greater WELLINGTON
REGIONAL COUNCIL

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Freshwater quality monitoring and investigations

1. Purpose

To provide the Committee with a brief overview of Greater Wellington's environmental monitoring programmes in relation to freshwater quality (surface water and groundwater) and relevant investigation work being undertaken to inform the review of our regional plans. At the committee meeting we will present the findings of one specific investigation: the Mangatarere Stream catchment water quality investigation (summary leaflet – **Attachment 1**).

2. Background

Section 35 of the Resource Management Act (RMA) (1991) requires regional councils to monitor and report on the State of the Environment (SoE). In the area of freshwater quality and ecosystem health, Greater Wellington fulfils its RMA obligations through specific water quality monitoring programmes. These programmes encompass a network of sites representative of the region's rivers, streams, lakes and groundwater aquifers.

Our SoE monitoring programmes are designed to detect spatial and temporal changes in the quality of fresh waters, determine the suitability of fresh waters for designated uses (e.g., swimming, trout angling) and provide information to determine the effectiveness of regional plans and policies. These programmes also provide direction for targeted investigations, such as indicating where remediation or mitigation of poor water quality is desired. For example, consistently poor water quality at our SoE monitoring site on the lower reaches of the Mangatarere Stream near Carterton led to a targeted investigation of soil, groundwater and surface water quality in this catchment; this investigation sought to better understand the causes of poor water quality (i.e., targeted investigations generally focus on specific issues or knowledge gaps identified from routine SoE monitoring data).

3. Surface water quality monitoring

Greater Wellington currently has three SoE surface water quality monitoring programmes covering general river and stream health, recreational water quality in selected rivers during summer, and lake water quality. There is also specific and separate monitoring associated with three streams undergoing riparian rehabilitation.

3.1 River and stream health

3.1.1 Rivers SoE (RSoE) monitoring programme

Greater Wellington currently monitors 55 river and stream sites across the region (Figure 1) that represent the natural diversity of rivers and streams, and the major land uses and human activities in the region. Water quality is assessed at monthly intervals by measuring a range of physical, chemical and microbiological variables: dissolved oxygen, temperature, pH, conductivity, visual clarity, turbidity, suspended sediment, faecal indicator bacteria, total organic carbon, dissolved and total nutrients and selected heavy metals at some urban sites. In addition, periphyton (streambed algae and slime) cover is assessed at monthly intervals at sites with hard substrates such as cobbles and coarse gravels.

Ecological health is monitored annually by assessing instream periphyton biomass and macroinvertebrate (small insects, molluscs, crustaceans and worms) community composition.

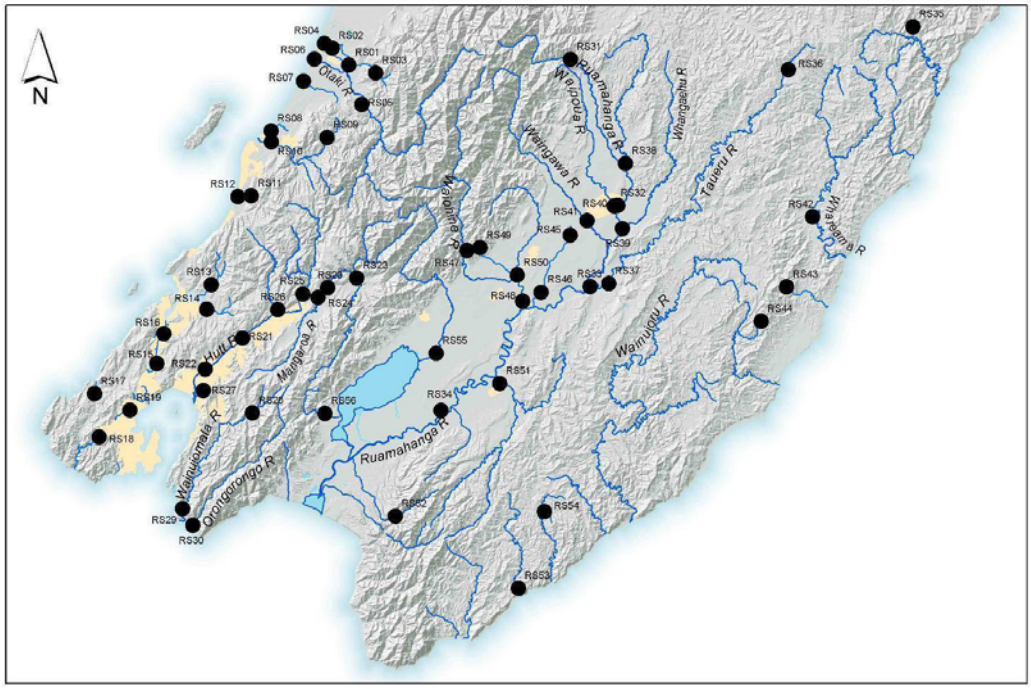

Figure 1: Current River SoE monitoring sites

General findings from RSoE monitoring to date are similar to those reported in other regions and nationally; water quality and aquatic ecosystem health are strongly influenced by land cover, being highest at RSoE sites located on hill-fed river and stream reaches with upstream catchments dominated by

unmodified indigenous forest cover. In contrast, RSoE sites with poor water quality and aquatic ecosystem health are typically located on smaller, low elevation streams draining predominantly intensive pastoral (e.g., dairying) or urban catchments. These sites also more commonly exceed guidelines for nuisance periphyton growth. Nearly two thirds of rivers and streams in the region are located in pastoral (~60%) or urban catchments (~3%).

3.1.2 Recreational water quality monitoring programme

Each summer Greater Wellington monitors the suitability of popular river sites for contact recreation[1]. Currently 23 sites are monitored across the Wellington region: 4 in the Kapiti Coast District, seven in the Hutt and Wainuiomata River catchments and 12 in the Wairarapa (Figure 2)[2]. Water samples are collected weekly from November to March inclusive (the official bathing season) and tested for *E. coli* indicator bacteria to assess the risk of faecal contamination and therefore the potential presence of harmful pathogens. Periphyton (including cyanobacteria/blue-green algae) cover is also assessed because excessive amounts of periphyton on the riverbed can reduce the amenity value of waterways and some species of cyanobacteria produce toxins which can be harmful to humans and animals, particularly dogs.

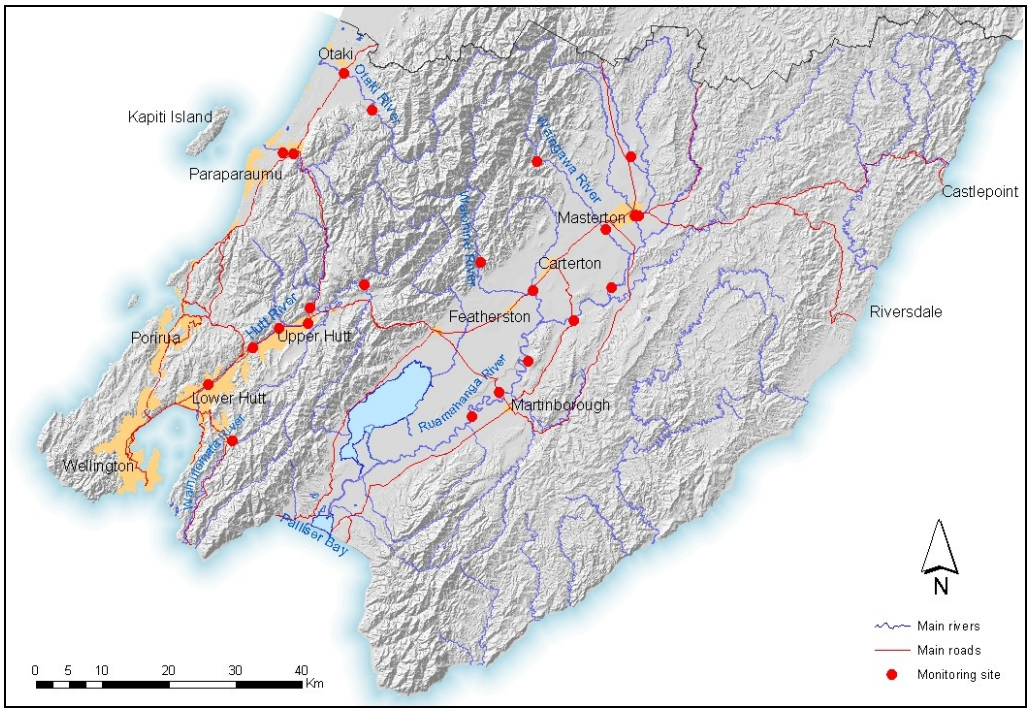

Figure 2: River sites sampled weekly over summer as part of Greater Wellington's recreational water quality monitoring programme[2]

Monitoring results to date highlight that sites with pastoral or urban land use in the upstream catchment are at times unsuitable for contact recreation. This is particularly the case after rainfall at sites on the Hutt, Waipoua and

[1] This programme also incorporates over 70 coastal sites that, in the western part of the region, are jointly monitored with the territorial authorities.

[2] Two of these sites – the Otaki River at The Pots (Kapiti) and the Waiohine River at Gorge (Wairarapa) – are included in the programme but because water quality is excellent, they are actually only sampled monthly as part of Greater Wellington's RSoE water quality monitoring programme.

Ruamahanga rivers, reflecting the effects of diffuse source agricultural and/or urban stormwater run-off. Heavier rainfall is generally needed for guidelines to be exceeded at sites on the Otaki and Waikanae rivers on the Kapiti Coast.

Toxic cyanobacteria growing on the riverbed is also an issue at times, particularly at sites on the Hutt, Waipoua and Waikanae rivers (Figure 3). At least nine dog deaths have been attributed to contact with cyanobacteria in these rivers since 2005 and there have also been several alleged reports of human illness. Toxic cyanobacteria growth can be prolific during extended periods of warm stable weather; frequent "freshes" help to remove cyanobacteria from the riverbed.

Figure 3: Cyanobacteria mats in the Hutt River at Silverstream

3.1.3 Riparian rehabilitation water quality monitoring programme

In January 2002 Greater Wellington introduced a programme to monitor three streams undergoing riparian rehabilitation: Kakariki Stream (Kapiti Coast), Karori Stream (Wellington City) and Enaki Stream (a subcatchment of the Mangatarere Stream near Carterton). The primary aim of this monitoring was to document the effects of riparian rehabilitation on stream ecosystems, with a particular focus on the first three environmental outcomes listed in Greater Wellington's Riparian Management Strategy relating to water quality, aquatic habitat and healthier river ecosystems.

A comprehensive report presenting the monitoring results for the period 2002–2007 was released in 2008 (and summarised in Regulatory Committee Paper 08.624). The report identified the principal benefits attributable to riparian rehabilitation to be:

- improved aesthetic values (Enaki, Kakariki and Karori streams);
- increased vegetation cover and streambed shade (Enaki and Kakariki streams);
- increased bank stability (Enaki and Kakariki streams);

- improved aquatic habitat quality (Enaki and Kakariki streams); and
- reduced water temperatures (Enaki and Kakariki streams).

The report concluded that riparian rehabilitation can be a very useful tool to mitigate some of the degradation in stream health caused by agricultural and urban land use. However, the report also highlighted that water quality and aquatic ecosystems in the three streams remain in a degraded state and riparian rehabilitation alone will not remedy the causes of the degradation. For example, in the Enaki Stream catchment improvements are also needed in farming practices (preventing stock access to stream beds and eliminating effluent run-off) while in Karori Stream, improvements are needed in stormwater management.

3.1.4 Lake health

Greater Wellington currently only has an established water quality monitoring programme in place for one lake, Lake Wairarapa. Since 1994 water samples have been collected from four sites on this lake three or four times a year and analysed for a range of physical, chemical and microbiological variables: dissolved oxygen, temperature, pH, conductivity, visual clarity, turbidity, faecal indicator bacteria, total organic carbon, dissolved and total nutrients, and chlorophyll *a*.

Monitoring results to date have all been fairly consistent and indicate that Lake Wairarapa is in a stable yet poor state with very high concentrations of nutrients and chlorophyll *a* (an indicator algal biomass), and poor water clarity. Algal blooms have been observed in the lake (and even more so in some other lakes in the region). Improvements in the health of the lake are unlikely without significant changes to current land use activities and management practices in the catchment.

4. Groundwater quality monitoring

Greater Wellington's SoE groundwater quality monitoring network comprises 71 bores distributed across most of the region's principal and secondary groundwater management zones (Figure 4). Water samples are taken from each bore quarterly and tested for a similar suite of physical, chemical and microbiological variables as RSoE water samples[3]. These variables provide an indication of baseline groundwater chemistry and groundwater contamination.

In addition to routine monitoring in 71 bores, there are five automated saline intrusion groundwater monitoring sites across 8 bores (Figure 4). These are located in Waikanae and Petone and are used to provide an early warning of saline intrusion in the aquifers from which Kapiti Coast District Council and Greater Wellington source their public water supply.

[3] The main exceptions are major ions which are tested in groundwater samples in place of total nutrients and suspended sediment.

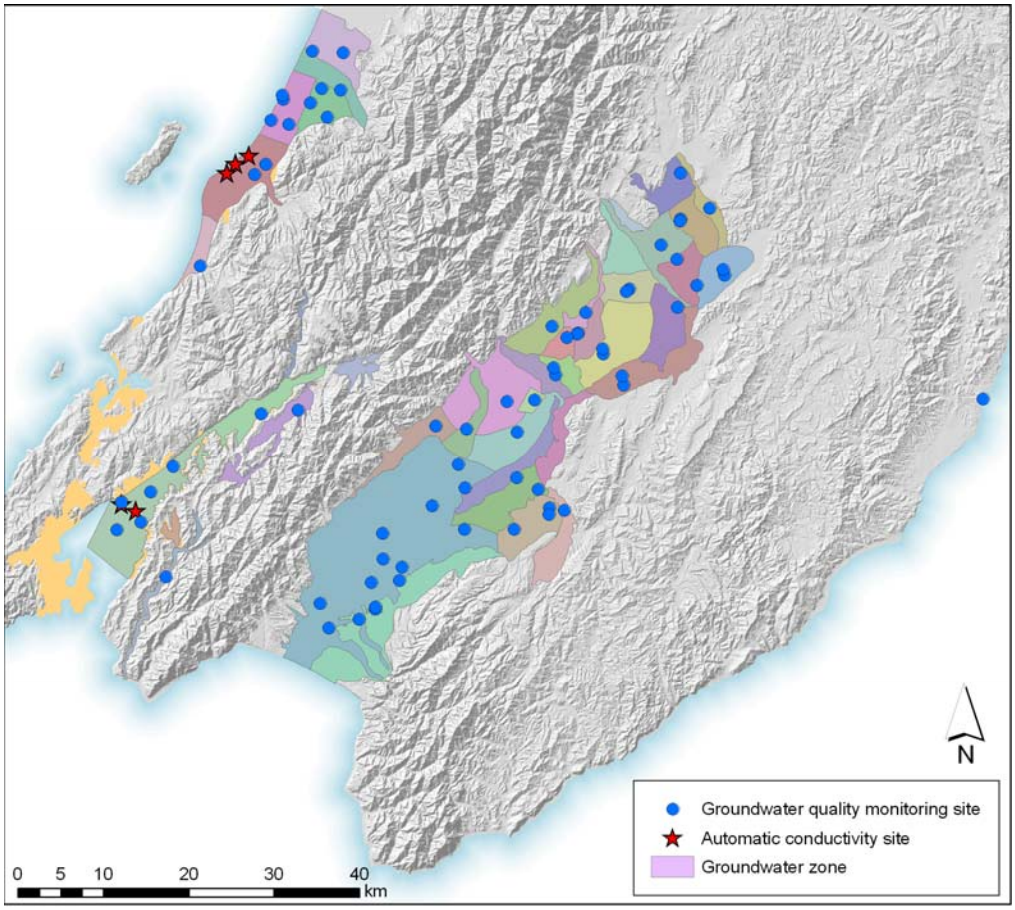

Figure 4: Current groundwater quality SoE monitoring sites

Groundwater quality is highly variable across the region, reflecting both natural geochemical processes and human influence. Around 20% of SoE monitoring bores show impacts on groundwater quality due to land use (characterised by elevated nitrate-nitrogen (nitrate) and/or sulphate concentrations) and there are also a few cases in the Wairarapa where there is evidence of seasonal irrigation influencing groundwater chemistry. Targeted groundwater quality investigations indicate that the greatest impacts are present in the intensively farmed areas of Carterton, Te Ore Ore and, to a lesser extent, South Featherston, as well as in horticultural areas on the Kapiti Coast. Some groundwater contamination is also present in residential areas serviced by on-site wastewater treatment systems, particularly at Riversdale and Te Horo where there have been occasional guideline exceedances for nitrate and faecal bacteria.

Higher nitrate concentrations – along with higher *E. coli* bacteria counts – are generally seen in shallow unconfined groundwater aquifers, particularly in winter when rainfall is greater, the soils are more saturated and groundwater levels are higher. Under these conditions, there is a greater likelihood of the shallow groundwater being impacted by animal or human waste disposed onto land. However, groundwater contamination is not limited to shallow aquifers. For example, a number of bores located in the deep confined or semi-confined aquifers (e.g., in Carterton and Te Ore Ore near Masterton) have also shown elevated concentrations that in some cases exceed the Drinking Water Standard MAV for nitrate nitrogen. This suggests a degree of connectivity between the

shallow and deep aquifers and that contamination is possibly migrating into deeper aquifers. As the deeper aquifers generally contain older groundwater that is less affected by contamination, the full effects of recent land use intensification are probably yet to be seen in these aquifers.

As well as evidence of nitrate contamination between shallow and deeper aquifers, piezometric (groundwater level) surveying in many of the targeted investigation areas shows that groundwater discharges into adjacent or downgradient surface water bodies. This clearly occurs in the intensively farmed Mangatarere catchment where elevated nitrate concentrations in shallow groundwater are contributing to poor water quality in the Mangatarere Stream.

The hydraulic connection between shallow groundwater and surface water systems highlights the need for an integrated approach to managing the region's soil and water resources, particularly when assessing resource consent applications for agricultural and municipal wastewater discharges to land. Soil nutrient loadings and wastewater application rates must be assessed carefully, particularly in areas of intensive land use.

5. Informing the review of the regional plans

A range of water quality-related projects have been undertaken or are currently underway to inform the review of the regional plans. These are outlined below.

5.1 Targeted and integrated investigations

Targeted investigations of water quality have been undertaken in selected catchments and groundwater zones. A small-scale investigation was undertaken in Hulls Creek (Upper Hutt) in 2006/07 and, over 2004–2008 groundwater nitrate contamination was monitored in intensively farmed areas of the Wairarapa Valley, horticultural areas of the Kapiti Coast, and existing and developing settlements in the region serviced by on-site wastewater treatment systems (e.g., Te Horo, Riversdale and Flatpoint). In 2008–2009, a comprehensive assessment of soil, groundwater and surface water quality was undertaken in the Mangatarere Stream catchment (see attached summary leaflet).

5.2 Enhanced environmental monitoring and assessment

Examples include:

- During 2008 water samples from SoE river and stream sites were tested for major ions (e.g., calcium, magnesium and sodium) and trace metals to inform linkages between surface water and groundwater across the region. At the same time, analysis of water samples for heavy metals (e.g., copper and zinc) began at some urban stream sites likely to be influenced by stormwater runoff.

- In early 2009 a fish survey was conducted across a number of urban streams in Wellington City and the wider metropolitan area to increase our

knowledge of fish communities in these streams. The results of these survey (and additional macroinvertebrate sampling) are being used in the ecological classification of urban streams in the Wellington region and will form a basis for tighter rules in the next regional plan around activities in urban streams (e.g., stream piping).

- Over 2003/04–2009/10 several investigations assessed the impacts of stormwater-derived contaminants on urban stream health. These investigations assessed both water and sediment quality as well as heavy metal accumulation in streambed biofilms/algae.

- In 2009/10 macroinvertebrate health was surveyed in several of the region's intermittently flowing streams (i.e., dry for part of the year) to assess the ecological values associated with these streams, along with management and protection requirements; intermittent streams are under significant pressure from infilling and piping during development.

- Streambed sediment deposition was assessed at selected SoE sites in early 2010. Sediment deposition has been identified as a key contributor to poor ecological health in many streams across the region and we aim to use the information gathered to establish targets for instream habitat quality.

- Monitoring of water quality in the region's lakes was extended to two further lakes in August 2009, with monthly sampling commencing in Lake Waitawa on the Kapiti Coast (12 months only) and Lake Onoke. Water quality monitoring is expected to start in the Pencarrrow Lakes later in 2010.

- Earlier this year the "condition" of ten of the region's most vulnerable wetland systems was assessed. While this work focussed on gaining a better understanding of wetland hydrology and monitoring requirements to assess such things as the effects of nearby groundwater abstraction on wetland water levels, water quality and ecological indicators, as well as indicators and sources of stress, were also examined.

- Over the last few years, monitoring of "downstream receiving environments" has increased. The primary focus to date has been on estuaries and harbours susceptible to nutrient enrichment, sedimentation and contaminant (e.g., heavy metal) accumulation.

5.3 Development of targets/standards to protect freshwater values

Existing water quality and ecological data-sets are currently being reviewed for use in developing region-specific water quality and ecological objectives and standards/targets appropriate for managing the region's rivers and streams. The majority of the effort in recent months has been placed on determining appropriate ecological objectives (for algae, invertebrate and fish indicators) for each river and stream type in our region. The next phase of work involves consideration of nutrient and other water quality guidelines.

5.4 SoE evaluation

Starting later in 2010, a comprehensive analysis of existing river, stream, lake and groundwater quality monitoring data will commence to update current knowledge with respect to the state of the region's freshwater resources. In particular, this analysis will provide information on the locations where water quality has improved, stayed the same or deteriorated over time.

6. Recommendations

That the Committee:

1. ***Receives*** *the report.*

2. ***Notes*** *the content of the report.*

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Attachment 1: Summary leaflet