

HE PUKENGA WAI, HE PUKENGA KŌRERO - UNDERSTANDING THE KNOWLEDGE LANDSCAPE FOR WATER IN AOTEAROA AND INTERNATIONALLY

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1. Aurecon
 2. Te Amokura Consultants
 3. Stantec
 4. Beca
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ABSTRACT

"He pukenga wai, he pukenga kōrero" speaks to the interconnectedness of wai and people. In this instance, it relates to a body of water bringing with it a body of knowledge (kōrero). This name derives its origins from a well-known whakataukī, "He pukenga wai, he nohonga tāngata, he nohonga tāngata, he putanga kōrero" which translates to "where waters meet, people meet, where people meet, knowledge flows".

In Aotearoa, Taumata Arowai the new regulatory agency, aims to lead the regulation of water services in a way that gives effect to *Te Mana o te Wai*¹, is consistent with the principles of Te Tiriti o Waitangi and to further affect positive change within the water services sector.

To carry out this function, Taumata Arowai requires a comprehensive understanding of the water sector knowledge landscape in Aotearoa and internationally, to inform future governance frameworks, policies, partnerships and investment. This includes drinking water, stormwater and wastewater services.

As a first step towards gaining this understanding, Taumata Arowai formed a partnership with Aurecon, Stantec, Te Amokura Consultants, and Beca to deliver

¹ *Te Mana o te Wai refers to the importance of water - Te Mana o te Wai imposes a hierarchy of obligations. This hierarchy means prioritising the health and well-being of water first. The second priority is the health needs of people (such as drinking water) and the third is the ability of people and communities to provide for their social, economic and cultural well-being.*

he pukenga wai, he pukenga kōrero; a research project that aimed to map out the knowledge landscape of water/wai with respect to the following questions:

- What is happening in the knowledge investment landscape pertinent to Taumata Arowai’s role with regards to Mātauranga Māori?
- What is happening in the knowledge investment landscape pertinent to Taumata Arowai’s role across Aotearoa generally?
- What happening in the knowledge investment landscape pertinent to Taumata Arowai role internationally?

He pukenga wai, he pukenga kōrero will establish Mātauranga Māori at the forefront of thinking across the knowledge landscape. In approaching this mahi the partnership team structured the research focus and the ultimate deliverables around the pou of Taumata Arowai (Ko wai, Ko au and Ko tatou; outlined in the table below) and the aspiration of Tiakina te wai, hei oranga mō te katoa (safe water every day for everyone) which guided the project overall. This paper describes the process followed in establishing the partnership and delivering the project outcomes, with the hope of inspiring others in the Aotearoa New Zealand industry to follow this example.

Pou and giving effect to the aspiration		Alignment: He pukenga wai, he pukenga kōrero
Ko wai – wai mauri	It speaks to the mauri – the essence of te wai and te tangata and the reciprocal relationship between the two. Wai has its own inherent mauri handed down as a taonga to sustains us. One affects the other. If we are not taking care of wai, we are not taking care of ourselves.	Throughout this mahi we will seek to understand the specific knowledge gaps, procedural barriers and overall opportunities that are impacting the mauri of wai and explore how Taumata Arowai can support through knowledge investment and enhancement of care of this taonga.
Ko au – wai mana	It speaks to the mana – the mandate and strength of te wai and te tangata, and the mana we have been given to steward long term sustainable change.	Throughout this mahi we will seek to establish the foundations of longer-term frameworks and opportunities for the investment of knowledge that are reflective of rangatiratanga, grounded in Te Tiriti o Waitangi and te ao Māori led. We will also look to whānau, hapū, iwi and wider Māori examples to inform our approach, our frameworks and recognising that they have been giving effect to Te Mana o te Wai for many generations.
Ko tātou – wai ora	It speaks to the ora – the wellbeing and health of both te wai and te tangata. Wai has its own inherent ora sustaining properties and like mauri and mana, is handed down as a taonga to give us life.	Throughout this mahi we will seek to understand current and emerging issues and trends for wai and tangata that may impact te ora o te wai and te ora o te tangata. To achieve this, we will need to be kanohi kitea and ensure that this mahi also operates with similar core tikanga as those taken from Te Mana o te Wai

KEYWORDS

Mātauranga Māori; Partnering; Te mana o te Wai – restoring and preserving the balance between the water; the wider environment, and the community; Water as the life force; regulatory framework; governance; holistic approach; Te Ao Māori lens; integrated water management.

PRESENTER PROFILE

Jessica Grinter is a Principal Environmental Scientist with Stantec. With over 14 years' professional experience in the water industry in Aotearoa, Australia and the United Kingdom, Jessica holds a BSc in Physical Geography and Environmental Science (University of Auckland) and a Master of Integrated Water Management (MIWM; University of Queensland, Australia). She is a Certified Environmental Practitioner (Impact Assessment Specialist) and her current work predominantly involves consenting of stormwater and wastewater discharges to water and land, as well as environmental compliance assessments/reporting and the development of water services bylaws and guidance for local and regional authorities.

Garrett Hall is a Technical Director with Beca Ltd and holds a BSc in Physical Geography and MSc (Hons) in Environmental Science and Chemistry. He has over 20 years' experience working on a wide range of complex wastewater and water supply projects, both in New Zealand and the United Kingdom.

Anna Lindgren is an Associate Engineer and project manager with Aurecon and holds a MEng in Environmental and Aquatic Engineering. Anna has 18 years' experience working in New Zealand, the United Kingdom and Sweden.

Te Wehi Wright, of Taranaki, Te Arawa, Ngāti Raukawa and Ngāti Kahungunu ki te Wairoa is a senior consultant at Te Amokura Consultants. Te Wehi was raised in te ao Māori. He is a product of Kōhanga Reo, Kura Kaupapa Māori and holds a BA/LLB from Te Herenga Waka. He has spent the past years working for one of the most successful Māori organisations in Aotearoa, Tuaropaki Trust where he worked for his people and on his own whenua. He has since been working for Te Amokura Consultants who advocate for and work towards delivering better outcomes for Māori in Aotearoa New Zealand. He has extensive experience in te ao Māori, mātauranga Māori, Te Tiriti o Waitangi, policy, engagements and strategy.

1.0 INTRODUCTION

“He pukenga wai, he nohonga tāngata, he nohonga tāngata, he putanga kōrero”

This whakataukī speaks to the interconnectedness of people with our natural environment, particularly with water. He pukenga wai, he pukenga kōrero is the name given to this project and it derives its meaning from the whakataukī above.

Taumata Arowai is the new water services regulator for Aotearoa New Zealand. Taumata Arowai is committed to ensuring all communities have access to safe drinking water and they also have an oversight role in protecting the environment from the impacts of wastewater and stormwater. Taumata Arowai aims to lead the regulation of water services in a way that gives effect to Te Mana o te Wai and is consistent with the principles of Te Tiriti o Waitangi.

Taumata Arowai completed this project in partnership with Aurecon, Beca, Stantec and Te Amokura Consultants. Key outputs from this work have helped to establish the beginnings of a comprehensive understanding of the knowledge landscape of water, through Aotearoa, mātauranga Maori, and international lenses.

The collective power of bringing our organisations together allowed He Pukenga Wai, He Pukenga Kōrero to

- Utilise our collective domestic and international networks
- Utilise our collective experience

Achieve the best possible results for Taumata Arowai in collecting and analysing the information required to guide the future of Aotearoa New Zealand's water sector and resources.

2.0 THE PROBLEM DEFINITION PRESENTED BY TAUMATA AROWAI

Gaining a comprehensive understanding of the water sector knowledge landscape in Aotearoa and internationally is vital to enable Taumata Arowai to identify where they can best target their resources. This needs to be achieved in a way that gives effect to Te Mana o te Wai and is consistent with the principles of Te Tiriti o Waitangi, to affect positive change within the water services sector.

Due to the complexity of this task and the time and funding available, it was necessary for the problem to be defined very clearly. The partnership team established the following research questions very early in the process, even before the engagement of the four consultants was formalised:

- What is happening in the knowledge investment landscape, pertinent to:
 - The role of Taumata Arowai with regards to Mātauranga Māori?
 - The role of Taumata Arowai across Aotearoa generally?
 - The role of Taumata Arowai (and similar organisations) internationally?
- How can Taumata Arowai prioritise funding and forward work based on the findings of the project?

Key project milestones and deliverables required to answer these questions are detailed for each of the water sectors here, with a discussion of the overall approach provided below.

3.0 THE DELIBERATE AMBITION AND HOW WE APPROACHED THE PROJECT

3.1 DESIGN TO INNOVATE WĀNANGA

The project commenced with an initial wānanga (workshop) to ensure the project and its kaupapa started from the right place, one that placed the *ora* (life and wellbeing) of water at the forefront of our thinking. The wānanga was a way to recalibrate the way the project team considered water resources, governance and industry practice giving particular regard to the idea of water as an indivisible whole, or as “one water”.

The wānanga was co-facilitated by Te Amokura and Aurecon with the aim to understand water in its purest form, with consideration to the whakapapa of Taumata Arowai and ensuring Mātauranga Māori remained at the forefront of the teams thinking across all areas of work and throughout the project. A ‘design to innovate’ model was utilised to help our team to discuss what is, what if, what works in order to gain a deeper understanding of the needs and requirements for Taumata Arowai over the long term. Design to innovate is an approach originally developed by Aurecon to guide innovative thinking in the scoping of projects. It guides a way of thinking and working to achieve deeper understanding, shape clearer choices and make better decisions.

The wānanga covered:

- Alignment of the project with Taumata Arowai Strategy and Whakapapa
- Governance and reporting for the project including tasks and team

It was also used to introduce our team to each other, share knowledge, and discuss the scope to ensure as a partnership we were collectively engaged with the approach and deliverables.

Figure 1 below shows the project stages and deliverables.

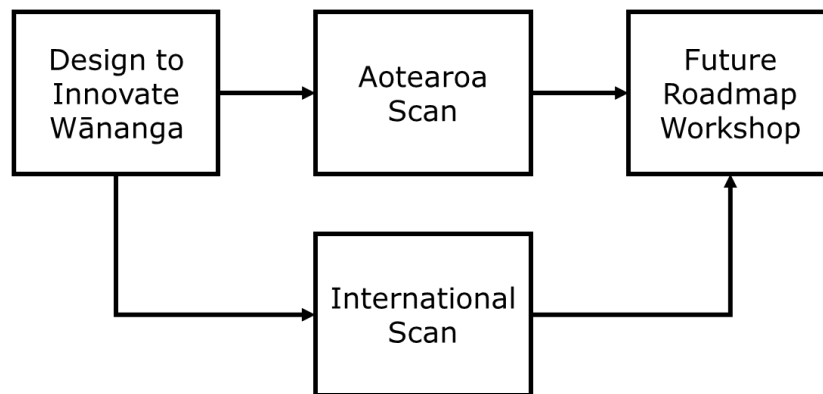


Figure 1: Project stages and deliverables

3.2 TAUMATA AROWAI WHAKAPAPA

This project was also driven by the *whakapapa* of Taumata Arowai that outlines their commitment to *Te Ao Māori* and *mātauranga Māori*.

“Ko wai, ko au, ko tātou” as reflected in Table 1 below, shaped the pillars of the *Pou* methodology that was developed to guide this work and ensured there was clear alignment between the project and the aspirations of Taumata Arowai, namely:

- **Ko wai - wai mauri** explores the essence of water and introduces Taumata Arowai
- **Ko au – wai mana** explores the current water regulatory and research landscape
- **Ko tatou – wai ora** explores what has happened to our water through project examples

These pillars acted as the common thread that ensured that *Te Ao Māori* and *mātauranga Māori* remained in the forefront throughout the work developed for this project. Te Amokura worked closely with Taumata Arowai to develop a series of questions to guide the teams thinking in ensuring the pou methodology was applied as an overarching thread throughout the work that was completed for the project, these questions are summarised in the last column in Table 1 below.

Table 1: Pou methodology

Pou	Giving effect to the aspiration	Alignment	Questions to guide our thinking
Ko wai – wai mauri	It speaks to the <i>mauri</i> – the essence of <i>te wai</i> and <i>te tangata</i> and the reciprocal relationship between the two. <i>Wai</i> has its own inherent <i>mauri</i> handed down as a taonga to sustains us. One affects the other. If we are not taking care of <i>wai</i> , we are not taking care of ourselves.	Throughout this project we will seek to understand the specific knowledge gaps, procedural barriers and overall opportunities that are impacting the <i>mauri</i> of wai and explore how Taumata Arowai can support through knowledge investment and enhancement of care of this taonga.	<ul style="list-style-type: none"> • How does this example reflect the essence/unique nature of wai and tangata in this particular location? • How does this example measure and respond to the impact of people on the wai (source to use)? • How does this example measure and respond to the impact of this wai on people (consumption to use)? • How is <i>mātauranga Māori</i> used in this example? • How is <i>mātauranga Māori</i> grown and developed in this space? • How is indigenous leadership reflected and developed in this example? – i.e., capability building
Ko au – wai mana	It speaks to the <i>mana</i> – the mandate and strength of <i>te wai</i> and <i>te tangata</i> , and the <i>mana</i> we have been given to steward long term sustainable change.	Throughout this project we will seek to establish the foundations of longer-term frameworks and opportunities for the investment of knowledge that are reflective of rangatiratanga, grounded in Te Tiriti o Waitangi and te ao Māori led. We will also look to whānau, hapū, iwi and wider Māori examples to inform our approach, our frameworks and	<ul style="list-style-type: none"> • How are iwi/mana whenua (indigenous people) included in decisions pertaining to this wai? • How are indigenous concepts and world views reflected in the practices and processes of this example? • How does this example give effect to partnership? • What accountability mechanisms are currently in place for this wai? • What are the funding structures of this example?

Pou	Giving effect to the aspiration	Alignment	Questions to guide our thinking
		recognising that they have been giving effect to Te Mana o te Wai for many generations.	
Ko tātou – wai ora	It speaks to the <i>ora</i> – the wellbeing and health of both te <i>wai</i> and te <i>tangata</i> . <i>Wai</i> has its own inherent <i>ora</i> sustaining properties and like <i>mauri</i> and <i>mana</i> , is handed down as a <i>taonga</i> to give us life.	Throughout this project we will seek to understand current and emerging issues and trends for wai and tangata that may impact te ora o te wai and te ora o te tangata. To achieve this, we will need to be kanohi kitea and ensure that this mahi also operates with similar core tikanga as those taken from Te Mana o te Wai	<ul style="list-style-type: none"> • How does this example look to measure the health and wellbeing of this wai? • How does this example look to enhance the sustaining properties of this wai? (Reinjection, reuse, riparian planting, watercress, koura, tuna, swamp lands) • How does this example provide for cross agency/organisation collaboration? • How does this example use <i>mātauranga Māori</i> to respond to issues, events and anticipate its effects? (e.g., tuatara storm/flood water in Matata) • What is happening in the fragmentation of this wai and how are we ensuring its health throughout that journey?

3.3 KEY OUTPUTS

The findings of the project were presented in two technical reports, respectively outlining the results of the scan of the Aotearoa New Zealand knowledge landscape, and the scan of the international knowledge landscape.

The report deliverables were followed by a workshop to discuss the findings of the work, referred to as the “Future Roadmap Workshop”.

3.4 AOTEAROA SCAN

The Aotearoa scan was across drinking water, stormwater and wastewater services to inform of the knowledge and practice.

Examples across Aotearoa were used to answer the questions described in Section 1 above, and to draw out any key learnings.

From a te ao Māori and mātauranga Māori perspective, the pou methodology mentioned above was used to guide and assess all parts of the project. This was challenging, especially for the international scan where some of the jurisdictions profiled did not have a history of colonisation or any particularly obvious influence of indigenous or traditional knowledge or belief systems in the respective water sectors. In these cases, an attempt was made to find specific case studies which demonstrated a successful approach to incorporating indigenous knowledge, where such an approach could be easily adapted to accommodate mātauranga Māori, or where concepts or practice were applied in a way that aligned well with and were relevant to te ao Māori world view. mātauranga Māori principles were used to structure the report and integrated throughout to highlight what is needed to shift thinking within the water sector to a place that centralises the life and wellbeing of water.

Over the course of this project, some Iwi, Hapū and other Māori representatives were asked to provide their thoughts to inform the early phases of this project. These discussions were also supported by case studies.

Some conversations were high-level and focussed on decision making opportunities, others focussed on understanding Māori aspirations for water, the steps they have taken to achieve those aspirations, which include current regulatory barriers and enablers as well as appropriate checks and balances at every level to ensure those aspirations can be met. Some case studies give a brief overview of important points while others allowed for more detail. However, it is important to note that these thoughts are only snapshots that should be used to motivate further research and engagement. They do not propose to be a reflection of all rohe, iwi, hapū and other Māori groups.

In order to gain an understanding of the research activities that crown research institutes and universities are undertaking, a series of interviews were undertaken and/or information was obtained via email correspondence. Given the short time available, only a snapshot of agencies were able to be contacted. As part of these interviews several additional contacts were also provided. Given this, this list of organisations is by no means complete, and further interviews would be required to gain a complete understanding of three waters research currently occurring in Aotearoa New Zealand.

Case Studies

Wai Ora speaks to the wellbeing and health of both water and people. It draws on the life essence that's carried through our water and sustains the environment around it, including the natural environment and people. Like mauri and mana, Wai Ora is handed down as a taonga from our atua. However, the transmission of life through water has been funnelled through a range of different ways and through a range of different processes.

To illustrate the point, several case studies were presented to understand that journey and give insight into what has happened to water through our use, interactions, and interventions.

Case studies were presented investigated and WWTP discharges and wastewater network management/consenting approaches for various environments (air, land, coastal water and freshwater).

Stormwater related case studies of best practice in stormwater management from a variety of locations across the country were profiled, with particular emphasis on those examples where a strong and collaborative relationship with mana whenua hapū had contributed to a more successful outcome, and/or where innovative or 'NZ-first' approaches had been implemented.

Industry Bodies and Research institutions

Research being carried out in Aotearoa by Crown Research Institutes, Universities, Polytechnics and water suppliers in relation to the drinking water supply, stormwater and wastewater sectors was also summarised. This included descriptions of the relationships between research organisations, funding arrangements, who decides what research is undertaken and industry and iwi/hapu input.

Water New Zealand is the main industry group for the water sector, covering drinking water, stormwater, and wastewater. Several other industry groups are active in specific areas of expertise such as WasteMINZ, which focuses on waste and resource recovery and is relevant to wastewater. Key areas of knowledge that industry groups are currently working were investigated in the report.

The following outputs were used to provide an overview of the water sector for Taumata Arowai, and most importantly identify gaps in knowledge, opportunities for collaboration (such as between research institutions and central or regional government), and opportunities to improve outcomes for freshwater and marine environments. They included:

- An understanding of how the matters outlined above currently align to and give effect to the Taumata Arowai Pou; and
- How te ao Māori and mātauranga Māori are currently given expression and reflected in decision making, practice, processes and research pertaining to drinking water management in Aotearoa.
- A summary and identification on who currently holds responsibility for drinking water management, including a brief history of drinking water regulation in Aotearoa and the relevant national and regional policies (including regulatory instruments and applied tools).

- A high level a high-level summary of relevant legislative instruments and national policy statements was undertaken to understand the regulatory landscape that stormwater and wastewater are governed through. Emphasis was placed on Te Tiriti based approaches between the Crown and Māori, such as legislation, and how those affect wastewater projects
- An analysis on how wastewater is managed in Aotearoa and the discussed the types of discharges associated with wastewater management and the associated planning and policy implications.
- Characterised the current responsibilities held by regional councils and local authorities with regards to the management of stormwater discharges, including analysis of enforcement and management powers associated with bylaws under the Local Government Act 2002, and the assessment and implementation of Best Practicable Options in stormwater design and management under the Resource Management Act 1992.
- Summarised the complexity of regulatory roles and responsibilities in urban environments, especially in urban centres located in predominantly rural or less populated regions, where agricultural land use and urban development coincide on the urban fringe.
- Reviewed and compared existing stormwater design guidelines, manuals and standards utilised across the country to identify those which are most widely implemented and represent best industry practice.
- Reviewed and compared regional and unitary plans across the country, to investigate how stormwater issues are represented and managed in recent plan changes, and in particular how the principles of te Mana o Te Wai are given effect to through stormwater management (and considered in decision-making processes).
- Identified recent trends in stormwater management such as the approval of 'global' consents to manage stormwater discharges from entire public stormwater networks into freshwater and marine environments. This included analysis of examples from multiple locations including local, regional and unitary authorities in urban and regional centres.

Key lessons

The above approach and outcomes of the Aotearoa scan provided an opportunity for the following lessons to be captured:

- The involvement of a Māori-led consultancy such as Te Amokura brought the voice of tāngata whenua and Te Āo Māori to the forefront of this work from a very early stage (during procurement) in a way that would likely not have been achieved had this not been the case.
- In conversations between Te Amokura and the other engineering and environmental consultants involved in this project, it became clear that there is a significant opportunity for these types of organisations to upskill their technical personnel and build strong, open and collaborative relationships with Māori thought leaders and professionals in the water sector. This is already occurring in isolated instances with great success, but as a partnership it is something we would like to see more of across

the industry in the near future as benefits from the involvement of Te Amokura were realised for everyone who contributed to this project.

- The collective knowledge of the partners in this work, being practitioners working at the 'coal face' of the water industry, added an immense value to published literature and white papers already available for Taumata Arowai to review.
- Existing relationships between the authors and organisations such as regional and local authorities; private sector operators; researchers and public servants meant that a truly 'real world' perspective could be gained regarding some key issues which are otherwise only presented in a particular light (for example, we were able to examine the multiple angles of wastewater overflows from the perspective of a water manager, a regulator, Te Āo Māori world view, and a subject matter expert).
- Members of the partnership have had direct involvement in some of New Zealand's most well-documented, established projects (such as wastewater treatment plants with innovative treatment and reuse technology) and as such had access to knowledge and learnings which have not been captured formally. One key finding was that we need to share more of this knowledge within the industry, and in particular between industry and central government: beyond traditional forums such as conferences and working groups.

3.5 INTERNATIONAL SCAN

Several jurisdictions around the world informed this scan of international knowledge and practice for the three waters sector. These included nations (such as Australia, the United Kingdom, Canada, the Netherlands, Germany, and Switzerland); states or provinces (California (USA), Victoria (Australia)), and cities (Vancouver (Canada), Philadelphia (USA) and Sydney (Australia)). These jurisdictions were narrowed down from an initial 'long list' based on their relevance to the Aotearoa New Zealand context, and extent of available information within the restricted delivery timeframes for the project.

Examples were drawn from across the drinking water supply, stormwater and wastewater sectors to answer the research questions described in Section 1 above, and also to draw out any key learnings (both in terms of learned experience, such as water reforms in other countries, and from academic or industry research) which could aid Taumata Arowai in forming their own path towards water reform.

The report also contained an overview of various leading research institutions, partnerships and industry bodies from around the world, illustrating a wide variety of governance and funding structures, and research foci, for each water sector.

As mentioned above, where possible efforts were made to identify examples which illustrated how indigenous knowledge (and traditional ecological knowledge) is recognised, incorporated or integrated into the provision of water

services overseas, and the degree to which indigenous peoples are empowered to participate fully in decision-making and implementation processes. This was challenging, as it was apparent that a great disparity exists in the degree to which such initiatives are documented (both within and between countries), and also the 'maturity' of political and cultural landscapes in terms of ongoing reconciliation, decolonisation and capacity building processes. However, some excellent examples were identified to link back to the aspirations of Taumata Arowai (where appropriate to do so) and explore the identity and participation of other indigenous peoples around the world in the management of water albeit at an elementary level.

For consistency in messaging and presentation of information, the final report was structured with separate sections for drinking water, stormwater and wastewater sectors. However, this was difficult to achieve while maintaining readability, because as research progressed it became clear that in many of the jurisdictions analysed, it was more common for regulators and researchers to take a "one water" approach to water regulation and service delivery, as opposed to separating three waters services out as we currently do in Aotearoa (in general). This was a key learning from the project.

Key outputs for this report included:

- High level analysis of governance frameworks and service provision in each jurisdiction, for each of the three water services
- A focus on jurisdictions, such as California (United States), which have been through significant reforms of their water sector in the last five years, and which could provide significant lessons for Taumata Arowai to inform their own experience.
- Comparison of the jurisdictions studied with Aotearoa New Zealand, in terms of geographic, demographic, economic and environmental context (such as water availability), to comment on the relevance of each example and any significant differences.
- Identification of successes and failures, and investigation of why these occurred where possible given the information available. In some cases, this included direct conversations between researchers and overseas contacts, to obtain an 'insider's perspective' from water managers, policy analysts, industry leaders and the like.
- Profiles of examples of world-leading practice, from project-scale initiatives to national programmes of work and democratic decision-making processes. Care was taken to focus on examples with a relevant or similar geographic context to Aotearoa New Zealand; innovative approaches not yet implemented in Aotearoa; collaborative decision-making processes, and in particular the active involvement of the community (including indigenous peoples) from an early stage.
- As for the Aotearoa scan report, the international report also identified gaps in knowledge (or subject matter which Taumata Arowai may like to

explore further) and opportunities to implement innovative approaches successfully based upon lessons learned elsewhere in the world.

The research process and outcomes described above brought the following lessons to light:

- Industry partners such as global consultancies, universities and research institutions, have extensive international networks which should be tapped into as a vital resource for decision-makers such as Taumata Arowai in Aotearoa New Zealand.
- The greatest insights were gained from talking directly to international experts and resource managers in the jurisdictions studied; something which was more easily achievable due to existing, strong relationships between the authors (Stantec) and international technical bodies such as the American Water and Waste Association.
- During the project, several examples of trans-boundary collaboration and mentoring were identified. This is where an organisation (such as a municipal wastewater service provider) in one country partners with an equivalent organisation in another country to share knowledge and undertake trials of technology (for example). It is our opinion this type of approach could bring immense benefit to the forward momentum of good practice water management in Aotearoa.
- Having a clear set of research questions and boundaries around the scope of analysis was vital to achieving timely delivery of the work while still providing useful outcomes for Taumata Arowai, especially given the potential breadth and depth of international practice examples which could be covered given the opportunity.
- Many aspects of the scope involved potentially subjective analysis (for example, providing commentary on how effective or otherwise an approach to water management had been). In this case, having the opportunity for independent critique of the work by the four partner organisations enabled us to maintain more objectivity and ensure that the conclusions presented were always of greatest relevance to Taumata Arowai, when it could have been easy to go on a tangent with our research.

3.6 FUTURE ROADMAP WORKSHOP

Upon completion of the Aotearoa and International Scan reports, He pukenga wai, he pukenga kōrero held a future roadmap workshop which:

- Outlined the recommendations and gaps identified in the Aotearoa and international scan reports
- Provided an overview to Taumata Arowai's Statement of Intent (SOI) and Statement of Performance Expectations (SPE)
- Mapped the recommendations and gaps from each of the reports against Taumata Arowai's SOI/SPE.

The outcomes of the workshop were:

- Identification and mapping of recommendations against Taumata Arowai Statement of Intent for 2022-2026 and Statement of Performance Expectations (**SPE**) for FY 22/23.
- A commitment from He Pukenga Wai, He Pukenga Kōrero to play an influencing role on other outcomes associated with the broader system of change.
- A commitment from He Pukenga Wai, He Pukenga Kōrero to take a deeper dive on particular issues in the near future (i.e. mātauranga Māori).
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4.0 CONCLUSIONS- HIGH-LEVEL RESULTS

4.1 SUMMARY OF INFORMATION GAPS IDENTIFIED AND RECOMMENDATIONS

Based on the review of the regulatory and research landscape combined with learnings from project examples, information gaps in the water sector were identified as detailed in Table 2.

The recommendations detailed in Table 2 below are for the entire water sector, including consultants, local government, universities, government agencies etc.

Table 2: Summary of information gaps identified and recommendations

Information gap	Recommendations for the water sector
Drinking Water	
Lack of policy or guidance on recycled water for potable use	Development of policy/guidance material
Records of historic water quality from existing water supplies may be lost in the transfer to a new system, or in the transfer to new water services entities	Setting data standards and establishing centralised data storage systems across the three waters
No dedicated drinking water funding is available, and sometimes falls into a gap between health research funding and environmental research funding	Coordination with water service entities and other water suppliers to identify research priorities and creation of a drinking water research programme
Stormwater	
Regional and territorial authorities are having to up-skill their staff very quickly to address the changing water industry, and struggle to find the resources to do this	Institute a government supported award/scholarship to fund conference attendance and encourage attendance from a wider selection of Councils across Aotearoa New Zealand

There is no national Model Bylaw for Stormwater (NZ standard), as there is for Trade Waste. As such, there are significant inconsistencies in the level of detail and degree of regulation provided in existing bylaws covering stormwater across the country.	Develop a model Bylaw or similar national standard for stormwater bylaws.
There are a range of different methods for calculating an allowance for climate change in Council guidance documents	Investigate options for bringing consistency to assumptions regarding future climate change scenarios in stormwater-related estimates and models across the country.
Existing stormwater network performance is poorly understood	Assist the local government sector to collect and process data to better understand and communicate the performance of existing stormwater networks. For example, reviewing national standard metrics for issues such as flooding, and nuisance associated with network performance.
Inconsistent framework for engineering standards/guidance. Different authorities take a wide variety of approaches to regulating additions and modifications to the stormwater network.	Assist local government sector to develop a consistent format across the country, while allowing for regional variation in content to suit the different needs of communities.
Organisations are using very different tools to address water quality issues	Consider the diversity in approaches (and geographic/socio-economic factors) when developing national guidance and focus on achieving outcomes rather than prescribing process.
The level of understanding of the scale, nature, and causes of contamination is highly variable across the country.	Assist local government sector to collect water quality data in a nationally consistent manner to better understand and target contaminant sources.
Wastewater	
Contaminant monitoring occurs in a piecemeal way without systematic regulation across WWTPs	Standardisation of monitoring suites/indicators for WWTP discharges (based on discharge type), which align with bottom lines set out in policy e.g., NPSFM
Variation in WWTP reporting requirements and compliance	Development of a standardised reporting system for monitoring results, compliance incidents and enforcement actions with reporting frequency requirements and oversight.

Lack of control over discharges into the wastewater network	Develop a wastewater bylaw or integrated three waters bylaw so that local government can better control what enters the wastewater network and reduce blockages
Land based wastewater discharge can lead to potential contamination of groundwater, particularly nitrogen leaching issues. Proximity of land discharge sites to groundwater takes needs consideration from public health and environmental perspectives	Further research is needed on the environmental and public health impacts of land-based discharge schemes and contaminant migration into groundwater, particularly with heightened awareness of groundwater quality from a potable water quality viewpoint
Lack of recent wastewater specific air discharge guidelines	Development of updated wastewater sector air discharge and odour guidelines (building on the <i>Manual for Wastewater Odour Management, 2000</i>)
Lack of performance knowledge or monitoring of wastewater networks in wet weather	Developing standard definition for overflow events so that they are measurable and prioritizing implementation of network consents with continuous improvement targets to reduce overflows. Setting up national monitoring process for overflows with reporting to oversight body (Taumata Arowai).
Lack of drivers for sustainability outcomes and resource reuse	Funding for industry sustainability innovation in reuse of waste streams. Build on existing research and innovation undertaken to meet the United Nations Sustainable Development Goals. Fund research on the beneficial reuse of biosolids, i.e., soil conditioning properties, carbon sequestering abilities. Develop Aotearoa New Zealand guidelines for wastewater reuse.
Wastewater infrastructure vulnerability to climate change	Coordination of adaptation response through consolidated water utility bodies (reform) should be a priority.
WWTP operators have widely varying approaches to measuring emissions and energy use (if at all) and setting targets for reducing emissions and energy use (if at all).	Build on existing industry guidance to develop standard process for measuring all types of wastewater treatment emissions. Develop guidance on setting targets and using technology to reduce emissions and energy use in the wastewater sector while also maintaining or improving treatment standards.
Te ao Māori and Mātauranga Māori	

Lack of focus and recognition for Te Ao Māori research into the water sector and where science and <i>mātauranga Māori</i> fit together	Targeted funding for the development of <i>mātauranga Māori</i> practices and the prioritisation of <i>mātauranga Māori</i> and Te Mana o te Wai technicians
Lack of knowledge corpus for <i>mātauranga Māori</i> practices in water care management	Dedicated programmes for Māori that support, develop and facilitate opportunities to build a knowledge corpus for <i>mātauranga Māori</i> practices in water care management
Lack of acknowledgement and understanding of processes that led to the loss of sacred and traditional knowledge in water	Acknowledging and reviewing knowledge capture processes and capability that prioritise relationships and the sacredness of information
Lack of Te Ao Māori perspectives and viewpoints included in industry body reports	Inclusion of Māori representatives and a focus on <i>mātauranga Māori</i> in industry groups, workforce planning and development pathways.
Lack of recognition and acknowledgement of <i>mātauranga Māori</i> as a genuine technical skillset beyond values and core principles	Targeted funding for the development and inclusion of <i>mātauranga Māori</i> based solutions (i.e., traditional practices). Incentives for the use and/or inclusion of <i>mātauranga Māori</i> as a technical skill.
Varying degrees of influence by Māori over water care management processes throughout Aotearoa New Zealand	Stronger requirements for Māori inclusion in decision making across the water sector that should not depend or rely on existing settlement legislation or personal relationships
Lack of mana whenua involvement in decision making	Three Waters reform where the new utility entities will have joint strategic direction and oversight through regional representative groups made up of local government and mana whenua.
Lack of knowledge on collaboration between wānanga and CRI's on water	Further research into partnerships and collaborations between wānanga and CRI's
Lack of capacity and capability for Māori to genuinely and effectively meet the increase in demand for Te Mana o te Wai expertise	Dedicated resources for councils and <i>iwi</i> to develop and support capability needed to ensure the sector can effectively give effect to Te Mana o te Wai
Some <i>iwi</i> , <i>hapū</i> and <i>mana whakahaere</i> carry the burden of all three water needs for their community	Further research into these examples is needed

Research in the water sector

Universities, CRIs, and industry groups can be siloed in terms of identifying research gaps and coordinating research	Develop a common repository for linking together research so that it is easily accessible and available to influence policy
There are not strong linkages or collaboration with international water/wastewater research agencies to gain leverage from their larger, well-funded programmes	Develop and promote research linkages with international organisations like the Water Services Association of Australia and Water Environment Federation.
Aotearoa New Zealand has long been in need of a national rainfall/runoff tool to offset gaps in observed datasets (i.e., poor resolution in rainfall gauging). This is one example of many where technical tools are in high demand, but there has been a lack of funding/support to develop them.	Assign greater priority to tools such as this, which can help to reduce disparity across different regions (in availability of data), reduce duplication of effort/expenditure between Councils trying to develop their own tools in the absence of a national one, and increase the quality and robustness of evidence supporting future planning decisions.

4.2 PUBLIC RELEASE OF REPORTS

The structure of the report was created such that the Pou of Taumata Arowai was integrated into the flow of the report. Taumata Arowai intend to release the reports to the public in the second half of 2022.