Technical Memorandum

✳SLR

To:	Rachel Pawson	**From:**	Claire Conwell

Company: Greater Wellington Regional Council **SLR Consulting NZ**

cc:		**Date:**	13 October 2023

Project No. 820.V14291.00001

RE: Baseline (2017) and current (2023) *E. coli* attribute states for primary contact sites across the Wellington region

Background

This memorandum sets out the baseline state (calculated as of September 2017) and current state (calculated up to the 30 March 2023), for 24 primary contact sites identified for Plan Change 1 (**PC1**), across the Wellington Region (Kapiti, Wellington and Hutt Valley, and the Wairarapa region).

Under the National Policy Statement for Freshwater Management (2020) (**NPS-FM,** updated February 2023), a primary contact site is defined as '*a site identified by a regional council that it considers is regularly used, or would be regularly used but for existing freshwater, for recreational activities such as swimming, paddling, boating, or watersports, and particularly for activities where there is a high likelihood of water or water vapour being injected or inhaled'.*

To date, baseline and current states have not been calculated for the NPS-FM 2020 *E. coli* attribute for primary contact sites (as per Table 22 of the NPS-FM 2020). This work is needed to set target attribute states for this attribute in future plan changes.

Assessment against the NPS-FM 2020 Table 22 *E. coli* attribute should be based on weekly samples taken during a pre-defined bathing season (see Clause 3.27 Primary Contact Sites, NPS-FM 2020). The bathing period is generally for 17-20 weeks, from November through to the end of March, and may vary between regional/unitary council authorities.

In 2018, Greater Wellington Regional Council (**GWRC**) shifted the sampling regime to:

- Implement a daily risk criteria model (based on a combined weighting of historical Microbiological Assessment Category (**MAC**) grades with daily forecast rainfall, to provide a daily risk assessment of whether sites are safe to swim; and

- Conduct fortnightly sampling across primary contact sites, the results of which are used to update the MAC grade of sites at the end of each season.

An unintended consequence of this shift was that against the current requirements set out in the NPS-FM, the full weekly surveillance data period across the bathing season became reduced, and the inability to apply weekly data to assign a current state. Therefore, there is a need to explore a 'best available' alternative approach to assigning current state on the basis of the available data.

Scope

The scope of the assessment as request from GWRC includes:

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- An assessment of the baseline state (at September 2017) calculated from weekly freshwater sampling collected over the standard council period for grading contact recreation sites (three years);

- Assessment of current state for all sites in two ways:

  o Fortnightly sampling data collected over the standard council period for grading contact recreation sites (three years); and

  o Fortnightly sampling data collected over whatever period is necessary to achieve the minimum number of data points set out in the latest guidance, detailed below (five years).

The results of GWRC's daily risk model were initially considered in the methodology to define the current state, but this was not considered appropriate for the purpose of attribute state assessment. This is discussed below.

Methodology

E. coli data were accessed via GWRC's Hilltop URL link, and also double checked against available data as listed on GWRC's Environmental Data Dashboard[1]. Several data sets that could not be accessed via these links were requested directly from GWRC. All data were cross checked against the summary of Recreational Water Quality Bathing Programme Network Summary (F. Drummond, supplied via email, 24/3/23).

E. coli data for each site were sorted by monitoring season, to ensure minimum data requirements for calculating baseline state could be achieved.

Data were sorted to identify any routine surveillance samples that exceeded a value of >260 cfu/100mL. This triggered additional sampling to be taken over subsequent days, until monitoring returns to below 260 cfu/100mL. This was to ensure that only routine surveillance data were analysed for the calculation of baseline states.

Data requirements

It is noted that Table 22 (*E. coli* for primary contact sites) of the NPS-FM does not specify minimum data requirements for the calculation of numeric attribute states. In the absence of this, guidance was taken from the following:

- GWRC's Natural Resources Plan, Table 3.1 Primary contact recreation and Māori customary use objectives in freshwater bodies:

  o Minimum of 30 data points, collected over a minimum of 3 years;

- Recommended data requirement for Table 9 (*E.coli*) of the NPS-FM (August, 2020)[2] of:

  o Monthly monitoring of sites visited on a regular basis regardless of weather and flow, grading a site is based on 5 years. This infers 60 data points is recommended for grading attribute state assessment.

- LAWA 'Is it Safe to Swim' module:

  o Minimum of 50 data points collected over a maximum time period of 5 years[3], sites must have had monitoring undertaken in the 2 most recent bathing seasons to be included.

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[1] https://graphs.gw.govt.nz/#dataViewer
[2] National Policy Statement for Freshwater Management 2020 (environment.govt.nz)
[3] https://www.lawa.org.nz/learn/factsheets/coastal-and-freshwater-recreation-monitoring/

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For the baseline state assessment, to achieve the minimum data requirements (as per the NPS-FM guidance) of 60 data points, this generally meant data from 1 January 2014 up to the 1 September 2017 was required.

However, for achieving consistency across bathing seasons, only data applicable for the full bathing season were applied. This meant that data from September 2014 to the end of March 2017 was applied. This accounted for three full bathing seasons across 2014/15, 2015/16, and the 2016/17 bathing periods. Whilst this meant a reduction in sample points (to just below 60), it still met the minimum data criteria as defined in the NRP and LAWA.

For the current state, the number of samples for analyses varies per site. Analyses were conducted using fortnightly data collected over the 3 time periods.

- 2017 baseline state:
  - 3-year baseline state, from 1 September 2014 to 31 March 2017 (2014/15, 2015/16, 2016/17 bathing seasons);
- 2023 current state:
  - 3-year current state, 1 September 2020 to 31 March 2023 (20/21, 21/22, 22/23 bathing seasons);
  - 4-year current state, 1 September 2019 to 31 March 2023 (2019/20, 20/21, 21/22, 22/23 bathing seasons);
  - 5-year current state (2018/19, 2019/20, 20/21, 21/22, 22/23).

Data were assessed to calculate the Hazen 95th percentile for the selected data range. Outputs were tabulated and benchmarked against Table 22 of the NPS-FM to identify attribute states for the selected data range.

Results

Table 1 lists the *E. coli* baseline attribute state, calculated up to the end of the summer bathing season in 2017 for 21 primary contact sites in the Wellington Region. The location of the primary contact sites are listed in Appendix 1 and mapped in Figure 1.

Due to the absence of available data (as monitoring was established after 2017), baseline states for 2017 could not be assessed for the following three sites listed in **Table 1**:

- Pākuratahi River at Kaitoke Campground (monitoring established in 2021);
- Hutt River upstream of Silverstream Bridge (monitoring established in 2017); and
- Hutt River at Taita Rock (monitoring established in 2022).

Table 2 lists the *E. coli* current (2023) attribute state, calculated up to the end of the summer bathing season in 2023 for 24 primary contact sites in the Wellington Region. The minimum data requirement for Pākuratahi River at Kaitoke Campground and Hutt River at Taita Rock was not achieved due to these two sites being newly established. The 95th percentile statistic and grade are indicative only.

Table 3 shows the summary of attribute state assessments across the 2017 and 2023 periods.

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Table 1:   Wellington Region primary contact swimming site _E. coli_ baseline attribute state at September 2017.

Site Name	Data available / range	No. Sample points	Hazen 95th percentile	Attribute State (Table 22)
Kāpiti Coast (3 sites)				
Ōtaki River at State Highway One	Weekly data	57	315	Fair
Waikanae River at State Highway One	Weekly data	57	366	Fair
Waikanae River at Jim Cooke Park	Weekly data	57	379	Fair
Wellington & Hutt Valley (11 sites)				
Pākuratahi River at Hutt Forks	Weekly data	57	199	Good
Pākuratahi River at Kaitoke Campground	Fortnightly from Nov 2021	NA (2017 baseline state could not be calculated, data not available)		
Akatarawa River at Hutt Confluence	Monthly data 05/09/2012 – 14/08/2017*	60	420	Fair
Hutt River at Birchville	Weekly data	57	122	Excellent
Hutt River at Maoribank Corner	Weekly data	57	123	Excellent
Hutt River at Poets Park	Weekly data	57	117	Excellent
Hutt River at Silverstream Bridge	Weekly data to 2017	57	164	Good
Hutt River upstream Silverstream Bridge	Weekly / fortnightly data from 2017	Refer to baseline state for Hutt River at Silverstream Bridge		
Hutt River at Taita Rock	Weekly from 2022	NA (2017 baseline state could not be calculated, data not available)		
Hutt River at Melling Bridge	Weekly data	57	704	Poor
Wainuiomata River at Richard Prouse Park	Weekly data	57	966	Poor
Ruamāhanga (10 sites)				
Ruamāhanga River at Double Bridges	Weekly data	57	158	Good
Ruamāhanga River at Te Ore Ore	Weekly data	57	960	Poor
Waipoua River at Colombo Road	Weekly data	57	240	Good
Waingawa River at South Road	Weekly data	57	89	Excellent
Ruamāhanga River at The Cliffs	Weekly data	57	110	Excellent
Ruamāhanga River at Kokotau	Weekly data	57	153	Good
Ruamāhanga River at Waihenga	Weekly data	57	157	Good
Ruamāhanga River at Morrisons Bush	Weekly data	57	157	Good

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Site Name	Data available / range	No. Sample points	Hazen 95th percentile	Attribute State (Table 22)
Waiohine River at State Highway 2	Weekly data	57	282	Fair
Tauherenikau River at Websters[1]	Monthly data	58	140	Good

*Monthly under River Water Quality and Ecology Programme, 5 years of available data required to meet sample numbers.

Table 2: **Wellington Region primary contact swimming site *E. coli* current attribute state at 31 March 2023.**

Site Name	Data available / range	3Y Hazen 95th percentile (No. Sample points)	3Y Attribute State (Table 22)	4Y Hazen 95th percentile (No. Sample points)	4Y Attribute State (Table 22)	5Y Hazen 95th percentile (No. Sample points)	5Y Attribute State (Table 22)
Kāpiti Coast							
Ōtaki River at State Highway One	Weekly/fortnightly	342 (48)	Fair	308 (60)	Fair	283 (69)	Fair
Waikanae River at State Highway One	Weekly/fortnightly	982 (48)	Poor	785 (60)	Poor	700 (69)	Poor
Waikanae River at Jim Cooke Park	Weekly/fortnightly	1352 (48)	Poor	1030 (60)	Poor	1084 (69)	Poor
Wellington & Hutt Valley							
Pākuratahi River at Hutt Forks	Weekly/fortnightly	992 (38)	Poor	902 (48)	Poor	863 (57)	Poor
Pākuratahi River at Kaitoke Campground[#]	Weekly/fortnightly since Nov 2021	3450 (23)	Poor	NA	NA	NA	NA
Akatarawa River at Hutt Confluence**	Monthly	564 (38)	Poor	1200 (48)	Poor	1200 (59)	Poor
Hutt River at Birchville	Weekly/fortnightly	1472 (38)	Poor	1922 (49)	Poor	1912 (58)	Poor
Hutt River at Maoribank Corner	Weekly/fortnightly	1088 (38)	Poor	1342 (49)	Poor	1284 (58)	Poor
Hutt River at Poets Park	Weekly/fortnightly	1072 (38)	Poor	1105 (49)	Poor	1012 (58)	Poor
Hutt River at Silverstream Bridge	Weekly data to 2017	NA					
Hutt River upstream Silverstream Bridge	Weekly / fortnightly data from 2017-2021	NA					
Hutt River at Silverstream Bridge (Combined data)	Bridge site combined with upstream site	888 (38)	Poor	929 (49)	Poor	780 (58)	Poor
Hutt River at Taita Rock[#]	Weekly from 2022	178 (12)	Good	NA	NA	NA	NA
Hutt River at Melling Bridge	Weekly/fortnightly	860 (30)	Poor	1127 (41)	Poor	1145 (55)	Poor

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Site Name	Data available / range	3Y Hazen 95th percentile (No. Sample points)	3Y Attribute State (Table 22)	4Y Hazen 95th percentile (No. Sample points)	4Y Attribute State (Table 22)	5Y Hazen 95th percentile (No. Sample points)	5Y Attribute State (Table 22)
Wainuiomata River at Richard Prouse Park	Weekly/fortnightly	664 (38)	Poor	1050 (48)	Poor	1325 (57)	Poor
Ruamāhanga							
Ruamāhanga River at Double Bridges	Fortnightly	480 (38)	Fair	300 (48)	Fair	272 (57)	Fair
Ruamāhanga River at Te Ore Ore	Fortnightly	1845 (37)	Poor	1064 (49)	Poor	898 (56)	Poor
Waipoua River at Colombo Road	Fortnightly	1437 (37)	Poor	1329 (49)	Poor	1254 (56)	Poor
Waingawa River at South Road	Fortnightly	87 (37)	Excellent	64 (49)	Excellent	59 (56)	Excellent
Ruamāhanga River at The Cliffs	Fortnightly	1577 (36)	Poor	529 (48)	Fair	346 (55)	Fair
Ruamāhanga River at Kokotau	Fortnightly	1850 (35)	Poor	860 (46)	Poor	2033 (53)	Poor
Ruamāhanga River at Waihenga	Fortnightly	2175 (35)	Poor	1635 (47)	Poor	2220 (54)	Poor
Ruamāhanga River at Morrisons Bush	Fortnightly	1218 (35)	Poor	1020 (47)	Poor	1234 (54)	Poor
Waiohine River at State Highway 2	Fortnightly	378 (35)	Fair	203 (47)	Good	144 (54)	Good
Tauherenikau River at Websters**	Monthly	213 (35)	Good	196 (46)	Good	190 (54)	Good

* Fortnightly – generally sampled weekly up to 31 December, then sampled fortnightly Jan – March (no follow ups).

** Monthly sampling under the RWQE Programme, data range April 2018 to March 2023.

Does not meet the minimum data requirements for the NRP, LAWA or NPS-FM

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Table 3:   Summary of baseline and current attribute state assessments

Site Name	3Y Baseline State	3Y Attribute State	4Y Attribute State	5Y Attribute State
Kāpiti Coast				
Ōtaki River at State Highway One	Fair	Fair	Fair	Fair
Waikanae River at State Highway One	Fair	Poor	Poor	Poor
Waikanae River at Jim Cooke Park	Fair	Poor	Poor	Poor
Wellington & Hutt Valley				
Pākuratahi River at Hutt Forks	Good	Poor	Poor	Poor
Pākuratahi River at Kaitoke Campground	NA (2017 baseline state could not be calculated, data not available)	Poor[#]	NA	NA
Akatarawa River at Hutt Confluence**	Fair	Poor	Poor	Poor
Hutt River at Birchville	Excellent	Poor	Poor	Poor
Hutt River at Maoribank Corner	Excellent	Poor	Poor	Poor
Hutt River at Poets Park	Excellent	Poor	Poor	Poor
Hutt River at Silverstream Bridge	Good			
Hutt River upstream Silverstream Bridge	NA (Refer to baseline state for Hutt River at Silverstream			
Hutt River at Silverstream Bridge (Combined data)	NA	Poor	Poor	Poor
Hutt River at Taita Rock	NA (2017 baseline state could not be calculated, data not available)	Good[#]	NA	NA
Hutt River at Melling Bridge	Poor	Poor	Poor	Poor
Wainuiomata River at Richard Prouse Park	Poor	Poor	Poor	Poor
Ruamāhanga				
Ruamāhanga River at Double Bridges	Good	Fair	Fair	Fair
Ruamāhanga River at Te Ore Ore	Poor	Poor	Poor	Poor
Waipoua River at Colombo Road	Good	Poor	Poor	Poor
Waingawa River at South Road	Excellent	Excellent	Excellent	Excellent

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Site Name	3Y Baseline State	3Y Attribute State	4Y Attribute State	5Y Attribute State
Ruamāhanga River at The Cliffs	Excellent	Poor	Fair	Fair
Ruamāhanga River at Kokotau	Good	Poor	Poor	Poor
Ruamāhanga River at Waihenga	Good	Poor	Poor	Poor
Ruamāhanga River at Morrisons Bush	Good	Poor	Poor	Poor
Waiohine River at State Highway 2	Fair	Fair	Good	Good
Tauherenikau River at Websters**	Good	Good	Good	Good

* Fortnightly – generally weekly up to 31 December, then fortnightly Jan – March (no follow ups).

** Monthly sampling under the RWQE Programme, data range April 2018 to March 2023.

Does not meet the minimum data requirements for the NRP, LAWA or NPS-FM

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Summary

For long term monitoring sites established prior to 2017, there is generally a consistent amount of data available for the calculation of baseline states. Data requirements across all sites complied with the minimum data requirements as defined in the NRP (30 sample points across a minimum of 3 years), and met the minimum data requirements used by LAWA (minimum of 50 sample points).

Sample numbers generally fell short of the suggested minimum indicated in Table 9 of the NPS-FM[4] – however it is again noted that for the assessment of bathing season data (rather than routine monthly data to which the Table 9 assessment applies), minimum data requirements are not specified for the calculation of attribute states.

For the 2023 current attribute state assessment, the suggested minimum data requirements for the NRP were met for sites across the three most recent full bathing seasons. Data requirements only fell short for sites that are newly established. These sites did not achieve the minimum sample size to enable the 95th percentile statistic to be calculated with some certainty, thus should be regarded as 'indicative' only (i.e. Pākuratahi River at Kaitoke Campground with 23 sample points since 2021, and Hutt River at Taita Rock with 12 sample points since 2022).

The comparison of attribute states across the 2023 period (**Table 2**), assessed on the basis of 3-year, 4-year or 5-year bathing season data demonstrates the marked influence of individual samples collated across a bathing season on the overall attribute state. For example, the past two bathing seasons (2021/22 and 2023/22) were notable for a series of high *E. coli* counts (in the 1000s) resulting in significant shifts in attribute state since the 2017 baseline. These elevated counts are often associated with rainfall either immediately prior to, or during routine surveillance monitoring. These elevated counts have a high influence on the 95th percentile calculation, thus the elevated attribute state may take several seasons to reduce.

Given the influence of wetter than usual seasonal effects, removing or only partially including data from a single bathing season is not recommended to achieve minimum data requirements. This was avoided for this current assessment to avoid any bias within the bathing season itself. Thus, the attribute states presented here represent the water quality across the full bathing season range, and not parts or seasons themselves.

Across the 3, 4 and 5 yearly attribute state assessment for 2023, only two sites recorded differences in the attribute state:

- Ruamāhanga River at The Cliffs – shifted from 'Poor' (3Y assessment) to 'Good (4Y and 5Y assessment); and

- Waiohine River at State Highway 2 – shifted from 'Fair' (3Y assessment) to 'Good' (4 and 5Y assessment).

This shift reflects the combination of the higher sample size to lessen the influence of elevated *E. coli* counts for the 95th percentile calculation, but this was not apparent for the majority of sites.

Applicability of the Risk Criteria Model

The risk model was introduced in the 2018/19 bathing season and was intended to overcome the problems faced in communicating the suitability for swimming based on data

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[4] Table 9 of the NPS-FM refers to '*a monthly monitoring regime where sites are visited on a regular basis regardless of weather and flow conditions. Record length for grading a site based on 5 years*', thus inferring 60 data points is recommended.

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that was out of date by the time is was publicly available. The intention was not to calculate or substitute numerical modelling outputs as the design is too simplistic.

GWRC's daily risk model is based on a series of criteria that combines the following information:

- Long term MAC grade (calculated based on the last three years of weekly or fortnightly sampling data);

- Rainfall, as measured from the most proximate rain gauge to the site, as measured in the past 24h); and

- Daily forecast rainfall.

The criteria are weighted to produce an overall rank of suitability for swimming.

The output is updated daily and gives a high level, daily risk assessment with one of the key messages: Suitable for Swimming, Caution Advised, Unsuitable for swimming.

Given the input data and simplistic weighting system, it does not reproduce a numerical *E. coli* count. The derivation or extrapolation of the results of the model are not appropriate to generate *E. coli* count data as the overall risk message is based on a range of the weighted score only. Any methods to derive or extrapolate numerical output would require a more sophisticated relationship between rainfall depth, source of contamination, and river hydrodynamics to inform a numerical output. This has been addressed to some extent under the Whaitua modelling programmes, but accurate modelling would require intensive sampling effort under a range of wet weather conditions to calibrate and validate any numerical model.

For the purpose of the attribute state assessment to inform PC1, the criteria model is not an appropriate tool to inform this process.

Monitoring effort

The current sampling effort applied across bathing water seasons meets the minimum data requirements for the NRP, even with the reduced sampling effort introduced in the 2018/19 season. It is acknowledged here, that whilst the NPS-FM (Section 3.27(4)) requires weekly sampling to be undertaken across the bathing season, the timing of the bathing season itself is not stipulated. The scheduling of bathing seasons itself may vary between council authorities carrying out primary contact site monitoring, which in turn may influence the final sample size available for analysis. Issues concerning the timing of the bathing season, and resourcing monitoring effort to give effect to Section 3.27(4) are not in the scope of this current assessment.

Given the reduced sample size, increasing the analyses to 4 or 5 bathing seasons overcomes any constraints, or perceptions of biases or misrepresentation of data across a shorter time frame that may be apparent with a 3-year assessment period. The analyses of 5 bathing seasons is consistent with the timeframes referenced in both the NPS-FM and LAWA approach. There is no indication that having a slightly reduced sampling effort, based on 3 bathing seasons, significantly changes the attribute state assessments across the board. Only two sites were shown to be affected by changes to the bathing season periods whereby attribute states were lower on the basis of a 3-year assessment, compared with a 4 or 5-year assessment.

If a 3-year attribute state is to be maintained across sites, sampling effort should be maintained and not reduced further.

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Regards
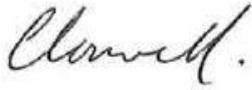
Dr Claire Conwell

Principal consultant

Reviewed by C. Lockyer , Principal Consultant

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Appendix 1: Freshwater primary contact sites for Plan Change 1 (PC1).

Whaitua	Site Name	E	N
Kāpiti Coast			
Kāpiti Coast	Ōtaki River at State Highway One	1781309	5484406
Kāpiti Coast	Waikanae River at State Highway One	1773752	5472296
Kāpiti Coast	Waikanae River at Jim Cooke Park	1772155	5472377
Wellington & Hutt Valley			
Wellington & Hutt Valley	Pākuratahi River at Hutt Forks	1784288	5452620
Wellington & Hutt Valley	Pākuratahi River at Kaitoke Campground	1784573	5451743
Wellington & Hutt Valley	Akatarawa River at Hutt Confluence	1776183	5449184
Wellington & Hutt Valley	Hutt River at Birchville	1776196	5449091
Wellington & Hutt Valley	Hutt River at Maoribank Corner	1775882	5446696
Wellington & Hutt Valley	Hutt River at Poets Park	1771462	5446092
Wellington & Hutt Valley	Hutt River at Silverstream Bridge	1767598	5443172
Wellington & Hutt Valley	Hutt River upstream Silverstream Bridge	1768396	5443805
Wellington & Hutt Valley	Hutt River at Taita Rock	1764779	5440885
Wellington & Hutt Valley	Hutt River at Melling Bridge	1759906	5436831
Wellington & Hutt Valley	Wainuiomata River at Richard Prouse Park	1764536	5429141
Ruamāhanga			
Ruamāhanga	Ruamāhanga River at Double Bridges	1824350	5471775
Ruamāhanga	Ruamāhanga River at Te Ore Ore	1825529	5462917
Ruamāhanga	Waipoua River at Colombo Road	1824996	5462889
Ruamāhanga	Waingawa River at South Road	1820756	5460858
Ruamāhanga	Ruamāhanga River at The Cliffs	1821476	5452180
Ruamāhanga	Ruamāhanga River at Kokotau	1815756	5447191
Ruamāhanga	Ruamāhanga River at Waihenga	1804604	5436519
Ruamāhanga	Ruamāhanga River at Morrisons Bush	1808918	5441108
Ruamāhanga	Waiohine River at State Highway	1809662	5451705
Ruamāhanga	Tauherenikau River at Websters	1797082	5439942

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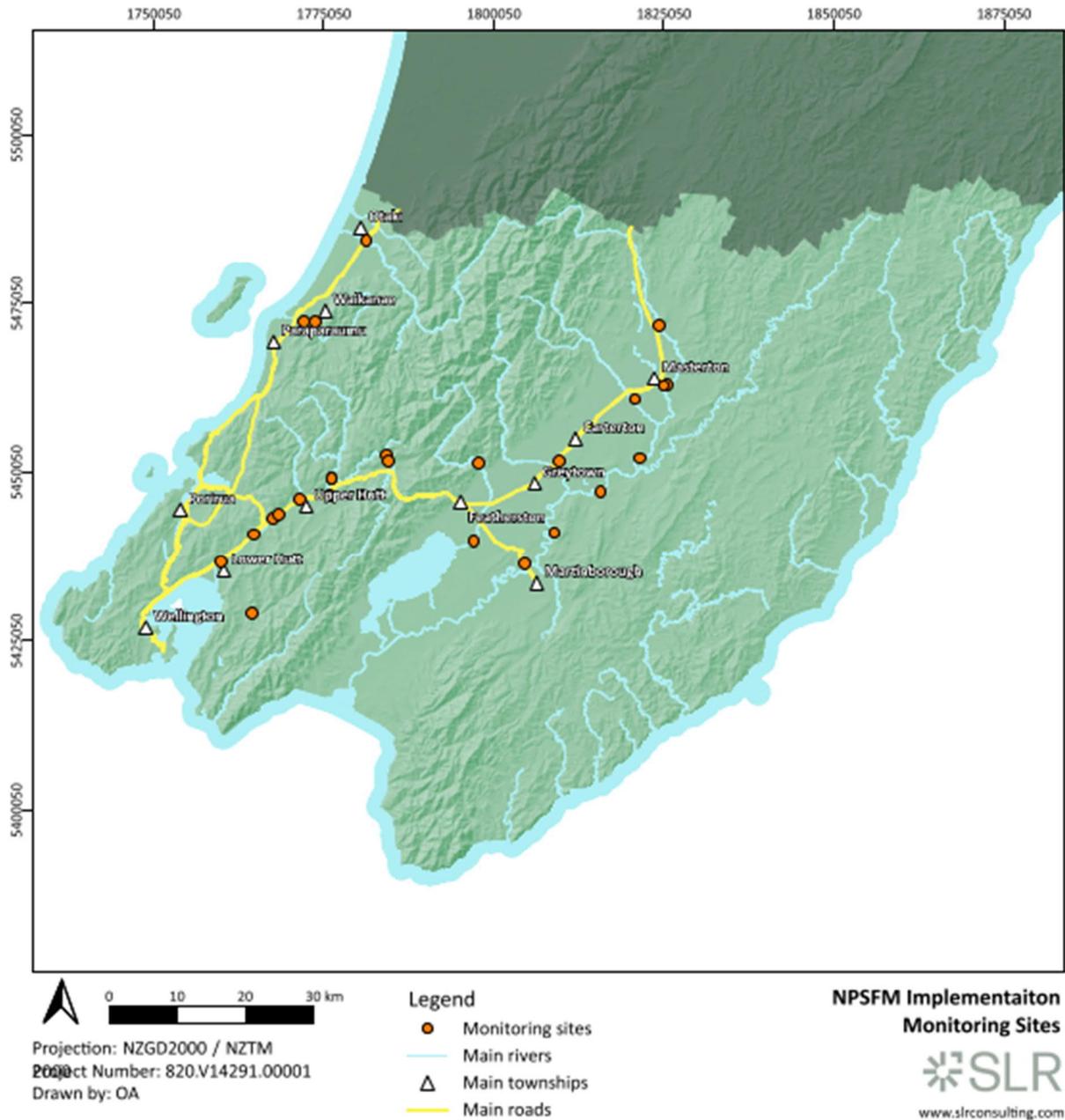
Figure 1: Primary contact sites across the Wellington Region