

At-risk Catchment Implementation – Geospatial Information to Support Mātauranga Māori



A Report for the Ministry for the Environment

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Glossary

awa	river, stream
iwi/hapū	tribal group
kaitiakitanga	guardianship
kaumātua	elder, person of status
kaupapa Māori	Māori approach, Māori agenda, Māori ideology
kōrero tuku iho	oral traditions
Mana Whakahono a Rohe	An arrangement for Māori and local authorities to work together under the Resource Management Act
marae	traditional gathering place
mātauranga ā-iwi	tribal knowledge
mātauranga Māori	Māori knowledge
moana	sea, ocean
moemoea	vision
Papatipu Rūnanga	Ngāi Tahu regional council
pātaka	repository, storehouse
pātere	chants, songs
pepeha	tribal sayings
pūnaha	system
rohe	region, district
rūnanga	council, iwi authority
tā moko	traditional tattooing
taiao	environment, nature
takutai moana	foreshore and seabed
tangata whenua	local people, indigenous people

taonga	treasured possession
Te Ao Māori	the Māori world, Māori world view
Te Arataura	executive committee of the Waikato-Tainui tribal authority
Te Arawhiti	the Office for Māori Crown Relations
Te Kāhui Manu Hōkai	Māori GIS Association
Te Mana o te Wai	the integrated and holistic well-being of water
Te Ohu Kaimoana	Māori Fisheries Trust
te wai māori	freshwater
Te Waipouonamu	South Island
tikanga	customs
tongi	proverb
wāhanga	category, section
wānanga	conference, seminar, forum
whaikōrero	speech-making
whakaaro	understanding
whakairo	carvings
whakapapa	genealogy
whakataukī	proverbial sayings
whānau	extended family
whānui	in general, overall
whenua	land

*Ki te kore te rere a te wai, ka piro;
ki te rere te wai, kāhore e piro.*

If the water does not flow, it will stagnant, it will fester.

However, if the water runs freely it will not

This is a proverb provided by Moka Hopa, of Ngāti Wairere, which refers to the physical state of water and that if it does not run freely it will fester and contaminate its surroundings. This proverb can also relate to a situation when two parties conflict and don't talk, and it becomes unhealthy; it can also relate to a person's state of mind.



(Photo courtesy of Keelan Walker, 2019.)

1. Introduction

1.1 Background

The Ministry for the Environment is working on a range of projects as part of the Essential Freshwater work programme. The objectives of this work programme are to:

1. stop further degradation of New Zealand's freshwater resources and start making immediate improvements so that water quality is materially improving within five years;
2. reverse past damage to bring New Zealand's freshwater resources, waterways and ecosystems to a healthy state within a generation;
3. address water allocation issues, having regard to all interests including those of Māori and existing and potential new users.

In particular, the Ministry is working to complete detailed implementation planning for the At-Risk Catchments (ARC) project. One objective of the ARC project is to develop a robust assessment process that is inclusive and will support tangata whenua, communities and regional authorities in policy development and implementation, at both national and regional levels, including targeting of investment and other non-regulatory activities.

As part of finalising the ARC project, the Ministry is working closely with the advisory groups that were set up to support the Essential Freshwater work programme on policy implementation. This includes Te Kāhui Wai Māori (KWM), the Freshwater Leaders Group (FLG) and the Science and Technical Advisory Group (STAG). KWM, FLG and STAG raised concerns about the lack of work completed to date on planning for implementation of the ARC work, facilitating the incorporation of mātauranga Māori (traditional knowledge) in catchment-level risk assessments. The ARC team is currently developing guidelines for taking into account mātauranga Māori in empirical, science-based catchment risk assessments.

1.2 Purpose

The purpose of this report is to improve the Ministry for the Environment’s understanding of how geospatial information can inform meaningful engagement with iwi/hapū. The focus of this report is the method, process, and resources available to build knowledge management frameworks at the community level, that can integrate and reconcile mātauranga Māori and scientific knowledge to support effective resource management for fresh water in ARCs, and align with the objectives and aspirations of iwi/hapū.

Project objectives are listed below:

1. Identify existing sources of geospatial information relevant to mātauranga Māori.
2. Provide recommendations on how to use the identified geospatial information effectively to engage with iwi/hapū for freshwater resource management.
3. Provide recommendations on how to communicate the ARC project objectives to iwi/hapū.

2. Ngā Whakaaro – An Understanding

This report does not attempt to provide a deep explanation of te wai māori or what mātauranga Māori, is but rather to provide an insight into how these notions can be used alongside the integration of geospatial technologies. This chapter briefly looks at te wai māori and mātauranga Māori to add context to what strategies of successful engagement look like, and how the different methodologies may be applied within a geospatial setting for iwi/hapū.

2.1 What is Te Wai Māori?

During the development of this report the writer has found several recent articles from Māori advocates on freshwater (te wai māori), identifying issues with the lack of monitoring, and procedures for the protection and management of rivers within their rohe.

Millan Ruka

<https://www.stuff.co.nz/business/115193700/more-than-200-convictions-and-6000-notices-issued-for-dirty-dairy-offences-over-past-decade>

Te Aitanga a Mahaki

<https://teaomaori.news/iwi-challenge-council-over-water-rights>

Ian Ruru

<http://gisborneherald.co.nz/localnews/4251231-135/waipaoa-river-munted>

The passion and emotion that te wai māori implies for iwi is apparent. It is intrinsically a part of their very being. The individuals above do not see a separation between te wai māori and the whenua. Te wai māori is not perceived as an abstract concept but as a part of a living organic cycle that encapsulates all things for these communities. There is an interconnected relationship between the water, land and sea: each plays a role, working together. In this writer's experience, when working with iwi/hapū in the use of geospatial technologies, taking a holistic approach generally works well.

According to Ngāti Hikairo (2005)¹

“Freshwater is the essence of life, the life giving quality that descends from Ranginui then in turn sprouts forth from Papatuanuku. For that very fact it should be cherished as a precious gift direct from the Atua. A connection to the Atua, between the parents and their children, a connection we cannot fracture, for once fractured, life shall shrivel up and cease.

It is this sense of mutual relationship and the cultural package that accompanies it that we strive to maintain. If water-bodies are polluted, altered or destroyed then a wealth of knowledge that has been accumulated over generations, becomes null and void. So too, if the knowledge is altered, forgotten or purposely suppressed then so too does the water-body suffer. We therefore avidly promote our environmental and cultural responsibilities, lest the springs of knowledge and life, dry up and cease to be”.

Te wai māori, freshwater, means a number of different things to different iwi. Through mātauranga Māori or mātauranga ā-iwi we have learnt to engage with and appreciate the meaning of te wai māori.

For example, Waikato Tainui (2018)² classify different forms of water as:

- Wai Ora – life giving and sustaining
- Wai Māori – usable for general purposes
- Wai Kino – waters of limited use
- Wai Mate – waters that have exceeded the ability to properly sustain life.

The Ministry for the Environment describes the concept of Te Mana o te Wai as the integrated and holistic well-being of water.

¹ <https://www.waikatoregion.govt.nz/assets/PageFiles/21886/Ngati%20Hikairo.pdf>

² <https://www.waikatotainui.com/services/taiao/tai-tumu-tai-pari/>

The Iwi Chairs Forum (ICF) describes Te Mana o te Wai as a universal concept that has been developed, which is supported by ICF as a critical component in redesigning NZ's water allocation framework.

2.2 What is Mātauranga Māori?

According to Hirini Moko Mead (2003)³ mātauranga Māori refers to Māori knowledge, the accumulation of knowledge that has been handed down through intergenerational knowledge transfer and the application of that knowledge is through tikanga. Tikanga (customs) allow the user to perform the various practices associated with that knowledge.

Doherty (2017)⁴ refers instead to mātauranga ā-iwi, which he says is about the relationship with which iwi interact and relate to their environment. He points out the unique relationship he has, as Tūhoe, to his surroundings and that the Te Urewera landscape helps to shape Tūhoe knowledge.

2.3 What is Kaupapa Māori?

This is an academic framework which describes engagement with Māori research but could apply to any form of activity undertaken by Māori, any Māori-led initiative developed and driven by Māori, with Māori design, engagement and ownership of the entire process. An example of a successful kaupapa Māori, mātauranga iwi project is [Ka Huru Manu](#)⁵, a Ngāi Tahu cultural mapping project that was developed over 8 years involving the Ngāi Tahu communities in capturing, creating and visualising their stories throughout their rohe. Tipene O'Regan refers to it as a Ngāi Tahu search engine. It is a most successful engagement tool within Ngāi Tahu, capturing over 5000 place names and content.

The [Indigenous Mapping Wānanga](#) is an initiative that looks to train iwi/hapū in geospatial tools to provide them with the capability to create, use, own and visualise data for iwi/hapū projects, on a variety of appropriate geospatial platforms.

2.4 What is Māori Data Sovereignty?

Leading Māori Data Sovereignty expert Karaitiana Taiuru (2016)⁶ describes Māori Data Sovereignty as:

1. Data that is produced by Māori.
2. Data that is held by Māori, describes Māori and the environments we have relationships with, made by Māori or contains any Māori content or association including genetic material and digitised genetic material, inclusive of information such as archives, records, DNA and images.
3. Recognition that Māori data should be subject to Māori governance.
4. Support for tribal sovereignty and the realisation of Māori and iwi aspirations.

³ Mead, H.M. (2003). Tikanga Māori: Living by Māori Values. Huia Publishers: Wellington

⁴ Doherty, W. (2014). Mātauranga ā-Iwi Applies to Tūhoe: Te Mātauranga o Tūhoe.

⁵ <http://www.kahurumanu.co.nz/>

⁶ <https://www.taiuru.maori.nz/maori-data-sovereignty-definition/>

While according to the Data Iwi Leaders Group (2018)⁷

1. all data that is about or affects Māori in any way e.g. 'data that is about or from Māori people, our language, culture, resources or environments we have relationships with', and
2. data that is directly derived about Māori e.g. Māori ethnic data, Māori descent data, Māori land data, iwi population data.

Hudson (2019)⁸ provides a framework for operationalising Māori Data Sovereignty through supporting a better practice model. This model could equally apply to iwi/hapū who are engaged in the GIS sector, their engagement with the government sector and what their capacity and capability is. The model is shown below.

Table 1: Operationalising Māori Data Sovereignty

	Weak	Min	Med	Strong
Māori Data Rights & Interests (Ownership)	No recognition of Māori data	Recognition of Māori interests in data	Māori governance of data	Māori ownership of data
Governance of Data (Control)	Consideration of risks for Māori	Māori participation in a data access committee	Māori protocols for data access	Māori data access committee
Data for Governance (access)	No specific access arrangements	Māori can access summary data about their collective	Māori can access raw data about their collective on request	Māori have full access to data about their collective (copies)
Jurisdiction (Possession) Security env, regulatory env, Sovereign env	Storage overseas – poor regulatory environment	Storage overseas – strong regulatory environment	Storage in NZ	Storage in Māori repository
Ethics	Consideration of risks for Māori	Integration of Māori principles (kaitiakitanga)	Use of Māori principles (guidelines)	Use of Māori principles and Data Model protocols
Consent	No consent	Individual consent – general use	Individual consent – specific use	Individual and collective consent
Capacity	No capacity building	Use of external expertise	Building organisational capacity	Building organisational & community capacity

⁷ Wilson, C. (2018) Te Ao Māori Data Hui - Data Iwi Leaders Group, 19 Sept 2018, Rotorua.

⁸ <https://www.otago.ac.nz/wellington/otago706724.pdf>

Fundamentally, a successful iwi/hapū GIS model would require medium to strong in the above categories to actively engage with both central and local government.

Building organisational capability in an iwi/hapū requires a long-term commitment from the top down, and inclusion in strategic planning and resource planning to ensure long term sustainability, as is reflected in the outcomes achieved by Ngāi Tahu. An unsustainable situation is where one individual works alone on desktop software, without support, or integration within wider processes.

To help a group understand the potential of using geospatial information, there are some short-term opportunities. The Ministry for the Environment has developed a Shiny application development geotool⁹ that could have the ability to import iwi/hapū data. Iwi/hapū could then cross reference their data against the data created by the Ministry for the Environment which may enable them to make an informed decision regarding an at-risk catchment. Once they close the browser the iwi/hapū data does not get transferred to the server and is removed from the system.

I recommend that the Ministry for the Environment investigates the importing of external data into their Shiny application development geotools, however a process of initiating strategic planning within groups is the best long-term sustainable solution.

2.5 What is Co-Design?

According to Toi Tangata¹⁰ co-design is the principle of participatory design: an approach to design that actively involves all stakeholders (those impacted by the design) in the design process to make sure the result both meets their needs and is usable. Co-design enables iwi/hapū to work alongside others to develop a solution, as opposed to its being a prescriptive solution.

Note that it could take a government-wide initiative, including the Ministry for the Environment, Land Information New Zealand, Te Puni Kokiri, Te Arawhiti and the Ministry for Primary Industries, working alongside iwi/hapū, to co-design a solution that restores the health and well-being of a river system and its surrounding environment.

At a recent Iwi Chairs Forum held in Heretaunga, Rukumoana Schaafhausen, who is the Chair of Te Arataura and Chair of the Iwi Chairs Freshwater Leaders Group, responding to the Waitangi Tribunal's Stage Two Report on Freshwater, told the Morning Report:

"Success looks like - in my view and in the view of iwi chairs - is iwi and hapū working with this Government to co-develop meaningful reforms that both address our rights and interests but at the same time improve the health of our waterways."¹¹

Fundamentally, a successful co-design project is when both parties are on an equal basis. This could take the shape of funding, participation or production. Ultimately it is where both parties are at a stage where they can equally engage in the process and contribute to its success.

⁹ <https://shiny.rstudio.com/>

¹⁰ <https://toitangata.co.nz/our-mahi/ol-or/>

¹¹ <https://www.rnz.co.nz/news/te-manu-korihī/397726/acknowledgement-of-maori-ownership-of-freshwater-needed-leader-says>

2.6 What is Participatory GIS?

Hauti (2011)¹² describes participatory mapping as a variety of methods and techniques which can range from simple, hand-drawn maps, to GIS and 3D modelling. Participatory GIS is community/participant driven whereby the GIS contractor works alongside the participants to create GIS outputs. The process is as important as the result, as participants feel informed and engaged in the process.

https://en.wikipedia.org/wiki/Participatory_GIS

Examples that exist of Participatory GIS within a Te Ao Māori setting are:

- **Te Rūnanganui o Ngāti Hikairo ki Kāwhia:**

Ngāti Hikairo worked with Digital Navigators to produce a series of GIS products which included maps, Esri GIS shapefiles and Google Earth files for and on behalf of Ngāti Hikairo, which would be used within the Waitangi Tribunal process. It involved working and training local Ngāti Hikairo participants in geospatial tools to capture and record signs of significance. It involved a series of participatory mapping wānanga at local Ngāti Hikairo marae, run by kaumātua from the iwi. Validation of sites of significance was done using mātauranga Ngāti Hikairo, local knowledge systems and tribal dialect. It was an end-to-end solution to data capture, data visualization and data storage. Ngāti Hikairo have since gone on to use the data in Treaty Settlement talks, resource and environmental management discussions, the Takutai Moana application process, as well as in language wānanga.

- **Indigenous Mapping Wānanga**

The Indigenous Mapping Wānanga grew out of an initiative called the Indigenous Mapping Workshop (IMW), which was first established in Canada in 2014 by the Firelight Group, which worked in partnership with the Google Earth Outreach team to deliver expert training to First Nations participants. The Indigenous Mapping Wānanga seeks to teach to iwi/hapū, geospatial tools and methods to capture, host, visualize, share and publish data that they have created through the wānanga. It also attempts to bring the world leaders in these technologies to engage with iwi/hapū. The idea is to have the developer of these tools showcase them to iwi/hapū and have iwi/hapū develop a project using a kaupapa Māori framework.

3. Nga Pūnaha - Geospatial Technologies

According to Land Information New Zealand (LINZ)¹³ geospatial information describes the location and names of features beneath, on or above the earth's surface. As understood by Māori, it is not new and has taken on multiple forms of expression, in a traditional sense, for a long time, such as the visualisation of the kōrero tuku iho (oral traditions), such as pepeha (tribal sayings), whakairo (carvings) tā moko (tattooing) pātere (chants/songs) whakataukī (proverbial sayings) and whaikōrero (speech making). These concepts are integral to the way that Māori express themselves and their relationships to their environment and could be defined as a pātaka kōrero tuku iho – a central repository of whakapapa.

¹² Hakopa. (2011), The Paepae, Spatial Information Technologies and the geography of narratives. Dunedin

¹³ <https://www.linz.govt.nz/about-linz/our-vision-purpose-and-values/our-location-strategy/what-geospatial-information>

Meto Hopa, Ngāti Hikairo, who mentored the writer, was asked how you would describe GIS to iwi/hapū, and he provided this tongi (proverb):

"He whakapapa ki te whenua. He takoto ki te ao"
The genealogy of the land. The lay of the earth.

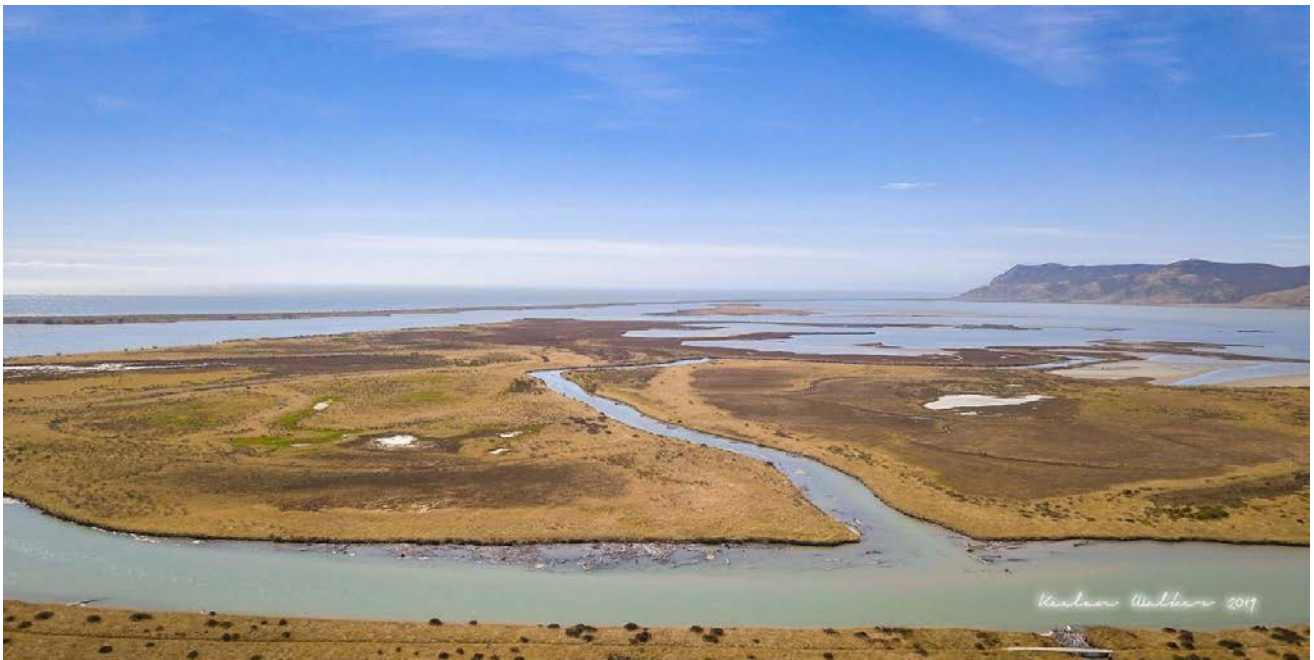
The integration of geospatial technologies within a mātauranga Māori framework is now achievable, depending on several factors highlighted in Table 1, as well as having the capability, capacity and funding necessary.

The range of software applications listed below in Table 2 give iwi/hapū the ability to express their cultural connections to whenua, awa and the moana within a geospatial digital environment see also Appendix 1.

Api Mahuika, Ngāti Porou, (1996¹⁴) referred to GIS as a whakapapa framework that not only records descent and relationships but also records and logs the history of a people. He goes on to state that the oral record of whakapapa and history has a geographical context.

"Mount Hikurangi is a symbol of Ngāti Porou mana and independence. Hikurangi is in turn, the source of the Waiapu river. These geographical landmarks locate and identify the people of Ngāti Porou".

He saw GIS as a vital tool to assist Ngāti Porou to manage all their assets, cultural, economic, social and environmental, and of great benefit to the iwi.



(Photo courtesy of Keelan Walker, 2019.)

¹⁴ Mahuika, A.T. (1996). GIS Past, Present, Future. The Conception, Development and Implementation of Ngāti Porou Information Systems. Paper presented at the Māori GIS Conference, Wellington.

Table 2: Software Considerations

Option	Type	Est Setup cost	Est Monthly Cost	Works offline	Private and Secured	Stored in NZ	Approx Users	End user Training need	Org Capability/ Sustainable
Digital Navigation hosted custom application	Hosted service	Medium	\$500-\$2000	No	Yes	Yes	As required	Dependent on implementation	Requires trustee or strategic leadership
Google Earth Pro	Desktop application	Minimal	None	Yes	No	Local devices/ high risk	1	Minimal	Useful for individuals but may not increase or sustain organisational capability.
Open source server application	Self-hosted application suite	High	\$500-\$1000	No	N/A	N/A	As required	Minimal for users	Requires high personal and organisational commitment with additional technical expertise.
ArcGIS Suite (Online, Mobile, Server, Desktop)	Proprietary enterprise integrated hosted service suite.	Minimal	\$2500 per year depending on scale. Conservation grants available.	Dependent on apps used	Yes	No	As required	Dependent on implementation	Contributes well to providing integrated organisational growth (Ngāi Tahu model).
Other web-based map services such as Mapbox	Hosted service	Medium	\$500-1000	No	N/A	No	As required	N/A	Requires high personal and organisational commitment with additional technical expertise.
PDFMaps	Local Application	Licensed	None	Yes	No	Local Devices	1	Minimal	Useful for individuals but may not increase or sustain organisational capability.
QGIS Desktop	Local Application	Low	No	Yes	No	Local devices	1	Very High	Useful for individuals but may not increase or sustain organisational capability.
Software as a service	Hosted Service	Dependent on configuration	\$1500-\$3000	No	Yes	Depending on provider	As required	Dependent on implementation	Requires high personal and organisational commitment with additional technical expertise.

4. GIS Engagement with Iwi/hapū

Technology can be a major asset, but equally, unless it is thoroughly understood and is embedded in the organisation, it can become a burden and a liability for the iwi/hapū.

Table 3, below, is used to indicate the state of iwi/hapū capacity and capability within the geospatial

sector. It should be used as a guide to assist the Ministry for the Environment in determining how they should engage with iwi/hapū and what potential resources they could assist them with. Each example is a representative case study for a particular wāhanga or category, and the recommendations made in the report on how to engage with each organisation.

Table 3: Iwi/hapū GIS Capability

Wāhanga	Description	Case Study Groups	Status	GIS Readiness	Resourced
Te Wāhanga 1	Post Settlement Governance Entity	Te Rūnanga o Ngāi Tahu	In-house	Fully operational GIS with both capability and capacity	Budgeted
Te Wāhanga 2	Post Settlement Governance Entity	Te Rūnanganui o Ngāti Porou	Outsource	No in-house capability or capacity to engage, hence it is outsourced	Budgeted
Te Wāhanga 3	Iwi/hapū	Te Rūnanganui o Ngāti Hikairo	Outsource	No in-house capability or limited capacity to engage, hence it is outsourced	Limited budget
Te Wāhanga 4	Iwi/hapū	Whangaroa Papa Hapū,	In-house	Capability and capacity	Limited Budget

As a note, it is difficult to estimate how prevalent each wāhanga is without a survey or assessment being undertaken of all iwi/hapū groups, however both the Indigenous Mapping Wāhanga and Te Kāhui Manu Hōkai record numbers exceeding 150 to 200 participants at their Māori GIS events. The Māori GIS Facebook page has over 800 participants, the majority being Māori who actively ask for assistance and engage on the weekly webinars.

4.1 Te Wāhanga 1: Te Rūnanga o Ngāi Tahu

<https://ngaitahu.iwi.nz/>

"Mō tātou, ā, mō kā uri ā muri ake nei – for us and our children after us".¹⁵

Profile

Te Rūnanga o Ngāi Tahu (Te Rūnanga), the tribal council, was established by the Te Rūnanga o Ngāi Tahu Act 1996 to be the tribal servant, protecting and advancing the collective interests of the iwi.

Te Rūnanga o Ngāi Tahu is responsible for the overall governance of the iwi, and for representing Papatipu Rūnanga and Ngāi Tahu Whānui and delivering benefits to them. Te Rūnanga o Ngāi Tahu deal with global tribal policy and issues, while Papatipu Rūnanga manage issues requiring wider or local consultation.¹⁶

The diagram on the following page shows the organisation structure for Te Rūnanga o Ngāi Tahu

GIS Status: Te wāhanga 1

Ngāi Tahu has a dedicated GIS unit using ArcGIS Enterprise across multiple workstreams. Ngāi Tahu have invested in GIS for at least the last 10 years, and have released Ka Huru Manu¹⁷ a project dedicated to creating a Ngāi Tahu Atlas of place names of Te Waipounamu.

Relationships:

The rūnanga has established relationships with both central and local government.

Recommendations:

- Provide support for Ngāi Tahu to increase their use and understanding of Ministry for the Environment data.
- Consider the benefits of Ministry for the Environment demonstrating the Shiny application tool, since the participants are highly organized.

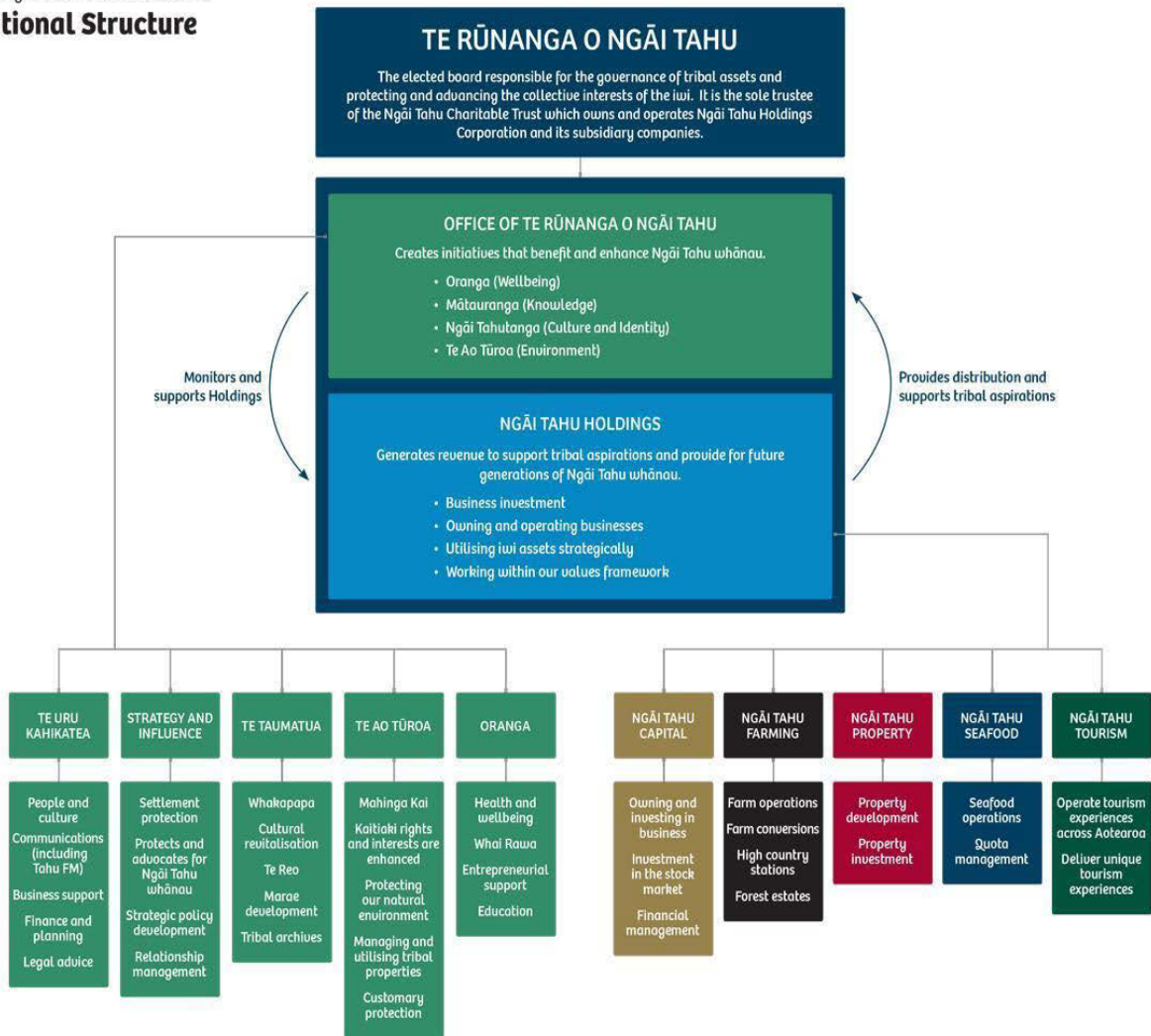
¹⁵ <https://ngaitahu.iwi.nz/>

¹⁶ <https://ngaitahu.iwi.nz/runanga/>

¹⁷ <http://www.kahurumanu.co.nz/>

Te Rūnanga o Ngāi Tahu Charitable Trust

Organisational Structure



4.2 Te Wāhanga 2: Te Rūnanganui o Ngāti Porou

<https://ngatiporou.com/>

"Ko te whakapūmau i te mana motuhake o Ngāti Porou i roto i tōna mana Atua, mana whenua, mana tangata".¹⁸

Profile

Te Rūnanganui o Ngāti Porou is the mandated iwi organisation which represents the collective interests of ngā whānau me ngā hapū o Ngāti Porou.

In 1996, Api Mahuika gave a speech at the very first Māori GIS conference which included this statement:

"Ngāti Porou want to be the data provider of all data associated with Ngāti Porou. This includes data held by Te Puni Kōkiri, Te Ohu Kaimoana, the Māori Land Court... Ngāti Porou intend to assert their cultural and intellectual property rights over all information that pertains to the tribe..."¹⁹

GIS Status: Te wāhanga 2

Te Rūnanganui o Ngāti Porou currently have no in-house GIS capability. They have a service agreement with an external GIS Provider who hosts their GIS data and provides GIS support. However, Ngāti Porou have worked with the GIS Provider since 2017 to develop a GIS database to inform and assess Ngāti Porou land use, with the goal of providing this as an internal service to Ngāti Porou landowners.

Relationships:

Te Rūnanganui o Ngāti Porou has established relationships with both central and local government. Local government have provided GIS data to assist in the development of the Ngāti Porou GIS Landuse Optimisation Platform.

Recommendations:

- Work with senior leaders to demonstrate the potential, and understand the value for Maori, of geospatial information, and to identify needs, opportunities and support requirements.
- Consider the benefits of Ministry for the Environment demonstrating the Shiny application tool, since the participants are highly organised.

¹⁸ <https://ngatiporou.com/nati-biz/who-we-are>

¹⁹ Mahuika, A.T. (1996). GIS Past, Present, Future. The Conception, Development and Implementation of Ngāti Porou Information Systems. Paper presented at the Māori GIS Conference, Wellington.

4.3 Te Wāhanga 3: Te Rūnanganui o Ngāti Hikairo

<http://www.ngatihikairo.iwi.nz/>

"Kia mau tonu ki tēnā; kia mau ki te kawau mārō. Whanake ake! Whanake ake!"

Profile

Te Rūnanganui o Ngāti Hikairo was registered as an incorporated society in 1995. It sets out the moemoea (vision), and the governance structures and processes for Ngāti Hikairo, within the Incorporated Societies Act 1908.²⁰

GIS Status: Te wāhanga 3

Te Rūnanganui o Ngāti Hikairo have collated GIS data since 2008, firstly as part of a Heritage Management plan, then as part of their Treaty settlement process. GIS database hosting and service is provided by an external GIS provider. There is limited funding to use for engagement with the GIS. Te Rūnanganui o Ngāti Hikairo lacks capacity to engage and relies on an external contractor for mapping services.

Relationship:

The rūnanga has established relationships with local government regarding heritage management. It is not formally recognised by central government.

Recommendation:

Assist Te Rūnanganui o Ngāti Hikairo to develop a Mana Whakahono a Rohe arrangement.

4.4 Te Wāhanga 4: Whangaroa Papa Hapū

<https://www.facebook.com/whangaroaph/>

Profile

The purpose of the Whangaroa Papa Hapū is to provide leadership and direction on all logistical matters pertaining to the preparation, management and presentation of submissions in the Te Paparahi o Te Raki Stage Two Hearings before the Waitangi Tribunal.

The Whangaroa Papa Hapū is a joint committee of representatives elected by their respective Whangaroa rohe Wai claimants.²¹

GIS Status: Te wāhanga 4

Whangaroa Papa Hapū has received GIS training through various initiatives including the Indigenous

²⁰ <http://www.ngatihikairo.iwi.nz/beginnings/>

²¹ https://www.facebook.com/pg/whangaroaph/about/?ref=page_internal

Mapping Wānanga in 2017 and 2018. They have limited internal GIS capacity but work on a number of initiatives.

Relationships:

They have established relationships with both local and central government.

Recommendation:

That the Ministry for the Environment works alongside Whangaroa Papa Hapū to determine GIS capability and GIS needs assessment.

5. Geospatial Initiatives

Table 4: Potential Initiatives that the Ministry can engage in with Iwi/hapū

Initiative	Organiser	Objectives	Frequency	Costs
Indigenous Mapping Wānanga	Digital Navigators Ltd	To promote geospatial initiatives amongst iwi/hapū	Annually	\$350 excl gst admission (individual)
Places	Te Kāhui Manu Hōkai - Māori GIS Association	To promote geospatial initiatives amongst iwi/hapū	Biennial	\$125 excl gst admission (individual)
Māori GIS	Facebook	Discussion forum on geospatial initiatives on behalf of Māori	Weekly Posts	Free
Te Wai Māori Freshwater Fisheries Conference	Te Wai Māori https://waimaori.maori.nz/	The vulnerability of our taonga freshwater species to a changing climate	Annually	\$200 excl gst admission (individual)
Kāhui Taiao Tūroa - National Conservation Hui	Department of Conservation, Land Information New Zealand	Growing taiao species expertise and mātauranga Māori practices	Annually	

5.1 Considerations

Iwi/hapū user needs and use cases need to be clearly understood and agreed to, prior to any investment in any option.

All ongoing maintenance and investment costs, upgrades, patching, backup, etc. should be fully costed.

If a server-based system is not required, and a system such as Google Earth access via local desktop is sufficient, then a one-off data preparation and distribution may meet requirements, however this is difficult to update and maintain, once multiple copies are distributed.

The total cost of ownership for any system should be considered, including aspects such as:

- Who are the users, how many users are there, how often will they use it, and what are their expectations?
- Who owns the information provided and who gets to see it?
- Who will maintain any systems, patch and update servers, perform backup and restore functions?
- Where will the license agreement come from, commercial or non-profit?
- What is the total cost of ownership for each option, including training, number of hours using the system, benefits available and requirements?
- How does this fit within the organization's strategic plan, both within the IT and external engagement arrangements?
- Is it likely further data will be added and updated, and how will it be maintained?
- What is the technological level of expertise of staff and users?
- Where will the information be accessed and for what purposes will it be used?
- What level of skill is available for long term maintenance of the technologies required, and what technical specialists are accessible to the hosting organisation?
- How will it be maintained?
- Where will the cost of keeping the system functional come from?

5.2 Land Information New Zealand.

LINZ has recently released a framework of outcomes and priorities, including geographic and property information used to address key challenges for NZ, improve outcomes for Maori and deliver significantly higher-value public services. Within the LINZ high value geographic and property outcome, one of the focus areas is organisations that can benefit the most and that are building capability to effectively use data. There is high potential for the Ministry for the Environment to partner with LINZ on a range of strategically aligned initiatives.

While they do not currently have plans for direct intervention and capability building within Māori groups, there is an opportunity to work closely to develop and align capability-building work.

5.3 Ministry for the Environment – Potential

Ministry for the Environment have created a series of tools using the Shiny application development/creation tool. Iwi/hapū could import data that can be cross-referenced against data created by the Ministry of Environment



(Photo courtesy of Wiremu Maurirere, 2018.)

Table 5: Potential Options for Iwi/hapū

	Pros	Cons
Option 1:	Esri ArcGIS Online - Part of an enterprise-level suite of tools	
	<ul style="list-style-type: none"> Expandable storage and capacity Approx \$250 per month No maintenance required Common throughout government, business and Māori GIS users. All councils and government agencies use this software 	<ul style="list-style-type: none"> Proprietary technology Basic training is required Hosted outside of NZ
Option 2:	Server-based database application and web server (local hardware or virtual – Datacom, Amazon, etc.)	
	<ul style="list-style-type: none"> Complete flexibility and control Can run any desired software option Ideal for hosting multiple web map applications 	<ul style="list-style-type: none"> High setup and maintenance costs Requires ongoing servicing and maintenance Not ideal for a single application. Large ongoing costs
Option 3:	Hosted Map server (Regional Council, Māori Trustee or other service provider)	
Alternative Option.	<ul style="list-style-type: none"> Data hosted securely, maintained and backed up at an agreed cost Opportunity to grow relationships with provider as a partner Based on whatever technology offered by the provider, using their current infrastructure and software. 	<ul style="list-style-type: none"> Ongoing contribution to costs Training required
Option 4:	Open source tools including QGIS, PostGres and Mapserver	
	<ul style="list-style-type: none"> widely available suite of applications Customisable No licensing cost 	<ul style="list-style-type: none"> Significant labour investment and expensive setup, maintenance and ongoing operational costs Limited support arrangements available. Low skill base in New Zealand (Esri ArcGIS is used by 90% of organisations) Requires coding and skilled development to deploy any networked application. Not always interoperable with councils.

Table 6: Proposed Project methodology to assist Iwi/hapū to work with the Ministry of the Environment

Step 1	The Ministry for the Environment to work with Iwi or Hapū to scope the project requirements.
Step 2	The Ministry for the Environment would co-design a project brief that can capture the core business of Iwi or Hapū to provide a series of recommendations regarding the development of solutions for Iwi or Hapū that are practical and sustainable.
Step 3	Engage a GIS Provider to work alongside Iwi or Hapū to develop a series of GIS models that highlight the value it can add to the core business processes of Iwi or Hapū.
Step 4	GIS provider makes recommendations, including high level investment requirements for Iwi or Hapū, to the steering group.
Step 5	GIS Provider presents fully costed options including planning, development, implementation, transition, ongoing maintenance and future roadmap. Costs would include technology setup, training, implementation and ongoing resourcing needs for Iwi or Hapū. Iwi or Hapū responsible for ensuring the business benefits; costs and opportunity cost are balanced against the overall return on investment.
Step 6	Planning for implementation is approved by Iwi or Hapū governance group.
Step 7	Good practice project management principles are followed to implement the most appropriate solution.

6. Recommendations

Provided are a series of recommendations on how the Ministry for the Environment can communicate the ARC project objectives to iwi/hapū:

- The Ministry for the Environment to lead a collaborative government ministerial approach that aligns ARC objectives and that should involve co-design initiatives with iwi/hapū.
- The Ministry for the Environment to provide dedicated funding and budget for time/cost incurred by iwi/hapū.
- The Ministry for the Environment to provide scholarships to build capability within iwi/hapū.
- The Ministry for the Environment to lever Crown Research Institutes like GNS Science and Landcare Research Manaaki Whenua to work collaboratively where possible on projects with similar goals and objectives.
- The Ministry for the Environment to avoid a 'doing it alone' approach.
- The Ministry for the Environment to support existing GIS building initiatives such as [Te Kahui Manu Hokai](#) and the [Indigenous Mapping Wānanga](#).
- The Ministry for the Environment to improve visibility and accessibility of geospatial tools and data on the Ministry for the Environment website.
- The Ministry for the Environment to develop a resource tool that shows iwi/hapū where to find funding for GIS projects.
- The Ministry for the Environment, with iwi/hapū, to identify a government facilitation service that can help draft funding applications.
- The Ministry for the Environment to create a Shiny application web portal through which iwi/hapū can import data that is cross-referenced against data created by the Ministry for the Environment

Appendix 1: Identify existing sources of geospatial information relevant to mātauranga Māori

Matauranga Māori	Dataset	Description of the theme	Organisation	Source
He Whenua Information pertaining to land	Māori Land Court Spatial Data (May 2017)	The Māori Land Spatial Dataset is a combination of the spatial data available in the Map Search section of the Ministry of Justice (MOJ) Māori Land Online website and static data about management structures from the MOJ Māori Land Information System	Ministry of Justice	https://www.maorilandcourt.govt.nz/your-maori-land/maori-land-data-service/
	NZ Property Tiles Owners	<p>This dataset provides registered ownership information for live and part-cancelled Records of Title (where there is a relationship to a primary parcel).</p> <p>Where multiple registered owners are associated with a Record of Title, multiple copies of individual title shapes will be shown. Likewise, if an owner is associated with more than one title, there will be a shape for each title interest.</p> <p>A Record of Title is a record of a property's owners, legal description and the rights and responsibilities registered against the title.</p> <p>The Privacy Act 1993 applies to personal information contained within this dataset, particularly when used in conjunction with other public data.</p> <p>Please ensure your use of this data does not breach any conditions of the Act.</p> <p>This dataset provides registered ownership information for live and part-cancelled Records of Title (where there is a relationship to a primary parcel).</p>	Land Information New Zealand	https://data.linz.govt.nz/layer/50806-nz-property-title-owners/
	NZ Property Titles	<p>This dataset provides title information (excluding ownership) where there is a relationship to one or more primary parcels.</p> <p>A Record of Title is a record of a property's owners, legal description and the rights and responsibilities registered against the title.</p>	Land Information New Zealand	https://data.linz.govt.nz/layer/50804-nz-property-titles/

		This dataset does not contain any ownership information so that it can be freely distributed. If ownership information is required, see the NZ Property Title Including Owners and NZ Property Title Owners datasets. Note: these are restricted access datasets and require you to agree to the LINZ Licence for Personal Data.		
NZ Primary Parcels		<p>This layer provides the current primary parcel polygons and some associated descriptive data that details the appellation (legal description), purpose, size and a list of titles that have an interest in the parcel.</p> <p>A primary parcel is a portion of land that is intended to be:</p> <ul style="list-style-type: none"> • owned by the Crown, except moveable marginal strips • Held in fee simple (predominately private ownership) • Māori freehold land or Māori customary land • Public foreshore and seabed • The bed of a lake or river • Road or Railway • Vested in a local authority <p>Primary parcels can be thought of as the 'base level' of the 'jigsaw puzzle' of all land making up New Zealand. Other 'levels' are NZ Non-primary parcels that essentially limit the full rights that would normally be associated with a primary parcel for example easements, covenants, leases and moveable marginal strips etc.</p>	Land Information New Zealand	https://data.linz.govt.nz/layer/50772-nz-primary-parcels/
NZLRI Land Use Capability		<p>The New Zealand Land Resource Inventory (NZLRI) is a national database of physical land resource information. It comprises two sets of data compiled using stereo aerial photography, published and unpublished reference material, and extensive field work:</p> <p>An inventory of five physical factors (rock type, soil, slope, present type and severity of erosion, and vegetation). A 'homogeneous unit area' approach is used to record the five physical factors simultaneously to a level of detail appropriate for presentation at a scale of 1:50,000.</p> <p>A Land Use Capability (LUC) rating of the ability of each polygon to</p>	Manaaki Whenua Landcare Research	https://data.mfe.govt.nz/layer/52375-lucas-nz-land-use-map-1990-2008-2012-2016-v006/

		sustain agricultural production, based on an assessment of the inventory factors above, climate, the effects of past land use, and the potential for erosion. The NZLRI covers the country in 11 regions, each with a separate LUC classification.		
NZLRI Soil		The NZLRI is a spatial database containing about 100,000 polygons (map units), each of which describes a parcel of land in terms of five characteristics or attributes (rock, soil, slope, erosion, vegetation). This layer represents a GIS dissolve on the soil attribute of the NZLRI.	Manaaki Whenua Landcare Research	https://iris.scinfo.org.nz/layer/48066-nzlr-soil/
S-map - a new soil spatial information system for New Zealand (current)		S-map's primary map layer is soil classes, i.e. delineated areas that are labelled with the soil family name. Each soil family is defined as a unique combination of attributes (NZ Soil Classification, parent material, rock type, dominant texture and permeability class). Soil classes are further characterised as siblings according to their depth to rock class, stoniness, land type, drainage, texture (more detailed), functional horizons and miscellaneous variant information.	Manaaki Whenua Landcare Research	https://iris.scinfo.org.nz/layer/48440-s-map-a-new-soil-spatial-information-system-for-new-zealand-current/
LUCAS NZ Land Use Map 1990 2008 2012 2016 v006		The Land Use Map is composed of New Zealand-wide land use classifications (12) nominally at 1 January 1990, 1 January 2008, 31 December 2012 and 31 December 2016 (known as "1990", "2008", "2012" and "2016"). These date boundaries were dictated by the First and Second Commitment Periods of the Kyoto Protocol. The layer can therefore be used to create either a 1990, 2008, 2012 or 2016 land use map depending on what field is symbolised.	Ministry for the Environment	https://data.mfe.govt.nz/layer/52375-lucas-nz-land-use-map-1990-2008-2012-2016-v006/
LINZ Managed Crown Property		This layer includes all Crown Land and Properties managed by LINZ which have been identified spatially and can include properties managed by LINZ on behalf of other agencies. The attributes in this dataset are derived from the National Property and Land Information System (NaPALIS), which is a centralised database for all Land Information New Zealand (LINZ) and Department of Conservation (DOC) administered land.	Land Information New Zealand	https://data.linz.govt.nz/layer/53358-linz-managed-crown-property/
Protected Areas		This Protected Area Layer contains land and marine areas, most of which are administered by the Department of Conservation Te Papa Atawhai (DOC) and are protected by the Conservation, Reserves, National Parks,	Land Information New Zealand	https://data.linz.govt.nz/layer/53564-protected-areas/

		Marine Mammal and Marine Reserves Acts.		
	NZ Trig Points (Topo, 1:50k)	A structure on top of a hill, usually coloured black and white, used as a physical reference point by surveyors to determine location. The symbol shown on the map includes the elevation and trig identification code for beacons trig stations.	Land Information New Zealand	https://data.linz.govt.nz/layer/103476-nz-trig-points-topo-150k/
	NZ Survey Plans	<p>This layer provides metadata about cadastral surveys along with reference points indicating the location of the survey.</p> <p>A cadastral survey determines and describes the spatial extent (including boundaries) of interest of land within New Zealand. Each survey is allocated a unique reference number (that prior to Landonline included reference to the land district).</p> <p>This data provides details that identify the type of survey, the purpose, description and key dates relating to the survey.</p>	Land Information New Zealand	https://data.linz.govt.nz/layer/50794-nz-survey-plans/
	NZ Primary Hydro Parcels	<p>This layer provides the current Hydro parcel polygons with associated descriptive data.</p> <p>The combination of this layer with the other land parcels and road parcels equates to the primary parcels layer which provides all current parcels for New Zealand (i.e. excludes historic and pending parcels).</p> <p>This set of three parcel layers (land, road and hydro) enables easy access to the most common groupings of parcel intents (excluding non-primary parcels).</p>	Land Information New Zealand	https://data.linz.govt.nz/layer/50771-nz-primary-hydro-parcels/

Te Wai Māori Information pertaining to water and particularly Freshwater	Vulnerable catchments	This dataset shows catchments that have been classified as vulnerable (as defined by the criteria for the Freshwater Improvement Fund).	Ministry for the Environment	https://data.mfe.govt.nz/layer/53523-vulnerable-catchments/
	NZ River Name Polygons (Pilot)	This dataset provides river name polygons for mainland New Zealand. It is part of a pilot to understand the benefit of combining river names and location, and making these openly available through the LINZ Data Service.	Ministry for the Environment	https://data.linz.govt.nz/layer/103631-nz-river-name-polygons-pilot/
	NZ River Name Lines (Pilot)	This dataset provides river name lines for mainland New Zealand. It is part of a pilot to understand the benefit of combining river names and location, and making these openly available through the LINZ Data Service.	Ministry for the Environment	https://data.linz.govt.nz/layer/103632-nz-river-name-lines-pilot/
	Location and extent of NZ's aquifers, 2015	A unit of rock or sediment is called an aquifer when it can yield a usable quantity of water. Aquifers may occur at different depths in the same location. The map shows the areas of New Zealand's land surface above one or more aquifers. The aquifer boundaries were described by White (2001), and some boundaries were updated by Moreau and Bekele (2015), using information provided by regional councils and from Lovett and Cameron (2015). The map has 153 polygons (aquifer outlines), some of which have more than one aquifer.	Ministry for the Environment	https://data.mfe.govt.nz/layer/52675-location-and-extent-of-nzs-aquifers-2015/
	River Environment Classification New Zealand (2010)	the New Zealand River Environment Classification (REC) organises information about the physical characteristics of New Zealand's rivers. Individual river sections are mapped according to physical factors such as climate, source of flow for the river water, topography, and geology, and catchment land cover e.g. forest, pasture or urban. Sections of river that have similar ecological characteristics can then be grouped together, no matter where they are.	Ministry for the Environment	https://data.mfe.govt.nz/layer/51845-river-environment-classification-new-zealand-2010/
	River Flows	River flow refers to the quantity of water passing a point in the river over a certain amount of time. Different rivers have different flow patterns, such as sharp peak flows following rain with low flows in between, or high spring flows from snow melt. These flow characteristics affect how much water is available for irrigation, drinking water, hydro–electric power generation, and recreational activities such as fishing and boating. River flows are also very important for maintaining the health and form of a waterway. This dataset relates to the "Geographic pattern of natural river flows" measure on the Environmental Indicators, Te taiao Aotearoa website.	Ministry for the Environment	https://data.mfe.govt.nz/layer/53309-river-flows/

He Tangata Information pertaining to people, places and connections to place	Census Māori descent by meshblock (2013 Census)	2013 Census meshblock dataset contains counts at meshblock levels for selected variables from the 2013 Census. The geographies correspond to 2013 Census boundaries. The counts are at the highest level of each variable’s classification.	Statistics New Zealand	https://datafinder.stats.govt.nz/layer/8445-Māori-descent-by-meshblock-2013-census/
	Marae	This shapefile contains Tribal, Urban, Institutional, and Historic Marae of New Zealand. Sourced and cross-referenced from Local & Central Government Depts, Te Kāhui Māngai (TKM), iwi/hapū websites.	Te Puni Kokiri	https://www.arcgis.com/home/item.html?id=3b9e52a2012a4e4cb434e07ce19b36dd
	Marae	Website	Te Potiki National Trust	https://Māorimaps.com/
	Archaeological Sites	Interactive website to search for archaeological sites	New Zealand Archaeological Association	http://www.archsite.org.nz/
	Counts of Te Reo speakers of Māori descent by Meshblock	This dataset contains counts of people of Māori descent by the official language indicator from the 2013 Census. The data is presented at meshblock level and uses the 2013 Census boundaries. The variables provided are as follows: <ul style="list-style-type: none"> • Number of Māori descent who speak te reo Māori • Number of Māori descent who do not speak te reo Māori (includes no language) This dataset allows for the comparison across areas to determine the strength or otherwise of te reo Māori language for people of Māori descent.	Statistics New Zealand	https://datafinder.stats.govt.nz/layer/8387-counts-of-te-reo-speakers-of-Māori-descent-by-meshblock/
	Te Kāhui Maunga	Directory of Iwi and Māori Organisations	Te Puni Kokiri	

<p>Te Repo Information pertaining to wetlands</p>	<p>Current wetland extent, 2013</p>	<p>Wetlands support unique biodiversity and provide important services. They clean water of nutrients and sediment, help dampen floods, provide habitat, and act as carbon sinks. They are also valued for their spiritual and cultural significance and as important sources of food and materials, such as flax. Draining them for agricultural and urban development has reduced their extent. Understanding this reduction provides insight into the loss of biodiversity and natural function. This dataset relates to the "Wetland extent" measure on the Environmental Indicators, Te taiao Aotearoa website</p>	<p>Ministry for the Environment</p>	<p>https://data.mfe.govt.nz/layer/52676-current-wetland-extent-2013/</p>
<p>Te Moana Information pertaining to the sea</p>	<p>NZ Terrain Basemap Bathymetry</p>	<p>The Basemap Bathymetry layer is to be used for cartographic visualisation purposes only</p>	<p>Land Information New Zealand</p>	<p>https://data.linz.govt.nz/layer/52022-nz-terrain-basemap-bathymetry/</p>
	<p>NZ Bathymetric Data Index</p>	<p>This index enables you to identify the freely available bathymetric data held and used by LINZ on its NZ coastal nautical charts. Some of LINZ data holdings date back to the 1930s. The polygons comprising the index show the extent of the survey datasets. The attributes attached to each polygon will enable you to view, amongst other attributes, the age and quality of the bathymetric data.</p>	<p>Land Information New Zealand</p>	<p>https://data.linz.govt.nz/layer/53388-nz-bathymetric-data-index/</p>
	<p>South West Pacific Scanned Sounding Sheet Index</p>	<p>This index enables you to identify the georeferenced TIFF images of sounding sheets held by LINZ throughout the SW Pacific region. Some of these sounding sheets date back to the 1950s. The polygons comprising the index show the extent of each original hard copy sheet - not just the soundings shown on the sheet. The attributes attached to each polygon will enable you to view, amongst other attributes, the date and scale of the bathymetric data shown on the sounding sheet.</p>	<p>Land Information New Zealand</p>	
	<p>Marine Charts (All)</p>	<p>The hydrographic raster data made available through the LINZ Data Service is based on the Paper Navigational Charts published and maintained by the New Zealand Hydrographic Authority at Land Information New Zealand (LINZ).</p>	<p>Land Information New Zealand</p>	<p>https://data.linz.govt.nz/layer/51362-nz-paper-nautical-chart-index/</p>

Appendix 2: Recommendations on how to use the identified geospatial information effectively to engage with iwi/hapū for freshwater resource management

He Whenua

Information pertaining to land.

Iwi/hapū are primarily interested in land use, best practice, sustainability, management of whenua and who do they need to consult/deal with on the matter.

The data layers associated with He Whenua primarily look at:

- Ownership (who owns the land).
- Where is the whenua?
- What is on the whenua?
- What land use options are available on the whenua for owners?

Te Wai Māori

Information pertaining to water.

Iwi/ hapū are interested in best practice, sustainability, management, health and well-being of te wai māori.

The data layers associated with **Te Wai Māori** primarily look at:

- location
- vulnerability
- quality
- flow.

He Tangata

Information pertaining to people, place.

Iwi/ hapū are interested in where are their people, what are they doing, what is the health and well-being of their communities.

The data layers associated with He Tangata primarily look at:

- health and well-being
- location
- whakapapa

Te Repo

Information pertaining to wetlands.

Iwi/ hapū are interested in best practice, sustainability, management and health and well-being of Te Repo.

Te Moana

Information pertaining to Te Moana.

Iwi/ hapū are interested in best practice, sustainability, management, health and well-being of Te Moana.