MAKARA SUB-CATCHMENT PLAN

DRAFT

TLC The Big Picture: Tackling the big issues sub-catchment by sub-catchment

Tukituki Land Care

A COHESIVE VOICE FOR THE LAND

Final Draft 27 March 2025

CONTE

Tukituki Land Care
A COHESIVE VOICE FOR THE LAND

1. Introduc **3**
- 1.1. Purpose of The Big Picture 3
- 1.2. Freshwater status of the Tukituki catchment 4
- 1.3. Approach: creating priority actions in the Tukituki 4

2. Tukituki's Overall Big Picture **5**
- 2.1. Summary of sub-catchment challenges and priorities 5
- 2.2. Outcome areas most sought by farmers (from workshops) 6

3 The Makara Catchment Context **7**
- 3.1 Background 7
- 3.2 Makara Catchment Context 8
- 3.4 Catchment Challenges and Key Focus Areas 9
- 3.5 Catchment Objectives 9
- 3.6 Landscape Context 10

4 Summary of Challenges, Impacts and Priority Actions **11**

5 Makara Implementation **11**
- 5.1 On farm good practice and farmer support 11
- 5.2 Flood resilience 12
- 5.6 Erosion and sediment management 12

1. Appendix 1- TLC On-Farm Action Planning Tool **13**

2. Appendix 2 - Understanding Highly Erodible Areas **14**
- 2.1. Highly erodible areas using mapping 14
- 2.2. Farm planning using RUSLE 15

3. Appendix 3 - Flow mapping to understand sites for edge of field management **16**
- 3.1. Identification of sites for edge of field mitigations (wetlands, dams, bunds) 16

4. Appendix 4 - TLC Plant Selection Tool **18**

1. Introduction to The Big Picture

1.1. Purpose of The Big Picture

In 2024 Tukituki Land Care (TLC) launched The Big Picture, a six-month project designed to create independent, science-based catchment plans for the 17 sub-catchments of the Tukituki River in Central Hawke's Bay. The initiative identified each sub-catchment's unique environmental challenges and developed practical, cost-effective solutions to address them. As TLC Chair Richard Hilson explained, "We tackled the big issues sub-catchment by sub-catchment, to piece together the bigger picture."

The project employed a comprehensive research approach that combined field investigations, insights from local farmers, and an in-depth analysis of existing studies and data on the Tukituki catchment. Environmental planning consultancy, Environment, Innovation and Strategy Ltd (EIS), led by Matt Highway, undertook this work.

This project reflects TLC's dedication to improving environmental health and farm productivity, paving the way for a sustainable future for the Tukituki community.

1.2. Freshwater status of the Tukituki catchment

Summary of State of the Environment reporting

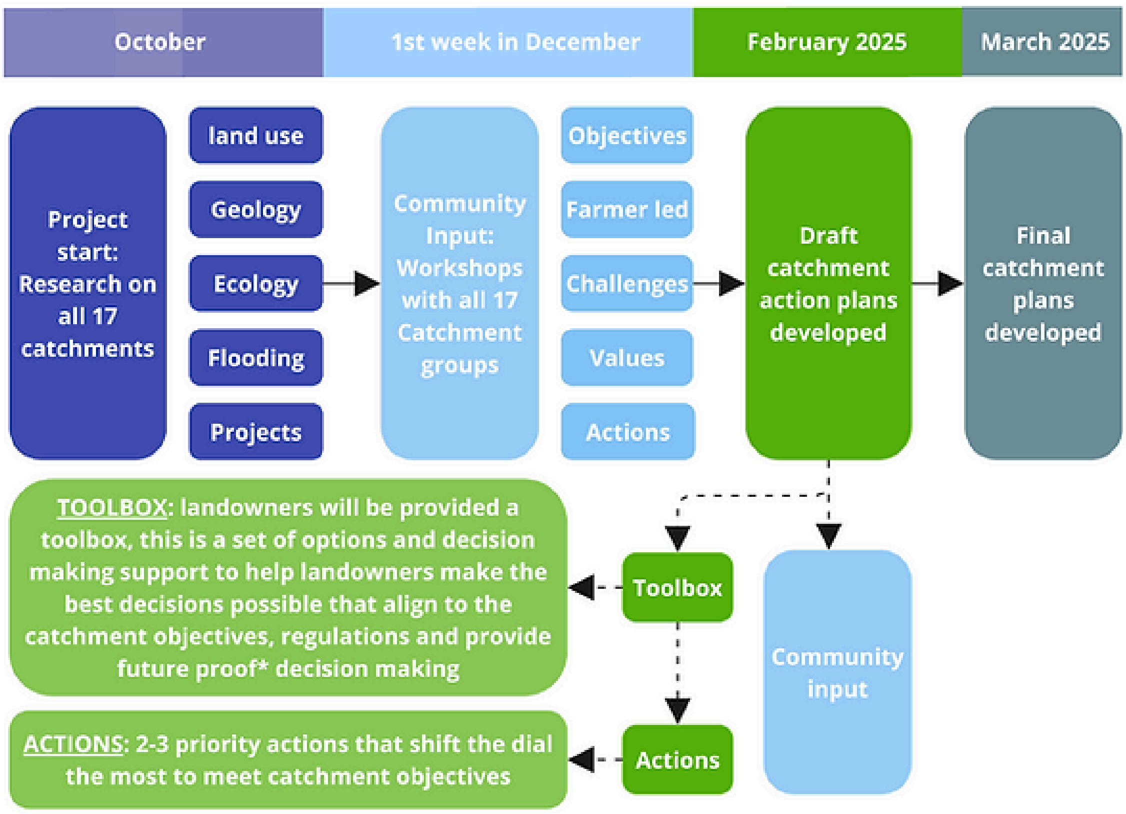
The Tukituki catchment faces water quality, land use, and climate challenges. The catchment, dominated by sheep and beef farming, has experienced significant modifications, leaving only about 10% of its land covered in indigenous vegetation. Water scarcity is a persistent issue, with decreasing river flows over the past three decades, exacerbated by droughts and climate change. Groundwater levels in the Ruataniwha Plains are under strict management to prevent further decline, but interannual variability and climate change pose ongoing risks.

Water quality is a major concern due to high levels of nitrogen, phosphorus, and sediment. The highest nitrogen concentrations in the region occur in streams draining the Ruataniwha Plains, and some areas exceed nitrogen targets by two to four times. Phosphorus and fine sediment issues, linked to erosion, contribute to poor water clarity and degraded aquatic habitats. Toxic algae, particularly Phormidium cyanobacteria, can proliferate in the river during low summer flows, posing a risk to both human and animal health. Despite these issues, the Tukituki River remains generally swimmable, except after heavy rainfall when contaminant levels rise.

1.3. Approach: creating priority actions in the Tukituki

The Big Picture project adopted a highly collaborative approach involving detailed catchment research, GIS mapping, and farmer engagement. Workshops were conducted with local farmers in each sub-catchment to better understand group dynamics, gather community values, and identify key issues and opportunities. Feedback from the workshops, survey results, and field investigations have been used to shape tailored catchment plans aligning with the local communities' specific landscape context and aspirations.

As part of the implementation phase, TLC introduced "THR3E"—three actionable steps designed for farmers in each sub-catchment to implement over three years. The TLC Farmer Toolbox was also launched, providing practical resources to help landowners make informed decisions and maximise the impact of their efforts. Additionally, monitoring strategies are to be implemented, and demonstration sites will be identified to help showcase best practices, ensuring that the plans remain relevant and actionable.



2. Tukituki's Overall Big Picture

2.1. Summary of sub-catchment challenges and priorities

The Big Picture project team has worked with farmers to identify challenges and opportunities in each of the 17 sub-catchments. While each sub-catchment has an individual plan, it is the big picture of the people, the land and the water within the Tukituki that TLC is trying to collectively support. The approach is reminiscent of a jigsaw puzzle where many pieces fit together and form something greater than themselves as an individual piece. Figure 1 below shows how the Tukituki sub-catchments fit together as a big picture, showing the sub-catchments that are aligned in similar top priorities. Note that the image only shows the proposed highest recommended priority area for each catchment, and all catchments will have multiple outcomes they are seeking.

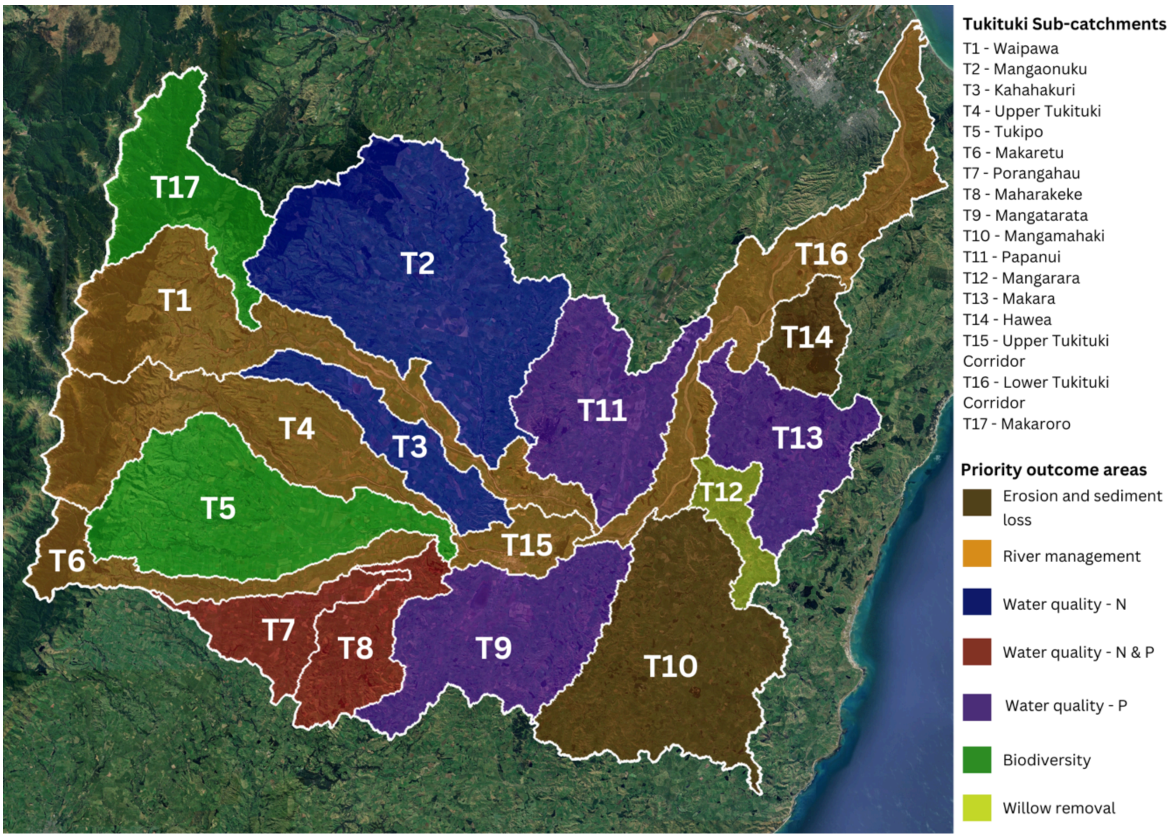


Figure 1 – Sub-catchment map for the Tukituki. Coloured areas highlight the recommended priorities for each catchment.

2.2. Outcome areas most sought by farmers (from workshops)

During workshops, farmers were asked to vote on a selection of outcome areas. Below are the top five outcomes:

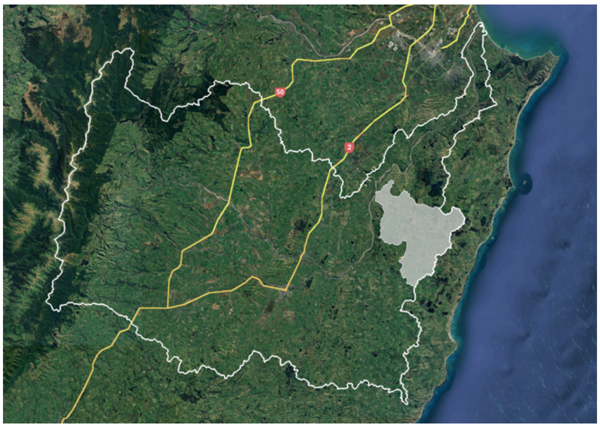
- Support landowners with the knowledge to make informed decisions to improve the environment

- Improve the flood resilience of the catchment, including upstream and downstream to reduce effects on community in adverse weather events
- Protect and enhance the economic viability of the area
- Protect and enhance the quality, ecology, mauri of waterways and wetlands
- Represent farmers interests in future regional government setting of rules and regulations

3 The Makara Catchment Context

3.1 Background

The Makara Stream, nestled in the eastern hill country, flows westward from its upper reaches down to join the Tukituki River. Draining a catchment of 12,465ha, the Makara and its tributaries flow through two forestry operations in the upper reaches of the catchment, pastoral land and some cropping on the lower flats.



The catchment is shaped by its hilly terrain and soils - predominantly Pallic, Brown, and Recent soils-prone to erosion, sedimentation, and nutrient loss. Combined with land use and seasonal rainfall, these characteristics have phosphorus and sediment as the primary contaminants impacting water quality. Despite this, the catchment has remained compliant with water quality limits set under the Tukituki Plan. For example, the 5 year average Dissolved Inorganic Nitrogen (DIN) level is 0.161mg/L, well below the 0.8 mg/L limit (table 1).

Water Quality Parameter	Makara	Standard*
Nitrogen (DIN)	0.161 mg/ L	0.8
Phosphorus (DRP)	0.028 mg/ L	0.015
Bacteria (E.coli)	140 (count)	260
Freshwater invertebrates (MCI)	56 (index)	100
Sediment (Turbidity)	3.1 mg/ L	5.6 FNU (light)

*Table 1- Makara catchment water quality indicators over a five-year rolling average. * The standard represents water quality levels based on the Tukituki plan or national standards. See link to the Makara dashboard[1] for more information.*

[1]https://www.hbrc.govt.nz/environment/farmers-hub/in-the-tukituki-catchment/tukituki-dashboard/makara-dashboard

Farmers in the catchment have been proactive in managing environmental challenges, including:

- 8,767 erosion poles planted since 2018
- 63ha of wetlands across eight farms fenced
- 54.5 km of riparian fencing completed
- 110ha of native bush and regenerating manuka preserved
- 97ha of the catchment fall under QEII covenants

A 2024 catchment stocktake completed by KS Agri, supported by a TLC Demonstration grant, examined the catchment. KS Agri provided three recommendations for potential future works: increased water testing sites, an erosion control scheme, and the use of dung beetles to help minimise sediment and phosphorus loss in the catchment. These recommendations and their feasibility were discussed at a catchment workshop in December 2024.

3.2 Makara Catchment Context

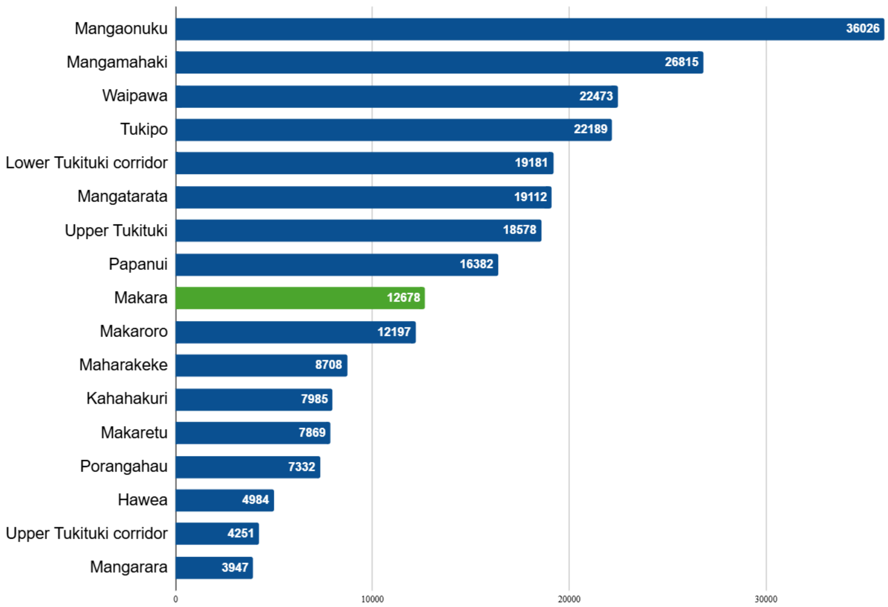


Figure 3 – Tukituki sub-catchment areas in hectares.

The Makara catchment is 12,678ha in size which amounts to 5.07% of the wider Tukituki catchment. The Makara is a moderately sized sub-catchment of the Tukituki, which is 250,000 ha in total (figure 3).

Land use in the Makara is typical of the wider Tukituki catchment with 91% of the catchment in pasture, 6% in exotic forest and 2% indigenous forest (figure 4).

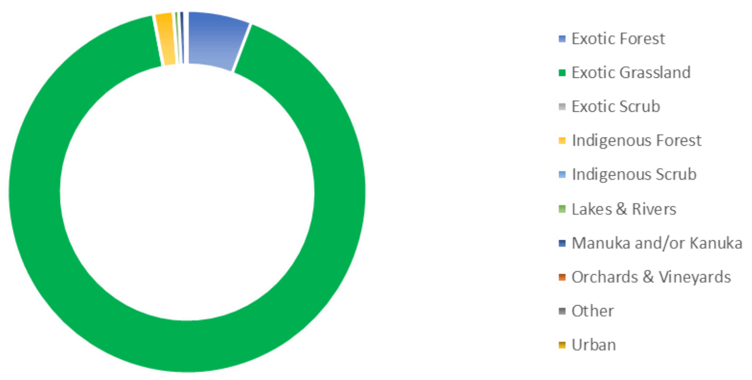


Figure 4 - Land use in the Makara catchment.

3.4 Catchment Challenges and Key Focus Areas

At the Makara Catchment workshop in December 2024, the attendees reflected on the feasibility of the KS Agri report's recommendations, which, as mentioned above, provide a snapshot of the state of the catchment.

Four additional water quality testing sites have been set up based on the recommendation by KS Agri, and the first water quality results were shared with the group. The group also discussed other priorities such as:

- a better understanding of the Emission Trading Scheme and the potential of promoting agroforestry within the catchment
- the need for greater landowner engagement with the focus at the catchment level
- the rising costs and lack of incentives for the development of farm environment plans

All attendees at the meeting were interested in learning how their on farm actions impact those further down the catchment, and what actions could support coordinated efforts to reduce legacy issues and focus resources effectively.

3.5 Catchment Objectives

Attendees at the 2024 Big Picture workshops were asked to vote on the main goals for the catchment and their preferred focus for TLC support. These objectives are included across workstreams in the below action plan. The highest-ranking objective areas were[2]:

- Support landowners with the knowledge to make informed decisions for environmental improvements
- Improve the flood resilience of the catchment
- Create robust farm plans and actions that reflect wider catchments issues

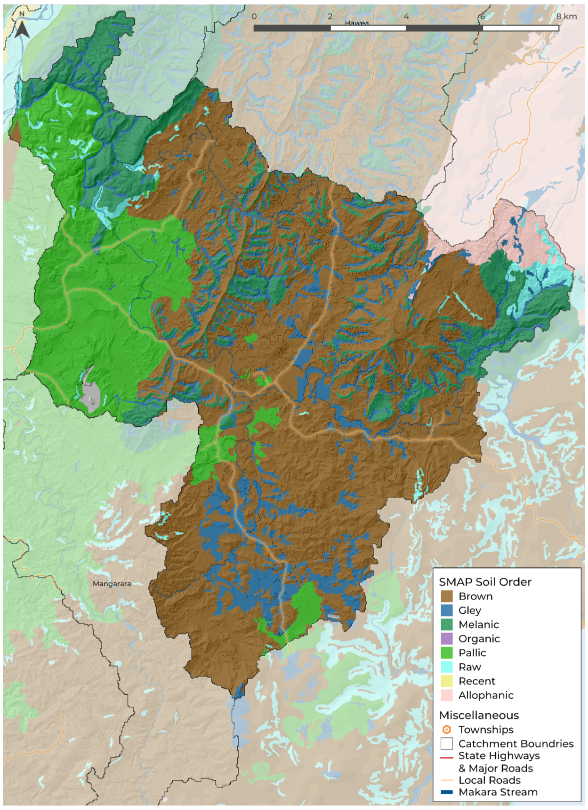
It is important to note KS Agri's recommended objectives:

- Improved understanding of water quality: Increased water testing sites.
- Reduce erosion and sediment loss: An erosion control scheme, and the use of dung beetles to help minimise sediment and phosphorus loss in the catchment

[2] Overall results of these surveys are held by Tukituki Land Care as provided by EIS Ltd.

3.6 Landscape Context

The Makara catchment is dominated by pastoral land use, with a mix of flat, rolling and steep land. The limestone areas in the catchment have led to interesting ridgeback landforms. The Gley soil areas represent historical wetland areas, which are abundant in the catchment (figure 5 - left). The topography and soils have a particular way that they interact with nitrogen and phosphorus. The soils left behind by wetlands will have a low nitrogen loss profile (figure 5 - right) and will often denitrify nitrogen rich water. However, they have a reduced ability to bind phosphorus to the soil, meaning phosphorus will easily leave the soil once in contact with water. Parts of the catchment will be more susceptible to nitrogen loss, particularly where raw free draining soils exist, and steep short gullies occur (figure 5 - right). Pallic soils which are derived from loess (windblown erosion) will be susceptible to erosion and these areas are particularly at risk (see Appendix 2).



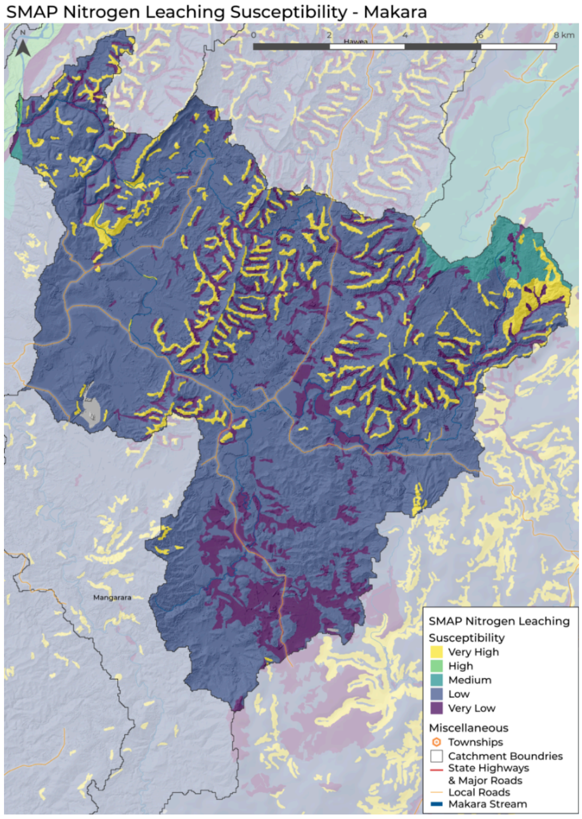


Figure 5 – Left: Soil orders in the Makara. Right: Nitrogen loss risk in the Makara. Both data sets have been sourced from SMAP (Manaaki Whenua).

The north and western parts of the catchment would be categorised as hill-country, and susceptible to erosion. Much of the phosphorus lost in a catchment will be attached to soil and dung and be released as erosion in rainfall events. Identification of high-risk erosion areas and high flow risk areas like critical source areas (CSA) will help prioritise action to reduce this risk.

4 Summary of Challenges, Impacts and Priority Actions

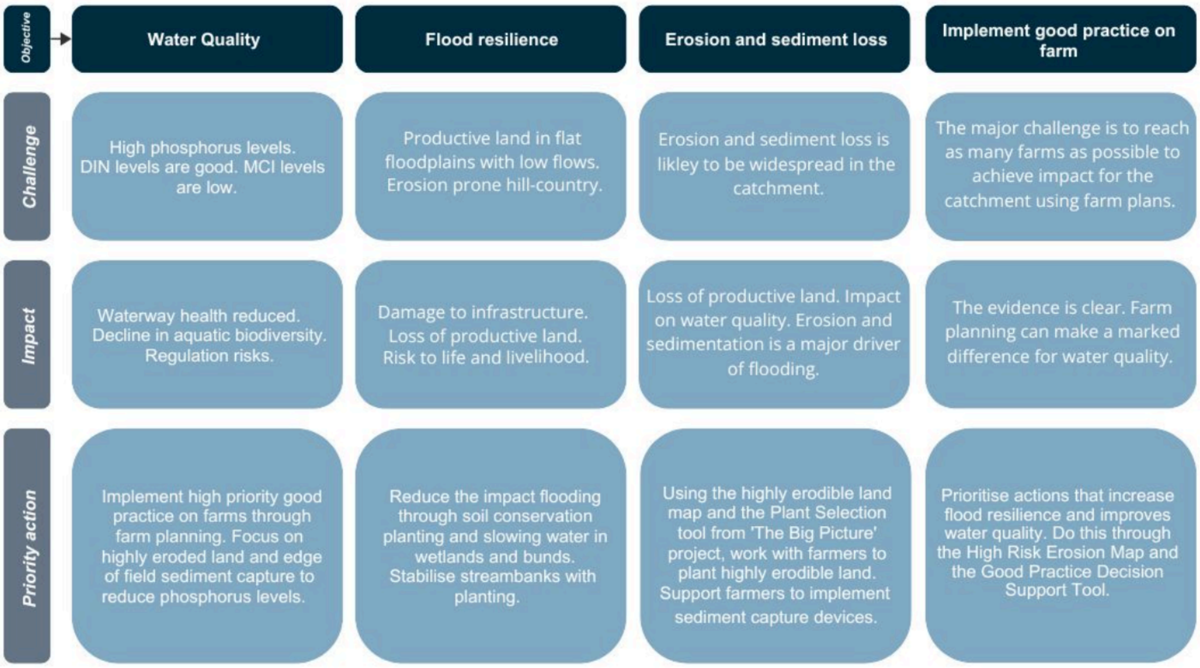


Figure 6 – Summary of the challenges, impacts and recommended priority actions for the Makara catchment, farmed against the four major objective areas.

5 Makara Implementation

5.1 On farm good practice and farmer support

The following workstream aims to support farmers in implementing priority actions, improving land management practices, and enhancing communication across the catchment. These actions focus on providing decision-support tools, engaging stakeholders, securing funding, and tracking progress to ensure long-term success.

- On-farm good practice guide (TLC): A decision-support tool to help farmers implement priority actions (see Appendix 1).
- Whole catchment communication and testing (Makara group): Engage landowners and residents through marketing channels to share plans, gather feedback, and test approaches with farmer input to ensure successful implementation.
- Seeking funding (TLC): Collaborate with HBRC to secure funding for erosion and sediment control, leveraging high-priority mapping and a catchment approach.
- Implementing priority actions (Farmers): Work with the catchment group and advisors to integrate priority actions into farm plans.
- Supporting farmers in recording change (Makara group): Track and communicate positive changes in the catchment to encourage further progress.

Estimated costs: Internal resources from TLC can be leveraged for many of these programmes.

5.2 Flood resilience

This workstream aims to enhance flood resilience by improving erosion control, water capture, and afforestation within the catchment. These actions focus on strategic planning, stakeholder engagement, securing funding, and tracking positive changes to support long-term environmental and community benefits.

- Prioritisation maps for erosion and water capture (TLC): A decision-support tool designed to ensure the right plant is placed in the right location for the right purpose (see Appendix 4).
- Seeking funding (TLC): Collaborate with HBRC to secure funding for erosion and sediment control using high-priority mapping and a catchment-wide approach.
- Implementing planting on highly erodible land (Farmers): Work with the catchment group and advisors to establish priority planting and water capture measures.
- Mapping afforestation and modelling sediment loss reduction (Makara group): Track afforestation efforts and other changes to estimate improvements in flood resilience and sediment loss reduction through the RULSE model. Communicate these positive changes to stakeholders.

Estimated costs: Given the extent of opportunity, priority actions, CSA management and afforestation for improved resilience falls in an extremely wide range of costs, some of which can be farmer costs and some of which can be accessed through grants.

5.6 Erosion and sediment management

This workstream aims to improve erosion and sediment management by identifying high-risk areas, implementing land-use changes, and promoting positive practices. These actions focus on mapping, engaging stakeholders, securing funding, and tracking progress to support long-term catchment resilience.

- Mapping highly erodible land (TLC): A decision-support tool designed to ensure the right plant is placed in the right location for the right purpose (see Appendix 2).
- Seeking funding (TLC): Work with HBRC to secure funding for erosion and sediment control using high-priority mapping and a catchment-wide approach (Estimated cost: $2,000).
- Afforestation, improved practices, and land-use changes on highly erodible land (Farmers): Use farm planning to identify and implement necessary changes to reduce erosion risks (Estimated cost: $2,000).
- Promoting and communicating farmer-led changes (Makara group): Record afforestation efforts and other land-use changes to estimate improvements in flood resilience and sediment loss reduction through the RULSE model. Share these successes to encourage broader adoption of best practices (in kind from TLC).

APPENDICES

1. Appendix 1- TLC On-Farm Action Planning Tool

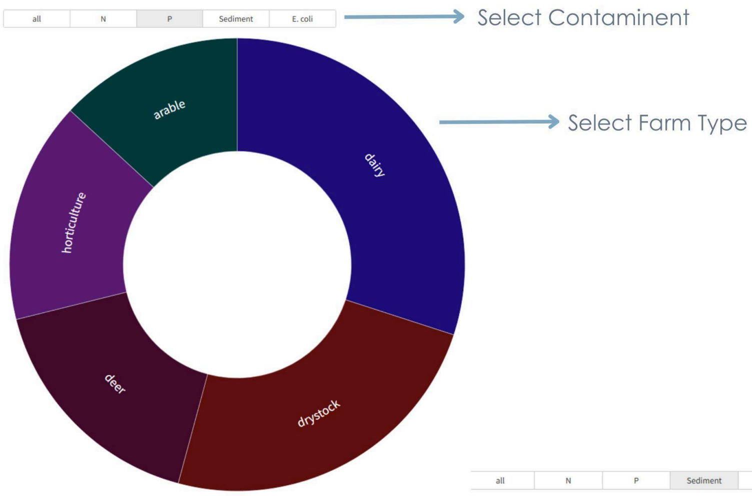
This decision-support tool is designed to help farmers identify and prioritise cost-effective environmental actions on their farms. Use the filters to explore mitigation options by contaminant and farm type.

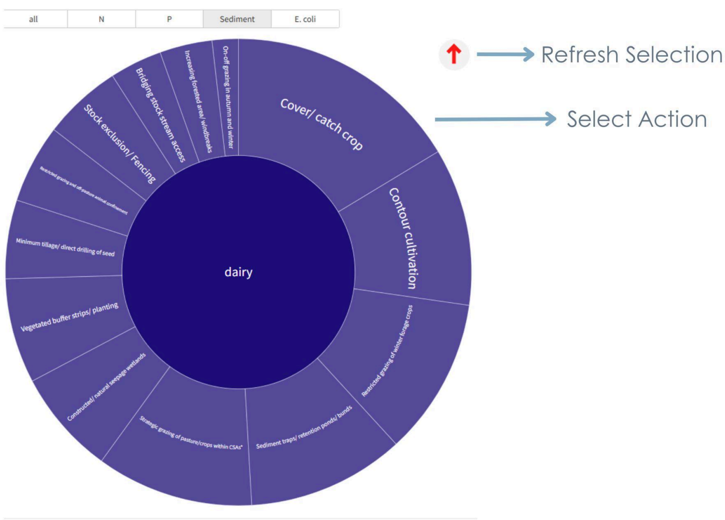
The larger the section, the greater the impact and cost-effectiveness of the mitigation. Recommended actions are displayed in descending order, starting from the top and progressing clockwise around the circle.

How to use the tool:

Visit the TLC Farmer Toolbox at www.tukitukilandcare.org/toolbox, select the On-Farm Action Planning Tool and follow these steps:

1. Select a contaminant.
2. Choose your farm type.
3. Select an action to view more details.
4. Click the red arrow to reset your selections.





2. Appendix 2 - Understanding Highly Erodible Areas

2.1. Highly erodible areas using mapping

Each catchment in the Tukituki has been mapped using LiDAR and the revised universal soil loss equation (RUSLE) has been applied. The equation, described in IECA as having the following form: A=R ·K ·LS ·C ·P where A is the annual soil loss due to erosion (t/ha year); R the rainfall erosivity factor; K the soil erodibility factor; LS the topographic factor derived from slope length and slope gradient; C the cover and management factor; and P the erosion control practice factor. The limitations of RUSLE are that it only accounts for soil loss through surface erosion (sheet and rill erosion) and ignores the effects of gully erosion.

This model enables understanding of the highest risk areas within the catchment, where soil loss is mostly likely and where to prioritise soil conservation measures.

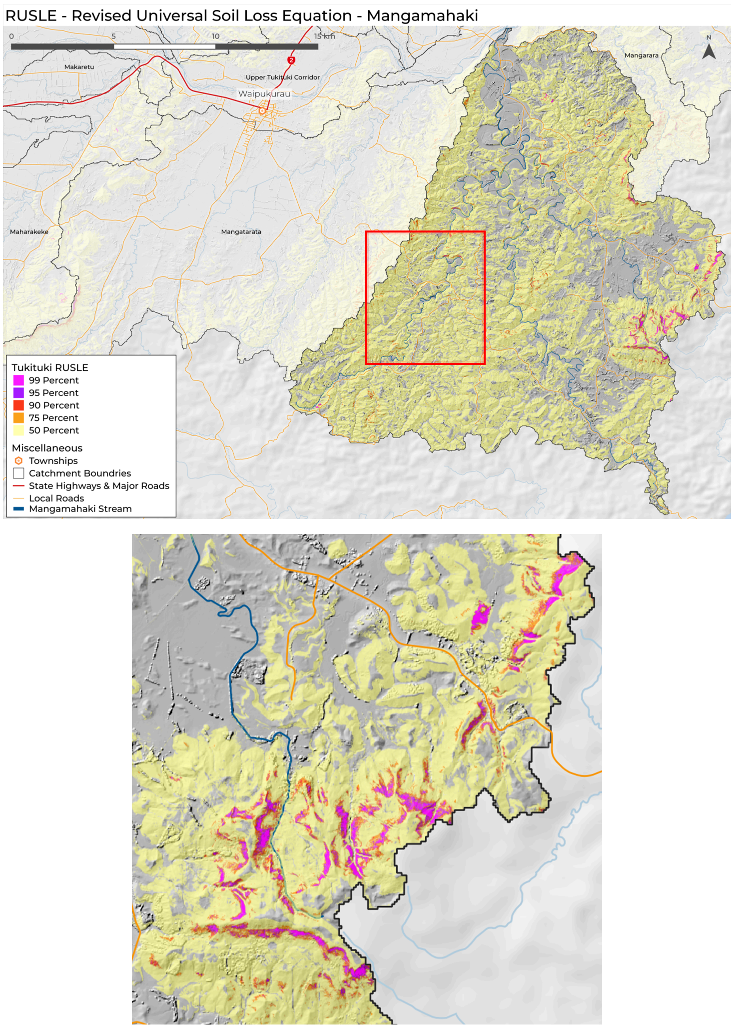


Figure 10 – RUSLE model at sub-catchment scale. High risk erosion is mapped at 99%, 95%, 90%, 75% and 50%, throughout the Tukituki catchment.

2.2. Farm planning using RUSLE

As HBRC's high resolution LiDAR data set enables high resolution mapping and prioritisation of action at Tukituki, sub-catchment and farm scale. If erosion, sediment or phosphorus is a priority for the sub- catchment, using this model will help find the areas to prioritise.

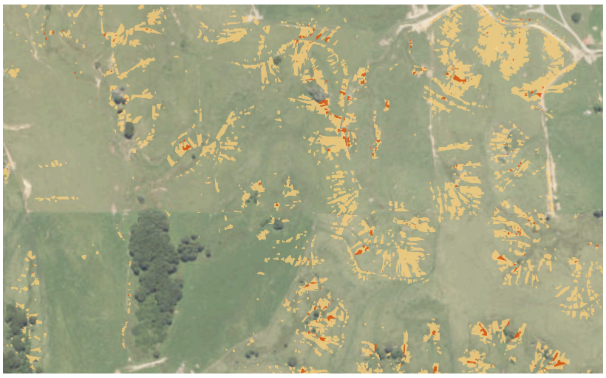


Figure 11 – From a farm planning point of view the RULSE can be used to prioritise areas to implement soil conservation measures.

3. Appendix 3 - Flow mapping to understand sites for edge of field management

3.1. Identification of sites for edge of field mitigations (wetlands, dams, bunds)

Topographic Wetness Index (TWI) is a measure of how likely an area is to accumulate and retain water based on its slope and contributing upslope area. TWI identifies wet or poorly drained areas in a landscape, making it useful for understanding placement of edge of field mitigations like bunds and wetlands.

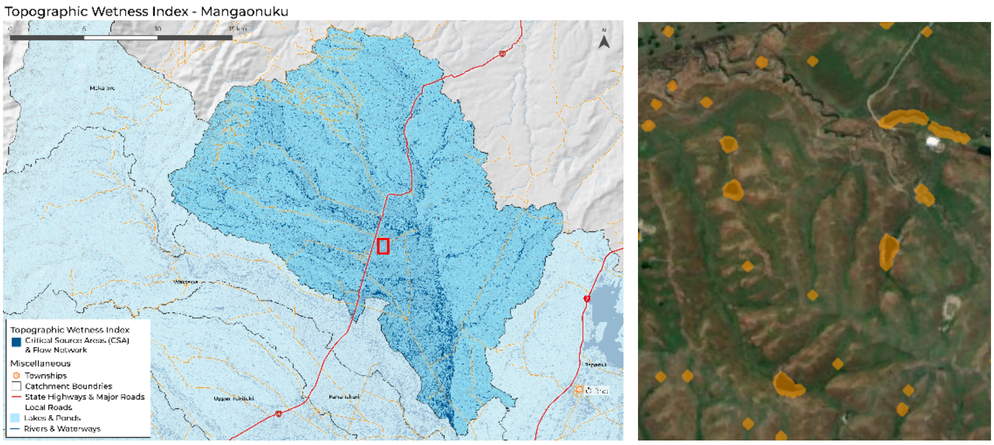


Figure 11- TWI example in a sub-catchment. Using the data layers supplied by EIS will enable exploration of the data using GIS or Google Earth.

TWI can be a very useful tool in catchment and farm planning for those wanting to implement over and above farm actions. It does need ground truthing but can be useful in finding appropriate sites, with an estimate of water accumulation areas and volumes.

It is important to note that the edge of field mitigation needs to suit the outcome each catchment is seeking. TLC will have to be aware of single focus edge of field, which has become a common narrative in New Zealand. For example, promotion of single solutions like installing only constructed wetlands or detention bunds (detainments bunds) was common in freshwater management during the 2010s.

Figure 12 – Examples of edge of field mitigations, from large detention bunds, large wetlands through to in-line or off-line sediment traps.

4. Appendix 4 - TLC Plant Selection Tool

This decision-support tool is designed to help farmers choose the right plants for on-farm environmental projects by matching the planting zone and soil type with suitable species.

Use the filters to explore options based on your specific conditions and requirements. The larger the section, the better suited the plant is to the selected environment. Recommended plants are displayed in descending order, starting from the top and progressing clockwise around the circle.

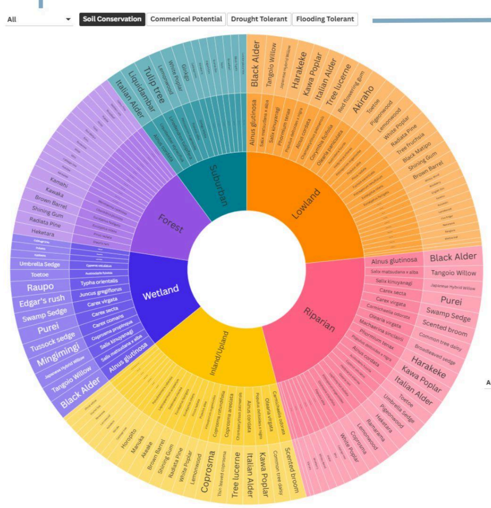
How to use the tool:

Visit the TLC Farmer Toolbox at www.tukitukilandcare.org/toolbox, select the Plant Selection Tool and follow these steps:

1. Select the planting zone from the drop down list.
2. Select your planting priority.
3. Select a species for more information.
4. Click the red arrow to reset your selections.

Select Planting Zone

Select Planting Priority



Refresh Selection

Select Species

5.