Mahurangi Land Restoration Programme

Warkworth Sub-Catchment Action Plan 2022

Photo by S. Tweddle 2022

The purpose of this plan is to describe the unique environment, land use, and risks in the Warkworth Sub-catchment and to link these with the actions and milestones achieved to engage the community and reduce sediment loss across this sub-catchment and the wider Mahurangi Harbour Catchment.

The Warkworth Sub-catchment Action Plan forms part of a series covering the sub-catchments of Mahurangi Harbour, produced under the Mahurangi Land Restoration Programme (MELR). This plan does not in any way serve as an action plan to give effect to the National Policy Statement for Freshwater Management, including Te Mana o te Wai.

Published June 2023

This sub-catchment action plan has been prepared for Auckland Council by Adaptive Environmental Consulting.

Ko au te awa Mahurangi, ko te awa Mahurangi ko au – I am the Mahurangi river, the Mahurangi river is me.

The river is of huge importance to Ngāti Manuhiri who used it as a highway, a food source, and a spiritual home. Our uniqueness and identity as Ngāti Manuhiri is expressed in all the things that we do, that we can see, touch, and hear. Our cultural footprint is underpinned by Manuhiritanga and how we express that through our tikanga and kawa. One of our responsibilities and obligations as Mana Whenua Kaitiaki is to actively protect and enhance Ngā Taonga for the use and benefit of future generations as acknowledged in our governance and management protocols. The name Mahurangi was taken from Motu Mahurangi, an island at the mouth of the Waiwerawera River - important in Ngāti Manuhiri traditions.
At some point in time, the name was re-used to refer to the entire coastal region. Generational occupation is also reflected by the other numerous place names and landmarks that dominate the wider area e.g. Waihē (inner Mahurangi River), Motu Kororā (Saddle Island), the island pā of Maunganui (Casnell Island), Motu Kauri (Grant's Island), Puhinui (the waterfalls at Warkworth), and Pukapuka, a kāinga and now the site of a Cemetery which remains at the head of the harbor.

"Ko te iti ō Waihē, he puta kino nui" - Even though Waihē (the disputed waterway) is not large, it has been the cause of great trouble.

The area known today as Warkworth is traditionally called Puhinui after the waterfalls at the head of the Mahurangi River in the centre of town. The Puhinui Falls are wāhi tapu, being of significance to Ngāti Manuhiri. Further south of the falls along the awa (river) are waka landing sites used by the people as they travelled inland from the coast, to kāinga, cultivations or through travel. Many Ngāti Manuhiri tupuna are associated with or known to have occupied this wider area.

The Mahurangi River flows southeast from Puhinui and into the inner Mahurangi Harbour which is known to Ngāti Manuhiri as te Waihē. Te Waihē is navigable for over 10 kilometres inland up to the waterfalls at Warkworth and was a main route inland with several known waka landing sites along the banks. The river itself and the falls are both wāhi tapu. The awa is known to be the resting place of a taniwha, Waawaia, who is a kaitiaki and protector of this wai and of Ngāti Manuhiri.

Historically this inland area was forested (kauri) and was utilized for many resources i.e., snaring forest birds; gathering fruits and berries for food or rongoā (medicine); trapping and gathering tuna (eels), koura, kākahi (freshwater mussels) and waterfowl from the Mahurangi River and its tributaries; felling trees for waka; and harvesting flax for weaving. New sites within Ngāti Manuhiri rohe (tribal area) are still being uncovered today.

Kourawhero (Red freshwater Crayfish) were a valued mahinga kai (cultivated food) species and considered a delicacy by Ngāti Manuhiri. In the past, they were a staple food item in that area. Kourawhero were found in abundance and greatly prized.

Introduction

The MELR is a co-governance project developed by Auckland Council in partnership with the Ngāti Manuhiri Settlement Trust. The project goal is "*to increase the mauri of the Mahurangi Harbour and its waterways by achieving measurable reductions in human induced sediment from rural land management activities*".

Catchment Description

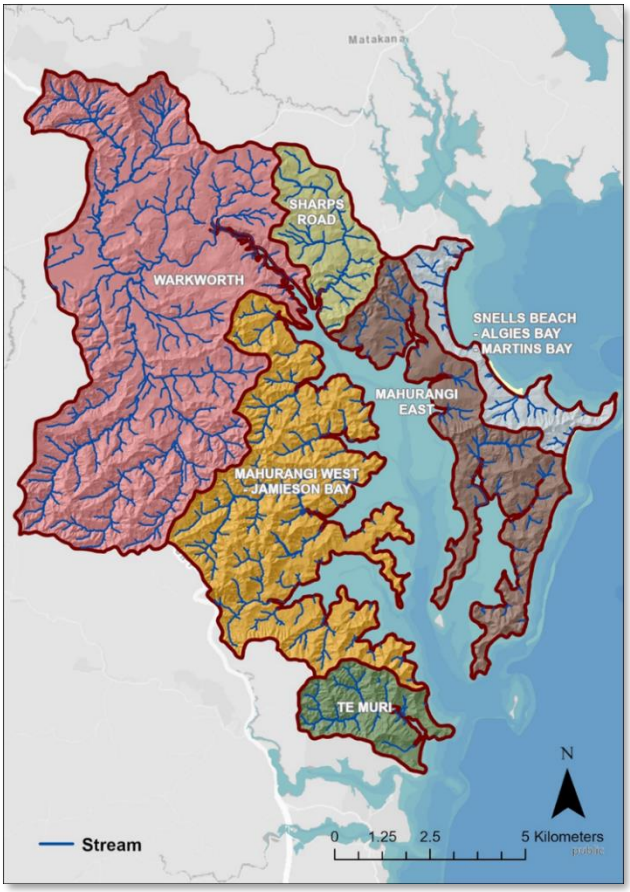
The Warkworth sub-catchment (SC) encompasses the Mahurangi River catchment. It is one of six sub-catchments that form the wider Mahurangi catchment centering around te Waihē - the Harbour (Map 1).

The sub-catchment covers 5,894 ha from The Dome in the north to Moir Hill and Pohuehue in the south. Approximately 5% of the SC is managed under national or regional parkland. It contains the town of Warkworth, the largest settlement and urban area in the catchment (Map 2).

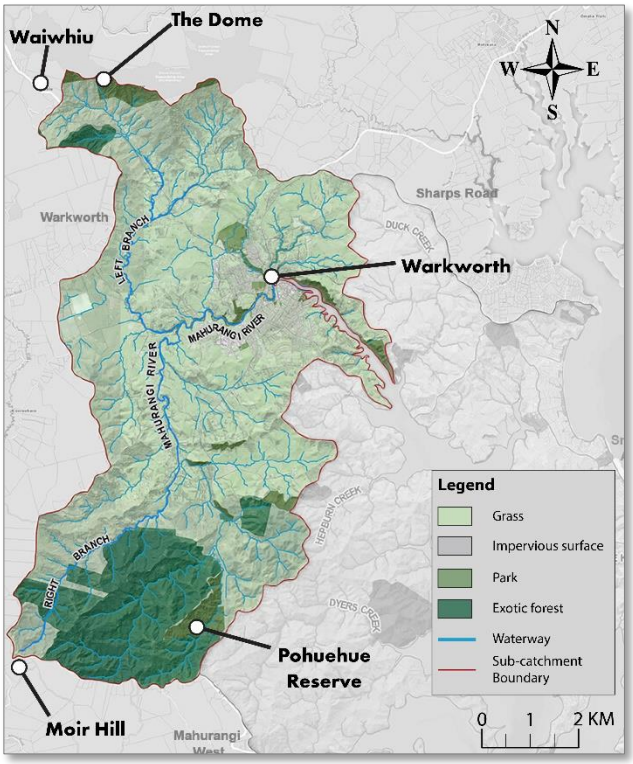
The average summer to winter temperatures range from 18.5°C and 10.8°C, respectively and the catchment receives approximately 1,432mm of rainfall annually. Elevation ranges from sea-level at the harbour margin to 336m at The Dome near Waiwhiu. Warkworth SC is steep with 45% of the land ≥ 21 degrees.

Warkworth SC has 181 km of permanently flowing streams and 11.8 km of harbour margin. The right and left branches of the Mahurangi River are the dominant waterways in the sub-catchment.

Map 1 – MELR Sub-catchments



Map 2 – Topographic Map of Warkworth SC



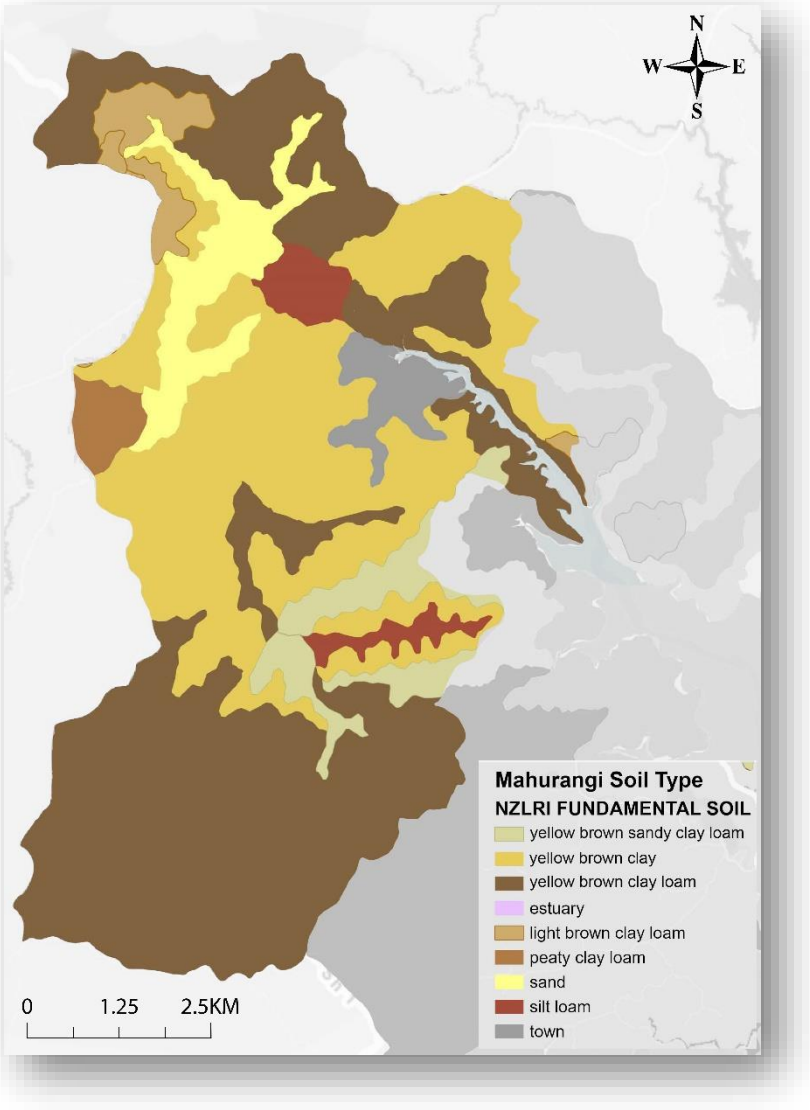
Bedrock, Soils and Slope

The catchment is dominated by Waitemata interbedded sandstone and siltstone (81%), alluvial rocks (10%) and limestone (8%) and a small amount of mudstone (<1%). The rocks are relatively young and of marine origin, formed between 11.6 to 5.3 Ma during the late Miocene period. These rocks are classed as weak bedrock and are subject to gully and slip erosion.

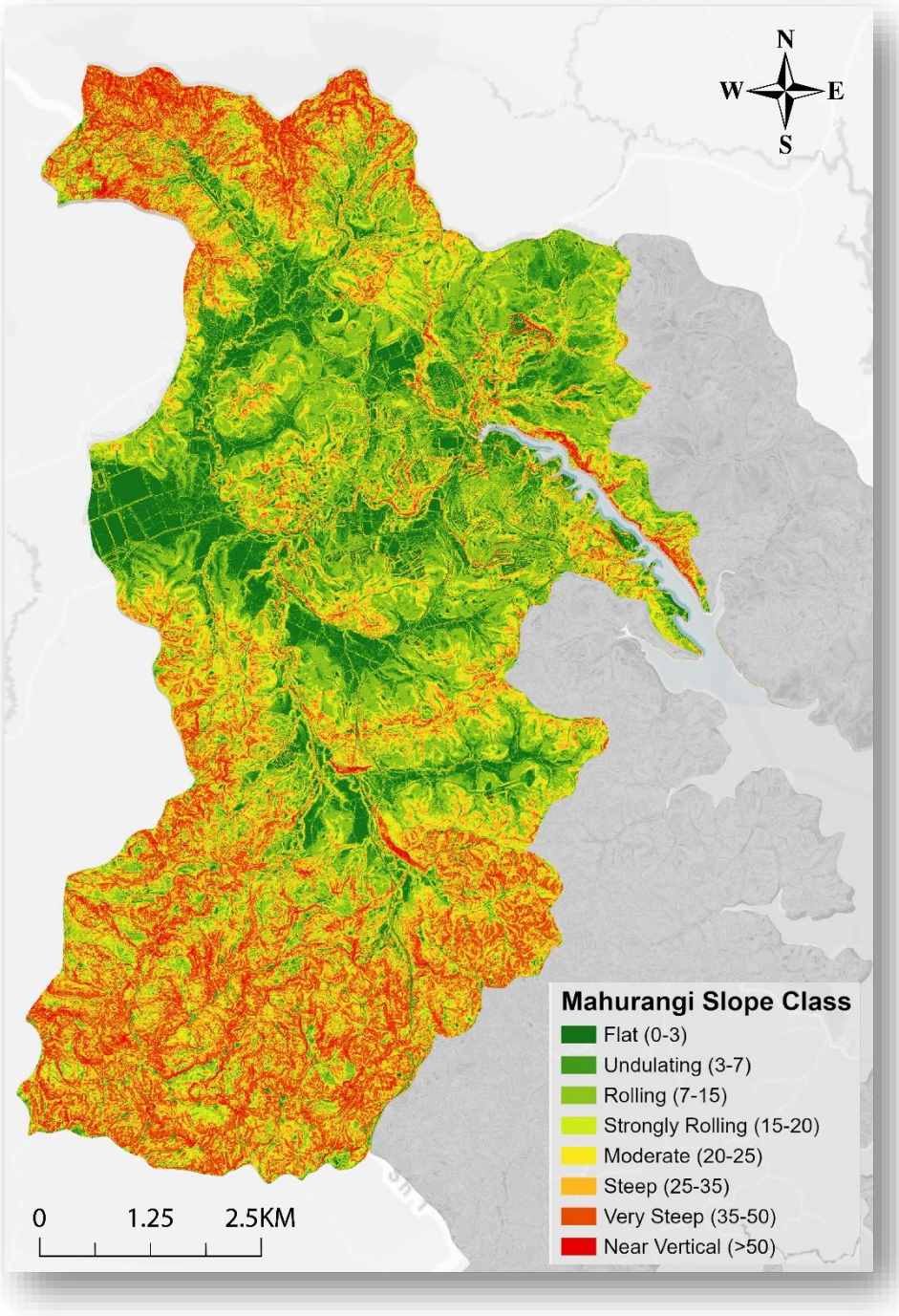
The main soil types are Whangaripo clay loam (37%), Warkworth Clay (28%), Whakapara sand (6%) and Atuanui clay loam (5%). The soil types are predominantly strongly weathered and poorly drained and as such can become waterlogged and prone to pugging (Map 3).

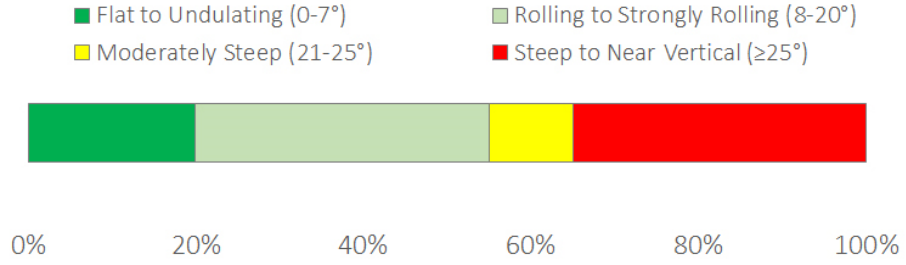
The catchment is steep with just under half the catchment (45%) classed as moderately steep to near vertical land (≥21-35 degrees) and 35% classed as rolling to strongly rolling (8-20°). Twenty percent of the SC is classed as flat to undulating (0-7°) (Map 4).

Map 3 - Soil Type



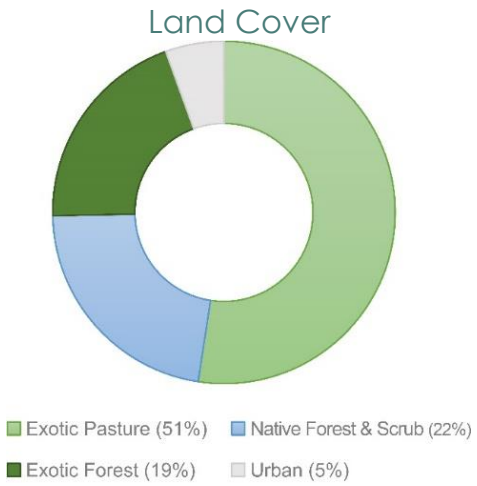
Map 4 - Slope


N
W
E
S
Mahurangi Slope Class
Flat (0-3)
Undulating (3-7)
Rolling (7-15)
Strongly Rolling (15-20)
Moderate (20-25)
Steep (25-35)
Very Steep (35-50)
Near Vertical (>50)
0
1.25
2.5KM

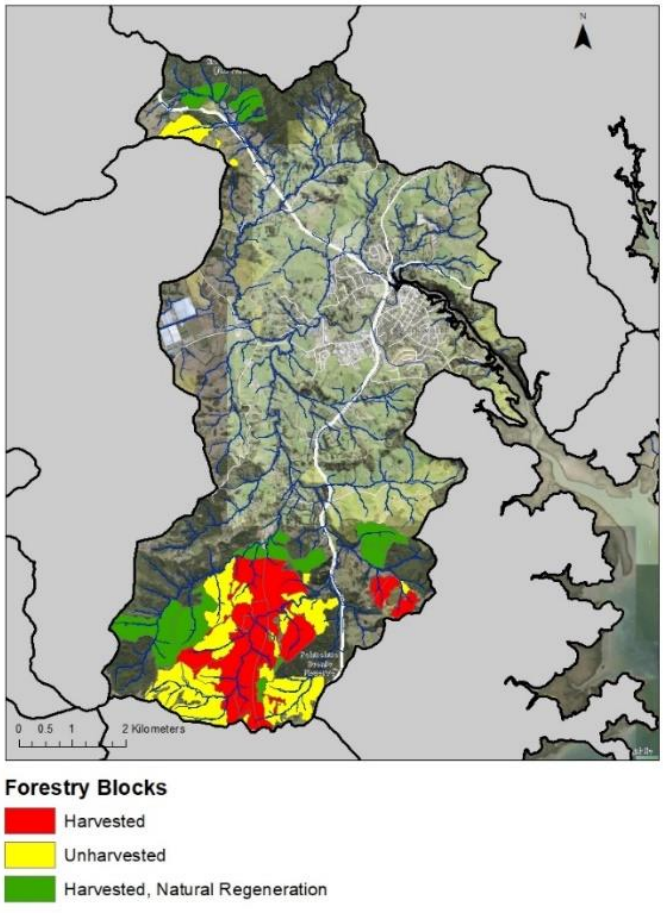

Flat to Undulating (0-7°)
Rolling to Strongly Rolling (8-20°)
Moderately Steep (21-25°)
Steep to Near Vertical (≥25°)
0%
20%
40%
60%
80%
100%

Land Use

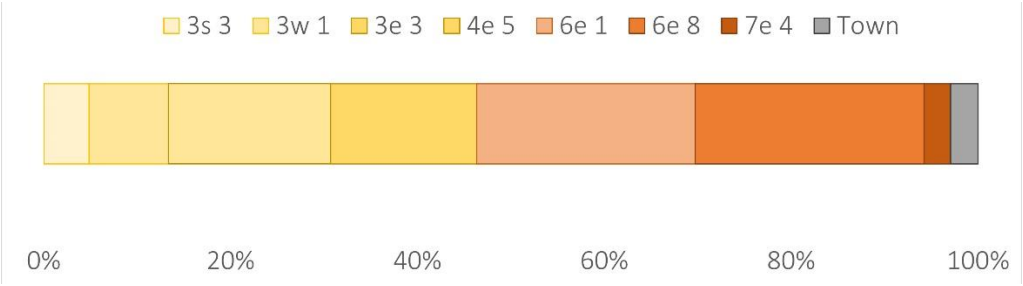
Drystock farming (sheep and beef cattle) is the main land use in the catchment and the dominant land cover is exotic pasture (3,026ha), accounting for 51% of the total catchment area. Warkworth has significant areas of indigenous forest (1,287ha), exotic forest and shrubland (1,142ha), covering approximately 22% and 19% of the total catchment area, respectively. Urban areas account for the remaining land area (319ha) accounting for 5% of the SC.



Map 5 - Location and Harvest Status of Plantation Forestry blocks in Warkworth



Land Use Capability (LUC)



LUC land use limitations table

Source: Harmsworth (1996)

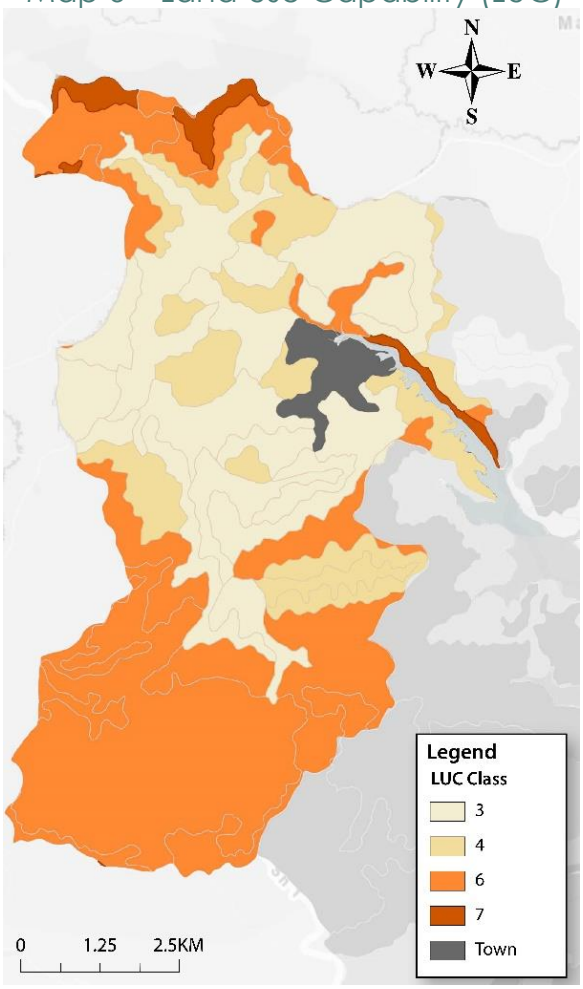
LUC Class	Arable cropping suitability†	Pastoral grazing suitability	Production forestry suitability	General suitability
1	High	High	High	Multiple use land
2	↓	↓	↓	
3	↓	↓	↓	
4	Low	↓	↓	
5	Unsuitable	Low	Low	Pastoral or forestry land
6				
7				
8		Unsuitable	Unsuitable	Conservation land

Increasing limitations to use ↓

Managing land sustainably and within its natural limitations allows the productive potential of the land to be realised whilst simultaneously reducing erosion and maintaining healthy waterways and ecosystems. Land use capability (LUC) is an assessment of the productive potential and limitations of the land, based on rock and soil type, slope, erosion type and severity and vegetation cover. It comprises eight classes of land (1 to 8) with higher numbers indicating greater land use limitations, see the LUC limitations table below.

The dominant land use capabilities in Warkworth are 6e8 (22%) and 6e1 (21%), followed by 3e3 (16%) and 4e5 (14%). Moderate erosion risks are associated with the above four LUC classes and LUC 7e4 (3%), including gully, tunnel gully, earthflow, slips and slumps, and sheet erosion. Land potentially limited by wetting (3w1) may be prone to flooding or pooling of water accounts for 10% of the SC. LUC 3s3 (4%) has moderate soil limitation being highly variable in fertility and drainage (Manaaki Whenua, 2023).

Map 6 – Land Use Capability (LUC)



Key Catchment Risks and Restoration Actions

Based on the local geology, slope, climate and land use the main contaminant risk in the Warkworth SC is sediment. Land use and management practices have the potential to either mitigate or exacerbate contaminant loss. Controlling livestock access to waterways, retiring and planting riparian margins and steep, erosion-prone slopes, and having well designed and maintained farm infrastructure (water troughs, stream crossings, tracks and laneways) are key actions to target sediment loss.

Monitoring in Warkworth SC

Freshwater quality is assessed from monthly grab samples collected at two locations in the Mahurangi River catchment; the Mahurangi River Forestry site (MR-F) and the Mahurangi River Warkworth site (MR-W). MR-F is a second order 5 stream, located in the upper catchment of the right branch of the Mahurangi River, exotic forestry accounts for over 90% of the catchment area above this site. MR-W is a fourth order stream located at the bottom of the Mahurangi River catchment at Warkworth, near the SH1 bridge. Site locations are shown in Map 7.

Catchment land cover upstream of MR-W is mixed with approximately 50% pasture, 20% native forest, 20% exotic forest, 8% urban and 2% other (Ingley, 2021b). The current state national water quality bands for suspended sediment (measured as visual water clarity in meters) at Exotic Forestry and Warkworth were 'C' (0.72 m) and 'A' (1.05 m), respectively. Visual clarity bands of C or lower indicate moderate to high impacts of suspended sediment on aquatic fauna (Ingley, 2021).

Trends for suspended sediment show conditions have been very likely degrading over the last 10 years at the Exotic Forestry site. Trends were indeterminate at Warkworth (see Table 1 and Map 7). The catchment above the Exotic Forestry site went through a harvest period from 2016 to 2019. During this time the area of harvested land increased from approximately 0% to 38% of the catchment area, after which the land was designated for the development of the Puhoi to Warkworth Motorway Corridor (Ingley, 2021).

Freshwater macroinvertebrates have been monitored at two sites in the upper catchment of the right Mahurangi River branch – Exotic Forestry site, since 2002 and at the Native Forest site, since 2008. Freshwater invertebrates are widely used indicators of ecological health because they respond predictably to physical and chemical changes in their environment. The Macroinvertebrate Community Index (MCI) was developed in New Zealand as a monitoring tool for streams and shallow rivers. Median freshwater MCI scores (2015-2019) were 'Good' (B band) at both sites. Long-term trends indicate that MCI is likely improving at the exotic forestry site, although the total number of invertebrate species collected over this time declined. No discernible trends were observed at the Native Forest site. Stream habitat as reflected by Stream Ecological Valuation Scores (SEVs) are also measured at each site. SEV scores range from 1 to 0 with higher numbers reflecting more pristine habitats. Both sites have 'Excellent' SEV scores (0.81).

TABLE 1. AUCKLAND COUNCIL STATE OF THE ENVIRONMENT MONITORING - WATER CLARITY

Site Name	Main Land Cover	Upstream Catchment Area (km²)	Year First Sampled	Suspended Sediment/ Water Clarity		
				Current State (m) *2015 - 2019*	Attribute Band	Trends *2010 - 2019*
Exotic Forest	Exotic Forest	4.90	1993	0.72	C	Very likely degrading
Warkworth	Rural (high intensity)	48.44	1993	1.05	A	Indeterminate

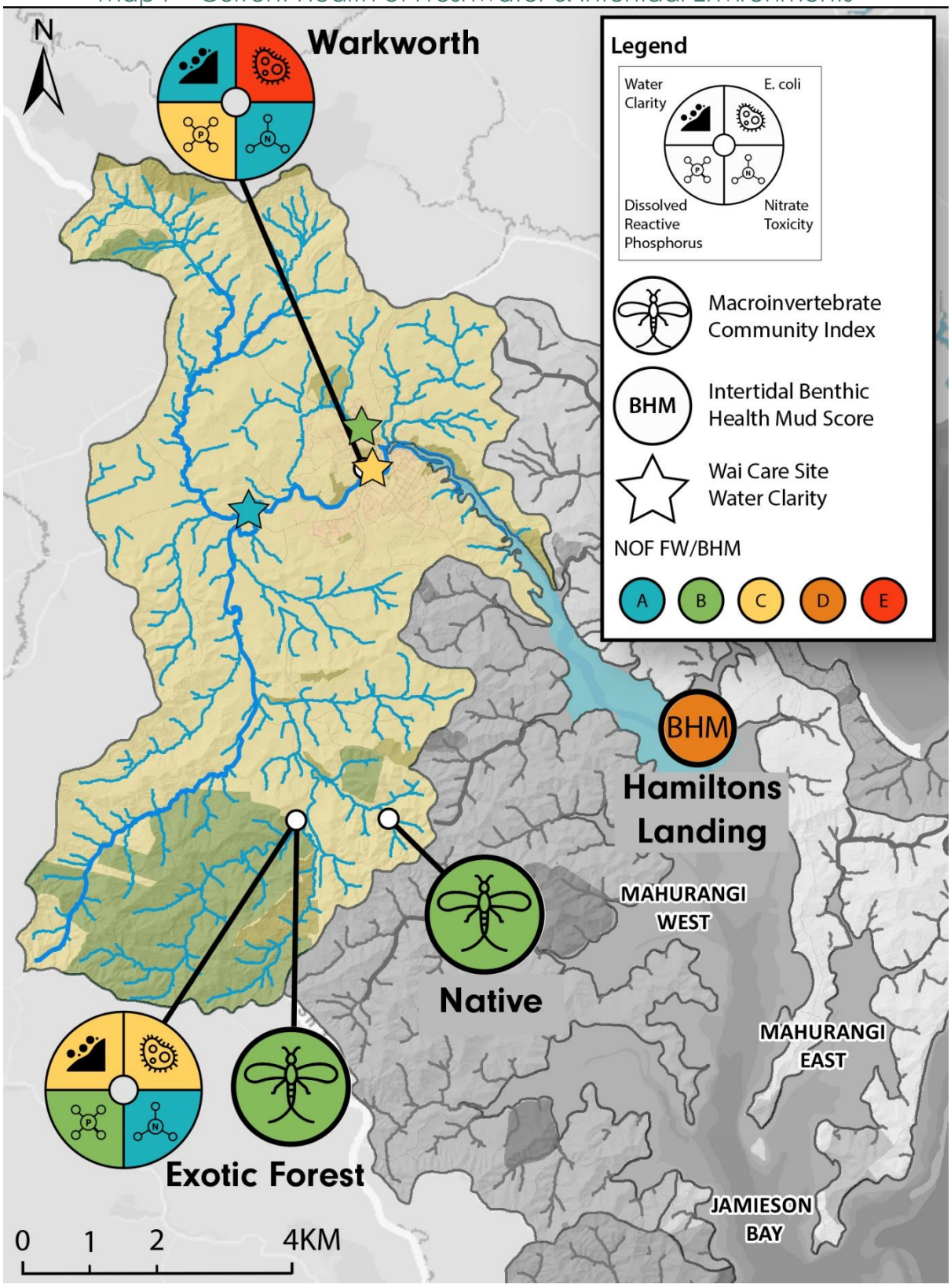
TABLE 2. WAI CARE MONITORING BY MAHURANGI COLLAGE - WATER CLARITY

Site Name	Number of observations	Frist Sample Date	Last Sample Date	Median Measured Water Clarity (m)	Attribute Band
Falls Road	18	1-May-19	8-Mar-22	0.93	A
Kowhai Park	18	2-Apr-19	8-Mar-22	0.78	B
SH1	19	2-Apr-19	8-Mar-22	0.73	C

Long-term monitoring of intertidal benthic communities in Hamilton's Landing (HL) has been undertaken since 1994. Intertidal BHM scores measured in 2019 were Poor (D band) and have decreased since monitoring began in 2019, reflecting a decline in intertidal benthic health (BHM) in relation to an increase in sediment mud content (Drylie, 2021).

Community monitoring of streams in the Warkworth SC – using Wai Care monitoring tools and protocols – has been regularly carried out by students at Mahurangi Collage since 2019. Wai Care results were download from the online Wai Care database. Median water clarity values were calculated for three sites located at Falls Road, Kowhai Park and State Highway 1. These sites were used on the basis of having a sufficient number of observations and because they had been monitored consistently over the last three years. Water clarity results for the three sites were assessed against national water quality bands. Median water clarity at the three sites were 'A' (0.93 m) at Falls Road, 'B' (0.78 m) at Kowhai Park and 'C' (0.73 m) at State Highway 1. Wai Care results are presented in Table 2 and Map 7.

Map 7 - Current Health of Freshwater & Intertidal Environments



Geomorphological Evaluation of Mahurangi River

Geomorphological processes occur at a range of scales, and while river restoration activities may sometimes occur at a small scale, it is important to consider the many factors that govern river form and process operating at catchment scale to support enduring restoration, and to "work with the river". In 2021 the Department of Conservation engaged the University of Auckland to conduct a desktop analysis and remote assessment of the geomorphological evaluation of the Mahurangi River in the Warkworth catchment. The reports looks at some techniques for analysing river gradient, confinement, stream power and morphology, as well as determining sediment pathway connectivity and simulating sediment routing. These can help to determine the behaviour and responsiveness of the larger system, or to examine the potential effectiveness of various rehabilitation scenarios.

The main aim of the investigation was to support decision-making processes for river restoration strategies that will identify opportunities to improve habitat diversity and connectivity. The Mahurangi River is one of fourteen Ngā Awa rivers under study that was selected based on recovery potential and local support among community and Iwi to progress the aims of river restoration.

The investigation concluded that recovery of systems such as the Mahurangi are difficult, as the system is so highly disturbed and has changed so markedly from its natural condition, and the forecasted growth for the area suggests that pressures on available land and water will continue. The report emphasised that it is key that communities take a longitudinal approach to restoration, varying strategies depending on the processes driving dynamic change and the morphological setting managers find themselves in (Tunnicliffe & Brierley, 2021).

To read more about the Geomorphological Evaluation of Three Nga Awa Rivers please visit:

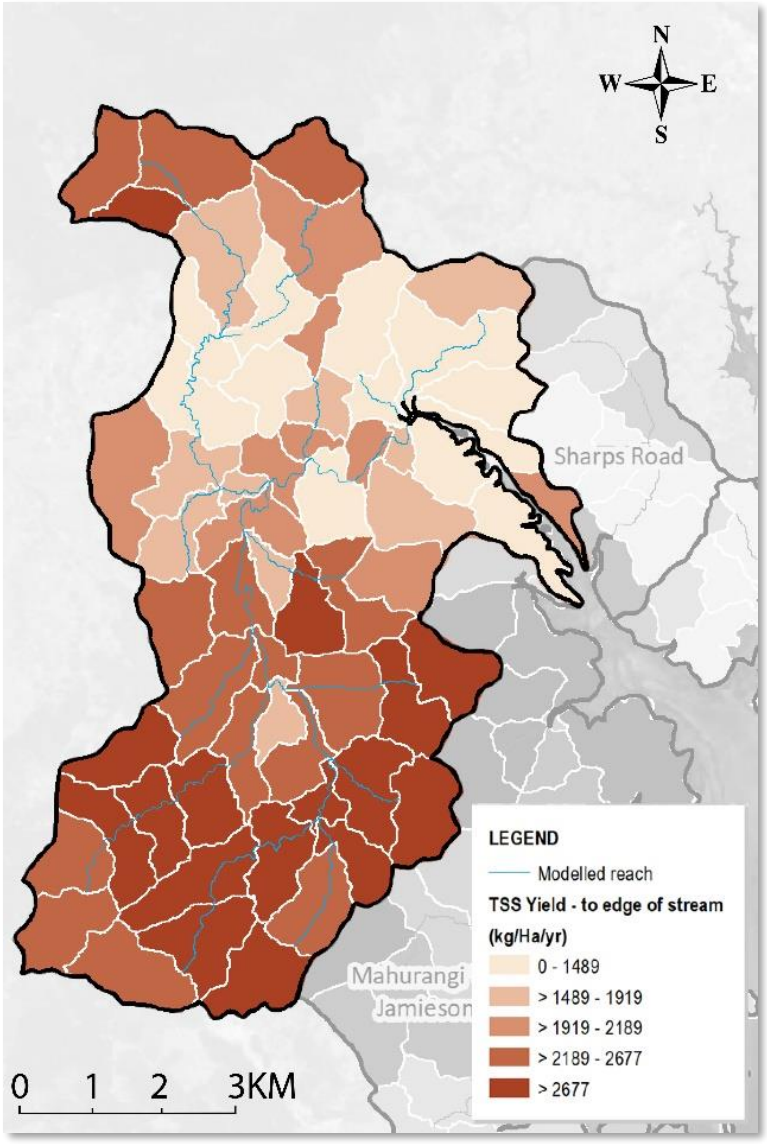
https://www.doc.govt.nz/our-work/freshwater-restoration/nga-awa/geomorphological-evaluation-of-three-nga-awa-rivers/

Freshwater Management Tool

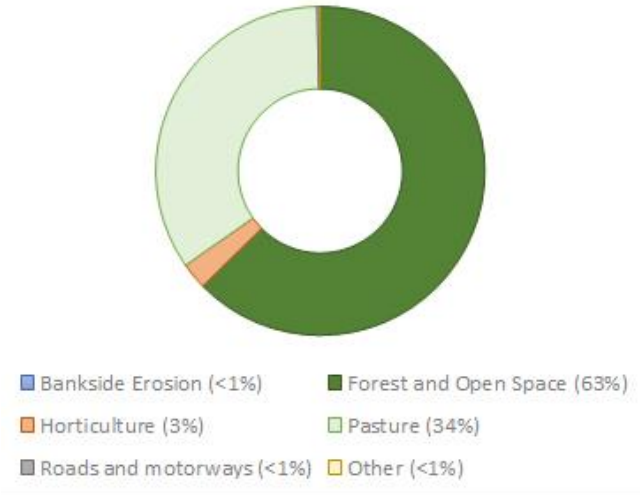
The Freshwater Management Tool (FWMT) has been designed by Auckland Council to support decision-making, community engagement and integrated catchment management throughout the Auckland region. The tool can estimate contaminant loads by processing information from landscape characteristics, rainfall, river flow and freshwater monitoring data. Sediment yield across Warkworth is estimated to be greatest (>2,677 kg/Ha/yr) in the upper catchment of the right and left branches of the Mahurangi River. Specifically, near Moir Hill and the Pohuehue in the south and Kraack Hill to the north.

Warkworth has the second highest estimated average annual sediment yield (887 tonnes/km^2/yr) of all sub-catchments surrounding the harbour. In relation to land cover, forests and open space accounts for the highest sediment contribution (63%) followed by pasture (34%) with a small amount attributed to horticulture (3%).

Map 8 - Estimated Sediment Yield Across Warkworth



Estimated Average Annual Sediment Load by Land Cover (Tonnes/year)



What Are We Doing About It?

The MELR team is working with mana whenua, private landowners and the wider council family to identify positive actions to reduce sediment loss and enhance the mauri of the catchment. Key actions being taken include:

- Excluding livestock from waterways, erosion prone gullies and slopes.
- Establishing permanent native vegetation cover.
- Protecting and enhancing natural wetlands.
- Funding alternative stock water supply on farms.
- Retiring critical sediment source areas on farms.
- Removing barriers to native fish migration.
- Implementing a catchment-wide monitoring programme to track our progress and learn as we go.
- Mitigating stream bank erosion

Cultural Monitoring and Tikanga Māori

Relates to the mauri of the awa and its taonga species. Acknowledges the natural rhythms of maramataka and mahinga kai. Weaves together knowledge from pūrākau and te ao mārama with scientific methods by applying the appropriate scientific tools and methodologies.

Collaborating with the Ngā Awa Strategic Waterways restoration programme

As part of the Government's Jobs for Nature (J4N) funding, the Department of Conservation (DOC) is administering the Ngā Awa Strategic Waterways restoration programme in the Warkworth sub-catchment. The DOC monitoring programme is focussed on measuring biodiversity outcomes and accommodates different restoration activities, such as riparian fencing and planting, wetland restoration, sediment interception, pest control, and fish passage remediation.

DOC are also currently undertaking drone wetland monitoring to identify the extent of current and potential wetlands.

Landowner and Community Engagement in Mahurangi West

At the end of August 2022 288 landowners have been engaged in the catchment and 33 landowners have received additional advice or support to identify restoration opportunities. To date 19 funding applications have been lodged resulting in the completion of 19 restoration projects on private land. This funding has contributed to 4,367 m of stream being retired and 25 ha of land protected. At the time of writing 85,793 native plants have been planted and 5.7 km of fencing has been completed on private land.

As of 30 June 2022, 9 community groups/schools were supported through the funding of planting days on parkland across the wider Mahurangi catchment. To date, MELR Programme support has contributed to the full retirement of 1000 m of stream and 5 ha of land, with 23,447 native plants being planted within Regional and Local parkland across the catchment.

Local Legends – Roger and Robyn Dunn

Roger and Robyn Dunn have run a beef cattle farm for the last 28 years on Kaipara Flats Road. They fatten heifers for the local market on 11 ha of land. We caught up with Robyn and Roger to talk to them about the environmental work they do.

Q. What environmental changes have you seen since farming in the area?

We have noticed it getting warmer and drier even though this particular winter [2022] has been a wet one.

Q. What achievements are you most proud of on the farm?

We are proud of fencing off all our waterways, almost eliminating all exotic weeds, undertaking pest control and creating habitat for birds by planting native species. We have registered a small forest woodlot with MPI for carbon sequestration We grow about 600 native seedlings per year in our nursery. Our cattle have a good life and all their needs are met. We have seen a noticeable increase in native birds of all types over the last few years.

Q. What inspires you to protect waterways and what benefits have you observed from doing this work?

We have seen the runoff from farms in this area washing brown silt into the Mahurangi River and on to the Hauraki gulf. From a farming perspective fencing off waterways means no cattle stuck in drains, no breaking down of drain banks and less pugging. Planting trees gives shade for the animals.

Q. How has getting involved with the MELR project helped you to achieve your environmental goals on the farm?

Being involved with the MELR project has given us great advice and assistance with native plants and fencing to protect the waters of the Mahurangi River and Hauraki Gulf.

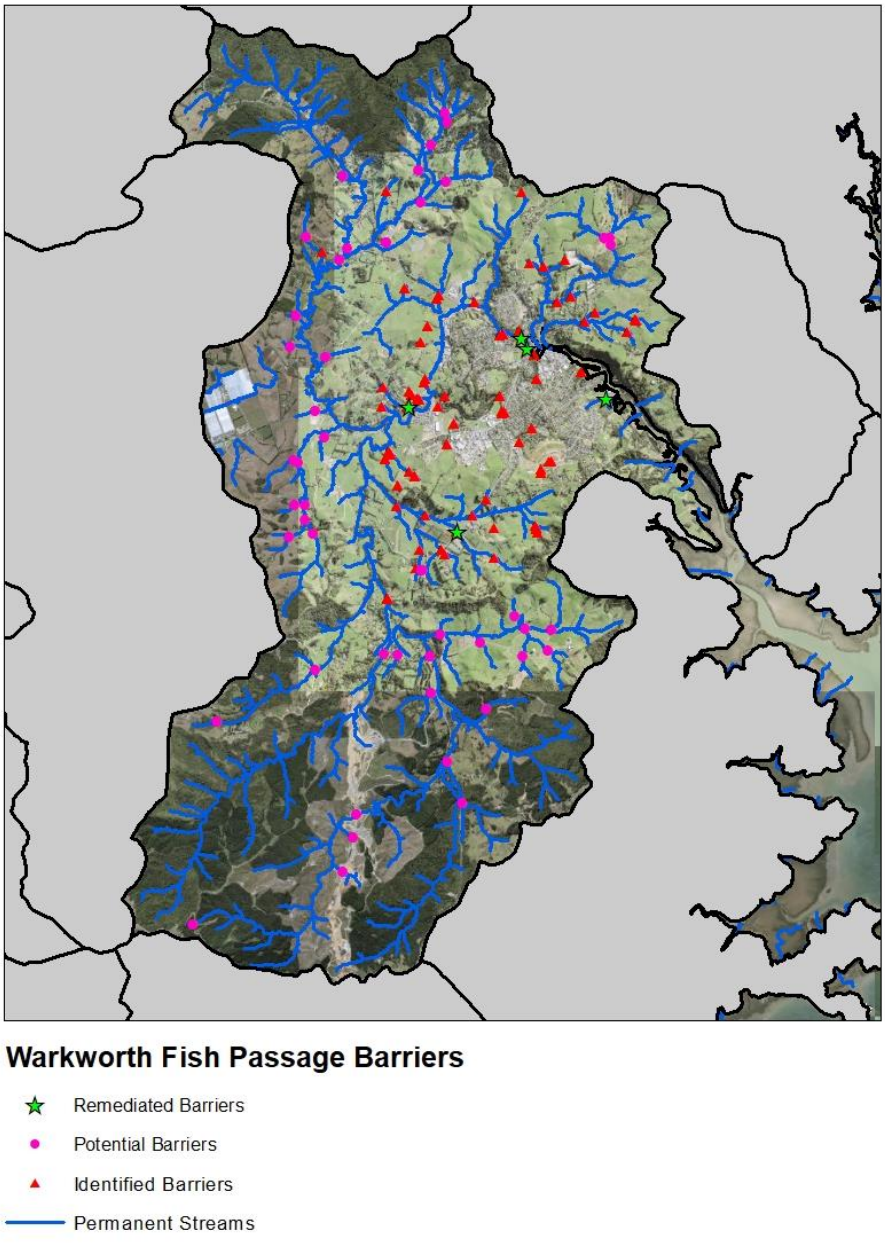
Q. Do you have any advice for other landowners who wish to do similar work on their farms?

Always get SECURE fencing in place before you start planting. Plant at least a meter back from the fence. iNaturalist is a great tool to help identify plant friend from foe. We urge local landowners to take advantage of the great support you will get from the MELR team, it will bring real benefits to your property and to the environment.

Barriers to Native Fish Migration

Many of our native freshwater fish species migrate to marine environments to complete their life cycle. Navigating their way up or downstream can be hampered by structures like perched culverts, weirs or undersized pipes with high velocity water flow. These can act as barriers, preventing fish migration. A desktop analysis was conducted in 2022 to determine potential barriers to native fish migration. In total 47 potential barriers to fish migration were identified from aerial imagery. Seventy-two barriers were identified during a ground survey of randomly selected stream reaches in the catchment. Five barriers have been remediated using artificial fish ramps to mitigate a drop at perched culverts. The below map provides the location of potential, identified and remediated barriers in the Warkworth SC.

Map 9 - Potential Barriers to Native Fish Migration



Targeted Monitoring of Sediment Impacts and Actions Under the MELR Programme

Sediment impacts and actions will be monitored in Warkworth under the MELR programme. Actions implemented under the MELR programme are linked to the programme goal and focus primarily on rural land management opportunities.

Programme Goal

To increase the mauri of Mahurangi Harbour and its waterways, by achieving measurable reductions in sediment from human related activities such as rural land management and urban development, forestry and roading. The programme goal builds on earlier work in the catchment implemented under the Mahurangi Action Plan (MAP).

Research Questions

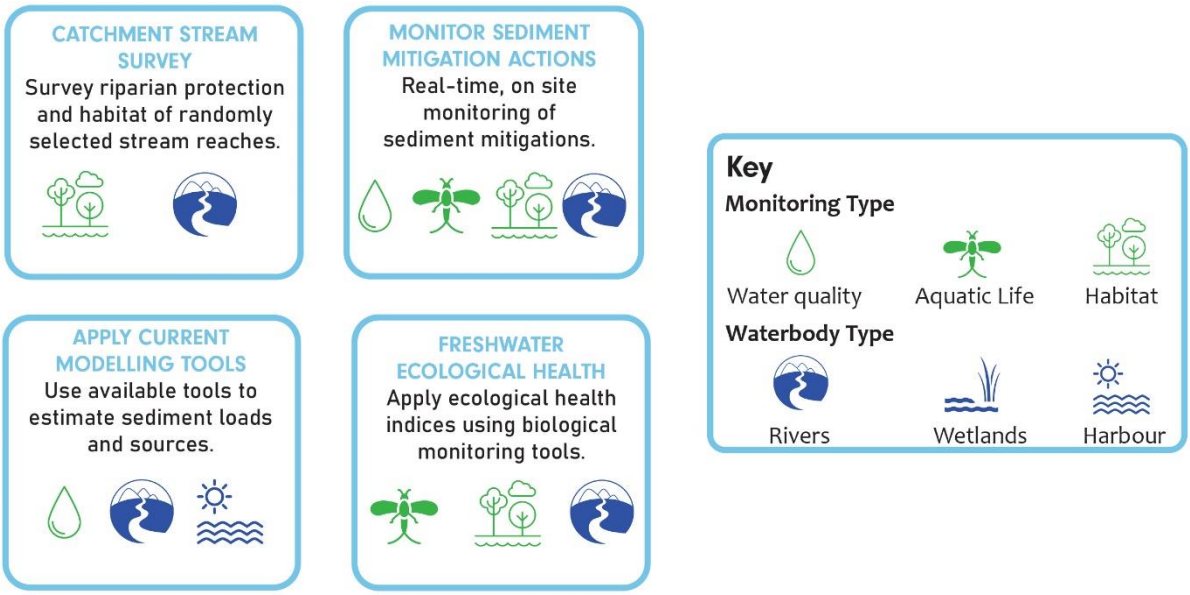
To determine if sediment actions implemented in the Mahurangi catchment are achieving measurable reductions in sediment derived from rural land the following research questions have been identified:

1. Is there evidence that sediment actions implemented prior to the MELR programme have reduced erosion and/or sediment transportation rates in the catchment?

2. Are sediment mitigation actions implemented during the MELR programme contributing to a reduction in erosion and/or sediment transportation rates in the catchment?

3. To what degree is bank erosion contributing sediment to the Mahurangi Catchment?

Monitoring Approach & Tools



Actions – Completed Across the Entire Mahurangi Catchment as of 30 August 2022

Actions	Milestones – by June 2026, unless otherwise stated	How we're tracking	Who is involved
Rural private and public land • Landowner engagement • Riparian protection and • Riparian planting • Community group engagement • Regional Parks	• 90% of landowners are engaged • At least 90% of community groups and Regional Parks are supported to undertake activities that assist the reduction in sediment loss in the catchment • 45km of new riparian fencing is constructed with a minimum setback of 3m • 250,000 native plants have been planted.	• 288 Landowners contacted • 19 Funding agreements signed • **7** Projects completed • 18 Landowners have completed the engagement survey • 5,700 m fencing complete • 25 ha of land protected • 85,793 native plants have been planted • 4,367 m waterway protected. • 100% of community groups have been engaged • 25% Regional Parks are supported • 75% of Schools are being supported	• Landowners • Community Groups • Auckland Council • Ngāti Manuhiri Settlement Trust
Unsealed roads	• Launch a pilot project using Environmentally Sensitive Maintenance to manage stormwater on up to 500m of unsealed road	• Pilot project launched on Ridge Rd towards Scotts Landing. to reduce the amount of sediment entering the harbour.	• Auckland Transport • MERRA • Auckland Council • Ngāti Manuhiri Settlement Trust
Small construction sites	• 100% of small construction sites in the catchment will be compliant with existing regulations to prevent sediment loss from sites	• 192 sites have been assessed by compliance officers • 62% are compliant	• Auckland Council • Ngāti Manuhiri Settlement Trust
Forestry	• 100% of forest landowners in the catchment will be engaged to improve harvest practices		• Forestry Landowners • Auckland Council • Ngāti Manuhiri Settlement Trust
Māori outcomes and cultural monitoring	• A co-governance agreement is formalized with Ngāti Manuhiri Settlement Trust • A cultural monitoring programme is developed and implemented		• Auckland Council • Ngāti Manuhiri Settlement Trust
Sediment Action Plan & Monitoring Framework	• A Sediment Action Plan is finalised by 2023 • A monitoring programme is implemented to measure the effectiveness of sediment actions	• Sediment Action Plan is underway • A catchment wide monitoring and evaluation plan has been drafted • Monitoring programme has been implemented.	• Auckland Council • Ngāti Manuhiri Settlement Trust

References

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