Mid Mokau Piopio & Mangaotaki-Mairoa 2021 Freshwater Monitoring Results

Merrin Whatley (PhD) – 26 July 2022

Overview

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

Photo: Susan Stoddard

Indicators of Freshwater Health

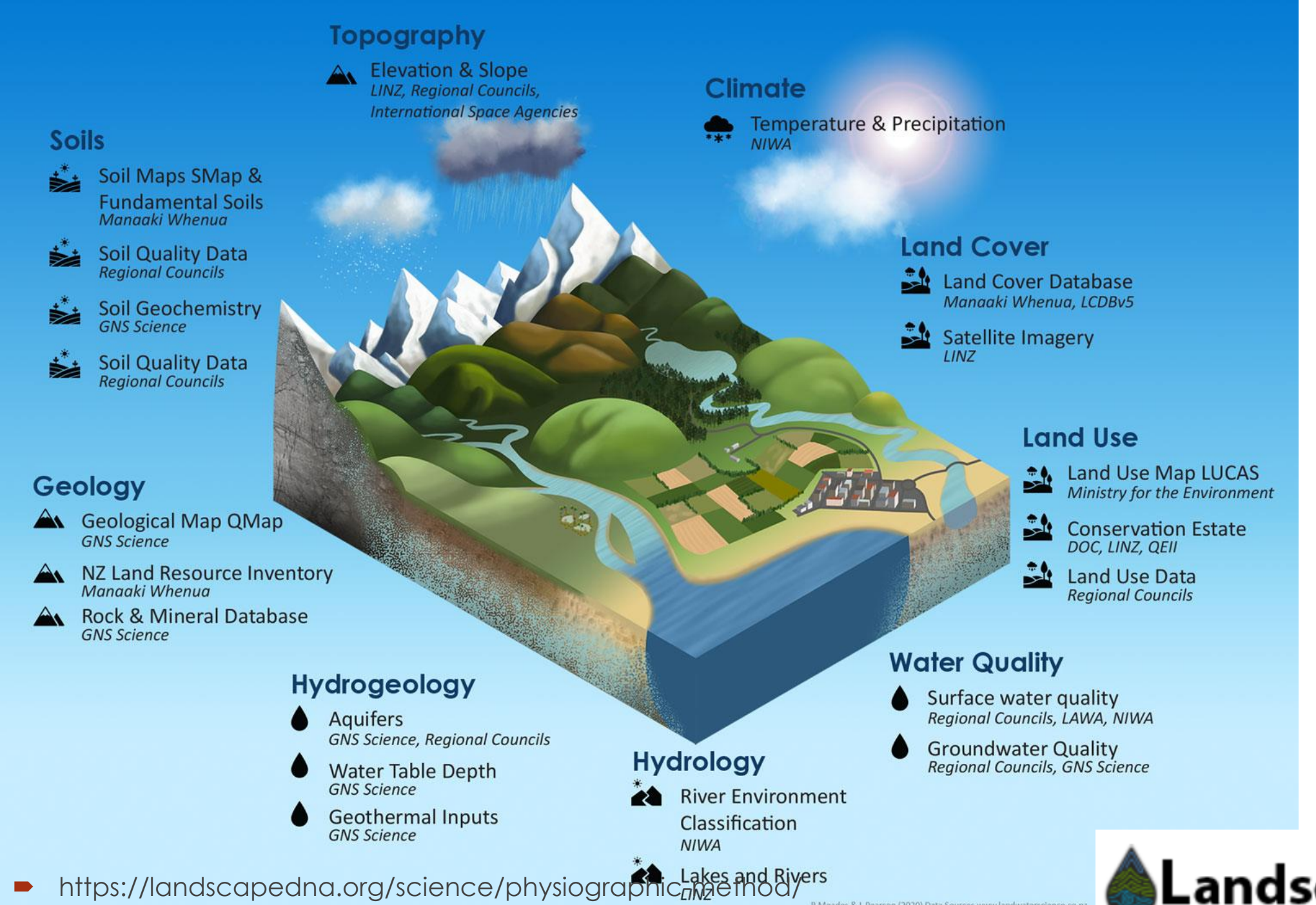
- Habitat
- Flow
- Wildlife
- Energy & Nutrient Dynamics
- Water Quality

Identifying drivers of Health/Mauri of our Waterways

- The key resources, attribute/indicator?
- 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 resource loss over time and space.

Natural Influences

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



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

LandscapeDNA

Mid Mokau –Piopio

Map Information

Oxidising Soil & Aquifer

Variants

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

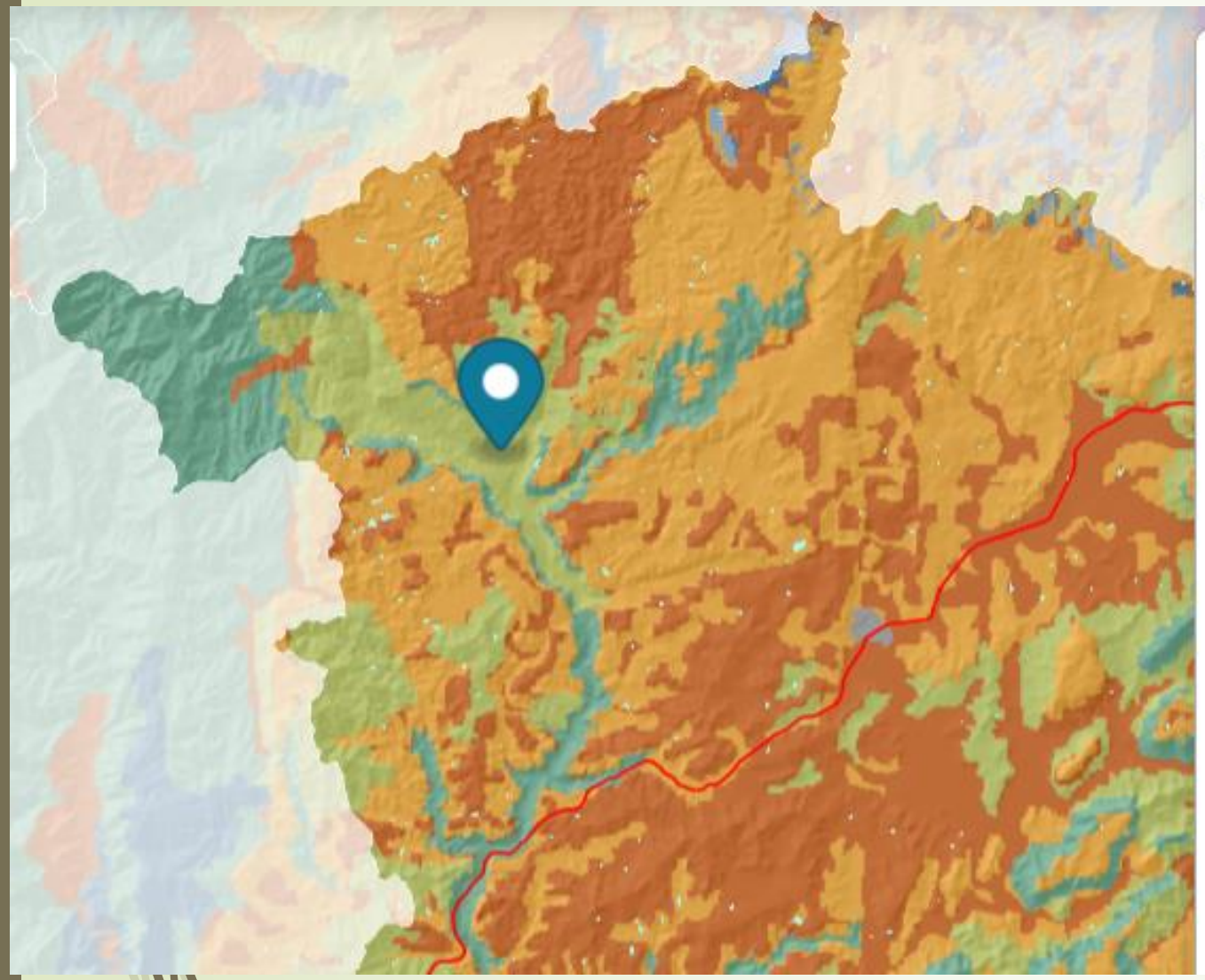
Key Information

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

Mangaotaki/Mairoa



Map Information

Weak Bedrock

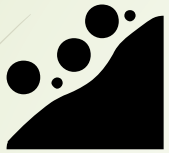
Variants

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

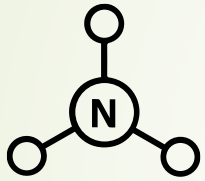
Key Information

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

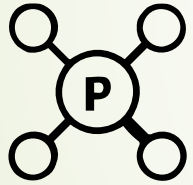
Attribute Descriptions



Water Clarity – Suspended Particles Including Sediment

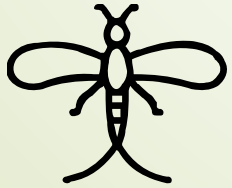


Nitrate



Dissolved Reactive Phosphorus (DRP)

Pathogens/E. coli (short for Escherichia coli)



Freshwater Macroinvertebrate Community Index (MCI)

Monitoring in Mid Mokau – Piopio

Waikato Regional Council Sites

- Mokau River – 22 sites in total
  - 5 River Water Quality Sites
  - 16 Ecological Monitoring Sites
  - 1 River flow Site
- Mid Mokau - 2 Ecology site

Frequency of Measurements

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

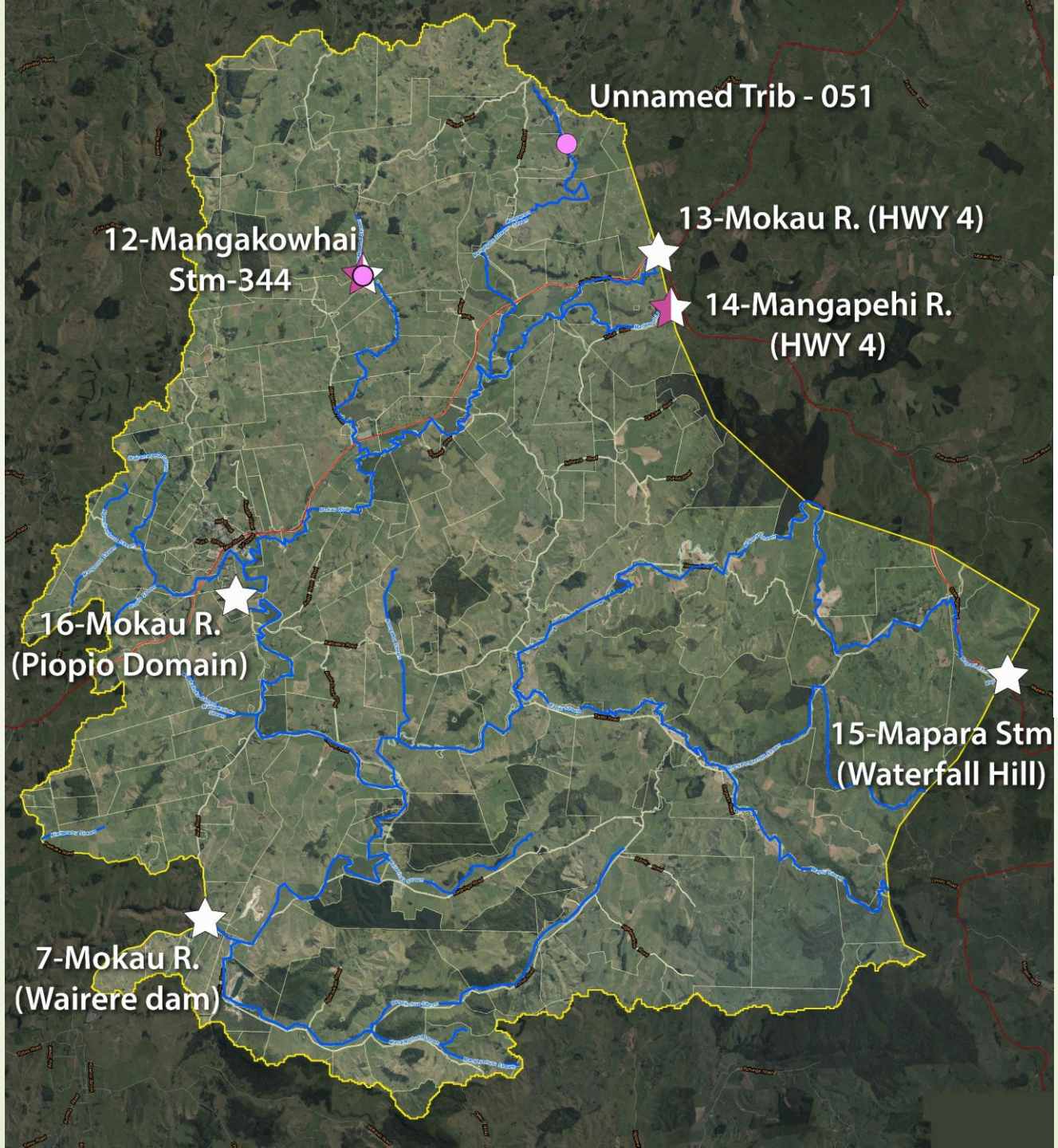
Monitoring in Mid Mokau – Piopio

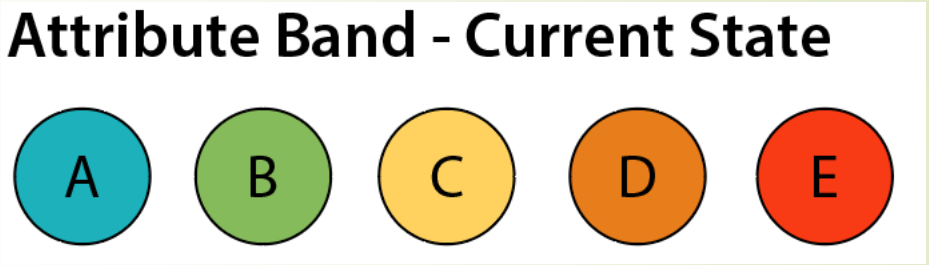
KCRC Sites

- Upper Mokau-Mangaphei SC – 6 sites in total
- 6 Water Quality sites
- 2 eDNA site

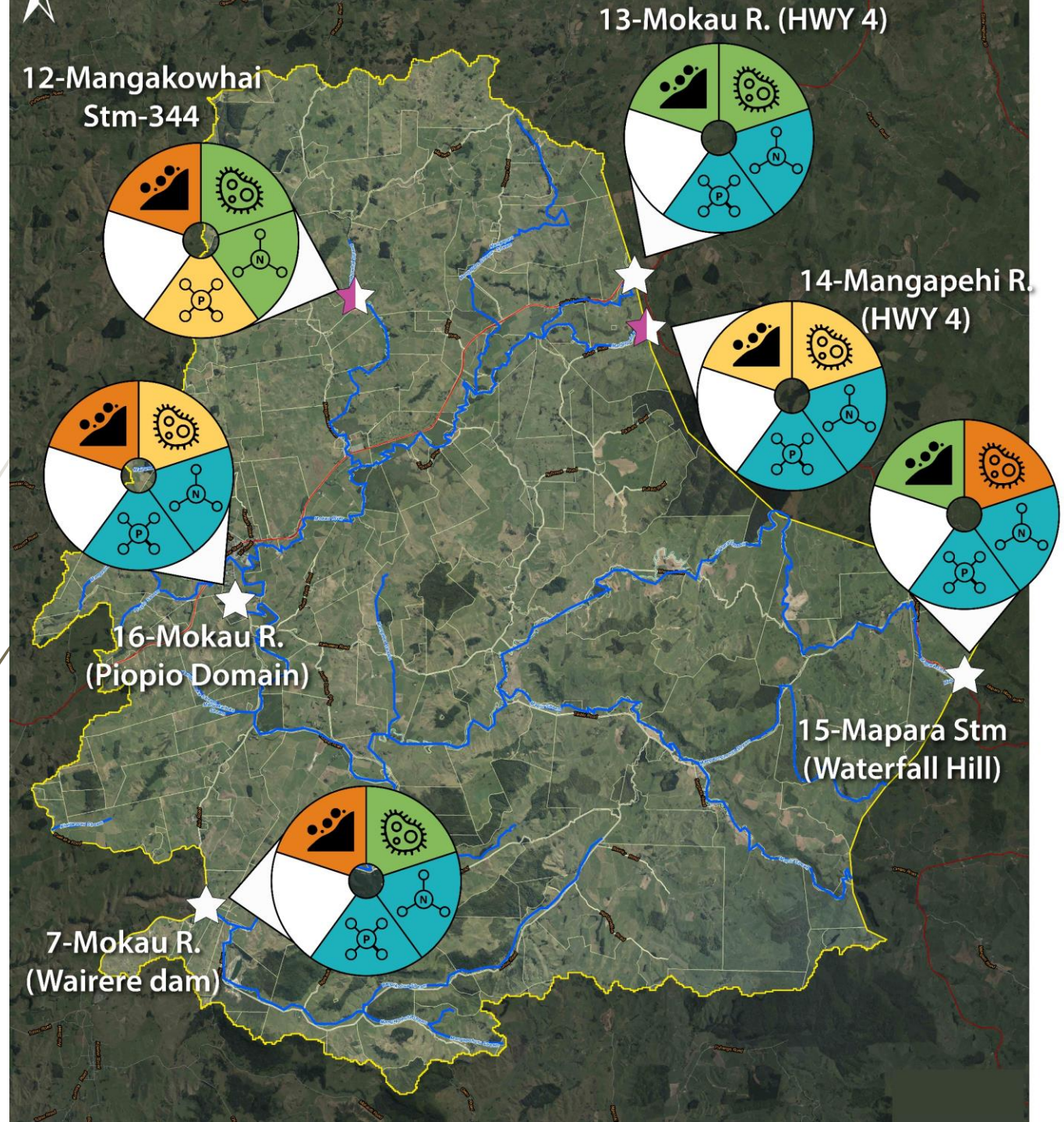
Frequency of Measurements

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


Unnamed Trib - 051
13-Mokau R. (HWY 4)
12-Mangakowhai Stm-344
14-Mangapehi R. (HWY 4)
16-Mokau R. (Piopio Domain)
15-Mapara Stm (Waterfall Hill)
7-Mokau R. (Wairere dam)
Monitoring Sites
Aquatic Life - WRC
Water Quality - WRC
River Flow - WRC
Water Quality - KCRC
eDNA - KCRC



Attribute Dials



Key Results

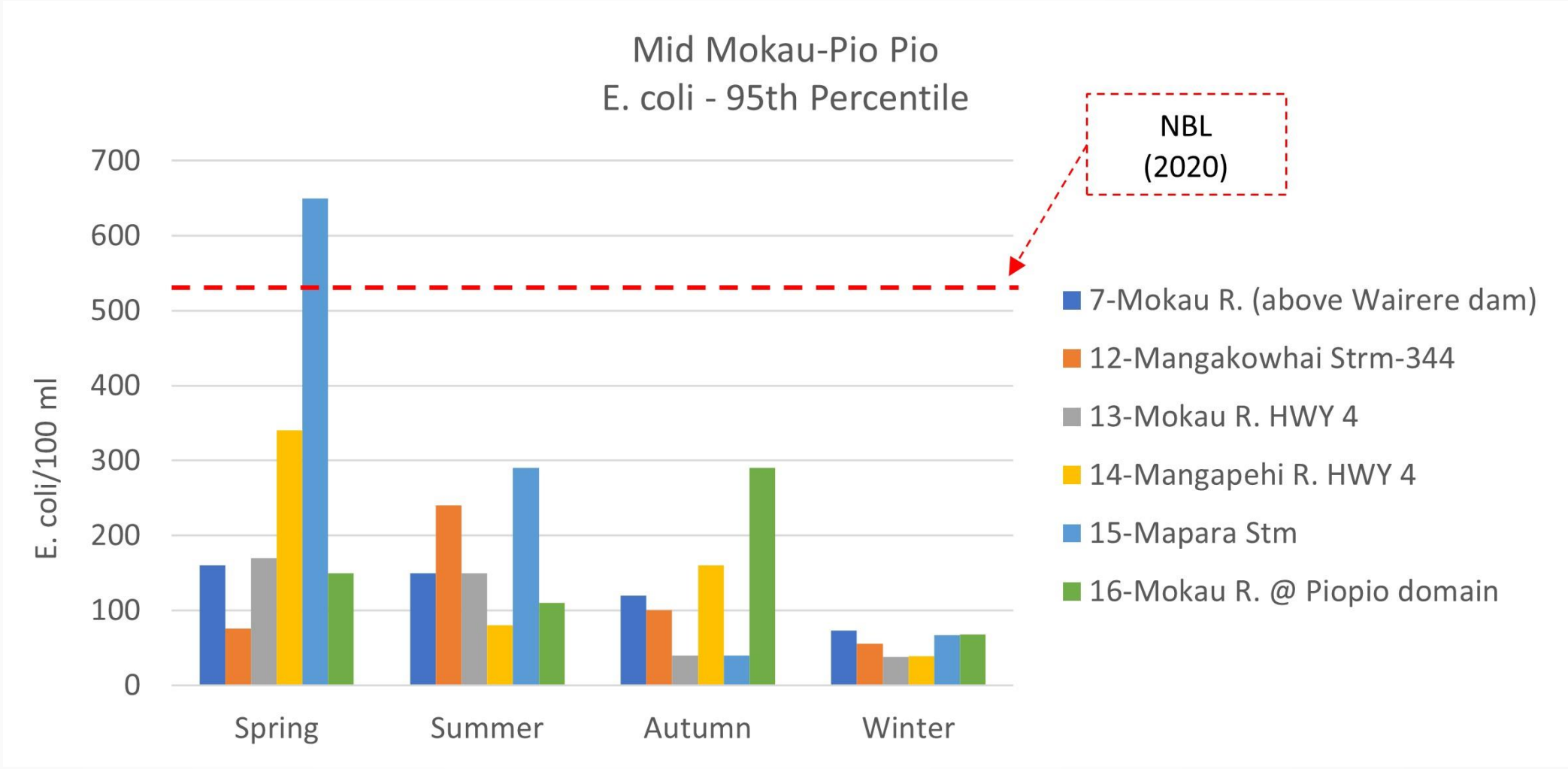
- E. coli and water clarity are the attributes to watch
- DRP and Nitrate are elevated at 12-Mangakowhai Stm
- Highest WQ at 13-Mokau R. HWY4
- Lowest WQ at Mangakowhai Stm

Mid Mokau-Pio Pio 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**	
7-Mokau R, above Wairere Dam*	159 ↓	0.45 ↓	0.95 ↓	0.010	0.018 ↓	0.006 ↓	0.008 ↓	1.27 ↑	1.34
12-Mangakowhai Strm-344	219 ↓	1.98 ↑	2.34 ↑	0.003 ↓	0.017 ↓	0.016 ↑	0.018 ↓	1.15 ↑	1.34
13-Mokau R. HWY 4	167 ↓	0.26 ↓	0.72 ↓	0.007 ↓	0.010 ↓	0.003 ↓	0.005 ↓	1.58 ↑	1.34
14-Mangapehi R. HWY 4*	313 ↓	0.39 ↓	0.63 ↓	0.006 ↓	0.026 ↓	0.005 ↓	0.007 ↓	1.35 ↑	1.34
15-Mapara Stm*	596 ↓	0.30 ↓	0.47 ↓	0.003 ↓	0.006 ↓	0.006 ↓	0.008 ↓	1.60 ↑	1.34
16-Mokau R. @ Piopio domain	269 ↓	0.52 ↓	1.09	0.009 →	0.019 ↓	0.006 ↓	0.006 ↓	1.33 ↑	1.34
WRC WQ SITES									
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**

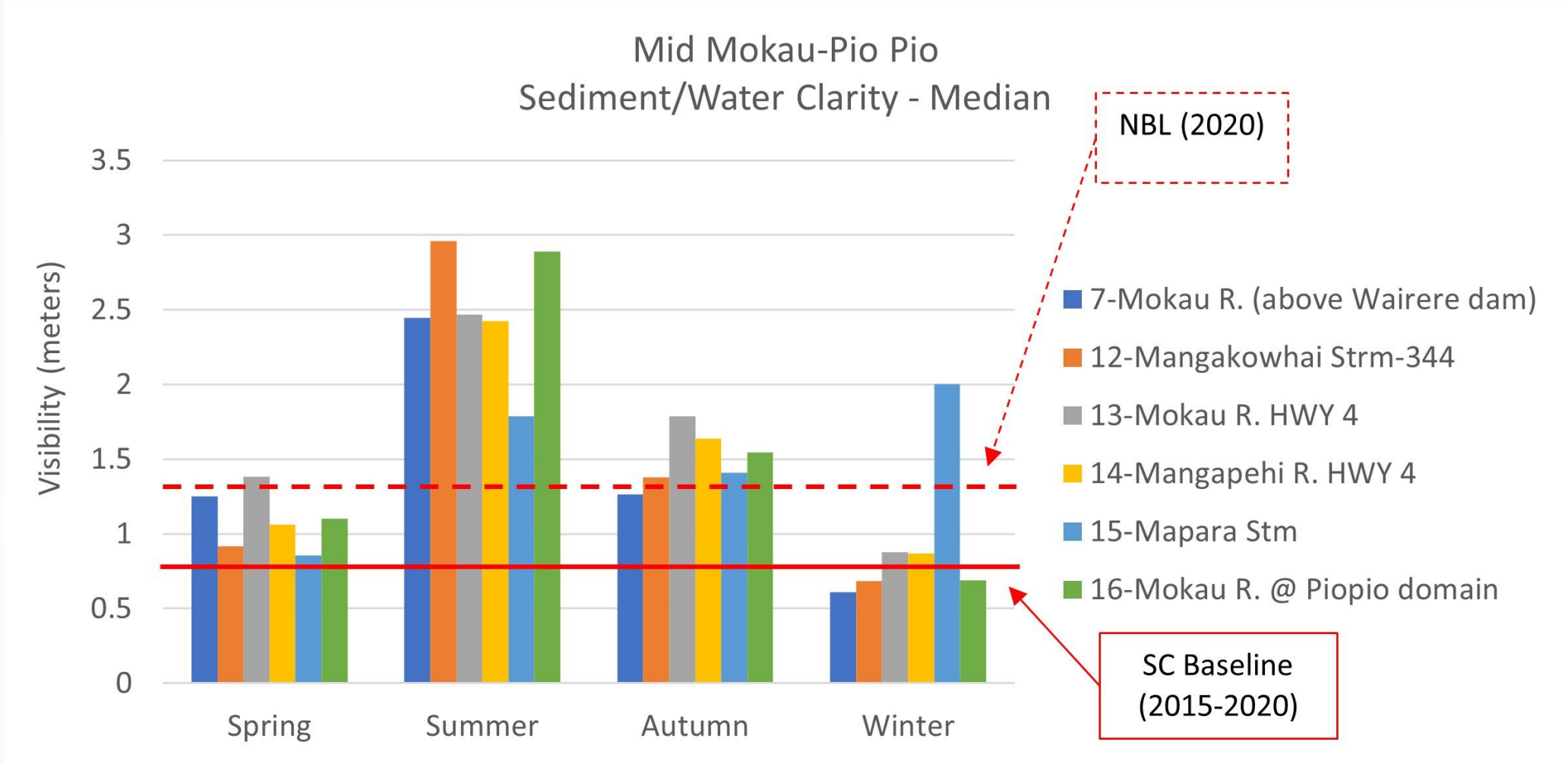
Annual Summary

Attribute Band - Current State

A B C D E



E. Coli – Seasonal Results



Water Clarity – Seasonal Results

Monitoring in Mangaotaki-Mairoa

Waikato Regional Council Sites

- 6 sites in total
- 1 River Water Quality
- 5 Ecology sites

Frequency of Measurements

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

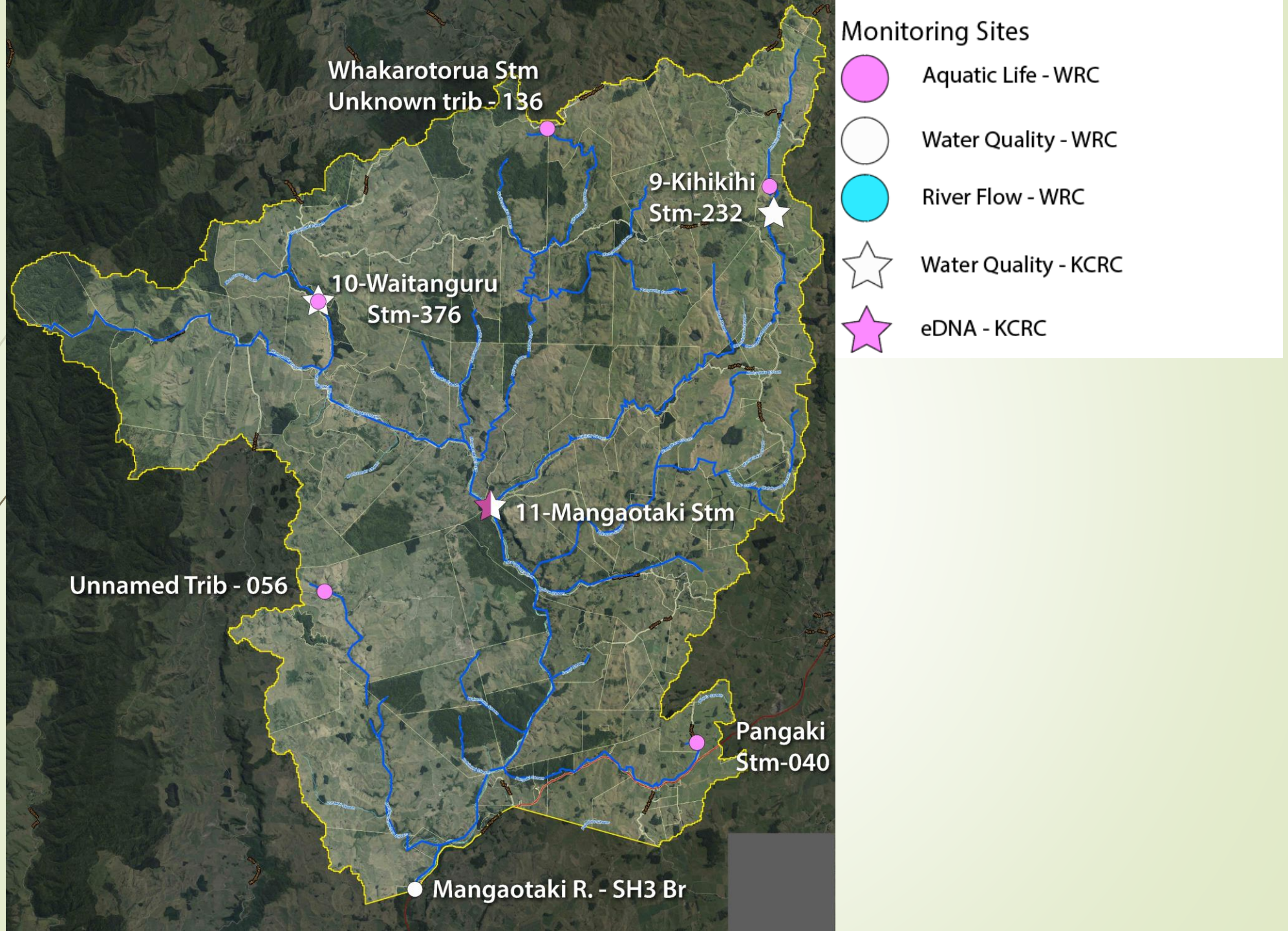
Monitoring in Mangaotaki-Mairoa

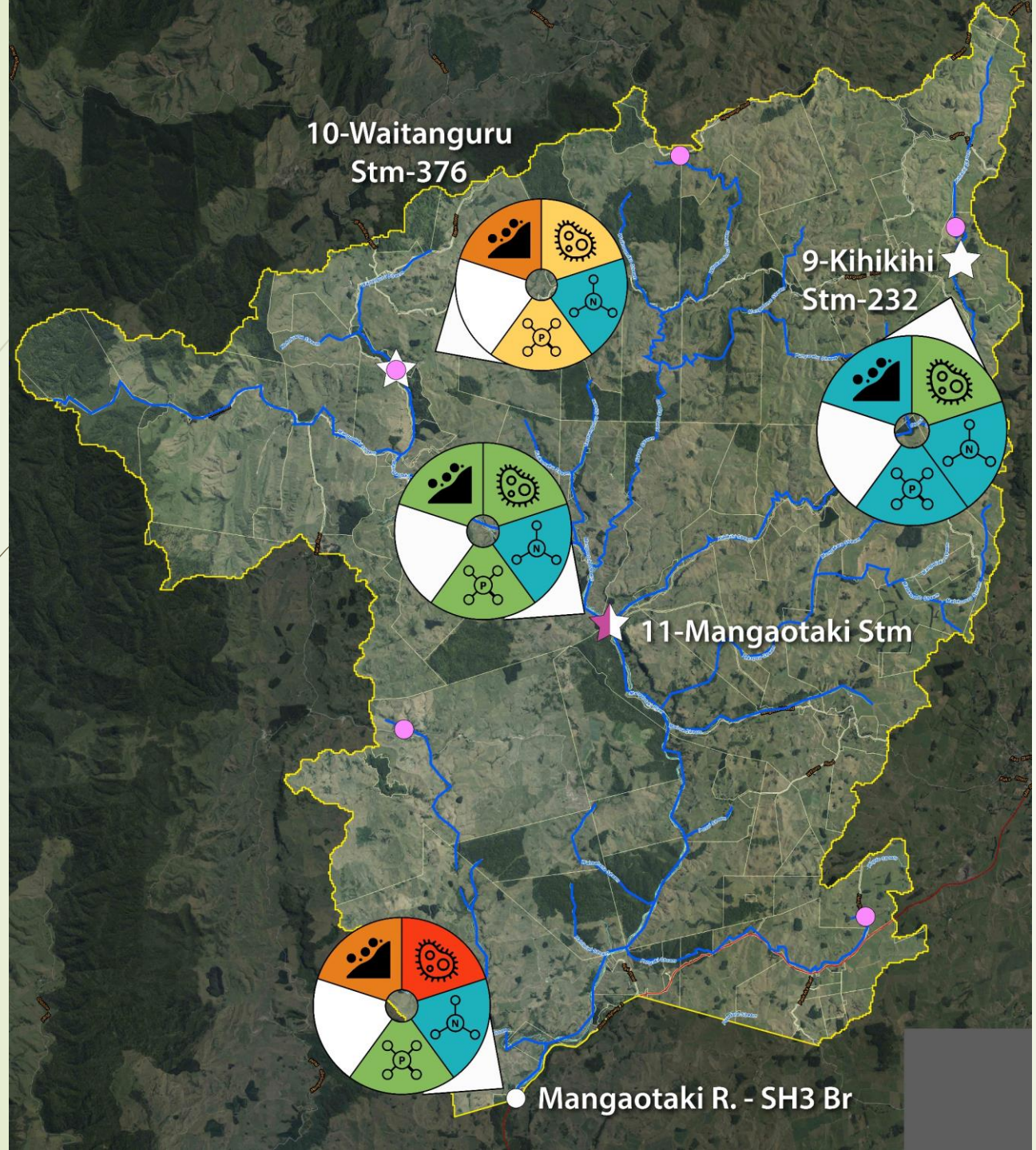
KCRC Sites

- Upper Mokau-Mangaphei SC – 3 sites in total
- 3 Water Quality sites
- 1 eDNA site

Frequency of Measurements

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


Whakarotorua Stm
Unknown trib - 136
9-Kihikihi
Stm-232
10-Waitanguru
Stm-376
11-Mangaotaki Stm
Unnamed Trib - 056
Pangaki
Stm-040
Mangaotaki R. - SH3 Br
Monitoring Sites
Aquatic Life - WRC
Water Quality - WRC
River Flow - WRC
Water Quality - KCRC
eDNA - KCRC



Key Results

- Water clarity and E. coli are the attributes to address
- DRP is elevated at Waitanguru

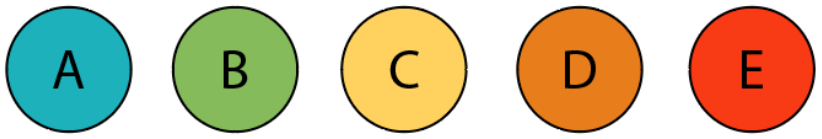
In general:

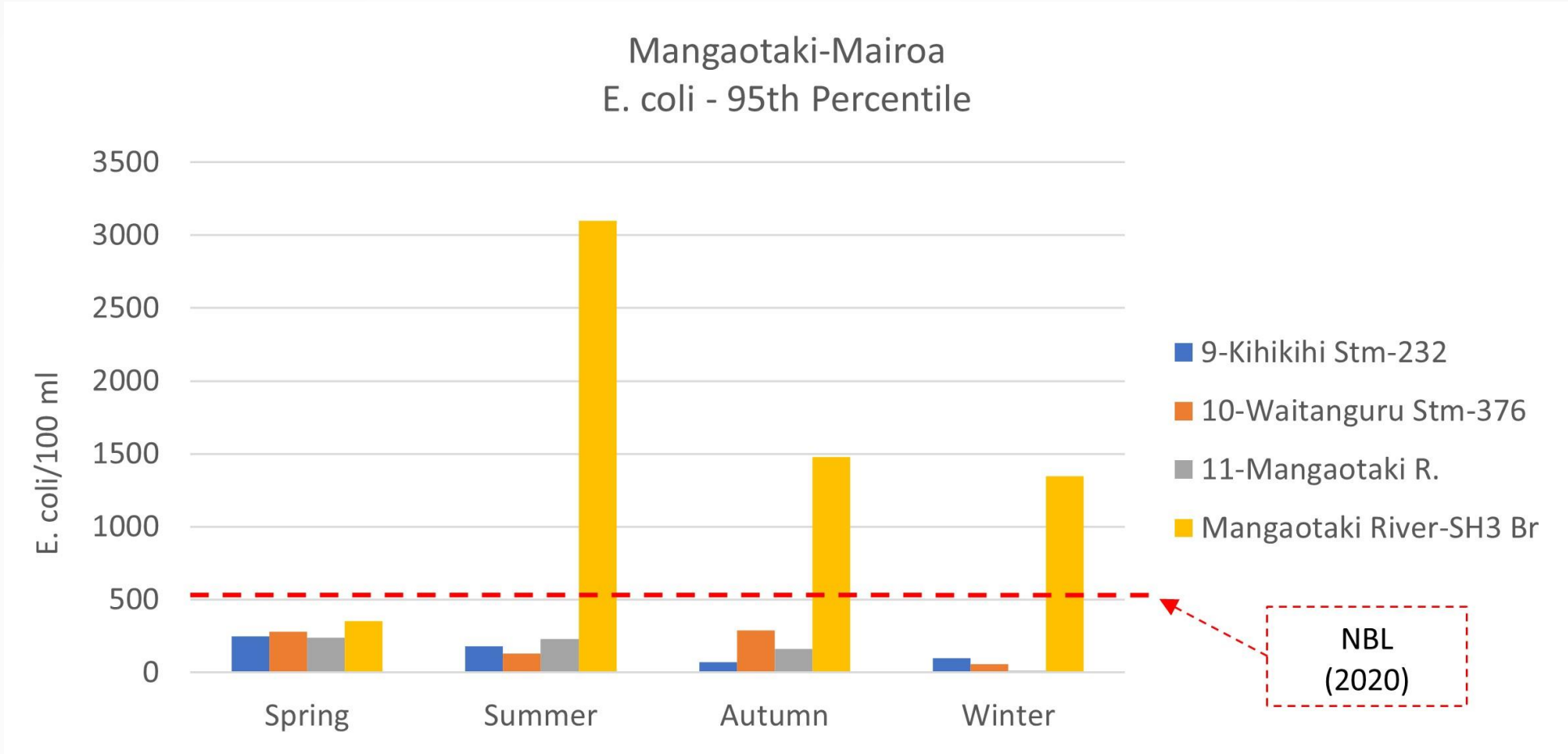
- highest water quality at 9.Kihikihi Stm
- Lowest general WQ at Mangaotaki R. – SH3 Br

Mangaotaki-Mairoa Annual Summary 2021 Labs: Hill/Analytica	Human Contact	Ecosystem Health							
		Water Quality						Sediment	
	E. coli/100 ml	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**	
9-Kihikihi Stm-232	240 ↓	0.66 ↑	0.96 ↓	0.006 ↓	0.061 ↑	0.003 ↓	0.008 ↓	1.94 ↑	1.34
10-Waitanguru Stm-376	289 ↓	0.61 ↑	1.03 ↑	0.005 ↓	0.010↓	0.015 ↑	0.118 ↓	1.25 ↑	1.34
11-Mangaotaki R.	239 ↓	0.55 ↑	0.81 ↓	0.004 ↓	0.007 ↓	0.009 →	0.013 ↓	1.56 ↑	1.34
WRC WQ SITES									
Mangaotaki River-SH3 Br	2535 ↓	0.61 ↑	0.85 ↓	0.005 ↓	0.014 ↓	0.010 ↑	0.021 ↓	1.02 ↑	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**

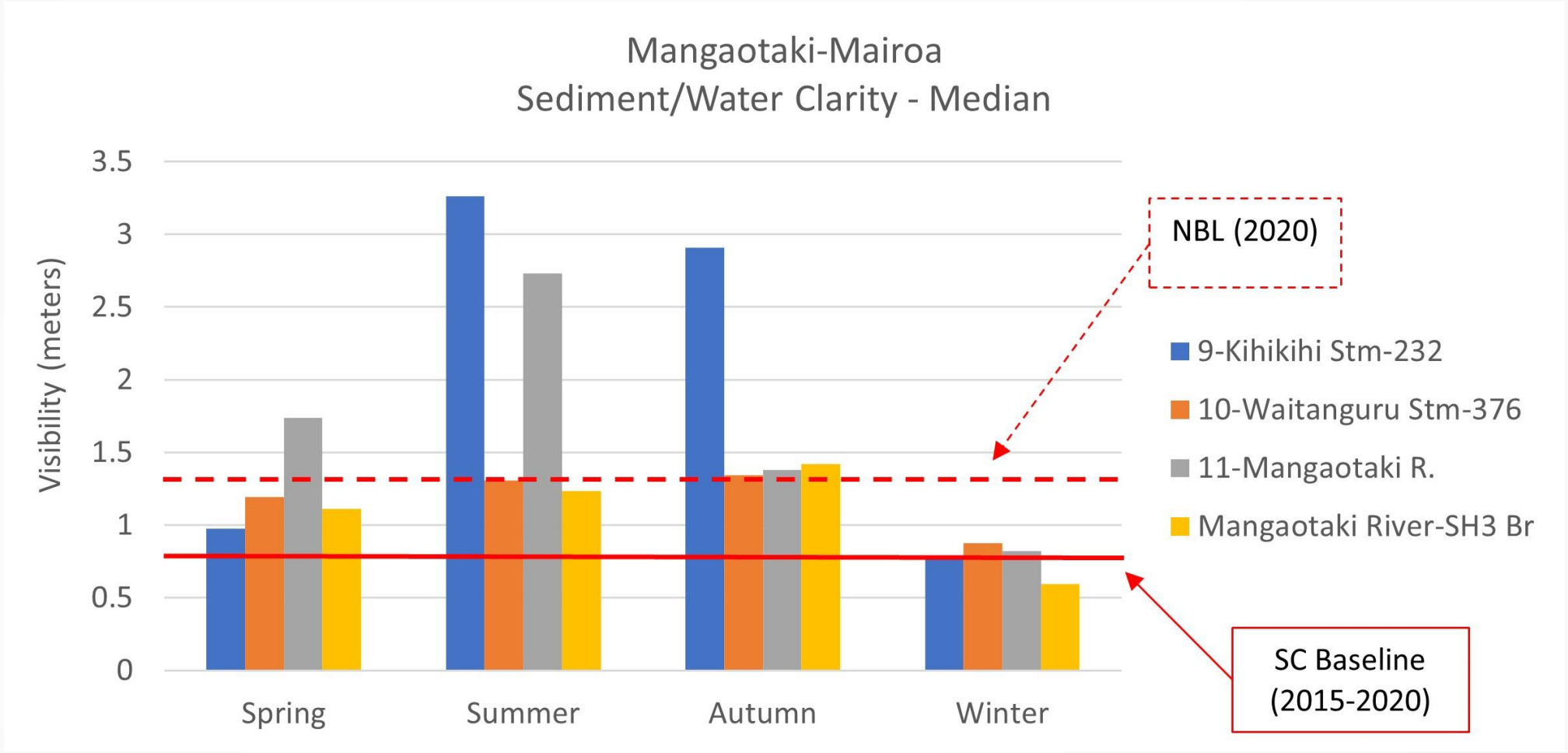
Annual Summary

Attribute Band - Current State

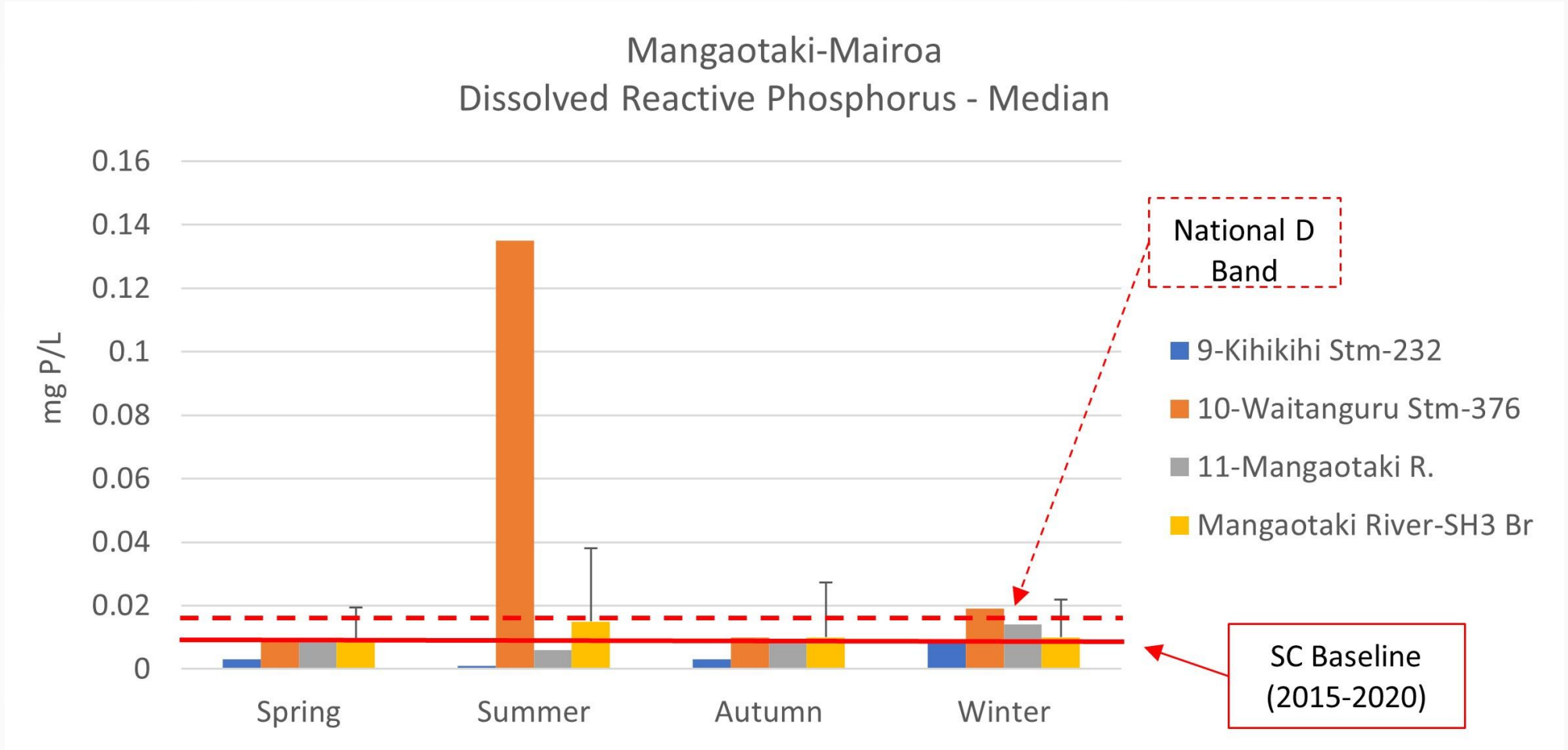




E. Coli – Seasonal Results



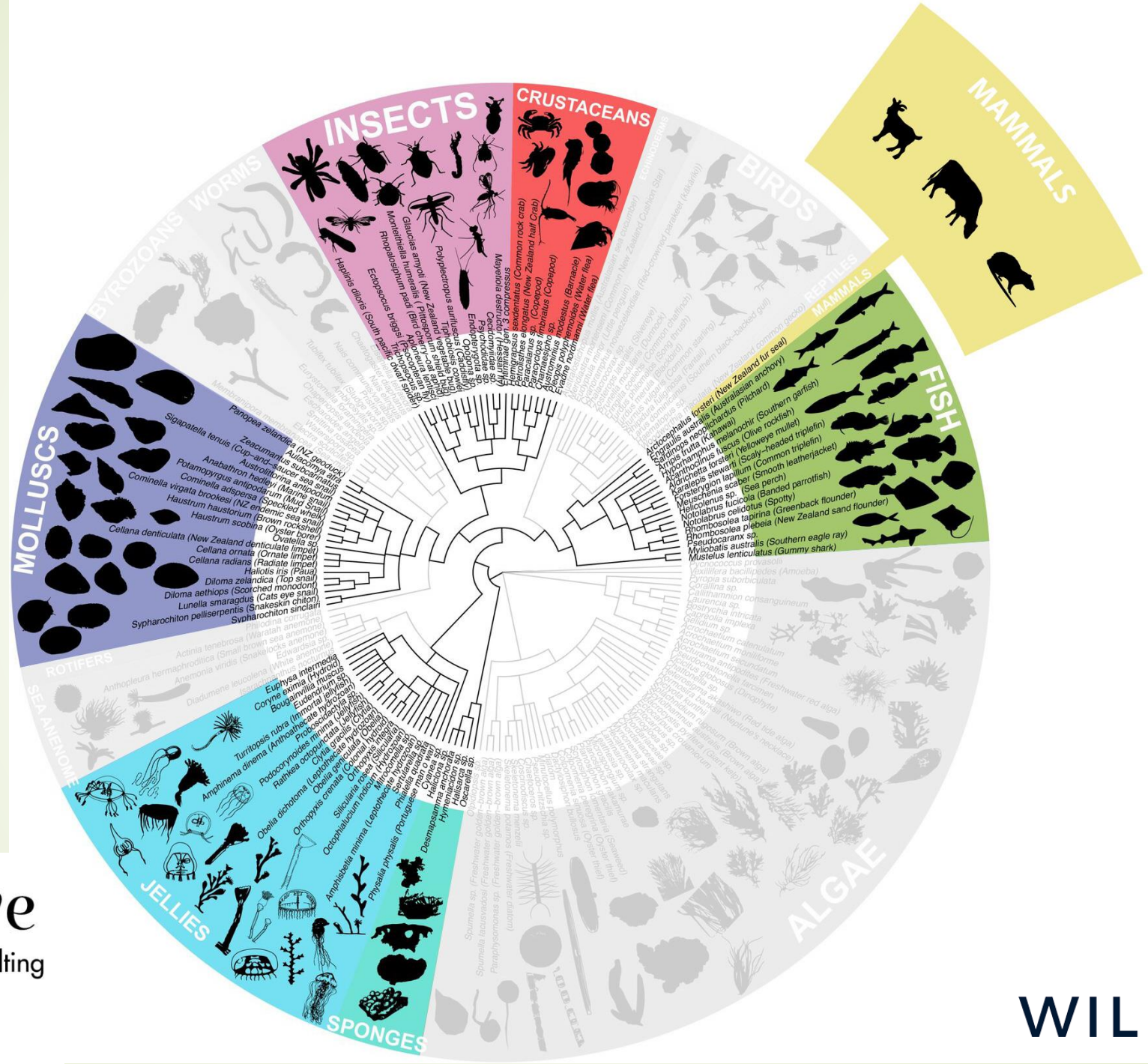
Water Clarity – Seasonal Results



DRP – Seasonal Results

Environmental DNA (eDNA)

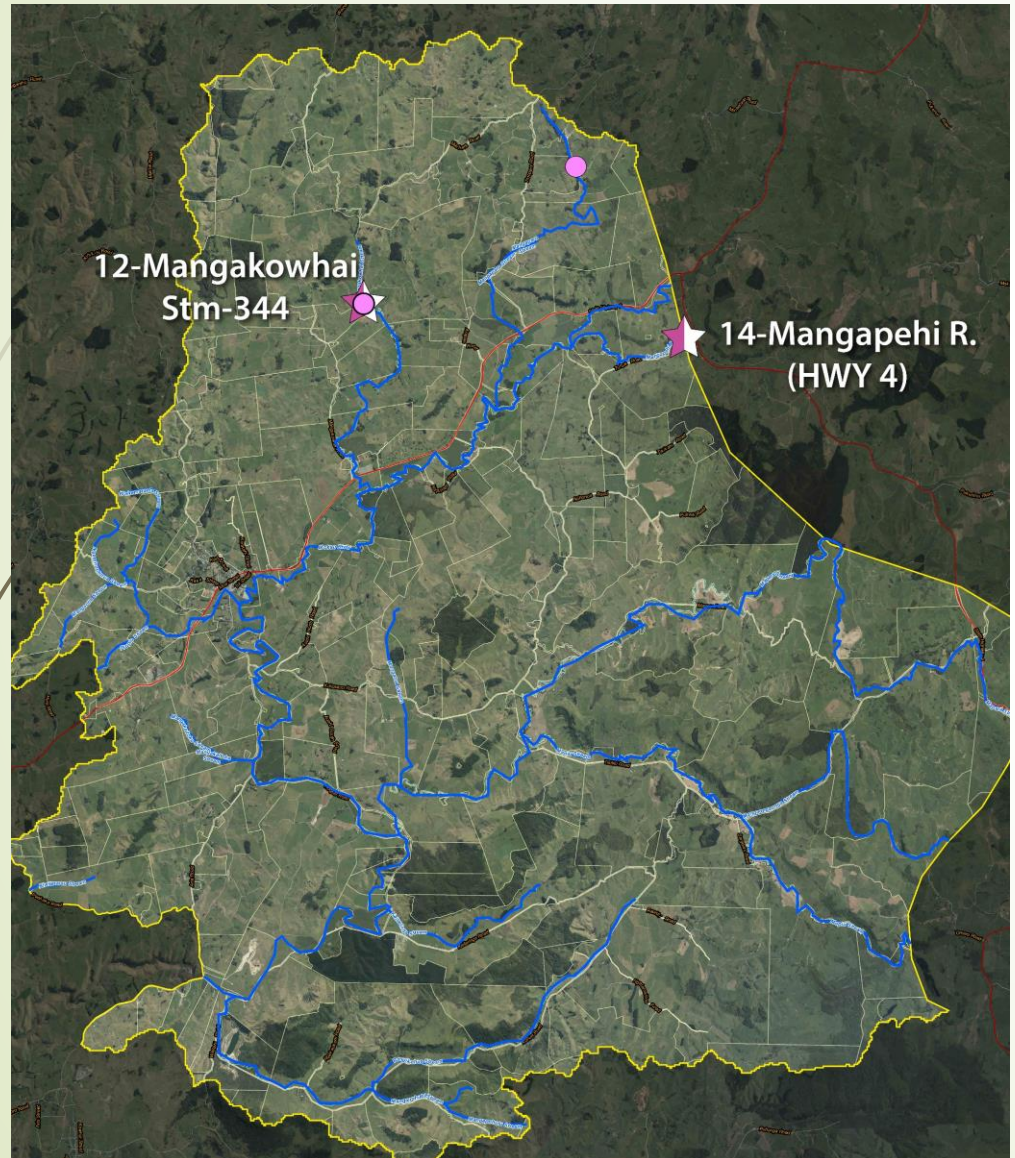
WILDERLAB



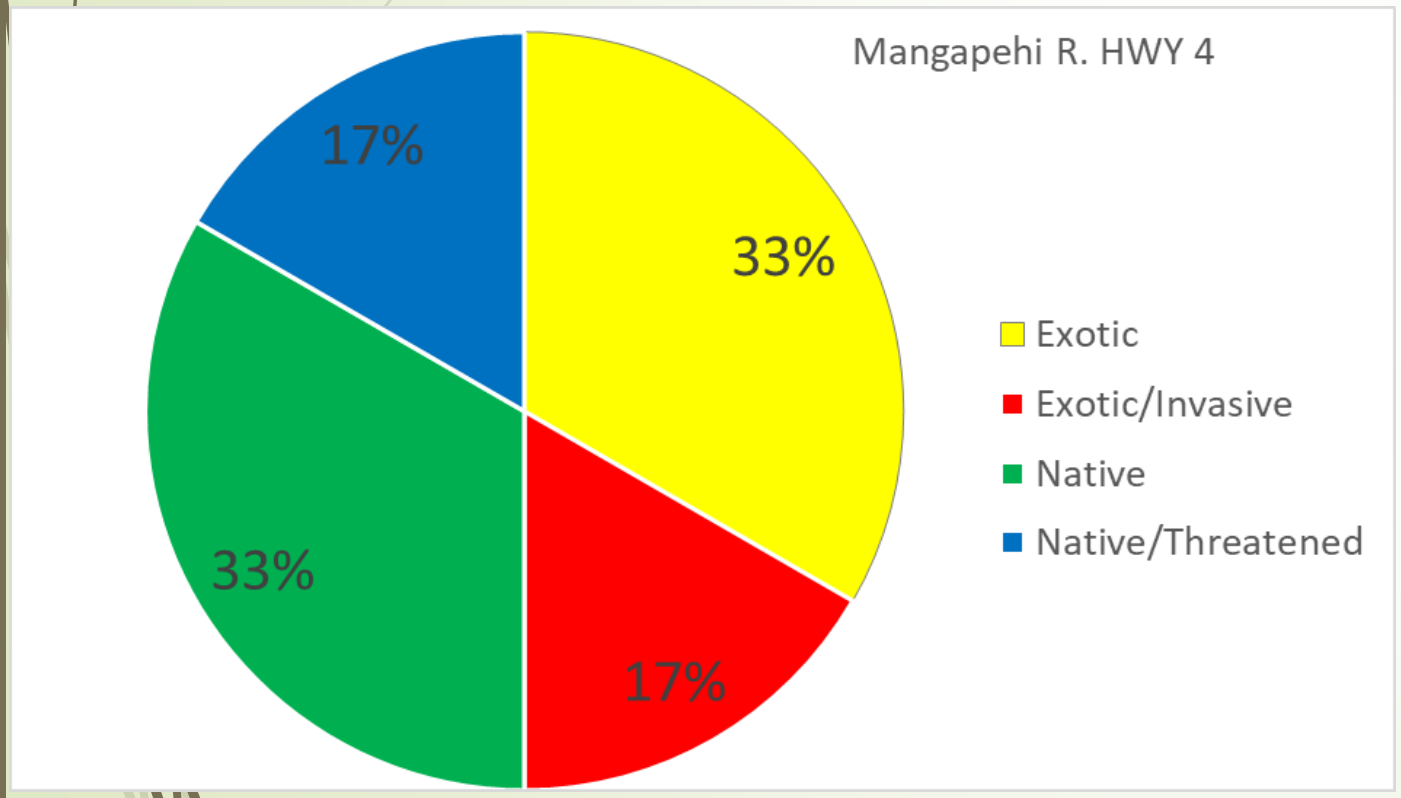
Adaptive
Environmental Consulting

WILDERLAB

eDNA site Mid Mokau

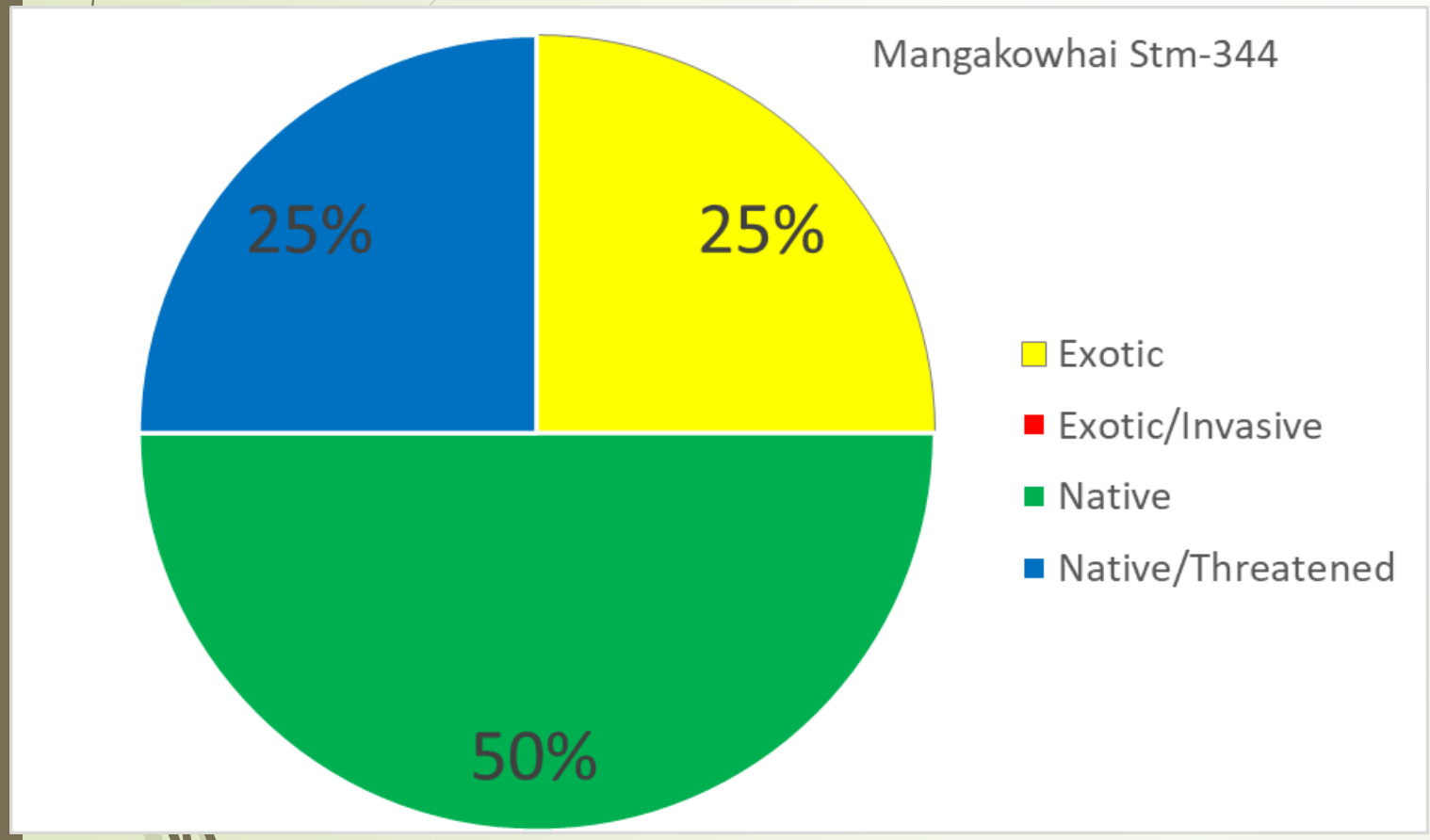


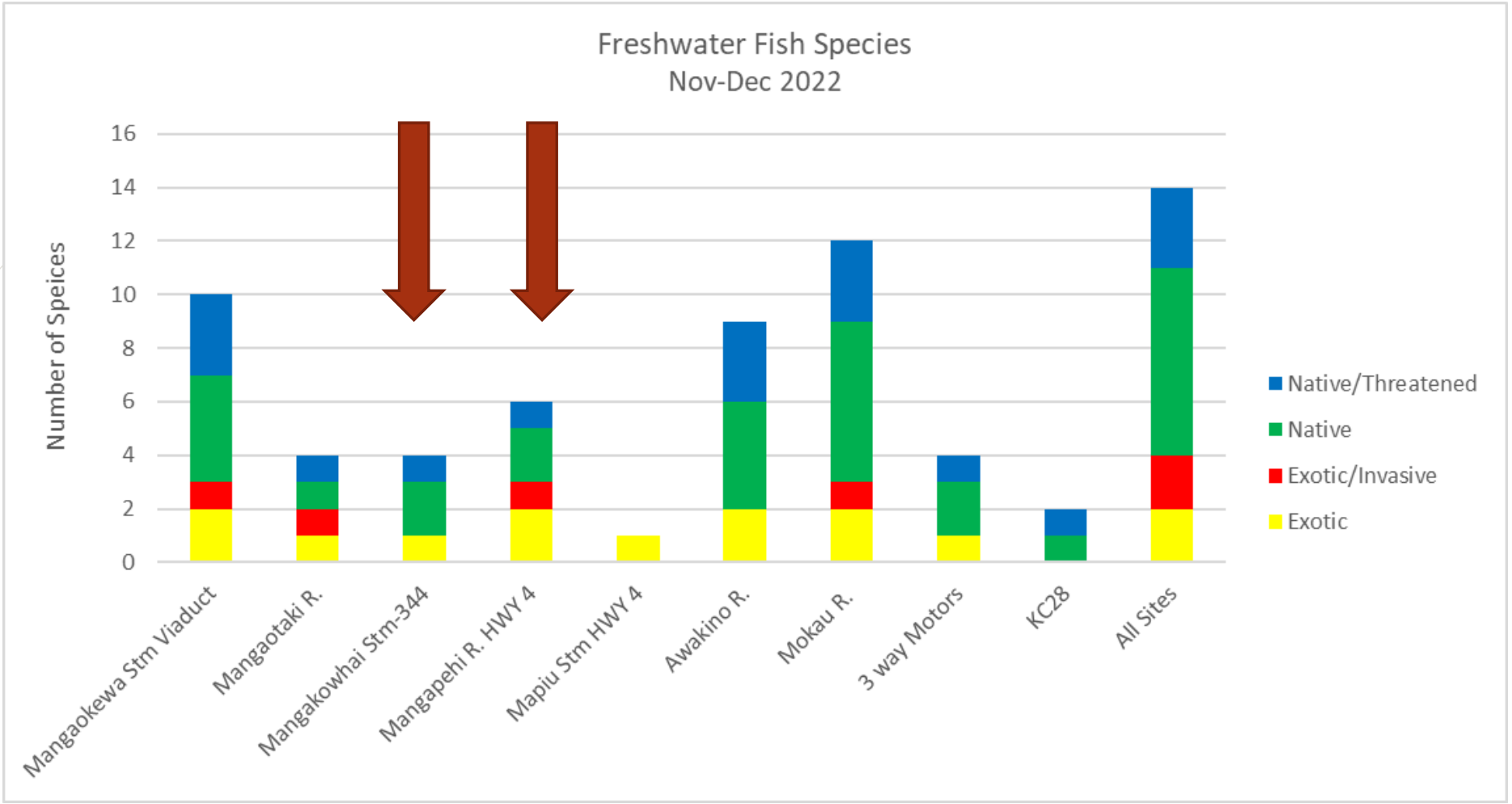
Mangapehi - Freshwater Fish Species
Threat status




Gambusia – Exotic - invasive

Manakowhai - Freshwater Fish Species
Threat status





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

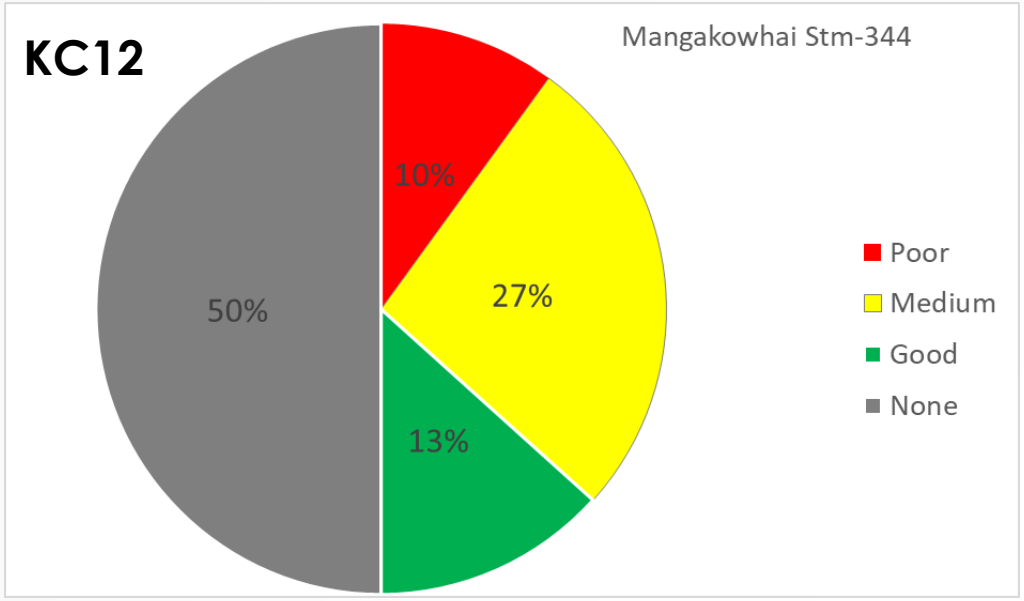
FACTSHEET

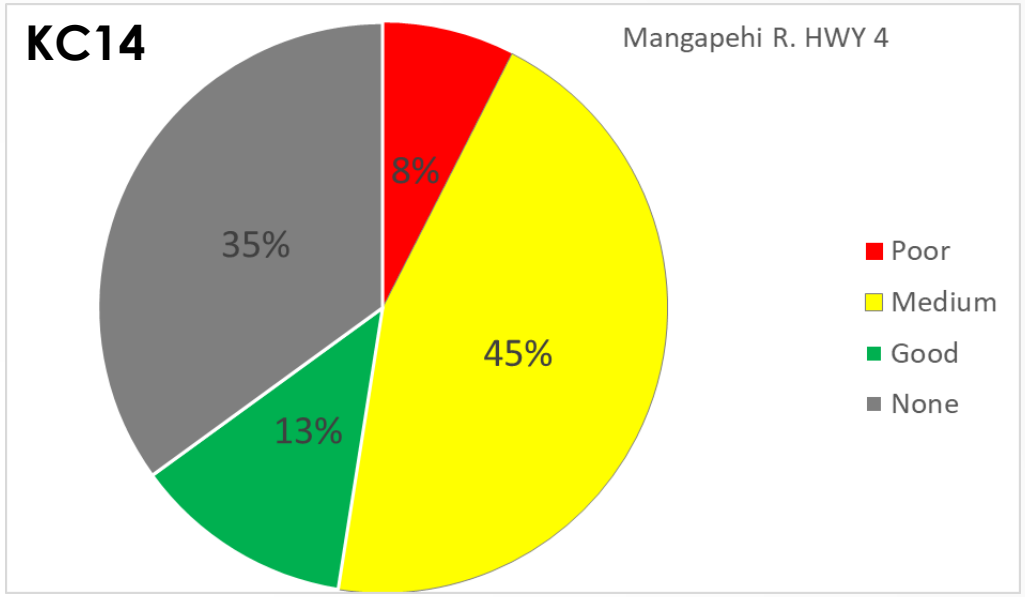
Chironomid midge (*Chironomus*)
Midges

Rat tail maggots (Syrphidae)
Other true flies

Macroinvertebrate Community Index Scores (MCI) 1 - 10

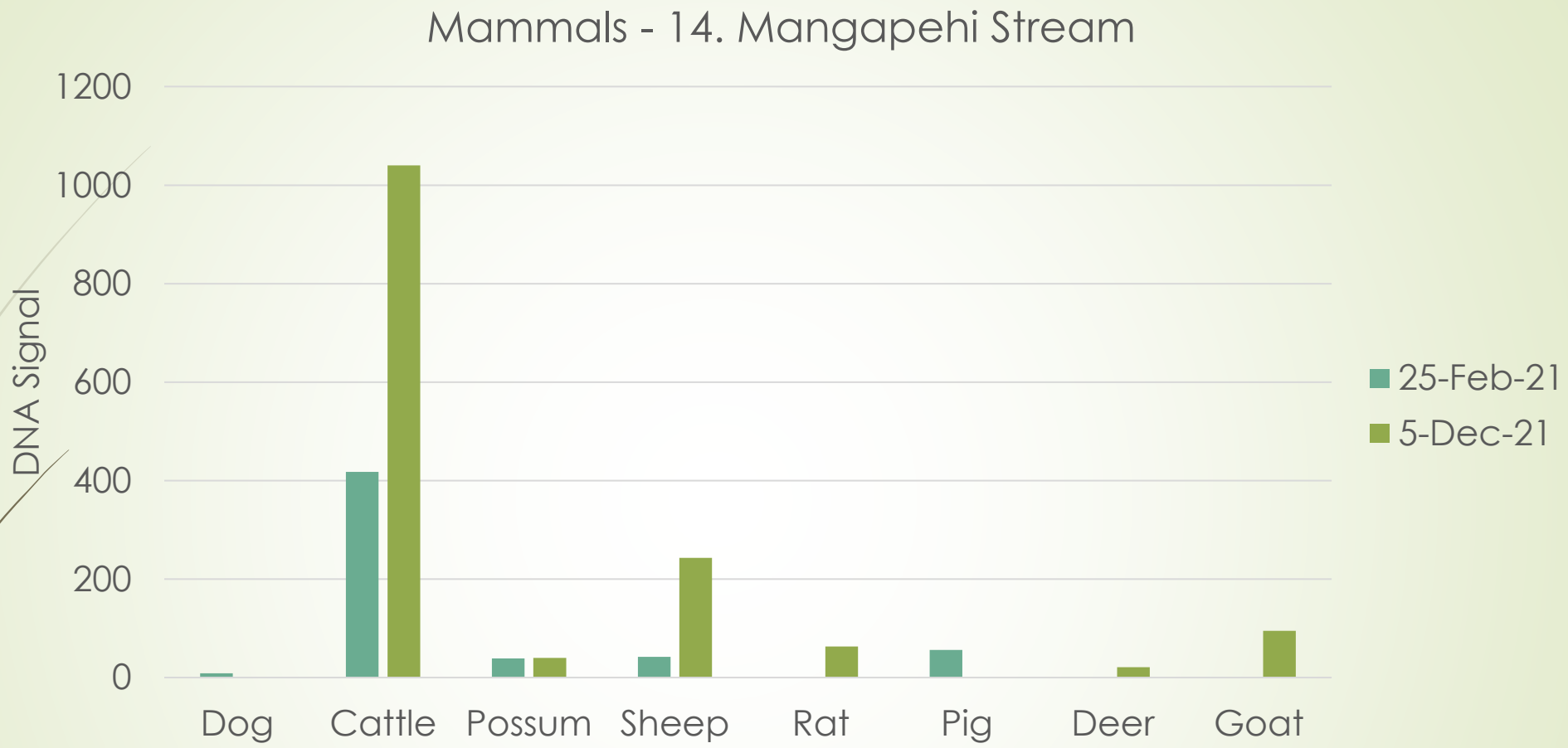
Dec 2021 – All Invertebrates



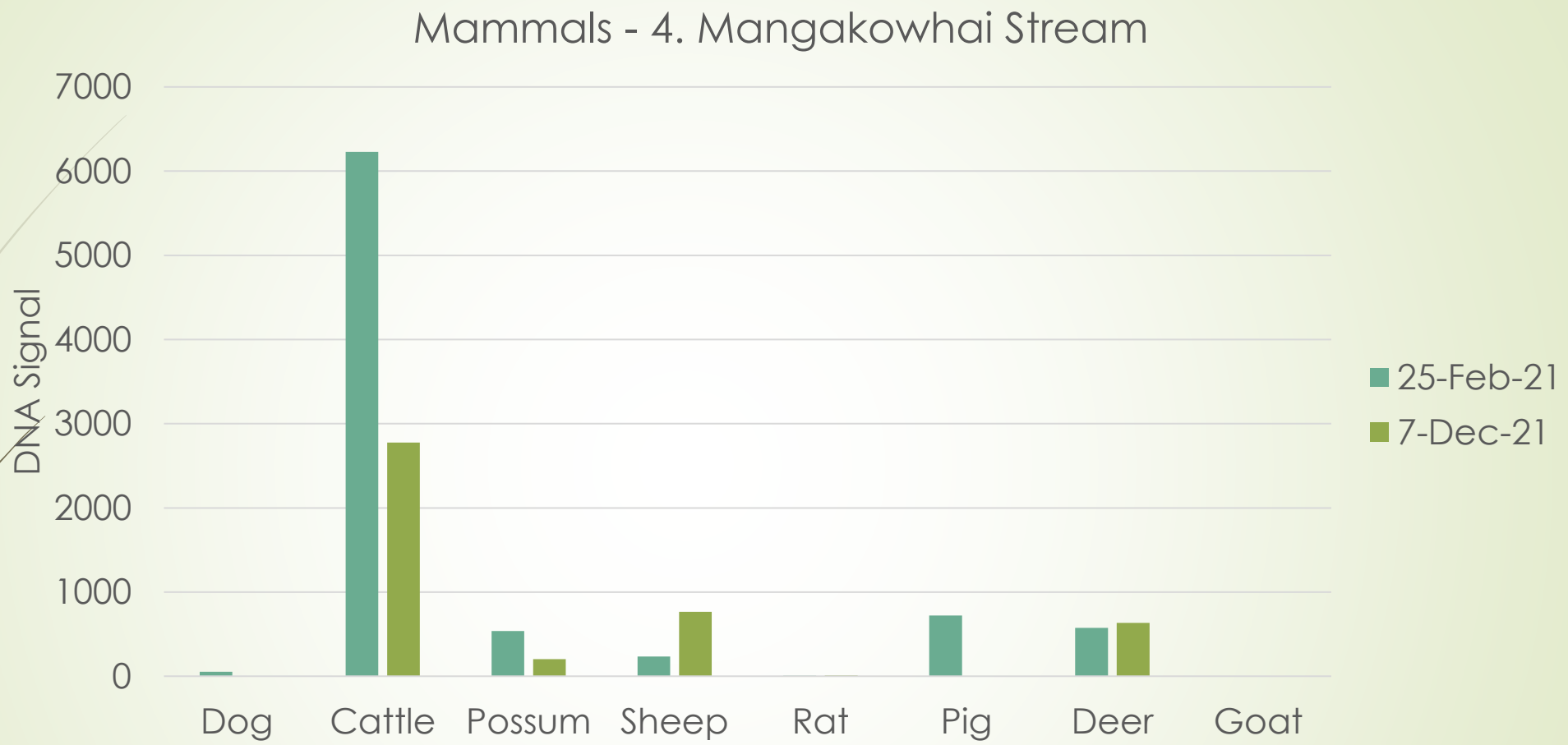


Sites	KC4 Mangaokewa Stm Viaduct	KC11 Mangaotaki R.	KC12 Mangakowhai Stm-344	KC14 Mangapehi R. HWY 4	KC20 Mapiu Stm HWY 4	KC25 Awakino R.	KC26 Mokau R.	KC27 3 way Motors	KC28 KC28
MCI Score	119	126	109	112	112	127	105	101	121
National Grade	B	B	C	B	B	B	C	C	B

Freshwater Invertebrate Community Health Index (MCI) eDNA Results 2021

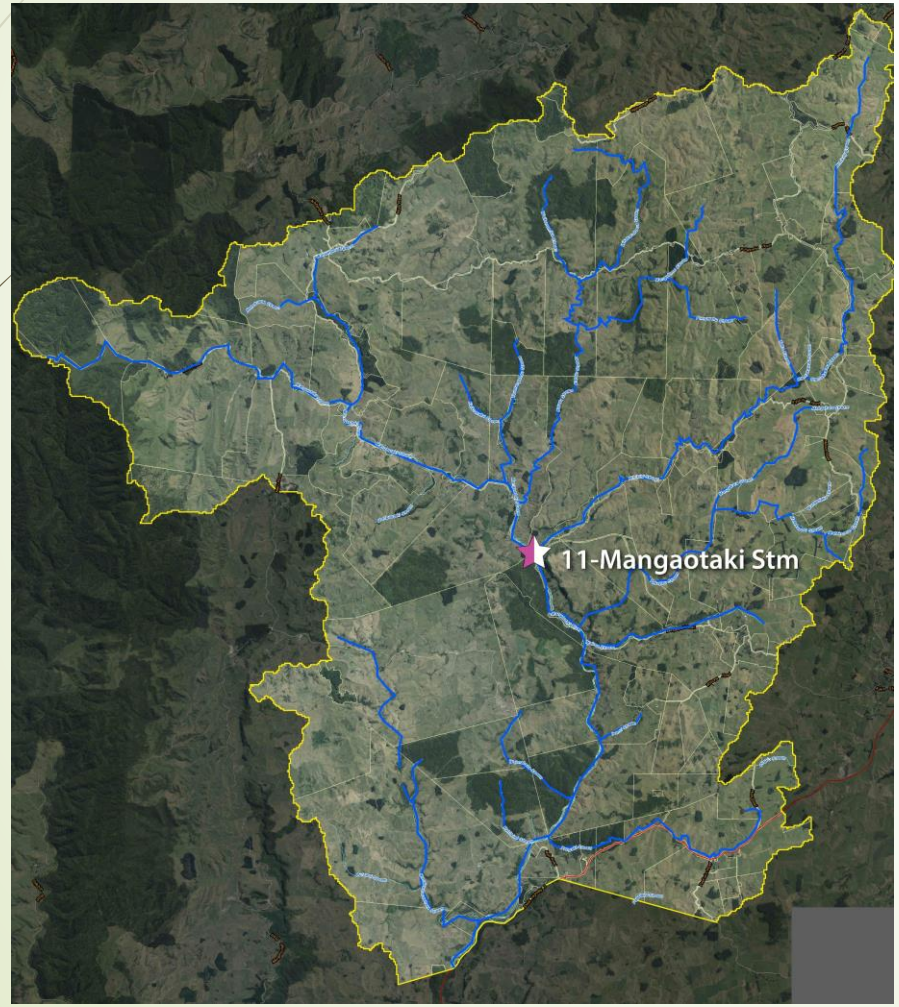


Mammalian eDNA Signal Strength

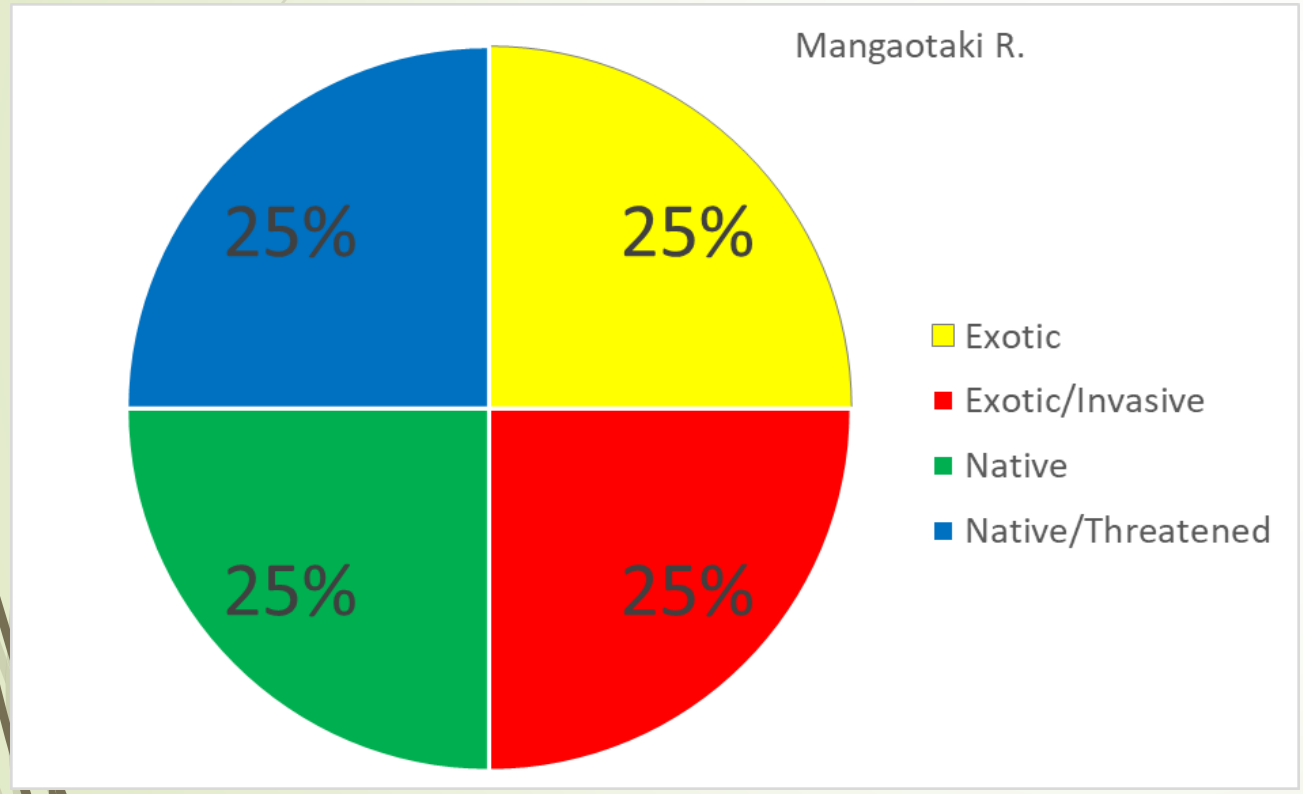


Mammalian eDNA Signal Strength

eDNA site Mangaotaki-Mairoa 11-Mangaotaki Stream

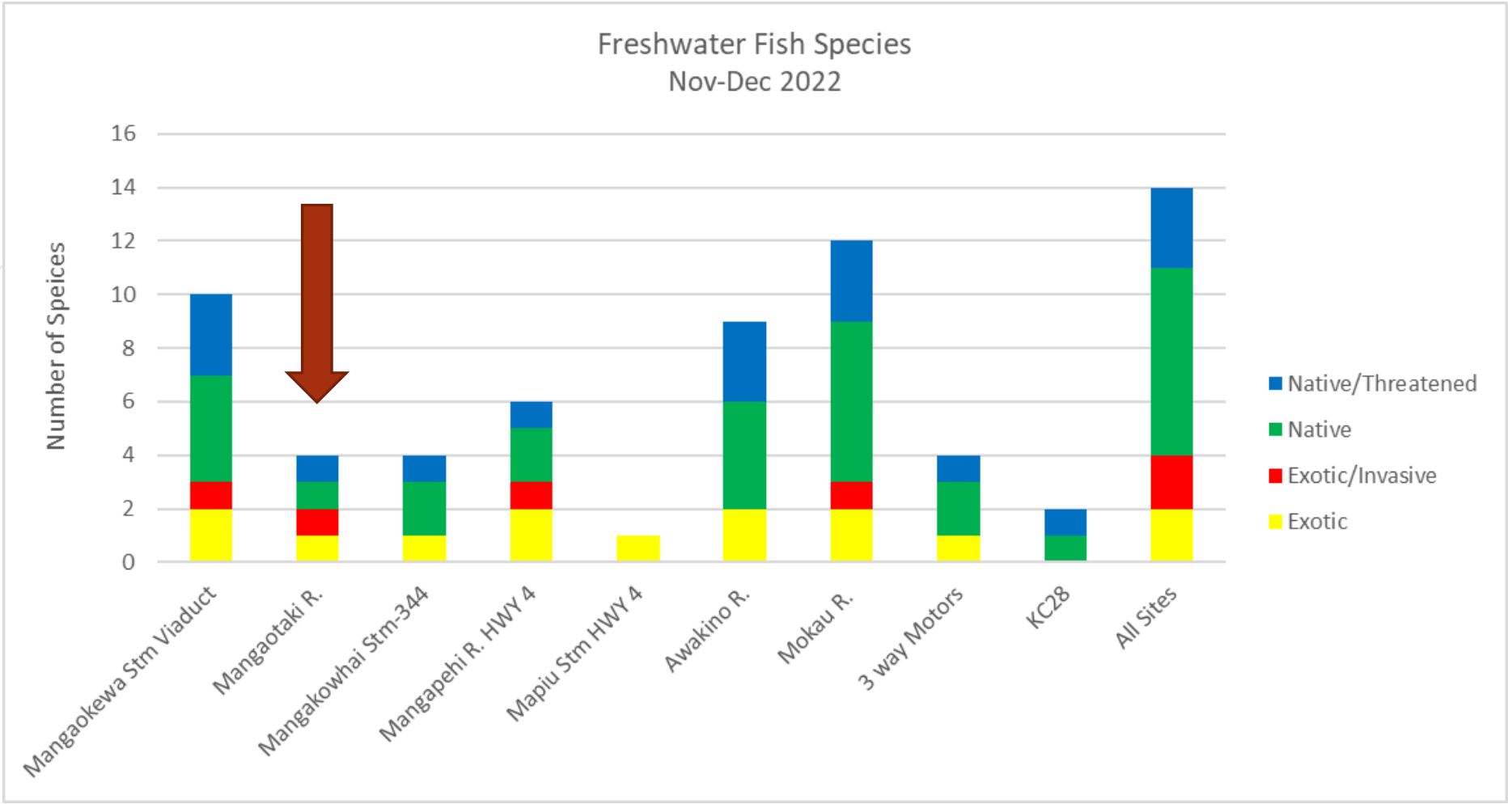


Freshwater Fish Species
Threat status




Longfin Eel – At Risk – Declining
Shortfin Eel - Native

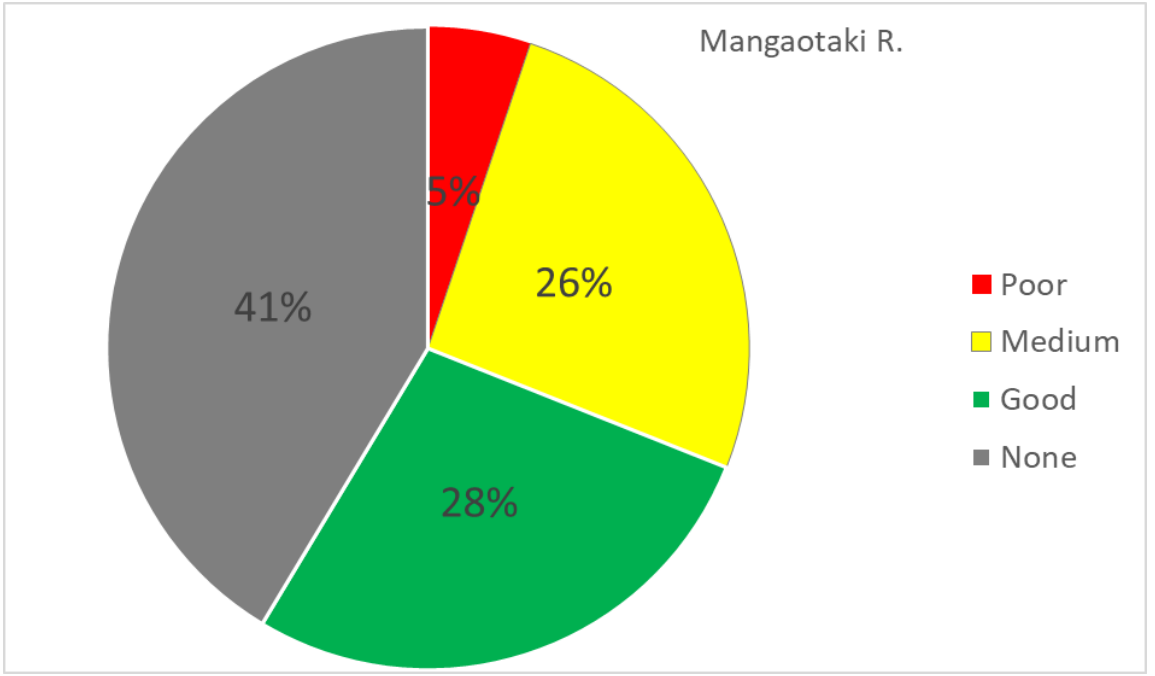

Rainbow Trout – Exotic



Freshwater Fish
Number of species detected and their threat status

Adaptive
Environmental Consulting

Dec 2021 – All Invertebrates



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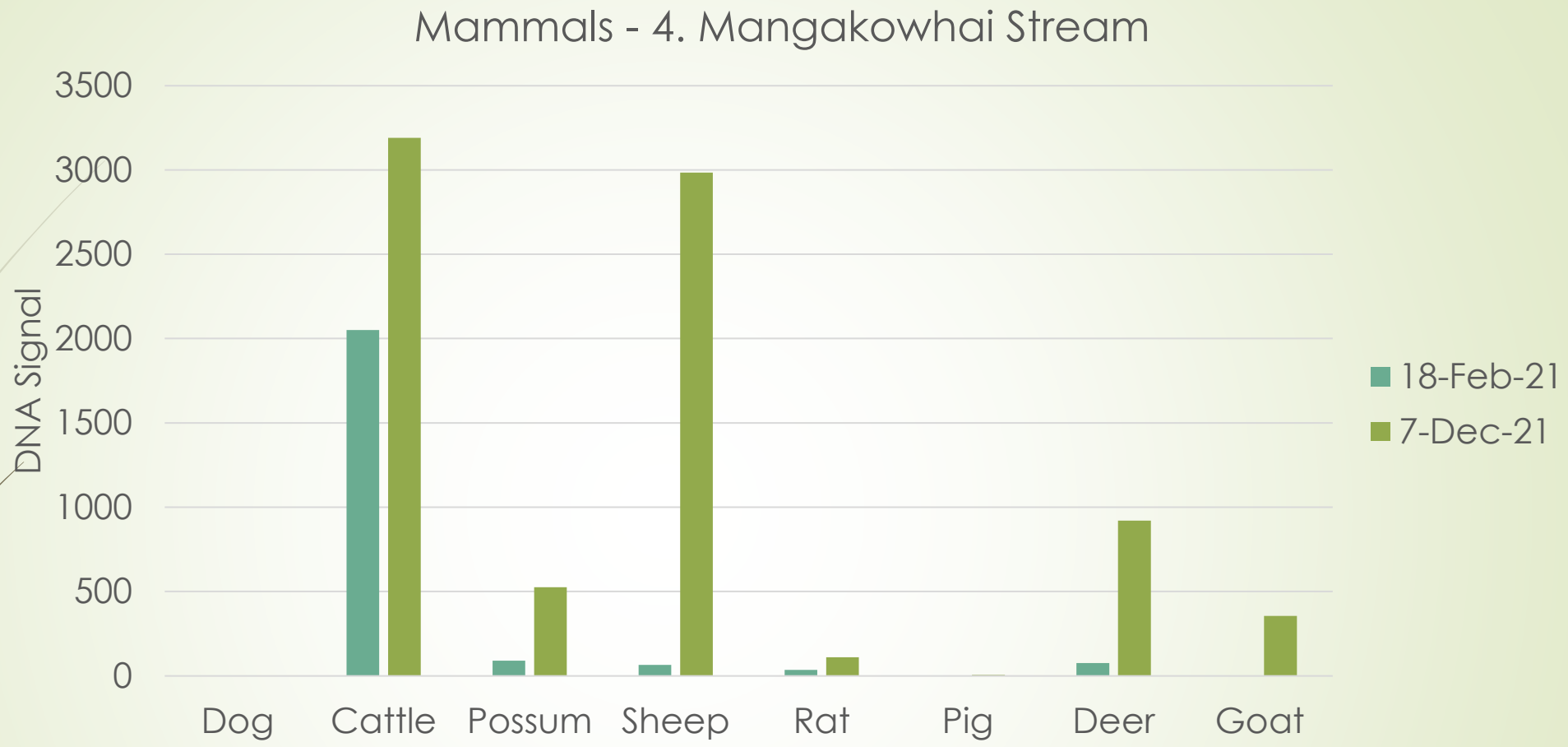
Freshwater Invertebrate Community Health Index (MCI) eDNA Results 2021



Mammalian eDNA Signal Strength

Summary Points - Mid Mokau – Piopio

Summary of 2021 KCRC Water Quality

- Water clarity is the key attribute to investigate
- Keep an eye out for risks for E. coli, P and/or N loss

Water Quality Baseline 2015-20

- E.coli and Sediment were elevated in Mokau River

Summary Points - Mangaotaki-Mairoa

Summary of 2021 KCRC Water Quality

- Water clarity and E. coli are the key attributes to investigate
- Keep an eye out for risks for E. coli, P and/or N loss

Water Quality Baseline 2015-20

- E.coli and Sediment were elevated in Mokau River

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%

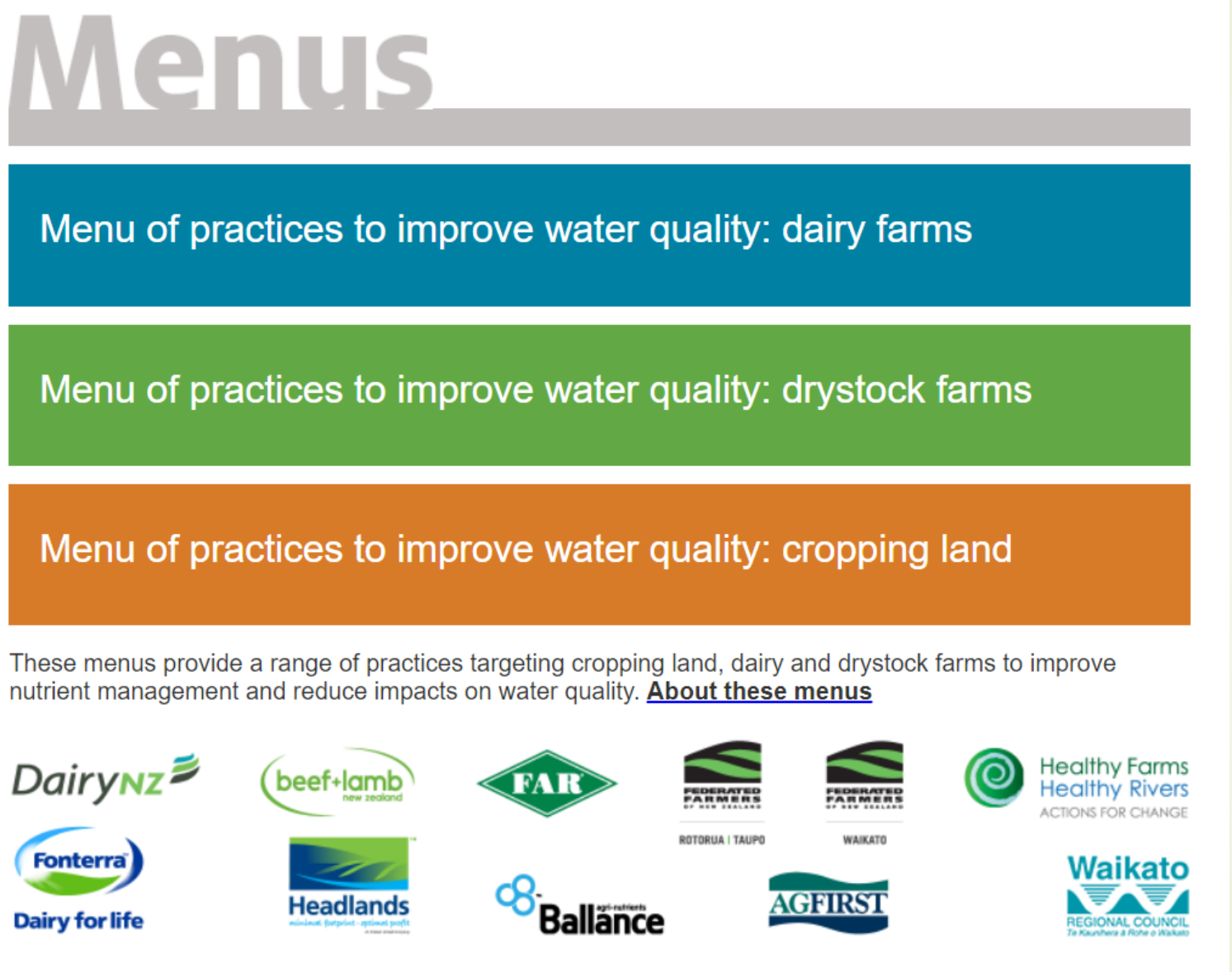
Management Actions

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.

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Soil Damage - Pugging

Source: Keith Betteridge, AgResearch

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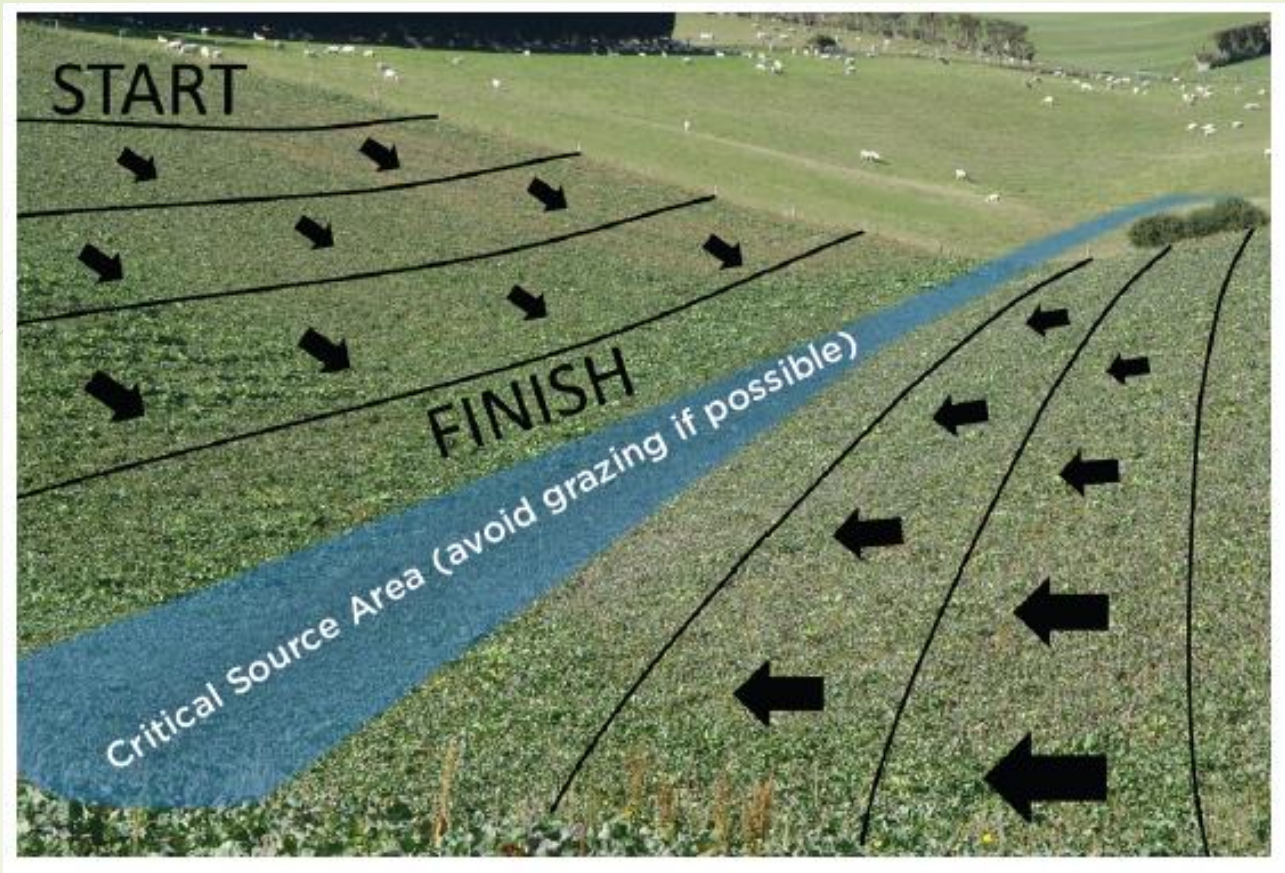
Overgrazing & soil damage

- 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

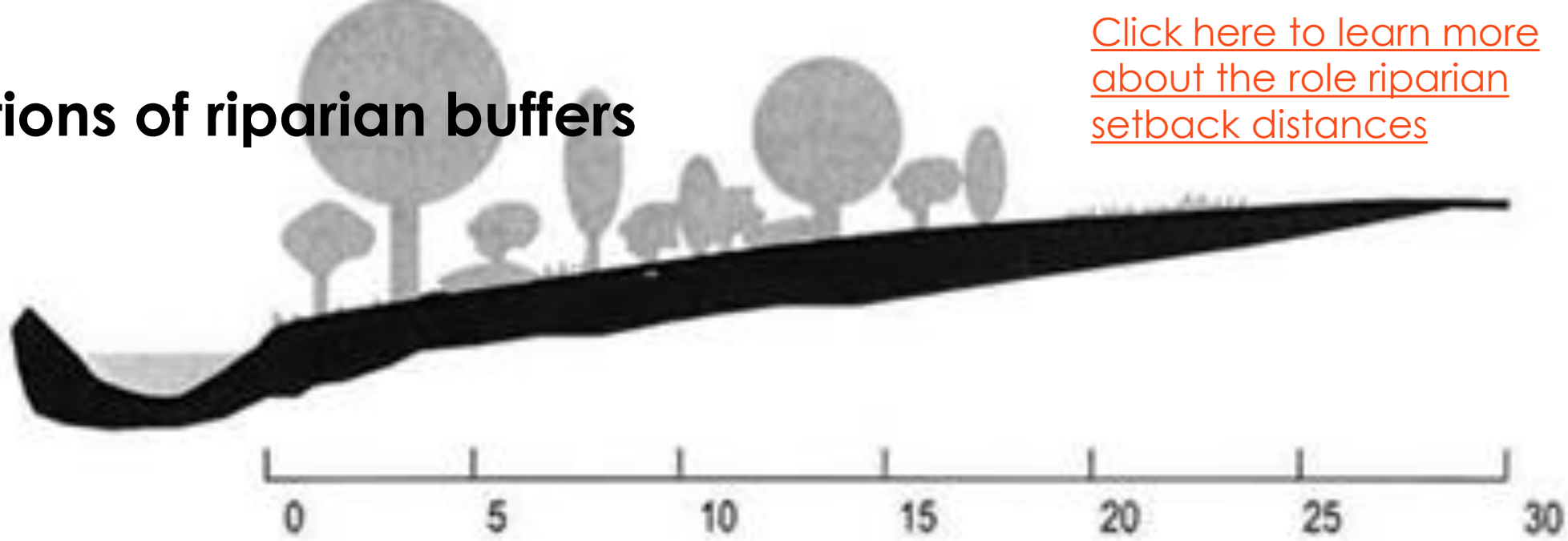


https://beeflambnz.com/wintergrazing/pre-grazing

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.

				Difference in buffer relative to pasture control reach						
Site	Time since planting (yr)	Planted length (m)	Average buffer width (m)	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-erature (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


Thank You