WAITIAKI

TOHU TAIAO JOURNAL

NGĀTI TŪWHARETOA

MIHI

Tēnei te mihi nui ki a tātou katoa. We would like to mihi to all the tamariki, rangatahi, pakeke and kaumātua who helped bring life to this journal. We thank you for your time, energy and letting us be a part of your taiao.

We mihi to our kaumātua and tīpuna whose invaluable mātauranga has helped to shape, influence and inspire this tohu taiao journal. Notably, the wisdom and mātauranga of Paranapa Otimi and the late Te Kanawa Pitiroi.

Lastly, we mihi to our taiao. As uri o Ngāti Tūwharetoa, we are indebted to ensuring our wai and taiao is healthy and thriving for generations to come.

WAITIAKI TŪWHARETOA

PROJECT KAITIAKI

KARAKIA MŌ TE WAI MĀORI

Haumia mai runga

Haumia mai raro

Haumia mai nga wai horapa

Kia tutaki takina te wai

Takina te tai

He wai aio

He ia aio

He ira tipua

He ira tawhito

Miria te kiri

Miria te wairua

Whiriwhiria te Ihorangi ki te Ahonuku

He au rere

He au ora

Tuturu whakamaua

Kia Tina

Tina!

Haumi e

Hui e

Taiki e!

JOURNAL GUIDE

WHAT IS IN THIS JOURNAL

Every season, use this guide to help you through each section of this journal.

We recommend using the journal to wānanga once a year, preferably in Takurua/during Matariki.

HEALTH & SAFETY

TOHU TAIAO

- Ngā mata o te marama
- Waitiaki Scale

TIROTIRO AWA & PŪTAIAO

- Tirotiro totō (flow conditions)
- Tirotiro tahataha (riverbank vegetation)
- Tirotiro whaiawa (stream composition)
- Tirotiro pūkohu wai (periphyton/algae)
- Tirotiro ngāngara (invertebrates)
- Pūtaiao (water quality test/SHMAK kit)
- Waitiaki Scale

TAIAO ID PAGES

- Ngā Mata o Te Marama
- Wind compass
- Cloud finder
- Ngāngara
- Ngā manu o te taiao
- Native ika
- Non-native ika

Go to https://www.tuwharetoa.co.nz/project-kaitiaki/ to watch instructional videos on how to fill out each section

WĀNANGA

- Mātauranga - Ka muri
- Mātauranga - Ka mua
- Waitiaki Plan

INSTRUCTIONS

- Tirotiro awa instructions
- Pūtaiao instructions

HEALTH & SAFETY

TOOL BOX TALKS

Before starting mahi wai, kōrero to your rōpū about any hazards and risks that you may encounter in the field. Ensure that everyone understands the risks and how to mitigate them. Complete a Job Safety Analysis form (see example below), share the JSA with your rōpū by completing a tool box talk before commencing mahi.

JOB SAFETY ANALYSIS (JSA)

1) Break mahi down into tasks. These could include driving to and from the site, in river sampling/ testing, testing wai from the riverbanks and any tasks with bespoke risks such as the nitrate test.

2) Identify the hazards and risks associated with each task. These could include driving hazards, personal injury (slips, trips, falls), drowning, exposure to elements and extreme weather, reactions to chemical reagents etc.

3) Identify risk level using a risk level matrix.

4) Identify controls to mitigate risk. These could include following road rules, wearing Personal Protective Equipment (PPE) such as waders, lifejackets, safety glasses, gloves, checking weather forecasts, and ensuring appropriate adult-to-child ratios. Ensure controls are in place before starting mahi.

5) Calculate the new residual risk level now that controls are in place, if the risk level is still high do not carry out mahi.

Example of a JSA:

TASK	HAZARDS	RISK LEVEL	CONTROLS	RESIDUAL RISK LEVEL
Sampling	Personal Injury	Medium	Maintain awareness	Low
	Drowning	High	Wear PPE / lifejacket	Medium
	Weather conditions	Medium	Check forecast, be prepared or reschedule	Low

TOHU TAIAO

CONNECTION

The main purpose of this journal is to encourage and facilitate connection to taiao. Before you begin your mahi, take a moment to breathe in the taiao around you, a moment to sit and just be - hā ki waho, hā ki roto.

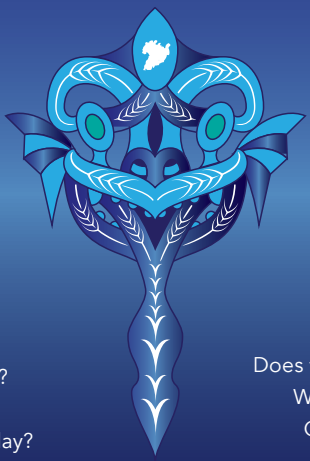
Record your observations, use the pātai in the Waitiaki Framework below to help you observe!

WAIRUA

What can you feel ā-wairua?
How do you think the wai is feeling ā-wairua?
Do you feel drawn to anything in particular?
Ngā Atua are all around you.
Which Atua are present today?
Are you open and prepared to receive tohu taiao?

TIROTIRO

What can you see?
Does anything catch your eye?
What does the sky look like?
Where is the sun sitting?
What colour is the whenua?
What's growing around you?
Is the ngahere in bloom?
How is the awa flowing?
Is there anything unusual?



WHAKARONGO

What can you hear?
What manu are singing?
What direction is the wind blowing?
Are the trees rustling?
What does the awa sound like?

HONGIHONGI

What can you smell?
Does the whenua smell damp? or dry?
What does the awa smell like?
Can you smell the ngahere?

TINANA

What can you physically feel?
How does the wai feel?
Would you swim in the awa today?
Would you drink the wai?
Is the awa safe today?

KUPU

The wai can hear and feel the vibrations of your kupu, karakia and waiata. Enhance connection to taiao by reciting a karakia or singing a waiata.

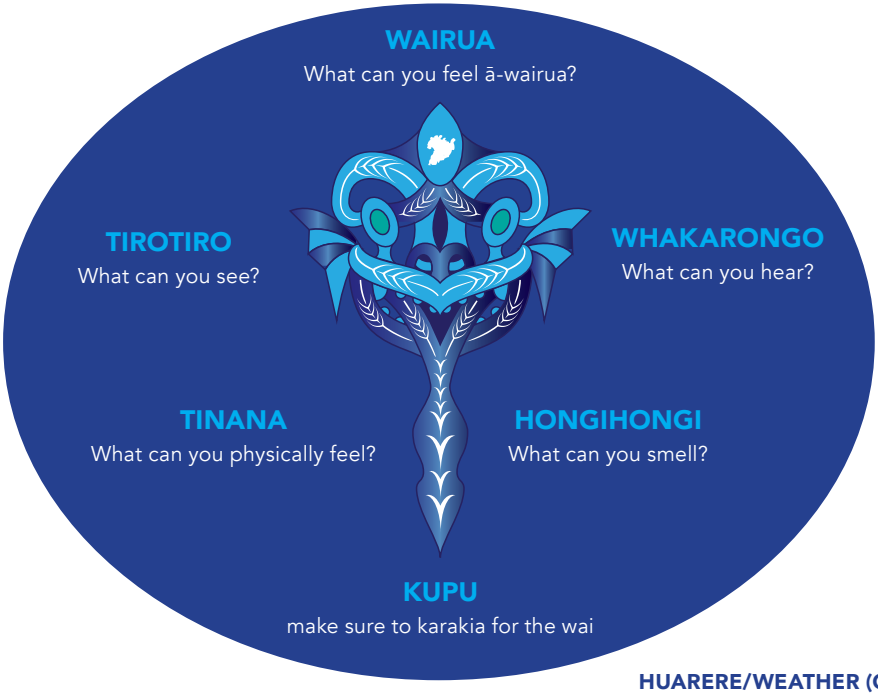
SEASONS

TAKURUA

WINTER (JUNE - AUGUST)

1. MĀTAURANGA - INĀIANEI

Tuatahi: after karakia and waiata, spend atleast 3 minutes in silence. Observe te taiao around you, feel te taiao within you. Think about what you think, see, smell, hear, feel and know in this moment. Ensure you and your rōpū are safe and have had a kōrero about health and safety.



INGOA/NAME _____

GREGORIAN DATE_____

NGĀ MATA O TE MARAMA_____

WHETŪ/MONTH_____

TAU/SEASON_____

WĀHI/LOCATION_____

HUARERE/WEATHER (CIRCLE)

1. MĀTAURANGA - INĀIANEI

RECORD YOUR OBSERVATIONS

WAIRUA	TIROTIRO	TIROTIRO
What can you feel ā wairua?	What can you see?	Does anything catch your eye?
How do you think the wai is feeling a wairua?	What does the sky look like? Which kāpua are out today?	Where is the sun sitting? Where is the moon?
Do you feel drawn to anything in particular?	What's growing around you? Is the ngahere in bloom?	What colour is the whenua?
Ngā Atua are all around you, which Atua are present today?	How is the awa flowing?	Is there anything unusual?

1. MĀTAURANGA - INĀIANEI

RECORD YOUR OBSERVATIONS

WHAKARONGO	HONGIHONGI	TINANA
What can you hear?	What can you smell?	What do you physically feel? How does the wai feel?
What manu are singing?	Does the whenua smell damp? or dry?	Would you swim in the awa today?
What direction is the wind blowing? Are the trees rustling?	Can you smell the ngahere?	Would you drink the wai?
What does the awa sound like?	What does the awa smell like?	Is the awa safe today?

NGĀ MATA O TE MARAMA

MARAMATAKA OBSERVATIONS

Recording your tohu taiao observations against the maramataka will help you to recognise patterns in te taiao and develop mātauranga of the present day taiao.
Take time to discuss the maramataka with your rōpū.
See pages 115-117 for ngā mata o te marama.

What is te marama phase?

What meaning can you derive from the ingoa of te marama?

Does the ahua of the day match the energy of te marama?

Did the ingoa of the marama predict any tohu you observed?

What time does te marama set and rise today?

What percent illuminated is te marama?

TOHU TAIAO OBSERVATIONS

FIELD NOTES:

WAITIAKI GUIDE

HOW TO USE THE WAITIAKI SCALE

INTERPRETATION KEY / DATA CODING

KAKARIKI / GREEN

represents **MAURI**, these results mean the mauri of te taiao is thriving and the wai has great ability to sustain life.

KŌWHAI / YELLOW

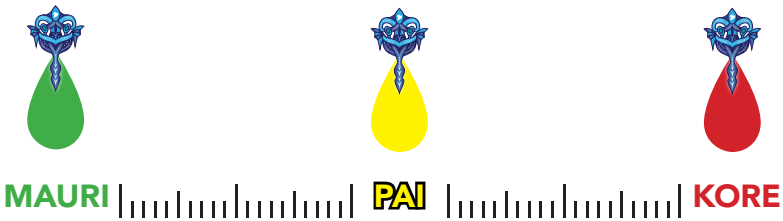
represents **PAI**, these results mean the mauri of te taiao is pai and the wai has good ability to sustain life.

WHERO / RED

represents **KORE**, these results mean the mauri of te taiao is lacking and could be improved and the wai has poor ability to sustain life.

WAITIAKI SCALE SCORING

Most awa will give a mixture of results, scale scoring will help you record and track progress and changes!



WAITIAKI SCALE
TOHU TAIAO

Circle the Waitiaki that resembles what you think/feel. Reflect on your observations from section one. The purpose of this is to use your own knowledge and observations to measure how healthy the awa looks and feels according to you. The intention is to understand your perception of healthy wai in a way that invokes further whakaaro to understand "why" and "how" this may be.

WAIRUA CAN YOU FEEL ANY TOHU?			
	Many Tohu	Some Tohu	No Tohu/Tohu Kino
TIROTIRO CAN YOU SEE ANY TOHU?			
	Many Tohu	Some Tohu	No Tohu/Tohu Kino
WHAKARONGO CAN YOU HEAR ANY TOHU?			
	Many Tohu	Some Tohu	No Tohu/Tohu Kino
HONGIHONGI CAN YOU SMELL ANY TOHU?			
	Many Tohu	Some Tohu	No Tohu/Tohu Kino
TINANA ARE YOU SAFE?			
	Āe (miharo lets mahi!)	Not sure (complete JSA & karakia)	Kāo (stop mahi immediately)
SCORE OVERALL TALLY			

MAURI PAI KORE

WĀHI/SITE_____

2. TIROTIRO AWA

Tuarua: focus on the wai, the awa herself. Spend some time to take a good look and record what you can see!

See pages 135-137 for instructions.

INDICATOR	METHOD
Flow	Tirotiro totō
Bank vegetation	Tirotiro tahataha
Stream composition	Tirotiro whaiawa
Periphyton / Algae	Tirotiro pūkohu wai
Invertebrates	Tirotiro ngāngara or kick net (hard bottomed awa) Sieve (soft bottomed awa)

TIROTIRO TOTŌ
Flow

FLOW	Description	Key
Stable	Steady flow, water level normal	
Low flow	Slower flow, water level low (look for exposed rocks or plants)	
High flow	Faster flow, water level high	
Flooded	Fast flow, turbid water, water level breaching riverbanks (STOP mahi immediately)	
Prolonged low flow	Trickle flow, water level consistently low	

TIROTIRO TOTŌ DATA SHEET

Awa				
Date				
Flow				

TIROTIRO TAHATAHA
Riverbank Vegetation

Whats growing on ngā tahataha o te awa?
Kōrero about what you can see growing on the riverbanks within your stretch of awa.

Estimate % cover in table below:

TIROTIRO TAHATAHA	Description	% cover	Key
Native rākau	Shade cover, bank stability, nutrient filtration, organic matter, invertebrate habitat		
Repo plants	Shade, nutrient filtration		
Tussocks	Shade, nutrient filtration		
Introduced rākau	Shade, bank stability, nutrient filtration, invertebrate habitat		
Scrub	Shade		
Pine plantations	Shade, sedimentation		
Pasture	No shade, no nutrient filtration		
Bare banks	Sedimentation / Erosion		
Manmade	Infrastructure / Run off		

List all the rākau/plants that you can identify:

NATIVE	INTRODUCED

**Tip: use the Aotearoa Species Classified app to help ID rākau/plants!*

TIROTIRO TAHATAHA DATA SHEET

Riverbank vegetation (estimated percentage cover)

	Awa				
	Date				
	Native rākau				
	Repo plants				
	Tall tussocks				
	Introduced rākau				
	Scrub				
	Pine plantations				
	Pasture				
	Bare banks				
	Manmade				

TIROTIRO WHAIAWA

Stream Composition

What can you see on the awa bed?
Inspect the awa bed in your awa stretch.

Estimate percentage (%) cover in table below:

TIROTIRO WHAIAWA	Description	% cover	Key
Toka (Boulders)	25 cm +		
Kōhatu nui (Large cobbles)	12 - 25 cm		
Kōhatu iti (Small cobbles)	6 - 12 cm		
Kirikiri (Gravel)	< 6 cm		
Rākau (Woody debris)	Fallen trees/limbs		
Tipu (Plants)	Macrophytes		
Tūāpapa (Bedrock)	Large solid surface		
Onepū (Sand)	Sandy sediment		
Kenepuru (Mud/Silt)	Fine sediment deposits or coverage		
Manmade	Infrastructure		

**Tip: use the Aotearoa Species Classified app to help ID the macrophytes, record species in field notes!*

TIROTIRO WHAIAWA DATA SHEET

Stream composition (estimated percentage cover)

	Awa				
	Date				
	Toka (Boulders)				
	Kōhatu nui (Large cobbles)				
	Kōhatu iti (Small cobbles)				
	Kirikiri (Gravel)				
	Rākau (Woody debris)				
	Tipu (Plants)				
	Tūāpapa (Bedrock)				
	Onepū (Sand)				
	Kenepuru (Mud/Silt)				
	Manmade				

TIROTIRO PŪKOHU WAI

Algae/Periphyton

Is there any algae growing on the rocks or riverbed? Yes / No

What does the algae look like?
Record the type and take note of the amount of algae you see in your awa stretch.
See page 136 for Tirotiro Pūkohu Wai instructions.

Record presence of algal mats in table below:

ALGAL MATS	Description	Green	Brown	Dark
Thin Film	< 0.5 mm			
Medium Mat	0.5 - 3 mm			
Thick Mat	3 mm +			

Record presence of filamentous algae in table below:

FILAMENTOUS ALGAE	Description	Green	Brown / Red
Short Filaments	< 2 cm		
Long Filaments	2 cm +		

Key:

ALGAL MATS	Green	Brown	Dark
Thin Film			
Medium Mat			
Thick Mat			

FILAMENTOUS ALGAE	Brown / Red	Green
Short Filaments		
Long Filaments		

**Tip: use the Aotearoa Species Classified app to help ID the algae, record species in field notes!*

TIROTIRO PŪKOHU WAI DATA SHEET

Algae/periphyton (presence)

	Awa				
	Date				
	Thin Brown				
	Thin Dark				
	Med Dark				
	Thin Green				
	Med Green				
	Med Brown				
	Thick Dark				
	Short Filaments Green				
	Short Filaments Brown				
	Thick Green				
	Thick Brown				
	Long Filaments Green				
	Long Filaments Brown				

TIROTIRO NGĀNGARA
Invertebrates

Turn over some rocks and debris or sieve through some sediment, what ngāngara can you see?
Record the type and number of ngāngara you find in your awa stretch.
See pages 136-137 for Tirotiro Ngāngara instructions.

Record invertebrate counts in table below:

	Presence	Count	Key
Kākahi			
Kōura			
Mayfly			
Stonefly			
Caddisfly			
Limpet			
Dobsonfly			
Small Crustacean			
Cranefly			
Damesfly			
Dragonfly			
Snail			
Small Bivalve			
Beetle			
Axehead Caddisfly			
Midge			
Worm			
Gold Clam			

TIROTIRO NGĀNGARA DATA SHEET
Invertebrate counts

	Awa				
	Date				
	Kākahi				
	Kōura				
	Mayfly				
	Stonefly				
	Caddisfly				
	Limpet				
	Dobsonfly				
	Small Crustacean				
	Cranefly				
	Damesfly				
	Dragonfly				
	Snail				
	Small Bivalve				
	Beetle				
	Axehead Caddisfly				
	Midge				
	Worm				
	Gold Clam				

WĀHI/SITE_____

3. PŪTAIAO

Tuatoru: What are the scientific measures for healthy wai?
See pages 138-141 for Pūtaiao instructions.

INDICATOR	UNITS	EQUIPMENT
Temperature	Degrees Celsius (°C)	Temperature/EC reader
pH	pH units	pH meter (or pH sticks)
Electrical Conductivity (EC)	Micro Siemens per centimetre (µS/cm)	Conductivity meter
Visual clarity	Metres (m)	Black disk and measuring tape (or clarity tube)
Current velocity	Metres per second (m/s)	Orange/lemon, measuring tape and calculator
Nitrate	Milligrams per litre (mg/L)	Visual observation using a colour comparator

TEMPERATURE

For general health of our ika, the temperature of the wai should be below 20 C.

TEMP (˚C)		< 16
		16 - 20
		> 20

What is the temperature of the wai?

_____ °C

Is this temperature good for healthy ika? Yes / No

pH

pH measures how acidic or basic the wai is. The pH of the wai needs to be between 6.5 - 9 to be safe for our ika to live in.

pH		7-8
		6.5-7 / 8-9
		<6.5 / >9

What is the pH of the wai?

_____ pH units

Is this a safe pH for ika? Yes / No

ELECTRICAL CONDUCTIVITY (EC)

Electrical Conductivity (EC) is a measure to tell us how much salt or solid material is dissolved in the wai.
This doesn't tell us how 'bad' or 'good' the wai is, just how much salt/material is dissolved.

EC (µS/cm)		< 150
		150 - 400
		> 400

In Tūwharetoa, some awa may have geothermal taonga nearby. Geothermal wai is rich in minerals and ions and can increase the EC reading of wai Māori.

What is the EC of the wai? _____ µS/cm

VISUAL CLARITY

Visual clarity measures how far you can see underwater, using a black disc and underwater viewer. It gives us an idea of how much sediment (dirt, sand, clay, silt), algae and other particles are floating in the wai.

CLARITY (m)		> 4
		1.6 - 4
		< 1.6

How far can you see underwater? _____ m

CURRENT VELOCITY

Current velocity is how fast the awa is moving. A fast-moving awa brings more kai to our ika than a slow moving awa, so fast moving awa tend to have more biodiversity! A fast awa also means more oxygen for our wai!

VELOCITY (m/s)		0.1 - 0.7
		0.7 - 1.0
		< 0.1 / > 1.0

How long did it take for the lemon to float 10m?

_____ seconds

Current velocity equation= (distance travelled / time taken) x correction factor = (10 / time taken) x 0.86

Current velocity = _____m/s

NITRATE

NITRATE (mg/L)	
	< 0.1
	0.1 - 0.5
	> 0.5

Nitrate (NO3) is a nutrient/ pollutant. It is a form of Nitrogen that gives us an idea of what the land around the awa is being used for. High nitrate concentrations can occur where the awa is near farms due to nitrate in fertilizers and livestock mimi. High nitrates can also occur when there is a spill of paru into the wai, like sewage or wastewater. For our wai to be healthy, nitrate levels should be below 0.5 mg/L.

How much Nitrate is in the wai? _____ mg/L

Is this a healthy level of Nitrate for the wai? Yes / No

PŪTAIAO DATA SHEET

Water quality

Awa				
Date & Time				
Temperature (°C)				
pH				
EC (µS/cm)				
Visual Clarity (m)				
Current velocity (m/s)				
Nitrate (mg/L)				

Download an excel template to record and graph your data. Scan the QR code or go to the Tūwharetoa Māori Trust Board - Project Kaitiaki webpage to find downloadable links.

TOHU TAIAO FIELD OBSERVATIONS:

WAITIAKI SCALE

TIROTIRO AWA & PŪTAIAO

Circle the closest Waitiaki according to the data collected in the pūtaiao section. This section aims to provide a general understanding and interpretation of the data collected.

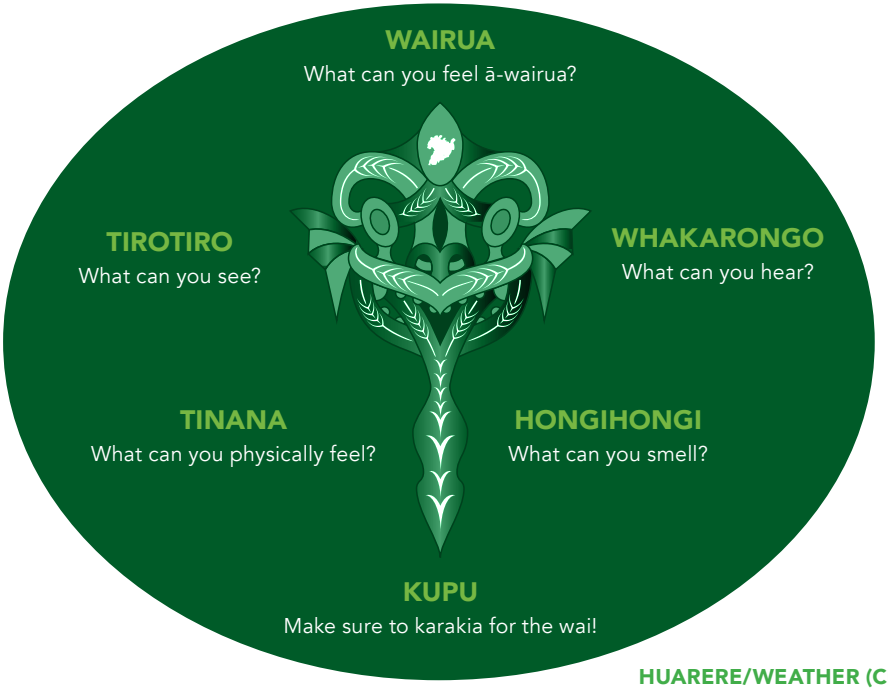
TIROTIRO TOTŌ Flow Conditions	 The flow of the awa is stable	 The flow of the awa is a bit high or a bit low	 The awa is flooding or not flowing much at all
TIROTIRO TAHATAHA Riverbank Vegetation	 Percentage of mauri rākau	 Percentage of pai rākau	 Percentage of kore rākau
TIROTIRO WHAIAWA Stream Composition	 Percentage of mauri habitat	 Percentage of pai habitat	 Percentage of kore habitat
TIROTIRO PŪKOHU WAI Periphyton / Algae	 Number of mauri algae present	 Number of pai algae present	 Number of kore algae present
TIROTIRO Ngāngara Invertebrates	 Number of mauri invertebrates present	 Number of pai invertebrates present	 Number of kore invertebrates present
PŪTAIAO Water Quality	 Number of mauri results	 Number of pai results	 Number of kore results
SCORE Overall Tally	 WAI MAURI	 WAI PAI	 WAI KORE

KŌANGA

SPRING (SEPTEMBER - NOVEMBER)

1. MĀTAURANGA - INĀIANEI

Tuatahi: after karakia and waiata, spend atleast 3 minutes in silence. Observe te taiao around you, feel te taiao within you. Think about what you think, see, smell, hear, feel and know in this moment. Ensure you and your rōpū are safe and have had a kōrero about health and safety.



HUARERE/WEATHER (CIRCLE)

INGOA/NAME _____

GREGORIAN DATE_____

NGĀ MATA O TE MARAMA_____

WHETŪ/MONTH_____

TAU/SEASON_____

WĀHI/LOCATION_____

1. MĀTAURANGA - INĀIANEI

RECORD YOUR OBSERVATIONS

WAIRUA	TIROTIRO	TIROTIRO
What can you feel ā wairua?	What can you see?	Does anything catch your eye?
How do you think the wai is feeling a wairua?	What does the sky look like? Which kāpua are out today?	Where is the sun sitting? Where is the moon?
Do you feel drawn to anything in particular?	What's growing around you? Is the ngahere in bloom?	What colour is the whenua?
Ngā Atua are all around you, which Atua are present today?	How is the awa flowing?	Is there anything unusual?

1. MĀTAURANGA - INĀIANEI

RECORD YOUR OBSERVATIONS

WHAKARONGO	HONGIHONGI	TINANA
What can you hear?	What can you smell?	What do you physically feel? How does the wai feel?
What manu are singing?	Does the whenua smell damp? or dry?	Would you swim in the awa today?
What direction is the wind blowing? Are the trees rustling?	Can you smell the ngahere?	Would you drink the wai?
What does the awa sound like?	What does the awa smell like?	Is the awa safe today?

NGĀ MATA O TE MARAMA
MARAMATAKA OBSERVATIONS

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Take time to discuss the maramataka with your rōpū.
See pages 115-117 for ngā mata o te marama.

What is te marama phase?

What meaning can you derive from the ingoa of te marama?

Does the ahua of the day match the energy of te marama?

Did the ingoa of the marama predict any tohu you observed?

What time does te marama set and rise today?

What percent illuminated is te marama?

TOHU TAIAO OBSERVATIONS

FIELD NOTES:

WAITIAKI GUIDE

HOW TO USE THE WAITIAKI SCALE

INTERPRETATION KEY / DATA CODING

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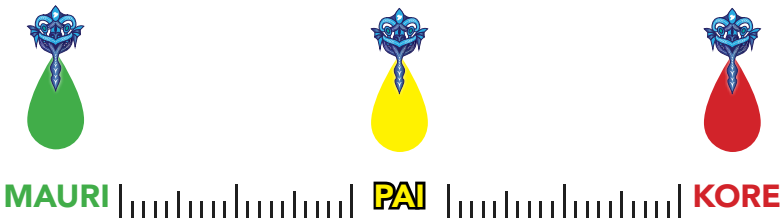

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TOHU TAIAO

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TIROTIRO CAN YOU SEE ANY TOHU?			
	Many Tohu	Some Tohu	No Tohu/Tohu Kino
WHAKARONGO CAN YOU HEAR ANY TOHU?			
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HONGIHONGI CAN YOU SMELL ANY TOHU?			
	Many Tohu	Some Tohu	No Tohu/Tohu Kino
TINANA ARE YOU SAFE?			
	Āe (miharo lets mahi!)	Not sure (complete JSA & karakia)	Kāo (stop mahi immediately)
SCORE OVERALL TALLY			

MAURI **PAI** **KORE**

WĀHI/SITE_____

2. TIROTIRO AWA

Tuarua: focus on the wai, the awa herself. Spend some time to take a good look and record what you can see!

See pages 135-137 for instructions.

INDICATOR	METHOD
Flow	Tirotiro totō
Bank vegetation	Tirotiro tahataha
Stream composition	Tirotiro whaiawa
Periphyton / Algae	Tirotiro pūkohu wai
Invertebrates	Tirotiro ngāngara or kick net (hard bottomed awa) Sieve (soft bottomed awa)

TIROTIRO TOTŌ
Flow

FLOW	Description	Key
Stable	Steady flow, water level normal	
Low flow	Slower flow, water level low (look for exposed rocks or plants)	
High flow	Faster flow, water level high	
Flooded	Fast flow, turbid water, water level breaching riverbanks (STOP mahi immediately)	
Prolonged low flow	Trickle flow, water level consistently low	

TIROTIRO TOTŌ DATA SHEET

Awa				
Date				
Flow				

TIROTIRO TAHATAHA
Riverbank Vegetation

Whats growing on ngā tahataha o te awa?
Kōrero about what you can see growing on the riverbanks within your stretch of awa.

Estimate % cover in table below:

TIROTIRO TAHATAHA	Description	% cover	Key
Native rākau	Shade cover, bank stability, nutrient filtration, organic matter, invertebrate habitat		
Repo plants	Shade, nutrient filtration		
Tussocks	Shade, nutrient filtration		
Introduced rākau	Shade, bank stability, nutrient filtration, invertebrate habitat		
Scrub	Shade		
Pine plantations	Shade, sedimentation		
Pasture	No shade, no nutrient filtration		
Bare banks	Sedimentation / Erosion		
Manmade	Infrastructure / Run off		

List all the rākau/plants that you can identify:

NATIVE	INTRODUCED

**Tip: use the Aotearoa Species Classified app to help ID rākau/plants!*

TIROTIRO TAHATAHA DATA SHEET

Riverbank vegetation (estimated percentage cover)

	Awa				
	Date				
	Native rākau				
	Repo plants				
	Tall tussocks				
	Introduced rākau				
	Scrub				
	Pine plantations				
	Pasture				
	Bare banks				
	Manmade				

TIROTIRO WHAIAWA

Stream Composition

What can you see on the awa bed?
Inspect the awa bed in your awa stretch.

Estimate percentage (%) cover in table below:

TIROTIRO WHAIAWA	Description	% cover	Key
Toka (Boulders)	25 cm +		
Kōhatu nui (Large cobbles)	12 - 25 cm		
Kōhatu iti (Small cobbles)	6 - 12 cm		
Kirikiri (Gravel)	< 6 cm		
Rākau (Woody debris)	Fallen trees/limbs		
Tipu (Plants)	Macrophytes		
Tūāpapa (Bedrock)	Large solid surface		
Onepū (Sand)	Sandy sediment		
Kenepuru (Mud/Silt)	Fine sediment deposits or coverage		
Manmade	Infrastructure		

**Tip: use the Aotearoa Species Classified app to help ID the macrophytes, record species in field notes!*

TIROTIRO WHAIAWA DATA SHEET

Stream composition (estimated percentage cover)

	Awa				
	Date				
	Toka (Boulders)				
	Kōhatu nui (Large cobbles)				
	Kōhatu iti (Small cobbles)				
	Kirikiri (Gravel)				
	Rākau (Woody debris)				
	Tipu (Plants)				
	Tūāpapa (Bedrock)				
	Onepū (Sand)				
	Kenepuru (Mud/Silt)				
	Manmade				

TIROTIRO PŪKOHU WAI

Algae/Periphyton

Is there any algae growing on the rocks or riverbed? Yes / No

What does the algae look like?
Record the type and take note of the amount of algae you see in your awa stretch.
See page 136 for Tirotiro Pūkohu Wai instructions.

Record presence of algal mats in table below:

ALGAL MATS	Description	Green	Brown	Dark
Thin Film	< 0.5 mm			
Medium Mat	0.5 - 3 mm			
Thick Mat	3 mm +			

Record presence of filamentous algae in table below:

FILAMENTOUS ALGAE	Description	Green	Brown / Red
Short Filaments	< 2 cm		
Long Filaments	2 cm +		

Key:

ALGAL MATS	Green	Brown	Dark
Thin Film			
Medium Mat			
Thick Mat			

FILAMENTOUS ALGAE	Brown / Red	Green
Short Filaments		
Long Filaments		

**Tip: use the Aotearoa Species Classified app to help ID the algae, record species in field notes!*

TIROTIRO PŪKOHU WAI DATA SHEET

Algae/periphyton (presence)

	Awa				
	Date				
	Thin Brown				
	Thin Dark				
	Med Dark				
	Thin Green				
	Med Green				
	Med Brown				
	Thick Dark				
	Short Filaments Green				
	Short Filaments Brown				
	Thick Green				
	Thick Brown				
	Long Filaments Green				
	Long Filaments Brown				

TIROTIRO NGĀNGARA
Invertebrates

Turn over some rocks and debris or sieve through some sediment, what ngāngara can you see?
Record the type and number of ngāngara you find in your awa stretch.
See pages 136-137 for Tirotiro Ngāngara instructions.

Record invertebrate counts in table below:

	Presence	Count	Key
Kākahi			
Kōura			
Mayfly			
Stonefly			
Caddisfly			
Limpet			
Dobsonfly			
Small Crustacean			
Cranefly			
Damesfly			
Dragonfly			
Snail			
Small Bivalve			
Beetle			
Axehead Caddisfly			
Midge			
Worm			
Gold Clam			

TIROTIRO NGĀNGARA DATA SHEET
Invertebrate counts

	Awa				
	Date				
	Kākahi				
	Kōura				
	Mayfly				
	Stonefly				
	Caddisfly				
	Limpet				
	Dobsonfly				
	Small Crustacean				
	Cranefly				
	Damesfly				
	Dragonfly				
	Snail				
	Small Bivalve				
	Beetle				
	Axehead Caddisfly				
	Midge				
	Worm				
	Gold Clam				

3. PŪTAIAO

Tuatoru: What are the scientific measures for healthy wai?
See pages 138-141 for Pūtaiao instructions.

INDICATOR	UNITS	EQUIPMENT
Temperature	Degrees Celsius (°C)	Temperature/EC reader
pH	pH units	pH meter (or pH sticks)
Electrical Conductivity (EC)	Micro Siemens per centimetre (µS/cm)	Conductivity meter
Visual clarity	Metres (m)	Black disk and measuring tape (or clarity tube)
Current velocity	Metres per second (m/s)	Orange/lemon, measuring tape and calculator
Nitrate	Milligrams per litre (mg/L)	Visual observation using a colour comparator

TEMPERATURE

For general health of our ika, the temperature of the wai should be below 20 C.

TEMP (˚C)	
	< 16
	16 - 20
	> 20

What is the temperature of the wai?

_____ °C

Is this temperature good for healthy ika? Yes / No

pH

pH measures how acidic or basic the wai is. The pH of the wai needs to be between 6.5 - 9 to be safe for our ika to live in.

pH		7-8
		6.5-7 / 8-9
		<6.5 / >9

What is the pH of the wai?

_____ pH units

Is this a safe pH for ika? Yes / No

ELECTRICAL CONDUCTIVITY (EC)

Electrical Conductivity (EC) is a measure to tell us how much salt or solid material is dissolved in the wai.
This doesn't tell us how 'bad' or 'good' the wai is, just how much salt/material is dissolved.

EC (µS/cm)		< 150
		150 - 400
		> 400

In Tūwharetoa, some awa may have geothermal taonga nearby. Geothermal wai is rich in minerals and ions and can increase the EC reading of wai Māori.

What is the EC of the wai? _____ µS/cm

VISUAL CLARITY

Visual clarity measures how far you can see underwater, using a black disc and underwater viewer. It gives us an idea of how much sediment (dirt, sand, clay, silt), algae and other particles are floating in the wai.

CLARITY (m)		> 4
		1.6 - 4
		< 1.6

How far can you see underwater? _____ m

CURRENT VELOCITY

Current velocity is how fast the awa is moving. A fast-moving awa brings more kai to our ika than a slow moving awa, so fast moving awa tend to have more biodiversity! A fast awa also means more oxygen for our wai!

VELOCITY (m/s)		0.1 - 0.7
		0.7 - 1.0
		< 0.1 / > 1.0

How long did it take for the lemon to float 10m?

_____ seconds

Current velocity equation= (distance travelled / time taken) x correction factor = (10 / time taken) x 0.86

Current velocity = _____m/s

NITRATE

NITRATE (mg/L)	
	< 0.1
	0.1 - 0.5
	> 0.5

Nitrate (NO3) is a nutrient/ pollutant. It is a form of Nitrogen that gives us an idea of what the land around the awa is being used for. High nitrate concentrations can occur where the awa is near farms due to nitrate in fertilizers and livestock mimi. High nitrates can also occur when there is a spill of paru into the wai, like sewage or wastewater. For our wai to be healthy, nitrate levels should be below 0.5 mg/L.

How much Nitrate is in the wai? _____ mg/L

Is this a healthy level of Nitrate for the wai? Yes / No

PŪTAIAO DATA SHEET

Water quality

Awa				
Date & Time				
Temperature (°C)				
pH				
EC (µS/cm)				
Visual Clarity (m)				
Current velocity (m/s)				
Nitrate (mg/L)				

Download an excel template to record and graph your data. Scan the QR code or go to the Tūwharetoa Māori Trust Board - Project Kaitiaki webpage to find downloadable links.

TOHU TAIAO FIELD OBSERVATIONS:

WAITIAKI SCALE
TIROTIRO AWA & PŪTAIAO

Circle the closest Waitiaki according to the data collected in the pūtaiao section. This section aims to provide a general understanding and interpretation of the data collected.

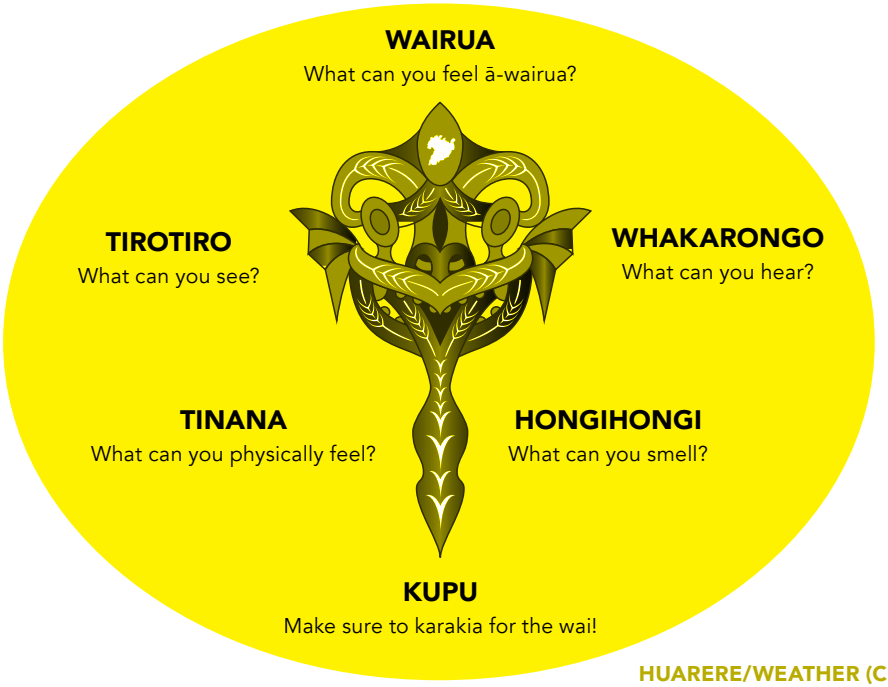
TIROTIRO TOTŌ Flow Conditions	 The flow of the awa is stable	 The flow of the awa is a bit high or a bit low	 The awa is flooding or not flowing much at all
TIROTIRO TAHATAHA Riverbank Vegetation	 Percentage of mauri rākau	 Percentage of pai rākau	 Percentage of kore rākau
TIROTIRO WHAIAWA Stream Composition	 Percentage of mauri habitat	 Percentage of pai habitat	 Percentage of kore habitat
TIROTIRO PŪKOHU WAI Periphyton / Algae	 Number of mauri algae present	 Number of pai algae present	 Number of kore algae present
TIROTIRO Ngāngara Invertebrates	 Number of mauri invertebrates present	 Number of pai invertebrates present	 Number of kore invertebrates present
PŪTAIAO Water Quality	 Number of mauri results	 Number of pai results	 Number of kore results
SCORE Overall Tally	 WAI MAURI	 WAI PAI	 WAI KORE

RAUMATI

SUMMER (DECEMBER - FEBRUARY)

1. MĀTAURANGA - INĀIANEI

Tuatahi: after karakia and waiata, spend atleast 3 minutes in silence. Observe te taiao around you, feel te taiao within you. Think about what you think, see, smell, hear, feel and know in this moment. Ensure you and your rōpū are safe and have had a kōrero about health and safety.



HUARERE/WEATHER (CIRCLE)

INGOA/NAME _____

GREGORIAN DATE_____

NGĀ MATA O TE MARAMA_____

WHETŪ/MONTH_____

TAU/SEASON_____

WĀHI/LOCATION_____

1. MĀTAURANGA - INĀIANEI

RECORD YOUR OBSERVATIONS

WAIRUA	TIROTIRO	TIROTIRO
What can you feel ā wairua?	What can you see?	Does anything catch your eye?
How do you think the wai is feeling a wairua?	What does the sky look like? Which kāpua are out today?	Where is the sun sitting? Where is the moon?
Do you feel drawn to anything in particular?	What's growing around you? Is the ngahere in bloom?	What colour is the whenua?
Ngā Atua are all around you, which Atua are present today?	How is the awa flowing?	Is there anything unusual?

1. MĀTAURANGA - INĀIANEI

RECORD YOUR OBSERVATIONS

WHAKARONGO	HONGIHONGI	TINANA
What can you hear?	What can you smell?	What do you physically feel? How does the wai feel?
What manu are singing?	Does the whenua smell damp? or dry?	Would you swim in the awa today?
What direction is the wind blowing? Are the trees rustling?	Can you smell the ngahere?	Would you drink the wai?
What does the awa sound like?	What does the awa smell like?	Is the awa safe today?

NGĀ MATA O TE MARAMA
MARAMATAKA OBSERVATIONS

Recording your tohu taiao observations against the maramataka will help you to recognise patterns in te taiao and develop mātauranga of the present day taiao.
Take time to discuss the maramataka with your rōpū.
See pages 115-117 for ngā mata o te marama.

What is te marama phase?

What meaning can you derive from the ingoa of te marama?

Does the ahua of the day match the energy of te marama?

Did the ingoa of te marama predict any tohu you observed?

What time does te marama set and rise today?

What percent illuminated is te marama?

TOHU TAIAO OBSERVATIONS

FIELD NOTES:

WAITIAKI GUIDE
HOW TO USE THE WAITIAKI SCALE

INTERPRETATION KEY / DATA CODING

KAKARIKI / GREEN

represents **MAURI**, these results mean the mauri of te taiao is thriving and the wai has great ability to sustain life.

KŌWHAI / YELLOW

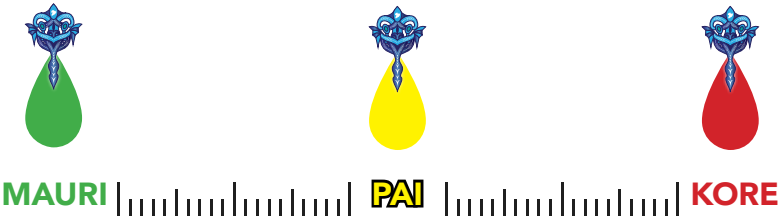
represents **PAI**, these results mean the mauri of te taiao is pai and the wai has good ability to sustain life.

WHERO / RED

represents **KORE**, these results mean the mauri of te taiao is lacking and could be improved and the wai has poor ability to sustain life.

WAITIAKI SCALE SCORING

Most awa will give a mixture of results, scale scoring will help you record and track progress and changes!



WAITIAKI SCALE
TOHU TAIAO

Circle the Waitiaki that resembles what you think/feel. Reflect on your observations from section one. The purpose of this is to use your own knowledge and observations to measure how healthy the awa looks and feels according to you. The intention is to understand your perception of healthy wai in a way that invokes further whakaaro to understand "why" and "how" this may be.

WAIRUA CAN YOU FEEL ANY TOHU?			
	Many Tohu	Some Tohu	No Tohu/Tohu Kino
TIROTIRO CAN YOU SEE ANY TOHU?			
	Many Tohu	Some Tohu	No Tohu/Tohu Kino
WHAKARONGO CAN YOU HEAR ANY TOHU?			
	Many Tohu	Some Tohu	No Tohu/Tohu Kino
HONGIHONGI CAN YOU SMELL ANY TOHU?			
	Many Tohu	Some Tohu	No Tohu/Tohu Kino
TINANA ARE YOU SAFE?			
	Āe (miharo lets mahi!)	Not sure (complete JSA & karakia)	Kāo (stop mahi immediately)
SCORE OVERALL TALLY			

MAURI PAI KORE

WĀHI/SITE_____

2. TIROTIRO AWA

Tuarua: focus on the wai, the awa herself. Spend some time to take a good look and record what you can see!

See pages 135-137 for instructions.

INDICATOR	METHOD
Flow	Tirotiro totō
Bank vegetation	Tirotiro tahataha
Stream composition	Tirotiro whaiawa
Periphyton / Algae	Tirotiro pūkohu wai
Invertebrates	Tirotiro ngāngara or kick net (hard bottomed awa) Sieve (soft bottomed awa)

TIROTIRO TOTŌ
Flow

FLOW	Description	Key
Stable	Steady flow, water level normal	
Low flow	Slower flow, water level low (look for exposed rocks or plants)	
High flow	Faster flow, water level high	
Flooded	Fast flow, turbid water, water level breaching riverbanks (STOP mahi immediately)	
Prolonged low flow	Trickle flow, water level consistently low	

TIROTIRO TOTŌ DATA SHEET

Awa				
Date				
Flow				

TIROTIRO TAHATAHA
Riverbank Vegetation

Whats growing on ngā tahataha o te awa?
Kōrero about what you can see growing on the riverbanks within your stretch of awa.

Estimate % cover in table below:

TIROTIRO TAHATAHA	Description	% cover	Key
Native rākau	Shade cover, bank stability, nutrient filtration, organic matter, invertebrate habitat		
Repo plants	Shade, nutrient filtration		
Tussocks	Shade, nutrient filtration		
Introduced rākau	Shade, bank stability, nutrient filtration, invertebrate habitat		
Scrub	Shade		
Pine plantations	Shade, sedimentation		
Pasture	No shade, no nutrient filtration		
Bare banks	Sedimentation / Erosion		
Manmade	Infrastructure / Run off		

List all the rākau/plants that you can identify:

NATIVE	INTRODUCED

**Tip: use the Aotearoa Species Classified app to help ID rākau/plants!*

TIROTIRO TAHATAHA DATA SHEET

Riverbank vegetation (estimated percentage cover)

	Awa				
	Date				
	Native rākau				
	Repo plants				
	Tall tussocks				
	Introduced rākau				
	Scrub				
	Pine plantations				
	Pasture				
	Bare banks				
	Manmade				

TIROTIRO WHAIAWA

Stream Composition

What can you see on the awa bed?
Inspect the awa bed in your awa stretch.

Estimate percentage (%) cover in table below:

TIROTIRO WHAIAWA	Description	% cover	Key
Toka (Boulders)	25 cm +		
Kōhatu nui (Large cobbles)	12 - 25 cm		
Kōhatu iti (Small cobbles)	6 - 12 cm		
Kirikiri (Gravel)	< 6 cm		
Rākau (Woody debris)	Fallen trees/limbs		
Tipu (Plants)	Macrophytes		
Tūāpapa (Bedrock)	Large solid surface		
Onepū (Sand)	Sandy sediment		
Kenepuru (Mud/Silt)	Fine sediment deposits or coverage		
Manmade	Infrastructure		

**Tip: use the Aotearoa Species Classified app to help ID the macrophytes, record species in field notes!*

TIROTIRO WHAIAWA DATA SHEET

Stream composition (estimated percentage cover)

	Awa				
	Date				
	Toka (Boulders)				
	Kōhatu nui (Large cobbles)				
	Kōhatu iti (Small cobbles)				
	Kirikiri (Gravel)				
	Rākau (Woody debris)				
	Tipu (Plants)				
	Tūāpapa (Bedrock)				
	Onepū (Sand)				
	Kenepuru (Mud/Silt)				
	Manmade				

TIROTIRO PŪKOHU WAI

Algae/Periphyton

Is there any algae growing on the rocks or riverbed? Yes / No

What does the algae look like?
Record the type and take note of the amount of algae you see in your awa stretch.
See page 136 for Tirotiro Pūkohu Wai instructions.

Record presence of algal mats in table below:

ALGAL MATS	Description	Green	Brown	Dark
Thin Film	< 0.5 mm			
Medium Mat	0.5 - 3 mm			
Thick Mat	3 mm +			

Record presence of filamentous algae in table below:

FILAMENTOUS ALGAE	Description	Green	Brown / Red
Short Filaments	< 2 cm		
Long Filaments	2 cm +		

Key:

ALGAL MATS	Green	Brown	Dark
Thin Film			
Medium Mat			
Thick Mat			

FILAMENTOUS ALGAE	Brown / Red	Green
Short Filaments		
Long Filaments		

**Tip: use the Aotearoa Species Classified app to help ID the algae, record species in field notes!*

TIROTIRO PŪKOHU WAI DATA SHEET

Algae/periphyton (presence)

	Awa				
	Date				
	Thin Brown				
	Thin Dark				
	Med Dark				
	Thin Green				
	Med Green				
	Med Brown				
	Thick Dark				
	Short Filaments Green				
	Short Filaments Brown				
	Thick Green				
	Thick Brown				
	Long Filaments Green				
	Long Filaments Brown				

TIROTIRO NGĀNGARA
Invertebrates

Turn over some rocks and debris or sieve through some sediment, what ngāngara can you see?
Record the type and number of ngāngara you find in your awa stretch.
See pages 136-137 for Tirotiro Ngāngara instructions

Record invertebrate counts in table below:

	Presence	Count	Key
Kākahi			
Kōura			
Mayfly			
Stonefly			
Caddisfly			
Limpet			
Dobsonfly			
Small Crustacean			
Cranefly			
Damesfly			
Dragonfly			
Snail			
Small Bivalve			
Beetle			
Axehead Caddisfly			
Midge			
Worm			
Gold Clam			

TIROTIRO NGĀNGARA DATA SHEET
Invertebrate counts

	Awa				
	Date				
	Kākahi				
	Kōura				
	Mayfly				
	Stonefly				
	Caddisfly				
	Limpet				
	Dobsonfly				
	Small Crustacean				
	Cranefly				
	Damesfly				
	Dragonfly				
	Snail				
	Small Bivalve				
	Beetle				
	Axehead Caddisfly				
	Midge				
	Worm				
	Gold Clam				

WĀHI/SITE_____

3. PŪTAIAO

Tuatoru: What are the scientific measures for healthy wai?
See pages 138-141 for Pūtaiao instructions.

INDICATOR	UNITS	EQUIPMENT
Temperature	Degrees Celsius (°C)	Temperature/EC reader
pH	pH units	pH meter (or pH sticks)
Electrical Conductivity (EC)	Micro Siemens per centimetre (µS/cm)	Conductivity meter
Visual clarity	Metres (m)	Black disk and measuring tape (or clarity tube)
Current velocity	Metres per second (m/s)	Orange/lemon, measuring tape and calculator
Nitrate	Milligrams per litre (mg/L)	Visual observation using a colour comparator

TEMPERATURE

For general health of our ika, the temperature of the wai should be below 20 C.

What is the temperature of the wai?

_____ °C

Is this temperature good for healthy ika? Yes / No

pH

pH measures how acidic or basic the wai is. The pH of the wai needs to be between 6.5 - 9 to be safe for our ika to live in.

pH		7-8
		6.5-7 / 8-9
		<6.5 / >9

What is the pH of the wai?

_____ pH units

Is this a safe pH for ika? Yes / No

ELECTRICAL CONDUCTIVITY (EC)

Electrical Conductivity (EC) is a measure to tell us how much salt or solid material is dissolved in the wai.
This doesn't tell us how 'bad' or 'good' the wai is, just how much salt/material is dissolved.

EC (µS/cm)		< 150
		150 - 400
		> 400

In Tūwharetoa, some awa may have geothermal taonga nearby. Geothermal wai is rich in minerals and ions and can increase the EC reading of wai Māori.

What is the EC of the wai? _____ µS/cm

VISUAL CLARITY

Visual clarity measures how far you can see underwater, using a black disc and underwater viewer. It gives us an idea of how much sediment (dirt, sand, clay, silt), algae and other particles are floating in the wai.

CLARITY (m)		> 4
		1.6 - 4
		< 1.6

How far can you see underwater? _____ m

CURRENT VELOCITY

Current velocity is how fast the awa is moving. A fast-moving awa brings more kai to our ika than a slow moving awa, so fast moving awa tend to have more biodiversity! A fast awa also means more oxygen for our wai!

VELOCITY (m/s)		0.1 - 0.7
		0.7 - 1.0
		< 0.1 / > 1.0

How long did it take for the lemon to float 10m?

_____ seconds

Current velocity equation= (distance travelled / time taken) x correction factor = (10 / time taken) x 0.86

Current velocity = _____m/s

NITRATE

NITRATE (mg/L)	
	< 0.1
	0.1 - 0.5
	> 0.5

Nitrate (NO3) is a nutrient/ pollutant. It is a form of Nitrogen that gives us an idea of what the land around the awa is being used for. High nitrate concentrations can occur where the awa is near farms due to nitrate in fertilizers and livestock mimi. High nitrates can also occur when there is a spill of paru into the wai, like sewage or wastewater. For our wai to be healthy, nitrate levels should be below 0.5 mg/L.

How much Nitrate is in the wai? _____ mg/L

Is this a healthy level of Nitrate for the wai? Yes / No

PŪTAIAO DATA SHEET

Water quality

Awa				
Date & Time				
Temperature (°C)				
pH				
EC (µS/cm)				
Visual Clarity (m)				
Current velocity (m/s)				
Nitrate (mg/L)				

Download an excel template to record and graph your data. Scan the QR code or go to the Tūwharetoa Māori Trust Board - Project Kaitiaki webpage to find downloadable links.

TOHU TAIAO FIELD OBSERVATIONS:

WAITIAKI SCALE
TIROTIRO AWA & PŪTAIAO

Circle the closest Waitiaki according to the data collected in the pūtaiao section. This section aims to provide a general understanding and interpretation of the data collected.

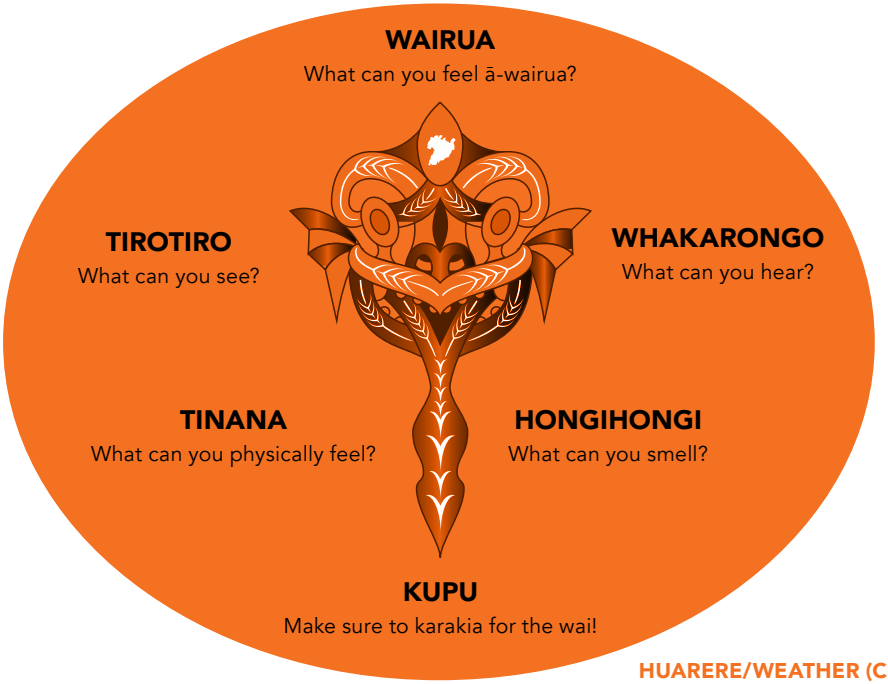
TIROTIRO TOTŌ Flow Conditions	 The flow of the awa is stable	 The flow of the awa is a bit high or a bit low	 The awa is flooding or not flowing much at all
TIROTIRO TAHATAHA Riverbank Vegetation	 Percentage of mauri rākau	 Percentage of pai rākau	 Percentage of kore rākau
TIROTIRO WHAIAWA Stream Composition	 Percentage of mauri habitat	 Percentage of pai habitat	 Percentage of kore habitat
TIROTIRO PŪKOHU WAI Periphyton / Algae	 Number of mauri algae present	 Number of pai algae present	 Number of kore algae present
TIROTIRO Ngāngara Invertebrates	 Number of mauri invertebrates present	 Number of pai invertebrates present	 Number of kore invertebrates present
PŪTAIAO Water Quality	 Number of mauri results	 Number of pai results	 Number of kore results
SCORE Overall Tally	 WAI MAURI	 WAI PAI	 WAI KORE

NGAHURU

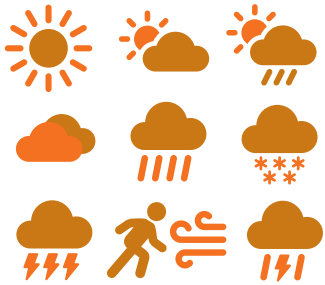
AUTUMN (MARCH - MAY)

1. MĀTAURANGA - INĀIANEI

Tuatahi: after karakia and waiata, spend atleast 3 minutes in silence. Observe te taiao around you, feel te taiao within you. Think about what you think, see, smell, hear, feel and know in this moment. Ensure you and your rōpū are safe and have had a kōrero about health and safety.



HUARERE/WEATHER (CIRCLE)



INGOA/NAME _____

GREGORIAN DATE_____

NGĀ MATA O TE MARAMA_____

WHETŪ/MONTH_____

TAU/SEASON_____

WĀHI/LOCATION_____

1. MĀTAURANGA - INĀIANEI

RECORD YOUR OBSERVATIONS

WAIRUA	TIROTIRO	TIROTIRO
What can you feel ā wairua?	What can you see?	Does anything catch your eye?
How do you think the wai is feeling a wairua?	What does the sky look like? Which kāpua are out today?	Where is the sun sitting? Where is the moon?
Do you feel drawn to anything in particular?	What's growing around you? Is the ngahere in bloom?	What colour is the whenua?
Ngā Atua are all around you, which Atua are present today?	How is the awa flowing?	Is there anything unusual?

1. MĀTAURANGA - INĀIANEI

RECORD YOUR OBSERVATIONS

WHAKARONGO	HONGIHONGI	TINANA
What can you hear?	What can you smell?	What do you physically feel? How does the wai feel?
What manu are singing?	Does the whenua smell damp? or dry?	Would you swim in the awa today?
What direction is the wind blowing? Are the trees rustling?	Can you smell the ngahere?	Would you drink the wai?
What does the awa sound like?	What does the awa smell like?	Is the awa safe today?

NGĀ MATA O TE MARAMA
MARAMATAKA OBSERVATIONS

Recording your tohu taiao observations against the maramataka will help you to recognise patterns in te taiao and develop mātauranga of the present day taiao.
Take time to discuss the maramataka with your rōpū.
See pages 115-117 for ngā mata o te marama.

What is te marama phase?

What meaning can you derive from the ingoa of te marama?

Does the ahua of the day match the energy of te marama?

Did the ingoa of te marama predict any tohu you observed?

What time does te marama set and rise today?

What percent illuminated is te marama?

TOHU TAIAO OBSERVATIONS

FIELD NOTES:

WAITIAKI GUIDE

HOW TO USE THE WAITIAKI SCALE

INTERPRETATION KEY / DATA CODING

KAKARIKI / GREEN

represents **MAURI**, these results mean the mauri of te taiao is thriving and the wai has great ability to sustain life.

KŌWHAI / YELLOW

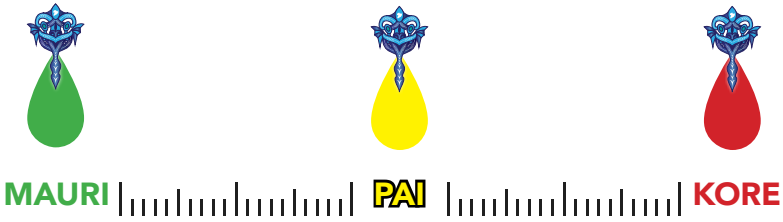
represents **PAI**, these results mean the mauri of te taiao is pai and the wai has good ability to sustain life.

WHERO / RED

represents **KORE**, these results mean the mauri of te taiao is lacking and could be improved and the wai has poor ability to sustain life.

WAITIAKI SCALE SCORING

Most awa will give a mixture of results, scale scoring will help you record and track progress and changes!



WAITIAKI SCALE
TOHU TAIAO

Circle the Waitiaki that resembles what you think/feel. Reflect on your observations from section one. The purpose of this is to use your own knowledge and observations to measure how healthy the awa looks and feels according to you. The intention is to understand your perception of healthy wai in a way that invokes further whakaaro to understand "why" and "how" this may be.

WAIRUA CAN YOU FEEL ANY TOHU?			
	Many Tohu	Some Tohu	No Tohu/Tohu Kino
TIROTIRO CAN YOU SEE ANY TOHU?			
	Many Tohu	Some Tohu	No Tohu/Tohu Kino
WHAKARONGO CAN YOU HEAR ANY TOHU?			
	Many Tohu	Some Tohu	No Tohu/Tohu Kino
HONGIHONGI CAN YOU SMELL ANY TOHU?			
	Many Tohu	Some Tohu	No Tohu/Tohu Kino
TINANA ARE YOU SAFE?			
	Āe (miharo lets mahi!)	Not sure (complete JSA & karakia)	Kāo (stop mahi immediately)
SCORE OVERALL TALLY			

MAURI PAI KORE

WĀHI/SITE_____

2. TIROTIRO AWA

Tuarua: focus on the wai, the awa herself. Spend some time to take a good look and record what you can see!

See pages 135-137 for instructions.

INDICATOR	METHOD
Flow	Tirotiro totō
Bank vegetation	Tirotiro tahataha
Stream composition	Tirotiro whaiawa
Periphyton / Algae	Tirotiro pūkohu wai
Invertebrates	Tirotiro ngāngara or kick net (hard bottomed awa) Sieve (soft bottomed awa)

TIROTIRO TOTŌ
Flow

FLOW	Description	Key
Stable	Steady flow, water level normal	
Low flow	Slower flow, water level low (look for exposed rocks or plants)	
High flow	Faster flow, water level high	
Flooded	Fast flow, turbid water, water level breaching riverbanks (STOP mahi immediately)	
Prolonged low flow	Trickle flow, water level consistently low	

TIROTIRO TOTŌ DATA SHEET

Awa				
Date				
Flow				

TIROTIRO TAHATAHA
Riverbank Vegetation

Whats growing on ngā tahataha o te awa?
Kōrero about what you can see growing on the riverbanks within your stretch of awa.

Estimate % cover in table below:

TIROTIRO TAHATAHA	Description	% cover	Key
Native rākau	Shade cover, bank stability, nutrient filtration, organic matter, invertebrate habitat		
Repo plants	Shade, nutrient filtration		
Tussocks	Shade, nutrient filtration		
Introduced rākau	Shade, bank stability, nutrient filtration, invertebrate habitat		
Scrub	Shade		
Pine plantations	Shade, sedimentation		
Pasture	No shade, no nutrient filtration		
Bare banks	Sedimentation / Erosion		
Manmade	Infrastructure / Run off		

List all the rākau/plants that you can identify:

NATIVE	INTRODUCED

**Tip: use the Aotearoa Species Classified app to help ID rākau/plants!*

TIROTIRO TAHATAHA DATA SHEET

Riverbank vegetation (estimated percentage cover)

	Awa				
	Date				
	Native rākau				
	Repo plants				
	Tall tussocks				
	Introduced rākau				
	Scrub				
	Pine plantations				
	Pasture				
	Bare banks				
	Manmade				

TIROTIRO WHAIAWA

Stream Composition

What can you see on the awa bed?
Inspect the awa bed in your awa stretch.

Estimate percentage (%) cover in table below:

TIROTIRO WHAIAWA	Description	% cover	Key
Toka (Boulders)	25 cm +		
Kōhatu nui (Large cobbles)	12 - 25 cm		
Kōhatu iti (Small cobbles)	6 - 12 cm		
Kirikiri (Gravel)	< 6 cm		
Rākau (Woody debris)	Fallen trees/limbs		
Tipu (Plants)	Macrophytes		
Tūāpapa (Bedrock)	Large solid surface		
Onepū (Sand)	Sandy sediment		
Kenepuru (Mud/Silt)	Fine sediment deposits or coverage		
Manmade	Infrastructure		

**Tip: use the Aotearoa Species Classified app to help ID the macrophytes, record species in field notes!*

TIROTIRO WHAIAWA DATA SHEET

Stream composition (estimated percentage cover)

	Awa				
	Date				
	Toka (Boulders)				
	Kōhatu nui (Large cobbles)				
	Kōhatu iti (Small cobbles)				
	Kirikiri (Gravel)				
	Rākau (Woody debris)				
	Tipu (Plants)				
	Tūāpapa (Bedrock)				
	Onepū (Sand)				
	Kenepuru (Mud/Silt)				
	Manmade				

TIROTIRO PŪKOHU WAI

Algae/Periphyton

Is there any algae growing on the rocks or riverbed? Yes / No

What does the algae look like?
Record the type and take note of the amount of algae you see in your awa stretch.
See page 136 for Tirotiro Pūkohu Wai instructions.

Record presence of algal mats in table below:

ALGAL MATS	Description	Green	Brown	Dark
Thin Film	< 0.5 mm			
Medium Mat	0.5 - 3 mm			
Thick Mat	3 mm +			

Record presence of filamentous algae in table below:

FILAMENTOUS ALGAE	Description	Green	Brown / Red
Short Filaments	< 2 cm		
Long Filaments	2 cm +		

Key:

ALGAL MATS	Green	Brown	Dark
Thin Film			
Medium Mat			
Thick Mat			

FILAMENTOUS ALGAE	Brown / Red	Green
Short Filaments		
Long Filaments		

**Tip: use the Aotearoa Species Classified app to help ID the algae, record species in field notes!*

TIROTIRO PŪKOHU WAI DATA SHEET

Algae/periphyton (presence)

	Awa				
	Date				
	Thin Brown				
	Thin Dark				
	Med Dark				
	Thin Green				
	Med Green				
	Med Brown				
	Thick Dark				
	Short Filaments Green				
	Short Filaments Brown				
	Thick Green				
	Thick Brown				
	Long Filaments Green				
	Long Filaments Brown				

TIROTIRO NGĀNGARA
Invertebrates

Turn over some rocks and debris or sieve through some sediment, what ngāngara can you see?
Record the type and number of ngāngara you find in your awa stretch.
See pages 136-137 for Tirotiro Ngāngara instructions

Record invertebrate counts in table below:

	Presence	Count	Key
Kākahi			
Kōura			
Mayfly			
Stonefly			
Caddisfly			
Limpet			
Dobsonfly			
Small Crustacean			
Cranefly			
Damesfly			
Dragonfly			
Snail			
Small Bivalve			
Beetle			
Axehead Caddisfly			
Midge			
Worm			
Gold Clam			

TIROTIRO NGĀNGARA DATA SHEET
Invertebrate counts

	Awa				
	Date				
	Kākahi				
	Kōura				
	Mayfly				
	Stonefly				
	Caddisfly				
	Limpet				
	Dobsonfly				
	Small Crustacean				
	Cranefly				
	Damesfly				
	Dragonfly				
	Snail				
	Small Bivalve				
	Beetle				
	Axehead Caddisfly				
	Midge				
	Worm				
	Gold Clam				

WĀHI/SITE_____

3. PŪTAIAO

Tuatoru: What are the scientific measures for healthy wai?
See pages 138-141 for Pūtaiao instructions.

INDICATOR	UNITS	EQUIPMENT
Temperature	Degrees Celsius (°C)	Temperature/EC reader
pH	pH units	pH meter (or pH sticks)
Electrical Conductivity (EC)	Micro Siemens per centimetre (µS/cm)	Conductivity meter
Visual clarity	Metres (m)	Black disk and measuring tape (or clarity tube)
Current velocity	Metres per second (m/s)	Orange/lemon, measuring tape and calculator
Nitrate	Milligrams per litre (mg/L)	Visual observation using a colour comparator

TEMPERATURE

For general health of our ika, the temperature of the wai should be below 20 C.

What is the temperature of the wai?

_____ °C

Is this temperature good for healthy ika? Yes / No

pH

pH measures how acidic or basic the wai is. The pH of the wai needs to be between 6.5 - 9 to be safe for our ika to live in.

pH		7-8
		6.5-7 / 8-9
		<6.5 / >9

What is the pH of the wai?

_____ pH units

Is this a safe pH for ika? Yes / No

ELECTRICAL CONDUCTIVITY (EC)

Electrical Conductivity (EC) is a measure to tell us how much salt or solid material is dissolved in the wai.
This doesn't tell us how 'bad' or 'good' the wai is, just how much salt/material is dissolved.

EC (µS/cm)		< 150
		150 - 400
		> 400

In Tūwharetoa, some awa may have geothermal taonga nearby. Geothermal wai is rich in minerals and ions and can increase the EC reading of wai Māori.

What is the EC of the wai? _____ µS/cm

VISUAL CLARITY

Visual clarity measures how far you can see underwater, using a black disc and underwater viewer. It gives us an idea of how much sediment (dirt, sand, clay, silt), algae and other particles are floating in the wai.

CLARITY (m)		> 4
		1.6 - 4
		< 1.6

How far can you see underwater? _____ m

CURRENT VELOCITY

Current velocity is how fast the awa is moving. A fast-moving awa brings more kai to our ika than a slow moving awa, so fast moving awa tend to have more biodiversity! A fast awa also means more oxygen for our wai!

VELOCITY (m/s)		0.1 - 0.7
		0.7 - 1.0
		< 0.1 / > 1.0

How long did it take for the lemon to float 10m?

_____ seconds

Current velocity equation= (distance travelled / time taken) x correction factor = (10 / time taken) x 0.86

Current velocity = _____m/s

NITRATE

NITRATE (mg/L)		< 0.1
		0.1 - 0.5
		> 0.5

Nitrate (NO3) is a nutrient/ pollutant. It is a form of Nitrogen that gives us an idea of what the land around the awa is being used for. High nitrate concentrations can occur where the awa is near farms due to nitrate in fertilizers and livestock mimi. High nitrates can also occur when there is a spill of paru into the wai, like sewage or wastewater. For our wai to be healthy, nitrate levels should be below 0.5 mg/L.

How much Nitrate is in the wai? _____ mg/L

Is this a healthy level of Nitrate for the wai? Yes / No

PŪTAIAO DATA SHEET

Water quality

Awa				
Date & Time				
Temperature (°C)				
pH				
EC (µS/cm)				
Visual Clarity (m)				
Current velocity (m/s)				
Nitrate (mg/L)				

Download an excel template to record and graph your data. Scan the QR code or go to the Tūwharetoa Māori Trust Board - Project Kaitiaki webpage to find downloadable links.

TOHU TAIAO FIELD OBSERVATIONS:

WAITIAKI SCALE
TIROTIRO AWA & PŪTAIAO

Circle the closest Waitiaki according to the data collected in the pūtaiao section. This section aims to provide a general understanding and interpretation of the data collected.

TIROTIRO TOTŌ Flow Conditions	The flow of the awa is stable	The flow of the awa is a bit high or a bit low	The awa is flooding or not flowing much at all
TIROTIRO TAHATAHA Riverbank Vegetation	Percentage of mauri rākau	Percentage of pai rākau	Percentage of kore rākau
TIROTIRO WHAIAWA Stream Composition	Percentage of mauri habitat	Percentage of pai habitat	Percentage of kore habitat
TIROTIRO PŪKOHU WAI Periphyton / Algae	Number of mauri algae present	Number of pai algae present	Number of kore algae present
TIROTIRO Ngāngara Invertebrates	Number of mauri invertebrates present	Number of pai invertebrates present	Number of kore invertebrates present
PŪTAIAO Water Quality	Number of mauri results	Number of pai results	Number of kore results
SCORE Overall Tally	WAI MAURI	WAI PAI	WAI KORE

WĀNANGA

Use the following pages to wānanga about the past and future of your awa, to process and understand the data you have collected.

WĀNANGA MĀTAURANGA
KA MURI

Thinking about the past and what the awa used to be look, feel and be like. These pātai may take time to reflect on and require you to wānanga with your whānau and kaumātua.

Do you know where the awa starts?	**Is the awa mainstem? A tributary?**	**Does the awa have any tributaries?**
Were there natural features nearby that are longer present?	**Is there any previous monitoring data to compare?**	**Do your kaumātua have any memories of the awa?**
Did your tūpuna collect kai from the awa?	**Do you know where the mahinga kai are?**	**Is there any kōrero tuku iho about the awa?**
What was the land around the awa historically used for?	**Was there any historic infrastructure on the awa?**	**Is this awa mentioned in any mōteatea?**

What do you think the water quality and plants/trees around the awa would have looked like 100 years ago?	**Do you know if this was a traditional site for your whānau/ hapū? E.g. Mahinga kai, rongoā, puna**
What do you think your kaumātua/tīpuna would say about this awa today?	**What do you think this site would have looked like and felt like for your tūpuna?**

DRAW WHAT YOU THINK THIS AWA/WĀHI WOULD HAVE LOOKED LIKE 20, 50, 100 YEARS AGO

Did the awa always flow like this? Were these trees always here? How wide was the awa?

WĀNANGA MĀTAURANGA
KA MUA

Thinking about the future, your dreams, aspirations and hopes you have for the awa and wāhi. These pātai may take time to reflect on and may require you to wānanga with your whānau and tamariki.

What does the data collected this year tell us?	**What changes did you notice most season to season?**	**Could you improve any kore results? How?**
What is your favourite tohu you have observed?	**Can you collect kai from the awa today?**	**Were there any major changes to wai quality of the awa?**

What do you think your tūpuna would have wanted for this awa/ wāhi?	**What aspirations do you have for this awa? What would you want for your mokopuna? Discuss and plan future monitoring and projects!**

TAIAO PLAN NOTES

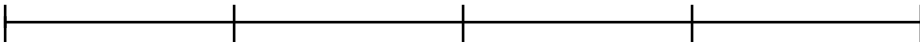
Note down any additional notes around your taiao aspirations, dreams and goals. Use your notes to help guide you in your taiao plan on the next page...

DRAW WHAT YOU WANT THE AWA/WĀHI TO LOOK LIKE IN 10, 20, 50 YEARS...

Do you see want to see more native rākau being planted along the banks? More manu return to this awa?

WAITIAKI PLAN

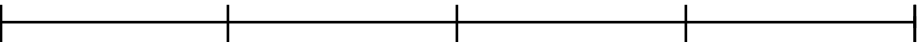
What has happened in the last 50 years for this awa?



__ years ago

What do you need to find out to remember this history?

What are our aspirations for the next 50 years?



__ years from now

What tools do you need to achieve this?

NGĀ MATA O TE MARAMA

NGĀTI TŪWHARETOA

Use the following pages to help you identfy the marama phase and whetū/month, you can also record your observations based on the maramataka to help you recognize patterns in te taiao.

TAITIMU
LOW

NOA

TAIPARI
HIGH

NGĀ MATA O TE MARAMA

NOTES

Record your tohu taiao observations from each season throughout the year

TE KOTAHI O WHIRO

TE RUA O TIREA

TE TORU O TE HOATA

TE PAE O TE MARAMA

KOHIKOHI WHETŪ

TAMATEA Ā MUA

TAMATEA KĀPUAPUA

TAMATEA WHATU PANGO

TAMATEA POU TAHI

KŌREHUREHU

TAKA KI TE RUA

WETEWETE WHETŪ

TAITIMU
LOW

NOA

TAIPARI
HIGH

NGĀ MATA O TE MARAMA

NOTES

Record your tohu taiao observations from each season throughout the year

TĀPEKA Ō RONGO

TE WHATU Ō RONGO

TE PAE Ō RONGO

HINA MATA NUI

TŪMĀTOHI

MATA TĀMOU

OIKE

TE AHU TUATAHI

TE AHU TUARUA

TE AHU TUATORU

TANGAROA Ā MUA

TAITIMU
LOW

NOA

TAIPARI
HIGH

NGĀ MATA O TE MARAMA

NOTES

Record your tohu taiao observations from each season throughout the year

TANGAROA Ā ROTO

TANGAROA MATA URA

TANGAROA MATA KIOKIO

TĀNE HOKIHOKIA

ORONGONUI

MAURI TŪ

MUTUWHENUA

NGĀ MATA O TE MARAMA

WHETŪ/MONTHS	APPROXIMATE GREGORIAN MONTH	TAU/SEASON
TE MĀ TAHI O PĪPIRI	June	Takurua
TE RUA O HONGONGOI	July	Takurua
TE TORU O HERETURIKŌKĀ	August	Takurua
TE WHĀ O MAHURU	September	Kōanga
TE RIMA O KŌPŪ	October	Kōanga
TE MĀONO O WHIRINGA Ā RANGI	November	Kōanga
TE MĀWHITU O HAKIHEA	December	Raumati
TE MĀWARU O KOHITĀTEA	January	Raumati
TE MĀIWA O RUHIOTERANGI	February	Raumati
TE NGĀHURU O POUTŪTERANGI	March	Ngahuru
TE NGĀHURU MĀTAHI O PAENGAWHĀWHĀ	April	Ngahuru
TE NGĀHURU MĀRUA O HAKI HARATUA	May	Ngahuru

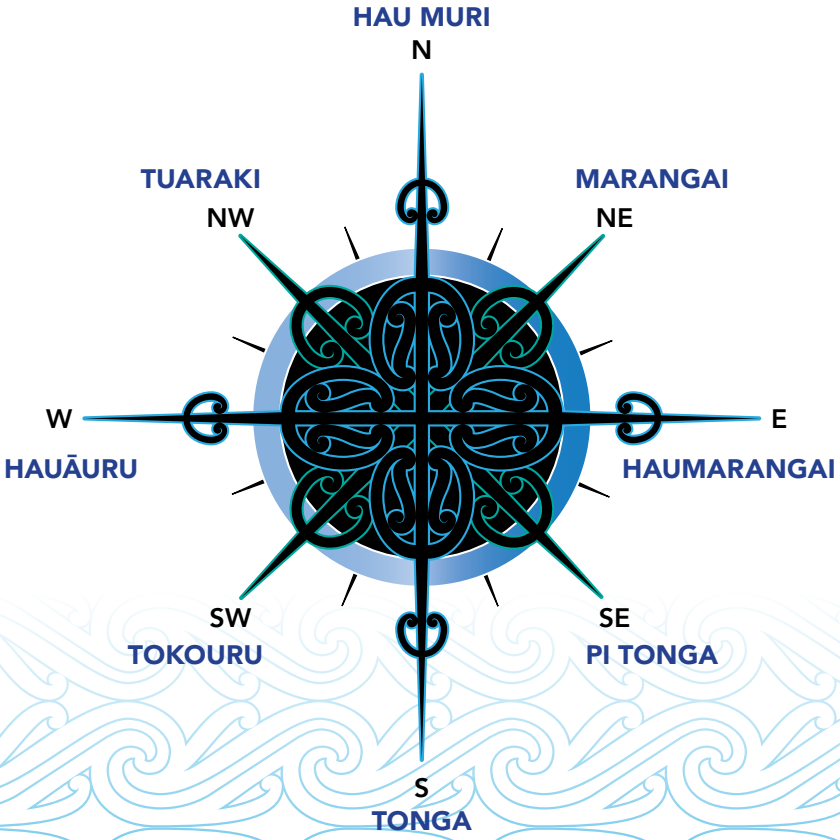
TAIAO ID PAGES

Use the following pages to help you identify different aspects of the taiao (e.g. manu, clouds, winds, invertebrates, ika) and record any observations you see.

WIND COMPASS

What direction is the wind blowing?
What is the ingoa of this wind?

TAWHIRIMATEA



CLOUD FINDER

What type of clouds can you see? What tohu do we receive?

KAPUA WHAKAPIPI (CUMULUS CLOUD)

- Fluffy
- Low-level
- Flat bottom
- Round/puffy top

Kōrero: Ngāti Tūwharetoa chief Tamamutu described this as Kapua Whakapipi (the guardian cloud) for how the clouds gathered over the Kaimanawa Ranges.

TE MĀRA KŪMARA A NGĀTOROIRANGI (CIRROCUMULUS CLOUDS)

- Rounded
- Thin rows/ripples
- High-level

Kōrero: cloud formation that resembles the ancient kūmara beds of Ngātoroirangi

Tohu: indicate a change in the weather

IORANGI (CIRRUS CLOUD)

- Wispy
- Thin and feather like
- High up

Kōrero: io (strips) in the sky (rangi)

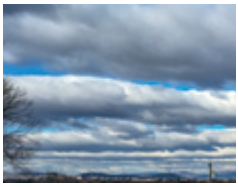
Tohu: indicate coming rains

KAPUA WAENGA (ALTOCUMULUS CLOUDS)

- Clumps of rounded clouds
- Ripple or wavy pattern
- Mid-level

PŪTAHI (STRATUS)

- Low-level
- Grey clouds that cover the sky
- "overcast"



STRATOCUMULUS

- Low-level
- Lumpy and grey
- Covers sky in rows

Scan the QR code for more cloud formations

NGĀNGARA
TUAIWI-KORE

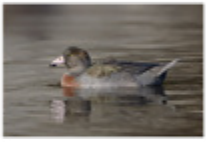
		
MAYFLY *Ephemeroptera*	**STONEFLY** *Plecoptera*	**CADDISFLY** *Trichoptera*
• 3x "feather" tail • Gills along abdomen • 6x legs • Indicate great water quality	• 2x "feather" tail • Flat body, can be green • 6x legs • Indicate great water quality	• Uses casing as "shell" • Leaves trails on rocks • 6x legs • Indicate great water quality
		
LIMPET *Mollusca*	**DOBSONFLY** *Megaloptera*	**SMALL CRUSTACEAN** *Amphipoda*
• Attach to rocks • Quite small • Indicate good water quality	• 4x legs • 8x gills on each side • Have a painful bite! Kia tūpato!	• Laterally compressed • Can be light, dark or mottled • Usually very small
		
CRANEFLY *Diptera*	**DAMESFLY** *Odonata*	**DRAGONFLY** *Odonata*
• Worm like • Light green to Grey/Brown • May have a "hairy" tail	• Green or sand coloured • 3x "feather" tail (but no gills along body like Mayfly)	• 6x legs • Large wide bodies • Spiny abdomen

NGĀNGARA
TUAIWI-KORE

		
SNAILS *Mollusca*	**SMALL BIVALVES** *Mollusca*	**BEETLES** *Coleoptera*
• Found under and on rocks • Shells can be rounded or pointed • Can be an indicator of declining water quality	• Found silty stream margins • Grey/Brown to mottled white coloured • Can be an indicator of declining water quality	• Larvae appear "striped" • Usually found on rocks • Can be an indicator of declining water quality
		
AXEHEAD CADDISFLY *Trichoptera*	**MIDGE** *Diptera*	**WORMS** *Oligochaeta*
• Wedge/axe head shaped casing • Usually found firmly attached to rocks • Can be an indicator of declining water quality	• Small and thin • Worm like • Can be transparent, white, brown or red coloured • Can be an indicator of declining water quality	• Often found in degrading streams • Indicated poor water quality
		
KŌURA *Crustacean*	**KĀKAHI** *Mollusca*	**GOLD CLAMS** *Mollusca*
• Taonga species • Indicate great water quality	• Oval shape • Adults dark coloured • Juveniles can be light/gold coloured • Indicate great water quality	• **INVASIVE!** (contact TMTB or MPI immediately if found!) • Gold coloured • Thumbnail size and shape

NGĀ MANU O TE TAIAO

Can you see any of these Native Manu?

MANU		KAI	BREEDING SEASONS	SCAN QR CODE FOR MORE INFO/MANU SOUNDS
TŪĪ/KŌKŌ		Flowers from trees (kōwhai, flax, rātā, pōhutukawa, rewarewa, harakeke). Fruits from trees (karaka, māhoe, tawa, māpou. Insects, spiders, honeydew	September - January	
KOEKOEĀ *Long-tailed cuckoo*		Large insects (wētā, cicadas), spiders, small invertebrates, occasionally small birds or bird eggs	September - February	
WHIO *Blue duck*		Fave kai: larvae of insects (mayflies, caddisflies, stoneflies), small fish, snails, small amounts of algae, plant material. **Good indicator of a healthy awa!**	August - November	
MIROMIRO *Tomtit*		Beetles, moths, caterpillars, flies, spiders, earthworms, small fruits	September - January	
RIRORIRO *Grey warbler*		Small insects (flies, moths, midges). Spiders, caterpillars	August - January	
KĀHU *Swamp harrier*		Small birds (waterfowl, eggs), small mammals (rats, mice), small fish from shallow wai, dead animals, insects (grasshoppers, beetles)	August - December	

NGĀ MANU O TE TAIAO

Can you see any of these Native Manu?

MANU		KAI	BREEDING SEASONS	SCAN QR CODE FOR MORE INFO/MANU SOUNDS
KERERŪ *NZ Pigeon*		Native fruits fom trees like tawa, miro, karaka, puriri, taraire, matai. Leaves & shoots from kowhai, willow and tree lucerne. Flowers from kowhai and rata.	September - April	
PĪWAIWAKA/ TĪRAIRAKA *Fantail*		Flying insects, spiders, caterpillars, insect larvae	August - February	
KORIMAKO/ MAKOMAKO *Bellbird*		Mainly nectar feeders from flax, kōwhai, rātā, fuschia, pōhutukawa, insects (flies, beetles, caterpillars, spiders). Fruits from māhoe, māpou, tawa, honedew.	September - January	
TAUHOU *Silvereye*		Small insects (caterpillars, flies, beetles, spiders). Fruits (from māhoe, māpara, kōwahi, flax). Nectar (from kōwhai, flax, rātā). Sap , pollen and small seeds.	August - February	
TOUTOUWAI *Robin*		Beetles, spiders, ants, caterpillars, earthworms, centipedes, small berries, fruits, small seeds	July - January	
KĀREAREA *NZ Falcon*		Small-medium manu (sparrows, starlings, finches, thrushes, kererū, tūī, tauhou, small mammals	August - December	
KŌTARE *Sacred kingfisher*		Fave kai: small fish, invertebrates (crabs, shrimp), insects (beetles, cicadas, grasshoppers), small reptiles, mice	September - February	

NGĀ MANU O TE TAIAO

Can you see any of these Non-Native manu?

MANU		KAI	BREEDING SEASONS	SCAN QR CODE FOR MORE INFO/MANU SOUNDS
SPARROW		Seeds, grains, insects and crumbs	August - March	
SONG THRUSH		Insects, worms, snails, berries and fruit	September - January	
EASTERN ROSELLA		Grass seeds, weed seeds (dandelions, thistles), fruits from plants, blossoms, nectar, insects	August - March	
STARLING		Insects, worms, fruits, berries and seeds	August - February	
BLACKBIRD		Worms, insects, berries fruit and seeds	August - March	
MYNA		Insects, fruit, nectar and scraps	October - March	

NGĀ MANU O TE TAIAO

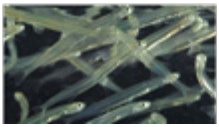
Can you see any of these Non-Native manu?

MANU		KAI	BREEDING SEASONS	SCAN QR CODE FOR MORE INFO/MANU SOUNDS
BLACK SWAN		Aquatic vegetation, grasses and algae	June - November	
CANADIAN GOOSE		Grasses, grains, clovers and aquatic plants	August - November	
MAGPIE		Insects, small animals, eggs and animal carcusses	August - December	
QUAIL		Seeds, grains, insects and leaves	October - February	
MALLARD DUCK		Aquatic plants, insects, seeds and small fish	August - January	
CHAFFINCH		Seeds, insects and small fruits	September - December	

NATIVE IKA

Can you see any native ika?

***Kōrero tuku iho**: At the summit of Tauhara Maunga, Ngātoroirangi erected a tūahu (alter) named Ikatere - the god of fish. Another tūahu was named Te Tūahu o Ngātoroirangi at Taharepa on the northern shores of Taupō Moana. Taharepa was named for the style of cloak Ngātoroirangi wore. As he plucked a feather from his cloak whilst chanting incantations to Ikatere, he threw the feather in the lake and a tuna appeared. The tuna died suddenly, indicating that tuna wouldn't survive in the lake. He threw a second feather in the lake which produced our native fish: kōaro, kōkopu, īnanga, kōura and kākahi.*

IKA		BREEDING SEASON	HABITAT	KAI
KŌARO (*Galaxias brevipinnis*)		March - May	Fast flowing, clear and cool streams often in forested areas. Prefer rocky lake/stream edges	Insects, algae, small invertebrates
SHORTJAW KŌKOPU (*Galaxias postvectis*)		April - May	Shaded forest streams with cool, clear water and good cover	Aquatic insects, land invertebrates
GIANT KŌKOPU (*Galaxias argenteus*)		June - October	Slow-moving streams and wetland margins	Insects, small fish, crustaceans
BANDED KŌKOPU (*Galaxias fasciatus*)		July - October	Small, shaded streams and wetland margins	Insects, land invertebrates
ĪNANGA (*Galaxias maculatus*)		February - May	Slow-flowing, shallow waters. Can be found in rivers, streams and lakes	Small insects, algae, plankton

NATIVE IKA

Can you see any native ika?

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IKA		BREEDING SEASON	HABITAT	KAI
KĀKAHI *(Echyridella menziesi)*		October - February	Sandy or muddy lakebeds and slow moving awa/manga	Filters plankton and organic matter from the wai
KŌURA *(Paranephrops planifrons)*		October - February	Rocky and vegetated lake edges, streams with woody debris	Decaying plant material, detritus, small invertebrates
TUNA *(Anguilla dieffenbachii)*		March - April	Inland lakes and awa that allow tuna to migrate to sea	Insects, fish, crustaceans, small mammals
COMMON SMELT *(Retrophinna retropinna)*		August - November	Found in the open water of the lake, during spawning smelt move to shallow lake shores	Zooplankton, phytoplankton

NON-NATIVE IKA

Can you see any Non-Native Ika?

IKA		BREEDING SEASONS	HABITAT	KAI
RAINBOW TROUT *(Onorhynchus mykiss)*		July - October	Cool, well-oygenated wai. Open lake waters and nearshore zones	Aquatic insects (e.g. mayflies, caddisflies, smelt, kōaro and terrestrial invertebrates)
BROWN TROUT *(Salmo trutta)*		May - August	Cool, well-oygenated wai. Open lake waters and nearshore zones	Aquatic invertebrates, small fish (e.g. smelt, kōaro) terrestrial insects and crustaceans
CATFISH *(Ameiurus nebulosus)*		October - January	Shallow, warm areas of Lake Taupō with muddy or silty substrates	Omnivorous: invertebrates, small fish, detritus and aquatic plants
GOLDFISH *(Carassius auratus)*		October - January	Shallow, still or slow-moving areas near lake edges with abundant vegetation	Omnivorous: algae, detritus, aquatic plants, small invertebrates
RUDD *(Scardinius erythrophthalmus)*		October - December	Calm, vegetated areas of Lake Taupō near shorelines and wetlands	Herbivorous: aquatic plants, algae and sometimes small invertebrates
MOSQUITO FISH *(Gambusia affinis)*		October - April	Shallow, warm shoreline zones and slow moving stream mouths feeding into Lake Taupō	Carnivorous: mosquito larvae, other invertebrates, small fish eggs

INSTRUCTIONS

Instructions and equipment lists for Tirotiro Awa and Pūtaiao sections.

TIROTIRO AWA INSTRUCTIONS

SITE SELECTION

- Go to the awa and mark out an approximate 10m stretch of awa.
- Ensure the site has safe access to the awa.
- Ensure the depth of the awa at this site is safe and wadeable.
- Try to find a stretch of awa with a mixture of riffles, runs and pools
- This will be your “awa stretch” or monitoring site.
- Ensure to return to the same site each season and to carry out monitoring at the approximate same time each season (e.g. morning sites stay morning, afternoon sites stay afternoon).

SAMPLE COLLECTION

Gear List:

- Bucket
- Sample bottles
- Waders

- If not everyone can be in the awa, collect samples for whānau on the riverbanks to test while others are in the awa.
- Temperature, pH & EC can be tested from a bucket.
- Nitrate test requires a sample and testing completed on the riverbanks.
- Clarity tube visual clarity can be measured from the riverbanks.

TIROTIRO PŪKOHU WAI

Gear List:

- Periscope

- Take a look around the awa and see what kind of algae you can find!
- Use the periscope (remove the mirror first) to look under the water for algae.
- Pick up a few rocks and see what kind of algae is growing on them.
- Record the type of algae and approximate abundance on the datasheet.

TIROTIRO AWA INSTRUCTIONS

TIROTIRO NGĀNGARA

Gear List:

- Bucket
- White tray
- Sieve
- Tweezers
- Dish brush
- White ice tray
- Magnifying glass.

- Select five equally spaced places along your 10m awa stretch.

- Fill the white tray one-third of the way with awa water, and place it somewhere flat and stable.

- At each place, pick up a stone at least a small cobble size (aim for a variety of sizes), use a sieve to place it underneath so that no ngāngara fall off the rock, and place it in a bucket.

- One by one, place rocks from the bucket into the tray and remove invertebrates using one of the following methods:

1. Gently swirl water around the rock in the tray
2. Wash invertebrates off with a water bottle
3. Use tweezers to remove invertebrates
4. Scrub invertebrates off with a dish brush
5. Remove any invertebrates still in the bucket with a sieve.

- Identify and count the invertebrates in the white tray and record counts on the datasheet. You can use an ice tray to help you sort and count the invertebrates and a magnifying glass to help you identify them ID. Take note of any algae on the rocks too!

- If no rocks are available, dig the sieve into the sand/ sediment in your five 5x places, add sieved samples to the bucket, and then tray.

PŪTAIAO INSTRUCTIONS

TEMP, PH & EC

Gear List:

- pH probe or strips
- EC/Temp reader
- Bucket

- Rinse the bucket and collect a sample.
- Turn on the reader and remove the cap.
- Place the probe into a bucket up to the grey line (do not fully submerge probes or readers).
- Wait a few seconds for the probe to stabilise.
- Repeat and record readings for pH, EC and temperature.
- If using pH strips, dip the strip into the bucket and match the colours to the pH on the colour card provided.

VISUAL CLARITY (Black Disc)

Gear List:

- Black disc
- Periscope viewer
- Measuring tape.

- One person in the stream holds a black disc (the holder stands upstream of the viewer).
- Another person (viewer) attaches a tape measure to a black disc and steps back a few steps.
- The viewer looks through a periscope viewer to see a black disc.
- Walk backwards slowly (allow time for sediment to settle) until you can no longer see the black disc.
- Measure from the back of the periscope viewer box and record visual clarity distance.

VISUAL CLARITY (Clarity Tube)

Gear List:

- Clarity tube.

- Fill the tube with wai.
- Hold the capped end of the tube, the viewer holds the other end and looks through the tube.
- The viewer moves the magnet until it is no longer visible (if you can't reach the end of the tube, ask someone else to move the magnet away for you).
- Record visual clarity with measurements on the tube.
- If visual clarity is over 1m (you can see the magnet for the whole length of the tube), consider using the black disc method.
- After visual clarity is determined with sample wai, add some paru to the tube to demonstrate what it would look like with dirty water!

CURRENT VELOCITY

Gear List:

- Measuring tape
- Lemon/Orange/Apple
- Stopwatch.

- Measure a 10m stretch of awa.
- One person instream drops lemon in awa around 2m upstream from the start of the measuring tape.
- Another person follows the lemon and begins timing once the lemon reaches the start of the measuring tape.
- Stop timing when the lemon reaches the end of the measuring tape.
- Another person downstream of the measuring tape to catch lemon.
- Record the time taken and calculate the current velocity with the equation provided.

NITRATE

Gear List:

- Nitrate kit
- Gloves
- Safety glasses
- Waste container

- **H&S:** Wear gloves, glasses, and masks if windy, do not let tamariki touch reagents!

- Rinse 2x vials with sample water.
- Fill each vial with 5 mL wai using a syringe.
- Place one vial at the top of the foam block (clear reference vial).
- Add 6 drops of Reagent A to the other vial a, put on the lid and invert the vial 3x.
- Remove the lid, and add once scoop of Reagent B, replace the lid and shake the vial for 60 seconds.
- Wait a few minutes for the colour to develop.
- Remove the lid and place the vial at the bottom of the foam block.
- Place foam block with vials on the colour card and find the best match.
- Record Nitrate mg/L.
- If the Nitrate sample is too dark to match the colour card, tip half of the vial out and carefully top up with tap water (do not top up with awa/sample water).
- Discard wai into waste bucket/container.

DATA SHEETS

Data sheets are provided to record data for up to 4 awa per season.

Tip: use a pencil to record data so you can reuse this journal over and over! We also encourage recording tohu taiao observations and wānanga answers in a separate notebook if the journal is used for more than one awa.

REFERENCE PHOTOS

Pick a spot to take a reference photo from each season. This way you can see how the awa changes season to season and over time.

REFERENCES/RESOURCES

NIWA Invertebrate ID guide:

https://niwa.co.nz/freshwater/stream-health-monitoring-and-assessment-kit/identification-and-e-guides

SHMAK Manual:

https://niwa.co.nz/freshwater/stream-health-monitoring-and-assessment-kit/shmak-manual

WRC Guideline Limits:

https://www.waikatoregion.govt.nz/environment/water/river-and-stream-monitoring/indicator-river-water-quality-ecological-health

National Policy Statement for Freshwater Management (NPS-FM):

https://environment.govt.nz/acts-and-regulations/national-policy-statements/national-policy-statement-freshwater-management

Ngā Mata o te Marama resource:
Te Kapua Whakapipi Trust

Apps to download:

Aotearoa Species Classified (taiao ID)
MetService (weather forecasts)
Stellarium (stars and moon info)
The Moon (moon data)

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WAITIAKI TŪWHARETOA

PROJECT KAITIAKI

TŪWHARETOA MĀORI TRUST BOARD