water first before anyone or anything else. Another natural fit for scenario modelling.</p>
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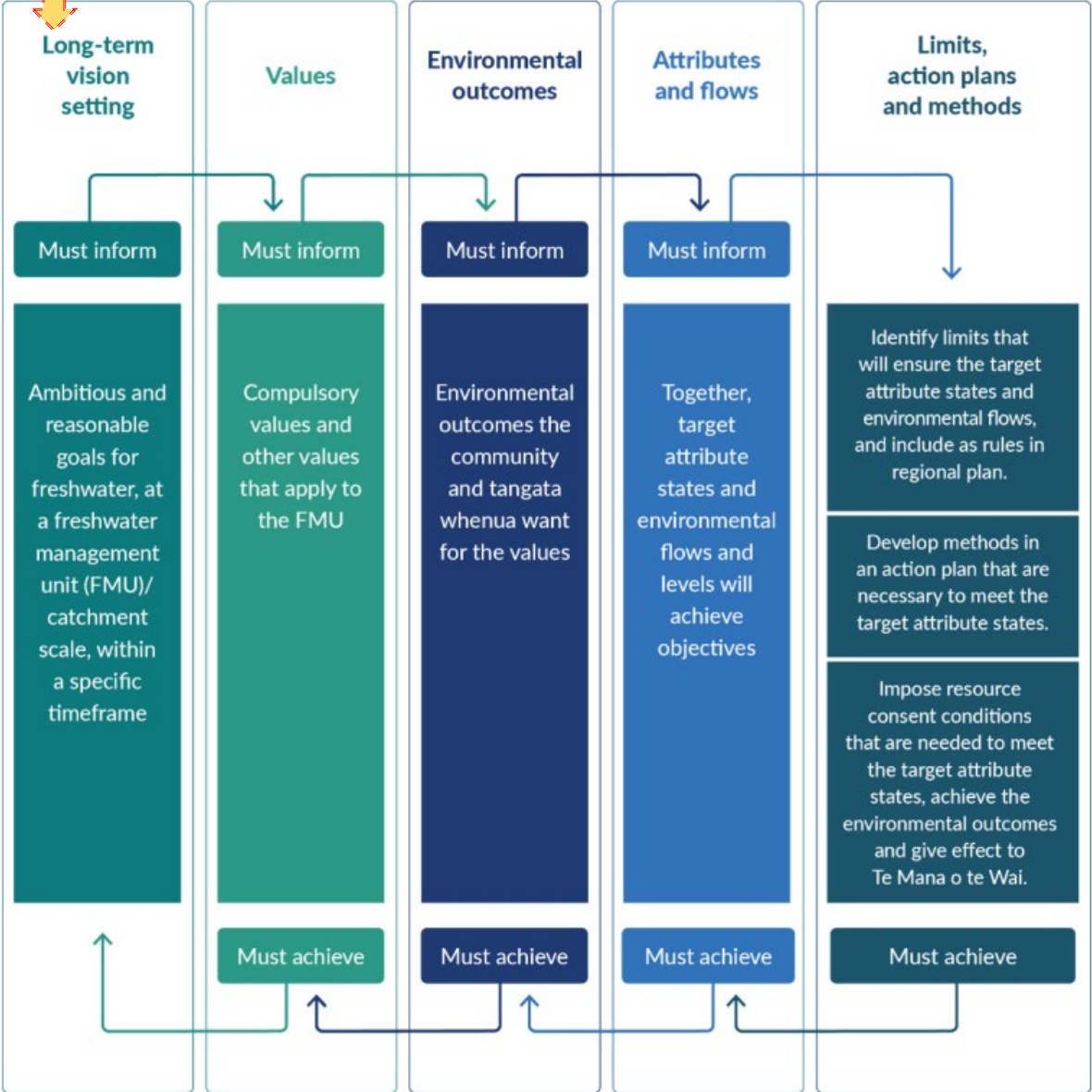


Figure 24: Adaptation of the freshwater management NOF cascade. (Source: MFE, 2023:46).

Ideally, this research would have included at least one example of a full collaborative NOF approach by council, Tāngata Whenua, and community, including their use of models at various stages of the process. However, such an example could not be found. Instead, this section considers the case studies within the NOF context, to assist councils in their considerations of how TMOTW and modelling might fit within the NOF context.

The best example of a collaborative modelling approach by council, Iwi, and third-party modelling expertise (GNS Science) was the Ngāti Rangiwewehi case study. That context regarded a discrete municipal water supply consenting (regulatory) process though, rather than general NOF implementation. In Kaipara, the modelling context involves a very sophisticated accounting model, but its development is in isolation of the NPS-FM and does not explicitly consider TMOTW (although there are obvious overlaps and potential associated with the vision to restore the mauri of Kaipara Moana, and TMOTW).

The third case study, the Mohaka me Waihua rivers, may well have provided an example of NOF implementation given the success of Tāngata Whenua involved to negotiate a partnership approach with the regional council that is resourced and self-determined. However, events including flooding and Cyclone Gabrielle resulted in the council delaying its NPS-FM implementation and a change intact which means less capacity to work alongside the Mohaka Tāngata Whenua at this time. Regardless, Mohaka me Waihua Mana Whenua are committed to the process and giving effect to TMOTW, hence their determination to commission their own modelling, gather further information as required, and complete the process with their wider communities. In Mohaka ki Waihua, the Leader's Rōpū and project team have agreed an overall vision and values. They are positioned around the 'Environmental Outcomes' pou. Their plan is to facilitate a series of wānanga with interested iwi, hapū, whānau over the next 12 months during which they will present the technical modelling tools they have developed to stimulate kōrero and the sorts of environmental outcomes desired for the different parts of the awa and catchment. Those models will complement the mātauranga shared from the facilitators and hau kainga (which in some cases may be some of the same people). From there the team will be able to go away with information gleaned with the help of the models, to consider options (attributes and flows, and limits, action plans, and methods). Further modelling might be required. With the findings/options ready to present at the next series of wānanga at which time iwi, hapū, whānau will be able to contemplate those options and inform decisions.

Ngāti Rangiwewehi has effectively completed the whole NOF process in relation to the municipal water supply from Awahou/Taniwha Springs. However, they may wish to replicate the same (or

similar) process for their other significant water bodies. It would be interesting to explore how their experience with Awahou informs their engagement in the NOF for their wider freshwater management too.

The Kaipara Moana case study sits outside of the regulatory NPS-FM context. However, it is still possible to consider how their context sits with the NOF process. The KMR vision is confirmed to “restore the mauri of Kaipara Moana”. KMR’s values for the Moana are also quite clear. However, Kōrero Tuku Iho (qualitative and conceptual model) will likely inform visioning, valuing, and anticipated outcomes for different sub catchments, recognising the mana of Mana Whenua from different areas and waterbodies which is integral to giving effect to TMOTW. Whereas Tātaki Wai has the potential to inform Environmental outcomes, Attributes and flows, and Limits, action plans, and methods. Those aspects will also align with the Mātai Onekura tool. Potentially a full NOF process could be run using Tātaki Wai as the focus. It would be a valuable exercise for numerous reasons, including greater understanding of:

- Identification of tensions and complexities associated with the shared jurisdiction between regional councils, and subsequently different/multiple FMUs.
- How/if an equitable process and outcomes could be achieved across the whole Kaipara catchment.
- How/if the Hierarchy of Obligations would be met, and whether it would make a difference if Kaipara Moana was positioned at the top of the Hierarchy with the first right to health and wellbeing.
- The roles and weights of mātauranga and scientific data, knowledge sharing, and co-production of new knowledge.
- Intersections between Kōrero Tuku Iho in particular, but also with Mātai Onekura.

SECTION III

DISCUSSION, CONCLUSION, RECOMMENDATIONS

Discussion

Responding to complex socio-ecological issues

Demand and pressure on water resources across Aotearoa (like most places) has increased in magnitude and complexity over time. The last three decades of freshwater management occurred under the RMA, which encouraged growth and development of primary industries in accordance with economic values, at the compromise of cultural and environmental values. Subsequently, the mana and mauri of freshwater has degraded across rohe, regions, and catchments.

The government's rules and regulations, consenting of water allocation and activities effecting water quality, and monitoring and compliance were inadequate for maintaining healthy waters. The cumulative result is a myriad of issues and challenges to be addressed, including a paucity of consistent and reliable data and information for water-related matters across the country and many uncertainties regarding the current state and future capacity of our water systems. The Parliamentary Commissioner for the Environment raised many of these issues in his 'Focusing Aotearoa New Zealand's environmental reporting system' (PCE, 2019). As evidenced by the MFE and Stats NZ (2023:37) in the "Our Freshwater 2023" report, those issues (specifically gaps in data, inconsistencies in methods and monitoring, lack of accessibility, and a gap in elevating mātauranga Māori) remain unresolved.

The recent reform of the resource management system offers greater direction for Tāngata Whenua involvement and leadership in the system, in accordance with Te Ao Māori, and specific requirement to recognise and uphold Te Oranga o te Taiao (environmental health and wellbeing). The system also presents a shift from 'effects-based' management of activities to an 'outcomes-focused' philosophy of management which pursues positive outcomes (EDS, 2023; Larner, 2016). This new system offers a korowai for TMOTW, and real opportunity for Aotearoa to improve freshwater management and outcomes, through a Tiriti-based ethic of care and responsibility.

Setting limits, targets, and freshwater accounting systems is fundamental to give effect to Te Mana o te Wai

Quantitative modelling focused on increased efficiencies and productivity (as the priority) and reducing adverse impacts on waterways (as secondary) remains the most prevalent use of modelling in the freshwater context – a result of the past 30 years' expansion of primary industries under the RMA (Hendy, 2018; Larned, 2016). The purpose driving those models is generally reactive, to resolve adverse impacts on water quality and in some cases quantity and/or the 'need' to increase land use efficiency to produce greater socio-economic outcomes (the two are not mutually exclusive). Those

models tend to reinforce status quo control and command over natural resources (or ecosystem services), that are still motivated by capitalist values and principles and support individual interests and private property rights (Hendy et al., 2018; Larned et al., 2016). For example, in a report⁵ on 'Land-use modelling in New Zealand: current practice and future needs' (Hendy et al., 2018:55) in reference to the model LUMASS (Land-use Management Support System), a geospatial modelling and optimisation framework, the report states "Optimisation outcomes can be constrained in terms of the land-use type, locality and performance. This enables the control of where potential changes can occur and what performance levels are required (e.g. expected revenue) or tolerable (e.g. environmental limits)". It is worth noting the language of 'tolerable' in relation to the environment compared with 'required' performance levels, which emphasises the prioritisation of performance including expected revenue.

Models will be used in a number of catchments to assist councils, Tāngata Whenua, and communities to set limits, targets, and accounting systems. Getting the balance right is a difficult exercise, however, models such as LUMASS can be used to help achieve a balance between economic and environmental priorities, *if* users are motivated to. The PCE (2015:11) recognised the concerted effort Aotearoa is making in this area, positing that "the great challenge for farmers is to increase productivity while simultaneously decreasing nutrient losses. This is the focus of much industry, government and scientific effort".

The increasing significance of freshwater accounting is recognised and provided for in the NPS-FM through the requirement on all councils to develop (or maintain) freshwater accounting systems for both water quality and quantity purposes. This requirement applies across all FMUs, and in many contexts use of models will be an integral component of those systems.

The Kaipara Moana case study exemplified a worst-case scenario when impacts on water quality are not effectively accounted for. The extreme sedimentation and subsequent impacts on water quality and the mauri of the Moana will be addressed through a freshwater accounting model (as discussed in the case study), but nevertheless, restoration is anticipated to be transgenerational (a reference to a timeframe greater than only one or several generations – conveyed through personal comms. 08/08/2023). Regarding water quantity accounting, the report by Hendy et al. (2018:38) warned "that there is relatively little modelling looking at questions around water quantity, biodiversity, biosecurity/pest control, soil and rural outcomes".

⁵ Hendy et al.'s (2018) report builds on earlier work for the Parliamentary Commissioner for the Environment in 2013 (Anastasiadis et al., 2013).

Te Mana o te Wai is a koha (gift) to shift Aotearoa's management paradigm

The status quo of freshwater management in Aotearoa is a deficit model (personal comms, 10/09/2023) consisting of effects-based management under the RMA and, in relation to modelling, reactive modelling in response to socio-ecological and economic issues. The tendency has been to privilege productivity and prioritise economic interests over the environment, including science effort and investment (Larned, 2016). This has always been a tension for Iwi and Hapū, particularly where land and resources have been lost, with subsequent impacts on mana and rangatiratanga in relation to their freshwater and other taonga (Harcourt et al., 2022).

The NPS-FM and TMOTW offer a pathway and incentive to shift the paradigm to prioritise freshwater first. A new system that recognises that the only way our waterbodies will be able to continue providing for us and our myriad uses, is if we care and provide for water first. As the MFE's guidance (2023:17) says:

The hierarchy requires a fundamental change to the way in which some resource managers have considered managing freshwater. It requires us to identify what is needed to give effect to Te Mana o te Wai, before deciding what other values can be accommodated in the catchment. The starting point is providing for the well-being of the water body not the current state of allocation or considering 'how much are we willing to give up?'

Again, (though not directly related to the NPS-FM at this time) Tātaki Wai is a useful example of purposeful design to support the re-balancing of interests, addressing both productivity and sediment reduction to improve water quality. Tātaki Wai appeals to the same control and command principles, through modelling different management options for private landowners and finding best efficiencies (for both freshwater outcomes and economic costs) and a greater return on any effort invested.

The philosophical underpinnings of models like Tātaki Wai are not necessarily a comfortable fit for Tāngata Whenua, and expertise required to design and develop such models are not typical skillsets. This point was reflected in a lack of active involvement by Kaipara kaitiaki in the model's development. Various conversations with kaitiaki indicated a general unawareness of the model design, its capabilities, or how it could be implemented. However, once discussions were underway, substantial interest was shown in regard to finding ways to influence the models use and outcomes. There was agreement that the Kōrero Tuku Iho model could (and should) influence the information feeding into Tātaki Wai and outcomes sought, so that the 'efficiencies' the users are aiming for include appropriate considerations of socio-ecological and cultural interests alongside economic

ones. In that respect, the process, or practices (kawa perhaps) associated with the use of Tātaki Wai are equally important as the 'information' inputs and outputs.

Although Tātaki Wai is not being developed specifically for NPS-FM implementation, it could be used for that purpose. If it were applied in the context of TMOTW, the focus would shift from a deficit model focused on reducing costs and increasing efficiencies, to a proactive model focused on abundance that prioritises the health and wellbeing of the water itself with the added value of also addressing economic interests, and likely better over the long-term because the resource will be sustained.

A closer look at freshwater accounting in practice, addressing over-allocation in Hawkes Bay

Though not included as a case study, it is worth highlighting the implementation of the NPS-FM by Hawkes Bay Regional Council for the Tūtaekurī, Ahuriri, Ngaruroro and Karamū (TANK) catchments where modelling played an instrumental role (noting that the related plan change (9) is still being challenged in court). The council stated that "efficient management of freshwater resources is supported by the development of surface water and groundwater models. These will be at the core of the review of our planning provisions" (HBRC, 2018). Like many other regions and catchments, the TANK catchments were/are overallocated, requiring the council to develop a programme of work. This was facilitated primarily with consent holders and data service providers, "to inform decision making to enable effective and efficient use and management of the regions water resources" (HBRC, 2018).

The ten-year TANK process established a co-governance leadership model, and a collaborative working group model, with their work culminating in significant (proposed) plan changes in 2015 and 2019. According to Ngāti Kahungunu, "shared governance may not equate to shared management or any meaningful management changes. Shared governance is dominated by council staff, agendas, long held approaches or culture. The tangata whenua taiao objectives 'promoted' by our leaders through shared governance MUST be supported and implemented by their own capable staff from their organisations and the peoples they represent. Otherwise, there are significant inequities and disadvantages in, and the real risk of no, tangible outcomes for Tangata Whenua" (pers comms, Dec. 11, 2023). Shared governance can also foster conflict amongst iwi, hapū and whanau. A serious issue that takes on many different faces, reported by other Mana Whenua entities in varying contexts regarding resource management since the RMA was introduced in 1991. Ideally, modelling that

supports environmental aspirations held by Mana Whenua would result in stronger freshwater management.

Although scientific modelling was reported by HBRC as being critical throughout the TANK process, informing the council's understanding of the interconnections and interdependencies between the overallocated Heretaunga Plains groundwater resource and the wider system, Mana Whenua are dubious of the actual weight the science and modelling has had on management outcomes. They argue that the council has its own aspirations and policy intent, and rather than being led by the science, let alone matauranga Māori, they use science to "backfill" or support certain values and aspirations namely the enablement of activities. For example, the Tukituki Catchment Proposal was described as a 'single nutrient' approach focusing on the management of phosphorus only. Nitrate-nitrogen controls were only intended to avoid toxicity effects on aquatic ecology. The Board of Inquiry rejected this approach in favour of 'dual nutrient' control which manages both phosphorus and nitrogen. The Environment Protection Agency's decision (2014) criticised the proposed approach as "a relatively 'hands off' approach to the management of nitrogen" (para 315), which recognised "the single nutrient approach seems to involve a high level of risk" (para 360).

Groundwater takes adversely impacting on the interconnected surface waters, evidenced the systems inability to meet consumer demand (noting that even greater amounts of water were allocated than what was being extracted at that time). The scenario did not exemplify the first right of water to water, above community and commercial interests, or consistency with the policy concept of TMOTW. This, and the council's lack of willingness to meaningfully recognise Tāngata Whenua interests and proactively engage with TMOTW, is why Mana Whenua have taken HBRC to court.

HBRC provides respective 'Plan Change 9' updates on its website, which include 'water quantity' aspects. Among those recent updates are "new objectives for water quantity, with new and amended allocation limits and minimum flow regimes for the surface and groundwater in the TANK catchments (detailed in Schedule 31 of the Plan)". However, as Mana Whenua point out, "despite new objectives the council has not set any targets for improvement. Nor any new limits besides their [Mana Whenua] hard-fought total allocation limit for the aquifer – which HBRC want to set at the highest level of water use ever. No real improvements for the environment and ignores the adverse effects we're experiencing. In contrary, water extraction has actually increased since TANK discussions began in 2012" (pers. comms, 11 Dec 2023). Water allocation reductions are to be enforced in some water take contexts, where allocation has not been used. Consistent water demand modelling will be required for irrigation (based on the Irricalc water demand model) but

Irricalc does not match actual use data making it arguably “useless” (pers. comms, 11 Dec 2023). Flow monitoring (and likely predictive modelling) will be fundamental for ensuring the health and wellbeing of the waters, ecosystems, and communities overall. For Mana Whenua in particular, an allocation of high-flow water to improve Māori well-being was included. Presumably modelling could assist with reliability and forecasting to reduce risks associated with any dependencies on that high flow.

This discussion about the TANK process and who and what is involved in freshwater accounting systems draws attention to the potential inequities for regions and catchments where Mana Whenua do not have the capacity or capability to engage in a similar manner. If Mana Whenua are not a part of that process, then in many cases, limits, targets, and accounting systems may forge ahead without them. Whereas even if they are involved like in this example, that still does not guarantee a meaningful process or outcomes. According to Mana Whenua engaged in the TANK process, though “involved extensively – they were more like an appendage to their [the councils] plans” (pers comms. Dec 2023). Though the policy intent may be different now (since HBRC facilitated the TANK process), and there is implementation guidance to support appropriate processes that (awkwardly) sits outside the actual catchment plan (enabling less accountability), there are still no specific requirements or accountabilities associated with involving Tāngata Whenua in freshwater modelling. With the majority of regional councils regularly reporting a lack of resourcing and capacity and the public sector’s tendency to be risk-averse rather than embracing change, it is difficult to imagine many councils going out of their way to involve Mana Whenua unless they have to. A related issue reported by Mana Whenua involved in the TANK process is a lack of “willingness”. These factors further relate to another prevalent issue in Aotearoa’s freshwater management, a lack of enforcement, monitoring, and compliance linked to a lack of public accountability (NZPC, 2023).

Research by the New Zealand Productivity Commission into addressing persistent disadvantage related to the public sector found that current accountability conditions are not fit for purpose and rather than accommodating relational, inter-generational and indigenous views of accountability the system maintains power imbalances, encourages short-termism and siloed government, and constrains more effective localised and whānau-centred commissioning and services in general (2023). This issue was partly attributed to entrenched risk-aversion which works against innovation and co-learning. In fact, our current system has developed siloed delivery models and accountability arrangements that incentivise and reinforce risk-averse behaviours (NZPC, 2023:87).

In council-led modelling scenarios, if Tāngata Whenua do not clearly communicate that they wish to be involved, conversations and decisions will likely be dominated by those with capacity that are already engaged in some way and have a relationship with that council (such as primary industry groups and Water Services providers). The concern is that Tāngata Whenua may not be aware in the first place or given the opportunity to understand the potential implications if they are involved to some extent (reflecting on insights from Kaipara). The NPS-FM includes a blanket requirement on councils to enable Tāngata Whenua involvement to the extent they wish to be involved, but presumably that relies on Tāngata Whenua having an understanding and being aware of any/all opportunities for involvement, which puts the onus (and power) back into local government's hands.

Types and uses of models within the context of Te Mana o te Wai

TMOTW, like other models, can be applied and interpreted in different ways. The stocktake analysis was constructed in such a way that the six TMOTW principles, council requirements, and other relevant matters could be considered for each model within its respective context. The stocktake table itself offers a conceptual model for councils and practitioners should they wish to conduct a similar analysis.

The findings showed that most models used by Tāngata Whenua were used reactively, in response to issues, particularly harm or risk posed by activities (such as wastewater discharges) to the mauri and mana of their freshwater taonga. An unsurprising finding given the discussion thus far.

The stocktake showed how Tāngata Whenua are using models in a variety of ways to help resolve many of those issues or at least inform the management context with greater data, predictions, and increased certainty, such as: the need for better allocation models that meet the Hierarchy of Obligations (e.g. cultural flow preferences and Kaitiaki Flow models from both Ngāi Tahu and Ngāti Rangiwewehi); measuring and addressing declining water quality and mauri (e.g. Cultural Health Assessments and Mauri models which can include both quantitative and qualitative components); and scenario testing and futuring in relation to freshwater visions and outcomes (e.g. Te Atiawa's Ngā Kete o te Wānanga; Ngāi Tahu who are developing the Ōtākaro Digital Twin; and a host of climate scenario models that include freshwater management aspects).

It is important to acknowledge that there are a number of models being developed now that have a more proactive, outcomes focus, many of which incorporate both qualitative and quantitative components (e.g. Wai Ora Wai Māori; Kaitiaki Flows; and some Cultural Health Assessments). This supports the notion of a shift beginning to occur towards a more abundant (rather than deficit) management paradigm.

To help with the stocktake analysis the examples considered were categorised into: Water quantity (n=1); water quality (n=6); integrated (n=15, two of which were integrated with a water quantity focus); and conceptual (n=11). Regarding the three case studies, they covered a breadth of model types and purposes, specifically: Ngāti Rangiwewehi – integrated with water quantity, use of both science and mātauranga, for consenting purpose; Kaipara Uri – water quality with science and accounting focus; and Mohaka me Waihua – water quality with science focus.

The different purposes influence the different model types used, which in turn aligned with different extents that science and/or mātauranga were used. The Mohaka me Waihua project team who are competent scientists and Kaitiaki, identified an information gap related to water quality data for the whole catchment, so their intention was to close that gap through modelling. Ngāti Rangiwewehi needed a model for municipal water consenting purposes and were comfortable using both science and mātauranga, as long as that use occurred within their own framing and under their mana. Mātauranga-a-Rangiwewehi must always be privileged in their context. Lastly, in Kaipara, the Tātaki Wai model is under development to assist the outcome of restoring the mauri of Kaipara Moana. Despite the strong orientation towards science and accounting the Uri seem comfortable because the model is anticipated to be an effective means to the end result they seek. The implementation of Tātaki Wai will be supplemented and informed by the cultural, conceptual model Kōrero Tuku Iho, implemented by Kaipara Uri.

Mana Whakahaere is paramount, mātauranga (best information) and tikanga (best practice) equally run alongside – all three in unison

In all 33 cases identified and analysed in the stocktake, Mana Whakahaere was expressed as being paramount in one way or another. Each case study began with a pūrākau, waiata, and in some cases additional whakataūākī to exemplify the significance of TMOTW to those people and places through use of conceptual, mātauranga-based, models. Those connections are what define Mana Whakahaere, or the right to have authority and act as kaitiaki for those waters. No other group, entity, or peoples has that same relationship, history, or knowledge. Mātauranga, generated through those intrinsic relationships and evolution through space and time, offers unique information for freshwater management. Though aratohu tend to reflect on the past, the information they provide (often referred to as ‘blueprints’) can also direct us on future pathways.

Two common themes emerged across the three case studies. One was the presence and significance of taniwha, which were acknowledged in most cases as kaitiaki/protectors except one which was associated with more ominous traits. The different narratives about taniwha also represented

tohu/indicators of something unique to those waters (possibly related to ‘best information’). The second was the commonality of important or paramount tribal figures reciting a karakia incorrectly, which led to their demise; a model for emphasising the importance of tikanga and getting things right (‘best practice’).

The Kaipara example spoke not only about the demise of their tipuna, but also the prohibition placed on the fish species that had devoured him. The practical outcome of the Kaipara model is that their people do not eat that species ever – because of its association with death and the flesh of their ancestor. This is an important model for prohibiting or controlling use. The deep respect and value associated with that context, is an important model for the current status quo of freshwater management which has become unbalanced through mismanagement.

A new (old) norm needs to be (re)established founded on care and respect for te mana o te ao Tūroa (the natural environment), recognising our position as just one species within a much broader ecosystem. Aotearoa generally (like much of the colonised world) needs to be reminded that we (humans) need water to survive. Water does not need us (humans) for anything. We are in fact the vulnerable species/element within Te Ao Mārama and would benefit greatly from a societal lesson in humility – which, helpfully, aratohu often provide.

The small collection of aratohu all expressed further observational data and values associated with TMOTW. For example, the gravel and hāngī stones of the Mohaka, the characteristics of the Kaipara waters pre-sedimentation, and the interconnecting tunnels below ground which the taniwha Pekehaua used to traverse the rohe of Ngāti Rangiwewehi.

These models illustrate and reinforce the importance of both mātauranga and tikanga for Te Ao Māori approaches to freshwater management. Furthermore, the Kaipara case study, in designing a digital ecosystem, included an aratohu ‘Kōrero Tuku Iho’ which is specific to Mana Whenua and critical to the direction of governance and management for Kaipara Moana. Kōrero Tuku Iho relates to a model developed in the Wairoa catchment, in northern Kaipara, which was used to explore and develop a proposed new kawa specific to Wairoa people and place.

Rich data provided through Kōrero Tuku Iho could (and likely will be) used to inform a new kawa to guide freshwater (and wider) governance and management across the Kaipara catchment (personal comms. 17/09/2023). Revitalised traditional mātauranga and evolving mātauranga in the form of new kawa, could play a role in capability and confidence building in both the Kaipara Uri’s own management practices and the way in which councils and communities engage and work alongside the Uri. Councils are likely to benefit from the guidance (kawa) itself, and the opportunities this pathway offers for building relationships and innovative approaches. Plus the additional value of any

associated data and knowledge shared with them (assuming trust, respect, and reciprocity are established between the parties).

The importance of tikanga or 'best practice' became glaringly integral to the use of models in the freshwater management context over the course of the research. The NPS-FM and TMOTW place more emphasis on 'best information' than 'best practice', which did not align with the findings of the case studies and wider stocktake examples. Tāngata Whenua use of models emphasised the significance of a values-based approach that prioritises the relationship and reciprocity between the entities and respective waterbodies well beyond, or in fact before, financial productivity.

Tāngata Whenua use of models highlighted ways of embodying or enacting those things (i.e. 'best practice'). Principles such as kaitiakitanga (an ethic of 'care' – not simply 'management') and manaakitanga (a selfless act of giving or providing to others) are imbued with other values and principles (of which trust, respect, reciprocity have already been mentioned). In Te Ao Māori best information requires best practices to be realised. The two go hand in hand, complementing one another.

The elevation of 'best information' in the NPS-FM (with less attention on 'best practice') reflects an onto-epistemological difference between Te Ao Māori and western management systems. While this may seem arbitrary, it is critical to effective implementation, including anything related to models. Through careful analysis, it became apparent that the six TMOTW principles are more than that, they are also processes that require 'best practice' to be implemented appropriately. For example, kaitiakitanga is an active application of care by kaitiaki.

In the context of freshwater modelling, to authentically recognise and provide for Te Ao Māori concepts including TMOTW, 'best practice' must be required in policy alongside 'best information'. If coupled in this way (as they should be) the potential to give effect to TMOTW will be much greater. On the other hand, if councils do involve Tāngata Whenua in modelling processes but only focus on 'best information' and are dismissive of 'best practice' (because, perhaps, there appears to be less requirement or accountability attached) they run the risk of derailing the process. Tikanga and kawa are fundamental aspects of implementation for Tāngata Whenua and there is an expectation (and should be a requirement) on councils to acknowledge and make space for the whole Te Ao Māori system, rather than separating out information from practice.

The idea of separating the two (mātauranga and tikanga) is unfathomable, as demonstrated by the two consistently being discussed together in each of the models analysed. Just as separating the two from the third component in the tripartite, rangatiratanga (or mana whakahaere in this context), is also nonsensical (Taylor et al., 2022). What this discussion highlights is the nature of Tāngata

Whenua systems of ‘management’ which are holistic and integrated, and based on values and first principles.

For Aotearoa to benefit from the koha that Tāngata Whenua and TMOTW have offered within the policy context, as explained earlier in the report with regard to the wisdom of tohunga Maori Marsden, there must be a commitment to the principles themselves and how they are embodied in practice (Royal, 2003). TMOTW cannot be a tick-box approach to freshwater management – that is the antithesis of what the concept offers. To attempt to limit TMOTW to a tick-box exercise would be a disservice to all involved (including other elements of Te Ao Tūroa, and our future generations).

Mana Whakahaere is critical because of its association with power, and the extent and manner of Tāngata Whenua involvement in any modelling or freshwater process. Having mana or authority in relation to a particular rohe is a critical component of being Mana Whenua, and having power to engage as they wish within their rohe or takiwā. Although the NPS-FM provides greater opportunities for Tāngata Whenua involvement and rebalancing of power asymmetries between Tiriti partners, decision making authority remains with councils, and the extent that Tāngata Whenua really are empowered and enabled continues to be at the discretion of government agencies.

In practice, councils can control implementation and use of modelling to support implementation and are also able to limit Tāngata Whenua (and community) engagement or on the other hand, establish meaningful relationships and ways of working together in mutually beneficial ways. This report included numerous examples of collaborative processes and made inferences regarding what ‘best practice’ looks like. Mana Whakahaere must be provided for first, in order to ensure that ‘best information’ can be identified and utilised for modelling. A whole systems approach is required.

‘Best information’ is also associated with power. Early in this report, Baker’s (2019) Doctoral Thesis work was referenced in which she emphasised the intersection between modelling, knowledge, and rangatiratanga (highlighting the privileging of mātauranga) in her freshwater management context with her iwi Ngāti Awa. Baker’s work was explicitly driven by tino rangatiratanga (iwi/hapū sovereignty or in the TMOTW context Mana Whakahaere) in relation to water, conveying the potentiality of using science, data, and information obtained from other sources (not entirely limited to one’s own) where that use supports their purpose (i.e. reclaiming and exercising tino rangatiratanga), and empowers and enables their relationship with and in relation to water. Two of the three case studies in this report emphasised rangatiratanga or Mana Whakahaere (Mohaka and Ngāti Rangiwewehi) and the significance of Tāngata Whenua-led processes which inherently privilege mātauranga and tikanga.

The case that differed was Kaipara, where Auckland Council leads model design and development. The difference there though, might be that power sharing has been negotiated and co-governance arrangements are already firmly in place. The implication being that, perhaps the outcome rather than the information and process increases in importance (or is able to take priority) when equity is already provided for. Who is leading, and who's information may be less important in catchments (FMUs) if the destination or outcome has been mutually agreed by both Tiriti partners.

A deeper dive into 'best information' for freshwater modelling and Te Mana o te Wai

The research has shown that a number of Tāngata Whenua entities are using models in different ways as they negotiate and navigate their way through NPS-FM and TMOTW implementation. Mana Whakahaere, or Māori governance associated with rangatiratanga and mana, emerged as the key overarching principle of significance to all use of models considered. The three case studies reinforced that point.

The first 10 years since the NPS-FM was introduced was more concentrated on water quality than quantity. A contention supported in the stocktake by the much higher number of models used for water quality purposes. This trend is likely associated with the unwillingness of Crown to redress Iwi/Māori freshwater proprietary rights and interests, despite proprietary rights being confirmed by the Waitangi Tribunal in 2019 (Tribunal, 2019). Focusing attention on quality rather than quantity assists the Crown in keeping Tāngata Whenua and communities distracted from more tenuous matters associated with water quantity.

Economic and private property values continue to dominate council and private sector investments, research, planning, policy, practice, and overall decision making; with the incoming economy-focused government unlikely to present greater opportunities for attention on freshwater or Māori rights and interests. Freshwater accounting in the planning and policy sphere should intersect with Water Services Entities, and how they give effect to TMOTW (as per the amended Water Services Entities Act 2022). These are all elements that Tāngata Whenua have a right to be involved with, and councils (and WSE) have requirements to provide respective opportunities.

The importance of modelling and awareness may increase as the deadline of 31 December 2024 approaches for councils to implement the NPS-FM and notify a regional plan and regional policy statement that gives effect to the NPS-FM (and therefore TMOTW, and accounting systems) (MFE, 2023:7). Kaipara Moana offered insights into the sophistication of modelling under development now, which will offer assist catchment-scale efforts in multiple ways. There is potential for

mātauranga to influence such modelling as well, and this is anticipated to be critical to give effect to TMOTW and ensure best information, best practice, and best outcomes.

Equity in information and opportunities to be involved is a critical human and Indigenous right. In some cases such as Mohaka, Tāngata Whenua have the expertise to be conducting their own research and modelling. However, resourcing is required across all regions and FMUs. Those that appear well funded and supported may be, relatively – but that is still far less than what is necessary in most cases to resource the information and processes critical for efficient and effective modelling.

There is a need to increase council guidance for modelling and inclusion of Tāngata Whenua. That could potentially be achieved through additions to the NOF process. Guidance should include ‘best practice’ or ‘best process’ alongside ‘best information’ – and those aspects should be stepped out alongside each step in the NOF to ensure greater detail and real insights and provision for improved implementation involving models. Simply directing councils to include ‘best information’ and leave them to interpret that, using their own limited capacities and capabilities, is inadequate. Some intervention is required to ensure equitable opportunities across all FMUs, so all Tāngata Whenua and kaitiaki have the opportunity to be involved as they wish.

Mana and mandate within the freshwater modelling context

The benefits for everyone that could be achieved through people and place-based ethics (or principles) of kaitiakitanga and manaakitanga can only be reaped if the mana of the people associated with TMOTW is recognised and given effect. The three case studies exemplified what is possible when the mana of kaitiaki and Tāngata Whenua is acknowledged and respected. The implications of Tāngata Whenua involvement in modelling (to the extent they wish) for councils and wider communities and stakeholders should be better recognised to help ensure that opportunities are not missed.

The importance of Mana Whakahaere is perhaps expected in a postcolonial society where mana and mandate are still being (re)established. The principle and process for recognising and providing for Mana Whakahaere is not defined (nor are the other five TMOTW principles and processes), because it varies between people and place (no two tribal entities are identical just as regional councils are not identical either). Ambiguity can result in uncertainty and challenges when it comes to implementation and the use of models.

Part of the challenge is determining who has mandate to exercise Mana Whakahaere. In a similar vein though, another issue is inherent in determining who has authority to make that decision,

which indicates the complex politics often associated with Tāngata Whenua involvement in freshwater modelling and management.

The case studies provided different insights into challenges related to mana and mandate.

If we return to the Hawke's Bay region, following the excessively long collaborative process (>10 years) taken for TANK and the post-cyclone Gabrielle response, the council has pared back its efforts on the ground in other parts of the region. This has frustrated other Mana Whenua groups that were/are poised to give effect to TMOTW. For the Mohaka me Waihua awa case study, they are already well underway developing their process and proposed plan provisions. Whilst Tāngata Whenua here acknowledge the serious impacts of the cyclone event, they wish to continue the process. The health and wellbeing of their awa is integral to their own health and wellbeing, it is their obligation, and will always be their priority.

The potential for conflicting priorities and desired extents for involvement and effort between councils and Tāngata Whenua is concerning. The HBRC wants to limit NPS-FM implementation, which may reduce opportunities for Tāngata Whenua involvement. In this case, Mana Whenua have pushed back because they have the necessary skills, experience, and capacity to forge ahead regardless. Their exercise of Mana Whakahaere is recognised and the council continues to fund their implementation. However, in other regions and catchments if Tāngata Whenua lack similar expertise on the ground, there may be a greater risk of being left out and/or unaware of potential opportunities for involvement. It is unclear how a situation like this, where the extent that Tāngata Whenua wish to be involved is greater than the extent of the regional council, would be resolved. It again raises the issue of compliance, monitoring and evaluation, transparency, and accountability.

In the Ngāti Rangiwewehi case study, modelling assisted the iwi's agenda to reclaim mana, ownership, and mandate in regard to their tipuna awa. This strategy helped them develop a deeper understanding of their groundwater, puna, and awa complex drawing on science that complemented and supported their cultural values and objectives. They conceptualised TMOTW for them and their context, through their own mātauranga lens first, then considered how science and quantitative modelling might support their aspirations. The models provided sufficient information for the iwi to apply for a joint consent with the Rotorua Lakes District Council to effectively "own" (or reclaim) water allocation rights from their sacred puna. It is an example of contemporary rangatiratanga or Mana Whakahaere, showing the advantage that iwi have in terms of connection and commitment to their waters. They are best placed to govern allocations given their inherent obligations, and transgenerational vested interests, to uphold the mauri and mana of that taonga.

Scaling up Tāngata Whenua use of freshwater models

The Kaitiaki Flows model demonstrates the shift in freshwater management philosophy away from a deficit model, towards an ethic of care and abundance. Through the use of models, and motivation to give effect to TMOTW, Ngāti Rangiwewehi worked collaboratively with Tāngata Tiriti to develop a wellbeing focused management regime. Their model invites regenerative potential by privileging the river's health and wellbeing first and foremost, but also considers their own allocation and use once the river is provided for.

During an interview with Ngāti Rangiwewehi their kaitiaki suggested that the one weakness in the model from their view was its specificity to the resource consent context, and a single location and puna. Whereas the concept could be provided for in regional planning provisions, as standard best practice across their rohe (and wider) where stream flows are important for water and ecosystem health. The iwi has very generously made their Kaitiaki Flows model accessible for other Mana Whenua to adopt and adapt if they wish. Ngāti Rangiwewehi is navigating ways to scale up the model into the regional plan so that all waters, and peoples can choose to benefit from this values-based approach. Unfortunately, there was concern about the difficulty of gaining sufficient councillor support for the model's adoption on a more formal and scaled up basis in their plan.

The success of the Kaitiaki Flows model in a municipal water supply and regulatory context offers the potential for wider application in other contexts requiring water use and allocation. Presumably in any context that environmental flows are currently applied because a Kaitiaki Flow is a natural extension of an environmental flow that concerns cultural values. The MFEs (2023:96) NOF guidance states that "Setting flows and levels requires a more holistic consideration of the 'suite of flows' (beyond minimum flows and allocation) to protect ecosystem health and other values. Under the NPS-FM, a flow can be considered the quantity, variability, flow, duration and timing of flows or water levels to give effect to Te Mana o te Wai, the long-term visions and outcomes set by the community and tangata whenua". Models can often be an important component for setting flows and levels.

The Mohaka me Waihua catchment may be another context where a cultural preference flow could be considered. A model could be developed, with cultural preference flows incorporated, to support protection and management of gravel and hāngī stones to sustain cultural uses. In a totally different context, cultural preference flows could be introduced into the flow regime for hydro dam systems. The Waikato River provides renewable power generation through access and use of a taonga and tipuna awa for multiple Iwi and hapū throughout the catchment. Modification of the awa for the hydro scheme has had monumental, and arguably irreparable, impacts on its natural flow, affecting

ecosystem health and wellbeing – and capacity to provide Mahinga Kai (a compulsory value under the NOF).

A programme to develop cultural preference flows along the Waikato (and/or elsewhere) could offer new innovations, new insights, re-establishment or sustainability of cultural connections, and support Te Ture Whaimana o Te Awa o Waikato the Waikato River Authority's Vision and Strategy. Strategic scaling up of cultural preference flows across such significant catchments and landscapes could offer meaningful opportunities for reconnection with TMOTW, active rebalancing of our tuakana – teina relationship with waimāori, and further commitment to Aotearoa-wide system change.

Conclusion

The NPS-FM (2020) with the inclusion of TMOTW and Hierarchy of Obligations offers a significant space of potentiality for Aotearoa to shift the paradigm on how we conceive of, relate to, and utilise our freshwater (and wider) 'resources'. This report explored the use of models by Tāngata Whenua in relation to freshwater. It also considered what modelling might become when councils, Tāngata Whenua, and communities learn to implement the policy more fully and authentically give effect to TMOTW.

Together, the research findings indicate that TMOTW is a game changer for modelling because the way that councils consider, design, develop, implement, evaluate, and revise models must all adapt to enable Tāngata Whenua to be involved to the extent they wish to be involved. That means adapting the way councils think of and use models, to be able to take full advantage of the koha offered by Te Ao Māori (TMOTW as a concept in policy) and reconcile our relationships with freshwater before it is too late.

Models that help to give effect to TMOTW must prioritise the health and wellbeing of our shared taonga (freshwater). It requires a shift in prioritising socio-economic values and interests first to environmental values and interests first. This notion to disrupt status quo may alarm some freshwater managers. However, the natural consequence of prioritising the health of freshwater and associated ecosystems is also greater socio-economic outcomes.

The NPS-FM, with the requirement to give effect to TMOTW, is a management regime that makes sense. The same cannot be said for an inverse management model (i.e. status quo) which prioritises socio-economic values and interests above and to the compromise of freshwater/environmental ones. In fact it's the opposite. Our normative freshwater regime, developed over the lifetime of the RMA (or longer), has resulted in a deficit model with negative cascading effects – which are then responded to through effects-based management.

Models have been employed reactively as well, in response to issues associated with adverse effects, or potential effects of human activities. The NPS-FM and TMOTW are an opportunity to turn this model around to focus on abundance. Models could be purposefully designed to support positive visions, values, and outcomes agreed to by all involved in the management of any FMU, as intended by the NOF, and consider more hopeful scenarios and possibilities for freshwater, communities, and economies.

Stronger policy requirements for ‘best information’ and ‘best practice’ use of models would assist this paradigm shift. Recent research by the Productivity Commission to address pervasive inequities found that Aotearoa’s public sector has low accountability across the board and high risk-aversion, both disincentives to transformative change. While the MFE has published useful guidance, there seems to be little awareness that it exists. The NPS-FM does require transparent decision making and a record of the council’s rationale, but there seems to be little or no accountability assigned to the use of models. This is insufficient given the significance of models for freshwater decision making, which is set to increase with growing pressures and complexities including climate change.

Current MFE guidance on NOF implementation focuses attention on ‘best information’ rather than ‘best practice’, which does not align with Te Ao Māori approaches to models and management. Tāngata Whenua are conceptual, systems thinkers. Modelling from a Te Ao Māori perspective requires both mātauranga (best information) and tikanga (best practice). The exercise of Mana Whakahaere cannot operate effectively without holistic thinking and operating. Therefore, TMOTW cannot be given full effect (or achieve maximum positive outcomes) without the construct of the whole system from which it emerges. TMOTW exists within te mana o Te Ao Tūroa, and can only be achieved through te mana o ngā tangata katoa (all of us). Greater effort is necessary to develop mana-enhancing implementation of TMOTW.

The NPS-FM instructs councils on how to engage Tāngata Whenua in monitoring, acknowledging that there is no one-size-fits-all and that contextual differences must be provided for. Yet the policy is silent on how Tangata Whenua should be engaged in modelling more generally, or for implementation of the NOF. The policy’s provisions only refer to “models/modelling” four times in total (all within the contexts of “Best Information” and “Water Allocation”). Both information and practice are critical to give effect to TMOTW and must involve tangata whenua to the extent that they wish. At this point in time, the research found a significant gap in awareness and understanding by tangata whenua about the importance of water-related modelling, including allocation and accounting contexts.

A lack of awareness and understanding of water-related modelling is a real concern for current and future freshwater governance and management. Both quantity and quality aspects will be increasingly influenced by modelling – particularly in relation to accounting systems and allocation. Failing to ensure tangata whenua have all of the necessary information, capacity, and capability to engage in modelling, including allocation and accounting models, would be non-compliant with Te Tiriti o Waitangi and risk failure to meet the NPS-FM requirements, including TMOTW.

To be Tiriti-compliant and ensure due diligence, it is necessary for councils to appropriately identify who has rangatiratanga and right to exercise Mana Whakahaere in water management processes (for example in and across each FMU within their authority), and the extent they wish to be involved⁶.

At the same time, councils need to determine what data it has, where the gaps are, and what modelling is necessary (at least from its view – to the best of their knowledge and cultural competency) to develop a full picture of current and future water under their jurisdiction. That information must be made available to tangata whenua, to provide them the opportunity to consider the extent they wish to engage in any of the modelling required and if/how they wish to utilize their mātauranga and tikanga in relation to model design, development, and use. Furthermore, responsible, fair, and accountable councils will ascertain capacity and capability requirements to support mana whenua to achieve those aspirations and desired outcomes. Again, matters of compliance, transparency, and accountability become critical, including in relation to power dynamics and who measures effectiveness and whether a councils implementation (including of models) is acceptable or not. Furthermore, if implementation is shown to be unacceptable then there needs to be clear and transparent consequences.

Councils do not have a right or role to assume superiority or privilege in water-related modelling contexts. Regarding TMOTW, tangata tiriti and western knowledge systems provide the tools to complement the articulation by mana whenua of the qualities and integrity of the wai (TMOTW). The extent that mana whenua wish to be involved must be provided for, without limitations or excuses for lack of capacity or capability on either tangata whenua or tangata tiriti behalf (MFE, 2023:11-12). Addressing any of those challenges as they emerge is a necessary part of the process of transformative change that gives effect to TMOTW.

Neglecting Tiriti obligations could result in re-entrenchment of historical grievances, mistrust, insidious racism and so forth. Such neglect would ultimately be a disservice to our collective water ecosystems and the communities that depend on them. Tāngata whenua ways of knowing and being, and Māori models and frameworks, have substantial and unique value to offer. At the very least, equitable inclusion of mātauranga and tikanga in water-related modelling would make the inputs and outputs more robust, as recognised by MFE in its guidance (MFE, 2023:30).

⁶ Taylor et al. (2022) have produced a conceptual model to assist kaitiaki and practitioners with the identification of user rights and extent of interests, based on WAI262.

Like the structure of the six principles for TMOTW which are Tiriti-based metrics (mana whakahaere/kaitiakitanga/manaakitanga | governance/stewardship/care and respect), the modelling context for water governance and management must also create space for dual knowledge systems, inputs, and outputs. Doing so offers an opportunity for our ecosystems, including human communities, to benefit from a combination of the best information and practices.

Though developing models based on a plurality of knowledge and behaviour systems may be challenging for a number of reasons, it is likely to strengthen freshwater modelling for Aotearoa (MFE, 2023). The strength of mātauranga is its deep connection and evolution associated with particular peoples and place. Mātauranga (best information) inherently intersects with nature, and particularly whenua and waimāori which are associated with our primeval parents Papatūānuku and Ranginui. An ideal process would create sufficient space to enable a plurality of data and knowledge. Mātauranga would be privileged through the ability of mana whenua to apply conceptual models using their inherited wisdom and relationships with wai, which this research found could then be applied alongside and complementary to other western based models (which are often but not always quantitative).

The subsequent stories that the models would be able to tell about current and future states of water quality and quantity, and integration of both and other interdependent systems, would be more robust. As the old adage goes, input equals output, meaning where a plurality of values, knowledges, practices are used to inform a model the outputs of that model are more likely to be as rich and responsive to multiple values and anticipated outcomes.

What is critical is that attempts to “integrate” or weave knowledge and value systems (i.e. mātauranga and western knowledge) is done in ways that honour both systems and maintain the integrity of the mātauranga, principles, and cultural values that have the opportunity to equally inform the information going into the model/s, and may direct the purpose, design, objectives, vision and outcomes to a greater extent than the science.

In practice, the qualitative values of mātauranga-based models could be seen as the toka (rocks) in the awa, while science is the water that flows past. Both toka and wai have mauri and mana, but the toka are fixed in position while the wai is constantly changing. This implies that different scientific and other tools can be adopted and used for modelling with tangata whenua as and when they see fit, as long as their mātauranga and tikanga are always valued and provided for equally.

Different models will be required for different FMUs due to their socio-ecological, political, and cultural contexts and varying degrees of real data availability. At the local scale, mana whenua know the water and the catchment better and more intimately than anybody else. Aratohu are situated in

intergenerational mātauranga that cannot be found in a statistical or quantitative model. However, as scale increases, we move beyond the boundaries of a single rohe (physically and culturally) and the extent of user interests including mana whenua tends to decrease. As modelling foci scales up, the need for additional sources of data and knowledge are also likely to increase. Empowering and enabling mātauranga alongside other knowledges for resource management is part of our responsibility as good kaitiaki and tīpuna to use the best information available. What remains critical at any scale is the 'how' or 'best practice' for involving mana whenua. Further guidance is offered in the following recommendations section.

Recommendations

To implement the NPS-FM and give effect to TMOTW councils must meet the five requirements on councils and six TMOTW principles. Table 3 (refer the bottom of this section) was developed to support effective implementation through a series of indicative questions. This is not an exhaustive list, but an offering of some initial guidance for authorities (both tangata tiriti and tangata whenua) to consider.

Thematic recommendations are also outlined below, based on topics that emerged through the findings and discussion. It is anticipated that these recommendations provide prompts to assist freshwater practitioners, managers, and kaitiaki to take the conceptual model of TMOTW out of where it sits in the NPS-FM and policy rhetoric, and into practical implementation that results in real improvements of mauri and mana, for the mutual benefit of all New Zealanders, across Aotearoa.

Mana and mandate

- Use of models must be Tiriti-compliant and ensure due diligence
- It is necessary for councils to appropriately identify who has rangatiratanga and authority to exercise Mana Whakahaere in water management processes (for example in and across each FMU within the council's jurisdiction), and the extent they wish to be involved⁷.
- Councils do not have a right or role to assume superiority or privilege in water-related modelling contexts.
- Ensure recognition of and provision for multiple Tāngata Whenua interests and assertions of Mana Whakahaere.
- Develop ways of working with Tāngata Whenua that are relevant to and appropriate for the FMU/s they relate to.
- If uncertain of who has mandate and which entities a council should be reaching out to, seek guidance and advice from the Ministry for the Environment, Te Arawhiti, and Te Puni Kokiri as a starting point.

Plurality of freshwater management systems

- Space needs to be negotiated, created, and held for Aotearoa to shift the FW mgt paradigm – including the use of models.
- Councils must adapt model design, development, implementation, evaluation, and revised versions of models to enable Tāngata Whenua involvement on their terms (using mātauranga and tikanga).

⁷ Taylor et al. (2022) have produced a conceptual model to assist kaitiaki and practitioners with the identification of user rights and extent of interests, based on WAI262.

- Councils need to determine what data it has, where the gaps are, and what modelling is necessary (at least from its view – to the best of their knowledge and cultural competency).
- Tāngata Whenua need to do the same from their perspective.
- A process should be established to guide Tiriti partners to collaborate and determine whether models are necessary, and if so what types, for what purpose and outcomes etc.
- When seeking to “integrate” or weave knowledge and value systems (i.e. mātauranga and western knowledge) is done in ways that honour both systems and maintain the integrity of the mātauranga, principles, and cultural values.
- Establish the right conditions, so that opportunities and provision for mātauranga to influence and inform model inputs, and direct the purpose, design, objectives, vision and outcomes are equal to opportunities and provision for western knowledge.

Disrupting status quo

- Freshwater values and interests must be prioritised above socio-economic values and interests.
- Doing so will deliver better socio-economic outcomes, particularly in the long-term.
- Rather than considering implementation of the NPS-FM and giving effect to TMOTW as a risk, councils have an opportunity to recognise that the Hierarchy of Obligations and providing for freshwater first (whether specifically referencing the concept TMOTW or not) is common sense and will benefit everyone.
- Engage in purposeful design and development of outcomes focused models, which have the capability to give effect to TMOTW.
- Responsible, fair, and accountable councils will ascertain capacity and capability requirements to support mana whenua to achieve their aspirations and desired outcomes regarding modelling and how to give effect to TMOTW.
- Councils do not have a right or role to assume superiority or privilege in water-related modelling contexts.
- Addressing capacity and/or capability issues as they emerge is a necessary part of the process of transformative change that gives effect to TMOTW.

Multiscalar considerations

- Explore opportunities for multiscalar models and modelling of/with indigenous data, knowledge, and values – from local, regional, national to international.
- Cross-cultural and geographical modelling may have important information to provide, particularly in relation to the hydrological and climatic systems and to inform future governance and management scenarios for Aotearoa-scale and planetary health and wellbeing of water, ecosystems, and communities.

Accountability

- The MFE should identify and address accountability gaps and needs.
- Effective monitoring and evaluation of council performance should be developed in relation to modelling and how Tāngata Whenua are involved (or not).

- Regular monitoring and compliance measures should be established to support the requirement in the NPS-FM for transparent decision-making which includes a description of the council's decision-making rationale.
- Develop accountability systems to ensure Tiriti compliance, and aim to exceed all Tiriti obligations.

Equitable opportunities

- Develop a programme of work for tangata whenua in different and multiple contexts (including at the pā, and for those that work within government agencies at national, regional, and local levels) to raise awareness and understanding about the relevance and importance of freshwater models and modelling processes for TMOTW, and opportunities for Tangata Whenua involvement.
- Particular attention to setting limits, targets, and freshwater accounting and allocation frameworks and processes is critical.
- Capacity and capability building for Tangata Whenua, including funding models that ensure fair and equitable resourcing and funding specifically for modelling (i.e. Tāngata Whenua in less resourced or wealthy regions should have the same level of opportunity to be involved if they wish).
- Capacity and capability building for Tangata Tiriti, particularly to support improved understandings about what information needs to be communicated and made available, and accessible for tangata whenua involvement.

Stronger policy requirements

- There is a gap in Tāngata Whenua (and likely community) understanding and awareness of the importance of water-related modelling, including allocation and accounting contexts.
- To help address this equitably, specific requirements could be developed for the NOF process to be used in contexts where models are being considered and/or will be used.
- Requirements should include specific consideration and provision of opportunities for Tāngata Whenua involvement.
- Requirements could be developed to ensure an effective process is undertaken if using models to help give effect to TMOTW.
- It would be useful to consider requirements or at least in-depth guidance or advice for each step in the NOF process.
- Develop requirements specific to 'best information' and 'best practice' for freshwater modelling, providing for Te Ao Māori freshwater management systems which are holistic and integrated, and require both mātauranga (best information) and tikanga (best practice).
- Policy requirements and/or regional council implementation strategies should ensure that all aspects of modelling is mana enhancing for all parties involved.

Table 2: Questions to prompt and support appropriate modelling that meets the five requirements on councils implementing the NPS-FM, and six principles of TMOTW. (Source: Author's own).

		Six Te Mana o te Wai Principles					
		Mana Whakahaere	Kaitiakitanga	Manaakitanga	Governance	Stewardship	Care and Respect
Five Council Requirements	Actively involve Mana Whenua	Has an agreed process between councils and mana whenua been made for decision making? Including how models will be considered, used, evaluated etc? If not, one needs to be developed. If yes, is this to the extent mana whenua wish to be involved? How is that being measured and iteratively reviewed and adapted?	Do Kaitiaki understand the full freshwater management and council regulatory context? Do they have all relevant information, capability, and capacity to engage? To know what modelling they may need or benefit from in any of the processes involved in freshwater management? And be able to engage in any proposed model development and/or use?	Has council actively involved mana whenua in a process that enables them to consider their cultural needs for showing respect, generosity, and care for freshwater, ecosystems, and communities? If there are gaps, or unknowns about the future, can modelling support better data and knowledge to help fulfil manaakitanga obligations?			
	Hierarchy of Obligations	Have mana whenua determined what the HOO looks like for them, and what models/modelling may be required?	Have Kaitiaki been involved in establishing what the HOO looks like for their rohe and relevant FMU/s? Was/is modelling required? To what extent do Kaitiaki wish to be involved?	HOO infers manaakitanga – it is a values-based, ethic of care that intends to regenerate our wai and subsequently ourselves. Modelling may help to understand how the balance required can be achieved – has there been an analysis and a process with mana whenua to consider modelling needs and ways to respond?			
	Dual Knowledges	Have mana whenua determined how mātauranga will inform and be informed by models/modelling for freshwater management?	Is there a mutual understanding between the council and mana whenua in their region regarding positions, capacities, and capabilities related with use of mātauranga and science for freshwater management?	How much data (from all sources: mana whenua, councils and communities) exists within any given FMU to provide for the values and anticipated outcomes in relation to Manaakitanga? How valuable would modelling be			

				for future scenarios and in what ways could you draw from both knowledges?			
	Vision, Outcomes, NOF	Do mana whenua have access to all necessary data and information to make informed determinations and decisions? Is there a parallel or at least agreed process for working together, utilising both mātauranga and science? To what extent are mana whenua involved? To what extent are mana whenua satisfied with their involvement in developing and/or using models to implement NOF?	In what ways is modelling being used or considered by both councils and mana whenua for NOF implementation? Can modelling help to protect, restore, enhance, and sustainably use (or even better, use in a net positive way) freshwater for this generation and future ones? What types of models are wanted, and how or to what extent do Kaitiaki want to be involved? How are future scenarios being considered and modelled? Are mana whenua involved to the extent they wish at every step of the NOF?	Will there be a parallel process for council visioning and mana whenua and/or communities? If, as an example, mana whenua want to restore kereru stocks to an extent where they can be harvested and eaten by the tribe again, where populations are thriving to be able to offer them as kai to manuhiri at their marae (i.e. manaakitanga), is there sufficient knowledge regarding freshwater capacity to support that aspiration or could modelling help to understand the goal, and how it could be achieved? And if so, what process can be agreed to ensure that both knowledges are engaged sufficiently?			
	Ki Uta, Ki Tai	Has “ki uta ki tai” been defined or interpreted by both mana whenua and council, and an agreement made around determining that extent? Does the FMU align with that determination? Is any modelling required to help understand “ki uta ki tai” and/or to integrate across the hydrological and other systems?	What types of models can be used to understand interconnections and interdependencies ki uta ki tai? Have mana whenua been involved in determining what ki uta ki tai means in this context – and acknowledgement of the value Kaitiaki can bring to conceptualising ki uta ki tai, and the needs and gaps that modelling might help with?	For mana whenua, showing respect, generosity, and care for freshwater and freshwater ecosystems <i>is</i> ki uta ki tai. How can models help freshwater managers to understand the whakapapa, the connections, between all entities within an ecosystem? And help them to fulfil that obligation?			

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