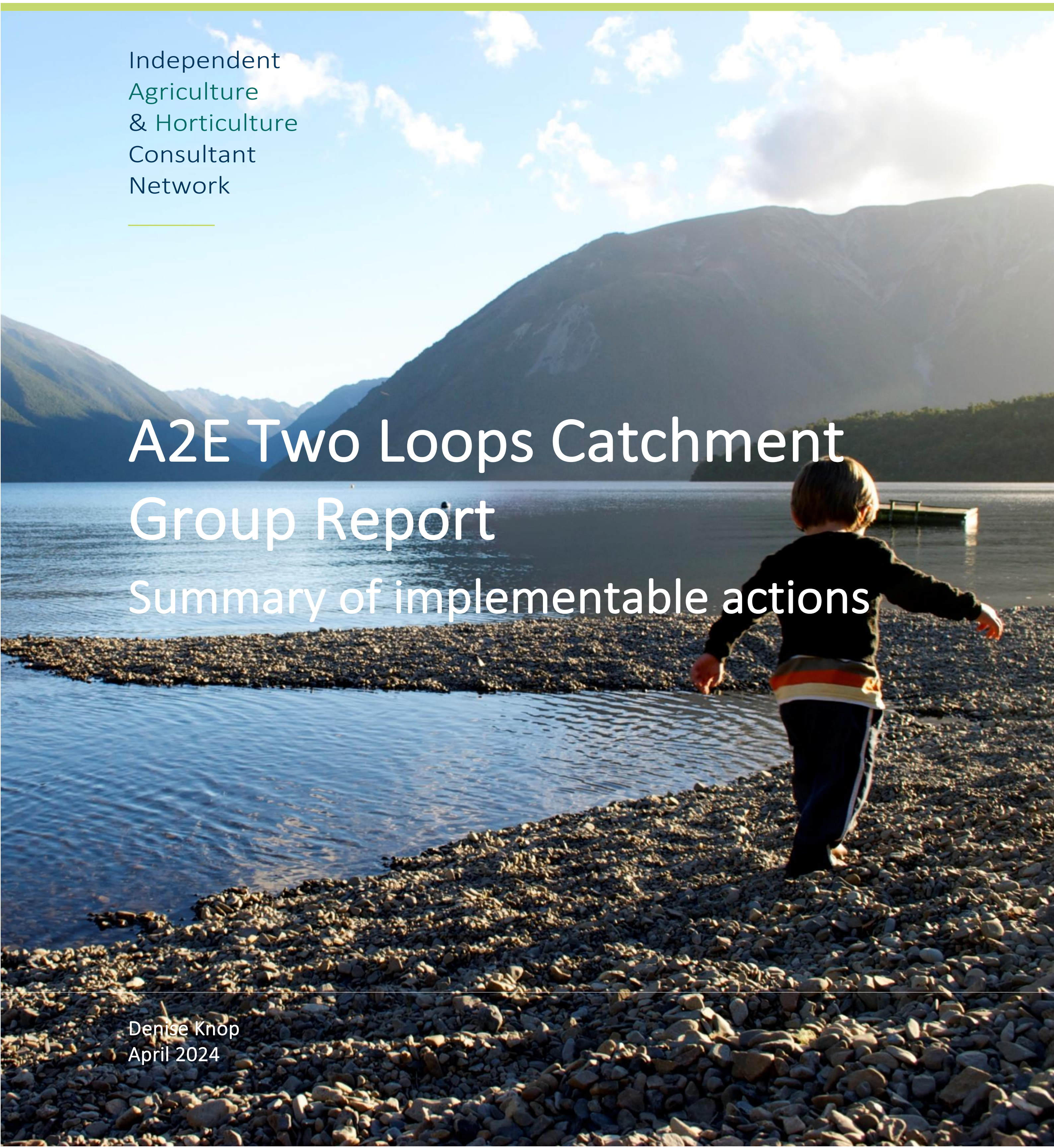

Independent
Agriculture
& Horticulture
Consultant
Network

A2E Two Loops Catchment Group Report

Summary of implementable actions

Denise Knop
April 2024

TABLE OF CONTENTS

1.0 Executive Summary 2

2.0 Background 3

3.0 Catchment Data 3

4.0 Walkover Findings 4

5.0 Implementable Actions 9

- 5.1 Nitrogen 9
- 5.2 Phosphorus 10
- 5.3 Sediment 10
- 5.4 E.coli 11

6.0 Next Steps 12

7.0 References 12

1.0 EXECUTIVE SUMMARY

The Two Loops Catchment Group is a newly formed catchment group in the Richmond Downs and Kereone area. The geographical area of the group includes the Piakoiti and the Piakonui streams, running from the Te Tapui and Maungakawa headwater into the Piako River.

As part of the A2E support, Roland Stenger, Lincoln Agritech Ltd, and Denise Knop, AgFirst, undertook a farm walkover with participants of the catchment group to understand the actions already taken on farm and identify opportunities for reducing contaminant loss to water on different properties throughout the catchment. The walkover was followed by a workshop for the group to start formulating their vision for the catchment, as well as identifying implementable actions to improve freshwater quality outcomes in the catchment.

When targeting improvements in freshwater quality, it is important to firstly consider what is the target contaminant and how losses may fluctuate during the season. This will enable the identification of the most suitable control measures for each property.

Despite the relatively short distance between the headwaters and the Northern boundary of the catchment, the pastoral land use along the banks of the Piakonui and Piakoiti Streams has a marked impact on the water quality of the catchment. Specifically, total nitrogen concentration in surface and shallow groundwater but also total phosphorus and E.coli concentrations in surface water increase substantially.

A large number of source and transfer control measures can be applied for each contaminant. Identifying the most appropriate intervention for each property is best based on an individual farm environment or freshwater farm plan to maximise positive freshwater quality outcomes. In most cases applying best farming practices around managing grazing, farm dairy effluent and critical source areas can achieve downstream water quality improvements with minimal financial resources.

2.0 BACKGROUND

The Two Loops Catchment Group is a newly formed catchment group in the Richmond Downs area. The geographical area of the group includes the Piakoiti and the Piakonui Streams, running from the Te Tapui and Maungakawa headwater into the Piako River.

To inform the creation of a catchment plan, the group was approved for A2E funding to enable a better understanding of existing freshwater quality catchment data and identify next steps to improve overall freshwater outcomes for the community and downstream catchment.

The first step of the A2E support was a farm walkover to identify common concerns and opportunities for participants of the group. This included visits to four pastoral properties in the catchment looking at actions already undertaken and planned, as well as brainstorming opportunities for other possible critical source areas.

Following the site visit a workshop was facilitated with the aim to support the farmers to identify their vision for the catchment, their needs as a collective, and individual on farm actions. The purpose of this report is to summarise the findings from the farm walk over and identified implementable actions that will drive improved freshwater outcomes for the catchment.

3.0 CATCHMENT DATA

Thriving freshwater ecosystems are a treasured resource for New Zealanders, for both supporting and providing food production as well as cultural and recreational significance. Land-based human activities and their impact on freshwater quality has been in the focus of research and public debate for many years. The first step in reducing contaminant loss to waterways and ground water is understanding the current state of water quality and its contributors to identify the most effective intervention methods.

The receiving catchment, the Piako River, fed by water from the Piakoiti and Piakonui Streams is dominated by agricultural land use along its banks, and estimated to be a major contributor of total Nitrogen and Phosphorus to the Firth of Thames. Waikato Regional Council monitoring data has also shown E.coli concentrations to often exceed satisfactory levels, while dissolved oxygen regularly drops below water quality guidelines for healthy ecosystems (WRC, 2016).

Piakoiti and Piakonui specific water quality data analysed and summarised by Roland Stenger, Lincoln Agritech Ltd, for the group showed a strong impact of agricultural land use on the downstream water quality. Water sampling in the Piakonui near the entry site of the stream from bush into farmland showed satisfactory water quality with limited fluctuation throughout the year. However, less than 20 km downstream monitoring data showed considerable changes in total nitrogen and phosphorus, dissolved oxygen and water temperature fluctuations (Stenger, 2024).

The data showed a strong influence of farming practices on total nitrogen concentration in surface and shallow groundwater in the catchment. Higher nitrate-nitrite-nitrogen (NNN) concentrations compared to ammonia-nitrogen in water samples indicate that bigger improvements will be seen over time when focusing on measures reducing nitrate losses through the soil profile.

Between the headwater of the catchment and the Piako River sediment suspension, total phosphorus and E.coli concentrations increase considerably. The increases indicate that overland flow and erosion are likely the leading cause for the changes as the water travels North.

4.0 WALKOVER FINDINGS

The objectives for the farm walkover were to identify common opportunities for freshwater quality improvements along the catchment, discuss further options for improving freshwater outcomes and identify easy wins. While in the catchment a focus on both surface runoff and subsurface flows will lead to improved water quality outcomes, most impactful actions will differ between all farms depending on land use, contour, soil types, farming practices and existing infrastructure.

As part of the day, four pastoral properties in the catchment were visited by the group joined by Roland Stenger, Lincoln Agritech Ltd, and Denise Knop, AgFirst. On all four properties it was evident pride is being taken in managing the farming activities impact on streams running through the land. The management of riparian margins and steep land through planting of natives is a strong priority on all properties with more planting projects planned.

Figure 1: Native planting along drain leading into the Piako river

Figure 2: Planting along unproductive slope near Piakonui stream

Through historic changes to stream channels and banks the risk of stream bank erosion has been heightened in parts of the catchment. While some segments will be able to be managed well through planting poplar and cabbage trees, others may require earth work to intervene or waiting for the stream to settle into a new stream bed.

Figure 3: Stream bank erosion where flow path of Piakonui stream was altered in the past

Stock crossings, culverts and bridges can be a common critical source area for sediment loss to waterways. Changing existing infrastructure can be costly, however, in many cases changing the flow path of surface runoff leading up to the crossing can lead to significant reductions in contaminant loss.

Figure 4: Bridge over Piako river near Kereone

The catchment has a variety of soil types along the different stems of the two streams, with soils close the waterways are often more poorly draining and prone to pugging damage during higher rainfall times of the year.

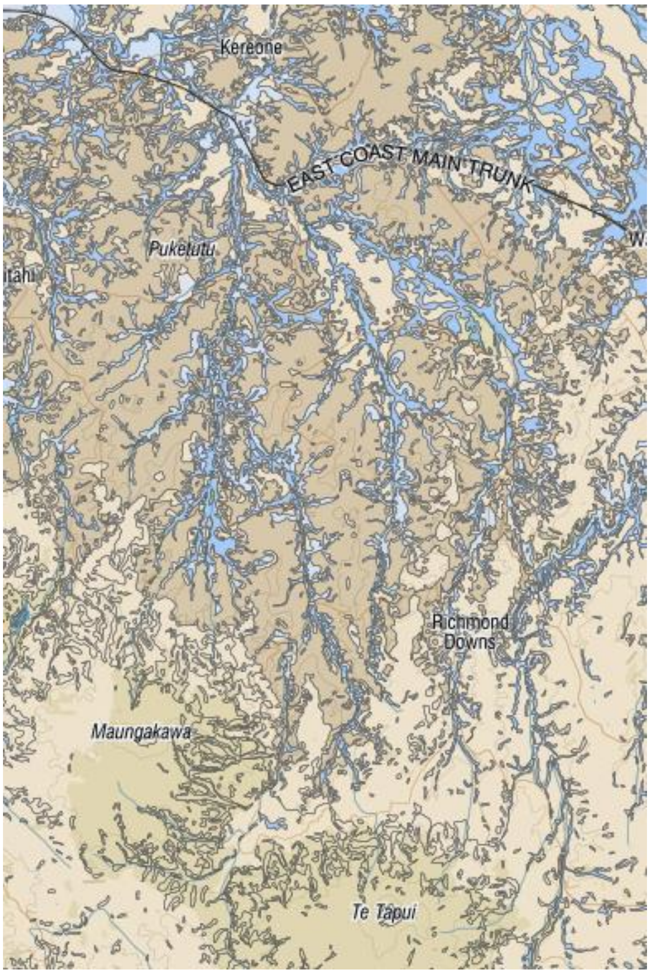

Figure 5: S-map soil type map of the catchment

Lower lying areas dominated by clay soils can be sites of higher sediment loss in the catchment. Increasing riparian margin to reduce the speed of surface flow and settle out sediments in the grass buffer is a very effective way of managing contaminant loss from these areas.


Figure 6: Low lying area draining into stem of the Piakonui stream with fenced surface drains

Leakage from effluent ponds and land application as well as leachate from feed storage areas or off paddock facilities have the potential to carry high nutrient loads into surface and shallow ground water. Pond drop testing unlined clay ponds and over time investing in upgrading existing infrastructure and installing sumps below silage stacks can significantly reduce nutrient loss from the system. Additionally, applying farm dairy effluent on a regular basis and particularly during drier times of the year, as well as keeping pond levels low leading into autumn and winter, reduces the risk of having to apply effluent to land during times of soil saturation.

The Piakonui and Piakoiti sites visited showed varying levels of existing riparian planting tall enough to shade the streams for parts of the day. Planting the northern and eastern banks of streams can be an effective control measure to reduce the impact on aquatic life of nutrients lost to the waterway further up in the catchment. In parts, the streams show evidence of substantial algae growth which during specific times of the year and day is leading to a significant reduction of dissolved oxygen saturation of the water.

Figure 7: Algae growth in the Piako river near Kereone

5.0 IMPLEMENTABLE ACTIONS

When deciding on the most effective actions to implement, it is important to remember that any human activity on the land will always have an impact on downstream water quality. This does not mean that no effort should be made, instead it emphasises the need to identify the most critical pathway of nutrient transfer to our aquatic ecosystems on each property first, before deciding on the most appropriate actions to take to significantly reduce the contaminant loss. While on some properties this will be achieved through increasing and planting riparian margins, on other properties this may mostly achieve a beautification of the property rather than an improvement in freshwater quality outcomes.

There is no “once size fits all” approach to reducing contaminant loss. The following section of the report focuses on higher level implementable actions for each contaminant and pathway to water.

5.1 Nitrogen

Nitrogen can be lost from the farm system through a large number of diffuse sources within the catchment. Increased concentrations of ammonia lead to toxicity of aquatic life and of drinking water, while increased nitrate promotes algae, water weeds and slime growth, affecting ecosystem health and recreational use. The diffuse nature of losses mean that in many circumstances improving existing farm management practices can achieve a bigger reduction in loss than infrastructure upgrades and riparian planting.

Existing input controls (synthetic Nitrogen fertilizer cap and WRC effluent management rules) are generally higher than average application rates on individual farms in the Waikato region and therefore have a low impact, overall, on the amount of nitrogen lost to waterways. Further source control on individual farms can be achieved through improved nutrient management, effluent management and farm system changes. Timing, application rate and application method of synthetic nitrogen can significantly reduce losses, often without reducing pasture harvested by particularly avoiding application during or right before periods with increased risk of drainage, after droughts, and generally during the months May to July.

Best practice effluent management combined with sufficient storage facilities and effluent block allow keeping nutrient losses from the farm system to a minimum. This includes applying low rates of effluent to avoid soil saturation and ponding and keeping the storage pond level low during the season to have maximum storage available during periods of unsuitable weather for land application.

The grazing system with large ruminants brings with it another risk area of nitrogen loss through the soil profile. Cattle consume large quantities of high protein pastures from large areas and deposit surplus nitrogen in the form of urinary nitrogen in comparatively small spots. Several farm systems changes can be undertaken to reduce the nutrient loss through this avenue, including balancing the diet with lower crude protein feeds, introducing plantain to the sward, investing in off-paddock facilities, or novel technologies, such as Spikey®.

On some properties, intercepting overland and subsurface flows of water with higher nutrient with the use of well-designed constructed wetlands is a very effective transfer control option. Well performing wetlands can reduce total nitrogen by up to 50% (Tanner et al, 2020). For the best location and most effective design of wetlands the NIWA report from 2020, as well as individual advise from experts including Roger John MacGibbon, should be consulted.

Effective impact control options for nitrogen loss to surface water are shading waterways through the establishment of riparian planting. However, this may not be an option for receiving waterbodies, such as the Firth of Thames, and is also ineffective for reducing impact of losses to ground water. Therefore, focus should be on source and transfer control options where nitrogen loss from the farm system has been identified as a priority.

5.2 Phosphorus

Phosphorus loss from properties within the catchment is less significant than nitrogen losses, however, for individual farms this may be different. Increased levels of phosphorus in the waterways promotes plant growth. At increased levels of algae, water weeds and slime growth, aquatic life and recreational use of the water bodies, is impacted negatively.

Generally, phosphorus is lost through overland flow of soil particles and soil erosion as well as sub-optimal effluent management. Keeping soil Olsen P levels at or below optimum for each individual land use can be both a very effective source control as well as cost saving for the farming business. Additionally, when applying fertiliser, allowing a sufficient buffer to waterways reduces the risk of unnecessary nutrient loss.

Farm dairy effluent can have high concentrations of phosphorus. Applying best practice effluent management and ensuring infrastructure, storage capacity and effluent block are sufficient for the operation, keeps the loss of valuable nutrients from the farm system to a minimum.

As phosphorus is often strongly bound to soil particles, any source and transfer control option effective for reducing sediment loss to waterways also leads to a reduction in total phosphorus. Options for controlling sediment loss will be discussed in Section 5.3.

Phosphorus similarities to nitrogen in effect on the receiving waterbody mean that constructed wetlands are also an effective transfer control. Well-designed wetlands have been shown to reduce total phosphorus by around half (Tanner et al, 2020).

5.3 Sediment

When reducing sediment loss from the land, this generally also provides effective control of phosphorus loss and E.coli contamination for the receiving bodies of water. Sediment itself has a number of negative effects on freshwater ecosystems. Increased turbidity reduces sunlight and visibility for the aquatic flora and fauna. Sediments that settle out can smother stream beds and damage fish gills, effecting habitats and food chains. Build up of sediment in the stream beds can increase the risk of flooding and increase the need for dredging, which further destroys aquatic habitats.

In the context of soil particle loss the term “critical source areas” (CSA) is often used. These describe small areas within a farm or catchment that discharge disproportionally large quantities of contaminants to surface water. CSAs can generally be identified by finding preferential overland flow paths into waterways from steeper land, races, tracks, stream crossings, troughs and gateways. In many cases intervention methods are cost effective and don’t require investment in infrastructure. These include shaping races and using cut-offs that take rain water away from streams and filter the runoff through grass or riparian margins and buffers, or moving troughs and gateways further away from streams to avoid stock congregating in those areas. Best practice grazing management that keeps stock out of wetter parts of paddocks or grazes these last is also a very effective source control. Reducing sediment loss from bridges and culverts is easiest achieved by considering it in the original design and shaping on the race leading up to either side of the waterway. However, changes can be made retrospectively, including adding nib walls to keep sediment losses to a minimum.

Riparian planting or increasing grass buffers along streams can, in many cases, be a very effective transfer control option. Plants, such as Carex, or rank grass slow down the overland flow of water and allow sediments time to settle out before the water reaches the stream. In the case of phosphorus, riparian planting is also an effective impact control where plants shade the waterways reducing water temperature and plant growth in the stream.

Cropping and arable land can be a significant source of sediment loss on some properties. Applying best practice when cropping on farm starts with choosing only suitable paddocks with low slope, undertaking seed bed preparations when soil conditions are suitable and, if grazing the crops, considering best practice grazing management. Choosing low or no tillage option for establishing crops, where possible, can also significantly reduces contaminant losses, including nitrogen.

While most options to reduce sediment, phosphorus and E.coli losses require low to no financial investment, other options, such as off paddock facilities and sediment traps require significant investment, however, in the right situation, are very effective at reducing total nutrient and contaminant loss from the system.

As for nitrogen and phosphorus, contracted wetlands are also an effective transfer control for sediment. Tanner et al. (2020) found an appropriately designed wetland can be up to 100% effective at filtering total suspended solids out of surface water. Wetlands in catchments with mostly clay soils likely have reduced effectiveness.

5.4 E.coli

Catchment data showed a marked increase in E.coli concentration in the surface water as it travels along the catchment. E.coli is used as an indicator pathogen for other, often more harmful microorganisms that can make waterways unsafe for recreational use, food harvesting and drinking water use.

E.coli mostly reaches surface waterways through overland flow or subsurface drains. By applying effective source and transfer control to reduce sediment loss to waterways E.coli is often also significantly reduced. Additionally, applying best practice effluent management further reduces the risk of the pathogen being transferred to water.

6.0 NEXT STEPS

The group is at an exciting point in their journey with participants already having a great level of existing experience and motivation to achieve improved freshwater quality outcomes for the catchment.

The next step for the group will be creating a catchment plan that includes a vision as well as individual and collaborative actions for the coming years. During the workshop the group very clearly articulated that part of their vision for the future is getting all farmers in the catchment to actively take part in the group. A strong focus was placed on native plantings becoming a common part of the catchment landscape, with steep slopes and riparian margins planted up. Collaborative action for the group may include the creation of a bird corridor, as one way to promote biodiversity of native birds and invertebrates. Overall, the aim would be that this work gives participating farmers the opportunity to reclaim their farming pride and that participants are recognized to be farming in an environmentally sustainable way.

The creation of the catchment plan may give the group the opportunity for further funding that can go towards workshops on freshwater farm environment plans as well as creating a biodiversity baseline with the help of eDNA testing.

7.0 REFERENCES

Stenger, 2024. Two Loops Catchment Group – Review of existing catchment data to inform development of action plan, Report 1630-01 R1.

Tanner et al, 2020. Provisional guidelines for constructed wetland treatment of pastoral farm run-off. NIWA client report to DairyNZ, 2020.

WRC, 2016. Water quality and sources of nitrogen and phosphorus in the Hauraki River, 2006-15, Waikato Regional Council Technical Report 2016/17.

Contact

Denise Knop

Agribusiness Consultant
027 201 8448
Denise.knop@agfirst.co.nz

AgFirst Waikato (2016) Ltd
26D Liverpool Street
PO Box 9078, Hamilton 3240, New Zealand
07 839 2683
waikato@agfirst.co.nz
www.agfirst.co.nz