Mapiu – Mapara Freshwater Monitoring Results

Merrin Whatley (PhD) – 27 July 2022

Overview

- Indicators of freshwater health
- Monitoring results
- On farm actions


Photo: Susan Stoddard

Indicators of Freshwater Health

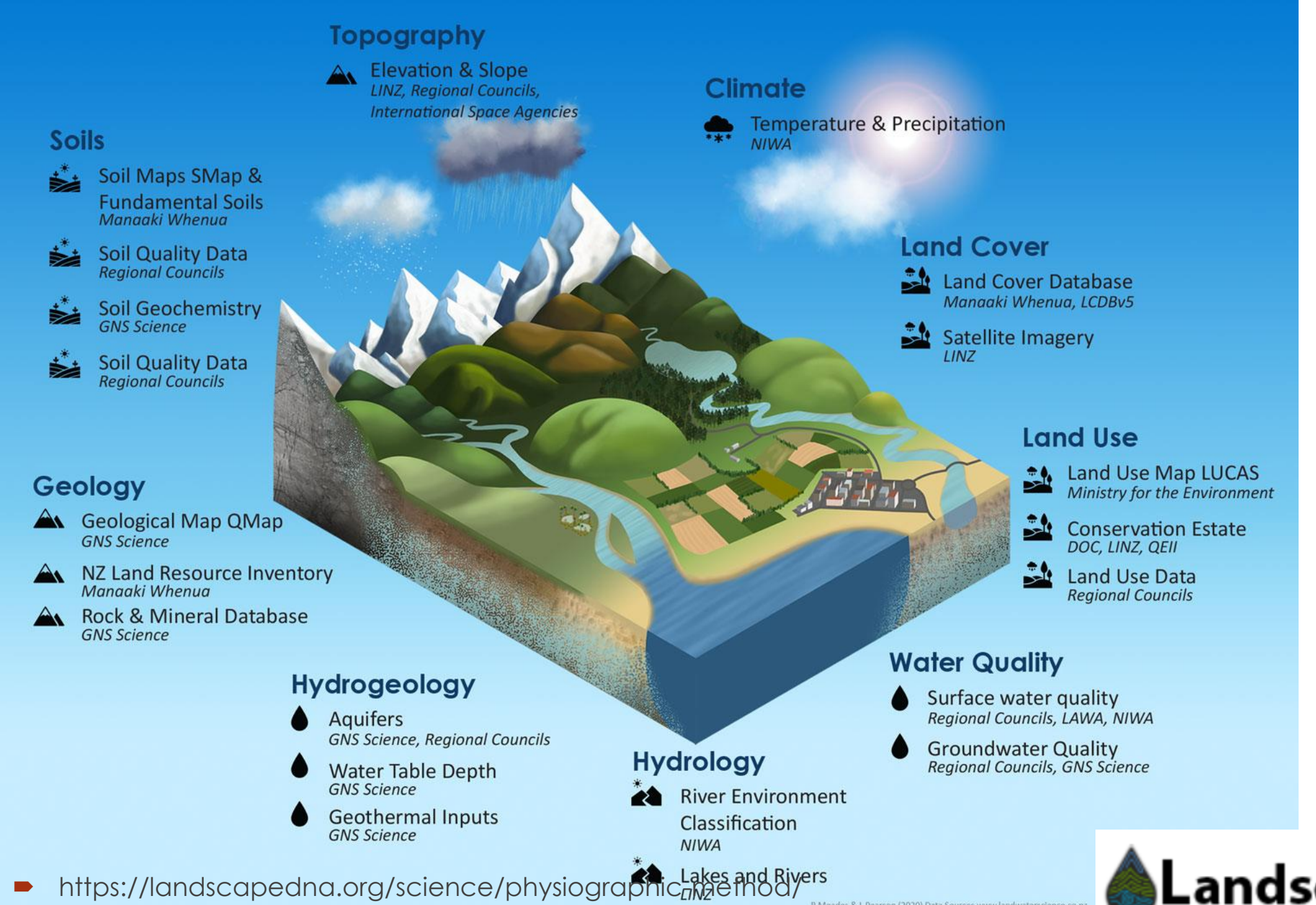
- Habitat
- Flow
- Wildlife
- Energy & Nutrient Dynamics
- Water Quality

Identifying the drivers of Waterway Health

- The key resources/attributes?
- Where in the catchment are they coming from?
- Are there seasonal changes or changes over time?
- What are the underlying processes or practices contributing to contaminant loss?
- Tailor catchment-based interventions to target key contaminants over time and space.

Natural Influences

- Climate
- Topography
- Geology
- Soils
- Hydrology
- Land cover



- https://landscapedna.org/science/physiographic_method/

LandscapeDNA

Map Information

Weak Bedrock

Variants

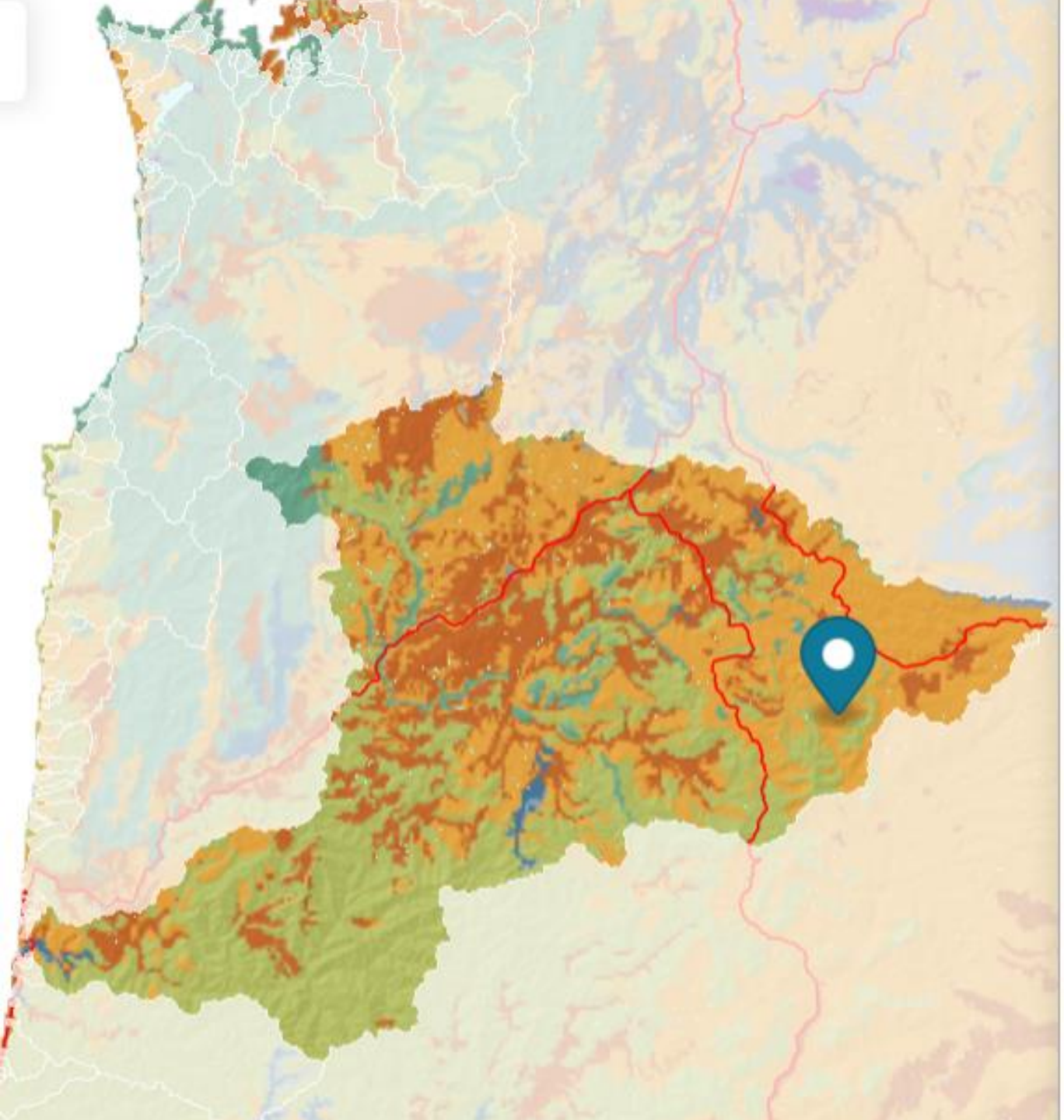
Overland flow	Not applicable
Artificial drainage	Not applicable
Natural soil bypass	Not applicable

Key Information

Hydrological Pathway	Lateral drainage
Contaminant Risk	Sediment, Particulate phosphorus
Surface water catchment	Mokau River

Description

- Typically occurs across rolling to steep topography where shallow soil overlies weak bedrock (also exists across plateaus where shallow soils overlie bedrock without



Map Information

Oxidising Soil & Aquifer

Variants

Overland flow	Not applicable
Artificial drainage	Not applicable
Natural soil bypass	Not applicable

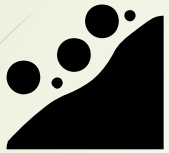
Key Information

Hydrological Pathway	Deep drainage
Contaminant Risk	Nitrate nitrogen
Surface water catchment	Mokau River

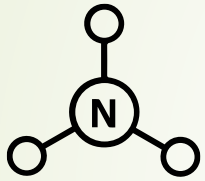
Description

- Predominantly occurs in lowland, low relief areas where there are moderately-well to well drained soils and oxygen-rich (oxidising) underlying aquifers.
- Runoff risk is elevated in areas of sloping or slowly permeable soils.

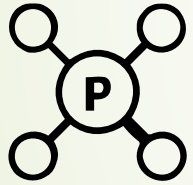
Attribute Descriptions



Water Clarity – Suspended Particles Including Sediment

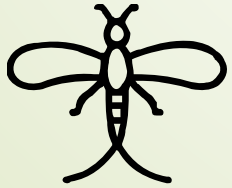


Nitrate



Dissolved Reactive Phosphorus (DRP)

Pathogens/E. coli (short for Escherichia coli)



Freshwater Macroinvertebrate Community Index (MCI)

Monitoring in Mapiu-Mapara

Waikato Regional Council Sites

- Mokau River – 22 sites in total
  - 5 River Water Quality Sites
  - 16 Ecological Monitoring Sites
  - 1 River flow Site
- Mapiu-Mapara - 1 Ecology site

Frequency of Measurements

- WQ collected by monthly grab sample
- Ecology site visited every 3 years
- Continuous river flow recorded every 15 minutes

Monitoring in Mapiu-Mapara

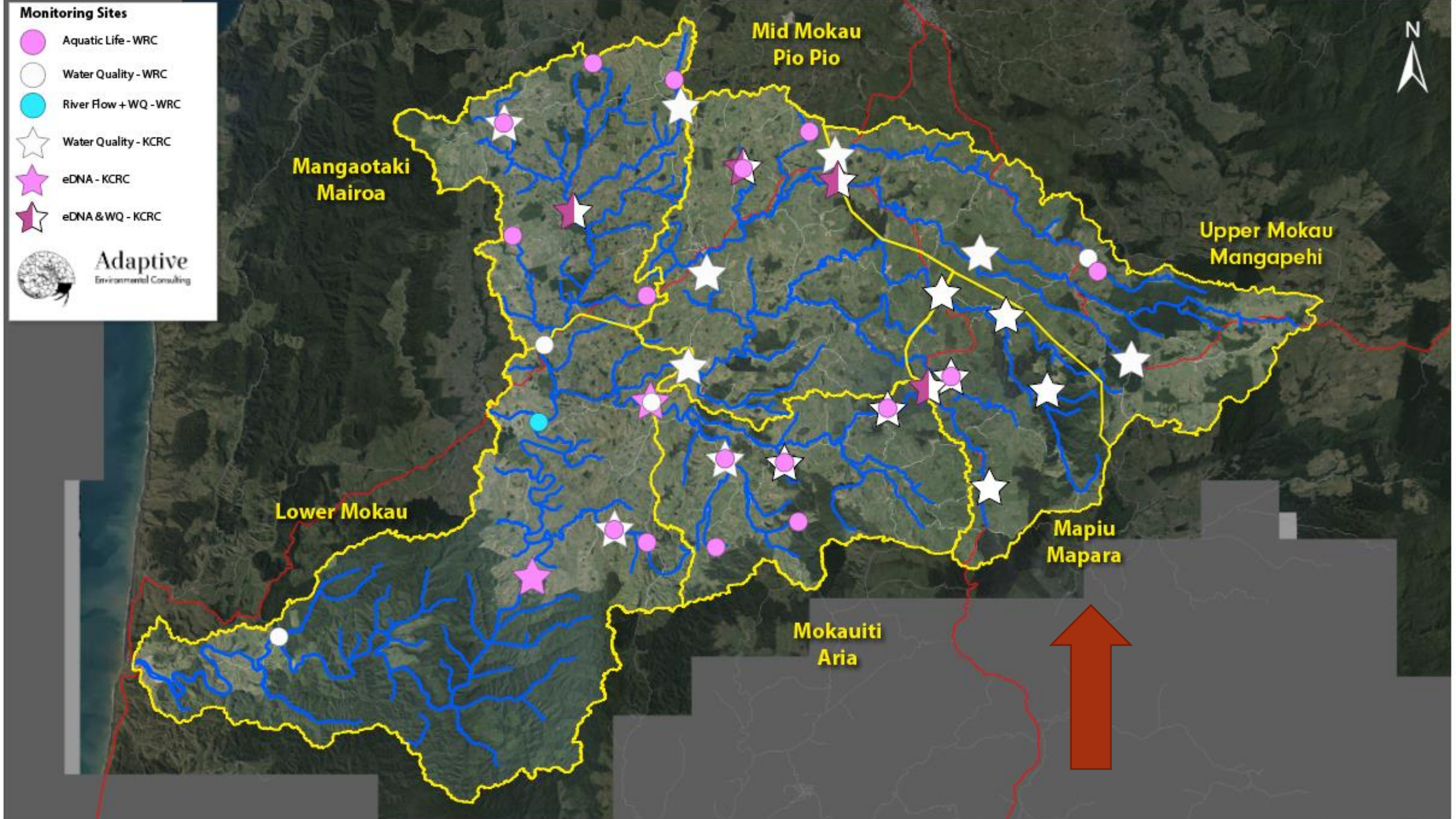
KCRC Sites

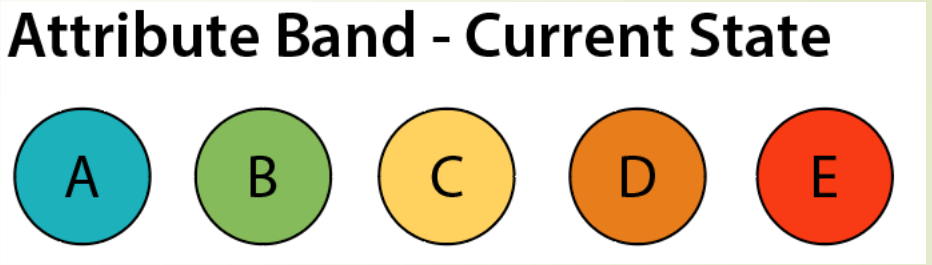
- Mokau River – 22 sites in total
- 20 Water Quality sites
- 6 eDNA sites

- Mapiu-Mapara – 6 sites in total
- 6 Water Quality sites
- 1 eDNA site + WQ

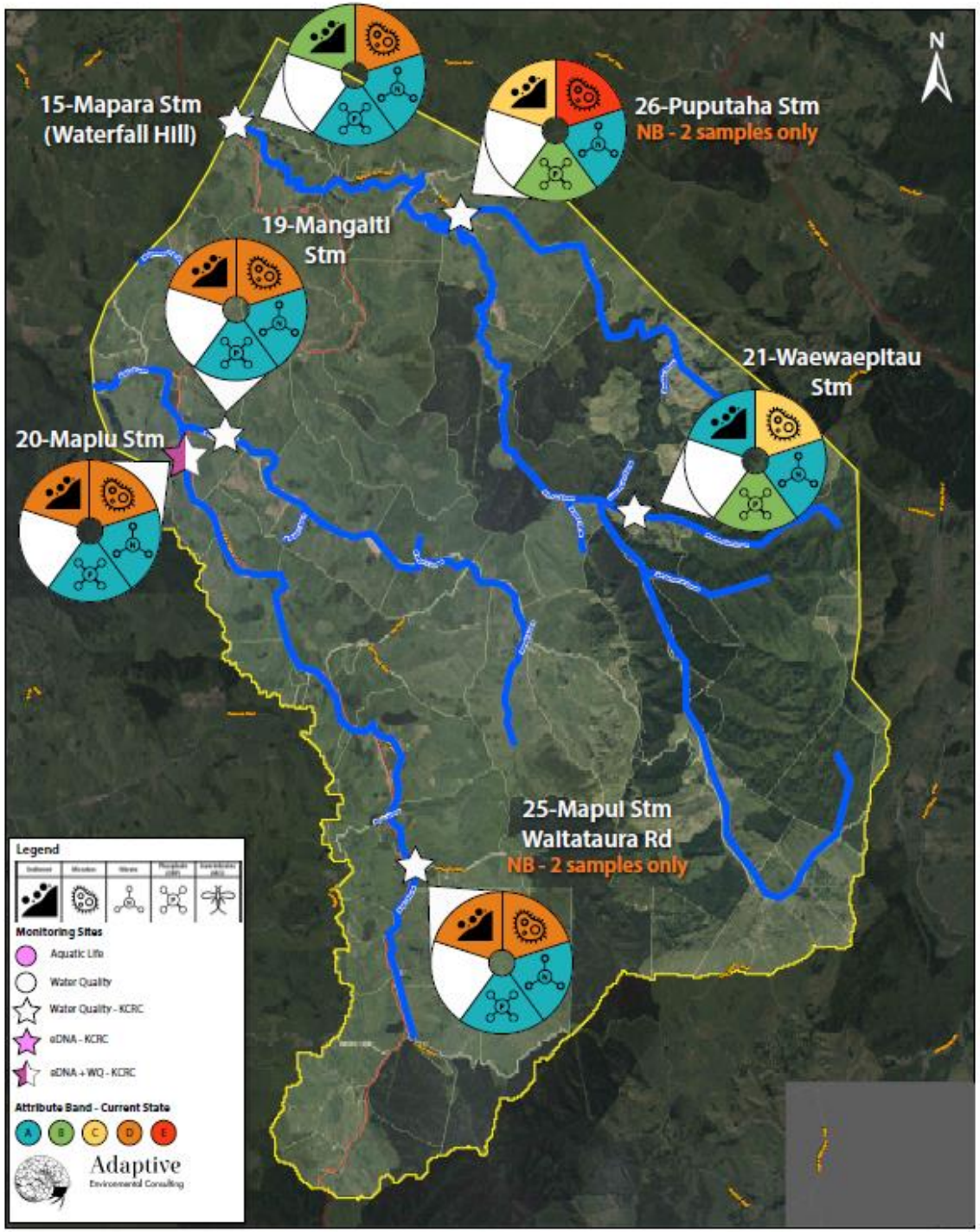
Frequency of Measurements

- Water quality collected by grab sample 4 times a year
- eDNA collected twice, 24 Feb & 5 Dec 2021


Monitoring Sites
Aquatic Life - WRC
Water Quality - WRC
River Flow + WQ - WRC
Water Quality - KCRC
eDNA - KCRC
eDNA & WQ - KCRC
Adaptive
Environmental Consulting
Mid Mokau
Pio Pio
Mangaotaki
Mairoa
Upper Mokau
Mangapehi
Lower Mokau
Mapiu
Mapara
Mokauiti
Aria
N



Attribute Dials

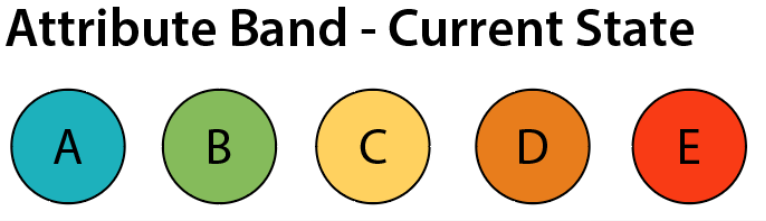


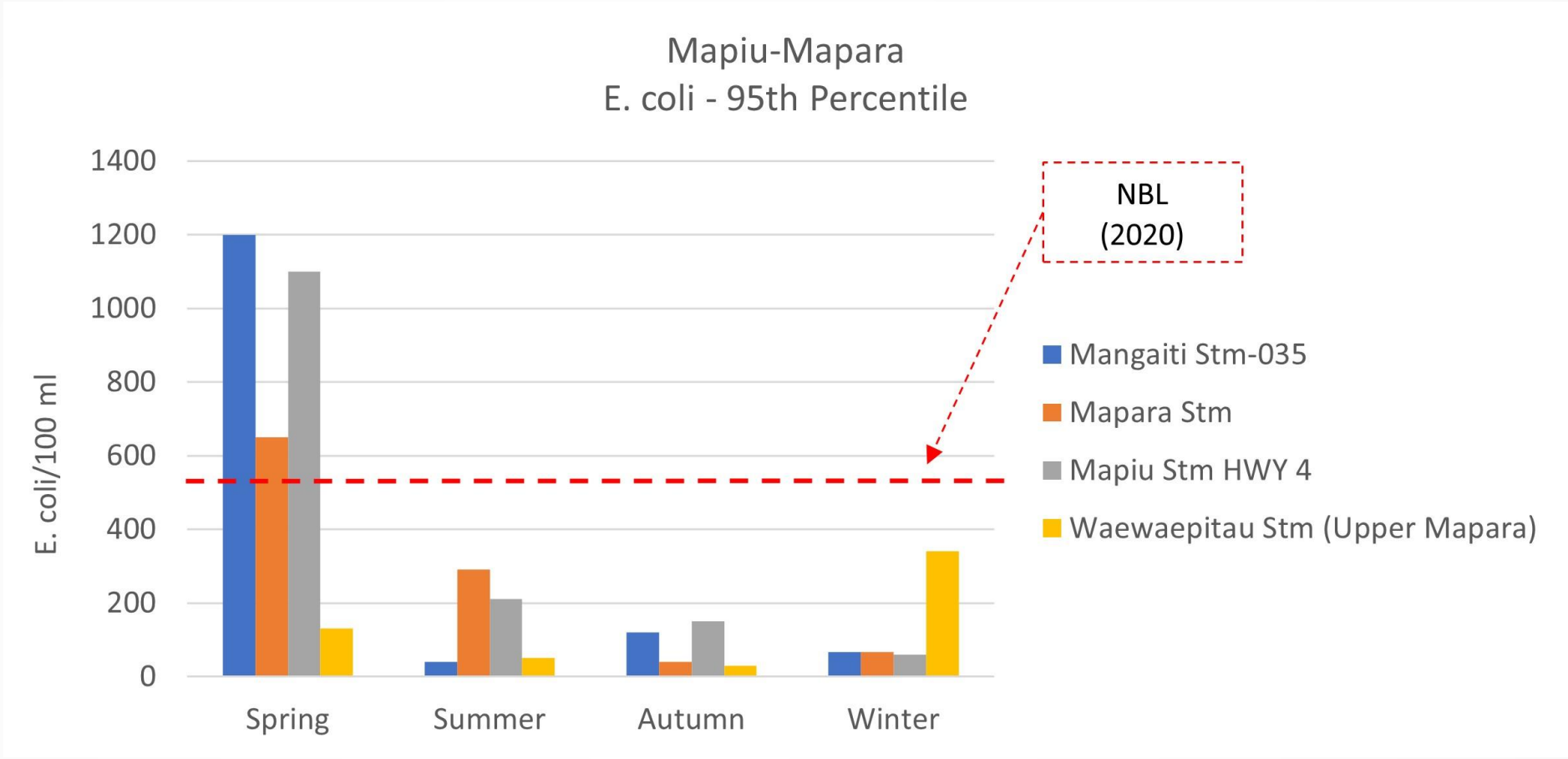
Key Results

- Water clarity and E. coli are the attributes to watch
- DRP is elevated at Puputaha and Waewaepitau streams
- Water clarity is lower in Mapiu stream than Mapara stream
- E. coli/ Pathogens are elevated at all sites

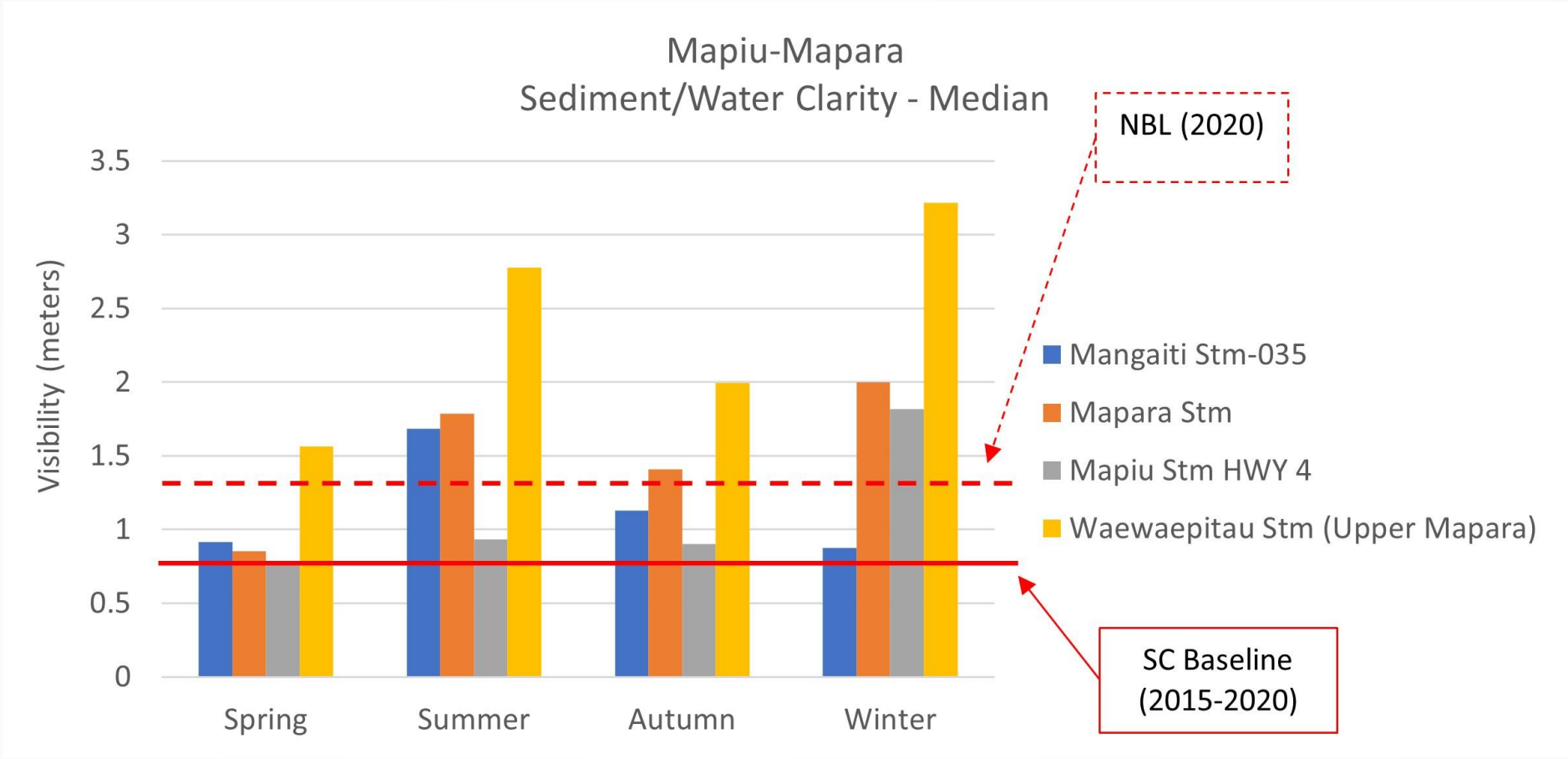
Mapiu-Mapara Annual Summary 2021 Labs: Hill/Analytica	Human Contact	Ecosystem Health							
		Water Quality						Sediment	
		Nitrate Toxicity (TON mg N/L)		Ammonia Toxicity (mg N/L)		Dissolved Reactive Phosphorus (mg P/L)		Water Clarity Value[1]	National Bottom Line
KCRC WQ SITES	95th Percentile	Median	95th Percentile	Median	95th Percentile	Median	95th Percentile	Median	
15-Mapara Stm	596 ↓	0.30 ↓	0.47 ↓	0.003 ↓	0.006 ↓	0.006 ↓	0.008 ↓	1.60 ↑	1.34
19-Mangaiti Stm	1038 ↓	0.24 ↓	0.40 ↓	0.015 ↑	0.020 ↓	0.001 ↓	0.002 ↓	1.02 ↑	1.34
20-Mapiu Stm	967 ↓	0.32 ↓	0.50 ↓	0.009 →	0.016 ↓	0.003 ↓	0.005 ↓	0.92 ↑	1.34
21-Waewaepitau Stm	309 ↓	0.07 ↓	0.11 ↓	0.003 ↓	0.003 ↓	0.007 ↓	0.009 ↓	2.38 ↑	1.34
25-Mapiu Stm - Waitataura Rd	625 ↓	0.45 ↓	0.54 ↓	0.008 ↓	0.010 ↓	0.004 ↓	0.005 ↓	1.22 ↑	1.34
26-Puputaha Stream	2377 ↓	0.50 ↓	0.63 ↓	0.006 ↓	0.010 ↓	0.007 ↓	0.010 ↓	1.39 ↑	1.34
Mokau R. Baseline (Jan-2015 to Aug-2020)	**5000**	**0.54**	**1.00**	**0.009**	**0.047**	**0.009**	**0.022**	**0.79**	**1.34**

Annual Summary

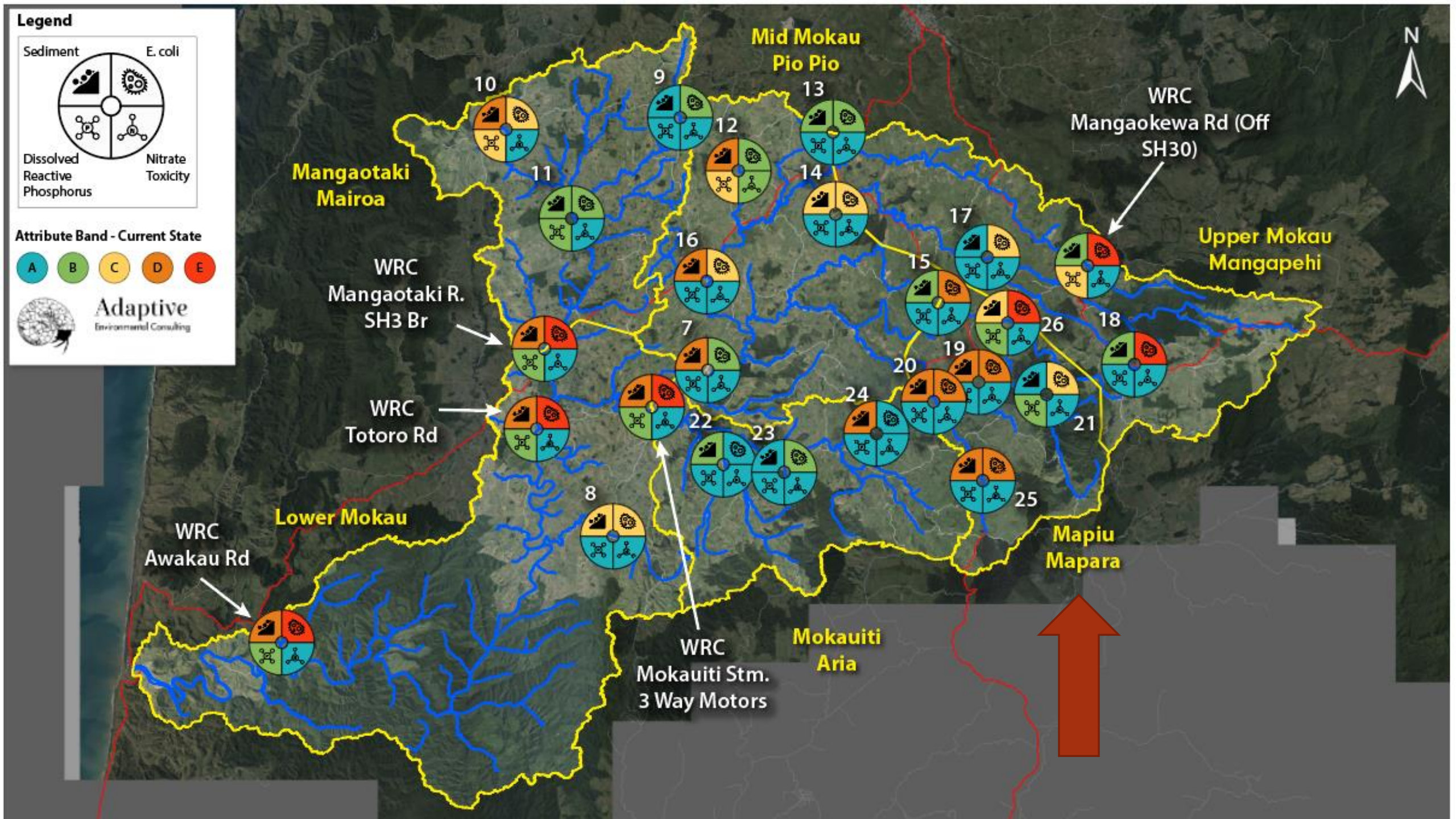




E. Coli – Seasonal Results



Water Clarity – Seasonal Results


Legend
Sediment
E. coli
Dissolved Reactive Phosphorus
Nitrate Toxicity
Attribute Band - Current State
A
B
C
D
E
Adaptive
Environmental Consulting
N
Mid Mokau Pio Pio
Mangaotaki Mairoa
Upper Mokau Mangapehi
Lower Mokau
Mapiu Mapara
Mokauiti Aria
WRC Mangaokewa Rd (Off SH30)
WRC Mangaotaki R. SH3 Br
WRC Totoro Rd
WRC Awakau Rd
WRC Mokauiti Stm. 3 Way Motors
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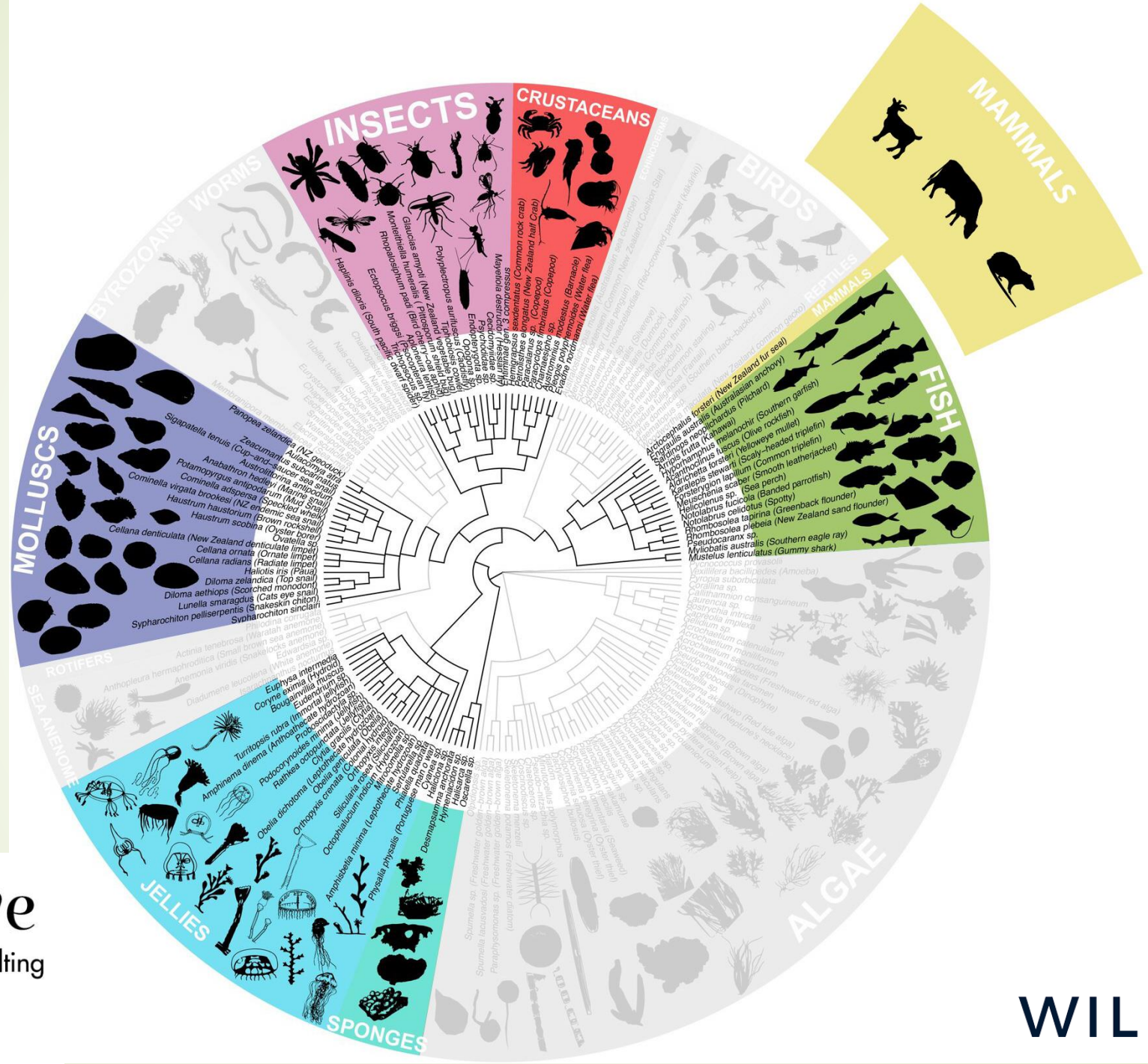
Environmental DNA (eDNA)

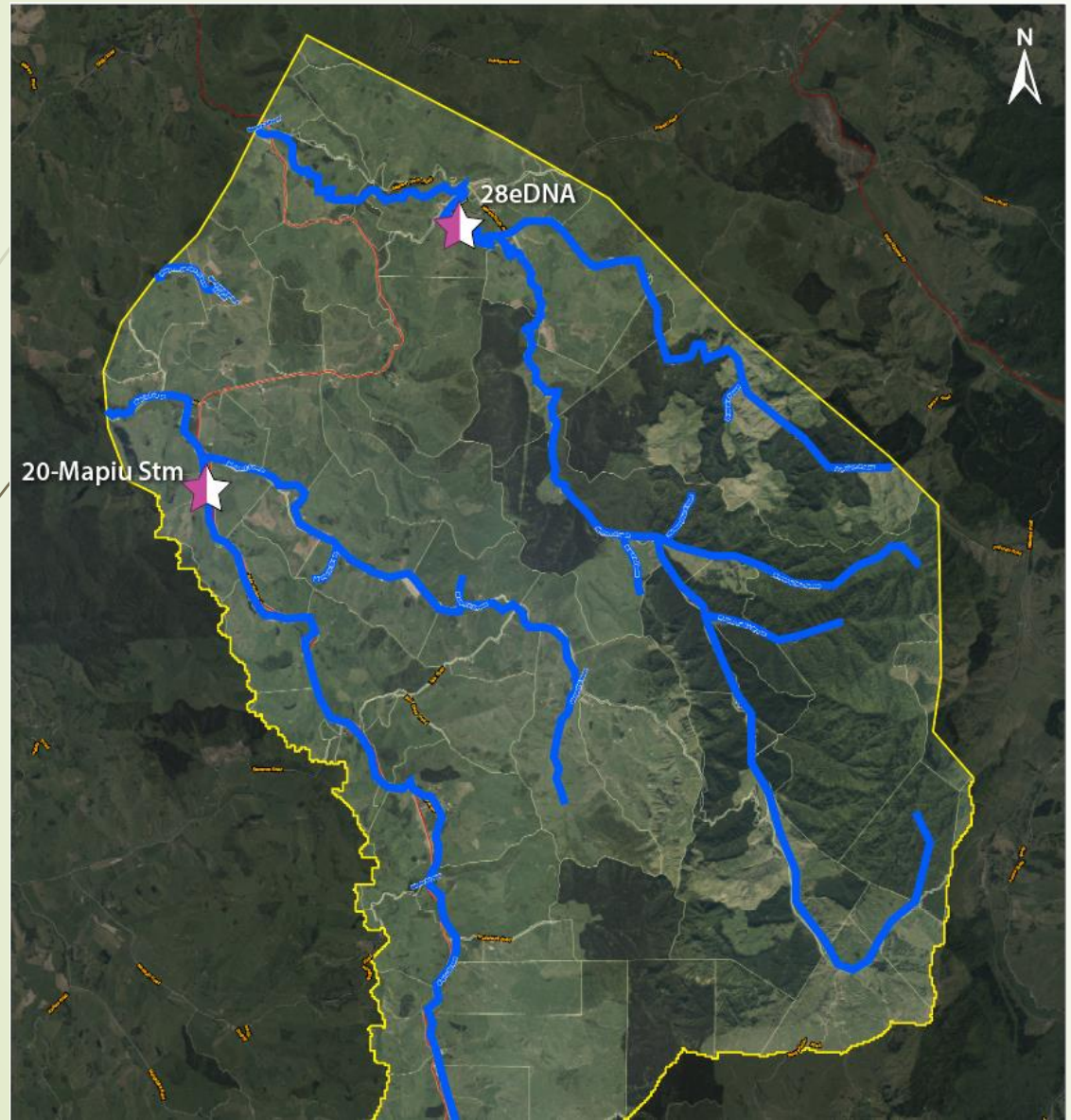
WILDERLAB



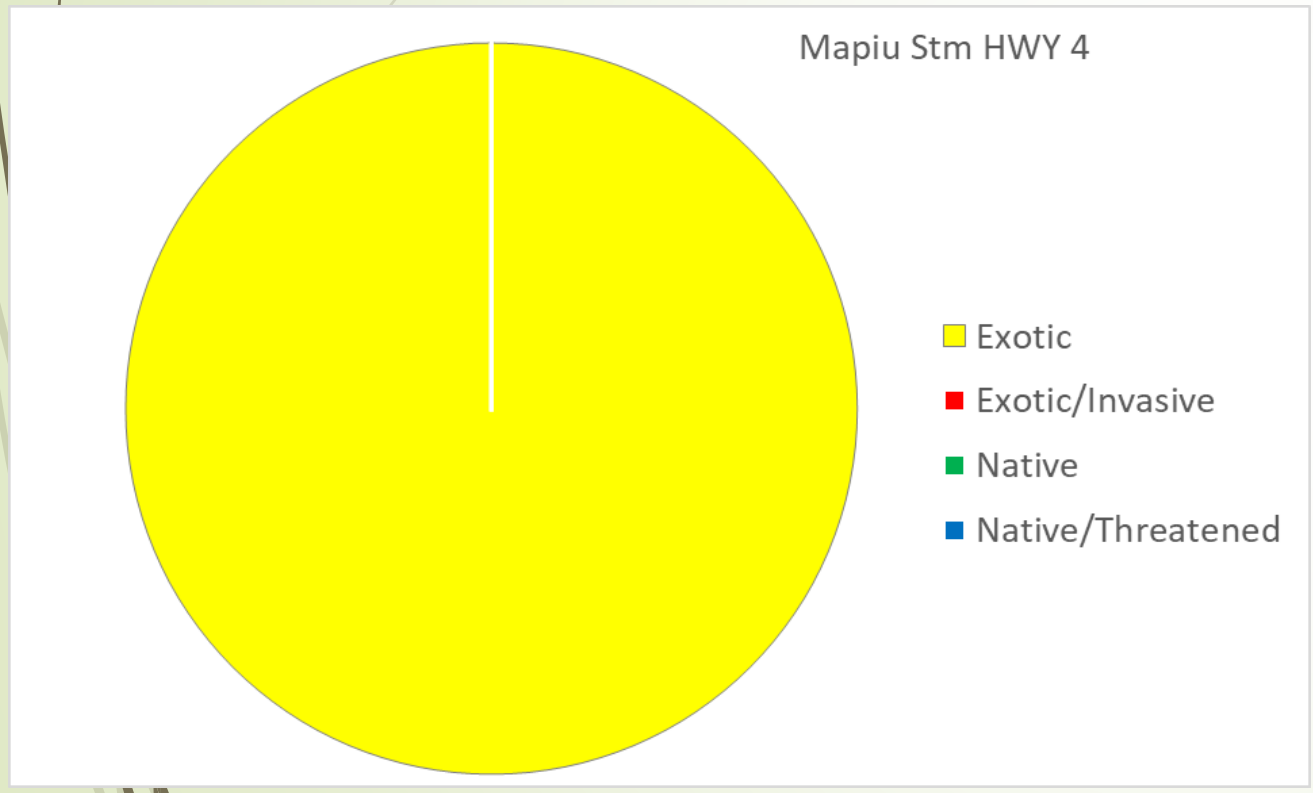
Adaptive
Environmental Consulting

WILDERLAB

eDNA site Maipu Stream - HWY 4



Freshwater Fish Species
Threat status & number of Sp.



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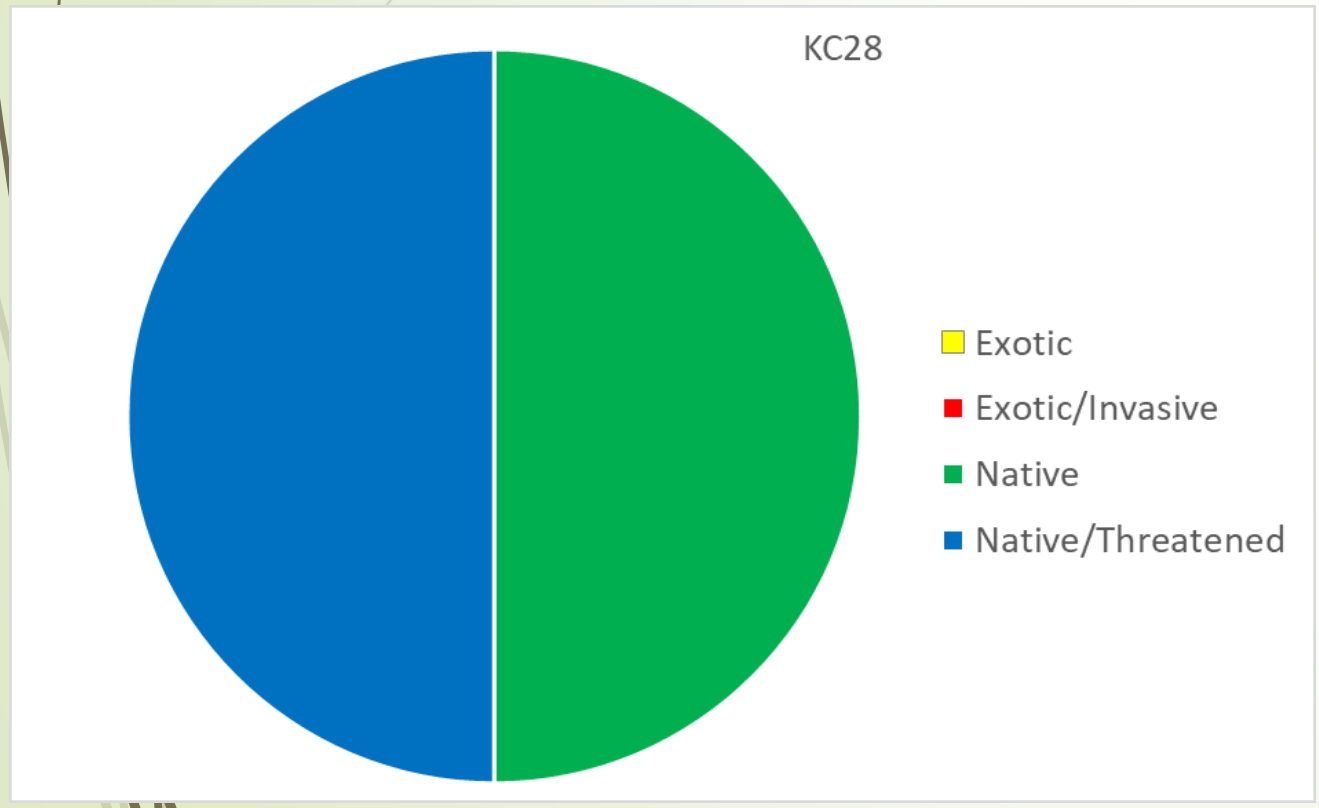
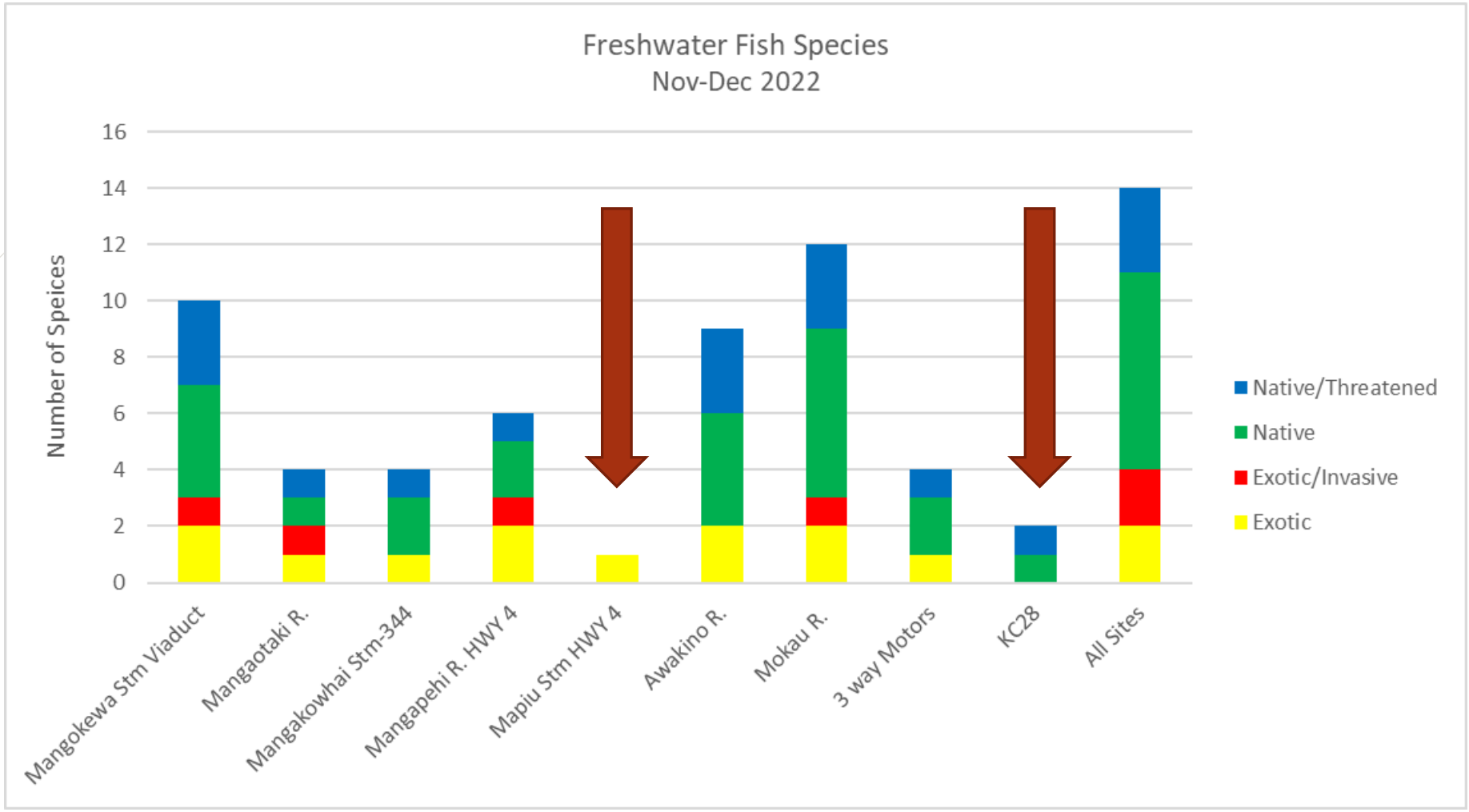




Freshwater Fish
Number of species detected and their threat status

Adaptive
Environmental Consulting

Sensitive taxa (values of 8 or more)

Double gill mayfly (*Tepakia*)
Mayflies

Green stonefly (*Stenoperla*)
Stoneflies

Spiral cased caddis (*Helicopsyche*)
Cased caddisflies

Swimming mayfly (*Nesameletus*)
Mayflies

Stonefly (*Zelandoperla*)
Stoneflies

FACTSHEET

Tolerant taxa (values of 3 or less)

Oligochaete worms (Oligochaeta)
Segmented worms

Snail (*Physa*)
Snails

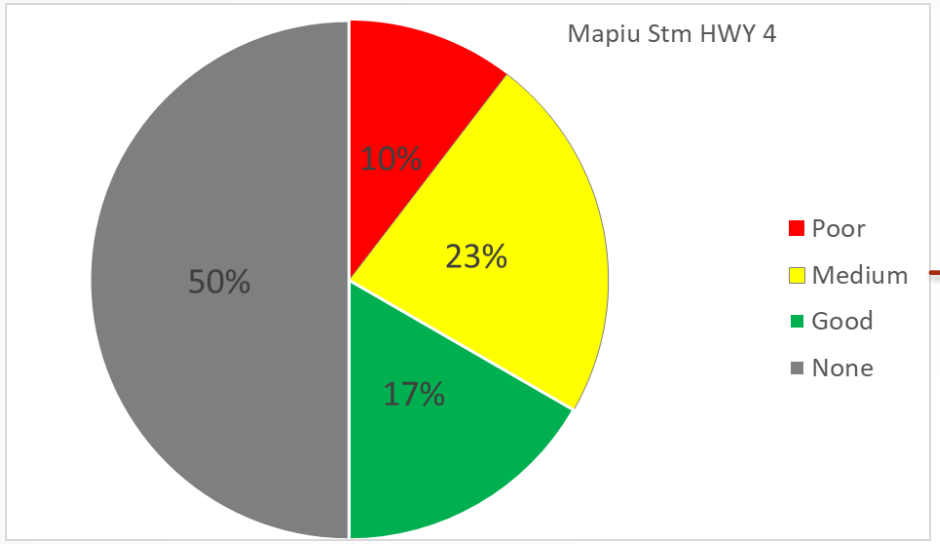
FACTSHEET

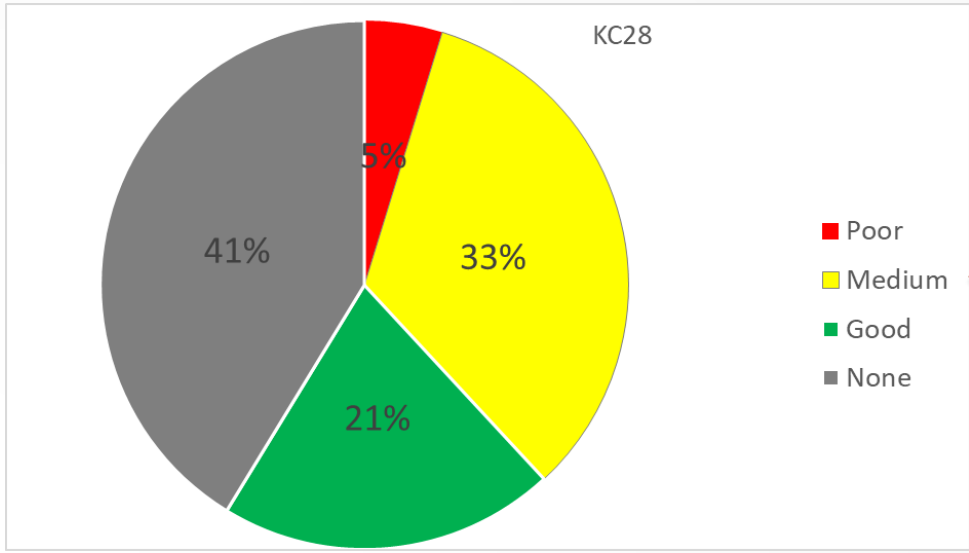
Chironomid midge (*Chironomus*)
Midges

Rat tail maggots (Syrphidae)
Other true flies

Macroinvertebrate Community Index Scores (MCI) 1 - 10

5 Dec 2021 – All Invertebrates





Sites	KC4 Mangokewa Stm Viaduct	KC11 Mangaotaki R.	KC12 Mangakowhai Stm-344	KC14 Mangapehi R. HWY 4	KC20 Mapiu Stm HWY 4	KC25 Awakino R.	KC26 Mokau R.	KC27 3 way Motors	KC28 KC28
MCI Score	119	126	109	112	112	127	105	101	121
National Grade	B	B	C	B	B	B	C	C	B

Freshwater Invertebrate Community Health Index (MCI) eDNA Results 2021

Mapiu Stream Site Characteristics

Riparian vegetation

- Some willows & exotic pasture, grazed to edges

Stock Access

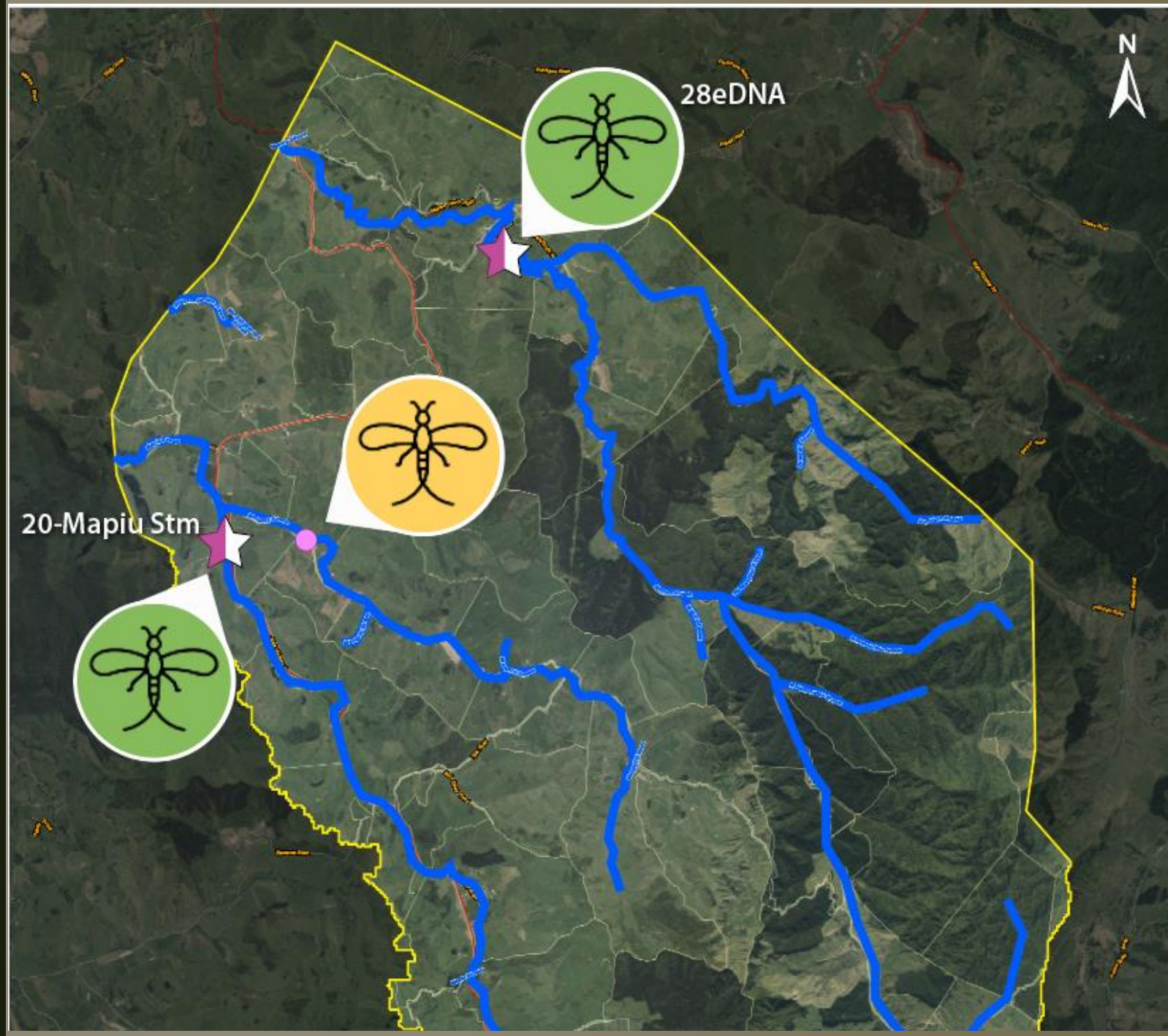
- Sheep access only

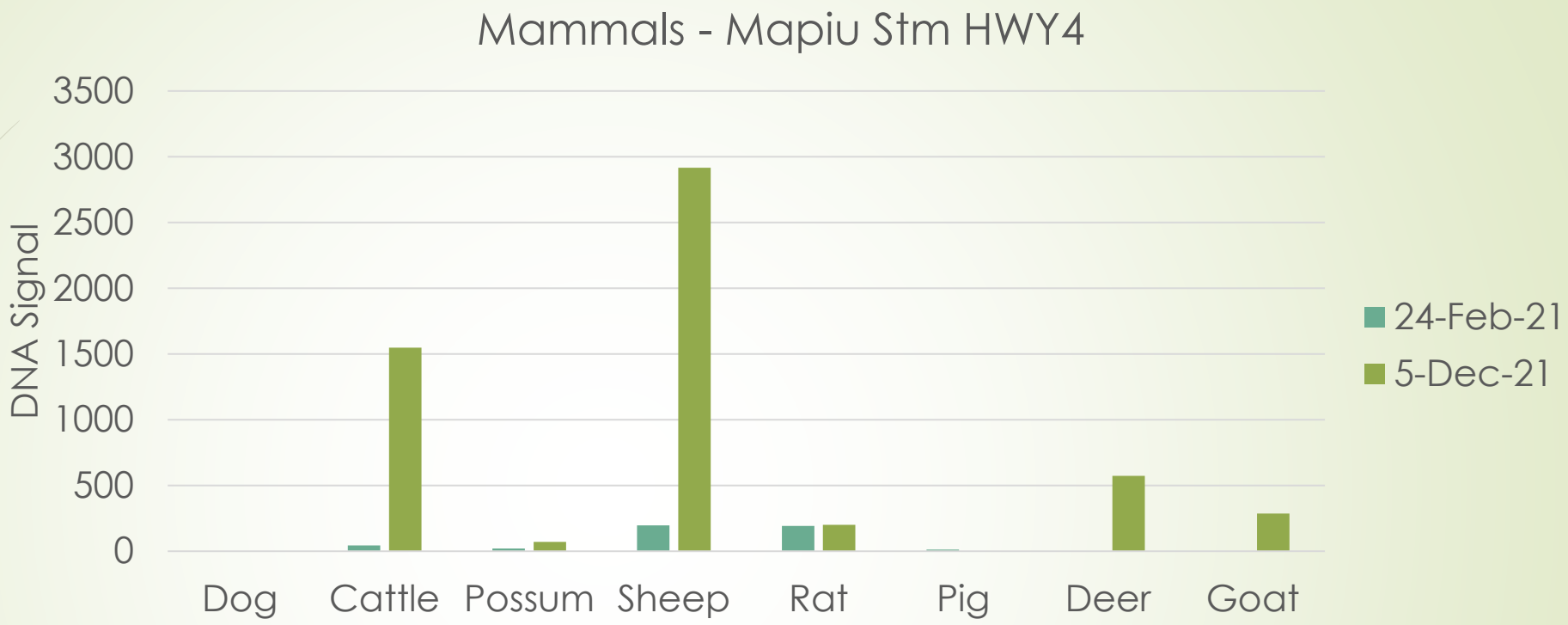
Water temperature

- Feb = 19.9 °C; May = 10.2 °C

Conductivity (µS/cm)

- Feb = 196; May = 129
- The electrical conductivity of fresh groundwater is typically <100 µS/cm.





Mammalian eDNA Signal Strength

Summary Points - Mapiu Mapara

Summary of 2021 KCRC Water Quality

- Water clarity and E. coli are the key attributes to address
- Phosphorus leaching may be occurring in the Mapara stream catchment

Water Quality Baseline 2015-20

- E.coli and Sediment were elevated in the Mokau River
- No data available for Mapiu-Mapara.

eDNA

- Rainbow trout was the only freshwater fish detected
- MCI grade = B

Ecology Baseline

- MCI baseline median grade = C
- MCI declined between 2009 & 2018 from B to D.

How Farm Management Influences Catchment Health

Management Actions

https://www.farmmenus.org.nz/drystock-farms/

Impact	N	P, Sed, E. coli
High	>25%	>50%
Medium	10-25%	20-50%
Low	<10%	<20%

Actions - Drystock Farms	Greatest Potential Reduction/WQ Benefit			
	Sediment	E. coli	N	P
Nutrient Management	20-50%	-	10-25%	>50%
Stock Management	>50%	20-50%	10-25%	>50%
- To improve herd fertility and finishing rate	-	-	10-25%	<20%
- To reduce erosion & soil damage	>50%	20-50%	<10%	>50%
Planting to Reduce Erosion	>50%	20-50%	10-25%	20-50%
Managing Critical Source Areas	>50%	>50%	<10%	>50%
Riparian Management	>50%	>50%	10-25%	>50%
- Sediment Traps	>50%	<20%	<10%	>50%
- Provide deer wallows away from waterways	>50%	>50%	<10%	20-50%
Management of Fodder Crop Areas	>50%	20-50%	>25%	>50%
FEP - Good farmer buy-in	>50%	>50%	>25%	>50%
FEP - Poor buy-in	<20%	<20%	<10%	<20%

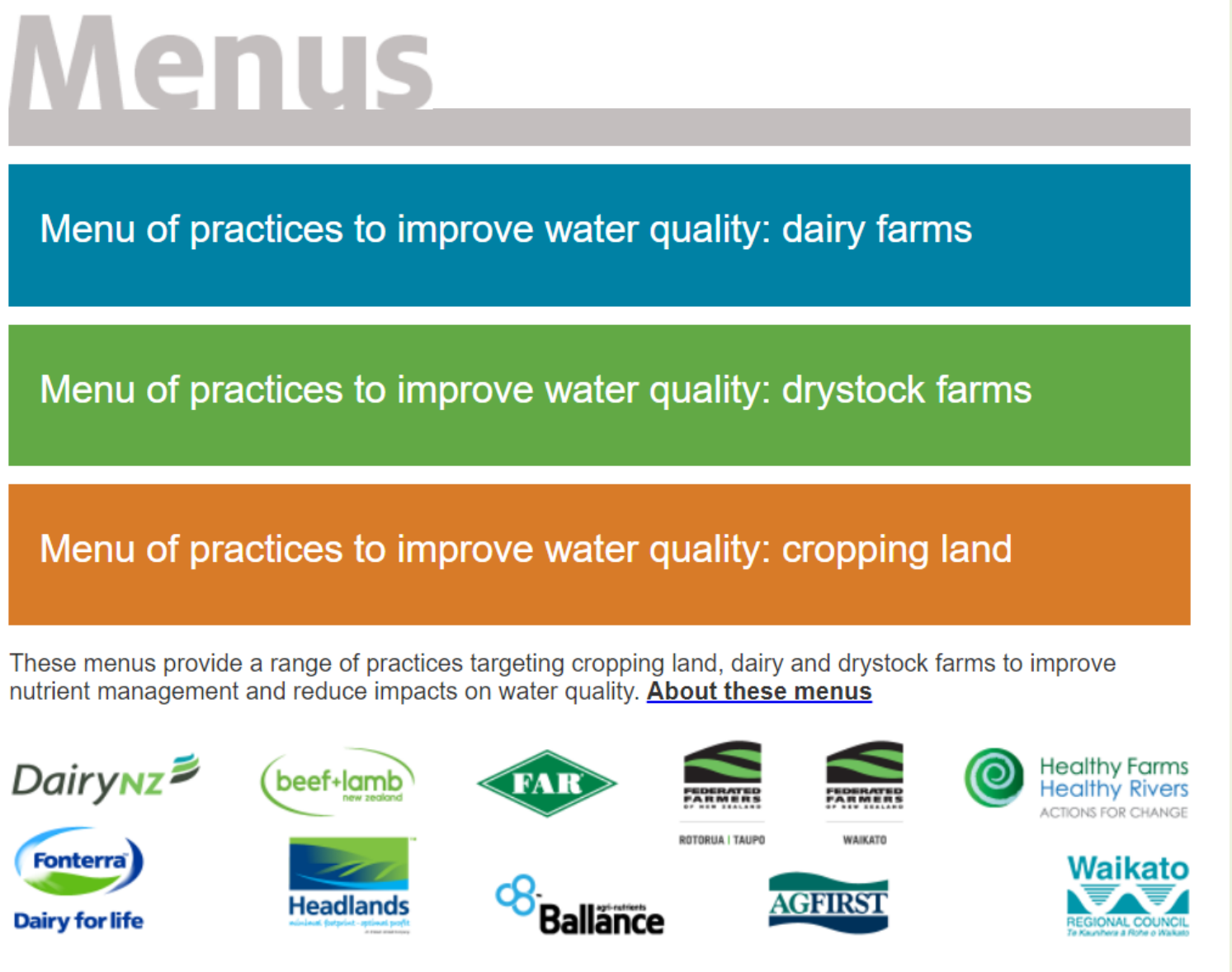
Management Actions

https://www.farmmenus.org.nz/dairy-farms/

Impact	N	P, Sed, E. coli
High	>25%	>50%
Medium	10-25%	20-50%
Low	<10%	<20%

Actions - Dairy Farms	Greatest Potential Reduction/WQ Benefit			
	Sediment	E. coli	N	P
Nutrient Management	-	-	10-25%	20-50%
Riparian Management	>50%	>50%	10-25%	20-50%
- Sediment Traps	20-50%	<20%	<10%	20-50%
- Constructed wetlands	20-50%	20-50%	10-25%	20-50%
Effluent management	20-50%	>50%	10-25%	>50%
Feed pads - Off Pasture Options	>50%	>50%	>25%	>50%
Good Grazing Management - On Pasture Options	20-50%	20-50%	<10%	20-50%
Managing Critical Source Areas	>50%	>50%	>25%	>50%
Cropping Management	>50%	20-50%	>25%	>50%
FEP - Good farmer buy-in	>50%	>50%	>25%	>50%
FEP - Poor buy-in	<20%	<20%	<10%	<20%

- **Reference**



https://www.farmmenus.org.nz/

Drystock farms

Click on the arrows on the variables in the header row to reorder the farm practices based on that variable. Use this menu in conjunction with your consultant or your Land Environment Plan.

Management area	On farm practice	N	P	Sed	Pa	Cost	Benefit	Factors to consider
Cropping management	Actively manage grazing of winter crop areas to reduce risk of N leaching, run off, soil loss and compaction	L	M	M	M	$$	$$$	Graze from top to bottom of paddock contour. Avoid leaving stock on during wet periods, for long periods, or concentrated on small sections of the crop.
Planting to reduce erosion	Afforestation of steep southern faces (above Land Use Capability 6e)	M	M	M	-	$$ - $$$	$ - $$	Protects areas of greatest erosion risk and replaces low growing slopes with long term productive investment. Best suited to areas with large weed burdens and minimal profitability. Profitability depends on forestry regime and market. Any afforestation plan should include a harvest plan to ensure all land is harvestable.

Soil Damage - Pugging

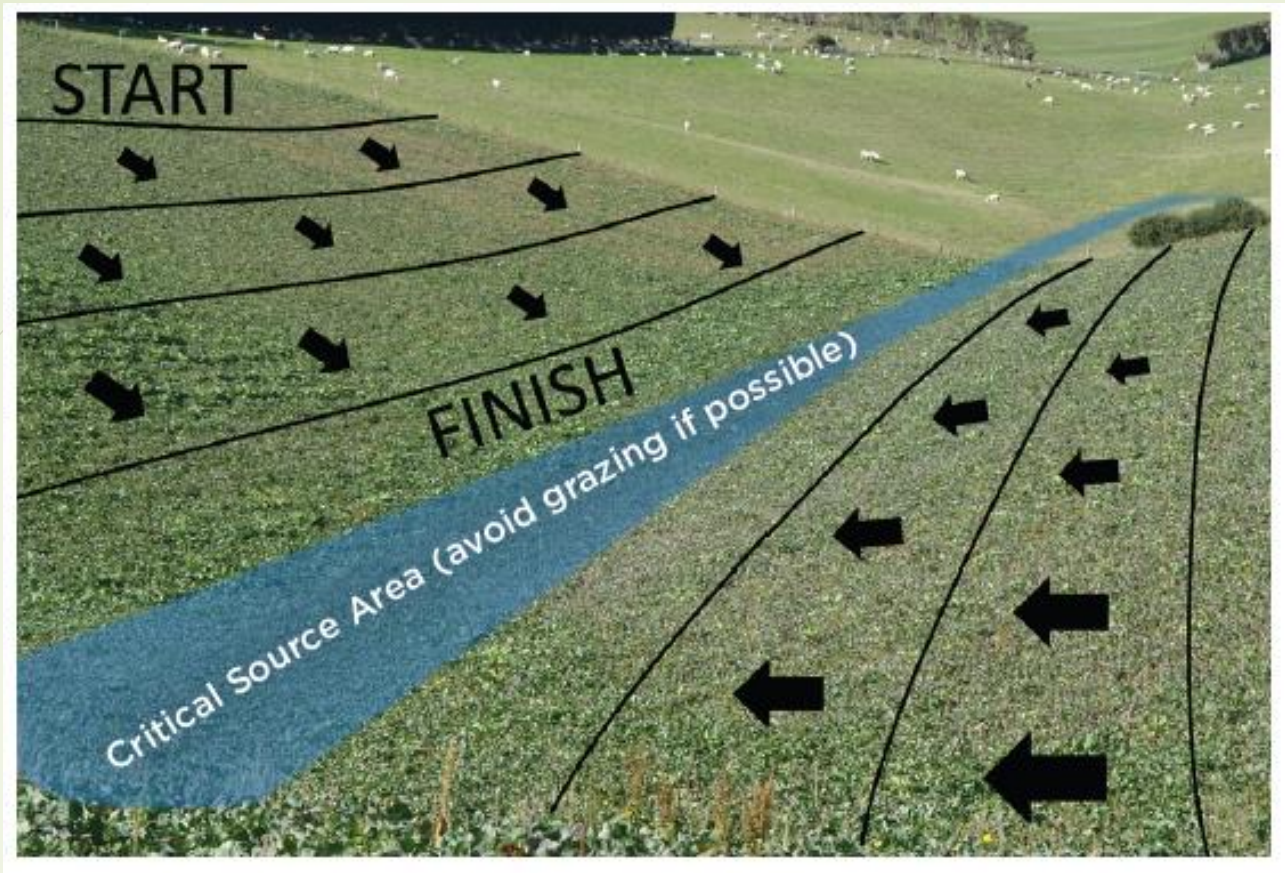
Source: Keith Betteridge, AgResearch

Source: Keith Betteridge, AgResearch

Overgrazing & soil damage

- Reduces spring pasture production by up to 80%
- Can take 3 or more years to recover.

Click here to find out more about soil erosion processes in New Zealand
Click here to find out more about soil and pasture management
Click here to learn about 11 ways to reduce pugging in your pasture

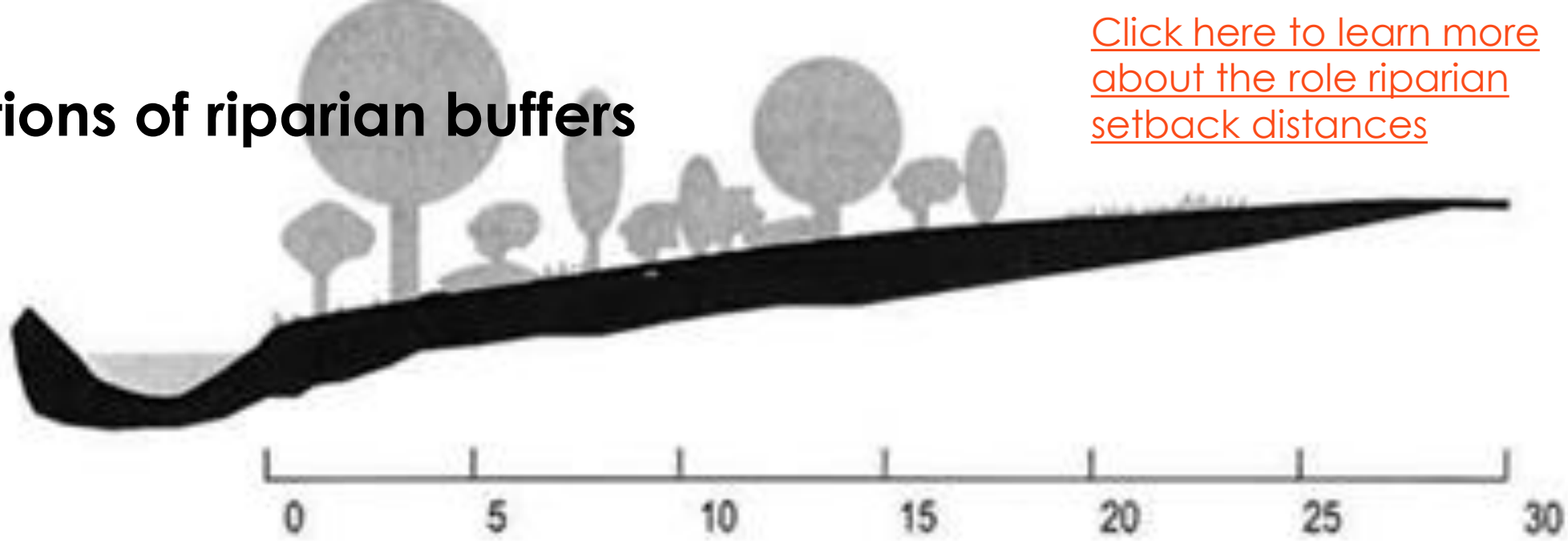


https://beeflambnz.com/wintergrazing/pre-grazing

Take action to reduce potential losses of sediment, nutrients and E. coli to waterways during wetter months

Functions of riparian buffers

[Click here to learn more about the role riparian setback distances]



Livestock damage
Fish habitat
Bank stability
Flood control
Shade
Leaf input
Filtration
Wood input
Nutrient uptake
Wildlife habitat

Diagram from conference paper by J Quinn (2012)

Riparian management - results from New Zealand

Riparian management schemes assessed, showing measures of water quality and stream health recorded as better (+), worse (–), or no change (=) in the buffer compared to the control reach for each variable.

Site	Time since planting (yr)	Planted length (m)	Average buffer width (m)	Difference in buffer relative to pasture control reach: Phosphorus (over 10% change in dissolved P)	Nitrogen (over 10% change in dissolved N)	Faecal inputs (over 10% change in *E. coli*)	Visual clarity (over 10% change)	Mean temp-perature (more than 1 deg change)	Stability (change in Pfankuch class)**	Invertebrates (change in QMCI class)***
Raglan	2	200	12.7	+	+	–	=	=	+	=
Matarawa	3	300	3.5	–	=	+	+	=	+	–
Little Waipa	4	660	10.6	+	=	+	+	–	=	=
Waitetuna	6	1600	7.2	=	–	nd	–	=	=	=
Mangawara	8	200	15.5	=	=	=	=	nd	=	+
Tapapakanga	10	2000	11.4	+	+	+	+	–	=	–
Kakahu*	20	3600	21	+	+	nd	+	+	=	+
Waitomo	20	100	18.8	=	=	–	–	=	=	=
Taupo*	24	4200	75	+	–	nd	+	+	+	+

Click here to view source publication

What can we do to improve catchment health?

- Retire & plant marginal land
- Exclude stock from streams, wetlands & boggy areas
- Plant retired riparian margins
- Manage nutrients & effluent conservatively
- Identify and address CSAs